

COMPUTER SCIENCE

Missouri Department of Elementary and Secondary Education



Introduction

WHAT IS COMPUTER SCIENCE?

Computer science is the study of computers and algorithmic processes, including their principles, their hardware and software designs, their implementation, and their impact on society (*Tucker et.al, 2006, p.2*). The national K-12 Computer Science Framework identifies the following as the five computer science core concept areas: Computing Systems, Networks and the Internet, Data and Analysis, Algorithms and Programming, and Impacts of Computing. Computer science focuses on understanding why computers work and how to create those technologies.

WHY IS LEARNING COMPUTER SCIENCE IMPORTANT IN MISSOURI?

Show-Me Success is Missouri's campaign to help public schools prepare every student to succeed in school and in life. The Department of Elementary and Secondary Education (DESE) has developed a strategic plan to achieve this goal. The plan's first strategic priority focuses on ensuring that all students have equitable access to a broad range of educational opportunities. Effective and relevant computer science education is essential to achieving our vision that every student graduates ready for success. Mastery of Missouri's computer science standards will allow Missouri students to be well-educated citizens in a computing-intensive world and be prepared for careers in the 21st century.

Every student in every school should have the opportunity to learn computer science. Studying computer science will help students develop knowledge and skills that transfer to success in many areas. Skills such as creativity, problem solving, critical thinking, and collaborating with others are emphasized in the study of computer science. Knowing how to approach complex problems, break down the challenges into small pieces, and approach resolving them in a logical manner are critical skills in all industries. Missouri's computer science academic performance standards also help students learn about appropriate social interactions, online safety, cyberbullying, laws pertaining to online resources and online activity, and ethical behavior.

Components of computer science skills can also transfer to other subjects in school. Students can use their computer science skills to design technical solutions to problems in science, mathematics, social studies, the arts, and literacy. This can make those courses more relevant for students, potentially improving their engagement and achievement in those areas (*National Center for Women & Information Technology, 2019*).

Creating a talented and diverse pipeline of students with computer science expertise is critical to Missouri's economic future. Missouri's Information Technology (IT) industry is a leading force in our economy, and science, technology, engineering, mathematics (STEM), and IT jobs are among our fastest growing occupations. Missouri's tech sector employed 209,250 people in 2018. Tech jobs statewide paid an average of \$73,534 in 2018, according to the report. The pay was 89 percent higher than the average of \$38,906 for non-tech sector jobs. Last year, the tech industry in Missouri gained 5,736 jobs, according to the report (*Computing Technology Industry Association, 2019*).

The need to develop a workforce with the skills necessary to fill these high-wage, high-growth jobs. Studying computer science will help equip Missouri's students with the foundational skills needed for the jobs of the future.

AN EQUITY ISSUE

Fewer than half of all public high schools in Missouri offer computer science courses. Women, minorities, and people with disabilities are often missing in computer science classes, majors, and occupations. In 2018, of 1,378 college graduates earning computer science degrees in Missouri, only 248 were female (*Code.Org, 2019*). Also, low-income students are less likely to have access to computer science courses than wealthier students, and minority students are less likely to have access than white students, according to an analysis by *Change the Equation*, a nonprofit aimed at improving access to STEM education. This disparity in access often marginalizes traditionally underrepresented students who already face educational inequities (*Change the Equation, 2016*).

By closing the access gap, and promoting computer science in general, schools can also help close the gender gap in computer science. Computer science should be available to all students, not to prepare all to go into college to major in computer science and enter careers in software engineering or technology, but to ensure that all students have the foundational knowledge that will allow them to productively participate in today's world and make informed decisions about their lives.

Computer science courses present a distinct opportunity to educate students about diversity, equity, and inclusion. Students can engage in thoughtful interaction about the value of diversity while using computational thinking to solve real-world problems. Educators and students can challenge implicit bias, stereotypes about computer science, and narrow perspectives while learning about core concepts like networks and security, data analysis, and impacts of computing (*Washington Department of Education, 2016*).

WHAT ARE ACADEMIC PERFORMANCE STANDARDS?

The Missouri Computer Science Standards identify the learning expectations for students to help ensure they acquire the skills and knowledge needed to become ready for success. The standards also provide an avenue for promoting consistency in what is taught to students across our state—from district to district, school to school, and classroom to classroom.

The standards are not curriculum. Curriculum is determined by local school districts. The Missouri Computer Science Standards are worded broadly enough to allow for local decision-making. Depending on school resources and community norms, instructional activities may vary. The standards do not necessitate the creation of a specific computer science course, they can be incorporated into existing classes and subject areas where appropriate. However, this does not preclude local school districts from choosing to create specific computer science courses.

Whether integrating computer science standards into existing curriculum or teaching it as a standalone course, teachers must be able to effectively teach computer science as well as clearly communicate the value of computer science for student learning. Local districts should support teachers in attending differentiated computer-science-focused professional development events to help them meet their particular needs.

Guidance for Public School Districts and Charter Schools Implementing the Computer Science Academic Performance Standards

USING COMPUTER SCIENCE TO FULFILL ACADEMIC CREDIT IN OTHER SUBJECTS

Section 170.018, RSMo allows a student to fulfill up to one unit of academic credit toward high school graduation with a district-approved computer science course for any mathematics, science, or practical arts unit required for high school graduation.

Districts that choose to allow students in grades 9-12 to earn mathematics, science, or practical arts credits by taking a district-approved computer science course must follow the procedures shown in Section 170.018, RSMo pertaining to parental notice and permission and End-of-Course assessment requirements. DESE has provided an example of a parental notice and permission slip in the *Graduation Requirements for Students in Missouri Public School. (2018). Appendix a: Statutory Requirements Related to Course Work and Instruction Computer Science (Section 170.0180, RSMo) Sample Computer Science Acknowledgement.*

TEACHING QUALIFICATIONS

1. Teachers (including elementary and middle school/junior high) will be considered appropriately certified to teach computer science to students in grades K-8 if they have any current certificate for the grade level(s) in which they are teaching.
2. Teachers who will be teaching a computer science course for any type of approved high school credit for students in grades 9-12 will be required to meet the Missouri Department of Elementary and Secondary Education's (DESE) approved computer science qualifications as outlined in Section 3 below beginning with the 2020-21 school year.
3. To be eligible to teach computer science courses in grades 9-12, a person must possess either **A** or **B** shown below:
 - A. A Missouri-issued teaching certificate at the appropriate grade level **with**
 - i. a passing score on the DESE-designated computer science assessment and DESE-issued computer science certificate; or
 - ii. a bachelor's or master's degree in computer science or some other computer science related four-year degree; or
 - iii. documented completion of a DESE-approved computer science training program or postsecondary course
Refer to the Computer Science Approved Trainings and Courses document found on the [Computer Science homepage](#) for the complete list of approved trainings.
 - B. A Visiting Scholar Certificate and **one** of the following criteria, i, ii or iii.
 - i. An associate's degree in computer science and
 - a. an Industry Recognized Credential (IRC) in computer science, or
 - b. an IRC in a computer science related field, or
 - ii. A passing score on the DESE-designated computer science assessment, or
 - iii. Documented completion of a DESE-approved computer science training program or postsecondary course
Refer to the Computer Science Approved Trainings and Courses document found on the [Computer Science homepage](#) for the complete list of approved trainings.

4. A panel made up of the following Office of College and Career Readiness (OCCR) staff members will make determinations regarding the approval of other training programs which may be utilized to meet the DESE-approved computer science teaching qualifications:

- Assistant Commissioner of the OCCR
- Coordinator of Career and Technical Education
- Standards and Assessment Administrator
- Director of Business, Marketing and Information Technology
- Director of Technical Skills

MOSIS REPORTING FOR COMPUTER SCIENCE

Credit type has been added as a field in the reporting system to meet the requirements outlined in the law and for meeting the transcript requirements for college entry use. This change will be effective during the 2019-20 school year.

Course codes for computer science courses will not change, however, a new field will appear in the June Student Course Completion file where schools must identify the type of credit earned by a student who has taken a district-approved computer science course for mathematics or science credit. Schools must also designate *computer science (mathematics)* or *computer science (science)* on transcripts for college entry use.

PROFESSIONAL DEVELOPMENT FOR TEACHERS

Legislation created a **Computer Science Education Fund**, which allows the State Board of Education to award grants to eligible entities for the purpose of providing teacher professional development programs relating to computer science, pending funding.

SOURCES OF INFORMATION CONTAINED IN THIS DOCUMENT

Section 160.526, RSMo - In establishing, evaluating, modifying, and revising the academic performance standards and learning standards and the statewide assessment system, the state board of education shall consider the work that has been done by the following:

- a. Other states
- b. Recognized regional and national experts
- c. Professional education discipline-based associations
- d. Other professional education associations
- e. The Department of Higher Education's curriculum alignment initiative



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