Computer Science Curriculum and Licensure Guidelines

Contents

Legislation Notes

House Bill 170

Ohio House Bill 170, effective March 2018, made five significant changes to the Ohio prescribed curriculum. The law:

1. Requires the Ohio Department of Education to create computer science standards and model curriculum for grades K-12 (Ohio Revised Code 3301.079 (A)(4)).
2. Provides a definition for computer science that includes "logical reasoning, computing systems, networks and the internet, data and analysis, algorithms and programming, impacts of computing and structured problem-solving skills applicable in many contexts from science and engineering to the humanities and business." (Ohio Revised Code 3301.012)
3. Permits credit in *advanced computer science* to satisfy Algebra 2/Math 3 or its equivalent mathematics curriculum requirement for high school graduation (Ohio Revised Code 3313.603 (C)(3)).
4. Permits credit in *advanced computer science* to satisfy an advanced science (excluding biology or life science) curriculum requirement for high school graduation (Ohio Revised Code 3313.603 (C)(5)).
5. Stipulates the licensure requirements for educators who teach computer science courses (Ohio Revised Code 3319.236).

Development of the Ohio Learning Standards and Model Curriculum for Computer Science were adopted by the State Board of Education in December 2018 for implementation in the 2019-2020 (FY 2020) school year.

The Ohio Learning Standards for Computer Science define what students should know and be able to do, and the Model Curriculum provides clarity to the standards as well as information to help educators plan and implement their local curricula.

The law does not mandate that districts include these standards in any school offering or provide a curriculum that addresses these standards (Ohio Revised Code 3301.079 (A)(4)).

House Bill 110

Ohio House Bill 110, passed in July 2021, includes several new provisions for K-12 computer science education. The law:

1. Requires the Ohio Department of Education to update the Ohio Learning Standards and Model Curriculum within one year of the effective date of HB 110 (Ohio Revised Code 3301.079(A)(4).
2. Requires that no later than thirty days after the effective date of this Legislation, the Department, in consultation with the chancellor of higher education, shall establish a committee to develop a state plan for computer science education not later than one year after the effective date of the legislation for the purposes of primary and secondary education (Ohio Revised Code 3301.23(A)).
3. Requires the state plan for computer science include a requirement that the Department collect any data regarding computer science courses offered by school districts and school buildings operated by school districts, including the names of the courses and whether the courses were developed using the standards and model and post the collected data on its website (Ohio Revised Code 3301.23(D)(1)).
4. Beginning with the 2022-2023 academic year, each state university shall recognize the successful completion of a course in advanced computer science in high school, as described in the standards adopted pursuant to division (A)(4) of section 3301.079 of the Ohio Revised Code, as a unit for admission to the university.

REPORT OF THE STATE COMMITTEE ON COMPUTER SCIENCE

As part of the requirements of House Bill 110, the Department of Education in partnership with the Ohio Department of Higher Education was required to create a plan for computer science education. This report was finalized Aug. 30, 2022 and is available on the Department website.

STANDARDS AND MODEL CURRICULUM UPDATE

Ohio law mandated a revision to Ohio's Learning Standards and Model Curriculum for Computer Science. Ohio educators and stakeholders met to revise the standards and model curriculum during 2021 and 2022. The revised standards were adopted by the Ohio State Board of Education in July 2022 followed by the model curriculum in Sept. 2022.

TEMPORARY LAW: COMPUTER SCIENCE LICENSURE FOR FY 2023

Ohio House Bill 110 section 610.10 extends the provision allowing an individual holding a valid educator license in any grades 7-12 to teach a computer science course if, prior to teaching the course, the individual completes a professional development program approved by the district superintendent or school principal that provides content knowledge specific to the course the individual will teach.

The superintendent or principal shall approve any professional development program endorsed by the organization that creates and administers the national Advanced Placement examinations as appropriate for the course the individual will teach.

Beginning July 1, 2023, a school district or public school shall permit an individual to teach a computer science course only in accordance with section 3319.236 of the Ohio Revised Code.

Teachers and districts have until Jan. 31, 2022 to submit the Computer Science Eligibility Form to take advantage of this temporary law.

Choosing EMIS Subject Codes

Districts may use names for courses that are different from the course names shown in Education Management Information System (EMIS). When recording courses in EMIS, districts must select the subject codes of the courses that match the content of their own courses. Brief descriptions of each course, below, will help districts determine the best matches for the courses they offer.

K-8 CS Courses

290245 Computer Science K-8
Includes content in the appropriate grade range portion of Ohio's Learning Standards for Computer Science.

101355 Robotics K-8
Students engage in a design process to manage and control devices through investigative and exploration activities. Products of student work in robotics may be descriptive and/or functional models of technology applications. Students will apply the knowledge and skills necessary to program and operate robots. The students will learn robotic operations and system configurations. Students will code and debug programs using the robotic programming language. This course can also serve as a computer science course.

High School CS Courses

101350 Robotics
Application of processes and knowledge in the design, development, and use of systems to manage and control devices. Products of student work in robotics may be descriptive and/or functional models of technology applications across all systems areas.

290170 Networking
In this course, students understand the concepts and use of network servers and devices (e.g., host, firewall, router, switch). Students understand the advantages and disadvantages of network models (e.g., peer-peer, client-server). Content addresses network design fundamentals including network type (e.g., LAN, WAN, MAN). Students also learn the application of network topologies (e.g., Star, bus, hybrid). At an advanced level, students design and build simple networks, understand server virtualization and network security.

290180 Computer Service
This course includes configuration, troubleshooting and repair of network hardware, clients and peripherals. In addition, content should include installation of operating systems including updates, computer security and customer service.

290200 Computer Programming
This course includes the study and use of programming languages (e.g., C++, C#, Java, Python).

290250 Computer Science
In this course, students develop an understanding of how computing is used to solve problems and enable innovation across fields and how these solutions can impact society. Students explore using computational thinking skills and tools to solve problems and create artifacts. Effective communication and collaboration skills are developed as students work individually and in group explorations. *This course is typically reported as advanced when it used to report as Advanced Placement (AP) Computer Science Principles.*

290310 Computer Science with In-Depth Study*
This course addresses computer science topics that include problem solving strategies, organization of data, algorithmic thinking and programming, analysis of potential solutions and the impacts of computing. The course provides the opportunity for a more in-depth study of selected computer science content. *This course is typically reported as advanced when reported as Advanced Placement (AP) Computer Science A.*

290325 Specific Topics in Computer Science
This course provides a focused examination of specific computer science topics (e.g., cybersecurity, robotics, data science).

299999 Other Computer Science
A high school level course that addresses content from the 9-12 section of Ohio's Learning Standards for Computer Science and is different in scope from any of the other Subject Codes described above.

290160 Website Development
This course includes planning, designing and coding webpages to create dynamic, usable websites. Content includes web programming using common design tools, e.g., HTML, XML, CSS, web-based editors. Students study and use web-based protocols, e.g., SFTP, TCP/IP, HTTP, HTTPS. In addition, content includes using tag elements, working with graphics, hypertext links, graphical tables and accessibility methods including Universal Design.

Using EMIS Course Level Element Field

EMIS allows districts to designate up to seven levels for each course. These are levels I-V, Advanced and Intervention. The levels allow districts to use the same subject codes for different course offerings. For example, a district can identify a single computer science course as an intervention, introductory or advanced course. You can find more information on the EMIS Course Level Element field in section 4.2 v 9.4 of the EMIS Manual.

To be considered at an advanced level, a computer science course must:

- Include Ohio's 9-12 *advanced level* standards; and
- Be recorded as *advanced* in the EMIS Course Level Element field (CN080).

Using a Computer Science Course to Satisfy Ohio Graduation Requirements

State law allows a student to use a computer science course to satisfy credit for mathematics, advanced mathematics or advanced science courses. It also allows students to use a coding course to satisfy Foreign (World) Language credit in schools that require Foreign (World) Language credit for graduation. Courses in computer science provide an alternative way for students to demonstrate what they know and can do. This option also will support students who plan to enter specialized careers that draw on knowledge and skills learned in computer science courses.

Districts record credits for computer science using the appropriate computer science subject codes in EMIS. Graduation credits are recorded in the Core area of EMIS. Each district is responsible for tracking how students fulfill graduation requirements. Ohio encourages districts to have a system in place for recording transcript credit(s) in computer science whenever applied toward the fulfillment of credit(s) for graduation.

NOTE: A student may satisfy only two of the four required mathematics graduation credits with credit in computer science.

Applying Credit in Computer Science to Satisfy a Mathematics Credit

A student may use credit in a computer science course to satisfy a mathematics credit. To do so, the course must address high school mathematics standards and focus on the study of, or usage of, algorithms for problem solving. A course that focuses only on learning a computer language without application and analysis does not qualify for mathematics credit. The district chooses the content and standards associated with each course and determines whether each course complies with these guidelines. Find additional guidance at Requirements for Mathematics Courses Beyond Geometry/Mathematics 2.

Applying Credit from an Advanced Computer Science Course to Satisfy Credit for Algebra 2/Math 3 or Its Equivalent

A student may choose to apply one credit of *advanced computer science* to satisfy the requirement of one unit of Algebra 2/Math 3 or its equivalent. Only credit in an *advanced computer science* course can be used to satisfy the Algebra 2/Math 3 or its equivalent graduation requirement in mathematics.

An *advanced computer science course* must address standards in the grades 9-12 *advanced section* of Ohio's Learning Standards for Computer Science and must be recorded as *advanced* in the EMIS Course Level Element field (CN080).

NOTE: A single credit in *advanced computer science* may only be used to satisfy one Algebra 2/Math 3 or equivalent, **or** an advanced science (excluding Biology or Life Sciences) credit.

NOTE: When students choose to take advanced computer science to satisfy the credit for Algebra 2/Math 3 or equivalent, the school must communicate that some institutions of higher education may require Algebra 2/Math 3 or equivalent for the purpose of college admission. Also, the parent, guardian or legal custodian of each student who chooses to take advanced computer science in lieu of Algebra 2/Math 3 or equivalent must sign and submit to the school a statement acknowledging that not taking Algebra 2/Math 3 or equivalent may negatively affect college admission decisions (ORC 3313.603 (C)(3)).

The Department provides an Advanced Computer Science Checklist template for districts. This documents how they have notified parents, guardians or legal custodians of any adverse effects students could experience regarding college admissions or entry into a program of study when using computer science or advanced computer science to satisfy graduation requirements.

NOTE: Ohio high school graduates who choose to participate in intercollegiate athletics should refer to the NCAA rules for details on how using credit in *advanced computer science* to satisfy Algebra 2/Math 3 may affect their eligibility.

Applying Credit from an Advanced Computer Science Course to Satisfy Credit for an Advanced Science Course

A student can choose to apply one credit in *advanced computer science* to satisfy the requirement of one unit of advanced science (excluding Biology or Life Sciences). An advanced science course builds on the content in Physical Science and Biology in Ohio's Learning Standards for Science. Physical Science and Biology are foundational courses for high school science. Computer science may not replace these courses.

NOTE: The requirement to earn a physical science credit and a life science credit must be met by science courses. A school cannot use computer science courses to satisfy either of these requirements for a student. A school can use an advanced computer science course only to satisfy the requirement that a student earn a third science credit in an advanced science course.

NOTE: A single credit in *advanced computer science* may only be used to satisfy a credit in an advanced science course (excluding Biology or Life Sciences) *or* Algebra 2/Math 3.

NOTE: Only a computer science course addressing standards in the grades 9-12 advanced section of Ohio's Learning Standards for Computer Science and recorded as advanced in the EMIS Course Level Element field (CN080) can satisfy the required credit of an advanced science course.

Applying Credit in Computer Science to Satisfy Foreign (World) Language Credit

If a school district or chartered nonpublic school requires a foreign language as an additional graduation requirement under 3313.603 (E) of the Revised Code, a student may apply one unit of instruction in computer coding to satisfy one unit of foreign language. If a student applies more than one computer coding course to satisfy the foreign language requirement, the courses shall be sequential and progressively more difficult.

Using Computer Science for Admission to a State University

House Bill 110 included legislation addressing using computer science for admission to a state university.

Beginning with the 2022-2023 academic year, each state university shall recognize the successful completion of a course in *advanced* computer science in high school, as described in the standards adopted pursuant to division (A)(4) of section 3301.079 of the Revised Code, as a unit for admission to the university, as follows:

(1) The state university shall recognize one unit of advanced computer science as one unit toward meeting a general mathematics requirement, as determined by the university if the student used that advanced computer science unit to meet the mathematics curriculum requirement under division (C)(3) of section 3313.603 of the Revised Code.

(2) The state university shall recognize one unit of advanced computer science as one unit toward meeting a general science requirement, as determined by the university, if the student used that advanced computer science unit to meet the science curriculum requirement under division (C)(5) of section 3313.603 of the Revised Code.

(3) The state university shall recognize one unit of advanced computer science as one unit toward meeting a general elective requirement, as determined by the university if the student used the advanced computer science unit to meet the curriculum requirement under division (C)(8) of section 3313.603 of the Revised Code.

(4) The state university shall recognize one unit of computer coding as

one unit toward meeting a general foreign language requirement, as determined by the university if the student used the computer coding unit to meet a school district's or school's foreign language curriculum requirement as described in division (E) of section 3313.603 of the Revised Code.

Technology Seal

Students in the classes of 2023 and beyond (those who entered grade 9 on or after July 1, 2019) are now required to meet a new set of graduation requirements. One of these new graduation requirements is *Demonstrating Readiness* by earning two Graduation Seals.

The Technology Seal is a state-defined seal. Students who earn Ohio's Technology Seal will understand the global impact of technology and use it to design solutions and communicate ideas. Students will earn the Technology Seal by demonstrating knowledge and skills on Advanced Placement and International Baccalaureate courses and tests, through College Credit Plus coursework or by completing a qualifying technology course. More information and guidelines are available on the Technology Seal Page.

Qualifications to Teach Computer Science

Teachers can qualify to teach computer science in several ways.

The **three most common pathways** are to:

- Hold a full teaching license in computer science;
- Hold a computer technology endorsement and have successfully passed the computer science Ohio Assessments for Educators (OAE) exam (currently OAE #054); or
- Hold a full teaching license in any area and add computer science through a supplemental pathway that includes passing the computer science OAE exam.

Alternative Pathway-Under the alternative pathway (which would be considered full licensure), an individual must hold a 2.5 undergraduate GPA, complete coursework at an Intensive Pedagogical Training Institute (IPTI) or an approved training institute and receive a passing score on the OAE exam.

Additional Licenses-There are two additional licenses available to individuals who do not hold a professional or alternative license:

- The 12-hour Teaching Permit allows an individual to teach up to 12 hours a week. Applicants must hold a baccalaureate, master's or doctoral degree or show evidence of significant experience, verified by the employing district, in the subject to be taught.
- The 40-hour STEM School Teaching Permit allows an individual to teach up to 40 hours a week at a Science Technology Engineering Math (STEM) designated school. Applicants must hold a baccalaureate, master's or doctoral degree or show evidence of significant experience, verified by the employing district, in the subject to be taught.

Teaching Advanced Placement (AP) Computer Science Courses-To teach an AP computer science course, in addition to holding a proper license, an individual must complete a professional development program endorsed or provided by the organization that creates and administers national advanced placement examinations. For this purpose, the individual may complete the program at any point during the calendar year.