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# Designing and Implementing Micro-Credentials to Support STEM Teaching

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Lessons from Louisiana's Project to Improve  
Pre-Engineering and Computer Science Education  
Through Micro-Credentialing



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# About This Report

In this report, authors detail the efforts that the Louisiana Department of Education (LDOE)—in collaboration with Louisiana State University (LSU), BloomBoard, Inc. (BBI), and the RAND Corporation—undertook to create, design, and implement micro-credentials intended to improve instruction among participating teachers and, as a result, improve student learning. In addition to providing an overview of those efforts, this report summarizes some lessons learned to support those developing or implementing micro-credentials in other settings.

This study was undertaken by RAND Education and Labor, a division of the RAND Corporation that conducts research on early childhood through postsecondary education programs, workforce development, and programs and policies affecting workers, entrepreneurship, and financial literacy and decisionmaking. This study was sponsored by the LDOE through an Educational Innovation Research grant from the U.S. Department of Education (Federal Award Number U411C190127).

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# Summary

Micro-credentials are increasingly being used to recognize knowledge, skills, and competencies across a variety of areas from teaching to technology to health care (Tooley and Hood, 2021b; American Institutes for Research, 2020; Council for Chief State School Officers, 2020; Foley, 2021; American Association of Critical-Care Nurses, undated). For this report, we define *micro-credentials* used in education as “a verification of a discrete skill or competency that a teacher has demonstrated through submission of evidence assessed via a validated rubric” (Tooley and Hood, 2021b, p. 4).

In the field of education, a growing number of micro-credentials are being made available by organizations like BloomBoard, Inc. (BBI); Digital Promise; and the National Education Association to allow teachers to demonstrate specific skills, including those in areas that might not be addressed in typical teacher preparation programs or regular opportunities for professional learning (Digital Promise, undated; National Education Association, undated-a).

However, despite the growing popularity of micro-credentials, the process of obtaining a micro-credential can vary widely depending on the micro-credential provider and the micro-credential’s purpose (Oliver, 2022; Tooley and Hood, 2021b). Although there is a growing understanding of what makes for a “good” micro-credential (Tooley and Hood, 2021b), we lack studies that independently explore specific micro-credential development and implementation processes and that examine what lessons emerge from this exploration that could be applicable to developers of micro-credentials more broadly.

In this report, we provide a preliminary look at one project to develop and implement micro-credentials as a means of providing scalable, competency-based certification of science, technology, engineering, and mathematics (STEM) teaching skills in Louisiana: Improving Pre-Engineering and Computer Science Education Through Micro-Credentialing (referred to as the Louisiana Micro-Credentialing Project throughout this report). Through this project, the Louisiana Department of Education partnered with Louisiana State University, BBI, and the RAND Corporation to develop 18 micro-credentials intended to give teachers in Louisiana the opportunity to demonstrate competency in STEM instructional topics related to pre-engineering, digital design and emergent media (DDEM), and computer science. The ultimate goal of this project is to improve teaching and learning of STEM courses and expand this micro-credential model across Louisiana.

To evaluate the Louisiana Micro-Credentialing Project, RAND is conducting an ongoing implementation and outcome evaluation study. In this report, we provide a comprehensive overview of the development of those micro-credentials (beginning in fall 2019) and the first year of the implementation of those micro-credentials in the 2021–2022 school year. The key research questions for this report are:

- How were the micro-credentials for this project developed, and what lessons learned about the development process can be shared for replication?
- How have micro-credentials been implemented among participating teachers in the first year of the project, and have they been implemented as intended?

In Chapter 1, we summarize what is known about micro-credentials from the literature, including how they have been most frequently used to support teachers and what is known about their effectiveness on student learning. We then provide an overview of the Louisiana Micro-Credentialing Project, including a description of partners’ roles, study timeline, and study goals. We conclude the chapter with a description of methods used in the study.

In Chapter 2, which focuses on findings regarding micro-credential development, we describe four intertwined stages in the micro-credential process: conceptualization, design, testing, and refinement. Key takeaways are broken down by stage:

- Conceptualization
  - Partners’ understanding of how to construct micro-credentials did not fully crystalize until after the first few micro-credentials had been developed.
  - In the early stages of micro-credential development, micro-credential conceptualization was reframed somewhat in response to state leadership shifts.
  - Disruptions to instruction related to the coronavirus disease 2019 (COVID-19) pandemic and Hurricane Ida, which struck Louisiana in August 2021, required partners to continually grapple with expectations and incentives for teachers’ completion of micro-credentials.
  - Earlier-stage micro-credentials targeted more-generalizable STEM pedagogy whereas later-stage micro-credentials emphasized teaching competencies across highly technical courses.
- Design
  - Micro-credential development became increasingly streamlined as partners communicated with one another and grew to understand their roles.
  - Team members perceived development challenges related to time constraints and a prescriptive model for micro-credential development.
  - Developers implemented new mechanisms to achieve consensus sooner and meet deadlines more effectively.
  - A decision to base design on one-page summaries of the content teachers were expected to master simplified establishing micro-credential aims for teachers.
- Testing
  - Workload requirements and the inability to communicate long-term potential benefits for undertaking micro-credentials created challenges for pilot recruitment.
  - Pilot teachers struggled to earn the micro-credentials and do so in the intended time period.
  - Selecting strong teachers to pilot the micro-credentials was important for garnering quality feedback on the micro-credentials.
- Refinement
  - Heightened leadership from the state led to more-substantial refinements of the micro-credentials.
  - Clear timelines and feedback loops aided the refinement process.

In Chapter 3, which focuses on findings regarding implementation of the micro-credentials in the first year, we discuss key takeaways for recruitment and implementation:

- Recruitment
  - Recruitment challenges necessitated expansion of the pool of eligible teachers.
  - Even after expanding the recruitment pool of teachers, it was harder to recruit teachers after a year and a half of teaching during the COVID-19 pandemic.
  - Incentives for participation offered to teachers were perhaps not large enough, or the right kind, to entice teachers and districts to enroll in the study.
- Implementation
  - Teachers did not progress on micro-credentials for a variety of reasons, including both the COVID-19 pandemic and Hurricane Ida.
  - Teachers taking micro-credentials were provided with various supports, which many appreciated.
  - Teachers voiced a variety of ways that micro-credentials supported their instruction.

- Teachers also voiced some concerns about what was missing from or could be improved in the process for earning micro-credentials, pointing out the desire for more collaboration with other teachers.

In both Chapters 2 and 3, we discuss multiple lessons learned from these takeaways that could inform the development of micro-credentials for teachers in other purposes or contexts. In particular, these lessons emphasized that micro-credential development teams should consider

- allocating ample time at the beginning of a development process to reflect on aspects of existing micro-credentials that might be used productively for their development project and outline a set of processes that can facilitate their development
- identifying incentives that might best compel teachers to participate in micro-credential development and testing
- involving and collaborating closely with expert teachers who can support piloting and potentially also support their fellow teachers
- aligning the content of micro-credentials with kindergarten through grade 12 academic standards that are applicable to areas on which micro-credentials are focused
- understanding competing demands on teachers' time and how micro-credentials could fit into the time teachers have.

Readers should keep in mind the limitations of our research, including that not all the developers involved in the micro-credential process consented to speak with us; we spoke to only a small number of teachers who agreed to be interviewed to discuss their experiences with the micro-credentials. This report does not reflect the perspectives of school or district leaders who employ teachers. In addition, importantly, this report focuses only on the first year of the micro-credentialing project's implementation. For these reasons, this report does not provide the fullest and most comprehensive picture of micro-credential development and implementation. Nonetheless, beyond the lessons we have already enumerated for development teams, this work offers some potential implications for stakeholders who might influence or benefit from the development and implementation of micro-credentials, including funders, researchers, and policymakers. These implications are laid out in greater detail in the concluding chapter of this report, but they highlight the following:

- Funders, researchers, and others who wish to encourage the creation of more high-quality micro-credentials should aim to create more resources to support micro-credential development, including more tools for learning about what micro-credentials include and emphasize.
- Those embarking on the creation of micro-credentials, along with funders, should consider the value proposition to teachers for the micro-credentials that they might develop and how to communicate that value to potential participants.
- Funders and those proposing the development of micro-credentials should ensure ample time for micro-credential development and testing processes and should possibly consider ways to certify their quality.
- Lastly, micro-credential development teams should try to leverage teacher expertise and peer collaboration as mechanisms to support micro-credential development and implementation.

We expect to gather further data in the second year of the Louisiana Micro-Credentialing Project across a larger number of teachers regarding their perceptions and instruction, as well as some student outcome data, which will help us consider how the implementation measures we have studied drive teaching and learning.





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# Introduction

Micro-credentials are increasingly being used to recognize knowledge, skills, and competencies across a variety of areas from teaching to technology to health care (Tooley and Hood, 2021b; American Institutes for Research [AIR], 2020; Council for Chief State School Officers [CCSSO], 2020; Foley, 2021; American Association of Critical-Care Nurses, undated). We define *micro-credentials* used in education as “a verification of a discrete skill or competency that a teacher has demonstrated through submission of evidence assessed via a validated rubric” (Tooley and Hood, 2021b, p. 4).

In the field of education, a growing number of micro-credentials are being made available by such organizations as BloomBoard, Inc. (BBI); Digital Promise; and the National Education Association to allow teachers to demonstrate specific skills, including those in areas that might not be addressed in typical teacher preparation programs or regular opportunities for professional learning (Digital Promise, undated; National Education Association, undated-a). For example, teachers might choose to complete micro-credentials to demonstrate competency in emerging or specialized topics, such as use of restorative practices, family engagement, trauma-informed pedagogy, or computer science.

However, despite the growing popularity of micro-credentials, the process of earning a micro-credential can vary widely depending on the micro-credential provider and the micro-credential’s purpose (Oliver, 2022; Tooley and Hood, 2021b). Based on interviews with a variety of micro-credential providers, Tooley and Hood (2021b) points out that existing micro-credentials vary considerably in terms of the “grain size” of the competencies they assess, the ways that those competencies are assessed, and the overall quality of assessment. Furthermore, micro-credentials are being used to meet a variety of goals, some of which might be met more readily than others through micro-credentials, including as a means to help meet teacher licensure requirements, career advancement, or professional learning (Tooley and Hood, 2021a). In addition, although there is a growing understanding of what makes for a “good” micro-credential (Tooley and Hood, 2021b), we lack studies that independently explore specific micro-credential development and implementation processes and that examine what lessons emerge from this exploration that could be applicable to developers of micro-credentials more broadly.

In Louisiana, as elsewhere in the United States, secondary public schools are increasingly aiming to provide more rigorous science, technology, engineering, and mathematics (STEM) instruction to propel students into STEM career fields and college programs. Yet schools can struggle to identify teachers who have the requisite STEM content knowledge and the pedagogical skills to teach advanced STEM subjects. Through a partnership among the Louisiana Department of Education (LDOE), Louisiana State University (LSU), the RAND Corporation, and BBI, the *Improving Pre-Engineering and Computer Science Education Through Micro-Credentialing* project (referred to as the Louisiana Micro-Credentialing Project throughout this report) aimed to develop and implement a set of micro-credentials that would allow teachers to identify and demonstrate specific competencies related to their STEM instruction, with a specific focus on competencies related to teaching pre-engineering, digital design and emergent media (DDEM), and computer science.

To evaluate the Louisiana Micro-Credentialing Project, RAND is conducting an ongoing implementation and outcome evaluation study. As part of that evaluation, this report provides a comprehensive overview of

the development and the first year of implementation of those micro-credentials with a pool of high school (grades 9–12) teachers. In a subsequent report, we will share findings on both the first and second year of the implementation and any detected impacts on teaching and student learning. The key research questions for this report are:

- How were the micro-credentials for this project developed, and what lessons learned about the development process can be shared for replication?
- How have micro-credentials been implemented among participating teachers in the first year of the project, and have they been implemented as intended?

In the remainder of this introductory chapter, we provide an overview of micro-credentials: what they are, how they are used in the field of education, and what is known about their effectiveness. Then, we provide an overview of the micro-credentials developed and tested through the Louisiana Micro-Credentialing Project. We conclude this chapter with a brief description of the methods we used to gather and analyze data for this report.

## What Are Micro-Credentials, and How Are They Used to Support K–12 Teaching?

Like other credentials, micro-credentials provide public recognition as a way to signal gained knowledge or skills, but they typically focus on a specific “micro” competency (Tooley and Hood, 2021b). Although there are various differences in how micro-credentials are defined and offered by providers, micro-credentials are typically competency-based and accessible online (Crow and Pipkin, 2017). 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 (AIR, 2020; Grunwald Associates LLC and Digital Promise, 2015). Micro-credentials for teachers typically provide an opportunity for teachers to show that they have mastered a particular skill through successful completion of performance-based tasks that often require them to draw on classroom artifacts and other evidence of their teaching practice (Carbaugh et al., 2022). Depending on policies in their specific locale, teachers might pursue a given micro-credential based on their own needs, student needs, and/or school goals (Acree, 2016; Crow and Pipkin, 2017). The National Education Association (undated-b), and Digital Promise (undated) currently provide large online libraries of micro-credentials for teachers in areas ranging from cultural competence to educator ethics to developing computational thinking.

As illustrated in Tooley and Hood (2021b), teachers typically engage in the following process to earn a micro-credential:

- A teacher completes a series of tasks that are accompanied by assessment requirements to demonstrate their competency in a particular area; such assessments could include submitting a classroom artifact, writing a reflection, or submitting other evidence to demonstrate competency.
- Along the way, a teacher might review a set of resources or engage in other professional learning to help them demonstrate that competency.
- After the teacher submits their evidence for a given task, they receive feedback from a trained evaluator, generally based on an established rubric, letting them know whether they have met the requirements of a particular task or will need to revise and resubmit the evidence.

- Upon meeting the requirements for a given micro-credential and earning that micro-credential, a teacher might be issued a digital certificate or badge, which then can be shared electronically across social media, through email, and on blogs and résumés.

Some states have started to investigate ways to employ micro-credentials to provide flexible and broadly accessible professional learning experiences for teachers and to support teacher career ladders (DeMonte, 2017). For example, the state of Kentucky recently approved a micro-credential–based pathway for changing ranks; upon completion of this program, teachers are eligible for a rank change, which enables them to advance in their career and earn more than before (Kentucky Education Association, undated). In addition, multiple states, including North Carolina, Wisconsin, South Carolina, and New Hampshire, give districts the option to count micro-credentials toward teachers’ professional development credits to maintain their teacher’s license (DeMonte, 2017; University of New Hampshire, undated; South Carolina Department of Education, undated).

Micro-credentials have also emerged as a potential strategy for improving preparation and support for teachers of advanced science subjects. For example, Code.org (2017) suggests that states might explore allowing teachers who earn classroom practice–based micro-credentials demonstrating computer science competencies to teach computer science courses.

## What Do We Know About the Implementation and Effectiveness of Teacher Micro-Credentials?

Prior research examining the impact of micro-credentials on teacher practice and student outcomes is limited (AIR, 2020; Rasberry, Weber, and Wilson, 2022; Ross, 2016). Most research on the effectiveness of micro-credentials focuses on teacher feedback about their experience and their perception of its effectiveness. Looking across 15 micro-credential programs, Acree (2016) found that most teachers reported applying what they have learned through obtaining micro-credentials to improve their instruction. Other survey research indicates that teachers enjoy earning micro-credentials and report instructional improvement in the process (Digital Promise, 2016; Teaching Matters, 2016). Teachers have also endorsed a desire for a cohort structure in which they can work with and learn from peers (Gamrat et al., 2014; Gish-Lieberman, Tawfik, and Gatewood, 2021).

Some studies suggest that micro-credentials are a promising strategy for improving teacher instruction (e.g., Acree, 2016), but most of these studies rely on self-reports from teachers. Furthermore, no research that we have seen attempts to better understand the micro-credential development process in terms of best practices for their development and challenges that developers are likely to face. Similarly, there is limited research about the implementation process of micro-credentials to understand the factors that facilitate or limit their use. For example, a recent study led by New America identified multiple conditions necessary for successful implementation of micro-credentials, including effective communication about the value of those micro-credentials, dedicated time for educators to work on micro-credentials, and ongoing peer support and coaching (Tooley and Hood, 2021b). In-depth examination of micro-credential development and implementation could provide a useful playbook for others seeking to support teachers’ learning through micro-credentials, including developers and policymakers. Moreover, studies on the design and content of different micro-credentials might help elucidate how design differences account for variation in competencies that teachers develop through completing the micro-credentials (DeMonte, 2017). Lastly, more research is needed regarding the impact of micro-credentials on teachers’ instruction and student learning.

## Overview of the Louisiana Improving Pre-Engineering and Computer Science Education Through Micro-Credentialing Project

The Louisiana Micro-Credentialing Project brought together four organizations to undertake the development and study of micro-credentials intended to improve STEM instruction in Louisiana high schools:

- LDOE, which leads the project by providing guidance on development and implementation
- LSU, which developed the micro-credentials in collaboration with BBI
- BBI, which provided the platform and worked closely with LSU to develop the micro-credentials
- RAND, which serves as the evaluator in this effort.

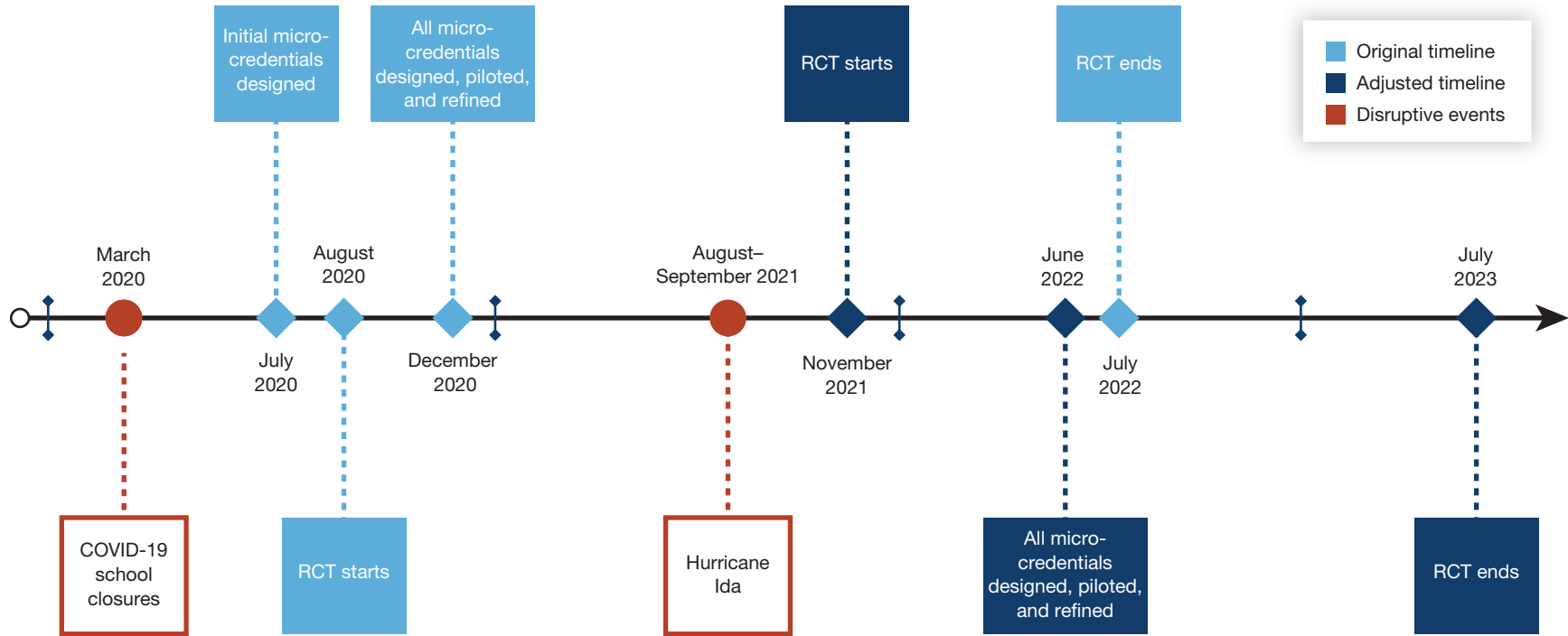
The project aimed to achieve four key goals. **First, the overall goal was to develop, pilot, and refine a set of micro-credentials for STEM teachers, particularly those teaching pre-engineering, DDEM, and computer science in 9th–12th grades, that provide scalable, competency-based certification of STEM teaching skills.** To create the micro-credentials, LSU, LDOE, and BBI partnered to identify the key pre-engineering, DDEM, and computer science competencies and content to include within each micro-credential. A small group of teachers piloted these micro-credentials and provided feedback, which LSU and BBI used to refine the micro-credentials. **The second goal was to implement the micro-credentials successfully with a randomly selected cohort of 9th–12th grade teachers.** Once the initial set of micro-credentials was developed and piloted, RAND conducted a randomized control trial with a larger group of teachers. Eligible teachers were recruited and randomly selected to either complete the micro-credentials over a two-year period (i.e., the *treatment group*) or to delay taking them until after the two-year period (i.e., the *comparison group*). Teachers in the micro-credential treatment group had the flexibility to complete micro-credentials at their own pace over two years. **The third and fourth goals of the project were, respectively, to improve teaching and learning of STEM courses through the implementation of the micro-credentials and to improve, spread, and sustain the micro-credential model in Louisiana.** The results of the randomized control trial and findings related to these third and fourth goals will be published in a subsequent report.

Initially, all micro-credentials were to be developed, piloted, and refined in 2020, with a randomized control trial slated to take place during the 2020–2021 and 2021–2022 school years. However, the study was first delayed for one year because of recruitment challenges associated with the coronavirus disease 2019 (COVID-19) pandemic. Later, as the organizations were preparing for the study's already delayed launch in August 2021, Hurricane Ida hit, disrupting many communities in Louisiana. To allow teachers time to recover, the study was postponed for three more months to November 2021. The planned versus actual study timelines are summarized in Figure 1.1.

The micro-credentials were developed to give STEM teachers in Louisiana the opportunity to demonstrate competency in STEM instructional topics related to pre-engineering, DDEM, and computer science. LSU and a few other organizations already provide training for teachers in course sequences that emphasize pre-engineering, DDEM, and computer science (LSU, undated). These course sequences are part of Louisiana's STEM Pathways program, a state-directed program in which independent organizations like LSU develop and support a set of courses and curricula for high school students in specific STEM content areas (LDOE, undated-b). Although the trainings from LSU and other Pathways providers are intended to equip teachers with the knowledge and skills needed to teach advanced STEM subjects, the trainings do not provide certification. Furthermore, other STEM courses being offered throughout the state were assuming that teachers had mastered core competencies related to areas like project-based learning and technical reading and writing, although teacher preparation programs did not necessarily emphasize that content. The Louisiana Micro-Credentialing Project was developed to offer a way for teachers to demonstrate that they had



**FIGURE 1.1**  
**Planned and Adjusted Study Timeline**



NOTE: RCT = randomized controlled trial.

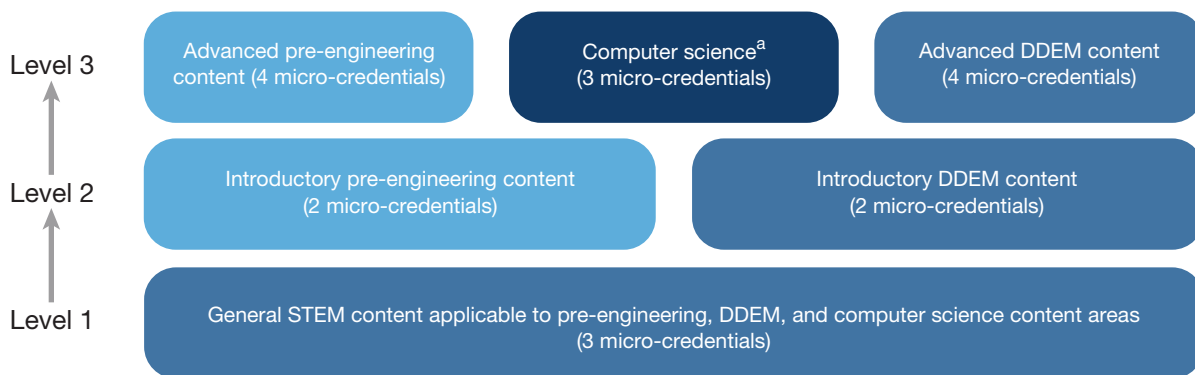
mastered such core competencies and other skills reflecting their ability to teach advanced STEM courses in pre-engineering, DDEM, and computer science.

BBI and LSU worked collaboratively to develop the micro-credentials, and LDOE provided input on the draft micro-credentials to inform revisions. Altogether, these project partners developed 18 micro-credentials reflecting core competencies in pre-engineering, DDEM, and computer science, starting with Level 1 broader competencies spanning all STEM subjects and moving toward Level 2 and Level 3 competencies more focused on developing expertise in specific content areas (see Figure 1.2).

- **Level 1** included three micro-credentials intended to cover critical pedagogical skills applicable across all STEM disciplines in the areas of project-based learning, computational thinking, and technical reading and writing.
- **Level 2** included four micro-credentials intended to cover introductory content-specific skills in pre-engineering and DDEM, including topics related to ethics, legality, safety, and design processes in the two areas.
- **Level 3** included 11 micro-credentials intended to cover more-technical, course-specific skills in pre-engineering, DDEM, and computer science; four of these micro-credentials focused on pre-engineering concepts (e.g., 3D modeling, circuitry concepts); four focused on digital design (e.g., programming for digital media, foundations of digital production); and three focused on computer science (e.g., software development, data science).

The Louisiana Micro-Credentialing Project originally focused on recruiting teachers to take the micro-credentials who were already taking the LSU training to teach course sequences that were part of Louisiana’s STEM Pathways for pre-engineering, DDEM, and computer science. Because of challenges in recruiting adequate numbers of teachers—and because of the broad applicability of the micro-credentials that had been developed—the study expanded recruitment in 2021–2022 to a broader pool of teachers to include both LSU STEM Pathways teachers and teachers of STEM Pathways courses that had been developed by Project Lead the Way (PLTW), another STEM Pathways provider in Louisiana offering course sequences to high school students in pre-engineering and computer science. By the 2022–2023 school year, the eligible pool of teachers was further expanded to include teachers of grades 9–12 biology, chemistry, and physics courses taught using OpenSciEd curriculum materials, which were regarded as closely aligned with the content focus of several of the developed micro-credentials.

**FIGURE 1.2**  
**Louisiana STEM Micro-Credential Sequence**



<sup>a</sup> Level 3 computer science micro-credentials were applicable to instructors of pre-engineering, DDEM, and computer science courses.

Teachers who enrolled in the study were randomly assigned to either the comparison group that did not take the micro-credentials or to the treatment group of teachers who were encouraged to earn at least five micro-credentials over two years. The first cohort of teachers was told that each micro-credential could take five to ten hours to complete, although that time estimate shifted to “about ten hours” for the second cohort of teachers on development of more micro-credentials and further assessment of the time commitment. The study team encouraged teachers, but did not require them, to complete Level 1 micro-credentials before proceeding to Level 2 and Level 3 micro-credentials.

The micro-credentials were located on BBI’s platform. To earn a micro-credential, teachers were expected to demonstrate that they have the required skills covered by the micro-credential, as determined by independent, certified BBI assessors based on already developed rubrics. As teachers worked through the micro-credential tasks, they were required to submit artifacts and evidence (e.g., student work examples, video of instruction) and reflect on how they applied the skills emphasized by micro-credentials in the classroom. To earn the micro-credential, the teacher needed to earn a “Demonstrated” score for the evidence they submitted for each component, based on a rating from the BBI assessor. If instead the teacher received a “Progressing” or “Not Met” score, they could review their feedback and receive support to resubmit. Teachers could submit as many times as they liked. They also had an opportunity to participate in optional office hours with teachers working on the same micro-credentials led by a certified BBI facilitator. Lastly, teachers were given access to a discussion board moderated by both the facilitator and an LSU staff member.

## Methods for Gathering and Analyzing Data

To answer our research questions related to the development and implementation of micro-credentials, we drew on several data sources: interviews with individuals from LSU, BBI, and LDOE who were on the micro-credential development team; interviews with teachers; data from the micro-credential platform on teachers’ progress; and documentation of the micro-credentials.

From winter 2020 through fall 2022, we conducted 11 focus groups and two rounds of interviews with members of the development team (16 different people over the course of the study) and one round of interviews with six teachers (see Table 1.1). We conducted our first developer focus group in February 2020, as the study was beginning. In June 2020, after the randomized control study had been delayed by COVID-19 pandemic-related complications, we reduced the frequency of our developer focus groups and interviews. We conducted a final round of focus groups with LSU and BBI in November 2022 to gather any final reflections on the micro-credential development and implementation process.

In our focus groups and interviews with development team members, we focused on four main topics: (1) the tasks that had been completed to date, (2) the parts of the development process that had been successful, (3) any related challenges or barriers, and (4) upcoming tasks. In our interviews with treatment teachers, we asked about their progress and preliminary reflections on the benefits and challenges of completing micro-credentials, in addition to brief background questions. Readers should keep in mind that the nature of focus group interviews might have encouraged more consensus among the developers who participated than might have been the case if we conducted only individual interviews. Six of the 13 teachers in our treatment group participated; we provided a gift card incentive to each teacher on completion of the interview.

We audio-recorded all focus groups and interviews and used these recordings to convert our notes into transcripts. We uploaded all developer focus group and interview transcripts into Dedoose for qualitative coding. Researchers on our team iteratively derived a coding scheme for the developer interviews based on our research questions. In their coding work, the researchers specifically focused on (1) the work completed at each stage of the development of micro-credentials, including conceptualization, design, testing, and refinement; (2) successes and challenges throughout the process; (3) lessons learned that could be applied

**TABLE 1.1**  
**Interview and Focus Group Data Collection**

Month and Year	Number of Participants by Organization	Type of Interview
February 2020	BBi: 1, LDOE: 1, LSU: 2	Focus group
March 2020	BBi: 3, LDOE: 1, LSU: 4	One-on-one interviews
April 2020	BBi: 1, LDOE: 1, LSU: 2	Focus group
May 2020	BBi: 3, LDOE: 1, LSU: 3	Focus group
June 2020	BBi: 1, LDOE: 1, LSU: 3	Focus group
August 2020	BBi: 2, LDOE: 1, LSU: 2	Focus group
October 2020	BBi: 2, LDOE: 1, LSU: 2	Focus group
January 2021	BBi: 1, LSU: 3	Focus group
March 2021	BB1: 1, LDOE: 2, LSU: 3	Focus group
May 2021	BB1: 1, LDOE: 2, LSU: 3	Focus group
October–November 2021	BBi: 3, LDOE: 2, LSU: 4	One-on-one interviews
April 2022	BBi: 2, LDOE: 2, LSU: 2	Focus group
May 2022	Teachers: 6	Treatment group teacher interviews
November 2022	BBi: 3, LSU: 1	Focus groups (separate)

in other contexts; (4) the timeline and adherence to deadlines; (5) how roles of various members changed over time; (6) the nature of collaboration between each of the partners involved at each stage; and (7) the work that developers did to support implementation with teachers in the randomized control trial. After several rounds of reliability testing to ensure codes were being applied to developer interviews and focus groups consistently and that decision rules for codes were clear, two researchers coded all of the transcripts.

The six teacher interviews were coded using a different process. For that process, one researcher coded all six interviews and identified key themes that emerged from these interviews and also coded for themes that had been identified by project partners as signaling intended implementation, including teachers’ progress through micro-credentials (and why teachers did not make significant process), supports that teachers were offered, and teachers’ perceptions about the extent to which the micro-credentials aligned with and were applicable to their classes, as well as what teachers perceived as missing from the micro-credentials. These implementation measures are described in greater detail in Chapter 3. For a full list of codes, code definitions, and example text excerpts for each code, see the Appendix.

In the second chapter of this report, we summarize findings based on our research question, “How were the micro-credentials for this project developed, and what lessons learned about the development process can be shared for replication?” In the third chapter, we summarize preliminary findings in response to our research question, “How have micro-credentials been implemented among participating teachers in the first year of implementation, and have they been implemented as intended?” These implementation findings are based on implementation of micro-credentials among 13 teachers in over 11 schools in Louisiana over the course of the 2021–2022 school year. More-comprehensive implementation findings based on a full two years of implementation (2021–2022 and 2022–2023) will be included in our final evaluation report. Lastly, in our final chapter, we discuss key conclusions and implications for the education field.

## Developing STEM Teacher Micro-Credentials

In this chapter, we describe how the development team created the micro-credentials in this project. We observed four intertwined stages in the process of developing a micro-credential:

- **conceptualization:** how the micro-credentials were envisioned, including their objectives and focus, and how they would be sequenced and build on one another
- **design:** how the individual micro-credentials were designed, including identification of concrete competencies to be assessed and performance tasks for assessing them, and the development and testing of rubrics for performance task assessment
- **testing:** how the micro-credentials were piloted by teachers to identify areas for revision
- **refinement:** how developers revised micro-credentials in response to partner and teacher input.

For all of these stages, we discuss time frame, the tasks required, and the partners most closely involved. Then, we highlight key takeaways reflecting overall challenges and successes at each stage. Lessons learned during the development process are highlighted in Boxes 2.1 through 2.4 and are discussed in more detail in the final chapter.

### Conceptualization of Micro-Credentials for the Louisiana Micro-Credentialing Project

The *conceptualization stage* of developing micro-credentials includes all vision-setting and logistical work occurring before the micro-credentials were designed individually (e.g., what a micro-credential should be, what kind of content it should include, how micro-credentials will build on one another).

Initial conceptualization of the micro-credentials that would be part of the Louisiana Micro-Credentialing Project started with a proposal to the U.S. Department of Education requesting funding for this endeavor. In this section, we provide an overview of conceptualization both at the proposal stage and as it unfolded after the project had started. We then discuss several critical takeaways that encompass how partners worked through and finalized project conceptualization successfully, along with lessons learned.

#### Overview of Micro-Credential Conceptualization

At the proposal stage, as described in Chapter 1, the partner organizations—LDOE, LSU, BBI, and RAND—mapped out the titles for each of the proposed 18 micro-credentials. Table 2.1 provides an overview of the micro-credentials as conceived at the proposal stage compared with the final, published micro-credentials developed through this project. As seen in the table, the micro-credential titles did not change substantially. Level 1 and Level 2 micro-credentials carried the same titles between proposal and final published versions. Most of the Level 3 micro-credentials were also similar; there were a few minor shifts in the titles for some of

**TABLE 2.1**  
**Proposed and Published Micro-Credentials**

Level	Proposed Micro-Credentials	Final Micro-Credentials
Level 1	1.1: Developing Technical Reading, Writing, and Presentation Skills 1.2: Facilitating Project-Based Learning 1.3: Understanding Computational Thinking	1.1: Developing Technical Reading and Writing Skills 1.2: Facilitating Project-Based Learning 1.3: Discovering Computational Thinking
Level 2	Pre-Engineering 2.1: Understanding Engineering Ethics and Safety 2.2: Understanding the Engineering Design Process  DDEM 2.1: Digital Media Ethics and Digital Citizenship 2.2: Understanding the Digital Design Process	Pre-Engineering 2.1: Ensuring Ethics and Safety in Pre-Engineering Courses 2.2: Exploring the Engineering Design Process  DDEM 2.1: Including the Application of Legal and Industry Best Practices for DDEM 2.2: Exploring the DDEM Design Process
Level 3 (pathway-specific)	Pre-Engineering 3.1: Teaching Technical Drafting in 2D and 3D 3.2: Teaching the Foundational Concepts of Robotics 3.3: Teaching Electrical Circuitry and Programming 3.4: Teaching Engineering Economics and Project Management  DDEM 3.1: Teaching Digital Storytelling 3.2: Understanding the Digital Design Process 3.3: Teaching Media Exhibition and the Digital Media Industry 3.4: Teaching Programming for Digital Media	Pre-Engineering 3.1: Teaching the Foundational Concepts of Robotics 3.2: Teaching the Foundations of 3D Modeling 3.3: Teaching Circuitry Concepts Through Mathematical Application 3.4: Teaching Engineering Project Management  DDEM 3.1: Teaching the Foundations of Digital Production and Practice 3.2: Teaching the Development of a Digital Media Portfolio 3.3: Teaching Media Exhibition in the Digital Media Industry 3.4: Teaching Programming for Digital Media
Level 3 (for both pathways)	3.5 Teaching the Software Development Process 3.6 Teaching Basic Programming Skills 3.7 Teaching Data Manipulation & Analysis	3.5: Teaching Computational Thinking 3.6: Teaching Basic Programming Skills 3.7: Building the Foundations of Data Science

the digital design– and computational thinking–focused micro-credentials. As we understand, the development team changed the titles of some micro-credentials to make them more meaningful and accurate.

Although the content focus of the micro-credentials remained consistent between the proposal and project, the timeline and recruitment pool shifted considerably, as we noted in Chapter 1. Specifically, although the project started out with a recruitment pool of teachers of pre-engineering, DDEM, and computer science courses—and specifically those teaching those courses through LSU STEM Pathways—it broadened that pool to include teachers who were providing core science instruction at the high school level through OpenSciEd curriculum materials. OpenSciEd has been identified by EdReports—an independent, nonprofit organization that reviews curriculum materials—as aligned with standards for college and career readiness in science (EdReports, 2022) and Louisiana’s science standards (LDOE, 2023). The project also broadened the pool of teachers because of recruitment challenges discussed in Chapter 3.

## Key Takeaways from the Conceptualization Process

In the remainder of this section, we highlight takeaways from our interviews and focus groups with developers on how conceptualization unfolded. Our takeaways broadly illustrate that the perceived purposes of the micro-credentials and what they should include came into sharper focus and became more explicit as the first few micro-credentials were developed; teacher workload and burden was a consistent developer concern.

**Partners’ understanding of how to construct micro-credentials did not fully crystallize until after the first few micro-credentials had been developed.** All partners—and particularly the primary development team of LSU and BBI—noted that it took time to determine what micro-credentials for this project would look like and their overall goals for how the micro-credentials would work together as a set. Although LSU and LDOE partners attended a training with BBI soon after the proposal was awarded to learn more about micro-credentials, several members of the development team agreed that the development of the first micro-credentials for the project were critical to really understanding the capabilities and limitations of micro-credentials and how each partner could optimize their contributions. In the words of one partner who reflected on the process in fall 2021 (after one year of micro-credential development):

[The first micro-credential under development, Facilitating Project-Based Learning] was really, like, our first breakthrough, our first everybody coming to the table and understanding: what does this look like . . . what should [project-based learning] be looking for as far as resources . . . what does that actually mean for teachers to demonstrate competency. So, I think it was really a very important micro-credential for the group because everybody was able to see more so what the expectations of a micro-credential were.

Another partner similarly commented that “once we did our first [micro-credential], it was much clearer.” A few of the developers further conceded that the learning curve for developing micro-credentials was pretty steep, and the first set of micro-credentials took much more time to develop than subsequent ones.

**In the early stages of micro-credential development, micro-credential conceptualization was reframed somewhat in response to state leadership shifts.** Most long-term state initiatives face challenges associated with leadership changes, which often shift with election cycles. The micro-credential project was no different. A new state superintendent was appointed in June 2020, after the micro-credential project had just begun. Shortly thereafter, a new LDOE team took over leadership of the micro-credentialing project.

As discussed in the introductory chapter, the proposal for the development of the micro-credentials was originally motivated by interest from the LDOE in formalizing credentials for teachers providing instruction on STEM Pathways. After the new state superintendent was hired, he put in place an initiative to encourage more college and career pathways beyond what had already been developed through LSU, PLTW, and some other providers (LDOE, undated-a). At that point, LSU partners communicated uncertainty about the future of STEM Pathways course sequences like those that they had developed and were implementing across Louisiana. In the words of one LSU staff member,

The state as a whole [previously] wanted to promote the Pathways to get more STEM activities in high schools. This whole premise is no longer clear to me. . . . From an accountability point or view or from a financial point of view, there’s almost no reason for school systems or principals or high schools to even consider encouraging teachers to take a micro-credential.

That said, the LDOE never communicated that it was stepping away from the STEM Pathways course sequences or deemphasizing them, or that the micro-credentials being developed through the project were no longer applicable. Instead, it communicated a desire to ensure that the micro-credentials were applicable both to STEM Pathways teachers and to a broader population of STEM teachers across Louisiana, who they felt could benefit from many of the micro-credentials being developed through the project. The new project team had—in the words of one member of that state team—“an in-depth discussion of what the state of Louisiana wants for micro-credentials and what work we’ve developed so far to try to make the fit as good as possible.” As a result of those discussions, the LDOE requested some revisions to the micro-credentials to ensure that they were clearly aligned with state academic standards across multiple subject areas.

In addition to these state leadership shifts, **disruptions in instruction related to the COVID-19 pandemic and Hurricane Ida required partners to continually grapple with expectations and incentives for teachers' completion of micro-credentials.** On top of routine leadership changes, the state of Louisiana was managing the fallout from the global COVID-19 pandemic in real time, challenges with STEM teacher recruitment and retention, and the impacts of Hurricane Ida in fall 2021. All these challenges led to some uncertainty about the purpose of micro-credentials and teachers' capacity to undertake micro-credentials in the face of considerable challenges and competing demands for their time.

Prior to the implementation of the micro-credentials with teachers, partners spent some time considering the work requirements for completing a micro-credential and whether they were reasonable. Partners estimated that a single micro-credential would require five to ten hours of work time and that a teacher would ideally undertake six to eight micro-credentials. The incentive structure was based on this premise; teachers earned up to \$125 per completed micro-credential (for a total possible incentive of \$1,000 if they completed eight). However, as one partner noted in fall 2021, when teachers had begun taking the micro-credentials, "It seems like we might have put the bar a little high [in terms of the number of micro-credentials teachers should be expected to complete]." Another partner commented that they thought "we have too many micro-credentials" and "I'm not really sure how these people can get through [them]."

In the second year of the project, the partners increased the incentives for completion of each micro-credential, which might have attracted additional teachers to participate. But, at this time, we do not know whether the additional incentives will encourage more micro-credential completion than occurred in the first year, and developers continued to question whether the idea of completing six to eight micro-credentials was reasonable for a typical teacher, regardless of compensation provided.

**Partners developed earlier-stage micro-credentials to target more-generalizable STEM pedagogy whereas later-stage micro-credentials emphasized teaching competencies across highly technical courses.** As noted in Chapter 1, the micro-credentials were developed to include several Level 1 micro-credentials that targeted pedagogical practices across any STEM discipline. When leadership on the project changed, partners from LDOE provided more structure around alignment to existing state standards that related to technical writing and project-based learning. In contrast, Level 2 and 3 micro-credentials were more specialized; that is, they were designed to access teaching competencies across highly technical engineering, DDEM, and computer science Pathways courses.

As explained by the development team, these micro-credentials were always meant to be applicable to teachers outside LSU STEM Pathways—including teachers trained by PLTW. However, because the curriculum requirements across different providers are somewhat varied, the development team needed to ensure that all the micro-credentials they were creating were applicable for engineering, DDEM, and computer science teachers trained by other providers. In the words of one LSU staff member, "That's been a little problematic because, you know, [the LSU team] want[s] to try to be general but at the same time they know that their curriculum is a little bit different . . . than the competitors." The need to provide broadly applicable content made it important to do a lot of cross-checking on development across Pathways experts to make sure micro-credential content would work across pathways. As another LSU partner noted, "We want to make it universal across the pathways without muddying the language."

As mentioned in Chapter 1, recruitment challenges led to opening up micro-credentials to additional teachers, including core STEM teachers who use a curriculum known as OpenSciEd, which meant that, at a later stage beyond initial conceptualization, the development team needed to proactively consider whether and how the micro-credentials they had already created could also be applicable for STEM teachers who taught courses like biology and chemistry.

For lessons learned from the conceptualizing stage, see Box 2.1.



## BOX 2.1

**Lessons Learned from Conceptualizing Micro-Credentials**

Using the data we collected from our partners regarding the conceptualization process, we offer the following recommendations for those embarking on similar processes:

- **Development teams should expect to spend more time on the front end of development to account for the learning curve in understanding the goals and content of micro-credentials for their particular project.** As noted in Chapter 1, micro-credentials are a relatively new innovation and are often developed for a variety of different purposes and audiences. Although BBI had models for the micro-credentials developed through the Louisiana Micro-Credentialing Project, the team spent significant time on the front end of the project—perhaps more time than anticipated—to come to consensus on what a micro-credential for this project should look like. For these reasons, we recommend that developers—and particular partners with content expertise but less experience in developing micro-credentials—build in ample time at the beginning of a project, as the first micro-credentials are developed, to reflect on what they should look like, in terms of tasks, sequence of activities, and objectives, among other characteristics of the micro-credentials for a given project.
- **If possible, development teams should plan ahead to ensure some stability among partners over the course of a project like this one.** LDOE is, in some ways, an ideal partner for an effort like this, given its connections across numerous school systems and its broad vision for improving education across the state. At the same time, department of education leadership is likely to shift with election cycles, which might not be ideal for longer-term efforts like the development of a large set of micro-credentials. That said, staff turnover is a risk for the continuity of any initiative, regardless of the organizations involved. For all these reasons, partners leading or co-leading efforts like the one described in this report might want to strategize ways to maintain stability of leadership. For example, a state department of education could partner with other states or identify close collaborators who would not be expected to turn over with an election cycle.
- **Project teams should identify ample incentives to support teachers' sustained work on the micro-credentials.** Time has always been a precious and limited resource for K–12 teachers, and that has only been exacerbated during the COVID-19 pandemic. Micro-credentials thus will likely not be undertaken by teachers unless they have considerable incentives to undertake them. Monetary incentives are potentially helpful. But incentives like public acknowledgement of teachers' efforts and regular communication with school and district leaders about what teachers are doing also could potentially encourage them to participate in programs like this one. In addition, when possible, project partners should build in ways for teachers to receive formal professional development credit, credit toward additional teacher licensure, or some form of professional benefit, like salary or pay scale changes, for their participation in intensive professional development efforts like this one.

## Design of Micro-Credentials for the Louisiana Micro-Credentialing Project

Whereas conceptualization involves deciding the overall objectives and purposes of micro-credentials or a set of micro-credentials, the design stage of developing the individual STEM micro-credentials includes identifying concrete and specific competencies to be assessed and the key performance tasks to assess them, among other decisions. In this section, we summarize the design process as it was originally envisioned, how the process and roles changed over time, and the accomplishments at each stage.

## Overview of the Design Process

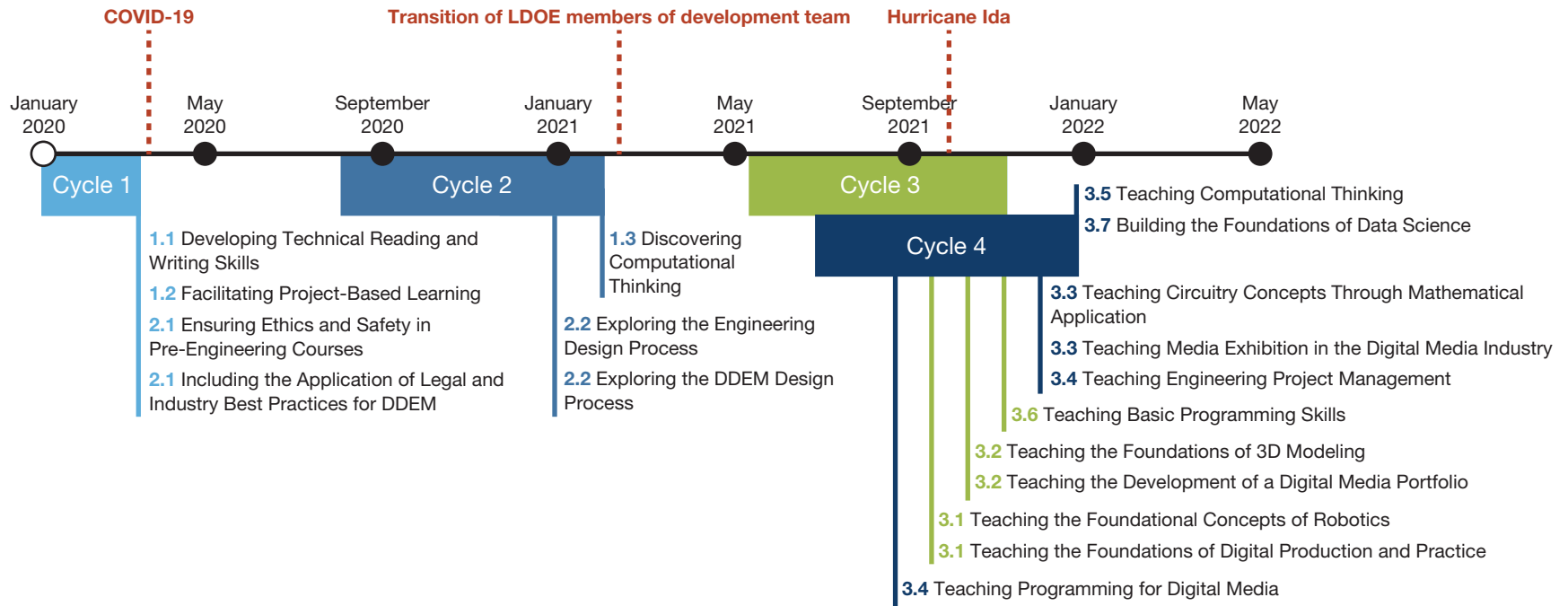
The process of designing the micro-credentials required the development team to synthesize broad STEM concepts from LSU's STEM Pathways courses related to pre-engineering, DDEM, and computer science into the analysis, design, development, implementation, and evaluation (ADDIE) model used by BBI. The ADDIE model is a widely used instructional design framework for the development of skills-based professional learning and assessment for educators (Alsaleh, 2020; Peterson, 2003). Using the ADDIE model, teachers engage in a set of tasks—i.e., analysis, design, development, implementation, and evaluation tasks—with each micro-credential to demonstrate competency in the topic or skill in their classroom. Along the way, participants create a portfolio of evidence that provides the basis for certifying competency. Upon completion of the micro-credential, participants submit this portfolio to two calibrated assessors who provide a rating—based on a rubric—to signal whether the participant's work has demonstrated mastery of the defined competencies. If the participant does not demonstrate the requirements for competency, they are supported with feedback and advised to resubmit their entry after making the required adjustments.

In fall 2019, prior to the development of any micro-credentials, BBI and LSU established their design roles: LSU would provide BBI with foundational content resources (e.g., course summaries and rubrics, syllabi, examples of student work) related to core competencies for each of the micro-credential topics, which BBI would use to build the micro-credentials into the digital platform. Through a process known as scoping, BBI distilled the underlying principles, or learning objectives, for each micro-credential and used these objectives to create core indicators—and sets of actions based on the core indicators—for assessors to use in their determination of whether a teacher working through a micro-credential had demonstrated competency in the areas assessed. To ensure that these initial frameworks aligned with LSU's training and key STEM competencies, BBI submitted its scoping documents to LSU for review. After several rounds of iteration between BBI and LSU, BBI drafted the learning experiences undergirding each micro-credential and digitized these for piloting.

For the Louisiana Micro-Credentialing Project, the design process unfolded in four writing cycles, each of which included pre-work and drafting, as described above, and final sign-off by LDOE. BBI and LSU completed the first and second design cycles of micro-credential development between winter 2020 and winter 2021, during which the development team designed and released seven micro-credentials for piloting. In the first two cycles of design and development, partner staff at LDOE took a more hands-off approach and left design decisions to LSU in collaboration with BBI. However, at the start of spring 2021, new LDOE staff came on board and engaged in a more active role in the design process based on new expectations for improved alignment of micro-credentials with the state's priorities for STEM instruction. In addition to requesting substantial revisions to the micro-credentials created during the earlier stages of design, LDOE influenced the design of the remaining micro-credentials and streamlined the contributions of all three partners. Specifically, LDOE pressed developers to align the micro-credentials with state content standards and use consistent terminology.

Between March and May 2021, the development team revised Facilitating Project-Based Learning (micro-credential 1.2, as cataloged in Table 2.1), which became the developers' de facto "gold standard" after which the design of the remaining micro-credentials were patterned and developed (see Figure 2.1 for the micro-credentials designed in each cycle and their timeline). By fall 2022, the team had completed substantial revisions on Cycle 1 and Cycle 2 micro-credentials, where required by LDOE. During this time, the developers were also busy designing Cycle 3 and Cycle 4 micro-credentials, which were released between fall and winter 2022.

**FIGURE 2.1**  
**Design Timeline Through LDOE Approval and Release for Piloting**



## Key Takeaways Drawn from the Design Process

In the remainder of this section, we highlight takeaways regarding how the partners were thinking about critical design elements and how they adapted the design process to address emerging challenges and deliver micro-credentials that cleared the bar for pilot testing. Our takeaways reflect that the design process grew more streamlined over time as developers built in better and more-efficient development processes.

**Micro-credential development became increasingly streamlined as partners communicated with one another and grew to understand their roles.** As noted in the conceptualization section, developers did not come to consensus on the exact tone, style, and content selection for each micro-credential until they had gone through the development process with several micro-credentials. In addition, partners took time to understand their roles and contributions to individual micro-credential design and development. Initially, LSU expressed uncertainty about expectations for its role during the designing of micro-credentials. As one participant explained, “For a long time, we weren’t sure what [BBI] needed from us or how [micro-credentials] were assessed.” BBI concurred that “until you actually start writing a micro-credential, it’s hard to jump into it.”

The partners regularly voiced how the process of providing iterative feedback to create the micro-credentials became smoother as LSU came to understand its expected role and as both sides adapted to the others’ preferred modes of exchanging content and feedback to align the design of the micro-credentials with their intended objectives. This work involved both sides learning how to format and pose questions to generate the feedback needed to push the process along. LSU and BBI acknowledged that their initial ability to progress past the steep learning curve involved in designing micro-credentials was attributable to LSU’s commitment to carefully align micro-credential content with best STEM instructional practices, BBI’s organization of the process, and strong communication between the two organizations.

**Team members perceived development challenges related to time constraints and a prescriptive model for micro-credential development.** Throughout the design process, developers commented on the challenges imposed by deadlines in the face of the COVID-19 pandemic and related staffing capacity. Moreover, they needed to make important decisions about Level 1 and 2 micro-credential content quickly without time to consider how those decisions might affect Level 3 micro-credentials. In the words of one developer, in fall 2021, “The problem is because we don’t have the content [for all the micro-credentials] mapped out before we start writing it, and then this is just something made within very short time periods . . . and that makes it more stressful.” This statement reflects that although the developers had content from their trainings and STEM Pathways courses that were intended to guide micro-credential content, the micro-credential content itself did not automatically follow from that, and development was necessarily iterative. Furthermore, because the micro-credentials were conceptualized to build on one another, any shifts in the content of early micro-credentials might somewhat disrupt or affect later micro-credentials that had not yet been written.

Adding to the complexity, developers had to adapt complex STEM content around the ADDIE model that some described as too “prescriptive” relative to their visions of authentic assessment. As one developer explained, the need to standardize around a particular model “made being experimental not possible.” Others explained that the model locked teachers into performing specific actions or submitting specific types of evidence without leaving room for teacher creativity or flexibility. In early 2020, BBI recognized the limiting nature of the ADDIE structure and began development on a new platform that allowed greater flexibility to meet the needs of a variety of projects. The new platform and micro-credential structure launched in late 2020. However, because of the timeline of this project and the need to keep development and implementation consistent across years, the new platform was not used for the STEM Pathways work.

**Developers established new mechanisms to achieve consensus sooner and meet deadlines more effectively.** During the earlier phases of the design process, the development team occasionally found themselves at an impasse with uncertainty about how to move forward, although the specific reasons depended on the

micro-credential. To address these challenges, the developers made several critical changes to the organizational mechanisms underpinning the design process prior to developing Cycle 3 micro-credentials. First, LDOE generated a uniform timeline for development, instated more-frequent meetings between partners to discuss the writing or the revision of one or two micro-credentials at a time, targeted meetings with fewer developers at a time, and standardized the process for providing feedback among all three partners. Moreover, LDOE settled into the role of holding all parties accountable to their deadlines, making decisions about when to halt the feedback process to move forward, and providing the sign-off on completion.

Although the partners did not always agree with LDOE's specific approaches, most acknowledged that one group should be vested with decision-making power. As one participant said,

At the beginning of this project, there was no clear leader because there was no clear final decisionmaker and that role has finally fallen to LDOE . . . [and they can say] this is the final decision. We are moving forward. . . . And because we didn't have this final decisionmaker, a lot of times, we just spun in circles . . . and nothing would happen.

**A decision to base design on one-page summaries of the content that teachers were expected to master simplified micro-credential aims for teachers.** As LDOE made structural changes to the process, BBI and LSU continued to streamline micro-credential production. To inform the development of the first few micro-credentials, LSU submitted many different content resources to BBI, from course summaries to syllabi and student work. BBI would then use these resources to create first drafts of micro-credentials for LSU's review. By fall 2021, LSU and BBI communicated through templates designed to discern the key objectives of new micro-credentials prior to scoping rather than submitting content resources (e.g., course summaries and rubrics, syllabi, examples of student work). This process evolved into the development of "overview documents" of the content that teachers were expected to demonstrate. As one participant said, "What made this round so much more productive, instead of outlining the activities and ideas and thoughts, we started with the content: what is important and what do we want participants to learn in a way that was more concrete." Although some participants felt that this approach was limiting, all agreed that adhering to this new structure made it easier to produce materials that met the expectations for what micro-credentials were intended to accomplish. By the end of the process, in spring 2022, the developers reported that these improvements resulted in substantially fewer revisions.

The documents that the development team created to support design were adapted for teachers to reference as they worked through each micro-credential. Previously, teachers were required to review content from external sources by clicking on a list of provided links and reviewing and analyzing the content at all those links, which the team felt led to confusion about the requirements for passing micro-credentials. Now, the developers provided participants with "one-pagers" aligned with the one-page documents that the development team had used to guide development. Those one-pagers laid out the requirements for demonstrating competency clearly and concisely, including the skills and knowledge teachers would need to demonstrate to meet mastery. These one-pagers were an easy artifact for teachers to consult to identify critical areas of skills and knowledge that they would need to demonstrate. The one-pagers also made clear that the micro-credentials were providing knowledge and skills agnostic of particular training providers but broadly applicable. In the words of one developer, the intention was to create a "permanent touchstone anchored in a document" for each micro-credential that memorialized its definition of success and quality instead of linking out to different sources that participants might analyze in less predictable ways. As another developer explained, "[I]nstead of making participants do all the analysis, we did it for them. The important part was they got the content. We bridged the stress for the participants."

Lessons learned from the design stage are highlighted in Box 2.2.

## BOX 2.2

**Lessons Learned from Designing Micro-Credentials**

Using the data we collected from our partners regarding the design process, we offer the following recommendations for those embarking on similar processes:

- **Establish leadership roles and standardize workflow procedures early.** The development team acknowledged that, in the beginning, they sometimes struggled to reach consensus and did not always make their deadlines. By the end, most agreed that having clearly defined roles, especially someone with authority to make final decisions, coupled with clear and realistic expectations about deadlines helped speed the process along. After LDOE assumed a more explicit leadership role, it standardized clearer feedback processes and deadlines, expectations around meeting pre-work, and the use of rolling agendas. For these reasons, we recommend that development teams determine feedback processes and—importantly—who has final approval for content early in the development process.
- **Begin the design process by delineating the goals and competencies that will be demonstrated through unique micro-credentials, and create concise documents outlining those competencies.** During the early stages of the design process, the development team reported having to rewrite portions of micro-credentials that were nearly completed. As several developers explained, this was the result of ambiguity about the specific content goals for each micro-credential and having to make decisions about content while simultaneously designing assessments for each individual micro-credential. One developer described this as a major “sticking point” because last-minute decisions involving content “caused a ripple effect” to the entire design. It is possible that some of these shifts could be avoided if the content for each micro-credential was discussed in more detail before the design phase for each micro-credential was already underway. As another developer said, “Pick your big rocks first.” Then, design from there. Project teams embarking on similar work might consider starting with a prototype micro-credential that they can fully optimize and then use as their exemplar model for subsequent micro-credentials. Furthermore, developers should consider ways to memorialize these “big rocks” and critical competencies to be assessed through concise documents that could serve as guides to both the developers and those taking the micro-credentials.

## Testing of STEM Micro-Credentials

The *testing* stage of the micro-credentials involved having a set of experienced LSU Pathways teachers pilot the micro-credentials and provide feedback on both the content and feasibility of earning the micro-credentials. In this section, we provide an overview of the testing stage, including how teachers were selected, how teachers were supported through the pilot, and how teachers provided feedback on each micro-credential. We then discuss several critical takeaways that encapsulate the primary strengths and challenges of the pilot, including the challenges of identifying expert pilot teachers and teachers’ challenges in completing the micro-credentials.

### Overview of the Micro-Credential Testing Process

The micro-credentials were piloted in three separate groups (see Table 2.2) with the hope that each pilot would inform not only the revision of the set of micro-credentials piloted but also the development of subsequent micro-credentials. One developer explained:

We’re assuming that there will be some “ahas” applicable to all micro-credentials in the series and take those into consideration as we develop the next two as well. . . . We discussed not getting too far down the road of having those totally fleshed out before we start getting some of this pilot feedback back.

**TABLE 2.2**  
**Characteristics of Each Pilot**

Pilot	Micro-Credentials Piloted <sup>a</sup>	Micro-Credentials in Pilot	Teachers in Each Pilot	Teachers Who Submitted at Least 1 Micro-Credential	Teachers Who Earned at Least 1 Micro-Credential	Start Date	End Date
Pilot 1	1.1, 1.2, 2.1 <sup>b</sup>	4	10 (5 DDEM, 5 pre-engineering)	10	6	March 2020	March 2020 (initial) August 2020 (extension) December 2020 (final)
Pilot 2	1.3, 2.2 <sup>b</sup>	3	6 (3 DDEM, 3 pre-engineering)	2	2	January 2021	May 2021
Pilot 3	3.1, <sup>b</sup> 3.2, <sup>b</sup> 3.3, <sup>b</sup> 3.4, <sup>b</sup> 3.5, 3.6, 3.7	11	7 (3 DDEM, 3 pre-engineering, 1 computer science)	5	4	November 2021	May 2022

<sup>a</sup>Numbers correspond to Table 2.1.

<sup>b</sup>District path-specific versions (one for pre-engineering and one for DDEM) were piloted.

To ensure that the developers could get quality and timely feedback, the project focused on recruiting some of the strongest teachers teaching on the LSU STEM Pathways.

For Pilot 1, LSU recruited ten teachers—five from both the pre-engineering and DDEM pathways; three of the ten had also been trained specifically in computer science although both the pre-engineering and DDEM pathways have a heavy computer science and computational thinking focus. Pilot 1 launched in mid-March 2020, right as schools were shutting down because of the COVID-19 pandemic. At that time, some developers expressed concerns about whether teachers would be able to effectively pilot any tasks requiring them to use or create artifacts as part of their classroom practice, given they were no longer teaching in person. To work around this, teachers were given the option to either complete any such tasks as if the artifacts had already been implemented in the classroom or use evidence from a prior lesson. One developer noted, “I think for our pilot it’s fine. It’s obviously not ideal, but they’re still going to be able to give us feedback on [the] micro-credential process, the time it took them.” To support teachers through the process, the developers hosted a couple of optional online “happy hours” where teachers could ask questions and provide feedback; developers described these as “really fun and productive.”

In Pilot 2, where the micro-credential content was more advanced, members of the development team hosted micro-credential workshops; team members from LSU were available to answer content questions, and those from BBI answered technical questions. Teachers were offered a stipend for attending these workshops, in addition to the incentives that were to be paid to teachers when they completed a micro-credential. Only two of the six teachers who agreed to participate in Pilot 2 ended up submitting the micro-credentials and providing feedback. At that point, the project team decided it would be helpful to have a designated LSU staff member checking in on teachers, including Pilot 3 teachers and the teachers participating in the randomized controlled trial. One developer explained:

What happened was the pilot was going and we lost a lot of our pilot teachers, and hearing why we lost the pilot teachers. . . . It’s not enough for teachers to sign on a paper and say, yes, [I’ll] do it. . . . We need someone I think who has the skill level and the experience that they can go to a teacher and say, Oh, come on, it’s not so hard, [I’ll] help you.

Although LSU had intended to hire a micro-credential coordinator to help with recruiting and mentoring at the outset of the project, it had been prevented from doing so by a hiring freeze in the months following the start of the COVID-19 pandemic. Then, in summer 2021, LSU was able to hire a team member whose role was to recruit and support both Pilot 3 teachers and teachers participating in the larger study.

In addition to providing informal feedback at the optional happy hours and workshops, each pilot participant was asked to complete one survey for each micro-credential they completed, providing feedback on whether any parts of the micro-credential were confusing (e.g., alignment between requirements and the rubrics). They also completed a survey to capture general feedback on the set of micro-credentials and the feasibility of earning them. The developers used feedback from these pilots to inform the final stage of development: refining the micro-credentials.

## Key Takeaways Drawn from the Testing Process

In the remainder of this section, we highlight three major takeaways from our interviews and focus groups with developers on how testing unfolded. Our takeaways highlight the difficulties developers had in recruiting teachers to pilot the micro-credentials—both to commit and to follow through—and the value of recruiting strong, experienced teachers to pilot the micro-credentials.

**Workload requirements and inability to communicate long-term potential benefits for undertaking micro-credentials created challenges for pilot recruitment.** Although the developers had hoped to have five to ten teachers pilot each micro-credential, most micro-credentials were piloted by only one or two teachers. Only one micro-credential was not piloted, and the last three computer science–focused micro-credentials were piloted by the same single teacher. The COVID-19 pandemic was one likely reason for the low number of teachers that the project was able to recruit for the pilot. The initial ten pilot teachers committed to the pilot before the pandemic affected daily life and shut down schools. Although they all participated in the initial pilot through May 2020, most did not continue with subsequent rounds of piloting.

Because teaching during the pandemic required so much additional work for teachers, developers expressed concern about asking teachers to commit to Pilot 2 following Pilot 1.

Teachers are going through so much. I am a little hesitant to even start the pilot of the new ones this fall. The only thing that is making me say it's okay is that these are some of our strongest teachers. But because they are the strongest teachers, they are also asked to do a lot more at their schools and being relied on for things they normally wouldn't. I am concerned about the pilot in the fall. If a number of our teachers just say "I can't do it this fall," it's too crazy.

Although six of the ten teachers from the pilot teachers did initially sign up to participate in Pilot 2, only two ended up actually participating in the pilot; those who dropped out all gave the reason that they did not have sufficient time to participate.

Developers also noted the difficulty of recruiting teachers given that the micro-credentials were only in a testing phase (as per the project plan) and did not carry any further benefit (e.g., a certification or more formal credential) beyond a monetary one. In November 2021, one developer noted that the project “would have had way more people interested” in piloting the micro-credentials if the state was able to link micro-credential completion to some concrete requirements. In the words of one developer: “It may be something that the state requires [in the future]. It may not. Right now, it [feels] like an added burden.”

**Pilot teachers struggled to earn the micro-credentials and to do so in the intended time period.** Related to the difficulties in finding teachers willing to pilot the micro-credentials, teachers who piloted micro-credentials struggled to find enough time to complete more than one or two micro-credentials per semester. Most teachers agreed that about ten to 15 hours per micro-credential was a reasonable expectation for com-



pleting them but had difficulty finding the time to complete them. Originally, developers set a deadline of May 2020 for teachers to complete Pilot 1 and tied an incentive to the teachers earning micro-credentials by this deadline. However, as it became clear that most pilot teachers would not be able to meet this requirement, developers allowed teachers to just submit (but not necessarily earn) micro-credentials by May. Developers were not initially worried by the fact that most teachers had not earned the micro-credentials by May, or even by the summer. One explained in mid-August 2020, “They’re our strongest teachers so I’m not terribly concerned. If anyone is going to do it, then they are going to do it. And if it’s not possible to get done then we will know they tried their hardest.”

By the start of the 2020–2021 school year, only four of the ten Pilot 1 teachers had earned all three of the micro-credentials from the pilot, and two teachers had earned two. Although one more teacher earned all three micro-credentials by December 2020, four had still earned none by that time. To encourage teachers who had not earned all three initial micro-credentials to participate in Pilot 2, developers extended the “earn” deadline for teachers who signed up to participate in the second round of piloting.

Only two of the teachers submitted and earned micro-credentials in Pilot 2, which focused on the remaining Level 1 and Level 2 micro-credentials. Both were pre-engineering teachers; although one DDEM teacher did start one micro-credential, all three DDEM teachers dropped out before submitting anything. One teacher who dropped out noted that although she thought the micro-credentials were valuable, the stipend to earn a micro-credential was not adequate compensation given all of her competing time constraints. A developer noted that the two teachers who did earn micro-credentials in the second pilot “told me they stuck with it because they liked me, because it was really difficult.” As described earlier, the developers hired an additional staff member after this second pilot in part to help support pilot teachers.

Only one Pilot 3 teacher earned all four micro-credentials she was piloting, although three more earned a subset of the micro-credentials. One teacher piloted all three computer science–focused Level 3 micro-credentials but did not earn them.

**Selecting strong teachers to pilot the micro-credentials was important for garnering quality feedback on the micro-credentials.** Although developers struggled to get teachers to pilot and earn the micro-credentials, those who did pilot them provided valuable feedback for the revision of the micro-credentials. The developers attributed the “really exceptional” feedback that they received to the strength of the teachers piloting the micro-credentials. After completing the initial deadline for the first pilot, developers from both LSU and BBI echoed the importance of selecting strong teachers for the pilot:

I definitely think [selecting strong teachers was the right decision for the pilot]. I think that if we had put weak teachers on here, they might not connect because it is not perfect—it’s frustrating. Our strong teachers were able to fail—and every person failed the first time—and not give up. They are go-getters and they are the ones that realize that this isn’t a reflection on their teaching.

Many of the pilot teachers had undergone training to teach several LSU STEM Pathways courses and had ongoing relationships with the LSU developers; the LSU developers described them as committed to developing their instructional practices, invested in the Pathways courses, and familiar with providing feedback to improve the courses.

Lessons learned from the testing stage are highlighted in Box 2.3.

## BOX 2.3

**Lessons Learned from Testing Micro-Credentials**

Using the data we collected from our partners, we offer the following recommendations for developers to keep in mind when piloting micro-credentials; these recommendations are also likely applicable to the broader pool of teachers who participated in the larger study to implement the micro-credentials (which we discuss in the next chapter):

- **Emphasize the value proposition for testing micro-credentials as clearly as possible.** The project could not award credit or other career advancement incentives to teachers who piloted the micro-credentials because the study itself was intended to provide evidence to inform any state policies related to the future benefits of micro-credentials. Nonetheless, teachers who participated in the pilot were motivated by various factors, including the monetary incentive, their prior positive relationships with project partners, and the desire to learn about and support the micro-credential effort. We recommend that future developers of teacher micro-credentials think carefully ahead of time about incentives that would be compelling enough to encourage pilot participation among teachers who are already very busy with their own teacher loads. Ample monetary incentives is one potential route. In addition, potentially giving teachers a designation of advisor or some other potentially reputable title could encourage their participation.
- **Be thoughtful about which teachers you invite to pilot the micro-credentials.** The developers in this study opted to recruit capable and experienced teachers who they knew would provide thoughtful feedback. This strategy proved to be helpful when all Pilot 1 teachers persisted in piloting the first set of micro-credentials, even as the COVID-19 pandemic added challenges. However, developers will also need to keep in mind that, if they recruit exemplary teachers to pilot micro-credentials, their feedback might not be representative of an average teacher's experience.
- **Regularly check in with pilot teachers and support them through the testing process.** During the piloting process, there will likely be hurdles that teachers encounter—either within the micro-credential or from external unanticipated events—that might impede their progress within a micro-credential. Teachers might not reach out when their progress stalls, so it is important for developers to proactively connect with pilot teachers individually or as a group to identify and help address barriers to piloting the micro-credentials.

## Refinement of STEM Micro-Credentials

Following the piloting, developers had the task of refining each micro-credential. By *refining*, we mean revising micro-credentials based on pilot feedback and the later substantive feedback from LDOE on the original micro-credentials. In this section, we provide a brief overview of the refinement stage, which was closely intertwined with design, and we discuss key takeaways on refinement, which echo many of our takeaways on design itself.

### Overview of the Micro-Credential Refinement Process

Refinement essentially happened twice for the first set of micro-credentials and once for the subsequent sets of micro-credentials. Initial refinements for the first set of micro-credentials were made after they were piloted and then again after LDOE provided more-substantive feedback on the need to align the micro-credentials with state and national STEM standards where possible. Thus, the first set of micro-credentials was the focus of much more refinement than later micro-credentials, not only because it went through two

rounds of revision but also because of efficiencies that improved the micro-credential design process more generally and because there was less pilot feedback on some of the Level 2 and 3 micro-credentials.

Refinement of the first three of the micro-credentials (two Level 1 micro-credentials and one Level 2 one) was thus undertaken first in fall 2020 in response to pilot feedback and then in more depth following more-substantive LDOE feedback in spring 2021. Refinement of the remaining Level 1 micro-credentials and some Level 2 ones occurred after the spring 2021 pilot. Small tweaks to the Level 3 micro-credentials occurred after the winter/spring 2022 pilot.

## Key Takeaways Drawn from the Refinement Process

In the remainder of this section, we highlight two takeaways that echo and extend what we noted as part of the design of micro-credentials: Heightened leadership from the state led to more refinements of some micro-credentials, and better refinement processes helped to make refinement more efficient.

### **Heightened leadership from the state led to more substantial refinements of the micro-credentials.**

As the state took on more of a leadership role, it particularly focused on the technical reading and writing micro-credential as one that could be refined to be more applicable to a variety of teachers. As an LDOE team member noted about the technical reading and writing micro-credential, “[T]here’s going to be different types of technical reading and different types of technical writing [and] . . . there are some elements that are going to [be] incorporated into any kind of technical reading [or writing].” Beyond the technical reading and writing micro-credential, the new LDOE team reflected further in spring 2021 on whether each micro-credential met various standards in the areas of Louisiana’s science, math, and professional learning domains.

**Clear timelines and feedback loops aided the refinement process.** As noted in the design section of this chapter, the development team became more efficient over time as they put in place more systematized processes for feedback and were on the same page in regard to the key elements of their micro-credentials and what it took to design a strong micro-credential. In addition, team members noted that the partners had created “very structured lines of feedback” that helped them get the feedback they needed in the timeline they expected. The team noted that the feedback cycle had previously been confusing. In the words of one partner:

It was very much a vicious cycle of, “Well, let’s make these changes.” Then, we would see it. And we were like, “Oh no, we need to change that.” And then [we would have to say], “Well, that’s not really what we meant.” . . . I think because of the massive number of edits to the first and second round of development, [one partner] put their foot down and said, “We need to have a process.”

Thus, the team created timelines with clearer deliverable dates for the resources preceding micro-credential development, the completion of the first pass at micro-credential content, provision of feedback, and other checkpoints. They also clarified when certain partners could weigh in with final feedback and who had the final say on revisions before a micro-credential was finalized. Another developer commented, “I think the feedback mechanisms we have in place [were] helpful for the content writers and our team as we discuss things in terms of where difficulty levels needed to be and everything else, which made it better: we have a clear goal.”

Lessons learned from the refinement stage are listed in Box 2.4.

## BOX 2.4

**Lessons Learned from Refining Micro-Credentials**

Using the data we collected from our partners regarding the refinement process, we offer the following recommendations for those embarking on similar processes:

- **Identify key existing K–12 academic standards related to micro-credential content and ensure that micro-credential content aligns with related standards.** Much of LDOE’s feedback on micro-credentials focused on ensuring alignment between micro-credential content and existing academic standards. Alignment between content of any K–12 micro-credentials and academic standards is an advantage because it can make that content more broadly applicable and useful for teachers. In addition, developers should ensure that the content they develop does not impose obvious conflicts with academic standards in other subjects that might be connected with the micro-credentials in some ways (e.g., literacy standards).
- **Create clear timelines for feedback and identify which partner will provide final approval of micro-credentials.** As noted, clear feedback loops and timelines can make refinement processes less painful and more efficient. In addition, by identifying the key decisionmakers who provide final approval for micro-credentials—the state, in this case—developers might avoid continual iterations without someone designated as having clear sign-off.

# Teacher Recruitment and Participation in the First Year of the STEM Micro-Credential Implementation

Project partners hypothesized that if micro-credentials are implemented as intended, they should drive a variety of outcomes, from improved teacher instruction to students' increased motivation and course completion and achievement. To examine whether the micro-credentials were implemented as intended by participating teachers, RAND and the project partners—LDOE, LSU, and BBI—identified a set of four measures that would reflect high-quality implementation of the micro-credential program:

- Teachers regard the micro-credentials as aligned with and applicable to the STEM courses they teach.
- Teachers earn five to eight micro-credentials over a two-year period.
- Teachers perceive the micro-credentials as giving them opportunities to build a portfolio of work, access collaborative discussions, and receive meaningful feedback that helps them revise and improve their teaching.
- Teachers receive support to complete the micro-credentials, including orientation and follow-on support, access to the micro-credential platform, and as-needed technical support.

Although the drivers of implementation might also include teacher beliefs, the types of STEM courses they teach, and other contextual factors, our project has focused on gathering information about these four concrete, measurable aspects of implementation. In addition, our project gathered information about teacher recruitment processes, given the importance of recruiting an adequate number of teachers in order to study implementation.

In this chapter, we summarize our preliminary data collected in the 2021–2022 school year and the first part of the 2022–2023 school year related to recruitment and teachers' participation in the micro-credentials as reflected by findings related to the four measures of micro-credential implementation. These data include partner interviews and documentation regarding recruitment; teachers' progress on micro-credentials in the first year of implementation as measured by BBI's micro-credential platform; and teacher interviews conducted in spring 2022. We provide some preliminary thoughts on lessons learned at the end of the recruitment and implementation sections. Our final report will provide additional findings related to our implementation measures and more-comprehensive recommendations, as well as data on outcome measures that we hypothesize to be connected to successful implementation.

## Recruiting Teachers to Participate in the Micro-Credentials Study

### Overview of Recruitment

Successful implementation is contingent on recruiting adequate numbers of teachers to participate. Without an ample sample of teachers, the evaluation will be underpowered to detect shifts in teacher practice or student outcomes as a result of the micro-credentials. Thus, this section presents an overview of how partners

recruited teachers to participate in the RCT of the micro-credentials and key takeaways from this experience that could offer lessons for similar efforts.

Initially, the project aimed to recruit 106 teachers for the RCT, with the plan that half of those teachers would be randomly assigned to undertake the micro-credentials over a two-year period, starting in fall 2020. If needed, we planned to recruit additional teachers to start in fall 2021, who would be in the study for one year. However, as was the case in the pilot, it was difficult to recruit teachers to participate in the RCT because of factors that included disruptions and burdens on teachers caused by the COVID-19 pandemic and Hurricane Ida, limited teacher time more generally, and not enough incentives available for teachers, as well as competing STEM-related projects that offered larger monetary incentives than this study.

As noted in Table 3.1, project partners expanded our pool of eligible teachers each year over the course of recruitment and increased monetary incentives for completing the micro-credentials to attract additional teachers. Our original recruitment plan and efforts focused solely on LSU STEM Pathways teachers, but recruitment was slow because of the COVID-19 pandemic. In addition, a competing STEM project also funded by the U.S. Department of Education that started at the same time as the Louisiana Micro-Credentialing Project identified multiple LSU STEM Pathways teachers in large schools who were willing to participate in that project. Because of the experimental nature of that competing project, the micro-credentialing project partners were asked to refrain from recruiting any teachers in schools participating in that competing project, which limited the recruitment pool to 51 LSU STEM Pathways teachers rather than the 90 that had been originally available to participate.

In 2021, recruitment expanded to include PLTW teachers who taught similar courses to the LSU STEM Pathways teachers. Despite expanding the pool of eligible teachers from about 50 to roughly 150, we were able to recruit only 26 teachers for the cohort of teachers that participated in the 2021–2022 school year. For the second cohort, the project also recruited teachers of biology and chemistry through OpenSciEd after confirming that at least five of the micro-credentials would be relevant to these teachers. In addition, starting in the second year of micro-credential implementation, the project partners created a sliding scale that provided a higher incentive if a teacher completed more than one micro-credential. For example, teachers completing one micro-credential received \$150 and \$400 for each additional one. In addition, starting in January 2023, the project doubled the incentives, so teachers received \$300 for their first micro-credential and \$800 for each additional micro-credential (as well as a bonus of \$350 for the third and fifth micro-credential completed. After three recruitment waves (in 2020, 2021, and 2022), only 51 teachers enrolled in the study. From this group, six teachers dropped out of the study for various reasons, including lack of time and changes in their

**TABLE 3.1**  
**Teacher Recruitment from 2020 to 2022**

Year	Eligible Teachers	Incentives	Number of Eligible Teachers	Number of Teachers Enrolled	Percentage of Eligible Teachers Enrolled
2020	LSU STEM Pathways pre-engineering and DDEM teachers	Control: up to \$500 Treatment: up to \$1,500	51	21 <sup>a</sup>	41
2021	LSU and PLTW pre-engineering, DDEM, and computer science teachers	Control: up to \$500 Treatment: up to \$1,500	154	26 (cohort 1)	17
2022	LSU and PLTW pre-engineering, DDEM, and computer science teachers; OpenSciEd biology and chemistry teachers	Control: up to \$650 Treatment: up to \$2,800	179	25 (cohort 2)	14

<sup>a</sup> These teachers initially signed up but did not start the micro-credentials in 2020, given study delays; only half of these teachers were eligible to sign up the following year.

course schedule that made them ineligible. At the start of the 2022–2023 school year, 45 teachers were randomly assigned to treatment and comparison groups in the RCT.

## Key Takeaways Regarding Recruitment

In the remainder of this section, we highlight three major takeaways from our interviews and focus groups with developers on recruitment, followed by some brief lessons learned.

**Recruitment challenges necessitated expansion of the pool of eligible teachers.** The project originally proposed that only LSU STEM Pathways teachers would participate in the micro-credential study. However, the pool of eligible LSU STEM Pathways teachers was smaller than anticipated for several reasons. First, fewer teachers who signed up to be trained to be an LSU STEM Pathways teacher in summer 2020 and 2021 agreed to participate in the study than originally projected in the project proposal. The project partners attributed this to a combination of factors, including COVID-19–pandemic disruptions and the aforementioned competing study that was also recruiting LSU STEM Pathways teachers.

**Even after expanding the recruitment pool to additional teachers, it was harder to recruit teachers and districts after a year and a half of teaching during the COVID-19 pandemic.** A much smaller percentage of eligible teachers consented to join the RCT in 2021 and 2022 (17 percent and 14 percent, respectively), compared with the 41 percent of the recruitment pool that joined the study in 2020. Although some of this drop might be attributable to recruiting from a new pool of teachers with fewer connections to LSU project partners, even LSU STEM Pathways teachers signed up at a lower rate—29 percent of eligible LSU STEM Pathways teachers enrolled in 2021.

Additionally, some school districts were hesitant to give permission for teachers' participation in the study. Although we did not formally collect data on why this was the case, the districts that declined participation provided one of two reasons. Either they were concerned about sharing data, or they felt that it was not a good time for teachers to add more to their already busy schedules. Other districts were slow to respond or nonresponsive.

**Incentives for micro-credential completion were perhaps not large enough, or the right kind, to entice teachers to enroll in the study or encourage districts to give teachers permission to participate.** As one BBI developer reflected in November 2022:

I think the bottom line was there wasn't a large enough incentive for teachers. . . . I think it has to do with incentives and not finding the right ones. With some of our other programs—we have things like, they have a rank change or a title change—those are very successful. This didn't have anything of that substance.

Close collaboration among school districts across Louisiana to drive a rank or salary change was beyond the scope of the proposed study. Additionally, as noted by LDOE, the project had been proposed for the express reason to better understand whether such a state endorsement might be warranted in the future, following micro-credential testing. In addition, given that the participating teachers were distributed across many districts and schools, the project partners could not identify a logical district- or school-level incentive that might encourage administrators to give their teachers permission to participate.

Lessons learned regarding recruitment are listed in Box 3.1.

## BOX 3.1

**Lessons Learned for Recruiting**

Based on the data we collected from our partners regarding recruitment, we offer a few recommendations:

- **Prior to embarking on micro-credential efforts, consider what competing demands for potential participants might suggest a shift in timeline or recruitment pool.** Of course, the study partners could not have anticipated all the impediments to recruitment, including both the COVID-19 pandemic and a competing study. But, if possible, development teams and funders should attempt to anticipate time and competing burdens among teachers that could limit recruitment, as well as what types of teachers might potentially derive value from the micro-credentials and could thus benefit from being in the recruitment pool.
- **Ensure ample incentives for teachers to earn micro-credentials, especially when endorsements or continuing education credits for participation are not yet available.** We recommend that those developing teacher micro-credentials set aside ample monetary incentives to increase teachers' willingness to participate in a study like this one. In addition, when possible, partners should consider whether district- or school-level incentives could make sense. For example, if all teachers of a particular subject in a given district or school could benefit from taking the micro-credentials, studies might consider appropriate district or school incentives (e.g., free professional learning opportunities, free breakfast for teachers).

## Teachers' Participation in Micro-Credentials in the First Year of Project Implementation

In this section, we discuss the first year of the implementation of the micro-credentials among participating teachers. These data are necessarily limited, given that our sources of data were interviews with only a small number of treatment teachers and developers' reflections, along with data from BBI on teachers' progress through the micro-credentials.<sup>1</sup> Therefore, this section is brief and incomplete. We will present a fuller picture of implementation, including data on how teachers integrated micro-credential learnings into their actual instruction and a set of recommendations, in our final report. We first provide an overview of teachers' progress through the micro-credentials, drawing on BBI data. We then discuss themes regarding micro-credential implementation based on interviews that we conducted with six teachers (only two of whom had submitted and earned a micro-credential) and two focus groups we conducted with developers of the micro-credentials.

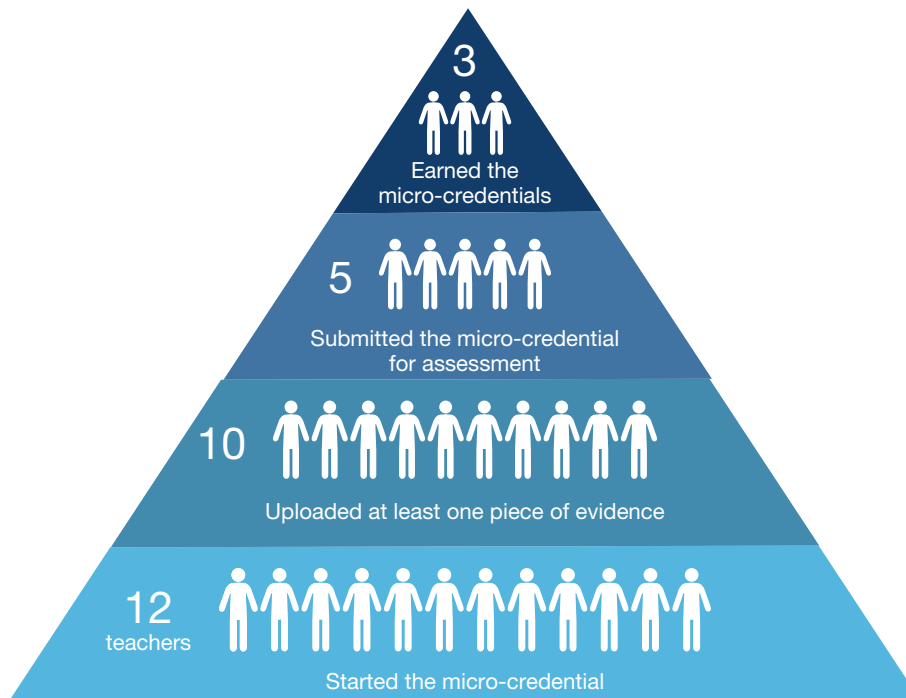
### Overview of Teachers' Progress Through Micro-Credentials in the First Year

Participating teachers were directed to begin with the Facilitating Project-Based Learning micro-credential, a Level 1 micro-credential that was intended to be applicable to all teachers in the sample (as were the other Level 1 micro-credentials). Teachers made little progress on that micro-credential or other Level 1 micro-credentials during the first year of the study. Figure 3.1 summarizes how many teachers completed each

<sup>1</sup> BBI tracks several measures of teacher progress on micro-credentials: start date (i.e., when a teacher clicks on content within a micro-credential), progress date (i.e., the last date a teacher uploaded evidence for the micro-credential), submission date (i.e., the date a teacher submitted a micro-credential for evaluation), and earn date (i.e., the date a BBI assessor certifies that a teacher has successfully met the requirements for the micro-credential).



**FIGURE 3.1**  
**Number of Teachers Completing Each Stage for the First Micro-Credential:**  
**Facilitating Project-Based Learning**



stage of Facilitating Project-Based Learning. Although 12 of the 13 treatment teachers started that micro-credential, only three earned it by August 2022.

The three teachers who earned the Facilitating Project-Based Learning micro-credential all started an additional micro-credential during the first year of the study. However, no teachers reached the submission stage for any micro-credential aside from Facilitating Project-Based Learning in the first year.

Progress through the first micro-credential was also slower than anticipated. A project delay because of Hurricane Ida meant that teachers were not introduced to the Facilitating Project-Based Learning micro-credential until November 2021. Although BBI's micro-credentials typically take four to six weeks to complete, the project team set a target earn date of February 2022 to allow additional time for the holidays and for teachers to familiarize themselves with the platform. The first teacher to earn a micro-credential in this study did so in the last week of March 2022. Of the teachers who started but did not submit, most (five of seven) did not upload any evidence to the platform after mid-November 2021.

### Key Takeaways from the First Year of Implementation

In this section, we describe four key takeaways on implementation of the micro-credentials in the first year, including our understanding on why teachers did not progress through the micro-credentials as initially intended, based on our interviews and focus group data.

**Teachers did not progress on micro-credentials for a variety of reasons, including both the COVID-19 pandemic and Hurricane Ida.** Interviews and focus groups provided some insights into the reasons that teachers did not make as much progress as anticipated. The obvious reasons included disruptions caused by Hurricane Ida and the COVID-19 pandemic. In addition, for some teachers, lack of time because of their teaching obligations limited their ability to make sufficient progress. For example, one teacher said, “[The micro-credential] was more work than I expected it to be. It has a lot of questions and is very detail oriented.

I didn't expect it to be as time consuming. I just didn't have the time with my classes. I teach at a small school, and I have extracurriculars too." Likewise, developers described grappling with how much time is reasonable to expect from teachers to invest in micro-credentials. In the words of one developer:

We started with this idea of a very high number of micro-credentials being attainable, and whether it's due to the pandemic or whether it's due to teacher workload and what's being requested of teachers in the modern age, it seems like we might have put the bar a little high. . . . I'm hoping that . . . one of the real take-aways that this study gives us is what is an actual attainable goal.

**Teachers attempting to earn micro-credentials were provided with various supports, which many appreciated.** As one form of support, BBI expected teachers to participate in an eight-week long Success Academy to orient them to the BBI platform as they worked to earn their first micro-credential. After supporting teachers in how to engage with the platform, BBI provided guidance to teachers about how to complete each component of the micro-credential, including how to submit evidence for their portfolios. Teachers were also provided with ongoing support from an LSU staff member who hosted weekly support sessions.

Teachers indicated that they recognized and appreciated the support that they were offered. For example, one teacher said, "Every staff person at LSU has been above and beyond helpful and patient, like, what can I do to help?" Several of the teachers commented on the helpfulness of the weekly meetings organized by the LSU team to support teachers working on the micro-credentials. Yet, some teachers noted difficulty in attending the meetings because of time and scheduling constraints. For example, one teacher described teachers' busy schedules as an obstacle: "When January rolled around, and my build season started [I couldn't]. We met every day until seven o'clock at night, and then on Saturday. It was just an insane work schedule, so that became really hard to do." Another teacher noted a scheduling conflict: "The meetings were on Tuesdays, which of course is when our faculty meetings are, which made it difficult to join in all the sessions."

Teachers were also satisfied with the feedback that they received on their micro-credentials. One teacher pointed out the clarity in the feedback, which helped with micro-credential revisions: "They pinpoint, tell you what you are missing, what you need to correct." Another teacher commented: "I love the feedback [from assessors]. I love how they get to us quickly. They are detailed."

**Teachers voiced a variety of ways that micro-credentials supported their instruction.** Although many teachers did not make substantial progress on the micro-credentials, most of those we interviewed perceived various gains and impacts on teaching, including helping them set aside valuable time to reflect and using new practices in their classrooms. One teacher perceived the micro-credential process as "an awakening experience," adding, "What it has done for me is refresh myself and critique myself and judge myself. When I went through these, I looked again, I thought I needed to reactivate some things."

Despite making little progress through more than one micro-credential, several teachers shared various new classroom practices they learned about through the micro-credentials, such as giving more voice to students in the classroom, more-frequent use of written feedback to students, and more-specific strategies that they can use in their teaching. For example, a teacher commented:

When I was looking at the materials, I purposely chose things I haven't done yet so that it would be new to me. So, one of the things was a project wall. I still don't feel like I did it right, but I've made an attempt at it. A project wall includes a timeline and [posted] student work, so that was really good. I feel like I learned some of the pros and cons of doing that.

Another teacher described a change in framing tasks for students to work on because of engaging in the micro-credential on project-based learning: "It helps me to think further into the lessons or activities to help

the student gain more information or insight about why we are doing something. Instead of just, this is one of the projects that we need to do.”

Some teachers also described various ways in which their work on micro-credentials might be shaping opportunities for their students. One teacher noted that her students became more motivated and were given the opportunity to take more ownership. Another teacher described how she started to slow down and focus more on trying to understand what and how her students were learning, which she thought was helpful for the students too.

**Teachers also voiced some concerns about what was missing from the micro-credentials or could be improved, pointing out the desire for more collaboration.** Several of the teachers with whom we spoke pointed out limited opportunities for teacher collaboration while working on micro-credentials and suggested ways to facilitate collaboration among teachers for engaging more productively in micro-credentials. One teacher said that although they had an opportunity to connect with other teachers, the collaboration should have been a requirement. She said, “By forcing it on me, pair me with someone with interest in a way that I am accountable, [and] I will report to you my progress. I may not want to tell you, but to have to come and tell you something . . . I have to prepare.” Another teacher commented, “I’m not sure what type of other motivation I need to do it. Perhaps peer pressure from the other teachers. I think if there’s any way for us to feel more like a cohort and holding each other accountable would help.”

Teachers also suggested that the structure and format of the support meetings could have been designed differently. For example, the meetings could be tailored to a specific group of teachers’ needs based on the micro-credential work they submitted, or the support team could offer more than one meeting time option. Teachers also suggested integrating the micro-credentials into existing professional development structures. One teacher, for example, noted,

You know, teachers have to do [professional development] throughout the year. We are required to do so many hours. I think getting with our academic assistant principal or faculty advancement coordinator. If that could have been our group for the year, that would have helped because we have to meet in those groups at a certain frequency.

Some teachers noted that there needs to be more buy-in and support for micro-credentials. One teacher said, “I don’t know. I think people know about it or some people do—but it doesn’t get pushed out there. People don’t realize that it is beneficial, could be beneficial to them. It is easier than you think. It isn’t presented in that manner to people.”



## Conclusion and Lessons Learned

This report provides a unique and in-depth investigation of the development and implementation of a set of micro-credentials that gave teachers an opportunity to identify and demonstrate specific competencies related to their STEM instruction. The project—Improving Pre-Engineering and Computer Science Education Through Micro-Credentialing (i.e., the Louisiana Micro-Credentialing Project)—is a partnership among LDOE, LSU, RAND, and BBI. Although our work echoes some findings from other research on micro-credentials, it is among the first to dig deeply into understanding one effort to develop micro-credentials across a variety of areas.

In this concluding chapter, we provide a brief summary of key insights gathered from the study. These findings were based on qualitative interview data and data from BBI’s micro-credential platform collected by RAND over the course of the development process (from 2019 through 2022) and throughout the first year of the implementation of the micro-credentials with teachers (2021–2022). After summarizing our findings, we provide some broad implications of our research thus far for policymakers, funders, and researchers.

In Chapter 2, we identified four intertwined stages of the micro-credential development process: conceptualization (how micro-credentials were broadly envisioned); design of individual micro-credentials; testing through piloting of micro-credentials by teachers; and refinement of micro-credentials based on piloting and partner feedback. For each stage of that process, we identified a set of key findings, along with lessons learned that might inform other development projects. In particular, our findings make the following clear:

- Partners faced numerous challenges in the development and implementation of micro-credentials, including considerable disruptions related to the COVID-19 pandemic, Hurricane Ida, and a change in state leadership, as well as difficulties in recruiting teachers to participate in the study.
- In addition to these challenges, partners faced a learning curve to establishing a shared understanding of what the individual micro-credentials for this project should look like, and it also took them time to identify the most-productive processes and practices for developing the micro-credentials.
- Despite these challenges in their work, the partners developed 18 micro-credentials, nearly all of which were pilot tested and are ready for teachers’ use.
- Although our data from the first year of implementation is relatively thin, teachers with whom we spoke commented on the value of the micro-credentials to their teaching, even when they had not completed them. Furthermore, teachers commented on the usefulness of the feedback they received from assessors and the helpfulness of supports provided by LSU and BBI.
- That said, few participating teachers completed more than one micro-credential, although the study goal was for teachers to complete six to eight micro-credentials per year.
- Teachers with whom we spoke also reflected that they might have been able to make more progress if they had been able to collaborate with and receive some support from their peers in completing the micro-credentials.

Our report also outlined a set of lessons for those developing micro-credentials for teachers in other projects, including lessons at each stage of the development process, as well as for recruitment of teachers. We refrained from discussing lessons for implementation given the preliminary nature of our implementation findings. The lessons we enumerated are not necessarily ones that the partners for this study were able to undertake but are instead derived from their experiences and the actions they took to solve the dilemmas they encountered. In particular, these lessons emphasized that development teams should consider

- allocating ample time at the beginning of the development process to reflect on aspects of existing micro-credentials that might be used productively for their development project and outline a set of processes that can facilitate their development
- identifying incentives that might best compel teachers to participate in their development and testing
- involving and collaborating closely with expert teachers who can support piloting and potentially also support their fellow teachers
- aligning the content of micro-credentials with K–12 academic standards that are applicable to areas on which micro-credentials are focused
- understanding competing demands on teachers' time and how micro-credentials could fit into the time teachers have.

Full details about these lessons and how they were derived from our data are provided in Chapters 2 and 3. These lessons are aligned with some prior research on micro-credentials. For example, as noted by Tooley and Hood (2021b) and others (e.g., Oliver, 2022), micro-credentials can vary widely in form and assessment, which underscores the importance of developers getting on the same page about their purpose and content early, potentially by studying a variety of existing micro-credentials. As with Acree (2016), teachers with whom we spoke noted the usefulness of the micro-credentials for their instruction. At the same time, as noted in other studies (Gamrat et al., 2014; Gish-Lieberman, Tawfik, and Gatewood, 2021; Tooley and Hood, 2021b), the teachers in this study also voiced a desire for more support for their micro-credential work from peers or cohorts.

Readers should keep in mind the limitations of our research, including that not all the developers involved in the micro-credential process consented to speak with us, and we spoke to only a small number of teachers who agreed to be interviewed to discuss their experiences with the micro-credentials. Thus, our research does not necessarily reflect the perspectives of all participants in the project. Nor does it reflect the perspectives of school or district leaders who employ teachers. In addition, importantly, this report focuses only on the first year of implementation. For these reasons, this report does not provide the fullest and most comprehensive picture of development and implementation. Nonetheless, beyond the lessons we have already enumerated for development teams, this work offers some potential implications for stakeholders who might influence or benefit from the development and implementation of micro-credentials, including funders, researchers, and policymakers. These implications are drawn from both the key takeaways and lessons learned that we have discussed regarding development, recruitment, and implementation of the micro-credentials.

- **Funders, researchers, and others who wish to encourage creation of high-quality micro-credentials should aim to create more resources to support micro-credential development, including more tools for learning about what micro-credentials include and emphasize.** The education field is just beginning to provide more guidance on what micro-credentials are and how they could be most beneficial for teaching and learning (e.g., Tooley and Hood, 2021b; Oliver, 2022). The time is ripe for the creation of better resources and processes to support micro-credential development. For example, a set of suggestions for their creation (e.g., how to get started, how to test and refine them, who should provide final approval) could have benefited the Louisiana Micro-Credentialing Project and similar projects. In

addition, such resources as Tooley and Hood (2021b) and other reviews of best practices for the development and implementation of micro-credentials—including the recent Quality Assurance Standards for Micro-Credentials from digiLEARN (digiLEARN, undated)—could serve as readings that lay the groundwork for development teams to reflect on how to harness the potential of the micro-credentials they wish to develop.

- **Developers and implementers of micro-credentials should carefully consider the value proposition for taking micro-credentials and how to communicate that value proposition to users.** The micro-credentials created through the Louisiana Micro-Credentialing Project provide teachers with an opportunity to demonstrate a unique set of STEM competencies that would otherwise not be available and are applicable to teachers of a variety of STEM courses. However, given that multiple STEM Pathways training programs already existed, teachers might not have fully understood the usefulness of the micro-credentials for their practice, which possibly created challenges for recruitment. Given that micro-credentials are a relatively new innovation, and given the resources it takes to develop them, those supporting their development should reflect on how to best communicate to teachers why work to demonstrate competency could be beneficial to their practice and why one would want to demonstrate competency in a particular area.
- **Developers of micro-credentials should ensure ample time for micro-credential development and testing processes and possible ways to certify their quality.** Relatedly, any micro-credential should be thoughtfully tested and refined to ensure its value to teachers. CCSSO has created a brief that provides guidance for ensuring high-quality micro-credentials, as have others (e.g., Tooley and Hood, 2021b; Oliver, 2022). However, there is no official organization that certifies the quality of micro-credentials, as accreditation organizations do for university programs. For these reasons, any development team should make sure they have set aside ample time for the testing and refinement of the micro-credentials they are developing. In addition, states or other entities might consider providing accreditation processes that guarantee the quality of a given set of micro-credentials, based on such standards as those set by CCSSO or other organizations.
- **Peer collaboration is likely a useful mechanism to pair with testing of micro-credentials.** For several reasons, the Louisiana Micro-Credential Project was limited in the extent to which it could form peer collaborations to support teachers working toward micro-credentials. First, participating teachers were generally not from the same districts and could not meet together within their home districts to discuss their work or get advice from other teachers. Second, teachers were given freedom to choose which micro-credentials to complete and work on them at their own pace, which meant that teachers were typically not working on the same content at the same time. In particular, given that teachers did not receive any recognition for completing the micro-credentials beyond monetary incentives, the support of peers might have encouraged them to work on micro-credentials more. In future work to test micro-credentials, it might therefore be advantageous for developers to have more-robust partnerships with a small number of districts or schools where leaders perceive advantages for their teachers to complete the micro-credentials and where teachers could potentially do more work on micro-credentials together or in professional learning communities. In addition, developers might consider being strategic about bringing a small number of teachers in to serve as critical advisors from the beginning of the project. As critical partners and advisors during the piloting stage, these teachers might also secure the involvement of other teachers and help to build cohorts of teachers who can seek input and support from one another to complete the micro-credentials.

We expect to gather further data in the second year of the project across a larger number of teachers regarding their perceptions and instruction, as well as some student outcome data, which will help us consider how the implementation measures we have studied drive teaching and learning.



## Qualitative Code Definitions and Examples

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

**TABLE A.1**  
**Qualitative Code Definitions and Examples**

Code	Definition	Example Text Excerpt
Development stage: conceptualization	Work done before individual micro-credentials were designed, including work related to vision-setting and discussion of goals and priorities for micro-credentials; subcodes included any discussion about (1) the purpose of micro-credentials (e.g., who they are for and what they will do) and (2) administrative decisions (e.g., how long a micro-credential should take, platform decisions)	<p>“It seems like . . . we started with this idea of a very high number of micro credentials being attainable, and whether it’s due to the pandemic or whether it’s due to teacher workload and what’s being requested of teachers in the modern age, it seems like we might have put the bar a little high.”</p> <p>“We figured that with these first three [micro-credentials], the goal would be that these are the three common ones that are shared amongst all the pathways or in some cases that there is some element of these caught in some way, shape, or form.”</p>
Development stage: design	Work done to produce individual micro-credentials prior to testing	<p>“What made this round so much more productive, instead of outlining the activities and ideas and thoughts, we started with the content: what is important and what do we want participants to learn in a way that was more concrete. At the beginning of the process, we didn’t make all the agreements that needed to happen before they started. We linked things out.”</p> <p>“The original spec [for the micro-credential] ended up saying it was just the four [aspects of computational thinking]—and then it kind of limited it from other things that could have/ should have fit into it. Now, we are opening things back up. I think it is a good space right now. Then, that will go off for a second round. I guess the rubrics are the next thing to take care of.”</p>

**Table A.1—Continued**

Code	Definition	Example Text Excerpt
Development stage: testing	Work done to pilot micro-credentials; subcodes included any discussion about (1) recruitment of pilot teachers and (2) support and retention of pilot teachers	<p>“Teachers are going through so much. I am a little hesitant to even start the pilot of the new ones this fall. The only thing that is making me say it’s okay is that these are some of our strongest teachers. . . . But because they are the strongest teachers, they are also asked to do a lot more at their schools and being relied on for things they normally wouldn’t.”</p> <p>“I should also mention that the high schools will also not reopen for the rest of the year. It’s already happened in Kansas and it seems to be the national trend, which is terrifying. So that means that the teachers would not have a chance to collect any data, the pilot teachers. They would definitely not have a chance. . . . If we went back they would at least have a chance to implement. If we don’t go back, they won’t have any chance of implementing it.”</p>
Development stage: refinement	Work done to improve and refine the micro-credentials after piloting	<p>“More broadly, once the pilot is wrapped up or once we’ve started to receive some feedback, we’ll be gathering that feedback and using it to iterate on these three micro-credentials and then starting to target and think about the development of the next two.”</p> <p>“The content [team] is digging into the feedback for revisions based on the round 1 pilot micro-credentials. Basically, at a high level we looked at feedback [from pilot teachers] on the requirements, on the rubrics, and we have pilot participants rate on a scale of 1–5 how strongly they agreed with certain rubric factors and required factors. And then we also opened it up for their general feedback on each of the micro-credentials. So we have all of that captured, and I know our content team is working through those edits and also incorporating some of the notes that our assessor team has made along the way.”</p>
Successes	Any comments explicitly about successes or things that have gone well	<p>“I definitely think that efficiency was improved, and I think in the process of improving efficiency, we uncovered that there were some issues with the structural design of the recruitment strategies and some of the strategies for the writing process.”</p> <p>“We went through the writing process a lot smoother than we did for the first round. This is evidenced by the fact we don’t really have edits to make. They are minor. Teachers successfully went through [micro-credentials] and passed them. That was really positive.”</p>
Challenges	Any comments explicitly about challenges, including challenges articulated by teachers in doing the micro-credentials	<p>“I say that probably the most challenging thing is that we’ve been trying to do this relatively quickly because we want to get a pilot group through these so we can get some feedback on the micro credentials before the summer program starts up again so we can launch it in full. So the timeline has been a little bit challenging. Just making sure that we’re hitting the deadlines.”</p> <p>“Remote is a challenge for us. It has been a struggle to develop [micro-credentials] while we also translate all of our materials to remote learning (LSU trainings).”</p>

Table A.1—Continued

Code	Definition	Example Text Excerpt
Lessons learned	Any comments on lessons learned, what partners would like to apply to the future or would recommend others do, and changes that partners would make if they had to undertake the process again	“I definitely think going into it, having a very clear framework of the concepts that you want to assess and the alignment of those concepts with your providers training or the training, system or the content that you wish to have, mapped out in such a way that like there’s almost a one-to-one alignment going in so that there’s no ambiguity and in what direction things are going [would be helpful for development of future micro-credentials].”
Timelines	Any comments related to the timeline of steps in the development process or meeting/sticking to timelines	“Best case scenario is . . . we have given [pilot teachers] some suggested milestones but there is one deadline we are asking folks to meet, which is May 18th, and that is the day we’re saying they have to have made all of their submissions by. We internally know that we have [a] little flexibility but we like to drive people to that date so that we can get feedback in time and start to process it.”
Role clarity and continuity	Any comments clarifying partner roles and responsibilities or noting confusion in regard to roles and responsibilities and/or continuity in roles over time	<p>“You really have to have a lot of resources and have a lot of really clear direction, and [name] was really helpful in the content calls of focusing people, particularly [our] team, to kind of get to the end goal, a little faster.”</p> <p>“And so when I came on board, obviously you know, there were some things that I had to learn and some things that BloomBoard had to learn about the project, and I felt like everybody was just trying to figure out what was best, and so we did take more of a heavy role in guidance to ensure that the project was successful.”</p>
Collaboration	Nature of collaboration or working styles	<p>“There were three back and forth drafts. They gave it their first shot, we gave them feedback, they updated it, and we looked at it again and made minor tweaks along the way. By the time we got to [the third micro-credential] the first draft was already in a really good spot. They’re learning [from] us, we’re learning [from] them. It’s been pretty good.”</p> <p>“Everything in general I think is going pretty well. I think the collaboration has been really strong. The LSU team is generally just great to work with. They have really great questions. They have really targeted specific feedback. They’ve given us their time to actually think through a lot of the content of the micro credentials. They’ve given strong resources to use.”</p>

Table A.1—Continued

Code	Definition	Example Text Excerpt
Implementation	Any developer comments regarding implementation of the micro-credentials with teachers and their recruitment into the study	<p data-bbox="795 310 1408 590">“I don’t know if we’re going to have ten or a hundred [teachers attending training to teach a STEM Pathways course]. And given the number of teachers that we need for the study, even if we get this online thing going and even if we go back in August and everything is great, we just may not have enrollment because schools can’t pay to attend the training. Teachers aren’t available because they have to take care of their families. You know, XYZ reasons. We’re not going to know our enrollment until mid-May because schools don’t know anything so they can’t commit to sending a teacher. So there’s so many variables.”</p> <p data-bbox="795 617 1408 842">“The Success Academy [to support teachers in taking their first micro-credential] is what we call it. . . . So, there’s a pre-orientation activity [prior to teachers starting the micro-credentials]. The orientation and then . . . it’s a seven-week model, eight if you count the asynchronous work in the pre-orientation activity, but we say every micro credential takes about four to six weeks to complete but that Success Academy is a little longer because in part of that they really need to understand the platform.”</p>
Implementation—reasons teachers did not make sufficient progress	Comments by the teachers about various reasons that contributed to making limited progress in completing the micro-credentials	<p data-bbox="795 863 1408 989">“It was more work than I expected it to be. It has a lot of questions and is very detail oriented. I didn’t expect it to be as time consuming. I just didn’t have the time with my classes. I teach at a small school, and I have extracurriculars too.”</p> <p data-bbox="795 1016 1408 1142">“It was my hardest year teaching. At least in our region, anyways, between COVID and Ida and the amount of damage we sustained personally and then the amount of damage at some of my kids’ houses. It’s just been one thing after another.”</p>
Implementation—supports for using micro-credentials	Comments about the kinds of support with which teachers were provided during their work on the micro-credential, including the feedback that they received, and teachers’ perceptions of the support	<p data-bbox="795 1163 1408 1289">“Anytime I had a question, I got specific feedback and examples on what to do—what to do, how to handle it. There were almost too many people helping. You know, on some Tuesday sessions, there were as many LSU folks as people in the study.”</p>
Implementation—teacher perceptions of micro-credentials	Comments that provide insights into teachers’ perceptions of the micro-credential and their impacts; subcodes included perceived gains and impacts on teaching, perceived impacts on students	<p data-bbox="795 1335 1408 1566">“I have learned a lot. What it has done for me is refresh myself and critique myself and judge myself. When I went through these, I looked again, I thought I needed to reactivate some things. I am looking a different way. For example, the best practices that you tend to forget. It is an awakening; I need to do a proper assessment. It brought me back to best practices, how to connect with students. As a long-time teacher, you know, I should be doing that. It has brought me back to life. Myself and the students.”</p>
Implementation—teachers’ perceptions on what was missing and/or could have been improved	Comments about what teachers thought was missing in micro-credentials and supports for their use and areas for improvement noted by the teachers	<p data-bbox="795 1619 1408 1850">“In the future, we need more active collaboration between . . . teachers [of particular types of classes]. That can motivate them more well. You know who they are, who is where, some have more knowledge than others. Maybe, I did not reach out so much on that line. You have to know it is important, that you want to. You always have teachers, there is always something to do. If we could create a scenario where we collaborate more. Sometimes you are alone in the jungle. It is easy to give up.”</p>

# Abbreviations

ADDIE	analysis, design, development, implementation, and evaluation
AIR	American Institutes for Research
BBI	BloomBoard, Inc.
CCSSO	Council for Chief State School Officers
COVID-19	coronavirus disease 2019
DDEM	digital design and emergent media
K-12	kindergarten through grade 12
LDOE	Louisiana Department of Education
LSU	Louisiana State University
PLTW	Project Lead the Way
RCT	randomized controlled trial
STEM	science, technology, engineering, and mathematics



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