Micro-credentials

Addressing Certification and Professional Learning in Computer Science

C O D E Advocacy Coalition

Summary

- There is surging demand for computer science instruction, yet the majority of computer science teachers do not have a formal computer science certification.
- Current pathways to certification are hard to find, arduous, costly, focused on content rather than pedagogy, and often irrelevant or inappropriate for teachers.
- Micro-credentials allow teachers to earn an endorsement in a way that is job-embedded, less expensive than coursework, and highly accessible. For teachers who have been teaching computer science without a computer science certification, micro-credentials recognize teachers' existing skills and prior experience.

Recommendations

1. State and local education agencies should support the use of micro-credentials in professional learning and as an option for teachers seeking to earn a computer science endorsement.
2. Issuers and recognizers of micro-credentials should design and implement micro-credentials that cover required content and pedagogy, align to standards, compare to other certification pathways, are developed by a range of stakeholders (including teachers), and are recognized through academic credit and/or compensation.

Micro-credentials: A Pathway for Certification and Professional Learning. (2019). Retrieved from http://advocacy.code.org.

Supporting Organizations

Key terms

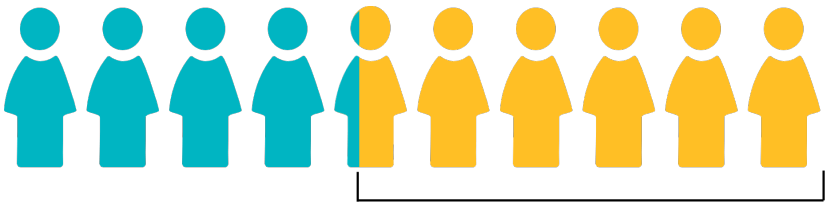
Certification: The overarching term for the process by which a candidate earns credentials to authorize them to teach a subject at particular grade levels, such as licensure or endorsement. **Examples**: A preservice candidate in an undergraduate program earning their initial license, a primary school teacher adding a specialization to their license, or a secondary school teacher adding a computer science endorsement to their license.

Licensure: The process of obtaining the initial credential to teach. **Example**: A preservice candidate in an undergraduate program completing the requirements to earn their initial license as a middle school science teacher.

Endorsement: The process of obtaining an addition or extension onto a teacher license for teachers who already possess licensure in another area. **Example**: A high school mathematics teacher adding an endorsement to teach computer science or an elementary school teacher adding a STEM specialization.

Policy Position

The demand for computer science education in our nation's schools is greater than ever, but there are not enough computer science teachers to meet this demand. Thousands of teachers whose licensure and training are in other content areas have stepped up to address the demand by engaging in professional development to begin teaching computer science courses. It is not surprising, then, that the majority of computer science teachers (56%) do not have credentials specific to the teaching of computer science, such as a computer science certification[1]. This policy paper recommends an innovative approach to computer science professional learning: earning a computer science endorsement through **micro-credentials**.



56%
of high school computer science teachers aren't certified in computer science

THE VALUE OF CERTIFICATION

Certification is valuable because it provides a process and structure for credentialing that:

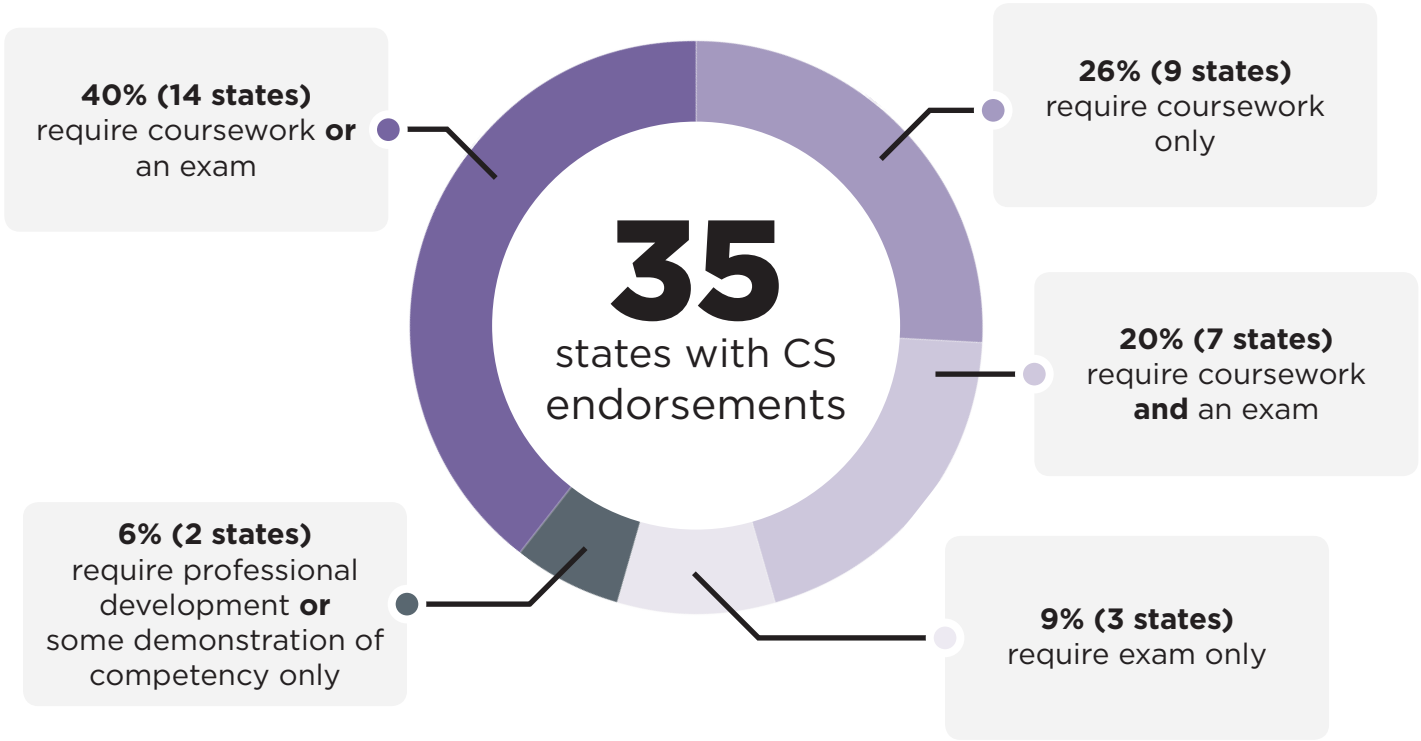
- Ensures that teachers have the content and pedagogical knowledge to teach computer science effectively.
- Increases the portability of teachers' computer science skills across schools, districts, and states, including for elementary school teachers who have fewer ways of

1. 2018 National Survey of Science and Mathematics Education

demonstrating specializations than high school teachers.
- Supports teachers' professional identity as computer science teachers which results in sustained teaching of computer science over the long term.[2]
- Professionalizes computer science education on par with other core subjects.
- Provides the necessary formal designation for districts to assign teachers to computer science classes.

THE STATE OF COMPUTER SCIENCE CERTIFICATION

Across the U.S., pathways to obtaining a computer science certification generally fall into one of five categories.[3]



These pathways typically include an exam and/or academic coursework, which can be challenging for teachers to complete. Although states have used state-specific exams for many years, nationally-recognized exams for computer science only became available in the fall of 2018. University-based computer science certification programs are hard to find, expensive, and time-consuming. This poses a challenge for teachers, particularly those in rural areas, who have limited access and opportunity for continuing education. Current pathways are unlikely to produce the number of qualified computer science teachers needed to meet the growing demand for computer science education in all areas of the country.[4]

In the fall of 2018, the nation's two largest teacher licensure exam development organizations, ETS and Pearson, launched new national computer science teacher exams. Although this a significant step forward for computer science education, these content exams primarily assess subject-specific knowledge at the secondary school level and do not address the practice of

2. Ni, L. & Guzdial, M. (2012). Who AM I?: understanding high school computer science teachers' professional identity. In Proceedings of the 43rd ACM Technical Symposium on Computer Science Education.
3. Determined via documents on state education agency websites and direct communication with state education agency employees.
4. Google Inc. & Gallup Inc. (2016). Trends in the State of Computer Science in U.S. K–12 Schools. Retrieved from http://goo.gl/j291E0

teaching that content in the context of a classroom (i.e., pedagogical content knowledge). At the same time, states are trending away from content exam requirements and toward performance-based assessments for initial licensure, such as the edTPA and the Praxis Performance Assessment for Teachers (PPAT).[5]

Although efforts are underway, very few teacher education programs in institutions of higher education (IHE) offer a pathway to obtain a computer science certification; this is partially because there are only a handful of school of education faculty dedicated to computer science in the entire nation. A 2013 Computer Science Teachers Association (CSTA) report[6] on the confusing landscape of computer science certification describes cases in which a state computer science certification requires either a course that is not available in the state, or a series of courses that must be cobbled together from various institutions (p. 11). Often, the available courses were irrelevant or inappropriate for K–12 computer science educators.

MICRO-CREDENTIALS AS A PATHWAY TO ENDORSEMENT

Micro-credentials (also referred to as competency-based credentials) allow teachers to earn an endorsement in a way that is specific, job-embedded, performance-based, and less expensive and time-consuming than coursework. For teachers who have been teaching computer science without a computer science certification, micro-credentials provide a pathway that recognizes teachers' existing skills and prior experience and do not require the teacher to spend hours in traditional models of professional learning or academic coursework. Additionally, teachers can select professional learning opportunities personalized to the specific competencies they still need to develop. The evidence of competency submitted by a teacher may include lesson plans, videos, reflections, analyses of student work, or a combination of these, which are then approved by an evaluator via rubrics. A "stack" (or set) of related micro-credentials can serve as key or contributing elements to a computer science endorsement.[7] Micro-credentials also align with the national trend toward performance-based assessments for initial licensure, as they allow teachers to demonstrate content knowledge, pedagogical knowledge, and targeted proficiencies not covered by content exams (such as integration of computer science into other subject areas).

In a policy paper on developing teacher certification pathways[8], the Code.org Advocacy Coalition recommended that states "develop multi-pronged approaches to computer science teacher preparation and licensure" (p. 1). State and local education agencies should support the use of micro-credentials as one of these approaches for teachers seeking a computer science endorsement.

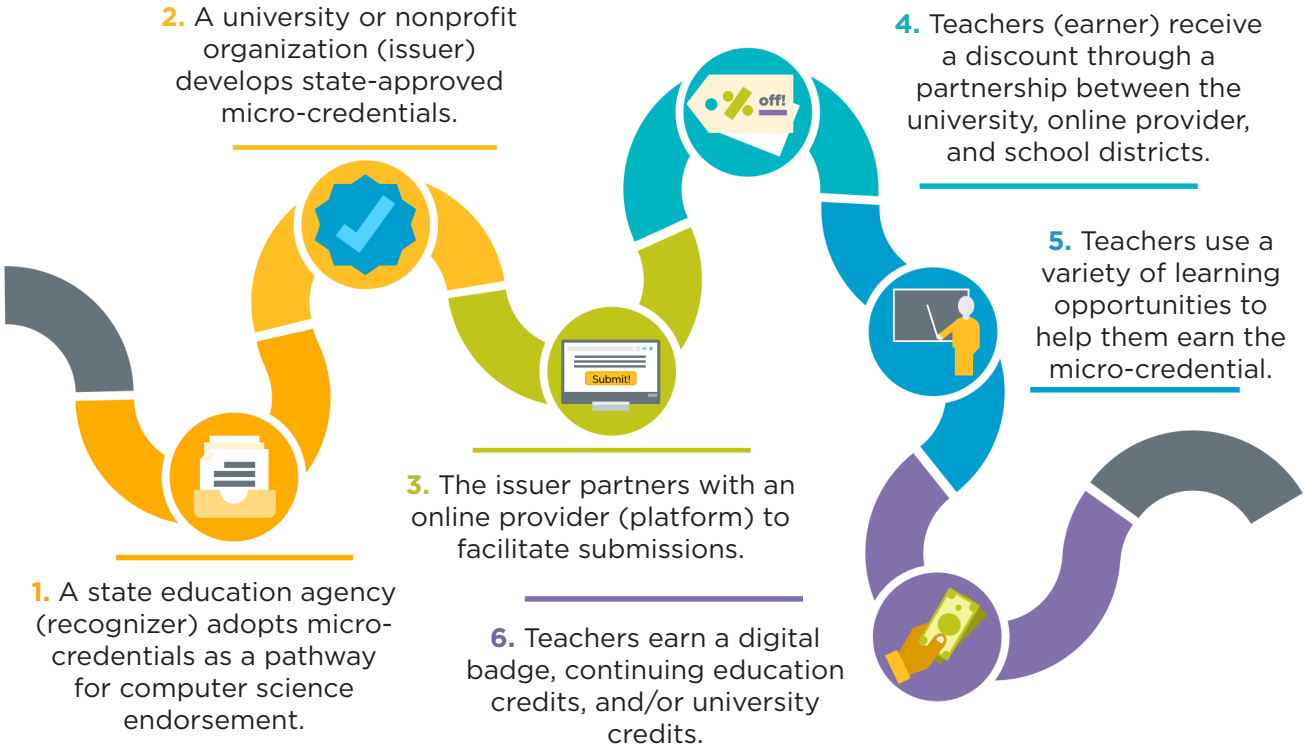
5. https://scale.stanford.edu/teaching/edtpa
6. http://www.csteachers.org/resource/resmgr/CSTA_BugsInTheSystem.pdf
7. For example, a state may require a combination of a stack of five micro-credentials and a university-based computer science teaching methods course.
8. https://code.org/files/TeacherPathwayRecommendations.pdf

Micro-credentials Overview

A micro-credential ecosystem is composed of the following:

- the issuer (e.g., university, professional learning provider),
- the earner (e.g., teachers),
- the platform (e.g., online provider), and
- the recognizer (e.g., state and local education agencies) that gives the micro-credential recognition for advancement, compensation (salary lane change), and/or endorsement.

The graphic below depicts a basic model for the implementation of micro-credentials.



In the scenario above, the state education agency (recognizer) begins the process by adopting a policy that allows teachers to earn a computer science endorsement by completing a stack of micro-credentials that cover the state's educator standards. A state university or nonprofit organization (issuer) develops the requirements of the micro-credentials, such as the skills to be demonstrated and evidence to be submitted, and receives approval from the state. The issuer partners with an online provider (platform) to allow teachers to access and submit the micro-credential work for evaluation by the issuer. Then through a partnership between the issuer, online provider, and local education agencies, the micro-credentials are offered at a discount to teachers (earner).

The micro-credential provides a standardized rubric for evaluation of effective teaching knowledge and practice across a variety of professional development options. Some teachers will choose to participate in a workshop or complete a course at a community college or

university, while others may learn the necessary content to complete the micro-credential through more informal means such as an online tutorial or through the experience of teaching course content; the micro-credential is agnostic about how the teacher develops the competency. All teachers who successfully complete a micro-credential earn continuing education credits, although some pay an additional fee to receive university credits that contribute to career advancement and compensation, such as step or lane changes.

CHARACTERISTICS OF MICRO-CREDENTIALS

Micro-credentials align with the broader educational reforms of competency-based education and personalized learning and address research-based topics in teacher professional learning. The use of micro does not reflect a lack of rigor; micro-credentials are so named due to the highly specific content and pedagogy they target, making them just as or more rigorous than traditional teacher professional development. The research-based defining characteristics of micro-credentials are:

- **Competency-based**: Teachers earn micro-credentials by demonstrating a set of skills and abilities rather than experiencing a set number of hours of learning in more traditional models of professional learning (i.e., "seat time").
- **Portfolio-based**: Teachers demonstrate their competency through the submission of a variety of artifacts, which may include lesson plans, videos, and reflections. These artifacts provide issuers with evidence of the practical application of content in a teacher's classroom.
- **Includes cycles of inquiry**: Teachers engage in the discipline of documenting, analyzing, and reflecting as a method for improving teacher practice.
- **Recognizes informal or formal learning**: Teachers can develop the competency through formal methods, such as academic coursework or a workshop, or via informal methods, such as classroom practice, Massive Open Online Courses (MOOCs), or professional learning communities. Micro-credentials often list options for gaining the knowledge or skills, but the credential is agnostic in terms of the learning option chosen by the teacher.

Micro-credentials versus digital badges

Micro-credentials, in the context of this paper, are earned based on a competency-based task that evaluates the specific knowledge and skills to teach computer science. A **digital badge** is a digital recognition of a skill or activity.

A micro-credential and a digital badge are not the same. A micro-credential leads to a digital badge, but not all digital badges are awarded for earning a micro-credential. Digital badges can be conferred for less rigorous activities, such as posting a certain number of times in an online discussion forum or attending a conference.

- **Job-embedded and on-demand**: As a type of contextualized professional learning, micro-credentials are directly relevant to, and are often earned as part of, the process of teaching in the classroom because they do not require multiple hours outside of the classroom. Micro-credentials are also responsive to teachers' schedules by allowing them to choose the time, location, and order in which they develop competencies and produce the evidence for submission.
- **Research-backed, evidence-based, and specific**: Micro-credentials can be designed to evaluate specific skills related to effective classroom practices. Research-backed rubrics are more effective at using evidence to measure changes in practice than traditional evaluation metrics such as self-reported measures of efficacy.
- **Stackable**: Related and complementary micro-credentials can serve as contributing elements to a larger certificate or credential, similar to a sequence or set of courses needed to earn a degree.
- **Agile**: A stack of micro-credentials can be developed and disseminated more quickly than an exam or a university-based teacher preparation program. In this way, micro-credentials are able to reflect changes in technology, course topics, standards, and research. An exam based on nationally-recognized standards may not adequately reflect variations in state standards, such as a greater emphasis on key topics important to the state economy.
- **Shareable**: Micro-credentials result in a digital recognition (e.g., digital badge) that can be shared across a variety of electronic platforms (e.g., social media, email, resumes) and serve as a portable currency describing specific skills.

IMPLEMENTATION CONCERNS

Issuers and recognizers should consider current micro-credential implementation challenges. First, the research base around the use and effects of micro-credentials, including the effect on student outcomes, is currently small but continues to develop[9]. Depending on the topic of a micro-credential, a lack of research makes it challenging to delineate the core competencies in a discipline and develop valid and reliable measures of competency. Second, it is difficult to compare the value of different micro-credentials from different issuers, even if they address the same topic, because micro-credentials can be awarded based on a wide range of artifacts. Recognizers may find it challenging to evaluate the quality of issuers' micro-credentials. Lastly, evaluating micro-credential submissions can be time-consuming. The amount of time can vary based on the number of submissions which puts challenges on managing the number and availability of staff to review them. The design and implementation guidance provided later in this paper address some of these issues.

9. American Institutes for Research, 2017

Micro-credentials and Professional Learning

Micro-credentials were initially piloted for professional development purposes. The nation's two largest providers for teacher micro-credentials, BloomBoard and Digital Promise, have several statewide initiatives to offer micro-credentials as alternatives to traditional professional development. As of May 2019, BloomBoard is working with hundreds of districts across 40 states. Digital Promise has a footprint in numerous states, has supported pilots of micro-credentials in school districts across the country, and has partnered with organizations such as the National Education Association (NEA) to design and develop micro-credentials for members. Digital Promise has also supported the use of micro-credentials to support teachers earning professional certificates such as the KQED & PBS media literacy educator certification.

Whether a stack of micro-credentials is completed to earn an endorsement or a few are selected to develop specific skills for integrating computer science (e.g., self-directed professional learning), micro-credentials have the overall potential for building the capacity of teachers to offer computer science instruction. Computer science micro-credentials can also be offered as part of other pathways, such as those for STEM or elementary school coach specializations. In some states, micro-credentials are equivalent to a certain number of continuing education unit (CEU) hours.

Micro-credentials and Certification

Recently, many state-level conversations around micro-credentials have transitioned from professional development to earning and renewing certifications and endorsements. BloomBoard reports 16 state-level partnerships focused on micro-credential-based initiatives for career advancement and/or licensure. As of May 2019, a number of states, including Arizona, Kentucky, Minnesota, Rhode Island, and Virginia, are exploring the use of micro-credentials for computer science teacher certification. For general information about state and district micro-credential initiatives, visit bloomboard.com and digitalpromise.org.

ARIZONA

New computer science endorsements that require a combination of professional learning, academic coursework, and/or competency-based credentials were approved by the State Board of Education in May 2019. The endorsements include a preK to grade 8 endorsement which requires nine semester hours covering specific topics and a grade 6 to 12 endorsement which requires twelve semester hours. Fifteen clock hours of professional learning or an analogous micro-credential is equivalent to one semester hour of college coursework, assuming the required topics are covered.

KENTUCKY

Since the passage of Senate Bill 117 in 2017[10], Kentucky has allowed certified teachers to renew certificates or achieve advanced ranks through pathways other than university-based programs. As a result, the Education Professional Standards Board appointed a committee to review options, including micro-credentials, to achieve Kentucky's second tier of professional licensure known as Rank II. Several districts and service centers in Kentucky plan to pilot the use of micro-credentials in SY 2019–2020 for Rank II licensure, including micro-credentials for computer science, artificial intelligence, and robotics.

MINNESOTA

Minnesota and Lakes Country Service Cooperative are using micro-credentials for alternative teacher licensure by developing a competency-based licensure program designed for several Career and Technical Education (CTE) licensure areas, including, soon, computer science.

RHODE ISLAND

The Rhode Island Department of Education is developing a computer science endorsement composed of elementary, middle, and high school bands that require teachers to demonstrate competency per the Rhode Island State Computer Science Education Standards (similar to the CSTA standards). Earning micro-credentials is one of four pathways to satisfy the requirements of the endorsements. The other pathways are completing academic coursework, attending professional development training, or passing a content exam. The University of Rhode Island and BloomBoard have developed a stack of micro-credentials based on the CSTA standards, allowing them to be nationally applicable.

Appendix A provides examples of the micro-credentials from the University of Rhode Island and Bloomboard.

VIRGINIA

In March 2019, Virginia adopted SB 1419[11] authorizing the department of education to allow teachers to earn micro-credentials in science, technology, engineering, and mathematics (STEM) endorsement areas, including computer science. The program will be open to any public elementary or secondary school teacher who holds a renewable or provisional license or any individual who participates in any alternate route to licensure program. Appendix B provides sample legislative language modified from SB 1419.

10. https://legiscan.com/KY/bill/SB117/2017
11. https://legiscan.com/VA/text/SB1419/2019

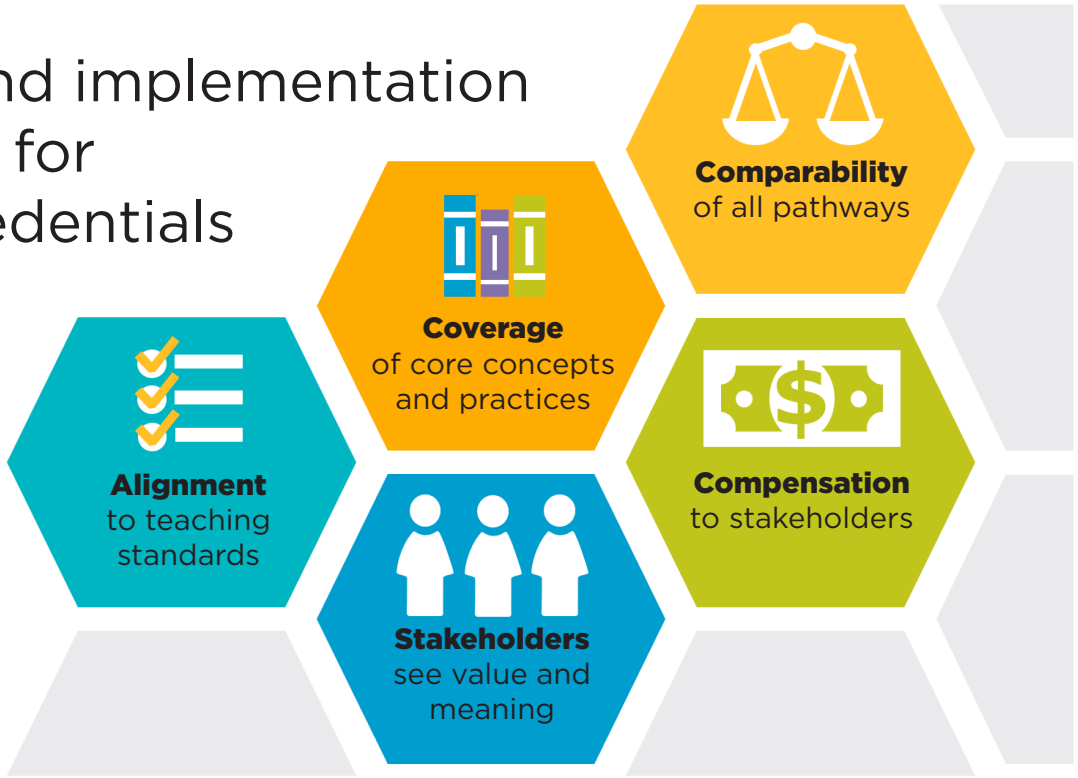
Design and Implementation Guidance

Issuers and recognizers should consider the following principles when designing or validating micro-credentials. The first three considerations are inspired by the National Board for Professional Teaching Standards[12] and are based on the importance of maintaining a high standard for teachers as professionals. The other recommendations come from Digital Promise's best practices guide for districts and states implementing micro-credentials[13] and from the NEA's guidance on the use of micro-credentials.[14] A national multi-organizational task force led by Digital Promise and the NEA is currently developing design principles to be released in late 2019.

- **Coverage**: Ensure that a stack of micro-credentials, taken together, appropriately covers the critical areas of knowledge, skill, and pedagogy specific to the teaching of computer science, such as the core concepts and practices in the K–12 Computer Science Framework and the CSTA K–12 Computer Science Standards.
- **Alignment**: One way to ensure coverage is to align the micro-credentials clearly and explicitly to standards for teaching and learning computer science. The CSTA and International Society for Technology in Education will release new computer science educator standards in the fall of 2019; the previous version was developed in 2011.[15]
- **Comparability**: If teachers are allowed to choose from a set of micro-credential options, ensure that any combination of choices is aligned to and covers the necessary endorsement requirements such as teaching and learning standards. Further, various endorsement pathways should be comparable. If one pathway to endorsement is passing a subject-matter exam, then a stack of micro-credentials should align to the same domains as the exam.
- **Stakeholder involvement**: States should include classroom educators in all steps of the implementation process to ensure that the micro-credentials are valuable, meaningful, and authentic to educators. For example, teachers can help design submission rubrics to measure evidence based on direct classroom practice rather than lesson plans or hypothetical sample projects.
- **Compensation**: Consider incentivizing teachers to complete micro-credentials by tying them to compensation, via "lane movement on a pay schedule across lanes (where a certain number of micro-credentials would equal advanced education credits) or a fixed dollar amount per micro-credential, depending on the pay structure" (NEA, p. 2). If the micro-credential is issued by a university, university credit could also be provided to recognize the value of the micro-credential.

12. https://www.nbpts.org/standards-five-core-propositions/
13. https://digitalpromise.org/wp-content/uploads/2017/09/District-and-State-Micro-credential- Implementation-Best-Practices-Guide.pdf
14. http://www.nea.org/home/microcredentials.html
15. https://www.iste.org/standards/for-computer-science-educators

Design and implementation guidance for micro-credentials



Appendix A

A micro-credential from the University of Rhode Island and BloomBoard.

Figure 1: This micro-credential consists of multiple phases, each with its own task and rubric. This view shows the Analyze phase.

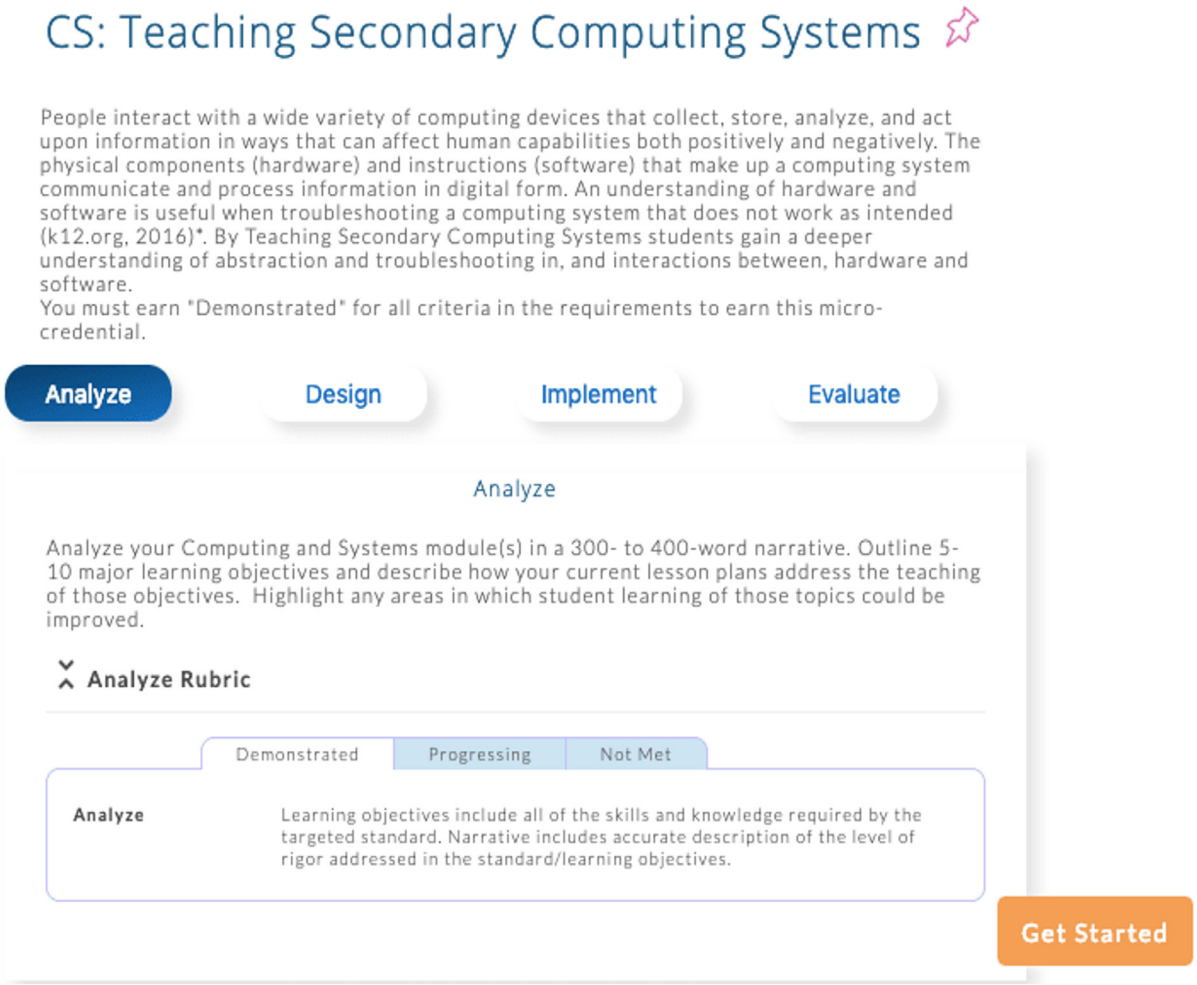
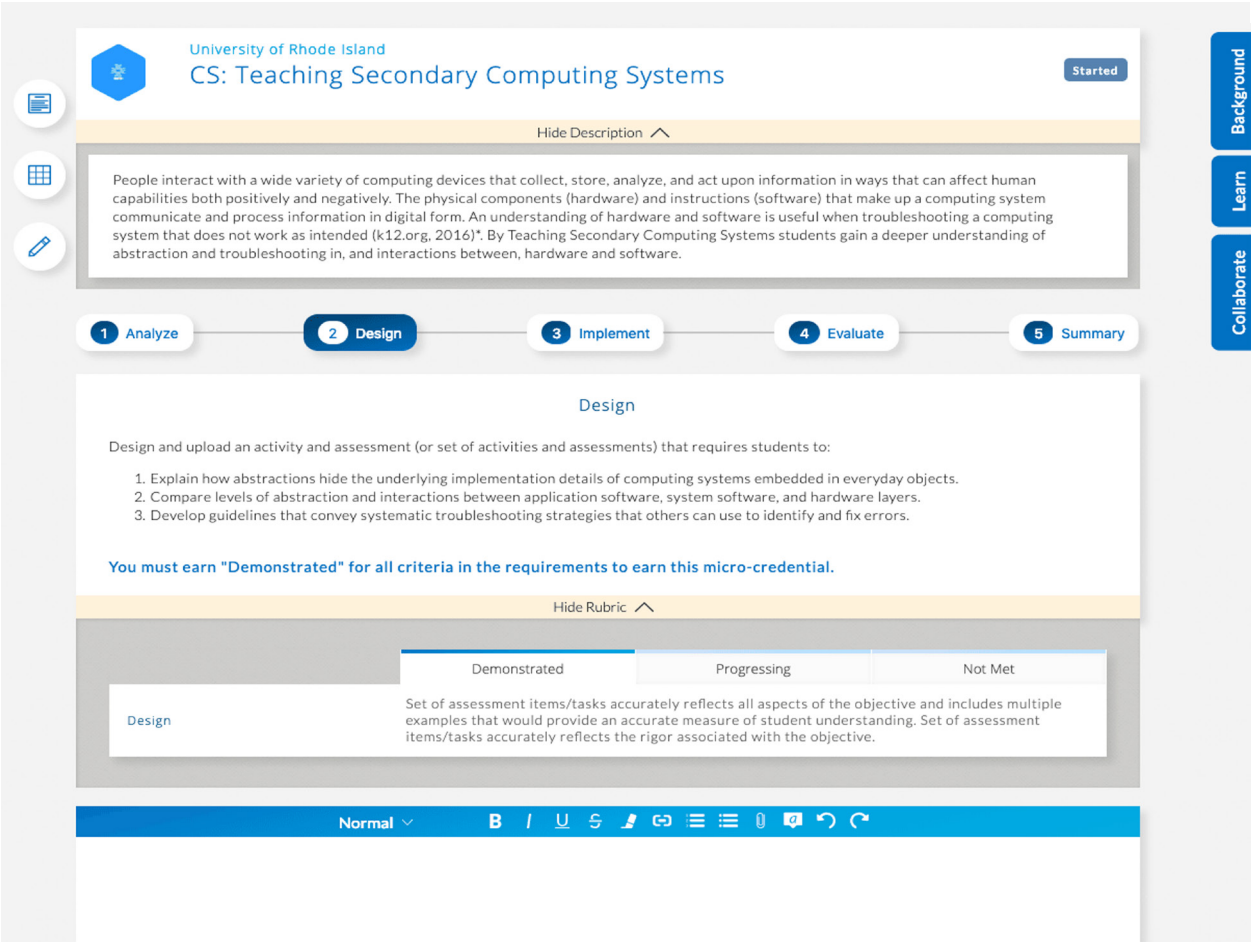


Figure 2: This view shows the Design phase of the micro-credential.



Appendix B

SAMPLE LEGISLATIVE LANGUAGE

Be it enacted by the General Assembly that the Code of [State] is amended by adding a section numbered X.Y.Z as follows:

A. The Department of Education may establish a micro-credential program for the purpose of permitting any public elementary or secondary school teacher who holds a renewable or provisional license or any individual who participates in any alternate route to licensure program to complete additional professional learning and earn micro-credentials towards computer science endorsement.

B. The Department of Education shall establish a micro-credential committee to determine how any micro-credential awarded pursuant to any micro-credential program established pursuant to subsection A will be used to award a computer science endorsement. Any teacher who holds a renewable license and who completes micro-credentials that do not contribute to an endorsement is eligible for a number of continuing education units to be determined by the micro-credential committee.

C. Any teacher who holds a renewable license and who participates, through any micro-credential program offered pursuant to subsection A, in courses that do not contribute to an endorsement is eligible for professional development points toward renewal of his license for the number of in-person hours of coursework completed, upon providing a certificate of such participation from the course.