The Role of Micro-Credentials in Strengthening STEM Teaching and Learning
An Evaluation of the Louisiana STEM Micro-Credentials Project
About This Report

This report presents the results of a study conducted by RAND researchers that investigated a set of micro-credentials intended to improve science, technology, engineering, and math instruction among participating high school teachers and, as a result, improve student learning. The creation, design, and implementation of micro-credentials was undertaken through a collaboration between the Louisiana Department of Education, Louisiana State University, and BloomBoard. RAND researchers designed and executed a randomized controlled trial of the effectiveness of micro-credentials and an implementation study. This report details the results of the randomized controlled trial and the final results of the implementation study. The results of the implementation study build on the results that are reported in *Designing and Implementing Micro-Credentials to Support STEM Teaching: Lessons from Louisiana’s Project to Improve Pre-Engineering and Computer Science Education Through Micro-Credentialing* (Kaufman et al., 2023).

**RAND Education and Labor**

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More information about RAND can be found at www.rand.org. Questions about this report should be directed to cdoss@rand.org, and questions about RAND Education and Labor should be directed to educationandlabor@rand.org.

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We note that this project coincided with the unique challenges of the coronavirus disease 2019 pandemic, which were most acute during the 2020–2021 and 2021–2022 school year but had continued effects in subsequent years. We are extremely thankful for all the aforementioned partners and educators for their engagement in this work as they navigated a particularly stressful period.

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Summary

Micro-credentials are becoming a popular way for organizations to identify workers with specific skills, knowledge, and competencies. In this study, we define a micro-credential as “a verification of a discrete skill or competency that a teacher has demonstrated through the submission of evidence assessed via a validated rubric” (Tooley and Hood, 2021a, p. 5). Micro-credentials are increasingly being adopted across a variety of industries and countries, including the kindergarten through grade 12 (K–12) education system in the United States. At the time of this writing, more than one-half of U.S. states have policies, guidelines, or programs that encourage educators to consider micro-credentials (Center on Great Teachers, 2020; Tooley and Hood, 2021b) and professional organizations, such as the National Education Association, are offering micro-credentials to their members (National Education Association, undated). These various efforts are exploring how micro-credentials can be used for different purposes, including fulfilling licensure requirements, providing continuing education credits, and moving up pay ladders.

As organizations within the K–12 system adopt and experiment with micro-credentials, researchers are investigating what features of micro-credentials are most effective, in which contexts, and for what purposes. However, there are a limited number of independent evaluations on how micro-credentials are implemented and even fewer on the effects of micro-credentials on teacher and student outcomes. This report is a second and final RAND report on Louisiana’s efforts to design and implement micro-credentials as a means of certifying that teachers have competencies connected with the instruction of science, technology, engineering, and math (STEM) courses in high schools throughout the state. The goal of introducing micro-credentials was to improve teaching and learning in these courses with the potential to expand the model across Louisiana.

In the first report, Designing and Implementing Micro-Credentials to Support STEM Teaching: Lessons from Louisiana’s Project to Improve Pre-Engineering and Computer Science Education Through Micro-Credentialing (Kaufman et al., 2023), we describe how the Louisiana Department of Education collaborated with BloomBoard and Louisiana State University to develop and pilot 18 micro-credentials that are aligned with pre-engineering, computer science, and digital design and emergent media pathway courses offered throughout the state. We also analyzed teacher recruitment for a two-year randomized controlled trial of micro-credentials and their implementation during the first year of the study.

This follow-on report provides additional analysis of the implementation of micro-credentials during the two-year study and of the randomized controlled trial–generated estimates of the effect of the offer of micro-credentials on student outcomes (i.e., effects comparing the teachers who were provided access and monetary incentives to earn micro-credentials compared with those who were not provided access or incentives). The main research questions that we answered in this report are the following:

1. How were micro-credentials implemented and were they implemented as reflected by measures of intended fidelity?
2. What is the effect of the offer of micro-credentials on student achievement in math and science after one year?
3. What is the effect of the offer of micro-credentials on student attendance and future pathways course-taking after one and two years?

Chapter 1 begins by summarizing the structure of the micro-credential project, which we refer to as the Louisiana STEM Micro-Credentialing Project throughout this report. We present a theory of action for how the process of earning these micro-credentials could affect teacher instruction, student engagement, and
student academic performance; review existing research literature on micro-credentials; and then discuss RAND researchers’ approach and methods for the evaluation study that is the focus of this report.

Chapter 2 focuses on our first research question regarding micro-credential implementation by the Louisiana teachers who participated in the study, organized by the following five topics: (1) teacher progress toward earning micro-credentials; (2) motivators, barriers, and facilitators to completing micro-credentials; (3) teacher perceptions of the usefulness of micro-credential content; (4) teacher perceptions of the supports offered; and (5) perceived impacts on teaching and learning. Key takeaways from this analysis are as follows:

- **Teachers’ progress toward earning micro-credentials fell far short of initial expectations.** A goal of teachers earning one to two micro-credentials a year may be more feasible than the initial goal of earning five to eight micro-credentials over two years.
- **Most teachers were motivated to try micro-credentials** because they viewed them as an opportunity for professional growth, although nearly all teachers indicated that linking micro-credentials to pay increases would be a powerful motivator for them to try micro-credentials in the future.
- **For many teachers, finding enough time was a main barrier to earning micro-credentials** because of the demands of their professional responsibilities as a teacher.
- **The disruptions caused by the coronavirus disease 2019 pandemic posed a major barrier to completing micro-credentials in the first year of the study. Linger ing disruptions caused by the pandemic, such as teacher absences when they contracted the virus, persisted into the second year of the study.**
- **Teachers who successfully earned micro-credentials shared certain characteristics,** such as having relevant content knowledge, setting goals, and mapping course content to micro-credentials in advance.
- **Teachers’ views on whether micro-credentials aligned with their STEM courses depended on several factors,** including what courses the teachers taught, the micro-credentials they attempted, and their efforts to plan in advance to foster this alignment.
- **Teachers who completed micro-credentials had mostly positive perceptions of the benefits and the supports that those micro-credentials provided.**
  - Teachers commented that micro-credentials provided them with new tools and strategies for their instruction and gave them opportunities to reflect on their current practice.
  - Most teachers had favorable views of asynchronous supports offered through the micro-credential platform, including embedded resources and feedback from trained assessors. However, teachers had more mixed feedback on synchronous support in the form of an initial orientation called the “Success Academy” and weekly office hours held by Louisiana State University; few teachers took advantage of those synchronous opportunities.
- **Teachers expressed a desire to work with peers on micro-credentials** as a potential mechanism to support their understanding of and progress on micro-credentials.

In Chapter 3, we present the effects of the offer of micro-credentials on student outcomes. We look at effects on standardized tests of math and science and proxies for student engagement in the form of the number of pathway courses that were taken and attendance. Our key takeaways are the following:

- **We did not detect effects on standardized tests of math and science** one year after teachers were randomly assigned to complete micro-credentials.
- **We did not detect effects on student course-taking or attendance** one and two years after teachers were randomly assigned to complete micro-credentials.
- **Null results may stem from the fact that few teachers completed one or more micro-credentials.**
• The impact study is limited in that the student engagement outcomes are proxies and may not reflect actual student engagement, and our measures of academic achievement are statewide assessments that have some, but not complete, overlap with the content of the STEM classes in this study.

In Chapter 4, we conclude with a summary of the results and key implications and recommendations for those developing micro-credentials, state and district leaders supporting micro-credential implementation in schools, and researchers studying micro-credential implementation and impact. We organized our implications and recommendations under three interrelated needs: the need to (1) clearly identify and communicate the goals of micro-credentials, (2) provide clear information to schools and teachers about the demands of micro-credentials, and (3) critically examine the value proposition that micro-credentials afford teachers. Key recommendations are as follows:

• **Identifying and communicating the goals of micro-credentials**
  - Clearly communicating the goals of micro-credentials to teachers, including the professional benefits they should expect to accrue, will help teachers decide whether to engage with micro-credentials.
  - Teachers may perceive micro-credentials as a form job-embedded development, even in instances when they are used as a form of credentialling.
  - Identifying policy goals first and planning backward to ascertain the role of micro-credentials may help clearly communicate the purpose and benefits of micro-credentials to educators.

• **Providing clear information to teachers and schools about the demands of micro-credentials**
  - Stakeholders should accurately estimate the time needed to complete a micro-credential and consider what is feasible for teachers given their professional demands.
  - Providing time and space for teachers to engage with micro-credentials during the school day can minimize the burden of completing micro-credentials.
  - Asynchronous supports may be more effective than scheduled, synchronous supports.
  - Cohort models may be effective in supporting teachers’ work on micro-credentials.

• **Critically examining the value proposition that micro-credentials afford teachers**
  - More-tangible and more-permanent career benefits may provide a stronger motivation to engage with micro-credentials.

• **Providing teachers with a choice among micro-credentials may help maximize the value proposition**
  - Policymakers, however, may need to reconcile this type of flexibility with the goals of micro-credentials.

The findings and recommendations in this report can be of use to policymakers, educators, and other education stakeholders as the adoption of and experimentation with micro-credentials continues in states and school districts throughout the country.
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CHAPTER 1

Introduction

Industries in the United States and globally are increasingly turning to micro-credentials as a way for workers to certify mastery in domain-specific skills and competencies. For example, in education, micro-credentials are being implemented in teacher preparation programs, used to fulfill licensure requirements, and used for in-service teachers to obtain continuing education credits and to move up pay ladders (Berry and Byrd, 2019; Oliva, 2022; Teach Tech Kentucky, undated; Tooley and Hood, 2021b). The scope, implementation, and goals of micro-credential initiatives can vary widely. In a review of the state of micro-credentials, Tooley and Hood (2021b) noted that there is considerable variation in the granularity of the skills, knowledge, and competencies on which micro-credentials focus and how teachers are assessed as exhibiting mastery of those skills and knowledge.

The research on the implementation and impacts of micro-credentials to date is limited, although efforts are under way to understand the features of effective micro-credentials and to understand whether micro-credentials have the intended effects on teachers and students (AnLar, 2022). This report is the second of two RAND reports that contributes to the growing knowledge base on micro-credentials, in which we analyze an initiative in Louisiana to develop and implement micro-credentials as a way of improving teaching and learning in science, technology, engineering, and mathematics (STEM) classrooms. In our first report, Designing and Implementing Micro-Credentials to Support STEM Teaching: Lessons from Louisiana’s Project to Improve Pre-Engineering and Computer Science Education Through Micro-Credentialing, we focused on micro-credential development, the recruitment of participants in the randomized controlled trial (RCT), and the preliminary implementation findings from the first year of the micro-credential project with the first cohort of teachers (Kaufman et al., 2023). This second report focuses on implementation from both years of the RCT and the results of the RCT on student outcomes.

Prior to this micro-credential initiative, the Louisiana Department of Education (LDOE) had undertaken several efforts to encourage students to enroll in STEM classes and to consider STEM careers. One of these efforts included the creation of the Louisiana High School STEM Pathways program, which provides students at participating high schools with opportunities to take specialized, elective courses in one of several high-demand STEM content areas, such as pre-engineering, computer science (CS), and digital design and emergent media (DDEM) (LDOE, 2023). Students who successfully complete STEM Pathways courses can earn special diploma endorsements (i.e., a silver or gold STEM diploma seal). As of March 2023, 58 percent of parishes in Louisiana offered STEM Pathways courses in partnership with a STEM Pathways provider (LDOE, 2023). Additionally, LDOE fostered the adoption of high-quality STEM curricula by piloting such initiatives as OpenSciEd.

For these STEM courses and curricula to effectively prepare students for STEM careers and majors, it is essential that they be taught by qualified teachers who possess sufficient knowledge and skills to align their instruction with the designed sequences and requirements for industry-based credentials. STEM Pathways providers, such as Louisiana State University (LSU), Project Lead the Way (PLTW), and Code.org, provide participating schools and teachers with resources and training in course sequences to support high-quality instruction in STEM Pathways courses (LDOE, undated). However, these trainings do not provide certifi-
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Moreover, as we mentioned in our previous report, other high school STEM course offerings throughout the state assume that teachers have “mastered core competencies related to areas like project-based learning [PBL] and technical reading and writing, although teacher preparation programs [may] not necessarily emphasize that content” (Kaufman et al., 2023, p. 4). In 2019, LDOE turned to micro-credentials as a potential means to identify teachers who have the pedagogical and content knowledge needed for teaching STEM Pathways courses. Through an Education Innovation and Research Program grant from the U.S. Department of Education, LDOE partnered with BloomBoard, Inc. (BBI), LSU, and RAND to develop, implement, and study micro-credentials that are aligned with select LSU STEM Pathways courses. This Improving Pre-Engineering and Computer Science Education Through Micro-Credentialing project (henceforth called the Louisiana STEM Micro-Credentialing Project) focused specifically on creating micro-credentials aligned with LSU pre-engineering, CS, and DDEM pathway courses.

In the rest of this chapter, we summarize the Louisiana STEM Micro-Credentialing Project, including the structure and timeline of the project, the process by which teachers earned micro-credentials, and a theory of action that connects earning micro-credentials to teacher and student outcomes. Our summary of the Louisiana STEM Micro-Credentialing Project draws heavily on the project description in our first report (Kaufman et al., 2023). In this report, we elaborate on our original literature review of micro-credentials in kindergarten through grade 12 (K–12). We conclude with an overview of the methods and data collection that contribute to the implementation of micro-credentials and the impact of the findings presented.

Review of Relevant Research on Micro-Credentials in Kindergarten Through Grade 12 Education and Their Effectiveness

How Are Micro-Credentials Being Used to Support Kindergarten Through Grade 12 Teaching?

Micro-credentials provide teachers with opportunities to earn recognition for mastery of knowledge and skills in discrete or “fine-grained” areas of practice (DeMonte, 2017; Gamrat et al., 2014). In some cases, that recognition is issued as a digital badge or certificate, which teachers can share electronically through email, social media, or on resumes after earning (Galindo, 2023). As we discussed in our first report, “micro-credentials are emerging as a promising tool to promote professional learning for teachers because the process for earning one provides a self-paced, job-embedded opportunity for learning that can be connected to teachers’ daily practice[s]” (Kaufman et al., 2023, p. 2). For states, one benefit of using micro-credentials is the ability to offer teachers personalized and accessible opportunities for learning and career advancement that align with statewide initiatives and goals for instruction (DeMonte, 2017; Hunt et al., 2020). Since our initial report, the use of educator micro-credentials by states and school districts has continued to increase (Galindo, 2023). Analyses by New America and the Center on Great Teachers and Leaders found that more than one-half of states have policies, guidelines, or programs to promote micro-credential use among educators (Center on Great Teachers and Leaders, 2020; Tooley and Hood, 2021b).

Although the basic features of educator micro-credentials are similar (e.g., competency-based, accessible online), the differences across micro-credential programs for educators are myriad (Tooley and Hood, 2021b). Several studies report wide differences in the incentive structures and benefits accrued to educators, the depth and quality of assessment, degree of specificity, supports for earning micro-credentials, and companion resources for learning (Berry and Byrd, 2019; Tooley and Hood, 2021b). Moreover, there is no widely accepted standard or universal definition for micro-credentials (Carbaugh et al., 2022b; Oliver, 2022). These differences make it challenging to draw conclusions about the efficacy of micro-credentials more broadly.
Among states that are deploying educator micro-credentials, many are doing so to address critical needs across their teacher workforce involving statewide learning goals, licensing and certification, and/or career advancement (Berry and Byrd, 2019; Tooley and Hood, 2021b). According to a New America report, at least 15 states are using micro-credentials to support professional learning (Tooley and Hood, 2021b). Some states allow teachers to count those micro-credentials toward professional development and/or license renewal requirements or licensure endorsements (DeMonte, 2017; Tooley and Hood, 2021b). When used to support professional development, micro-credentials are often offered in conjunction with other traditional learning opportunities or resources, such as online courses or coaching (Tooley and Hood, 2021a). For example, Florida implemented a hybrid micro-credential instruction program to promote evidence-based literacy instruction (Lastinger Center for Learning, undated; Oliva, 2022). After completing the program, which includes online instruction and individualized feedback, participants receive a stipend and can use the literacy micro-credential to satisfy Florida’s requirements for a level 1 reading endorsement (Lastinger Center for Learning, undated). In another example, the Oklahoma State Board of Education is implementing a micro-credential program for educators of students with severe-profound disabilities. To earn this micro-credential, educators “learn, practice, receive feedback, and demonstrate mastery of standards” (Oklahoma State Department of Education, 2023). On completion, eligible Oklahoma educators can receive a standard certification in the area of severe-profound disabilities.

One potential use for educator micro-credentials that is attracting attention is the ability to train and certify teachers in emerging STEM areas, such as CS and computational thinking (CT) (AnLar, 2022; Burke et al., 2022). Proponents suggest that micro-credentials could provide a valuable mechanism for rapidly upskilling and certifying teachers’ knowledge and skills in these critical content areas (Burke et al., 2022; Hunt et al., 2020). Across the United States, several initiatives are underway to develop and deploy CS-oriented and CT-oriented micro-credentials for teachers. For example, the Wyoming State Department of Education recently developed and piloted a series of 17 CS micro-credentials for elementary and secondary teachers and is exploring using these micro-credentials as an alternative pathway to CS endorsement (American Institutes for Research, undated). In another example, the American Institutes for Research is piloting CS micro-credentials in partnership with the Ohio Valley Educational Cooperative (American Institutes for Research, undated). Eligible teachers in Kentucky who earn these micro-credentials can apply them toward a rank change through a rank change program partnership with BBI (Teach Tech Kentucky, undated).

Embedded in this constellation of uses is a tension between the conceptualization of the main goal of micro-credentials as a means of certifying that teachers have already mastered focal skills versus micro-credentials as a means of providing professional learning for teachers to develop their skills further (Cumberland et al., 2024). As our theory of action illustrates, micro-credentials could provide an opportunity for professional learning in the tradition of assessment for learning (Carbaugh et al., 2022a; Carbaugh et al., 2022b). Yet, if the goal of micro-credentials as an opportunity to support professional growth is unclear during their development, those goals may not be explicitly targeted in the design of the micro-credentials.

What Do We Know About the Impact of Micro-Credentials on Teacher and Student Outcomes?

Despite their growing popularity, little is known about how micro-credentials affect teachers’ instruction or student outcomes (Aydarova, 2021; Center on Great Teachers and Leaders, 2020; DeMonte, 2017; Ross, 2016). As we stated in our previous report, few studies have rigorously examined the impact of micro-credentials on K–12 teachers’ instructional practices or on student outcomes (Kaufman et al., 2023). Moreover, because of the wide variation across existing micro-credential–based programs for educators, measuring the impact of micro-credentials on teacher learning and advancement poses a unique challenge (Tooley and Hood, 2021b). Much of the micro-credential research relies on qualitative feedback from teachers about their perspectives...
and their experiences with micro-credentials. Some studies based on teacher surveys and interviews report positive perceptions of micro-credentials after teachers take them, such as the desire to earn additional micro-credentials and an appreciation for skills they say they have learned (Acree, 2016; DeMonte, 2017; Luke and Young, 2020). Other results have been more mixed. Looking across studies that examined digital badging as a feature of micro-credentials, Cumberland et al. (2024) reported that while participants in some digital badging professional learning programs perceived earned digital badges positively, participants in these studies were not consistently motivated to complete the requirements for earning (Cumberland et al., 2024).\(^1\) Other authors have reached similar conclusions (Rieder, 2022; Roy and Clark, 2019).

A few studies that quantified the impact of micro-credentials on teacher learning have demonstrated positive effects. Borland et al. (2022), for example, conducted an RCT of elementary math micro-credentials for teachers and found teacher knowledge gains across several “targeted learning competencies” as measured on pre- and post-assessments (Borland et al., 2022, p. 505). In other studies, among small samples of pre-service teachers in university settings, researchers have reported evidence of increased pedagogical knowledge, awareness, or confidence in such topics as CT and technology integration among teachers who completed micro-credentials or earned digital badges in these topics (Bal et al., 2022; Newby and Cheng, 2020).

What Factors Support or Discourage Teacher Use of Micro-Credentials?

Although micro-credentials could offer a promising pathway to promoting teachers’ professional advancement and learning, research suggests multiple challenges to the development and implementation of high-quality micro-credential systems that meet these goals. Because of the wide variation of micro-credential offerings, ensuring the robustness of micro-credentials as a tool for professional growth and their validity as a measure of competence presents an ongoing obstacle (Rieder, 2022; Tooley and Hood, 2021b). Moreover, buy-in among teachers to take and earn micro-credentials may be difficult, especially if the program lacks sufficient purpose or professional incentives for completing micro-credentials (Cumberland et al., 2024; Diamond and Gonzalez, 2014; Stefaniak and Carey, 2019). Previous research has demonstrated that the logistics and time involved in earning micro-credentials or digital badges can be cumbersome for educators, which in turn can affect motivation and intent to complete micro-credentials (Diamond and Gonzalez, 2014; Roy and Clark, 2019; Stefaniak and Carey, 2019). Finally, insufficient access to resources or content information could impede teachers’ progress toward earning micro-credentials if the teachers otherwise lack access to meaningful opportunities to master relevant content (Diamond and Gonzalez, 2014).

This and other research has suggested that when developing micro-credential programs for educators, states need to be clear about the purpose of these programs and take steps to ensure that these opportunities align with state-level standards for teaching and expectations for high quality professional development (DeMonte, 2017; Tooley and Hood, 2021a). To further incentivize teachers to take micro-credentials, providers could consider allowing teachers to work through micro-credentials as a cohort, provide access to high-quality resources to support professional learning, and/or offer clear incentives for career advancement (Diamond and Gonzales, 2014; McDiarmid et al., undated). Additionally, because of the constraints on their time, educators—like other working adults—may require systems that provide them with easy-to-navigate access to essential learning materials that they can use to prepare their submissions (Tee et al., 2023).

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\(^1\) As previously mentioned, many micro-credential programs use digital badges to recognize and award demonstrated mastery of a skill or set of skills (Galindo, 2023). In the literature and across the field, the terms digital badge, digital badging, and micro-credential are sometimes used interchangeably.
The Louisiana STEM Micro-Credentialing Project

Project Partners, Structure, and Timeline

The Louisiana STEM Micro-Credentialing Project was a collaboration among four organizations, each with a specific role during the creation, implementation, and analysis phases of the project (Figure 1.1).

As we described in our previous report, project partners created, piloted, and refined 18 distinct micro-credentials for STEM Pathways teachers. The 18 micro-credentials spanned three levels. Level 1 micro-credentials addressed general STEM content that was applicable for teachers of all three targeted STEM Pathways courses. Level 2 micro-credentials targeted introductory skills in the pre-engineering and DDEM pathways. Level 3 micro-credentials focused on advanced content across all three target pathways. Figure 1.2, reproduced from Kaufman et al. (2023), illustrates the intended sequence of micro-credentials. All teachers were asked to complete the micro-credential “1.2: Facilitating Project-Based Learning” before they moved on to other micro-credentials.

FIGURE 1.1
The STEM Louisiana Micro-Credentialing Project Partners

LDOE was the project leader, advising on all elements of the project.

LSU co-developed the micro-credentials and supported teachers through the micro-credentials.

BBI co-developed the micro-credentials, provided the online platform, and assessed teachers’ submissions.

RAND served as the project evaluator.

FIGURE 1.2
Louisiana STEM Micro-Credential Sequence

Level 3
Advanced pre-engineering content (4 micro-credentials)

CS* (3 micro-credentials)

Advanced DDEM content (4 micro-credentials)

Level 2
Introductory pre-engineering content (2 micro-credentials)

Introductory DDEM content (2 micro-credentials)

Level 1
General STEM content applicable to pre-engineering, DDEM, and CS content areas (3 micro-credentials)

SOURCE: Reproduced from Kaufman et al., 2023, p. 6

* Level 3 CS micro-credentials were applicable to instructors of pre-engineering, DDEM, and CS courses.
The Louisiana STEM Micro-Credentialing Project timeline was revised several times because of challenges that included the coronavirus disease 2019 (COVID-19) and Hurricane Ida. Figure 1.3 illustrates the original timeline and the revised timeline. As depicted, the project team planned on finalizing four micro-credentials by July 2020 and the remainder by December 2020. Project partners originally planned to launch the first cohort of teachers in the two-year RCT in the 2020–2021 school year, recruit a second cohort for the 2021–2022 school year, and conclude in spring 2022. Although the first four micro-credentials were completed in the original time frame, the remainder of the micro-credentials were not completed until June 2022. Because of the COVID-19 pandemic, the RCT was delayed one year, with the first cohort launching in the 2021–2022 school year, the second cohort launching in the 2022–2023 school year, and the RCT concluding in spring 2023. Because of complications from Hurricane Ida, the first cohort of teachers did not start earning micro-credentials until November 2021.

Review of the Micro-Credential Earning Process

As described in Kaufman et al. (2023), LSU and BBI anchored the process of earning a micro-credential into the analyze, design, develop, implement, and evaluate (ADDIE) model.2 The ADDIE model was adopted from other education settings in which the goal is to help educators with skill-based professional learning and assessment (Alsaleh, 2020; Peterson, 2003). During the analyze portion of the micro-credential, teachers analyze their plan for how they will apply the focal micro-credential content in their courses with students. Micro-credentials often include resources to help teachers understand how to integrate micro-credential focal content into their instruction. In the design and develop portions, teachers create or compile the instructional materials needed to produce evidence of mastery of the identified skill. They then implement those instructional materials in the classroom and submit artifacts from the lesson, such as student work, to demonstrate competency in the skill. Finally, in the evaluate portion, teachers reflect on their experiences, including successes and challenges.

In this project, trained assessors from BBI used predetermined rubrics to evaluate teachers’ submissions for each portion of the ADDIE process. Teachers had access to these rubrics as they completed each portion of the process. For each rubric, BBI assessors evaluated teachers with ratings of “Not met,” “Developing,” or “Demonstrated.” To earn the micro-credential, teachers had to receive a “Demonstrated” rating on each portion. If a teacher was rated as “Not met” or “Developing” on a portion of the micro-credential, the assessors provided feedback and the teachers could resubmit that portion after addressing the feedback. Teachers could resubmit as many times as necessary until they were given the “Demonstrated” rating. In addition to the resources and feedback provided by BBI, a staff member from LSU held weekly office hours during which teachers could come and ask questions about the micro-credentials they were working on.

Theory of Action

The aforementioned process provided an avenue through which teachers could improve their instructional practices and, in turn, improve student outcomes. The ADDIE framework made it possible for teachers to develop new knowledge and practices, gather evidence from their classroom to illustrate that knowledge and those practices, and refine their knowledge and practices through feedback, refinement cycles, and reflection. This process could affect teacher practice in two ways.

First, completing the ADDIE process could provide teachers an opportunity to develop new pedagogical or content knowledge. The analyze portion of the micro-credential provided teachers with resources on the

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2 BBI as an organization has moved away from the ADDIE model since the completion of this project.
FIGURE 1.3
Original Project Timeline and Revised Project Timeline

Original timeline

Adjusted timeline

- **March 2020**: COVID-19 school closures
- **August 2020**: RCT starts
- **December 2020**: RCT ends
- **August-September 2021**: RCT starts
- **November 2021**: Hurricane Ida
- **March 2020** to **August 2020**: All micro-certifications designed, piloted, and refined
- **July 2022**: All micro-certifications designed, piloted, and refined

**SOURCE**: Reproduced from Kaufman et al., 2023, p. 5.
focal skill and how those resources can be integrated into the classroom. The *design, develop, and implement* portions gave teachers the opportunity for job-embedded learning as they created, modified, or organized instructional materials, deployed them in the classroom, and collected evidence of mastery. Potential cycles of feedback from BBI gave teachers the opportunity to clarify concepts and improve the planning and enactment of lessons until they reached the “Demonstrated” threshold. Finally, the *evaluate* portion allowed teachers to reflect on their successes and challenges and potential ways to mediate the challenges.

Second, teachers may have already been competent in the focal skill, and the ADDIE process may have caused teachers to focus on those particular skills to a greater extent to build their portfolios of evidence. In completing each part of the ADDIE process, teachers may have modified or created new lesson plans to emphasize the focal skill and gather explicit evidence of practice from the classroom. The reflection process provided another opportunity for teachers to reflect on their successes and challenges and potential ways to mediate those challenges.

In each case, teacher practice among those who engaged with the micro-credentials may have differed from those who did not. If the micro-credentials change the pedagogical and content knowledge of teachers in ways that improve instruction, students may become more engaged in classes. The greater level of student engagement may then improve student disposition toward learning math and science and increase their desire to continue math and science course-taking. Finally, increased teacher pedagogical or content knowledge could improve student learning and increase student performance on assessments of math and science. This theory of action is summarized in Figure 1.4.

**Louisiana STEM Micro-Credentialing Project Implementation and Impact Studies**

Our previous report focused on the study’s implementation activities from the inception of the project in 2019 through June 2022. We also reported on the process by which the micro-credentials were created, piloted, and refined and on recruitment for the RCT. In this report, we provide results from the implementation that focus on both years of the RCT evaluation (2021–2022 and 2022–2023). These years include the implementation of the micro-credentials by the first cohort of teachers during their first and second year of implementation and the second cohort of teachers during their first and only year of implementation.

Additionally, we provide the quantitative results from the RCT evaluation. We designed the study to analyze the effect of the offer of micro-credentials on teacher instruction as measured by teacher logs, student attitudes toward STEM as measured by student surveys, and student academic outcomes as measured by

**FIGURE 1.4**

*Theory of Action: How Micro-Credentials Can Affect Teacher and Student Outcomes*
LDOE administrative data. Efforts to collect teacher logs and student surveys were substantially hampered by the COVID-19 pandemic. Therefore, we focus on student outcomes contained in LDOE administrative data.3 The research questions addressed in this report are as follows.

Implementation Research Question:

1. How were micro-credentials implemented, and were they implemented as reflected by measures of intended fidelity?

Impact Research Questions:4

2. What is the effect of the offer of micro-credentials on student achievement in math and science after one year? (Confirmatory)
3. What is the effect of the offer of micro-credentials on student attendance and future pathways course-taking after one and two years? (Exploratory)

Study Population

We recruited two cohorts of Louisiana STEM teachers. As noted in Table 1.1., 50 teachers agreed to participate in the study: 27 teachers in cohort 1 and 23 teachers in cohort 2. We originally aimed to recruit more than 100 LSU-trained STEM Pathways teachers, with the intent of randomly assigning one-half of those teachers to take micro-credentials over a two-year period beginning in fall 2020. However, as explained in Kaufman et al. (2023), our study team encountered numerous challenges to recruitment, including educators grappling with acute disruptions from the COVID-19 pandemic during the 2021–2022 school year, the study being delayed two months after Hurricane Ida hit Louisiana in August 2021, and a competing STEM project that was also funded by the U.S. Department of Education and that was recruiting from the same pool of teachers. In 2021, after delaying the start of the project by one year, we expanded the recruitment pool to include PLTW-trained STEM Pathways teachers who taught similar content. In year two, RAND and LDOE once again expanded the recruitment pool to include select teachers who were teaching OpenSciEd courses. OpenSciEd is a nonprofit organization with a collection of high-quality, open-source STEM curricula (McElhaney et al., 2023).

Implementation Methods and Data

To answer the research question related to the implementation of micro-credentials, we drew on several data sources: interviews with teachers randomly assigned the offer of micro-credentials (treatment teachers), survey responses of treatment teachers, participation data from BBI’s micro-credential platform, and data

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3 One-half of teachers (25) completed teacher logs, but we found a substantial imbalance in response rates by treatment and control status (fewer treatment teachers completed logs), which led to a substantial imbalance in baseline measures of the outcome. We therefore do not present these results because of selection bias. Less than 20 percent of the student sample responded to student surveys. We do not present these results because the generalizability of the results is unknown.

4 This study was preregistered in the Registry of Efficacy and Effectiveness Study (REES, ID 9300). Our registered, confirmatory questions sought to measure student engagement directly through student surveys. Because of low response rates, we report on the effects on attendance and student pathways course-taking, which may be seen as more-distal measures of student engagement in pathway courses and school.
Our project team conducted two rounds of interviews with treatment teachers at the end of each year of the study: first in spring 2022 \((n = 6)\) and again in spring 2023 \((n = 7)\). All treatment teachers had the opportunity to participate, regardless of their progress toward earning micro-credentials. In total, we conducted 13 interviews with 10 teachers. Three teachers from cohort 1 participated in both rounds of interviews (see Table 1.2). Of those that participated in interviews, four teachers had earned at least one micro-credential at the time of their interview (i.e., “earners”). The remaining interview participants had never started a micro-credential or had made little progress after their first semester in the study (i.e., “non-earners”). The ten teachers who participated in the interviews had varying years of experience teaching in Louisiana, ranging from 1 to 20 years. Two teachers were OpenSciEd biology teachers, five were LSU teachers (three in pre-engineering pathways and two in DDEM pathways), and three were PLTW teachers instructing CS, engineering, and/or DDEM classes.

In our interviews, we focused on four main topics: (1) teachers’ motivations for participating in the micro-credential project, (2) barriers and facilitators to completing micro-credentials, (3) the alignment and applicability of micro-credentials with their courses, and (4) their overall perceptions about the benefits of completing micro-credentials. Each interview lasted approximately 30 minutes, and we provided a gift card incentive to each teacher on completion of the interview. We audio recorded all the interviews.

We used the recordings to convert our interview notes into transcripts and uploaded the transcripts into Dedoose for qualitative coding. Dedoose is a secure cloud-based application that supports coordinated analysis of data using qualitative and mixed-methods approaches (Dedoose, undated). Two researchers on our team collaboratively developed a coding scheme based on the research questions and fidelity measures. The main categories that we attended to in our coding included (1) teachers’ motivation and progress toward earning micro-credentials, including facilitators and barriers to completing micro-credentials; (2) teachers’ perceptions of micro-credentials and the covered content; and (3) the impacts of micro-credentials on instruction and students’ learning. Please see Appendix A for details about the descriptions of the codes and examples. Two researchers tested and refined the codebook by individually coding two different interviews. Once they developed a common understanding of the codes and how to apply them, they individually coded the remaining interviews and came together to discuss any disagreements in their coding. Once they completed this process, they used their coding to generate themes (Braun and Clarke, 2006) within the main categories that we attended to in our coding.

We also fielded a 15-minute survey to all participating teachers in spring 2023 \((n = 50)\). The survey included some common questions for treatment and control teachers about teachers’ STEM backgrounds from LSU and BBI about teachers’ participation in various professional learning supports. We describe these sources below in detail.

### Table 1.1
**Teacher Recruitment and Enrollment from 2021 and 2022**

<table>
<thead>
<tr>
<th>Cohort</th>
<th>Year</th>
<th>Eligible Teachers</th>
<th>Incentives</th>
<th>Number of Eligible Teachers</th>
<th>Number of Teachers Enrolled</th>
<th>Percentage of Eligible Teachers Enrolled</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2021</td>
<td>LSU and PLTW STEM Pathways, pre-engineering, DDEM, and CS teachers</td>
<td>Control: up to $500, Treatment: up to $1,500</td>
<td>154</td>
<td>27</td>
<td>18</td>
</tr>
<tr>
<td>2</td>
<td>2022</td>
<td>LSU and PLTW STEM Pathways, pre-engineering, DDEM, and CS teachers, OpenSciEd biology and chemistry teachers</td>
<td>Control: up to $650, Treatment: up to $2,800</td>
<td>179</td>
<td>23</td>
<td>13</td>
</tr>
</tbody>
</table>
and experiences with STEM-focused professional development. To enhance our understanding of the implementation of the micro-credentials, the survey included additional questions for treatment teachers that focused on their experiences with and perceptions of micro-credentials. Fourteen treatment teachers and 23 control teachers completed the survey. We provided a gift card incentive to each teacher on completion of the survey. In our analysis related to the implementation of micro-credentials, we focused on the responses from 14 treatment group teachers (seven of whom were among the teachers that we interviewed) and generated simple descriptive statistics to understand the overall patterns. Our analyses across the interviews and surveys represent insights from 17 treatment teachers out of a total of 23 teachers who were randomly assigned to the treatment group.

Impact Study Methods and Data

The impact study leverages a block, clustered RCT to understand the effect of the offer of micro-credentials on student outcomes. In this section, we summarize the process by which we recruited participants for the RCT and randomized the participants. We then report on the analytic sample and the outcomes instruments used in the study.

Data Sources

This study leverages administrative data from LDOE. LDOE provided data on student achievement, student demographics, and other student information, such as grade point average (GPA), disciplinary infractions, attendance, and course-taking. Additionally, we received background data on teachers, such as course assignments, teacher demographics, certifications, and licensure scores.

We used student achievement on state standardized tests in math during middle school as our baseline assessment. These assessments are part of the Louisiana Educational Assessment Program (LEAP). Because the sample contained students in all high school grades, we used each student’s grade eight test score. The scores were standardized by student cohort.

Our confirmatory outcomes of interest are student performance on high school standardized assessments of math and science. STEM Pathways teachers instruct math and science through coursework that focuses on specific STEM fields, such as pre-engineering or CS. There are no standardized tests that align with the

5 We provide a description of the teacher logs and the student survey data instruments in Appendix B.

6 We used seventh-grade test scores for students who were in eighth grade in spring 2020 because standardized tests were not given during the COVID-19 pandemic.
content of these pathways specifically. We leveraged standardized tests of math and science that are available throughout the state because pathways courses teach math and science concepts that all high school students are expected to know. The LEAP assessment system includes two math assessments that high school students take at the end of specific courses (not in specific grades): algebra I end-of-course tests and geometry end-of-course tests. Additionally, all grade 11 students in the state are required to take the American College Testing (ACT) exam, and we obtained those students’ performance on the math and science sections of the ACT. Because students in different grades took each of the tests, we standardized scale scores by the statewide cohort of students who took each test in a given year. We then made a composite math outcome measure of the standardized algebra I, geometry, and ACT math assessments. The science section of the ACT is our sole science measure.7

Beyond improvements in academic achievement, improvements in teacher pedagogy or content knowledge could also improve student engagement in pathway courses and in STEM courses and careers more broadly. In the absence of direct measures of student engagement, we analyzed two proxies as exploratory outcomes: the number of pathway courses a student had taken and attendance. Higher engagement in pathway courses could induce a student to enroll in more courses. This increase in enrollment could occur in the same year because many pathway courses are one semester long. However, because the effect on course-taking may be greater in subsequent years, we analyzed the number of pathway courses taken in year two of the RCT for students in classrooms of teachers in the first cohort of the study. We also looked for effects on attendance at school—a more distal measure of engagement—under the theory that higher engagement in coursework could induce students to attend class and school more regularly.

Randomization
Cohort 1 teachers were recruited during spring and summer 2021. Randomization occurred in October 2021. The randomization was slightly delayed in cohort 1 because schools were continuing to navigate the aftermath of the COVID-19 pandemic and Hurricane Ida. Randomization occurred at the school level. After recruiting teachers, one-half of represented schools were randomly assigned to one of two conditions: the offer of micro-credentials condition (the treatment group) or the business-as-usual condition (the control group). All teachers in a school followed the same condition to prevent within-school spillover. After randomization, cohort 1 teachers in schools randomized to the treatment group were given access to micro-credentials for two years (school years 2021–2022 and 2022–2023).

Cohort 2 teachers in additional schools were recruited during spring and summer 2022. The same school-level randomization occurred during September 2022. After randomization, cohort 2 teachers in schools randomized to the treatment group were given access to micro-credentials for one year (school year 2022–2023).

For both cohorts, schools were stratified by pathway provider (LSU, PLTW, OpenSciEd), and school-level baseline student academic achievement and randomization occurred within those strata. A total of 50 teachers in 39 schools were recruited into the study and randomized. The analytic sample focuses on 37 teachers and their students in 34 schools.8 Details on the scheme and the subsequent baseline balance of background characteristics are presented in Appendix B.

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7 All grade 11 students in Louisiana are required to take the ACT. The only high school science LEAP assessment is the biology end-of-course assessment. We did not include this assessment as an outcome because the micro-credentials focus on pathways that are less aligned with biology, and only a few OpenSciEd teachers taught biology.

8 Teachers were dropped from the analytic sample for three reasons. First, four teachers across four schools left prior to the end of the year and did not match with the administrative data. Two of these schools are still represented because other teachers in those schools were in the study. Second, the sample included magnet high schools that serve higher-achieving students. One stratum was removed to mitigate imbalance on baseline test scores. The three schools and six teachers in this stratum...
Table 1.3 shows the number and characteristics of schools, teachers, and students that were randomized in the analytic sample. The analytic sample contains a diverse set of students and teachers. A minority of students were female (36 percent) and White (44 percent), and a majority of students were considered economically disadvantaged (55 percent). Baseline standardized tests scores showed that the sample scored 0.466 standard deviations above the state mean. Teachers, on the other hand, were majority female (68 percent) and White (73 percent) with an average of 12 years of experience teaching.

Organization of the Remainder of the Report

The remainder of the report is laid out as follows. In Chapter 2, we describe the implementation of micro-credentials and compare teacher take-up of micro-credentials with the fidelity of the implementation threshold we established at the outset of the study. In Chapter 3, we present the results of the confirmatory questions of the RCT. In Chapter 4, we summarize the results and provide policy implications and recommendations. Appendix A includes the final codes used for our analysis of qualitative data, and Appendix B provides additional details on the RCT impact evaluation of micro-credentials.

were removed from the analytic sample in keeping with What Works Clearinghouse (WWC) guidelines. Third, two additional teachers in two cohort 1 schools joined the study with cohort 2. These teachers and their students are not included in the analysis because they are considered “joiners” by WWC standards. Although the second two reasons are not relevant to WWC attrition, the first reason does contribute to attrition. Appendix B details how each of the above restrictions affects the sample.
### TABLE 1.3
Sample Summary Statistics

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Randomized</th>
<th>In Analytic Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Student characteristics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>36.3</td>
<td>36.4</td>
</tr>
<tr>
<td>Black</td>
<td>43.7</td>
<td>42.2</td>
</tr>
<tr>
<td>White</td>
<td>43.4</td>
<td>43.5</td>
</tr>
<tr>
<td>Special education</td>
<td>2.7</td>
<td>2.4</td>
</tr>
<tr>
<td>English language learner</td>
<td>1.0</td>
<td>1.2</td>
</tr>
<tr>
<td>Economically disadvantaged</td>
<td>53.6</td>
<td>54.7</td>
</tr>
<tr>
<td>Standardized baseline math score</td>
<td>0.454</td>
<td>0.466</td>
</tr>
<tr>
<td><strong>Teacher characteristics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>67.4</td>
<td>67.5</td>
</tr>
<tr>
<td>Black</td>
<td>26.1</td>
<td>27.0</td>
</tr>
<tr>
<td>White</td>
<td>73.9</td>
<td>73.0</td>
</tr>
<tr>
<td>Greater than a bachelor’s degree</td>
<td>52.2</td>
<td>43.2</td>
</tr>
<tr>
<td>Years of experience</td>
<td>12.0</td>
<td>12.2</td>
</tr>
<tr>
<td><strong>Number of students</strong></td>
<td>1,917*</td>
<td>1,568</td>
</tr>
<tr>
<td><strong>Number of teachers</strong></td>
<td>46*</td>
<td>37</td>
</tr>
<tr>
<td><strong>Number of schools</strong></td>
<td>37*</td>
<td>34</td>
</tr>
</tbody>
</table>

* Indicates that four teachers in two schools were not matched with LDOE administrative data because they left early in the school year. Two of those four schools are represented by other teachers. A total of 50 teachers across 39 schools were randomized.
Implementation of Micro-Credentials

In this chapter, we focus on findings related to the implementation of micro-credentials. Specifically, we address the following research question: How were micro-credentials implemented and were they implemented as reflected by measures of intended fidelity? Our findings in this chapter build on those from our initial report, which included a summary of the implementation efforts of cohort 1 teachers during the 2021–2022 school year. As we described in that report (Kaufman et al., 2023), the project developers created 18 micro-credentials that reflect core teaching competencies in pre-engineering, CS, and DDEM. To examine whether the micro-credentials were implemented as intended, we and our project partners—LDOE, LSU, and BBI—identified four fidelity indicators at the beginning of the project that would reflect high-quality implementation of the micro-credential program (Table 2.1). As we discuss in this chapter, the first fidelity measure was later revised to one to two micro-credentials over the two-year period based on observation of the challenges that teachers experienced in completing micro-credentials and their reports of the work involved in doing so.

We organized this chapter into five sections, and our findings related to the fidelity indicators in Table 2.1 are woven into these five sections. In the first section, we discuss teachers’ progress toward earning micro-credentials, which addresses the first fidelity indicator. Specifically, we investigate the number of micro-credentials that participating teachers started, submitted, and earned. In the second section, we focus on teachers’ motivations for undertaking micro-credentials, the obstacles they encountered, and the facilitators that enabled progress on micro-credentials. In the third section, we provide a comprehensive analysis of teachers’ perceptions of micro-credentials, including their perceptions about the content of the micro-credentials. These findings provide insights into the second and third fidelity indicators, which are related to the alignment with and applicability of the micro-credentials to STEM courses (i.e., the second fidelity measure) and the extent to which micro-credentials provided teachers with opportunities to build a portfolio.

<table>
<thead>
<tr>
<th>Table 2.1</th>
<th>Louisiana STEM Micro-Credential Program Fidelity Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicator 1</td>
<td>Teacher progress toward earning micro-credentials</td>
</tr>
<tr>
<td>Indicator 2</td>
<td>Micro-credential alignment and applicability</td>
</tr>
<tr>
<td>Indicator 3</td>
<td>Learning opportunities through micro-credentials</td>
</tr>
<tr>
<td>Indicator 4</td>
<td>Opportunities for support</td>
</tr>
</tbody>
</table>

¹ Project partners later revised this measure to one to two micro-credentials over the two-year period.
of work, access collaborative discussions, and receive meaningful feedback (i.e., the third fidelity measure). In the fourth section, we discuss findings related to teachers’ perceptions of the supports that they were offered. This section provides insights into the fourth fidelity measure. In the fifth section, we conclude with teachers’ perceptions of the impacts of micro-credentials on their teaching and students’ learning.

**Teachers’ Progress Toward Earning Micro-Credentials**

In this section, we provide an overview of teachers’ progress toward earning micro-credentials during the 2021–2022 and 2022–2023 school years.

**Of the 23 teachers randomly assigned to complete micro-credentials, only four teachers earned one or more micro-credentials.** In Table 2.2, we summarize teachers’ activity on the BBI platform by semester (i.e., fall and spring) and the total number of teachers who submitted or earned micro-credentials by cohort. We identified “active” teachers as those who logged onto the BBI STEM micro-credential platform during the indicated time frame and completed one of the following actions: started or worked on a micro-credential, submitted a micro-credential, or earned a micro-credential. This table reveals several trends. First, participation fell off rapidly among teachers in both cohorts during their first year of participation, but especially among the members of cohort 2. Likewise, few teachers from cohort 1 worked on micro-credentials during the second year of the study. Second, the number of teachers who submitted or earned any micro-credential was low; in total, only six teachers submitted micro-credentials (i.e., submitters). Among the submitters, only four teachers earned micro-credentials (i.e., earners). Two cohort 1 teachers submitted micro-credentials but did not earn any micro-credentials. Among these teachers, one was no longer eligible for the study after the first year. Five teachers never started a micro-credential and 13 teachers started micro-credentials but did not submit or earn.

Out of the 18 micro-credentials that were available, teachers submitted and earned a total of seven unique micro-credentials. In Table 2.3, we list the specific micro-credentials that were submitted or earned by teachers during any year of the study. As Table 2.3 illustrates, all four earners submitted and earned micro-credential “1.2: Facilitating Project-Based Learning,” which was a requirement for teachers to advance to other micro-credentials. Of the four teachers who earned the PBL micro-credential, three were from cohort 1 and one was from cohort 2. Of the four earners, one earned four micro-credentials, two earned three micro-credentials, and one did not advance beyond PBL. All four earners taught pre-engineering courses and earned PBL during their first year of the study. Three of four earners were PLTW teachers. One earner taught in the LSU Pathways program. No DDEM or OpenSciEd teachers submitted or earned PBL or any other micro-credential.

**TABLE 2.2**

**Summary of Teachers’ Activity and Progress Toward Earning Micro-Credentials**

<table>
<thead>
<tr>
<th>Cohort</th>
<th>Number of Teachers</th>
<th>Activity in Year 1: 2021–2022</th>
<th>Activity in Year 2: 2022–2023</th>
<th>Number of Submitters and Earners</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Active in Fall</td>
<td>Active in Spring</td>
<td>Active in Fall</td>
</tr>
<tr>
<td>1</td>
<td>13</td>
<td>12 (92%)</td>
<td>7 (54%)</td>
<td>2 (15%)</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>N/A</td>
<td>N/A</td>
<td>6 (60%)</td>
</tr>
<tr>
<td>Total</td>
<td>23</td>
<td>N/A</td>
<td>N/A</td>
<td>8 (35%)</td>
</tr>
</tbody>
</table>

**NOTE:** N/A = not applicable. The table summarizes teachers’ activity on the BBI platform by year and cohort and by the number and percentage of teachers who submitted (i.e., submitters) or submitted and earned (i.e., earners) any micro-credentials in any year by cohort. Through its online platform, BBI was able to track participant actions such as logging in, accessing content, and submitting micro-credential content.
Project partners and participants agreed on the need for more-reasonable expectations for the number of micro-credentials that could be completed in a typical school year. Although the project partners originally set a goal for teachers to earn five to eight micro-credentials over a two-year period, no teacher met this threshold. As in any project that involves iterative design and the implementation of innovations, the project partners gained new perspectives on the feasibility of the initial objectives about the implementation of micro-credentials. Over time, the project partners concluded that it is more reasonable to expect that teachers can earn at least one to two micro-credentials over a two-year period. This is consistent with what teachers shared in the interviews about the number of micro-credentials that could reasonably be completed within a year. Three of the four teachers who earned micro-credentials said that two micro-credentials per year would be a reasonable expectation.

Main takeaways about teachers’ progress toward earning micro-credentials are highlighted in Box 2.1.

### TABLE 2.3
**Micro-Credential Titles by Number of Teachers Who Submitted and Earned**

<table>
<thead>
<tr>
<th>Level and Title</th>
<th>Year 1 2021–2022 (n = 13)</th>
<th>Year 2 2022–2023 (n = 23)</th>
<th>Total (n = 23)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Teachers Who Submitted</td>
<td>Number of Teachers Who Earned</td>
<td>Number of Teachers Who Submitted</td>
</tr>
<tr>
<td>1.2: Facilitating Project-Based Learning</td>
<td>5 (38%)</td>
<td>3 (23%)</td>
<td>1 (4%)</td>
</tr>
<tr>
<td>1.1: Developing Technical Reading and Writing Skills</td>
<td>0</td>
<td>0</td>
<td>2 (9%)</td>
</tr>
<tr>
<td>1.3: Discovering Computational Thinking</td>
<td>0</td>
<td>0</td>
<td>1 (4%)</td>
</tr>
<tr>
<td>2.1 Ensuring Ethics and Safety in Engineering</td>
<td>0</td>
<td>0</td>
<td>1 (4%)</td>
</tr>
<tr>
<td>2.2 Exploring the Engineering and Design Process</td>
<td>0</td>
<td>0</td>
<td>2 (9%)</td>
</tr>
<tr>
<td>3.2 Teaching the Foundations of 3D Modeling</td>
<td>0</td>
<td>0</td>
<td>1 (4%)</td>
</tr>
<tr>
<td>3.6 Teaching Basic Programming Skills</td>
<td>0</td>
<td>0</td>
<td>1 (4%)</td>
</tr>
</tbody>
</table>

**NOTE:** 3D = three-dimensional. The table shows the titles of the micro-credentials that were submitted and earned by year and overall. For a full list of micro-credentials that were developed as part of the Louisiana STEM Micro-Credentialing Project, please see our original report (Kaufman et al., 2023).
Motivators, Barriers, and Facilitators to Completing Micro-Credentials

In this section, we describe patterns that emerged during our analysis of teachers’ motivations for undertaking micro-credentials, the obstacles that got in their way, and the facilitators that enabled some teachers to make progress toward earning micro-credentials. The content in this section and the sections that follow is based on our analysis of teacher interview and survey data.

Motivations for Undertaking Micro-Credentials

Most teachers said that the main reason they were motivated to try micro-credentials was because they viewed them as an opportunity to improve their instructional practice. During our interviews, most teachers said that they opted into the micro-credentials project because they viewed micro-credentials as an opportunity to deepen or improve their instructional knowledge and STEM instructional practice. For example, two teachers said that they joined specifically because they wanted to learn how to better incorporate PBL into their instruction with students. Another teacher talked about the value of training and the perception that micro-credentials would make her a better teacher. As this teacher shared, “I [take] training whenever there is an opening. [To teach] engineering, I need to plan as much as I can. I was interested [in undertaking micro-credentials] because it would add value to my teaching to get more knowledge.”

Some participants said that the financial incentives were a motivator and affirmed that compensation throughout the study was important, although no one said that financial incentives were the main reason they joined the study. As one teacher explained, “I would be lying if I didn’t look at the money that could have been. But I wouldn’t say that was the only driving thing. I am a big fan of improving my craft. The idea of being able to, not having to pay for those [micro-credentials], and getting paid for those was a thing I was interested in.”

In response to our survey, most respondents agreed or strongly agreed that the professional and financial incentives for earning micro-credentials were compelling. Although we did not ask teachers on our survey about their primary motivations for joining the study, more than 75 percent of teachers agreed or strongly agreed that both the financial and professional incentives for earning micro-credentials were compelling (see Figure 2.1).

Notably, a substantial proportion of the teachers we surveyed (a little more than 20 percent) disagreed or strongly disagreed that the professional incentives were compelling. Indeed, because of the pilot nature of the micro-credential project, there were no tangible professional incentives for participating (e.g., license endorsements, rank changes, salary increases) beyond the promise of professional learning. As we learned during our interviews, a few teachers shared that one reason they joined the study was because they believed certification was important or they were curious about what future certification would entail. As one teacher clarified, The way it was explained to me [was] that [micro-credentials] were a way to see how they can certify student teachers with the subject areas they teach. . . . So, that kind of sparked my interest to see how they would go about showing a teacher or helping somebody learn how to teach that particular subject area.
Nearly all teachers indicated that getting a pay increase would motivate them in the future to try out micro-credentials. To understand ways to foster teachers’ progress toward earning micro-credentials, we asked teachers on our survey what would motivate them to try out micro-credentials in the future. Ninety-two percent of survey-takers said that earning a pay increase would motivate them “to a great extent” to undertake micro-credentials in the future (see Figure 2.2). In addition to intrinsic motivators, such as the desire to be a better teacher, the goal of creating better learning experiences for their students, and a love of learning, most survey-takers (62 percent) also said that the potential for a promotion would motivate them to complete micro-credentials in the future.

Barriers to Completing Micro-Credentials

Despite their initial interest in pursuing micro-credentials, only a few teachers successfully earned micro-credentials during the two years of the study. As we shared in our previous report, cohort 1 teachers encountered substantial barriers to working on micro-credentials during the 2021–2022 school year, including disruptions caused by the COVID-19 pandemic and Hurricane Ida. Likewise, many cohort 1 teachers reported not having enough time to work on micro-credentials. In this section, we supplement our previous findings by analyzing teacher-reported barriers to earning micro-credentials across the 2021–2022 and 2022–2023 school years using the data that we collected during interviews in both study years and the teacher survey data from spring 2023.

Our data confirmed that teachers struggled to find enough time to work on and plan for micro-credentials during both years of the study. When we asked teachers to describe the barriers to completing micro-credentials that they encountered, 86 percent of survey respondents reported that limited time posed a major or moderate obstacle to their completion of micro-credentials (see Figure 2.3). Likewise, during our interviews, most teachers expounded on how work-related commitments, including their teaching load and school events (e.g., prom, coaching, end-of-year exams) left them with limited time to work on micro-credentials. As one teacher from cohort 2 explained,

Initially, when [the project team] sent me the information about micro-credentials, it was before the class load sunk in. I didn’t know anything about what my workload would be like. I was very into it, into the idea.
I thought I would have as much free time as I had last school year. It did not turn out that way. I had no time to do the micro-credentials because I was working on something else. I didn’t start on one.

In addition to having limited time for micro-credentials, some teachers may have been unprepared for the time demands that are required to earn a micro-credential. As another teacher explained, “I think a lot of us were clueless about what [micro-credentials] would be like and the time commitment involved.” As illustrated by our survey results, certain micro-credential–related tasks may have been especially time intensive. For example, when teachers were asked about the barriers to their completion of micro-credentials on our survey, more than 35 percent described as a major or moderate obstacle the time involved to create videos and/or assemble a portfolio. During our interviews, in reference to building a portfolio, one cohort 2 teacher shared that

[j] it is not hard to collect the data, but it is kind of hard trying to get everything together in the way [the micro-credentials] are asking for when you have so many other things on your plate. . . . We are constantly busy, but that took a lot more effort.
One additional time-related challenge that some teachers highlighted during the interviews was the need to map out and align their instruction with the requirements for micro-credentials in advance. For example, one teacher noted, “One thing I found with micro-credentials, if I had organized myself earlier and planned beforehand, so I lined up my teaching content with micro-credentials, that would [have been] a wonderful thing.” These teachers noted that not being able to plan and pace their own classroom instruction with the micro-credentials that they wanted to work on delayed—or halted—their progress. However, teachers also did not consistently indicate a “best time” for starting micro-credentials. Depending on the teacher, some had more availability during the fall while others had less availability in the spring.

At least one-half of the teachers we spoke with struggled with the work required for micro-credentials, including encountering technical difficulties. At least one-half of the teachers we surveyed and one-half of the teachers we interviewed identified the work involved in completing a micro-credential as challenging. For example, one-half of the surveyed teachers reported that difficulties involved in creating or posting a video and/or creating a portfolio posed a major or moderate obstacle to their completion of micro-credentials (see Figure 2.3). Similarly, in the interviews, a few teachers commented on the difficulty of selecting artifacts from their practice to provide the evidence needed to demonstrate proficiency in micro-credentials they were working on. Some teachers also shared logistical issues they encountered as a barrier to progress toward
 earning micro-credentials. These issues included difficulties accessing support sessions and/or uncertainty about the expectations for earning. For example, one teacher from cohort 2 explained that they were unable to access the available support sessions, confused about expectations, and eventually unable to complete any micro-credentials.

Approximately one-quarter of surveyed teachers rated the response “micro-credential content is difficult or confusing” as a major or moderate obstacle to their completion of micro-credentials. Although we do not know from our survey which micro-credentials teachers were referring to, our platform data indicate that few teachers progressed past PBL. During our interviews, two teachers indicated that the “1.1 Developing Technical Reading and Writing Skills” micro-credential content was challenging and not particularly relevant for their instruction, two factors that contributed to a delay in their completion of micro-credentials. As one teacher explained, in reference to the technical reading and writing micro-credential, “I think I wasn’t as good at it. So, it was going to take new learning on my part and that was why I was stuck on it. I wanted to do it . . . but it was harder. My kids write stuff, but I wasn’t doing as many technical [writing] assignments.” Conversely, responses from two teachers, both non-earners, suggested that they became less interested in micro-credentials when they realized that the PBL micro-credential emphasized pedagogical approaches with which they were already familiar. Although some of the more content-rich micro-credentials focused on more-advanced micro-credentials in the developed series, some teachers may not have even been aware of those micro-credentials.

Although the COVID-19 pandemic had largely subsided by year two of the study, the impacts of Hurricane Ida and the global pandemic on some teachers’ ability to make progress may have lingered. As we described in our previous report, many of the cohort 1 teachers we spoke with in spring 2022 described large unforeseen obstacles, including illness from the COVID-19 pandemic and disruptions caused by Hurricane Ida, as barriers that were difficult to overcome. Although these teachers told us that they were still interested in completing micro-credentials, they did not—for reasons unknown—reengage during year two of the study. By comparison, teachers in cohort 2 did not report facing as many large unforeseen obstacles; although, one non-earner from cohort 2 did report contracting COVID-19 and trying to play catch-up as a result. As this teacher explained, “After [catching COVID-19], it just seems like it became overwhelming for me to try and complete a school year in addition to trying to get myself well [and] in addition to [completing] a micro-credential.”

Facilitators for Completing Micro-Credentials

In addition to understanding barriers that hindered the completion of micro-credentials, our analysis of the surveys and interviews provided further insights about the factors that facilitated the completion of micro-credentials during this study and the factors that might motivate teachers to complete micro-credentials in the future. We describe these below.

Teachers who successfully completed micro-credentials attributed their success to a variety of factors, including their prior knowledge of the content, and that earning became easier over time. All earners reported expert knowledge of their content, either from a previous STEM career or from many years of teaching relevant STEM courses. When we asked teachers who had earned micro-credentials (n = 4) about the reasons they were able to persist, two earners said that they were motivated by a desire to improve their respective teaching practices. The other two earners described their pride in earning multiple micro-credentials; one of these earners shared how experiencing early success with PBL contributed to her desire to earn more micro-credentials. One earner, a cohort 1 teacher, also said that the extra financial incentives offered during the second year of the study were a powerful motivator. Among the teachers who earned multiple micro-credentials (n = 3), two shared that earning micro-credentials became easier over time as they became familiar with the expectations for submitting and earning.
In addition to those factors, these teachers also shared certain circumstances that may have contributed to their success. First, two earners told us that, prior to joining this project, they had completed other micro-credentials through a separate LDOE initiative. Thus, compared with other teachers, these teachers may have had more-realistic expectations about the work involved to complete micro-credentials and the benefits. Second, three teachers who earned multiple micro-credentials adopted a similar approach to planning. Specifically, these earners (1) set goals about the micro-credentials they wanted to complete in the allotted time, (2) planned in advance the projects they could use to complete the micro-credentials, and (3) made sure the timing of micro-credentials coincided with the timing of relevant class projects. Although one teacher completed the micro-credentials one at a time, two earners told us it was easier to work on different chunks of multiple micro-credentials at the same time.

Main takeaways about teachers’ motivators, barriers, and facilitators to completing micro-credentials are highlighted in Box 2.2.

Teacher Perceptions of the Usefulness of Micro-Credential Content

As we explained in the introduction of this chapter, project partners identified two fidelity indicators that are directly related to teachers’ perceptions of micro-credential content. In this section, we present survey and interview results focusing on teachers’ perceptions of these key indicators of implementation, including the alignment and applicability of the micro-credential content and learning opportunities that were intended to improve teaching.

Alignment and Applicability of Micro-Credential Content to Teachers’ STEM Courses

In this study, we defined alignment as the compatibility of micro-credentials with teachers’ course objectives and applicability as the degree to which micro-credentials provided teachers with strategies, tools, and practices that they can use in the STEM courses they teach. Teachers’ perceptions on these topics were necessarily limited to the micro-credentials they attempted. We remind readers that few teachers progressed beyond the PBL micro-credential and that only three teachers attempted level 2 and level 3 micro-credentials beyond PBL. Thus, our ability to draw conclusions about teachers’ perceptions of micro-credential alignment and applicability were limited. With these caveats in mind, we present the following findings.

BOX 2.2

**Main Takeaways About Motivators, Barriers, and Facilitators to Completing Micro-Credentials**

Most teachers were motivated to try micro-credentials because they viewed them as an opportunity for professional growth. Nearly all teachers indicated that the promise of a pay increase could motivate them to try out micro-credentials in the future.

For many teachers, finding enough time was the main barrier to earning micro-credentials. Because of the ongoing demands of their job, most teachers struggled to find time to work on micro-credentials, even with additional incentives. Some teachers may have decided that, given the other demands on their time and the lack of a compelling professional incentive, micro-credentials were not worth the effort.

Teachers who successfully earned micro-credentials shared certain characteristics that appeared to facilitate their success. Earners set goals and mapped their content to micro-credentials in advance.
Nearly all survey respondents agreed that micro-credentials were at least moderately aligned with and moderately applicable to the content they taught in their STEM courses. On our survey, we asked all treatment teachers, regardless of their micro-credential progress, how well the micro-credential content they worked on (1) aligned with and (2) was applicable to the STEM courses they teach (see Figure 2.4). Among those that responded (n = 13), 93 percent indicated that STEM micro-credentials were at least moderately aligned with the content of the STEM courses they taught. Eighty-five percent of respondents said that the content of the STEM micro-credentials was moderately or totally applicable to the content of the STEM courses they taught.

Teachers’ views on alignment may have depended on a combination of factors, including (1) what courses they taught, (2) the micro-credentials they attempted, and (3) whether they had enough time to plan. Our interviews revealed several potential sources of variation in teachers’ perceptions of alignment. First, teachers’ responses indicated that their perceptions about alignment may have differed depending on the type of courses they taught (e.g., courses in the pre-engineering pathway or the DDEM pathway). For example, among the teachers who started PBL, most pre-engineering teachers—including all four earners—said that PBL aligned well with their courses. Comparatively, fewer DDEM teachers started working on PBL. However, of the two who did, one DDEM teacher told us that the content in the PBL micro-credential and the provided supports seemed less geared toward media arts teachers. Relatedly, teachers’ perceptions of micro-credentials may have also depended on the course they selected as their focal course. For example, one

FIGURE 2.4
Teacher-Reported STEM Micro-Credential Alignment with and Applicability to Teachers’ STEM Courses

![Diagram showing teacher-reported STEM micro-credential alignment with and applicability to teachers' STEM courses](image)

NOTE: The figure shows teachers’ responses (n = 13) to the following two questions: “Regardless of whether you have worked on any micro-credentials through the Louisiana STEM Micro-Credential Project, how (a) aligned and (b) applicable do you think the content of the STEM micro-credentials is with the content of the STEM courses you teach?” Teachers could select from the following responses: “not applicable,” “slightly,” “moderately,” or “totally.” Because of rounding, wedges might not sum to 100.
Implementation of Micro-Credentials

cohort 1 pre-engineering teacher shared that the PBL micro-credential did not align well with the amount of content this teacher needed to cover in robotics class or with this teacher’s preferred method for delivering that content. However, this teacher conceded that PBL may have been easier to implement in other classes. As this teacher explained, “If I was able to [do the micro-credential] with my bio kids, it would have taken me a nano-second to make a real-world project for them, that I know they would really get into.”

Second, our interviews revealed that teachers’ perceptions of micro-credential alignment may also have been influenced by the micro-credentials they attempted—or, more specifically—whether they progressed to level 2 and level 3 micro-credentials, which were focused on specific STEM content related to pre-engineering, DDEM, and CS. All three teachers who had earned level 2 or level 3 micro-credentials said that these micro-credentials aligned well with their courses. As one earner explained, “The 3D modeling [micro-credential] was exactly what I do.” With the exception of PBL, which all earners described as well aligned with their instruction, earners’ views on the alignment of the other level 1 micro-credentials were mixed. For example, among the four teachers who started working on micro-credential “1.1 Developing Technical Reading and Writing Skills,” only two successfully earned the micro-credential. The two teachers who did not earn this micro-credential said that they don’t do a lot of reading or writing in their pre-engineering courses, so they perceived this micro-credential as less aligned. Of those who were successful, one said that the content of this micro-credential was too basic for her students; however, it did align with the schools’ goals of fostering reading and writing overall.

Finally, teachers’ perceptions about alignment may also have been influenced by whether they had time to align micro-credentials with the courses they teach and, to some extent, their own creativity in doing so. During the interviews, several teachers, including all four earners, described their efforts to map out and align their content with micro-credential requirements in advance of teaching their courses. As one of the earners explained, all four of the micro-credentials she had completed had been “flexible” enough that she was able to align her instruction with the micro-credentials. In this teacher’s words, “I think as far as alignment goes, you can go with it across the board. It doesn’t have to be one subject area. We, as teachers, can figure out how it can align. Not in a bad way, but in a good way.” Another earner explained his struggle to align micro-credential content with his course content as a problem related to scheduling. As this earner explained, “I was trying to look through and plan my course material with these micro-credentials in mind, [so] that I [could] align them properly. One problem is, well, you have the freedom to continue doing what you are doing, but . . . the problem is they don’t run well timewise.”

Most teachers—and, particularly, the earners—we spoke with described specific learnings or elements from micro-credentials that they said were applicable to their teaching. Among those who commented on applicability during their interviews, most teachers—especially earners—responded positively, describing specific things from micro-credentials that they had applied to their teaching. For example, one teacher described specific strategies that he incorporated into his teaching, such as a note-taking guide from the 3D modeling micro-credential. This teacher said,

I’ve been teaching the “Intro to Engineering” class for seven or eight years, so it can be easy to just fall into doing the same project again and doing it in the same way. It did make me think about what I can do different and what I can do better, so it was really good in that way.

Some teachers described how micro-credentials mirrored their current or desired instructional style, which these teachers described as hands-on, student-centered, and student-led. As one teacher explained,

What it has done for me is refresh myself and critique myself and judge myself. When I went through these, I thought I needed to reactivate some things. I am looking in a different way. For example, the best practices you tend to forget. It is an awakening.
Other teachers in this group talked about how micro-credentials encouraged them to emphasize real-world practices with students (i.e., meeting deadlines, collaborating with peers), which they said made them applicable to their instruction. Other teachers talked about how micro-credential products and planning procedures were similar to or flexible enough for them to incorporate alongside their existing practices.

Our interviews with the teachers suggest that micro-credentials may be more applicable to teachers who have a background in the content area and are brushing up on pedagogy compared with teachers who are newer to the content and well versed in pedagogy. All four teachers who successfully completed micro-credentials—who also had relevant content knowledge—said that micro-credentials helped them refresh some aspects of their pedagogy. Those teachers acknowledged that teachers without background knowledge would likely struggle. Likewise, a few teachers with pedagogical knowledge—but not an industry background—said that micro-credentials were less applicable to them or were not what they were looking for; these two teachers did not complete any micro-credentials.

Opportunities for Professional Learning Provided in Micro-Credentials

The Louisiana STEM Micro-Credential Project developed micro-credentials as a way for teachers to demonstrate STEM content and pedagogical competencies. At the same time, one of the reasons teachers decided to undertake micro-credentials for this study was because they considered micro-credentials as an opportunity for professional learning. In this discussion, we explore what teachers said about the opportunities micro-credentials provided for professional learning, beginning with what teachers said during our interviews and followed by what teachers who had earned or worked on micro-credentials (n = 6) reported on the teacher survey.

Most teachers considered their experiences working on the micro-credentials as a form of professional development but different than typical professional development. Except for one teacher, who felt strongly about not framing micro-credentials as a form of professional development, most teachers considered micro-credentials as a form of professional development. These teachers commented on the self-paced and flexible nature of micro-credentials. One teacher said, “Yes [it is a form of] professional development, though it is laid back, on your own, personal inner drive.” Another teacher said,

We are already at school all day long. I don’t want to sit. I think the ease or the convenience, midnight, weekends. While you are grading. It is so convenient. It is not stressful by any means. You put the information in, you get feedback, and you revise it if you need to. Much easier than attending a PD [professional development] session.

On our survey, among teachers who reported working on micro-credentials (n = 6), including all four earners, one-third strongly agreed that the micro-credential program was more useful than other professional learning opportunities in which they have participated (Figure 2.5). On the basis of our data, we are unsure of the reference point teachers used to make this determination; however, during our interviews, some teachers mentioned an overall lack of STEM-specific professional learning opportunities for STEM teachers in their respective content areas.

Teachers resoundingly affirmed that working on micro-credentials gave them opportunities to reflect on their instructional practice, hone their existing skills, and identify best STEM practices. To understand how micro-credentials could support teachers’ professional learning, on our survey, we asked teachers who said they were actively working on micro-credentials (n = 6) about the learning opportunities provided by micro-credentials. As illustrated in Figure 2.5, although nearly all teachers agreed or strongly agreed that micro-credentials provided all the learning opportunities we asked about, a relatively higher proportion strongly agreed that micro-credentials provided teachers with opportunities to reflect on their practice,
honed their existing skills, and identify best STEM practices. In contrast, relatively fewer strongly agreed that micro-credentials helped deepen their STEM content knowledge or required them to gather evidence on their teaching practice. Seventeen percent of teachers disagreed that the micro-credentials helped them learn new skills, which was a sentiment echoed during our interviews. Two earners specifically commented on how the micro-credentials helped them develop their skills in teaching rather than deepening their content knowledge. One teacher said,

I think in order to get a really [good] grasp of the [micro-credential], you have to have some type of background in the area that you are teaching. For example, my background is engineering. I graduated in mechanical engineering, so I am familiar with a lot of the terminology that was used in [the micro-credentials]. So, I would say someone that is teaching [the] “Intro to Engineering” course or [the] “Robotics” course, I would tell them that it is very helpful to bridge the gap between actual engineering and learning about engineering. It was sets of how to teach it, basically.

Some teachers regarded micro-credentials more as an opportunity to demonstrate skills. Building off the findings above, during our interviews, a few teachers explained that, for them, the micro-credentials were less about learning new approaches, practices, or strategies but instead more of a process to help them demonstrate mastery of existing skills and competencies. As one teacher explained,

I felt like if I wasn’t good at these things, I wouldn’t be able to do it. Like if I was learning it and trying to do a [micro-credential], it would be a lot. . . . I wouldn’t recommend doing programing skills if you have

---

**FIGURE 2.5**

**Teacher-Reported Perceptions of Micro-Credential–Related Professional Learning**

The micro-credentials I have worked on have helped me hone my existing skills.

<table>
<thead>
<tr>
<th>Percentage of teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
</tr>
<tr>
<td>83</td>
</tr>
</tbody>
</table>

The micro-credentials gave me opportunities to reflect on my instructional practices.

<table>
<thead>
<tr>
<th>Percentage of teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
</tr>
<tr>
<td>83</td>
</tr>
</tbody>
</table>

The micro-credentials I have worked on have helped me identify best STEM practices.

<table>
<thead>
<tr>
<th>Percentage of teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
</tr>
<tr>
<td>67</td>
</tr>
</tbody>
</table>

The micro-credentials required me to apply what I learned to my teaching.

<table>
<thead>
<tr>
<th>Percentage of teachers</th>
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</thead>
<tbody>
<tr>
<td>Strongly agree</td>
</tr>
<tr>
<td>33</td>
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</tbody>
</table>

The micro-credentials helped deepen my STEM content knowledge.

<table>
<thead>
<tr>
<th>Percentage of teachers</th>
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</thead>
<tbody>
<tr>
<td>Strongly agree</td>
</tr>
<tr>
<td>33</td>
</tr>
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</table>

The micro-credentials required me to gather evidence on my teaching practice.

<table>
<thead>
<tr>
<th>Percentage of teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
</tr>
<tr>
<td>67</td>
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</tbody>
</table>

The micro-credentials I have worked on have helped me learn new skills.

<table>
<thead>
<tr>
<th>Percentage of teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
</tr>
<tr>
<td>67</td>
</tr>
</tbody>
</table>

The micro-credential program is more useful than other professional learning opportunities in which I have participated.

<table>
<thead>
<tr>
<th>Percentage of teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
</tr>
<tr>
<td>33</td>
</tr>
</tbody>
</table>

Note: The figure shows teachers’ responses (n = 6) to the following questions: “Based on your experience so far with the micro-credentials that you have worked on through the Louisiana STEM Micro-Credential Project, how much do you agree with the following statements about micro-credentials?” and “Please rate your level of agreement with the statements in the section below about the micro-credentials that you have worked on so far.” Participants could select from the following responses: “strongly agree,” “agree,” “disagree,” or “strongly disagree.” Because of rounding, bars might not sum to 100.
never taught programming. It will be tough to learn and do at the same time. It would be like taking the AP [Advanced Placement] test at the beginning of the class instead of the end.

The same teacher said that micro-credentials “felt like more of an assessment rather than a learning process.” For another teacher, micro-credentials were not what she expected; she said, “Whatever it is, I thought we would learn about that concept and apply it to that lesson. But—if this was taking what you already knew and making new lesson plans—I already kind of do that.” This teacher went on to explain that what she was hoping for was more opportunities to learn new skills and knowledge that would help her explain challenging topics to her students in a content area that she was relatively unfamiliar with.

Teachers’ responses to our survey (n = 6) provided additional insights about teachers’ perceptions of micro-credentials as a way to demonstrate mastery of learning (Figure 2.6). Specifically, 83 percent of teachers agreed or strongly agreed that the STEM micro-credentials they worked on allowed them “to earn recognition for skills mastered” and “reflected competency in specific skills.” However, 17 percent of teachers said that they were unsure how to respond to these questions.

The teachers we interviewed derived various benefits from their experiences with creating a portfolio, engaging in reflection, and the feedback that they received during their work on micro-credentials. Some teachers commented on how micro-credentials provided them with feedback that helped them reflect on their practice. One teacher, for example, said, “It challenged me to reflect and ask myself. Do they get it? What can they do better?” Another teacher said, “It made me stop and think about how I presented things to students.” All three teachers who commented on feedback they received as part of a micro-credential submission described it as helpful but for different reasons. One teacher thought that the feedback that she received helped her recognize how to provide better feedback to her students. Another teacher noted that feedback was helpful to correct things in her submission rather than learning new things; this teacher said, “It was more like ‘you needed to talk about this, but you never talked about that,’ which is helpful in terms of earning the micro-credential but not learning new skills.” Finally, some teachers commented on their experience with creating a portfolio, expressing varied, but mostly positive, feelings. For example, one of the teachers said that creating a portfolio was somewhat useful; she used it as evidence for her professional growth at school.

Main takeaways about teachers’ perceptions of the usefulness of micro-credential content are highlighted in Box 2.3.

FIGURE 2.6
Teacher-Reported Perceptions of Micro-Credentials as an Assessment

![Bar Chart]

NOTE: The figure shows teachers’ responses (n = 6) to the following question: “Based on your experience so far with the micro-credentials that you have worked on through the Louisiana STEM Micro-Credential Project, how much do you agree with the following statements about micro-credentials?” Participants could select from the following responses: “strongly agree,” “somewhat agree,” “somewhat disagree,” “strongly disagree,” or “not sure.”
Implementation of Micro-Credentials

Teacher Perceptions of the Supports Offered for Implementing Micro-Credentials

Teachers had access to three main supports to help them work through micro-credentials. These supports included (1) an orientation and a six-session training series hosted by BBI personnel (i.e., Success Academy), (2) weekly office hours and one-on-one support from LSU personnel, and (3) in-platform supports, including resources and activities within the micro-credentials. In the remainder of this section, we summarize teachers’ perspectives about the various supports they received. These findings provide insights into the fidelity indicator related to the supports teachers were offered to complete micro-credentials.

Although most teachers said that they appreciated BBI and LSU support personnel, relatively few teachers accessed the supports that were available to them. As we noted in our earlier report, most of the teachers we spoke with acknowledged and appreciated the support they were offered throughout the study. However, attendance logs from the various sessions offered by BBI and LSU, including Success Academy sessions and office hours, reveal that few teachers took advantage of these supports. During the first year of the study, cohort 1 teachers attended an average of two Success Academy sessions per teacher out of six sessions, with a range from 0 to 4 sessions. Cohort 2 teachers averaged less than one Success Academy session each, with most teachers attending no sessions. Likewise, relatively few teachers attended weekly office hours, for which we have records only for the second year of the study. During year 2, of the six cohort 1 teachers remaining in the study, only three teachers (all earners from the previous year), attended any session out of 40 possible sessions. Similarly, out of ten cohort 2 teachers, only three attended any session each out of 26 sessions.

Among those that did access BBI and LSU supports, teachers provided mixed feedback about the value of those supports. Survey responses indicated that all teachers found the Success Academy sessions they participated in valuable or extremely valuable (see Figure 2.7). However, interviewees provided a slightly more nuanced picture of teachers’ perceptions of these sessions. First, at least one-half of the teachers we interviewed shared that they were unable to attend or did not wish to attend any or most Success Academy sessions. Second, most teachers who attended were ambivalent about the degree to which they found Success Academy content supportive of their work on micro-credentials, although a few mentioned specific aspects of the Success Academy that were helpful. These specific aspects included (1) learning how the platform worked and (2) providing set-aside time to work on micro-credentials.
Of those who reported participating in LSU-led supports on our teacher survey, most (67 percent) said that LSU-led micro-credential office hours were valuable or extremely valuable in supporting their work on micro-credentials. Likewise, one-half said that one-on-one sessions with LSU staff were valuable or extremely valuable in supporting their work on micro-credentials. Moreover, the few teachers we interviewed who attended these sessions also commented on their usefulness. As one teacher explained,

I did some of the weekly meetings with [personnel from LSU] to work on different things. She also read over some of my micro-credentials because I submitted them just to make sure that I [had my] wording right. [This was] very, very helpful. She was always there. Every time I emailed her, she emailed me right back. So, I really appreciated how we were able to collaborate and talk with each other about different things.

Teachers were mostly positive about the in-platform supports they received, including assessor feedback and other resources within the micro-credential platforms. In addition to the supports from BBI and LSU, the micro-credential platforms contain elements that are intended to assist users with completing the various requirements for earning micro-credentials. To further understand which aspects of the micro-credential platforms were most supportive, we asked teachers about the extent to which they agreed or disagreed about the clarity or helpfulness of specific components of those platforms (see Figure 2.8). Overall, the teachers who responded to these items provided resoundingly positive feedback.

Teachers said that working with a cohort or peer group on the micro-credentials and having more time for advance planning may have helped them make more progress. We did not ask teachers on our survey about supports that might be useful if micro-credentials are offered in the future. However, during our interviews, some teachers suggested that working on micro-credentials with a group of teachers who are “all working on the same thing” may be useful. As one teacher explained, “Teachers would do well if they
work together as a group. Just that moral support.” Another said, “[I was] definitely by myself. The curriculum specialist knew I was doing this but offered zero support. That would have helped, to have been paired with someone.”

Additionally, some teachers said that it would have been helpful if they had gotten time to work with support staff before the school year to learn about the requirements for micro-credentials and/or to map out their content in advance of the school year, so that it aligned with the timing for micro-credentials. As one teacher said,

If we had some of these sessions before the school year, that would have been good too. Maybe [they could have provided] a bulleted list of, like, you are going to have to record a lesson, you are going to have to come up with a super collaborative hands-on activity.

Main takeaways about teachers’ perceptions of supports offered for implementing micro-credentials are highlighted in Box 2.4.
Perceived Impacts of Micro-Credentials on Teaching and Learning

The findings presented in this section focus on teachers’ perceptions of the impacts of micro-credentials on their teaching and on students’ learning. In Chapter 3, we will focus on quantitative measures of impact drawn from student outcome data.

All responding teachers who attempted micro-credentials perceived a positive impact from micro-credentials on their practice. On our teacher survey, 100 percent of the responding teachers who had worked on micro-credentials (n = 6) agreed or strongly agreed that working on micro-credentials (1) had a positive impact on their practice as educators and (2) made them feel more confident in their instruction (see Figure 2.9). Most respondents in this group (87 percent) also said that they likely or definitely will apply the knowledge and skills they learned through micro-credentials to the STEM courses they teach in the future (not shown).

Our interviews with teachers revealed consistent patterns with the survey results. Among those who commented on their perceptions of how micro-credentials affected their teaching (n = 8), most teachers told us...
that micro-credentials helped them improve some aspect of their instructional practice. For example, at least two teachers shared that micro-credentials required them to “slow down” and think about their practices, which then resulted in their taking more time to monitor closely their students’ learning. Although most teachers acknowledged that micro-credential content served more as a refresher for the approaches or strategies they already knew, they also said that micro-credentials were a good reminder of ways they can better support student learning. As one teacher explained, “It brought me back to best practices, how to connect with the students. As a longtime teacher, you know, I should be doing that.”

More than one-half of teachers—and all four earners—we spoke with described one or more improvements they made to their practice. One earner shared how the feedback she received from BBI prompted her to provide her students with more-varied forms of feedback during class, including the use of rubrics and more written feedback. Another earner talked about how micro-credentials made him reconsider using scaffolds and incorporating more student choice into his curriculum. A third said that micro-credentials made him realize that there were other ways of having students document their work and/or describe what they are doing. Finally, two teachers said that participating in micro-credentials helped them improve their ability to plan and implement lessons, which included the use of new strategies to ensure better student learning.

Like alignment and applicability, teachers’ perceptions of the impacts of micro-credentials may have differed depending on the content they taught and how far they progressed through the micro-credentials. Teachers’ responses consistently suggested that their perceptions of impacts differed depending on what content they taught. For example, on the teacher survey, nearly all teachers who had worked on micro-credentials reported that working on micro-credentials prepared them to teach courses related to 21st-century skills (i.e., employment skills and skills needed for success in the “the real world”) and engineering-related content (see Figure 2.10). Fewer teachers said that micro-credentials prepared them to teach DDEM-related or CS-related content. Of note, the only teachers in our sample who progressed past PBL were pre-engineering teachers who took level 2 and level 3 micro-credentials in pre-engineering; thus, those teachers’ perceptions were skewed toward engineering preparation compared with other subject areas.

During our interviews, a few pre-engineering teachers specifically described how micro-credentials helped them align their instruction with practices they said aligned with what would be expected of students in the real world. For example, a few teachers shared how in the real world, where students would be working with clients, they would be expected to work autonomously, be results-driven, and meet deadlines—skills they said they implemented with students during PBL. Referencing the class project they implemented to fulfill the requirements for PBL, one teacher explained,

> It was around Christmas. I told them we were going to do something outside [our normal curriculum]. . . . I said that it will be fun. “You will create your own Christmas light design.” Like, if the mayor walked in and said, “Hey, I want you to design a new light display to hang downtown. You have the autonomy to put together whatever you want.” The kids took off the ground with it. . . . So, I think it helped them think more about why it was being done, how it was being done, and that [there needed to be] follow-through with it. A lot of times in project work, they don’t know what the end result could [possibly] have been. The end result, in the real world, would be whether their customer is satisfied.

**On our survey, teachers were positive about the impacts of micro-credentials on student learning.** In response to our survey, all teachers said that they agreed or strongly agreed that their work toward earning micro-credentials positively affected student learning. However, during our interviews, only a few teachers were able to provide explicit connections between their work on micro-credentials and their students’ learning. Of those that commented on student impacts during our interviews, some said that the projects students completed during their micro-credential submissions increased student engagement and enjoyment of the curriculum. For example, one or two said that their work on micro-credentials resulted in students making
FIGURE 2.10
Teachers’ Perceptions About How Well Micro-Credentials Prepared Them to Teach Courses in Their Respective Content Areas

NOTE: The figure shows teachers’ responses (n = 6) to the following question “How much has working on micro-credentials prepared you to teach courses related to the following content?” Teachers could select from the following responses: “prepared me to a great extent to teach this,” “prepared me somewhat to teach this,” “prepared me a little to teach this,” “did not prepare me at all,” “not applicable because I do not teach this course and/or do not anticipate teaching it.”

more real-world connections and taking more initiative in their classwork. Another teacher said that working on micro-credentials helped this teacher’s students realize that even their teachers are still learning, which this teacher said students appreciated. On the other hand, a few teachers noted that they had not yet noticed direct impacts of micro-credentials on their students.

Main takeaways about teachers’ perceived impacts of micro-credentials on teaching and student learning are highlighted in Box 2.5.
BOX 2.5

Main Takeaways About Perceived Impacts of Micro-Credentials on Teaching and Student Learning

Teachers, who attempted or earned micro-credentials perceived positive impacts on their instructional practices but had less to say about impacts on their students. Although for some teachers who had prior relevant pedagogical knowledge and experiences, micro-credentials helped refresh what they already knew; for other teachers, micro-credentials helped introduce new pedagogical approaches and strategies.
Impact of the Offer of Micro-Credentials on Student Outcomes

The implementation findings in Chapter 2 indicate that teachers who engaged with micro-credentials reported that the process helped improve their instruction. That said, teachers did not make many clear connections between their work on micro-credentials and student achievement. In this chapter, we report the results from the RCT, which was designed to empirically test whether the offer of micro-credentials affected teacher practice and student outcomes. We report on the following research questions:

1. What is the effect of the offer of micro-credentials on student achievement in math and science after one year? (Confirmatory)
2. What is the effect of the offer of micro-credentials on student attendance and future pathways course-taking after one and two years? (Exploratory)

We focus on student-level academic outcomes and proxy measures of student engagement as measured by pathway course-taking and student attendance. Our confirmatory research question focuses on one-year academic outcomes, when both cohorts of teachers can contribute to the estimate. Our exploratory analyses of student course-taking and attendance focus on one-year and two-year estimates. Two-year estimates may be most relevant for course-taking, which often is planned during the prior school year. In all cases, only the first cohort of teachers can contribute to two-year estimates. Additional details on the RCT, baseline balance, and additional exploratory results are presented in Appendix B.

Effect of the Offer of Micro-Credentials on Student Academic Outcomes

Pathway courses teach math and science concepts that high school students are expected to master through courses that are aligned with such science fields and careers as pre-engineering. Recall from Chapter 1 that math outcomes were either the algebra I end-of-course LEAP assessment, the geometry end-of-course LEAP assessment, or the math section of the ACT. We combined these assessments into one composite measure of math achievement by standardizing scale scores within the statewide cohort of students taking the exam in a given year. In other words, we standardized the data by test year. Our measure of science achievement is the science section of the ACT. In Louisiana, all grade 11 students are expected to take the ACT. Our sample is substantially smaller for this outcome because it is restricted to one grade. Table 3.1 shows the results, which are expressed in standardized effect units (Hedges g), a measure that can help compare our estimates with others found in the literature. The estimates represent the difference in outcomes between students in classrooms that were assigned micro-credentials and students in classrooms that were assigned to the business-as-usual condition.

We found no detectable effects of the offer of micro-credentials on math or science achievement after one year. All estimates are small in magnitude and statistically insignificant. Table B.6 in Appendix B also
shows that, for cohort 1 teachers, there are no detectable effects on these outcomes after two years. The lack of effects may be explained by the limited engagement of teachers with micro-credentials.¹

**Effect of the Offer of Micro-Credentials on Student Course-Taking and Attendance**

Effects on student academic achievement can be seen as more-distal outcomes occur as a result of changes in teacher instruction and potentially student engagement with the course material. The COVID-19 pandemic hindered efforts to obtain direct measures of these outcomes.² We analyze effects on student course-taking and attendance as proxy measures of student engagement. Student course-taking is a count of the number of pathway courses a student enrolled in during a given academic year, and attendance is the percentage of school days a student was marked as having attended. If micro-credentials improved teaching and learning in pathway courses, students may have been induced to take more pathway courses and attend school more regularly.

Table 3.2 shows the effects of the offer of micro-credentials on these outcomes, with each estimate representing the difference in the outcome between the students of teachers who were provided access to micro-credentials and the students of teachers who were not provided access to micro-credentials. The effects are expressed in standardized effect units (Hedges $g$) to aid the comparison of the results with other studies.

We found no detectable effects of the offer of micro-credentials on student course-taking or attendance after one year or two years. The coefficients on attendance in both years are relatively small and insignificant. The coefficient on the year 1 attendance estimate implies that students instructed by a teacher in the treatment group attended school 1.26 fewer days, and the coefficient on the year 2 attendance estimate implies

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¹ Table B.6 in Appendix B presents the first stage during which assignment to treatment predicts a student being in a classroom where a teacher earned at least one micro-credential. Estimates from the regression are between 10 and 12 percentage points and not statistically significant. The F-statistic is around 2 and is below the generally accepted threshold of 10 for a strong instrument. This analysis highlights the fact that limited engagement with micro-credentials is likely driving the null results.

² Recall from Chapter 2 that we measured teacher instruction via teacher logs and student attitudes toward STEM via student surveys. We had a substantial imbalance between treatment and control teacher responses on the log, and the limited sample precludes the use of such techniques as propensity score weighting to correct for the imbalance. Meanwhile, a small subset of students participated in the survey. See Appendix B for more details.
that students instructed by a teacher in the treatment group attended 0.36 more days. The estimates for course-taking are larger but noisy. A potentially meaningful increase in course-taking in year 1 is followed by a larger negative estimate in year 2. Neither of these estimates are significant. Students took between one and three pathway courses a year. The coefficient on the year 1 estimate implies that the students taught by teachers in the treatment group took about 0.063 more pathway courses, while the coefficient on the year 2 estimate implies that students in classes taught by teachers in the treatment group took about 0.35 fewer pathway courses. The imprecision of the estimates, as well as the inconsistency in direction across years, precludes us from making inferences on the potential effect of the offer of micro-credentials on this outcome. Our results, therefore, indicate there was no detectable effect of the offer of micro-credentials on student course-taking and attendance.

**Summary of Impact Findings and Limitations**

Overall, we did not detect an effect of the offer of micro-credentials on student achievement in math and science or on attendance and student pathway course-taking. These results are consistent with the implementation findings that show that few teachers meaningfully engaged with micro-credentials. Limited engagement with micro-credentials would, therefore, provide limited opportunities for teachers to change their instruction, which in turn would provide limited opportunities to change student outcomes. We discuss implications and recommendations in Chapter 4.

There are important limitations to the impact study. First, the COVID-19 pandemic not only affected teachers’ ability to engage with micro-credentials, it also increased the difficulty of collecting more-proximal measures of micro-credentials on teaching and learning. Specifically, the study gathered more-proximal measures through teacher logs (daily reports from teachers on their instruction through short surveys) and student surveys. Such measures could have gleaned information about specific teaching practices that could

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3 In a robustness specification, in which the sample is limited to students who have math outcomes (1,200 students), the effect on course-taking is slightly higher and significant at the 5 percent level (coefficient = 0.256; standard error = 0.125; \( p = 0.049 \)). The year 2 estimate is slightly less negative and remains insignificant. Because the estimate in the first year is not robust, we do not make firm inferences that the micro-credentials increased course-taking in the first year. All other academic and non-academic results in the main body and in Appendix B are robust in both samples. All other results are of similar magnitude and remain insignificant.
have been affected by the micro-credentials and measures of student engagement. However, these data could not be collected with adequate sample sizes to provide clear evidence of impact.

In the absence of such measures, we are left to rely on proxy measures of student outcomes gleaned from state administrative data. These proxy measures are likely less sensitive than survey questions, which can probe engagement more directly. We also cannot speak to changes in teacher instruction in the absence of teacher logs.

Furthermore, these micro-credentials were created to align with the content of Louisiana High School STEM Pathways courses, which focus on math and science related to the identified pathways. No statewide assessment of academic knowledge specific to the content of the pathways was available. We thus focused on statewide assessments of math and science. Although many of the math and science topics embedded in these pathways were likely to be present in the assessments, the assessments also likely contained many other science and math topics that are not covered in the pathways. The more-limited alignment of the assessments with the content of the pathways could have limited our ability to detect the effects of the offer of micro-credentials on academic achievement.

Finally, the smaller-than-anticipated number of teachers who joined the study reduced our ability to detect meaningful effects. Although the null results here are likely driven by the lack of engagement of teachers with micro-credentials, we describe the power of the study to detect effects in greater detail in Appendix B.
Conclusion and Lessons Learned

This report is the second of two reports that presents analysis of the design, implementation, and impact of the Louisiana STEM Micro-Credentialing Project. These micro-credentials were intended to be aligned with the skills and knowledge provided by the Louisiana High School STEM Pathways program, which support teachers’ learning to teach in high school course pathways for pre-engineering, CS, and DDEM. Several micro-credentials were applicable to similar pathway courses offered in the state of Louisiana and other high-quality science curricula, such as those offered through OpenSciEd.

The Louisiana STEM Micro-Credential Project is among the first to rigorously study every step of the micro-credential creation and execution process, from the conceptualization of micro-credentials to an RCT evaluation of their potential effects on teacher and student outcomes. LDOE undertook this effort as one of many avenues to expand science curriculum offerings in the state and to ensure that classes are taught by teachers who can demonstrate mastery in teaching STEM Pathways course curricula.

In this chapter, we synthesize the results based on our study on the implementation of the micro-credentials that were developed as part of the Louisiana STEM Micro-Credentialing Project and on the impacts that the offer of micro-credentials had on teacher and student outcomes. We then share implications and recommendations for policymakers and practitioners, as many at the state and local level are considering adopting micro-credentials or continuing with their current efforts at leveraging micro-credentials. Finally, we note limitations of the study.

Summary of Findings

Teacher Engagement with Micro-Credentials Was Relatively Low

Across both cohorts of teachers in the RCT, most of those who were randomly assigned to work on micro-credentials showed initial interest that quickly faded. Although 78 percent of teachers started at least one micro-credential, only 26 percent submitted one or more micro-credentials and only 17 percent earned at least one micro-credential. Few teachers from cohort 1 reengaged with any micro-credentials in the second year of the RCT. The patterns in teachers’ progress toward earning micro-credentials led project partners to amend the initial goal for teachers to earn five to eight micro-credentials over the two study years. The project partners determined that the completion of one to two micro-credentials would have been a more reasonable goal. This pattern of teachers being initially receptive to the concept of micro-credentials but less consistently engaging with them when given the opportunity is a recurring theme in many micro-credentialing efforts (Borrás-Gené, 2018; Dyjur and Lindstrom, 2017; Rieder, 2022).

Teachers expressed many reasons for their interest in trying out micro-credentials, including professional development, financial incentives, and possible professional incentives. However, many teachers could not complete the process to earn micro-credentials. The biggest barrier to micro-credential completion expressed by teachers revolved around time: both the time commitment micro-credentials demanded and the lack of time teachers had during the school day. Although time was noted as the main barrier, almost all teachers...
agreed that a permanent raise in pay associated with completing micro-credentials would be a powerful motivator to try micro-credentials in the future.

On the basis of the insights from teachers who were able to make progress toward earning micro-credentials, important facilitators for micro-credential completion likely include a strong command of relevant content knowledge and a deliberate planning process that aligns the work and needs of the micro-credentials with teachers’ course content and timing. Teachers who were successful in earning micro-credentials reiterated the previously mentioned motivations, including the desire for professional learning and a financial incentive.

**Teachers Provided Mixed Feedback About the Micro-Credentials’ Value as Professional Development and the Accompanying Supports but Largely Saw the Micro-Credentials as Aligned with Their Courses**

Despite limited engagement with micro-credentials, the vast majority of teachers expressed that micro-credentials were moderately or completely aligned with their courses. Sources of variation in these perceptions were based on the courses the teachers taught, the micro-credentials they attempted, and, more specifically, whether they progressed to level 2 and level 3 micro-credentials. Teachers who progressed to level 2 micro-credentials, which cover more subject-specific content, expressed a perception that the micro-credentials were more aligned with the courses they taught.

Additionally, although the micro-credentials were designed to operate as a form of credentialing so that teachers could demonstrate their competency in several areas of STEM instruction, no official credentials were offered through the study because the study was intended by the state to be a test of those micro-credentials. Therefore, for most teachers, micro-credentials did not present anything beyond an opportunity for professional learning, albeit one that differed from typical professional development. Teachers expressed that micro-credentials were more of a self-paced and job-embedded version of professional development that provided avenues for reflection on their teaching. There was also a sense that this type of professional development was better suited to learning and honing pedagogy as opposed to learning content knowledge. A few teachers who were successful in earning micro-credentials credited their content knowledge as a facilitator of their success.

Finally, the supports available to teachers to help them complete the micro-credentials received mixed reviews. Platform-embedded supports, such as resources embedded in the micro-credential platform and feedback from BBI raters, were positively received. Across the survey results and interviews, teachers provided mixed feedback about the value of the supports through the Success Academy and the weekly help sessions hosted by LSU. Many teachers had difficulty attending synchronous sessions because of scheduling constraints. Some teachers expressed that being part of a more cohesive cohort or peer group could support their progress toward earning micro-credentials. The more informal cohort structure leveraged by BBI during the study suggests that cohort models may need to be more intentionally developed and structured to achieve this goal.

**Teachers Perceived Some Impacts from the Micro-Credentials on Their Teaching, Although the Study Showed No Impacts on Objective Student Outcome Measures**

Although a limited number of teachers engaged with micro-credentials, almost all teachers we interviewed who had started at least one micro-credential expressed some indication that engaging in micro-credentials supported their instructional practices. Specifically, these teachers shared that micro-credentials helped them reflect deeply on their practices and were a good reminder of best instructional practices. In some instances, micro-credentials encouraged teachers to experiment with new teaching strategies, such as providing stu-
Conclusion and Lessons Learned

Students with more feedback or implementing new methods for notetaking with students. That said, teachers had less to say about the effect of micro-credentials on their students. Although a few teachers reported direct impacts on students as a result of the micro-credential process, others did not observe any effects on students.

The RCT analysis did not detect effects from the offer of micro-credentials on student outcomes. Estimated effects on proxies for engagement, such as pathway course-taking and attendance, were small and insignificant, as were effects on math and science standardized test outcomes. An important limitation to the RCT is that increased collection of direct measures of student engagement via student surveys and of teacher practices via logs were hampered by the COVID-19 pandemic. Furthermore, because pathway courses are a unique context through which to teach science concepts, the content of the available standardized tests are not as aligned with the content of the pathway courses that are intended to be aligned with the micro-credentials. Therefore, the pathway course might not be expected to reflect any impacts of micro-credentials. Nevertheless, the lack of detectable effects is perhaps not surprising given the limited engagement of the teachers with micro-credentials.

Implications and Recommendations for Policy and Practice

This study has some implications and recommendations for policymakers and practitioners, especially given ongoing efforts among states and other organizations to create and implement micro-credentials. We organize these implications and recommendations around the three broad, interrelated themes for those developing or implementing micro-credentials to consider and articulate: goals for micro-credentials, demands of micro-credentials on those who intend to undertake them, and the value proposition for completing micro-credentials. In the following discussion, we envision interested stakeholders who may want to consider these recommendations as micro-credential developers, state and district leaders who may implement micro-credentials, and researchers.

Identify and Communicate the Goals of Micro-Credentials as They Are Being Developed and Implemented

Education leaders must think critically about the goals of micro-credentials because of the breadth of their possible uses (Tooley and Hood, 2021a). In our study, project partners articulated the goal of developing micro-credentials for teachers to demonstrate particular STEM teaching competencies. Yet, the micro-credential testing phase did not provide policy-connected incentives (e.g., permanent pay raises or credit toward licensure or certifications) for teachers to demonstrate those competencies, which might have contributed to low recruitment and micro-credential low completion. Additionally, teachers perceived micro-credentials as a unique type of job-embedded professional development, particularly around pedagogical knowledge and practice. To maximize teachers’ motivation to take micro-credentials and the ability to test the impact of micro-credentials, those developing, testing, or implementing micro-credentials should keep in mind the following:

- **Clearly communicating the goals of micro-credentials to teachers will help teachers decide whether to engage with micro-credentials.** Teachers noted that unclear micro-credential goals, in this study and others (Diamond and Gonzalez, 2014; Stefaniak and Carey, 2019), contributed to a lack of continued investment in earning micro-credentials. Articulating clear goals to teachers, such as the professional benefits they should expect to accrue from completing micro-credentials, can help teachers make informed decisions on whether micro-credentials fit with their career goals.
• Teachers may perceive micro-credentials as a form of job-embedded professional development, even in instances when micro-credentials are used as a form of credentialing. Even in instances when micro-credentials are communicated as a form of credentialing, teachers may also see a professional development opportunity in completing them. The format of micro-credentials in this study contained features that teachers regarded as an opportunity for professional development, such as reflection on practice. The micro-credential supports that are provided, the expected micro-credential effects, the micro-credentials’ purpose, and communication about micro-credentials to teachers should all take into consideration the possibility of this dual role of micro-credentials as both a mechanism for professional development and a form of credentialing.

• Identify policy goals first and plan backward to identify the role of micro-credentials. When conceptualizing the role of micro-credentials, stakeholders can first identify the policy outcome of choice and then work backward to design and deploy the micro-credentials. This approach may help clearly communicate the purpose and benefits of micro-credentials to educators.

Provide Information to Schools and Teachers About the Demands of Micro-Credentials and Take Steps to Minimize Those Demands

Although micro-credentials are meant to focus on one skill at a time, the requirements to complete micro-credentials can nevertheless be substantial. Although the Louisiana Micro-Credential Project partners originally estimated that participants in the study might complete up to eight micro-credentials over two years, the partners quickly realized that the demands on teachers’ time made those expectations unrealistic. Stakeholders should accurately estimate the time needed to complete a micro-credential and consider what is feasible for teachers given their professional demands. Furthermore, stakeholders should consider the following:

• Providing time and space for teachers to engage with micro-credentials during the school day can minimize the burden of completing micro-credentials. Districts and schools can help teachers carve out time during the school day to plan the activities, assemble the portfolios of evidence, and respond to the feedback needed to complete micro-credentials. In the current structure of their workday, we found that many teachers were unable to take on these additional demands while juggling their responsibilities as teachers. Additionally, ensuring strong alignment of micro-credentials with teachers’ courses can minimize the time needed to plan and execute the work of micro-credentials.

• Asynchronous supports may be more effective than scheduled, synchronous supports. Teachers in the study almost universally agreed that the asynchronous supports embedded in micro-credential platforms and in the form of feedback from BBI assessors was helpful for completing micro-credentials. Teachers often did not attend synchronous supports, which may be ill suited because of teachers’ busy and variable schedules.

• Cohort models may be effective in supporting teachers’ work on micro-credentials. During our interviews, a few teachers shared that they would have appreciated the opportunity to work through micro-credentials with other teachers from their district or school. Intentionally developed and structured cohort models could provide a built-in support system and a mechanism to promote better accountability.

• Teachers may only be able to complete a few micro-credentials per year. In this study, it quickly became apparent that teachers would be unable to complete five to eight micro-credentials over two years, as initially anticipated. The slower pace of micro-credential progress has been seen in other efforts as well (Diamond and Gonzalez, 2014; Roy and Clark, 2019; Stefiak and Carey, 2019). This study indicates that a more-reasonable expectation, given the constraints the teachers faced, was one to two micro-credentials per year.
Critically Examine the Value Proposition That Micro-Credentials Afford Teachers

The demands of micro-credentials and the anticipated benefits of earning micro-credentials figure into the cost-benefit calculations that teachers make when choosing to attempt and complete micro-credentials. Clearly defining and communicating the goals of micro-credentials to teachers can help; however, stakeholders should also consider how to provide and communicate to teachers a wider array of professional and other benefits of completing micro-credentials. Some examples include the following:

- **More-tangible and more-permanent career benefits may provide a stronger motivation to engage with micro-credentials.** Teachers in our study indicated that our substantial financial incentives (up to almost $3,000 depending on the number of micro-credentials competed) and the desire to learn and improve professionally were both motivating factors to engage with micro-credentials. However, these incentives ultimately did not provide enough motivation for the vast majority of teachers participating in the project to complete micro-credentials. For many teachers, more-tangible and more-permanent career benefits, such as pay increases, might have been strong motivators to engage in the work. Efforts in Florida, where micro-credentials are being used to fulfill some licensure requirements (Lastinger Center for Learning, undated), and in Kentucky, where micro-credentials can lead to rank changes (Teach Tech Kentucky, undated), are linking micro-credentials to more-permanent career benefits, which may encourage greater uptake of micro-credentials.

- **Providing teachers with a choice among micro-credentials may help maximize the value proposition.** Our study findings suggest that the requirement to start with the PBL micro-credential might have been limiting for some teachers. Providing teachers more flexibility to choose among the micro-credentials offered and the order in which they can be completed may promote more engagement, maximize the alignment of micro-credentials with teachers’ contexts, and maximize the value of micro-credentials for teachers. Policymakers, however, may need to reconcile this type of flexibility with the goals of micro-credentials, such as using micro-credentials to satisfy licensure requirements, which may require teachers to demonstrate mastery in specific skills.
APPENDIX A

Qualitative Codes: Definitions and Examples

Table A.1 includes the final codes used for our analysis of qualitative data. The table includes the code, its final definition, and some examples of text excerpts to which each code was applied. For each example excerpt, other codes could have been applied to the text in addition to the code used in the example.

<table>
<thead>
<tr>
<th>Code</th>
<th>Definition</th>
<th>Example Excerpt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher motivation and progress toward completing micro-credentials</td>
<td>Comments about why teachers opted into taking micro-credentials and factors that contributed to their interest</td>
<td>• “Another reason why I did it was because . . . I [previously] participated in a different thing, which was also BBI—I thought it was a good experience in general. It was the mentoring [micro-credential], with future mentors.” • “I thought it was interesting and would be a good learning experience. I thought it would help me with project-based learning.”</td>
</tr>
<tr>
<td>Teacher motivation and progress toward completing micro-credentials</td>
<td>Comments related to teachers’ progress toward earning micro-credentials, including how teachers paced themselves and their timelines for starting, submitting, and earning</td>
<td>• “For each step they asked us to do something, I made sure that I understood the question, I made sure that I was able to make application, and I made sure that I was able to execute what they were asking me to do. So, the way that I paced myself, I had to first understand every part of the question before I began to answer the question. So, that’s how I paced myself.”</td>
</tr>
<tr>
<td>Teacher motivation and progress toward completing micro-credentials</td>
<td>Comments about factors that limited progress to complete micro-credentials</td>
<td>• “So, I initially, when they sent me the information about MCs [micro-credentials], it was before the class load sunk in. I didn’t know anything about what my work load would be like. I was very into it, into the idea. I thought I would have as much free time as I had last school year. It did not turn out that way. I had no time to do the MCs because I was working on something else. I didn’t start on one. I had never had the access point in my personal life to do.” • “Yes, [COVID-19] was very much the only reason why I was not able to complete it because once I became sick with COVID, it just took a lot out of me. To get back well was a struggle and so, I was not able to complete it. Like I said, I do enjoy PBL.”</td>
</tr>
</tbody>
</table>
Table A.1—Continued

<table>
<thead>
<tr>
<th>Code</th>
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<th>Example Excerpt</th>
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<tr>
<td><strong>Teacher motivation and progress toward completing micro-credentials</strong>&lt;br&gt;• Facilitators to completing micro-credentials</td>
<td>Comments about factors that facilitated completion of micro-credentials</td>
<td>• “The thing that I was stuck on was I didn’t have access to all of them right away. I got stalled on the Technical Reading and Writing one. I didn’t make much progress on that. When I got access to all of them, when I could pick and choose the ones that fit with what I was doing, it went fast. With the 3D modeling and the programming, these are the things I teach, and so it was quicker to do them.”&lt;br&gt;• “I think really—if not for financial incentive, I don’t know if I would have. That was big. They came and said, ‘We have a new enhanced system’ and bumped up the amount—once I saw that, I was like ‘OK fine, I’ll do it.’ Being so busy with a full teaching load, it is hard to find time. You have to do certain things before you start the project or you won’t get the right work samples and things. That was a big part of it. I do feel accomplished. I am proud of having done three of them. I have seven total now. These last two were the only two I got on the first attempt. Every one of the others, I had to fix things. I got better at reading the rubric closely and knowing what they were looking for.”</td>
</tr>
<tr>
<td><strong>Teachers’ perceptions</strong>&lt;br&gt;• Perceived purpose of micro-credentials</td>
<td>Teachers’ understanding of the purpose of micro-credentials</td>
<td>• “From what I gathered, it was just a way to take mini-little courses to get trained in things that were not super important, [not things] to take a whole big course about but [were] also important to know. Take small doses to get trained and have those credentials that could help you with a résumé or job application or moving forward. That is what my idea of it was. But, I could get to it.”</td>
</tr>
<tr>
<td><strong>Teachers’ perceptions</strong>&lt;br&gt;• Micro-credential content&lt;br&gt;• Alignment of micro-credential content with courses</td>
<td>Teachers’ perceptions about how well the micro-credentials they worked on aligned with their course content</td>
<td>• “Yes. Once I got access to all of them—the 3D modeling was exactly what I do. My introduction to engineering course, CAD [computer-aided design]—so, it is a lot of 3D modeling. With the programming skills, even though I am not teaching computer science, we still do robotics in the class. I also do after-school robotics. So, I had the knowledge from doing that. If it was just a physics teacher or something, they would be capable of doing it, but it wouldn’t be as easy.”</td>
</tr>
<tr>
<td><strong>Teachers’ perceptions</strong>&lt;br&gt;• Micro-credential content&lt;br&gt;• Applicability of micro-credential content to instruction</td>
<td>Teachers’ perceptions about the degree to which the micro-credentials they worked on were applicable to their instruction</td>
<td>• “I had a hard time doing the whole project. So, in [Introduction] to Robotics, I have kids who have never touched a tool in their life, all the way up to some of the advanced robotics kids that I work with on my team. So, I found it hard to do something real-world for them when each unit was very specific on what they needed to learn in order to further their design and their programming. So, that was really hard to put it into that context.”&lt;br&gt;• “I would say a good bit of it [was applicable]. It made me stop and think about how I presented things to students. If I said I needed to videotape something for class. They were like, ‘Oh yes, what do I need to do?’ Then, they would start getting their hair ready. But I think they really enjoyed how some of this stuff was presented to them. It is very applicable. They enjoyed it. It really brought some skills out in them that they didn’t know they had.”</td>
</tr>
<tr>
<td>Code</td>
<td>Definition</td>
<td>Example Excerpt</td>
</tr>
<tr>
<td>------</td>
<td>------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Teachers’ perceptions • Micro-credentials as an innovation</td>
<td>Teachers’ perceptions about the usefulness of micro-credentials as a tool to support teachers’ learning or professional growth and whether they would recommend micro-credentials to their colleagues</td>
<td>• “The only thing I would say is, don’t try to do one that is totally new. If you are looking at it, and it is more aspirational. If you have been doing PBL, then that will be fine. I wouldn’t recommend doing programing skills if you have never taught programing. It will be tough to learn and do at the same time. It would be like taking the AP [Advanced Placement] test at the beginning of the class instead of the end.” • “I’m not getting my credential in an entire content area. I’m getting to specialize in a content area that I see as a means to bringing more STEM education into my own teaching and my own programs. And I think there are a lot of areas in Louisiana where I can guarantee that teachers aren’t, even nowadays, aren’t thinking 100 percent STEM and how everything is changing. I think they would be really important. And again, to be able to specialize in a smaller content area and many different ones is very appealing to myself. I think it would be very appealing to many teachers, especially if it’s a doable thing and it doesn’t become this crazy thing that sometimes happens in education.”</td>
</tr>
<tr>
<td>Teachers’ perceptions • Number of micro-credentials possible per year</td>
<td>Teachers’ perceptions about the number of micro-credentials they believed it would be possible for teachers to complete each year</td>
<td>• “If I have to do all of this stuff and teach all of my classes, one. I suppose that would be a good goal.” • “I think it really depends. If I was new to teaching something, I don’t know if it would be overwhelming to do one. If it was something I was already teaching and just kind of was adapting a few things and doing the writing . . . I did two this year, that was doable. When we first started, I probably said I could do three to four. I would change that. Two would be a reasonable number. It isn’t that I don’t have the time. It is the planning; it is tough to make sure you are doing the right things. I might get into a project, and then look at it, and ‘Oh, if I would have done it that way . . . then I could have used it—but now I need to pick a new project.’”</td>
</tr>
<tr>
<td>Teachers’ perceptions • Suggestions, considerations, and future motivators</td>
<td>Comments about what teachers’ thought was missing from their micro-credential experience and suggestions about changes that would increase their interest in taking micro-credentials in the future</td>
<td>• “I think the main thing is more content for the teachers to go through and learn. More readings, add videos. I didn’t feel like that supported in terms of . . . It felt like more of an assessment rather than a learning process. If that is what is meant to be, cool. But, I think it would improve if there was more opportunity to learn new stuff. If it was stuff I knew, I could skip it. If there was something that I was learning, having some readings or videos would be good.”</td>
</tr>
<tr>
<td>Impacts of micro-credentials • Instruction</td>
<td>Comments from teachers about how micro-credentials affected their teaching and planning</td>
<td>• “I think it’s made me more aware that I need to keep everything relevant to my kids.” • “Having to, I guess, create different techniques of how to work with the kids outside of what I typically do. Coming and reading and researching which technique would be best for managing activities. What are some techniques that other teachers are doing. So, doing that kind of helped, it changed my outlook on having them doing projects because everything was project- based design. It was a lot of different strategies that I was able to implement, and this program helped me to see the other strategies.”</td>
</tr>
</tbody>
</table>
Table A.1—Continued

<table>
<thead>
<tr>
<th>Code</th>
<th>Definition</th>
<th>Example Excerpt</th>
</tr>
</thead>
</table>
| Impacts of micro-credentials  
• Students | Comments from teachers about how their participation in micro-credentials may have affected their students and/or student learning | • “I don’t know how much impact it’s had this far [on students], since it’s been mostly on my end—it’s all still in the plan out stage.”  
• “Yes. I think it helped them realize there are end results, not just because the teacher says so. If they realize there is a true end result that could impact them or their business, there is that end result.” |
| Micro-credential opportunities for learning  
• Micro-credentials compared with other professional development | Comments about how micro-credentials compared with traditional professional learning | • “It was similar to national board certification. I did feel like some of it would be hard if they were new to teaching the subject. In that way, it was like national board—because they don’t let you apply until you have taught like the last three years or something. That applied here too.”  
• “Oh yes, it should be a form of PD [professional development], by far yes. PD helps us to understand what best practices are. When we get to our best practices, if we are able to have someone come and give us more information on how to get to best practices, that’s always a great addition to education.” |
| Micro-credential opportunities for learning  
• Micro-credential–specific opportunities provided for learning | Comments from teachers about the types of learning opportunities they had access to through micro-credentials and how these influenced their learning (or not) | • “Yes, I did develop a portfolio about my teaching practices and, yes, I find it quite useful. When you do a portfolio, you get to see a body of work and when you show somebody a body of work, then, that’s something that everyone can look at and say, ‘Oh wow, this is a body of work.’ That’s what I think the portfolio did.”  
• “The feedback was helpful in the sense that they said exactly what to do in order to fix what wasn’t right—but it wasn’t helpful in, like, there was a misconception I had they were correcting. Does that make sense? It wasn’t like my answer was wrong and they were like ‘In order to learn the correct answer, go here.’ It was more like ‘You needed to talk about this, but you never talked about that’—which is helpful in terms of earning the [micro-credential], but not learning new skills.” |
| Supports for teachers completing micro-credentials  
• Engagement with and perception of supports | Comments about the kinds of support teachers accessed during their work on the micro-credential, including the feedback they received and teachers’ perceptions of that support | • “Right. I think the biggest thing was limitation—they were available at four o’clock. That’s just the worst time. [Did someone give you contact information you could reach out to?] I did—they said you could log on and attend Zoom sessions. Four o’clock, couldn’t make it. So, I felt like I didn’t have any support.”  
• “We had weekly Zoom meetings we could go to, there was even a financial incentive. I never did. I do robotics after school. The timing wasn’t good. But, I don’t think people utilized it. My thought was just speculating on other people, I am very busy with the classes I teach. I also do the after-school stuff. I think a lot of people are in the same boat. It is hard to add another thing. We could have—if we made the time.” |
<table>
<thead>
<tr>
<th>Code</th>
<th>Definition</th>
<th>Example Excerpt</th>
</tr>
</thead>
</table>
| Supports for teachers completing micro-credentials  
  • Supports that would be useful | Comments about supports that would have been useful, had they been offered | • “I think they would be more useful if they were tailored to specific people in the program. For instance, if I did the first step and submitted it, someone reviewed it, and then a personal Zoom where the person says, ‘I’ve seen you’ve done this, that, and the other, and this is where you can improve.’ Does that make sense? I don’t know if it’s possible, but even if we all had one person who was the manager of a subgroup who could look over what they submitted and help them along.”  
  • “It would have been helpful to have at least one other colleague from another school. We could have done breakout groups in those online sessions and talked more specifically about what those lessons would look like.” |
APPENDIX B

Additional Impact Study Details

In this appendix, we provide additional details on the RCT impact evaluation of micro-credentials. We describe the independence of the RCT, the teacher logs and student surveys, the statistical models and baseline balance for the confirmatory student outcomes, the results of the student survey analysis that was not included in the report because of low response rates, and the results from the exploratory research questions.

Randomized Controlled Trial Design and Independence

The RCT was designed and executed by RAND researchers. LDOE took the lead in recruiting two cohorts of high school STEM pathways teachers throughout the state of Louisiana. As stated in Chapter 1, RAND researchers independently executed a block, clustered RCT. For each cohort, teachers were recruited from throughout the state. One-half of the schools represented in the sample were then randomly assigned to a treatment condition or a control condition, with all teachers in a building experiencing the same experimental condition to prevent any spillover. Schools were organized into ten blocks that were created from within the pathways program and by prior year student achievement data gathered from publicly available data sources on the LDOE website. On average, each of the ten blocks contained four schools and five teachers. As stated in Chapter 1, RAND researchers obtained detailed administrative data from LDOE on teachers and students and were solely responsible for collecting the teacher logs we describe below. RAND researchers and partners from LSU administered a student survey—LSU partners administered the survey to LSU pathway teachers, and RAND researchers administered the survey to PLTW and OpenSciEd teachers. All data analysis was done independently by RAND researchers.

Teacher Logs and Student Surveys

Teacher Logs

To understand how teaching practices may be affected by micro-credentials, we fielded baseline and end line teachers logs. We fielded logs in fall 2021, 2022, and 2023. In each year, teachers were given four weeks to complete ten logs. Teachers were asked to pick a focal class (e.g., introduction to engineering design) and were asked to complete a log after each day’s lesson in that focal class. The log first asked teachers to provide information on the students in the class. The log then asked teachers what sources they used for lesson planning and the extent to which micro-credentials helped in their lesson planning (this latter question was asked of treatment teachers only). Teachers were then asked to indicate whether certain micro-credential–aligned topics were among the two topics taught in the day’s lesson and, if so, how much time was spent on those topics. For each of the topics selected, teachers were presented a series of questions detailing the frequency of specific pedagogical practices associated with the topic. Finally, we asked teachers to indicate how often they had engaged in 24 more-general science pedagogical practices. The questions were adapted from the 5Essentials Survey and the Measuring Science Instructional Practice survey (Bryk et al., 2010). Fall 2021 logs
were meant to serve as baseline logs for cohort 1 teachers. Fall 2022 logs were meant to serve as year 1 outcome logs for cohort 1 and as baseline logs for cohort 2. Fall 2023 logs were meant to serve as year 1 outcomes logs for cohort 2 and year 2 outcomes for cohort 1. All logs were fielded within one month after randomization. During that period, treatment teachers were orienting themselves to the micro-credential intervention.

Student Surveys of Attitudes Toward Math and Science
To understand the effect of the offer of micro-credentials on these student outcomes, RAND researchers and project partner LSU fielded a student survey. Included in the survey were questions from the Student Attitudes Toward STEM survey (Faber et al., 2013), the Development of STEM Career Interest survey (Kier et al., 2014), and Panorama Education surveys of attitudes toward teacher instruction (Panorama Education, 2015). We averaged items within developer-validated domains to provide measures of interest in math or science careers, interest in math and science course-taking, self-efficacy in math and science, and perceptions of teacher instruction. LSU worked with teachers in school years 2021–2022 and 2022–2023 to survey students at the beginning and at the end of their pathways courses. RAND researchers worked with project partner PLTW and OpenSciEd teachers in those years to survey their students at the beginning and at the end of the relevant courses.

Analysis of Student Data
Statistical Model
The random assignment of micro-credential access and supports results in unbiased estimates of the effects of the micro-credential offer on teacher and student outcomes. To estimate the effect on student level outcomes, we used models of the following form:

\[ Y_{ipsbt} = \beta_0 + \beta_1 MC_{sbt} + X_{ipsbt}\beta_2 + W_{psbt}\beta_3 + \gamma_b + \epsilon_{ipsbt} \] (1)

where \( Y_{ipsbt} \) is the relevant outcome for student, \( i \) taught by teacher, \( p \) in school, \( s \) nested in randomization block \( b \). The subscript, \( t \), indicates whether it is a first-year or second-year outcome. \( MC_{sbt} \) is an indicator for school, \( s \) being assigned to offer micro-credentials. \( X_{ipsbt} \) is a vector of student characteristics, \( W_{psbt} \) is a vector of student-level characteristics aggregated to the teacher level, \( \gamma_b \) are block fixed effects, and \( \epsilon_{ipsbt} \) is a stochastic student-level error term. Student characteristics included in the model (individually and aggregated to the teacher) are student grade, baseline attendance rate, baseline cumulative GPA, student achievement on a baseline standardized math assessment, indicator for being economically disadvantaged, gender, indicators for identifying as Black or White, indicator for special education status, and number of disciplinary infractions at baseline. In all models, standard errors are clustered at the school level.

Standardization of Achievement Variables
As stated in Chapter 1, the baseline student assessment was the student’s grade eight math LEAP score or, for students in grade eight in spring 2020, their grade seven math LEAP score. Because the analytic sample contains students in different grades, student baseline scores were standardized to the state sample by grade. Also, as stated in Chapter 1, a student’s outcome math academic achievement assessment was either the algebra I or geometry end-of-course test or the math portion of the ACT. Each assessment was standardized by the cohort of students in the state who took the assessment in a given year. Our measure of science achievement is the science section of the ACT, which is only taken by grade 11 students.
Baseline Variable Imputation
Because our main student outcomes were derived from LDOE administrative data, the amount of missing baseline data was minimal. Baseline LEAP math scores had the greatest amount of missing data, with 4.5 percent of the sample missing cumulative GPA. We replaced each baseline variable that had missing baseline data with the sample average of the variable and included an indicator for the missing baseline variable in our models as covariates. This method is an acceptable baseline data imputation method set forth by WWC. We do not impute missing outcome variables.

Baseline Balance and Attrition for Student Outcomes
Baseline Balance
Tables B.1 through B.3 present the baseline balance for student outcomes and Table B.4 presents the baseline balance for teacher outcomes. We present means and standard deviations by treatment status, raw differences, and standardized differences. Standardized differences in continuous variables are expressed as Hedges $g$ and standardized differences in binary outcomes are expressed as a Cox index. We used formulas from the WWC’s Procedures and Standards Handbook, version 5.0, to calculate standardized effect sizes (Institute of Education Sciences, 2022). These sample sizes differ because imputed baseline data were not used in determining baseline balance. As per WWC requirements, no standardized difference was greater than 0.25 and all variables are included as control characteristics, even if the standardized difference is less than 0.05.
### TABLE B.1
Baseline Balance, Student Sample

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control Condition</th>
<th>Treatment Condition</th>
<th>T-C Diff.</th>
<th>Standardized Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Schools</td>
<td>Number of Students</td>
<td>Mean</td>
<td>Standard Deviation</td>
</tr>
<tr>
<td>Baseline math achievement</td>
<td>15</td>
<td>554</td>
<td>0.34</td>
<td>0.99</td>
</tr>
<tr>
<td>Grade</td>
<td>16</td>
<td>922</td>
<td>10.10</td>
<td>0.97</td>
</tr>
<tr>
<td>Baseline attendance rate</td>
<td>16</td>
<td>891</td>
<td>0.94</td>
<td>0.08</td>
</tr>
<tr>
<td>Baseline disciplinary infractions</td>
<td>16</td>
<td>922</td>
<td>0.15</td>
<td>0.57</td>
</tr>
<tr>
<td>Baseline GPA</td>
<td>13</td>
<td>493</td>
<td>3.10</td>
<td>0.74</td>
</tr>
<tr>
<td>Female</td>
<td>16</td>
<td>917</td>
<td>0.38</td>
<td>0.49</td>
</tr>
<tr>
<td>Black</td>
<td>16</td>
<td>917</td>
<td>0.46</td>
<td>0.50</td>
</tr>
<tr>
<td>White</td>
<td>16</td>
<td>917</td>
<td>0.39</td>
<td>0.49</td>
</tr>
<tr>
<td>Special education</td>
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<td>917</td>
<td>0.02</td>
<td>0.15</td>
</tr>
<tr>
<td>Economically disadvantaged</td>
<td>16</td>
<td>917</td>
<td>0.58</td>
<td>0.49</td>
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</tbody>
</table>

**Note:** T-C Diff. = treatment to control difference. Features statistics derived from administrative data provided by LDOE. The sample includes all students in the analytic sample for all non-test score outcomes. Standardized differences are expressed in Hedges g for continuous measures and Cox indexes for binary measures.

### TABLE B.2
Baseline Balance, Student Sample, Math Outcomes

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control Condition</th>
<th>Treatment Condition</th>
<th>T-C Diff.</th>
<th>Standardized Difference</th>
</tr>
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<tr>
<td></td>
<td>Number of Schools</td>
<td>Number of Students</td>
<td>Mean</td>
<td>Standard Deviation</td>
</tr>
<tr>
<td>Baseline math achievement</td>
<td>15</td>
<td>554</td>
<td>0.34</td>
<td>0.99</td>
</tr>
<tr>
<td>Grade</td>
<td>15</td>
<td>698</td>
<td>10.23</td>
<td>1.02</td>
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<tr>
<td>Baseline attendance rate</td>
<td>15</td>
<td>674</td>
<td>0.94</td>
<td>0.07</td>
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<tr>
<td>Baseline disciplinary infractions</td>
<td>15</td>
<td>698</td>
<td>0.16</td>
<td>0.60</td>
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<tr>
<td>Baseline GPA</td>
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<td>3.11</td>
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<tr>
<td>Female</td>
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<td>0.36</td>
<td>0.48</td>
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<tr>
<td>Black</td>
<td>15</td>
<td>693</td>
<td>0.46</td>
<td>0.50</td>
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<tr>
<td>White</td>
<td>15</td>
<td>693</td>
<td>0.38</td>
<td>0.49</td>
</tr>
<tr>
<td>Special education</td>
<td>15</td>
<td>693</td>
<td>0.03</td>
<td>0.16</td>
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<tr>
<td>Economically disadvantaged</td>
<td>15</td>
<td>693</td>
<td>0.56</td>
<td>0.50</td>
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</table>

**Note:** T-C Diff. = treatment to control difference. Features statistics derived from administrative data provided by LDOE. The sample includes all students in the analytic sample for math outcomes. Standardized differences are expressed in Hedges g for continuous measures and Cox indexes for binary measures.
### TABLE B.3
Baseline Balance, Student Sample, Science Outcomes

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control Condition</th>
<th>Treatment Condition</th>
<th>T-C Diff.</th>
<th>Standardized Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Schools</td>
<td>Number of Students</td>
<td>Mean</td>
<td>Number of Schools</td>
</tr>
<tr>
<td>Baseline math achievement</td>
<td>13</td>
<td>175</td>
<td>0.67</td>
<td>1.08</td>
</tr>
<tr>
<td>Baseline attendance rate</td>
<td>13</td>
<td>252</td>
<td>0.94</td>
<td>0.06</td>
</tr>
<tr>
<td>Baseline disciplinary infractions</td>
<td>13</td>
<td>263</td>
<td>0.16</td>
<td>0.73</td>
</tr>
<tr>
<td>Baseline GPA</td>
<td>12</td>
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<td>3.20</td>
<td>0.76</td>
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<td>Female</td>
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<tr>
<td>Black</td>
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<td>Special education</td>
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<tr>
<td>Economically disadvantaged</td>
<td>13</td>
<td>258</td>
<td>0.49</td>
<td>0.50</td>
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</table>

**NOTE:** T-C Diff. = treatment to control difference. Features statistics derived from administrative data provided by LDOE. The sample includes all students in the analytic sample for science outcomes. Standardized differences are expressed in Hedges $g$ for continuous measures and Cox indexes for binary measures. Grade balance not shown because all students who take the ACT are in grade 11.

### TABLE B.4
Baseline Balance, Teacher Sample

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control Condition</th>
<th>Treatment Condition</th>
<th>T-C Diff.</th>
<th>Standardized Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Schools</td>
<td>Number of Teachers</td>
<td>Mean</td>
<td>Number of Schools</td>
</tr>
<tr>
<td>Years of experience</td>
<td>15</td>
<td>18</td>
<td>13.04</td>
<td>9.86</td>
</tr>
<tr>
<td>Female</td>
<td>15</td>
<td>18</td>
<td>0.74</td>
<td>0.45</td>
</tr>
<tr>
<td>Black</td>
<td>15</td>
<td>18</td>
<td>0.22</td>
<td>0.42</td>
</tr>
<tr>
<td>White</td>
<td>15</td>
<td>18</td>
<td>0.78</td>
<td>0.42</td>
</tr>
<tr>
<td>Masters or above</td>
<td>15</td>
<td>18</td>
<td>0.61</td>
<td>0.50</td>
</tr>
</tbody>
</table>

**NOTE:** T-C Diff. = treatment to control difference. Features statistics derived from administrative data provided by LDOE. The sample includes all teachers in the analytic sample. Standardized differences are expressed in Hedges $g$ for continuous measures and Cox indexes for binary measures.
Attrition for Student Outcomes

The use of LDOE administrative data help minimize attrition. As stated in Chapter 1, there are three sources of attrition from the administrative data: (1) four teachers who did not match with the administrative data because they left early in the year, (2) six teachers in a block that was eliminated because it showed substantial imbalance, and (3) two teachers who joined in the second year of the RCT in schools randomized in cohort 1 (i.e., joiners). Although the first source of missing data on teachers counts as attrition, the second does not because the elimination of the schools was based on a baseline variable (blocks), and the third does not because the WWC considers the inclusion of teacher joiners as high risk for bias.

Table B.5 presents the total number of schools, teachers, and students randomized in the study, the number that remain after removing teachers and students who do not count toward attrition, and the number of remaining teachers and students who matched with LDOE data. The fourth column presents the total number of teachers and students who are present, accounting for those missing from our main outcome of interest—standardized test scores in math.¹

We calculate attrition as the difference between the number of schools (clusters) and students in rows 3 and 4 for the attendance and course-taking outcomes and rows 3 and 5 for the math outcomes in the respective panels. At the school (cluster) level for attendance and course-taking outcomes, overall attrition is 5.6 percent and differential attrition is 0.6 percent. At the student level, overall attrition is 13.0 percent and differential attrition is 3.2 percent. At the school (cluster) level, overall attrition is 8.3 percent and differential attrition is 6.5 percent for the math outcomes and overall. At the student level, overall attrition is 25 percent and differential attrition is 4.2 percent.

Statistical Power of the Study

As stated in the “Summary of Impact Findings and Limitations” section of Chapter 3, the smaller number of teachers in the study than anticipated hindered our ability to detect meaningful effects. Originally, the project aimed to recruit 106 teachers and assumed that about two teachers would be present in a school for a total of 50 schools in the sample. We also assumed about 72 students per school for a total sample size of 3,640 students. Under the assumption of a two-tailed test, a 5 percent probability of Type I errors, an intra-class correlation of 0.05, covariates accounting for 60 percent of the variance in the outcome at the student level and school level, and 13 blocks of four schools, we estimated that we would be able to detect a minimum effect of 0.13 standard deviations in student outcomes and 0.41 standard deviations in teacher outcomes.

The final sample was composed of 37 teachers in 33 schools, teaching 1,568 students. Using the same assumptions with 10 blocks of three schools and 48 students per school yields a minimum detectable effect size of 0.19 standard deviations in student outcomes and 0.53 standard deviations in teacher outcomes. Although the final sample was less than half the original sample, the power was hindered to a smaller extent because the teachers were spread out among a larger number of schools than anticipated and the power of a study with school-level randomization is primarily derived from the number of schools.

¹ Students in the analytic samples are those who were present in the October data pull from LDOE.
Additional Impact Study Details

Additional Results

First Stage

Because of the limited engagement of teachers with micro-credentials, we present models that show the effect of being assigned to the treatment group on the probability of a student being taught by a teacher who completed at least one micro-credential. This can be thought of as the first stage that tests the strength of randomization as an instrumental variable. Models in this regression take the same form as the equation, except $Y_{ipds}$ is an indicator variable for whether a student was taught by a teacher who completed at least one micro-credential. Table B.6 shows the results for the non-test score and math outcomes samples. The results show that assignment to the treatment condition predicts about a 10 to 12 percentage point increase in being taught by a teacher who completed at least one micro-credential. Importantly, the estimates are not statistically significant and the F-test of the strength of the instrument is around 2, far short of the accepted threshold of 10 for a strong instrument. These results highlight that a lack of engagement with micro-credentials likely drove the null results seen in the study.

TABLE B.5
Attrition at the School, Teacher, and Student Level

<table>
<thead>
<tr>
<th>Count</th>
<th>Treatment Condition</th>
<th>Control Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schools</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Number of schools randomly assigned in study</td>
<td>20</td>
<td>19</td>
</tr>
<tr>
<td>2. Number of schools after removing block</td>
<td>19</td>
<td>17</td>
</tr>
<tr>
<td>3. Number of schools after removing cohort 2 joiner teachers</td>
<td>19</td>
<td>17</td>
</tr>
<tr>
<td>4. Number of schools matched to LDOE data (attendance and course-taking analytic samples)</td>
<td>18</td>
<td>16</td>
</tr>
<tr>
<td>5. Number of schools in math outcomes analytic sample</td>
<td>18</td>
<td>15</td>
</tr>
<tr>
<td>Teachers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Number of teachers randomly assigned in study</td>
<td>23</td>
<td>27</td>
</tr>
<tr>
<td>2. Number of teachers after removing block</td>
<td>21</td>
<td>22</td>
</tr>
<tr>
<td>3. Number of teachers after removing joiners</td>
<td>21</td>
<td>20</td>
</tr>
<tr>
<td>4. Number of teachers matched to LDOE data (all analytic samples)</td>
<td>19</td>
<td>18</td>
</tr>
<tr>
<td>Students</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Number of students randomly assigned in study</td>
<td>902</td>
<td>1,284</td>
</tr>
<tr>
<td>2. Number of students after removing block</td>
<td>727</td>
<td>1,087</td>
</tr>
<tr>
<td>3. Number of students after removing cohort 2 joiner teachers</td>
<td>727</td>
<td>1,076</td>
</tr>
<tr>
<td>4. Number of students matched to LDOE data (attendance and course-taking analytic samples)</td>
<td>646</td>
<td>922</td>
</tr>
<tr>
<td>5. Number of students in math outcomes analytic sample</td>
<td>502</td>
<td>698</td>
</tr>
</tbody>
</table>
Additional Student Outcomes from Administrative Data

In conceptualizing this study, our team specified various student outcomes that could be affected by micro-credentials. These outcomes were considered to be more-distal outcomes and, therefore, were deemed exploratory in nature. Table B.7 shows the one-year and two-year effects of the offer of micro-credentials on these outcomes. We also show year 2 effects on math and science outcomes and include year 1 effects from the main table for completeness. No detectable effects were found on these outcomes.

TABLE B.7
The Effect of the Offer of Micro-Credentials on Additional Student Outcomes

<table>
<thead>
<tr>
<th>Measure</th>
<th>Year 1</th>
<th></th>
<th>Year 2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Effect</td>
<td>Clusters</td>
<td>Students</td>
<td>Effect</td>
</tr>
<tr>
<td>On-time progression</td>
<td>0.022 (0.080)</td>
<td>17</td>
<td>975</td>
<td>N/A</td>
</tr>
<tr>
<td>Graduation</td>
<td>0.159 (0.102)</td>
<td>34</td>
<td>1,563</td>
<td>-0.125 (0.086)</td>
</tr>
<tr>
<td>FAFSA application</td>
<td>0.048 (0.099)</td>
<td>34</td>
<td>1,566</td>
<td>-0.052 (0.083)</td>
</tr>
<tr>
<td>College enrollment</td>
<td>0.114 (0.137)</td>
<td>17</td>
<td>985</td>
<td>N/A</td>
</tr>
<tr>
<td>Math achievement</td>
<td>0.003 (0.111)</td>
<td>33</td>
<td>1,200</td>
<td>0.045 (0.108)</td>
</tr>
<tr>
<td>Science achievement</td>
<td>-0.025 (0.080)</td>
<td>34</td>
<td>454</td>
<td>-0.008 (0.080)</td>
</tr>
</tbody>
</table>

NOTE: FAFSA = Free Application for Federal Student Aid; N/A = not applicable. Standard errors are clustered by school. No estimate is significant at the 10 percent level or below. On-time progression and college enrollment could only be estimated for cohort 1 in year 1. The 2023–2024 school year files would be needed to obtain additional data on on-time progression and were not available at the time of publication. College enrollment data are lagged and were also not available at the time of publication.
## Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3D</td>
<td>three-dimensional</td>
</tr>
<tr>
<td>ACT</td>
<td>American College Testing</td>
</tr>
<tr>
<td>ADDIE</td>
<td>analyze, design, develop, implement, and evaluate</td>
</tr>
<tr>
<td>BBI</td>
<td>BloomBoard, Inc.</td>
</tr>
<tr>
<td>COVID-19</td>
<td>coronavirus disease 2019</td>
</tr>
<tr>
<td>CS</td>
<td>computer science</td>
</tr>
<tr>
<td>CT</td>
<td>computational thinking</td>
</tr>
<tr>
<td>DDEM</td>
<td>digital design and emergent media</td>
</tr>
<tr>
<td>GPA</td>
<td>grade point average</td>
</tr>
<tr>
<td>K–12</td>
<td>kindergarten through grade 12</td>
</tr>
<tr>
<td>LEAP</td>
<td>Louisiana Educational Assessment Program</td>
</tr>
<tr>
<td>LDOE</td>
<td>Louisiana Department of Education</td>
</tr>
<tr>
<td>LSU</td>
<td>Louisiana State University</td>
</tr>
<tr>
<td>PBL</td>
<td>project-based learning</td>
</tr>
<tr>
<td>PLTW</td>
<td>Project Lead the Way</td>
</tr>
<tr>
<td>RCT</td>
<td>randomized controlled trial</td>
</tr>
<tr>
<td>STEM</td>
<td>science, technology, engineering, and mathematics</td>
</tr>
<tr>
<td>WWC</td>
<td>What Works Clearinghouse</td>
</tr>
</tbody>
</table>
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