RIDE Readiness-Based Graduation Requirements:

Computer Science Proficiency

Guidance for Implementation & Resources

Revised January 2024

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Computer Science Graduation Requirement Guidance and Resources

Introduction

The Rhode Island Department of Education (RIDE) is committed to ensuring all students have access to high-quality curriculum and instruction as essential components of a rigorous education that prepares every student for success in college and their career. On November 15, 2022, the RI Council on Elementary and Secondary Education approved Readiness-Based Graduation Requirements for all RI students beginning with the graduating Class of 2028. RIDE's adoption of Readiness-Based Graduation Requirements presents an opportunity for increasing engagement through real-world, relevant learning experiences in all RI K-12 schools. Specifically, this has presented the opportunity to ensure Rhode Island students graduate high school prepared with the knowledge and skills necessary for the 21st century. This includes ensuring all Rhode Island students graduate proficient in Computer Science (from here on referred to as CS) to graduate high school ready to create their own futures and to pursue their postsecondary goals.

Purpose of this document

This document provides guidance and resources for schools and LEAs implementing the new Readiness-Based Graduation Requirement specifically as it relates to computer science education. This is supplemental to the CS4RI (Computer Science for Rhode Island) standards, and resources. It makes extensive use of, and reference to, resources that are kept up-to-date on RIDE's CS4RI (cs4ri.org) website.

Computer Science Proficiency Requirements for Graduation

Overview

The adoption of Readiness-Based Graduation Requirements set the default expectation that all students will graduate proficient in computer science by earning, at minimum, 0.5 credits of computer science during their secondary school experience (middle or high school) for high school graduation purposes. This 0.5 credit must include the demonstration of proficiency based upon the six core concept proficiency statements that are grounded in the RI Core Standards for Computer Science.

Based on Standards

The Rhode Island Computer Science Education Standards were endorsed by the Rhode Island Council for Elementary and Secondary Education in 2018 and identify the knowledge, practices, and skills in CS that all students should know and be able to do at each level in their education. The RI CS standards should be used to guide the planning of K-12 CS instruction in LEAs with early introduction to CS concepts in primary grades, regular practice throughout elementary and middle school, and an opportunity for deep CS exploration in secondary schools. LEAs should provide integrated and stand-alone CS programs for all students.

A Growing Field

The world of technology is ever changing. Recently, artificial intelligence has become both a subject of concern and an opportunity. While the RI CS standards do not include artificial intelligence, LEAs are

encouraged to support students' understanding of these new technologies. The RI CS standards will be revised once the National K-12 CS Framework on which they are based is revised and will include artificial intelligence and other emerging technologies and fields.

Prioritizing Equity

It is imperative that LEAs include CS education for all students to deepen their understanding of technology they use every day, support their success in proficiency course work, and strengthen all students' belief that a computer science career pathway is an option for them.

All LEAs should aspire to making inclusive, innovative, and accessible CS education based on the standards, a part of every Rhode Island student's experience beginning in kindergarten and continuing throughout high school. With the understanding that there is a wide spectrum of growth towards this goal, the proficiency statements below were created to guide LEAs towards measuring and achieving the CS proficiency requirement for their students.

It is understood that many LEAs have moved to a 1:1 instructional model in secondary schools over the last few years. Ensuring that students are proficient in the use of their school issued devices and school-based software is a first step in supporting CS proficiency, but it is not a substitute for it.

No assumptions should be made that students (or educators) have the technology skills necessary for effective use of devices. Districts should plan for supporting teachers with adequate professional development in the use of technology, and students with appropriate technology orientation for safe and successful integration of technology.

Computer Science Proficiency Statements & Examples

The six Core Concepts of Computer Science and the sub-concepts are described more fully in the RI CS Standards document beginning on page 14. The Proficiency statements were developed based on the grade band 6-8 and 9-12 standards. Example activities are provided to help illustrate the proficiency statements.

As LEAs strengthen their K-12 CS programs, RIDE's guidance on CS Proficiency will evolve to support emerging trends in CS. Currently, schools should cover several of the secondary standards in each sub-concept area (more are encouraged). This may include standards from the 6-8 or 9-12 grade bands.

Core Concept and Definition	Proficiency Statements
1. Computational Thinking & Programming: *Problem solving that requires the logical analysis of data & developing a set of directions to have a computer perform a task* *Topics that could be covered:* Algorithms, Variables, Control Structures, Modularity, Computational Design, Data Structures & Data Types	Students create computer programs. Students use problem solving strategies to break down larger problems into smaller parts and use logical processes to develop, test and evaluate solutions. ***Example Activity:*** ***Students design and program a computer game.***
2. Computing Systems & Networks *Physical components (hardware) and instructions (software) that make up a computing system and the networks that provide connectivity.* *Topics that could be covered:* Human-Computer Interaction, Hardware & Software, Troubleshooting, Networking & the Internet	Students understand systematic troubleshooting techniques used to resolve hardware and software errors in networked devices, applications, and understand how technological solutions are communicated to users. ***Example Activity:*** ***Students explore and simulate the behavior of the Internet through plugged and unplugged activities.***

3. Cybersecurity: *Practices, processes, technologies, and other protective measures that are designed to protect against unwanted, unauthorized, or illegal access to or use of data, through onsite or remote devices, programs, and/or networks.* *Topics that could be covered:* Risks, Safeguards, Response	Students can identify the cybersecurity risks associated with working online and in various digital platforms. Students understand physical and digital security measures and how to respond appropriately to security breaches. ***Example Activity:*** ***Students complete exercises in encryption and test password strength.***
4. Data & Analysis *Collection, analysis, and storage of digital data.* *Topics that could be covered:* Collection, Visualization, & Transformation, Inference & Models, Storage	Students gather, analyze and present data in various formats, while understanding the impact of bias in data collection, the use of data in models and simulations, and issues related to data storage. ***Example Activity:*** ***Students collect and analyze data related to their life and engage in discussion about bias in data collection.***
5. Digital Literacy *Ability to leverage software technology to create, share, and modify artifacts, as well as search digital information.* *Topics that could be covered:* Creation & Use, Searching Digital Information, Understanding Software Tools	Students develop digital literacy skills by selecting appropriate software tools and resources tailored to their needs. They break down complex problems, search for and synthesize digital information, and create engaging artifacts. ***Example Activity:*** ***Students create a Google site with images, videos and text***.

6. Responsible Computing in Society *Social implications of computing technology and the effect on many aspects of our world in both positive and negative ways, and at local and global scales.* *Topics that could be covered:* Culture Safety, Law, & Ethics, Social Interactions	Students engage with digital tools in a safe and ethical manner to cultivate a positive web presence and to minimize negative consequences of digital use. Students can identify opportunities and challenges of a technology for individuals and society. ***Example Activity:*** ***Students regularly engage in discussions on the ethics of AI, personal data privacy and intellectual property.***

Please review the RI CS Education Standards document for a deeper understanding of the expectations for schools and students regarding CS education. Information regarding proficiency is provided at cs4ri.org/cs-proficiency.

Computer Science Curriculum Resources

Many existing CS curricula either meet only a subset of the six RI CS proficiencies or are designed for students who want a more intensive computer science learning experience, making these curricula inappropriate for *all* students. RIDE recommends taking one of two approaches to meet RI CS proficiency for all students:

- Implement one of the two CS4RI recommended RI CS proficiency curricula described below OR
- Have a curriculum which has been developed in your LEA be vetted by CS4RI

Of those two options, RIDE recommends using one of the two RI CS proficiency curricula described below, due to the challenge of effectively creating a good CS curriculum for all students.

RIDE also recommends providing a CS proficiency course which is accessible to all students **and** offering more in-depth courses for students who wish to pursue additional CS coursework. Examples include dual and concurrent course opportunities or courses which are part of a CS CTE program or pathway endorsement seal.

RI CS Proficiency Curriculum for All Students

By the Summer of 2024, CS4RI will have published two new recommended RI CS proficiency curricula:

1. *CS4RI Exploring Computer Science* (ECS, cs4ri.org/ecs). ECS is a 0.5 credit course. It meets all RI CS proficiency requirements in a fun, engaging way. This course has been developed from the existing URI Intro to Computing and Data Science (ICDS) curriculum (teachers trained in ICDS can deliver it with minimal preparation.) This course is similar to ICDS but is at a more foundational level.

2. *Computer Science Discoveries* (CSD+, cs4ri.org/csd-plus). CS Discoveries is a year-long curriculum for all students grades 6-12 that is provided by Code.org; it is taught in tens of thousands of schools. **Code.org's CS Discoveries curriculum meets most RI CS proficiencies, but not all.** CS4RI is developing a CSD+ curriculum modification that has most of the Code.org CS Discoveries curriculum but replaces some modules with modules that meet the missing RI CS proficiencies.

Both ECS and CSD+ are appropriate for instruction to all students in any of grades 6-12. Each curriculum is modular so that modules can be taught in different semesters of different years if the LEA/school chooses to do so. RIDE recommends that LEAs choose one of those two curricula and coordinate its delivery in appropriate grades so that all students take all modules prior to graduation it to achieve RI CS proficiency.

These proficiency courses are introductory and should not be part of a three course CTE program or endorsement pathway. They should be thought of as a great tool to introduce students to concepts and understandings that may interest them in further pursuing a CS pathway endorsement or CTE program.

Best Practices for CS Instruction

The RI CS Standards highlight specific practices that describe the behavior and ways of thinking that computationally-literate students use to engage in the Core Concepts and are described more fully in

the **RI CS Standards document** on page 20, with examples in Appendix A. These practices should be incorporated when designing learning experiences for students.
LEAs are encouraged to explore ways to cover the concepts and sub concepts through integrated activities and deliver instruction following the practices listed below.

Practice #1: Fostering an Inclusive Computing Culture	**Practice #5: Creating Computational Artifacts**
Practice #2: Collaborating Around Computing	**Practice #6: Testing & Refining Computational Artifacts**
Practice #3: Recognizing & Defining Computational Problems	**Practice #7: Communicating About Computing**
Practice #4: Developing & Using Abstractions	**Practice #8: Using Technology Appropriately**

Additional Course Curriculum that meets CS Proficiency Curriculum

The existing CS courses listed below also meet all RI CS proficiency requirements. However, these courses provide a deeper understanding of CS concepts and may not be appropriate for all students.

1. URI's Introduction *to Computing and Data Science* (ICDS)
2. *AP Computer Science Principles* (APCSP)

Both courses offer the option of concurrent enrollment college credit from the University of Rhode Island and are described on the CS4RI website(cs4ri.org/high-school-programs). They could also be used to meet the 0.5 credit requirement for CS proficiency.

Computer Science Educator Professional Development

CS4RI has offered free professional development (PD) in CS curricula for Rhode Island teachers since 2016 at the elementary, middle, and high school levels. These PDs are offered by a variety of curriculum providers in a variety of formats (in-person, online, hybrid), that have durations from one to eight days. In addition to the existing PDs, 1-3 day PDs in the two RI CS Proficiency curricula described in the previous section will be offered.

Information on professional development for CS proficiency courses and more in-depth CS courses is available at cs4ri.org/professional-development.

Computer Science Endorsement for Teachers

In 2018, RIDE established the Computer Science Teacher Endorsement to ensure high-quality CS instruction in RI. The endorsement is not required, it is an LEA-level decision. RIDE strongly encourages all CS teachers to participate in RIDE-supported training. Hiring preferences may exist within the LEA.

RI CS Teacher Endorsement requires that teachers meet the following instructional proficiencies:

- Demonstrate and apply grade band appropriate knowledge of computer programming, algorithms, abstraction, computer systems, computer networks, data science, digital literacy, cybersecurity, and the impact of computing in society.
- Design and implement grade band appropriate computer science instruction.
- Understand and apply techniques to foster an inclusive computing culture and environment for instruction.
- Assess student learning in computer science and use it to inform instruction.

RI CS Teacher Endorsement can be earned in several ways, the most common way being approved PD training, which addresses all the four CS instructional proficiencies listed above. Note that not all CS professional development courses address all instructional proficiencies and qualify to yield RI CS Endorsement.

Details on obtaining endorsement can be found at RIDE's Educator Certification "Paths to Certification" webpage.

Frequently Asked Questions

1. **How should a school and LEA keep track of students who met the RI CS proficiency requirement?** Schools and LEAs should track students who have met the CS proficiency requirement using their existing systems, as they do with other graduation requirements. This is a 0.5 minimum credit requirement that should be reflected on a student's high school transcript. If the credit is earned in middle school, the credit needs to be reflected on the student's high school transcript.

2. **Does a student need to demonstrate proficiency in ALL the RI CS Education Standards?** No. See the Proficiency Statement document for guidance and clarification on covering CS standards.

3. **Can a student's RI CS proficiency be completed in Middle School?** Yes, if the 0.5 course is completed in middle school and reflected on the student's high school transcript.

4. **What courses cover proficiency requirements?** See the *Computer Science Curriculum Resources* section above.

5. **Do students have to take a course to meet RI CS Proficiency?** Taking a CS proficiency course will be the most common way for students to meet the RI CS proficiency requirement. Alternatively, LEAs may implement other approaches to assess and track CS proficiency and grant students the 0.5 credit requirement using tools such as Individual Learning Plans (ILPs). Contact CS4RI for guidance on establishing additional approaches for demonstrating CS proficiency.

6. **Does Advanced Placement Computer Science A (AP CSA) count as a proficiency course?** No, AP CSA is a high-level programming course that does not cover all the proficiency statements.

7. **Do CS teachers need to be endorsed?** No, this is an LEA-level decision, but RIDE strongly encourages that all CS teachers participate in RIDE-supported training. In 2018, the K-12 Council on Elementary and Secondary Education approved a RIDE CS endorsement that is available. Hiring preferences may exist within the LEA. See the Computer Science Endorsement for Teachers section above.

8. **How can we get our teachers trained to teach CS?** CS4RI offers many free CS PD options linked here. See the *Computer Science Educator Professional Development* section above.

9. **What is the connection to CS CTE programming**?
   In general, RI CS Proficiency is independent of CS Career and Technical Education (CTE) programming. RI CS proficiency is for *all* students; CS CTE pathways are for students who desire a deeper dive into CS. Ideally, students would meet CS proficiency before embarking on a CTE pathway. However, students can achieve proficiency in the CTE pathway.

10. **Does a student that completes a CS CTE Program or a CS endorsement pathway need to take a separate CS proficiency course to meet proficiency?**
    Not necessarily, it would depend on the course content in the pathway. LEAs should audit their endorsement pathway or CTE program courses to determine that they cover the CS proficiency statements. If a student has decided to enter the CS CTE program or CS endorsement pathway program, they may forgo a dedicated proficiency course identified by the LEA, if the course covered in the pathway or program will count for the 0.5 CS proficiency credit.

11. **Can I use CS Discoveries+ or CS4RI Exploring Computer Science as a course in a three-course endorsement pathway or CTE program?**
    No, these courses are meant to be foundational and provide a broad understanding. If a student has decided to enter the CTE pathway or endorsed pathway program, they may forgo a dedicated proficiency course identified by the LEA, if the course covered in the pathway or program will count for the 0.5 CS proficiency credit.

12. **Who do I contact for help with CS proficiency for my school or LEA?**
    You may email ReimaginingHS@RIDE.RI.GOV with any questions or to request help or support.