EDUCATION TRENDS

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Computer Science in High School Graduation Requirements (SEPT. 2016 UPDATE)

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Computer science and coding skills are widely recognized as a valuable asset in the current and projected job market. The Bureau of Labor Statistics projects 37.5

ALLOWING HIGH SCHOOL STUDENTS TO FULFILL A MATH OR SCIENCE HIGH SCHOOL GRADUATION REQUIREMENT VIA A COMPUTER SCIENCE CREDIT MAY ENCOURAGE MORE STUDENTS TO PURSUE COMPUTER SCIENCE COURSEWORK.

percent growth from 2012 to 2022 in the computer systems design and related services industry, from 1,620,300 jobs in 2012 to an estimated 2,229,000 jobs in 2022.[1]

Yet, some reports point to an alarming absence of female and minority students in courses such as Advanced Placement (AP) computer science. Of AP Computer Science A exam takers in the Class of 2013, 81 percent were male and 82.5 percent were white or Asian/Asian American/Pacific Islander.[2] Change the Equation reports that 56 percent of high school seniors have no computer science courses offered at their high school.[3]

This Education Trends report, an update to the April 2015 report, identifies states that allow or require districts to apply computer science coursework toward completion of high school graduation requirements in math, science or foreign language.

Many states place additional requirements on the computer science credit so that it may substitute for a traditional math/science course, i.e., the course must be an advanced computer science course.

Twenty states require a computer science credit to be allowed to fulfill a math (or in some states, science) graduation credit, while three states permit, but do not require, computer science credit to fulfill a math or science credit. Code.org has identified additional states that authorize such course substitutions, but that have not established them in statute or regulation.

Policies mandating awarding of math, science or foreign language credit

Currently, 20 states require that students be allowed to apply specified computer science courses toward completion of mathematics, science or, in one state, language other than English graduation requirements for the standard diploma. The section that follows sets forth the specifics of these course substitution policies.

Arkansas: Students choose to complete the rigorous Smart Core curriculum or the less rigorous Core curriculum. For each of these two curricular options, students select between Option 1 and Option 2 to complete math and science requirements. Smart Core students may use computer math to fulfill the fourth math credit or may take three math credits from Option 1 plus one unit of computer science. Math Option 2 for Core students includes one unit of computer science plus three units selected from Option 1.

Similarly, Smart Core students may fulfill the science requirement by taking one unit of computer science and two units of lab science identified in Option 1. Arkansas Core students may fulfill the science requirement by completing one unit of computer science plus two units selected from Option 1. (Ark. Admin. Code 005.15.2-14.02)

ARKANSAS SMART CORE AND CORE OPTION 1 AND 2 FOR MATHEMATICS

	Option 1	Option 2
Arkansas Smart Core (4 units)	Algebra I or Algebra A & B	1 unit computer science + 3 units chosen from Option 1
	Geometry or Investigating Geometry or Geometry A & B	
	Algebra II	
	4th unit chosen from: Transitions to College Math, Pre-Calculus, Calculus, Trigonometry, Statistics, Computer Math, Algebra III or an AP math	
Arkansas Core (4 units)	Algebra I or equivalent	1 unit computer science + 3 units chosen from Option 1
	Geometry or equivalent	
	2 additional units building on algebra and geometry knowledge and skills	

ARKANSAS SMART CORE AND CORE OPTION 1 AND 2 FOR SCIENCE

	Option 1	Option 2
Arkansas Smart Core (3 units)	Lab sciences chosen from Physical Science, Biology or Applied Biology/Chemistry, Chemistry, Physics or Principles of Technology I & II or PIC Physics	1 unit computer science + 2 units chosen from Option 1
Arkansas Core (3 units)	Biology or its equivalent	1 unit computer science + 2 units chosen from Option 1
	A physical science	
	One additional unit science	

Florida: One math or science unit may be fulfilled by one unit in computer science and the earning of related industry certifications. Computer science may not fulfill Algebra I or higher-level math, or Biology I or higher-level science credit requirements. (West's F.S.A. § 1007.2616(3)(a))

Georgia: Fourth science unit may be fulfilled by AP computer science. (Ga. Comp. R. & Regs. 160-4-2-.20)

Idaho: One math unit may be fulfilled by an AP or dual credit computer science or dual credit engineering course if the student has completed Algebra II. One science unit may be fulfilled by one of these courses. Students taking these courses may not count such courses as both a math and science credit. (IDAPA 08.02.03.105.01(d), (e))

Illinois: One math unit may be fulfilled by an AP computer science course if the student completes Algebra II or an integrated math course with Algebra II content. If a school district offers an AP computer science course to high school students, the school board must designate that course as equivalent to a high school math course and note on the student's transcript that the AP computer science course qualifies as a mathematics-based, quantitative course. (105 ILCS 5/27-22(e)(3), (f-5)

Louisiana: AP Computer Science A may fulfill one of the math credits for the Louisiana Basic Core curriculum or Louisiana Core 4 curriculum, both of which will last be offered for the Class of 2017. Effective with the Class of 2018, these curriculum options will be replaced with the TOPS University Diploma curriculum, under which students will also be able to fulfill a math credit with AP Computer Science A. (La. Admin Code. tit. 28, pt. CXV, § 2318)

Maryland: AP computer science may fulfill a math credit towards graduation requirements. Another computer science course may fulfill a math credit requirement if the district determines the course meets the math standards required by regulation. (COMAR 13A.04.12.01(A)(2)(a))

Michigan: The Algebra II credit may be partially or fully fulfilled by completing a department-approved formal career and technical education (CTE) program or curriculum, including in computer science, and in that program, successfully completing the same content as the Algebra II benchmarks assessed on the department-prescribed state high school assessment, as determined by the department. The third science unit requirement may be fulfilled by completing a department-approved computer science program or curriculum. (M.C.L.A. 380.1278a(1)(a)(i), M.C.L.A. 380.1278b(1)(b))

Minnesota: A computer science credit may fulfill a mathematics credit requirement if the credit meets state academic standards in mathematics. In addition, a Project Lead the Way credit [including Project Lead the Way Computer Science] may fulfill a science or mathematics credit requirement if the credit meets the state academic standards in science or mathematics. (M.S.A. § 120B.024, Subd. 2(e), (f))

New Jersey: Beginning with students entering ninth grade in the 2016-17 school year (Class of 2020), the state board of education must require that local graduation requirements allow an AP computer science course to satisfy a part of the total credit requirement in mathematics. For an AP computer science course to satisfy a part of the mathematics credit requirement, the student must be concurrently enrolled in or have successfully completed Algebra I and geometry or the content equivalent. (N.J.S.A. 18A:7C-2.1)

North Carolina: The NCDPI Math Options Chart referenced in state board rule provides that the fourth credit students may use to fulfill math requirements may include Computerized Accounting II, AP computer science, or PLTW Computer Integrated Manufacturing. In rare instances, a student's principal may exempt a student from

the Future-Ready Core mathematics sequence and allow the student to complete Computer Programming I and II as a pair of courses fulfilling application-based math course requirements. (Policy GCS-N-004)

Ohio: Effective with students entering ninth grade in the 2014-15 school year (Class of 2018), one of the four math units must be chosen from computer programming, probability and statistics, applied mathematics or quantitative reasoning, or any other course approved by the department using standards established by the superintendent. (R.C. § 3313.603 (D)(5)(b))

Oklahoma: The state board is statutorily required to approve an AP computer science course to meet one of the math course requirements for the college preparatory/work ready curriculum if the course is taken in a student's senior year and the student is concurrently enrolled in or has successfully completed Algebra II. (70 Okl. St. Ann. § 11-103.6(G)(3))

In addition, computer science is one of the units or sets of competencies students opting out of the college preparatory/work ready curriculum may complete to fulfill a math credit. To earn math credit, the course must be taught by a teacher certified to teach mathematics. (70 Okl. St. Ann. § 11-103.6 (D)(2); Okla. Admin. Code 210:35-9-31 (e)(B)(ii))

Pennsylvania: A public high school student who successfully completes a computer science or information technology course must be permitted to apply up to one credit earned for such course to satisfy the student's math or science credit requirement for graduation. The governing body of the student's public high school has discretion to determine the graduation credit requirement to which the credit earned by the student must be applied. (24 P.S. § 16-1605(c)(1))

South Carolina: One unit of computer science, if approved by the department of education, may be counted toward math requirements. (§ 59-39-100(B))

Texas: The third math credit under the Foundation High School Program (default diploma option effective with students entering ninth grade in the 2014-15 school year (Class of 2018),and also available to students in Class of 2017, may be selected from one full credit or a combination of two half credits from two different courses, subject to prerequisite requirements, from a number of courses, including AP computer science and Discrete Mathematics for Computer Science. (19 TAC § 74.12(b)(2)(B))

Students under the existing Minimum, Recommended or Advanced high school programs (available to students through the Class of 2017) may earn one unit of math credit for completing AP computer science or Discrete Mathematics for Computer Science. (19 TAC § 111.61(d), 19 TAC § 74.72(b)(2)(B), 19 TAC § 74.73(b)(2)(B), 19 TAC § 74.74(b)(2)(A))

In addition, students under the Foundation High School Program may fulfill two units of Languages Other Than English (LOTE) by completing two credits in computer programming languages selected from Computer Science, I, II and III. If a student, in completing the first credit of LOTE, demonstrates that s/he is unlikely to be able to complete the second credit, the student may substitute another appropriate course, including computer programming languages. (19 TAC § 74.12(b)(5)(A), (B))

Utah: The three science credits must be fulfilled, at a minimum, by two courses from any of the five science foundation areas, one of which is computer science. Students may complete 0.5 or 1.0 units of credit in

AP computer science, Computer Science Principles or Computer Programming II to meet that portion of the science requirement. (R277-700-6(C)(3)(a))

Virginia: 2014 legislation directs the state board to consider all computer science course credits to be math, science or CTE course credits and to develop guidelines on how computer science credits can satisfy graduation requirements. (VA Code Ann. § 22.1-253.13:4(D)(14)) Under those guidelines, adopted by the state board in January 2015, AP Computer Science A may fulfill:

- A standard graduation credit in math.

- A standard graduation credit in science when students successfully complete lab science courses from the different science discipline areas in accordance with the 2012 Regulations Establishing Standards for Accrediting Public Schools in Virginia (SOA). For AP Computer Science A to be applied as a standard credit for lab science, the course must include a significant experimental component, as defined in state board guidelines. International Baccalaureate (IB) computer science coursework may be applied as a lab science as part of the recognized IB diploma requirement, which is currently governed under the 2012 SOA regulations.

- A standard credit in CTE. (Virginia Board of Education Guidelines for the Use of Computer Science Courses to Satisfy Graduation Requirements, January 22, 2015)

In addition, Virginia permits a student to use a computer science exam as the student-selected end-of-course assessment to fulfill high school exit exam requirements, provided a student completes a CTE program sequence in programming or a related programming sequence and scores three or higher on the AP Computer Science A exam. (8 VAC 20-131-50(B)(2), (Virginia Board of Education Guidelines for the Use of Computer Science Courses to Satisfy Graduation Requirements, January 22, 2015)

Washington: Local boards must approve AP computer science as equivalent to high school mathematics or science and denote on a student's transcript that AP computer science qualifies as a math-based quantitative course for seniors taking the course. For a board to approve AP computer science as equivalent to high school math, the student must be concurrently enrolled in or have successfully completed Algebra II. (West's RCWA 28A.230.097(1))

Wisconsin: One math unit may be completed by a computer science course approved by the department of education. (118.33(1)(a)(1)

Code.org has identified additional states that have authorized computer science to be recognized as a math or science credit through avenues other than statute or regulation. These avenues may include a board resolution or other public announcement. States recognized by Code.org as implementing non-policy means for computer science to be applied toward graduation credit in math or science include:

Alabama

Washington, D.C.

Indiana

Kentucky

New York

Oregon

Rhode Island

Tennessee

Vermont

Source: https://code.org/action

Policies permitting awarding of math or science credit

Arizona: A district or charter school governing board may approve a rigorous computer science course to fulfill a math credit requirement only if the course includes significant mathematics content and the governing board determines the high school that will offer the course has sufficient capacity, infrastructure and qualified staff, including competent teachers of computer science. (A.R.S. § 15-701.01(B)(2), § 15-183(EE))

California: A district that requires more than two units of math for high school graduation may award up to one math credit for successfully completing a category C-approved computer science course, defined as a course that meets the A-G admission requirements for the California State University and the University of California. (West's Ann. Cal. Educ. Code §51225.35)

Colorado: 2016 H.B. 1198 directs the state board of education to adopt standards by July 2018 that identify the knowledge and skills that a secondary student should acquire related to computer science, including computer code writing, in one or more courses that qualify as a graduation requirement in either math or science. Local education providers may elect to implement the standards.

Policies mandating awarding of credit in other subject areas

One state has enacted policies in the last year permitting a computer science course to fulfill course credit requirements beyond math, science or a language other than English. Specifically, **Tennessee** 2016 Chapter 667 directs the state board, beginning with the 2016–17 school year, to approve appropriate computer science courses that every high school diploma candidate may enroll in and complete to satisfy the elective focus requirement for graduation. As used in this section, computer science courses include, but are not limited to, software engineering, computer programming, computer graphics and design, and computer-aided design.

State in which mandatory versus voluntary awarding of math or science credit is to be determined

West Virginia 2016 H.B. 4730 directs the state board of education, prior to the 2017 regular legislative session, to submit a plan to the Legislative Oversight Commission on Education Accountability for the implementation of computer science instruction and learning standards in the public schools. The plan must include, among other components, recommendations for a core set of learning standards designed to provide the foundation for a complete computer science curriculum and its implementation at the K–12 level. The learning standards must present computer science at the secondary school level in a way that is both accessible and worthy of an academic curriculum credit and may fulfill a computer science, math or science graduation credit. (W. Va. Code, § 18–2–12 (b)(1)(B))

Endnotes

1. United States Department of Labor, Bureau of Labor Statistics, Employment Projections, "Table 2.3, Industries with the Fastest growing and Most Rapidly Declining Wage and Salary Employment," December 2013, http://www.bls.gov/emp/ep_table_203.htm (accessed Jan. 14, 2015)

2. College Board, 10th Annual AP Report to the Nation, Subject Supplement: Computer Science A, 2014 http://media.collegeboard.com/digitalServices/pdf/ap/rtn/10th-annual/10th-annual-ap-report-subject-supplement-computer-science-a.pdf (accessed April 10, 2015).

3. Change the Equation, Blog Post, "New Data: Bridging the Computer Science Access Gap," http://changetheequation.org/blog/new-data-bridging-computer-science-access-gap-0, August 9, 2016, accessed August 23, 2016.

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