Office of Public Instruction

Economic Impact Statement for Content Standards Revision Computer Science

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Computer Science

Executive Summary

Using a negotiated rulemaking process involving stakeholder groups, Superintendent of Public Instruction Elsie Arntzen has developed recommendations for the creation of the Montana Computer Science Content Standards. The proposed standards are a new set of standards. In order to benefit students, it is important to implement standards that are based on relevant and current subject areas. The standards reflect best practices for Computer Science instruction to ensure that Montana schools provide students with relevant and rigorous learning expectations across the range of Computer Science learning opportunities.

The content areas covered by the K-12 Computer Science standards may include:

a. algorithms and programming
b. computing systems
c. data and analysis
d. impacts of computing
e. computer science networks and the internet.

When a district incorporates or integrates computer science content into district curriculum or offers a course in computer science, the following skills at each grade level apply:

a. fostering an inclusive computing culture
b. collaborating around computing
c. recognizing and defining computational problems
d. developing and using abstractions
e. creating computational artifacts

The Office of Public Instruction (OPI) surveyed school districts in January - May 2020 about the impact of the proposed standards on district resources for staffing, instructional materials, curriculum development, and professional development. There were thirty respondents for Computer Science. Forty percent (40%) of respondents indicated that their district could implement the proposed standards using existing resources. A majority of the respondents in this group indicated that they have a shortage in personnel and materials for curriculum development and professional development. Eight-two percent of respondents indicated they had a shortage in teachers who are endorsed in Computer Science.

The OPI has calculated an estimated $1,783, 375.00 to support the implementation of the proposed Computer Science standards. This funding request is an estimate developed by Code.org as an approximate one-time cost for expanding access to Computer Science to offer a basic K-12 pathway in every school in Montana. This does not model teacher attrition or long-term costs. Once teachers are established, existing state and federal funding streams should address this issue. (Refer to Appendix B to see calculations). The OPI estimates that not all school districts will be able to absorb, in their existing budgets, the cost of starting or expanding their Computer Science programs that align with the proposed standards. The OPI has identified an additional $1,305.00 to support the implementation of the proposed Computer Science standards. This funding will provide online professional development opportunities. The OPI will also develop a model curriculum guide to assist school districts with curriculum development.

Based on the analysis of the survey results and the advice of the negotiated rulemaking committee, the OPI has concluded that the school district expenditures required under the proposed standards are substantial expenditures that cannot be readily absorbed into the budgets of existing district programs.

Introduction

Content standards are adopted by the Board of Public Education through the administrative rulemaking process. The content standards for thirteen academic subject areas are promulgated in Title 10, Chapters 53 and 54. The content standards are used by school districts to develop local curriculum and assessments in all the content areas that include the arts, career and technical, English language arts, English language proficiency, health enhancement, library media, mathematics, science, social studies, technology, traffic education, workplace competencies, and world languages. The addition of computer science standards was requested and confirmed during the research and review phases of standards proposal development. The K-12 content standards describe what students shall know, understand, and be able to do in these content areas.

This economic impact statement analyzes the impact of the proposed adoption, amendment, or revisions to the Montana Content Standards as prescribed in 2-4-405, MCA.

Affected Classes of Persons

Describe the classes of persons who will be affected by the proposed rule, including classes that will bear the costs of the proposed rule and classes that will benefit from the proposed rule. Refer to Section 2-4-405 (2)(a).

The individuals who will be affected by the proposed Computer Science content standards are those persons who have responsibilities for implementing the Computer Science standards at the local level. These responsibilities include allocating resources for curriculum development and coordination, developing and adopting curriculum, delivering curriculum in the classroom, supporting students in meeting learning goals, and paying for any changes that are required by the standards. The affected classes include school administrators, teachers, school trustees, school business officials, parents, students, and taxpayers.

The beneficiaries of the proposed rule are students and the educators and parents who educate those students. In order to benefit students, it is important to implement standards that are based on current knowledge and understanding of best practices for Computer Science instruction to ensure that Montana schools provide students with the up-to-date and current learning expectations across the range of Computer Science learning opportunities.

The proposed standards are organized by grade level for grades K-5, and by grade band for grades 6-8 and 9-12. The benefit of having grade level standards from K-5 is to clarify learning expectations for the elementary teacher who is responsible for teaching all standards in all content areas. The 6-8 and 9-12 grade bands provide clarity of expectations while allowing flexibility of staffing and program delivery at those grade levels.

The Superintendent of Public Instruction is recommending the addition of the Computer Science content standards, and the Computer Science program delivery standards.

The proposed standards will also benefit higher education institutions who prepare Montana's pre-service teachers with alignment to high-quality, college-and-career ready learning expectations.

The costs of the proposed rules will be borne by local school districts and their taxpayers as well as the Office of Public Instruction (OPI). To support the implementation of the proposed standards, the OPI will provide professional development opportunities and include supplemental materials that districts can use to assist in curriculum development.

The OPI will also provide workshops at state conferences (when appropriate) for educators, help design a model curriculum guide and instructional resources accessible on the OPI website and offer online professional development for educators through the OPI Teacher Learning Hub (Hub).

The Hub is an online interactive professional learning network dedicated to providing free high quality professional development and training for all K-12 educators throughout Montana. As part of the OPI's service to Montana schools, the Hub's readily accessible learning opportunities aim to minimize the time teachers spend away from their classrooms to attend trainings as well as save school districts money on professional development costs. The Hub offers facilitated and self-paced modules, as well as a video library with a variety of trainings that support instruction, positive school climate, and student success. The Hub currently has two courses on implementation of Computer Science for educators.

Economic Impact

Describe the probable economic impact of the proposed rule upon affected classes of persons, including but not limited to providers of services under contracts with the state and affected small businesses, and quantifying, to the extent practicable, that impact. Refer to Section 2-4-405 (2)(b).

The Office of Public Instruction (OPI) conducted a survey of schools to assess the impacts of the proposed rule between February and May 2020. A total of 30 responses were received from superintendents, principals, district clerks, curriculum coordinators, teachers, and county superintendents. Not all questions were required to complete the survey. The respondents represented all school class sizes (AA- small schools) and all grade levels (elementary - high school).

Twelve of the 30 respondents (40%) indicated that their district would be able to meet the proposed standards within existing resources. Sixteen of the respondents (55%) indicated that the proposed standards would require their district to substantially revise the district's current curriculum.

Twenty- four of the respondents (82%) indicated that their districts has a shortage of teachers endorsed to teach Computer Science. The proposed rule does not require schools to hire additional Computer Science teachers. Specifically, the proposed rule is written in a manner that recognizes that elementary teachers (with an elementary endorsement) are most often the teachers who will deliver the Computer Science education curriculum in grades K-5. The issue of teacher shortages for Computer Science may be part of Montana's larger challenges with recruitment and retention of teachers in general. With the addition of the proposed content standards work will need to be done statewide to increase the number of Computer Science endorsed educators.

The OPI does not anticipate that providers of services under contract with the state or small businesses will be affected by the proposed rules. It is possible that school districts will replace existing instructional materials and supplies, which may be a minor benefit to local service providers.

Cost to State Agencies

Describe and estimate the probable costs to the agency and to any other agency of the implementation and enforcement of the proposed rule and any anticipated effect on state revenue. Refer to Section 2-4-405 (2)(c)

The Office of Public Instruction (OPI), in accordance with 20-7-101, MCA, has incurred costs associated with the negotiated rulemaking process, including contracting with a facilitator and convening the rulemaking committee. The OPI also pays for rule filings and publication of notices with the Secretary of State for standards revision. The OPI does not anticipate any additional costs associated with the accreditation of schools. The new standards will be incorporated into the OPI's accreditation review process within the existing budget of the OPI.

The Board of Public Education is responsible for the adoption of content standards. The costs associated with board member attendance at public hearings will be paid within the existing budget of the Board of Public Education.

In addition to the costs associated with the rulemaking process, the OPI will incur costs associated with providing professional development opportunities. The OPI has budgeted $1,305 to assist with the implementation of the proposed rule. The OPI plans to offer free professional development online through the Teacher Learning Hub in addition to providing regional training (when appropriate) across Montana.

Cost and Benefits of the Proposed Rule

Analyze and compare the costs and benefits of the proposed rule to the costs and benefits of inaction. Refer to Section 2-4-405 (2)(d).

The Board of Public Education has adopted a regular cycle for review of content area standards. The purpose of the regular review of standards is to ensure that content standards reflect current knowledge and best practices for each content area. The new proposed Computer Science content standards provide clear benchmarks for what students should know as they move through the K-12 grades.

The majority of the costs associated with the proposed standards are for ensuring that teachers understand the new Computer Science standards and have acquired current knowledge and best-practice instructional strategies to support engaged student learning and understanding in Montana K-12 classrooms. These proposed standards provide teachers and students a wide range of up-to-date Computer Science teaching and learning opportunities that connect Computer Science to our students' lives and the world around them.

The proposed standards will benefit teaching and learning in the following ways:

- The standards help to build the structure for a Computer Science pathway for all K-12 students in Montana.
- The standards are broken out in K-5 standards to clearly define what students should know and be able to do at the end of each grade and then by grade band for grades 6-8 and 9-12.
- The standards can be incorporated into multiple programs of studies and academic content areas.
- The standards integrate Montana's Indian Education for All with a commitment to inclusiveness and respect for diversity in the learning community.

The following addresses four areas of potential economic impact on school district operations and budgets.

Personnel

The proposed standards were developed with the expectation that the K-5 Computer Science curriculum will be delivered by elementary teachers with the 00 elementary endorsement. At the middle school and high school levels, districts will need teaching staff with endorsements in one of the Computer Science areas. (See Appendix A)

Twenty-four respondents (82%) indicated that their district has a shortage of teachers endorsed in computer science. Seventy-five percent of respondents said the Computer Science standards would require the district to hire additional teaching staff. Others commented that the grade level standards in grades K-5 would require additional instructional time with K-5 students. Districts and teachers will need time to integrate the new standards into their curriculum and lesson plans.

The Office of Public Instruction (OPI) does anticipate that more time will be required for educators to increase their knowledge of Computer Science topics and to align curriculum and instruction to the proposed grade level standards. The OPI has developed a plan for providing professional development to educators and administrators who are responsible for delivering the Computer Science standards. This plan is outlined under the Professional Development section of this statement.

Curriculum and Instructional Materials

A majority of the respondents (83%) indicated that they would or may need to substantially revise their existing curriculum to implement the proposed standards. The OPI will provide a model curriculum guide and instructional resources for the Computer Science standards once the proposed rule is adopted. The guide will be useful to districts as they begin the review and revision of their current Computer Science curriculum.

Districts are likely to follow a combination of one or more of four approaches to revise their curriculum and identify supporting instructional materials:

- Identify the gaps in their existing curriculum and make adjustments to align with the proposed standards;
- Adapt and adopt the model curriculum guide developed by the OPI;
- Adapt and adopt the curriculum materials provided by their local curriculum consortium or the Montana Small Schools Alliance; or
- Adapt and adopt curriculum materials that are aligned to the state standards and available online.

Eleven respondents (38%) indicated that their district will have difficulty finding instructional materials to meet the proposed standards. Twenty-one percent said they may have difficulty finding instructional materials.

As stated in the previous section, it is likely that all teachers of Computer Science will need time away from their classrooms to work on curriculum development both at the school and through professional development opportunities. Districts will incur costs for substitutes and travel expenses to curriculum consortia meetings and conferences. The OPI plans to provide funding to support these efforts as described in the next section under Professional Development.

If school districts determine that updated or additional instructional materials are needed to implement their revised curriculum, the cost of these instructional materials will be borne by the school district.

Professional Development

The OPI anticipates that at least one elementary teacher at each school will need to be trained on the Computer Science standards. A common practice of school districts is to send one or two lead teachers to training (in person or online); these teachers are then responsible for sharing information and resources with their colleagues to implement the necessary curriculum revisions.

Computer Science teachers at the middle school and high school levels will also need to be trained on standards to support Computer Science courses.

Computer Science teachers at every grade level will need access to professional development opportunities that will help integrate the new standards and instructional strategies into their curriculum guides.

The OPI will provide a curriculum guide for the Computer Science standards once the proposed rule is adopted. The guide will be useful to districts as they begin to develop or expand their Computer Science curriculum. The guide will also help districts incorporate Indian Education for All into their Computer Science curriculum.

The cost of inaction would compromise of the quality of educational opportunity in Computer Science for Montana students. The adoption of statewide Computer Science standards and expectations for what students should know reduces the Computer Science programs and course offerings disparities that may occur across the state.

Less Costly or Less Intrusive Methods

Are there less costly or less intrusive methods for achieving the purpose of the proposed rule? Refer to Section 2-4-405 (2)(e).

No. The process for proposing, reviewing, and adopting academic content standards is prescribed in statute in 20-7-101, MCA and in Montana Administrative Procedure Act. It is not possible to have statewide implementation of standards without formal rule adoption.

The role of the Board of Public Education is to set standards that apply to all accredited schools. The proposed rules reflect a set of best practices identified by educators that establish a minimum level of quality for all schools to meet. While there are school district costs associated with the implementation of these standards by school districts, the Office of Public Instruction will offer and coordinate professional development opportunities in a manner to reduce the burden of costs on school districts.

The proposed rule for revising the Computer Science content standards includes the following Statement of Reasonable Necessity:

> The Board of Public Education has determined it is reasonable and necessary to adopt, amend, and repeal rules relating to Computer Science content standards pursuant to ARM 10.54.2503 Standards Review Schedule and 10.53.104 Standards Review Schedule. The board has

determined that to stay consistent with the legislative intent of 20-1-102 and 20-9-309, MCA, it must review and make contemporary amendments to its standards. The Legislature recognizes the need to reassess educational needs on a cyclical basis and the board recognizes its standards represent the minimum standards. These standards are the basis upon which a quality system of education is built and maintained. The board strives to conform to a regular review cycle for every chapter of accreditation. The standards review process shall use context information, criteria, processes, and procedures identified by the Office of Public Instruction with input from representatives of accredited schools and in accordance with the requirements of 20-7-101, MCA.

Selection of Proposed Rule

Analyze any alternative methods for achieving the purpose of the proposed rule that were seriously considered by the agency and the reasons why they were rejected in favor of the proposed rule. Refer to Section 2-4-405 (2)(f).

In recent years, the Office of Public Instruction (OPI) has promoted educator best practices and updated information on Computer Science education to Computer Science educators that typically were only Career and Technical Education teachers. However, this has not reached all schools or all educators. With the adoption of the proposed K-12 Computer Science standards, all schools and educators will be seeking updated information and best practices in Computer Science education.

The Board of Public Education agreed to move forward with the Superintendent's request to begin the process for the creation of the Computer Science content standards and program delivery standards.

Efficient Allocation of Public and Private Resources

Does the proposed rule represent an efficient allocation of public and private resources? Refer to Section 2-4-405 (2)(g).

Yes, the proposed content standards will apply to all public and any private schools seeking accreditation by the Board of Public Education.

Data Gathering and Analysis

Quantify or describe the data upon which the economic impact statement was based and an explanation of how the data was gathered. Refer to Section 2-4-405 (2)(h).

The Office of Public Instruction disseminated an electronic survey tool to all school districts in the state. The recipient list included superintendents, principals, district clerks, and county superintendents. Many school districts shared the survey tool with teachers and curriculum coordinators. The survey was available for 22 days. The existing standards and proposed standards were linked to the survey tool, so that respondents could compare the two. Please see the OPI Content Standards Revision webpage for more information.

Attached to this economic impact statement is a summary of the results from respondents. (Attachment A)

Applicable Statute

2-4-405. Economic impact statement. (1) Upon written request of the appropriate administrative rule review committee based upon the affirmative request of a majority of the members of the committee at an open meeting, an agency shall prepare a statement of the economic impact of the adoption, amendment, or repeal of a rule as proposed. The agency shall also prepare a statement upon receipt by the agency or the committee of a written request for a statement made by at least 15 legislators. If the request is received by the committee, the committee shall give the agency a copy of the request, and if the request is received by the agency, the agency shall give the committee a copy of the request. As an alternative, the committee may, by contract, prepare the estimate.

(2) Except to the extent that the request expressly waives any one or more of the following, the requested statement must include and the statement prepared by the committee may include:

(a) a description of the classes of persons who will be affected by the proposed rule, including classes that will bear the costs of the proposed rule and classes that will benefit from the proposed rule;

(b) a description of the probable economic impact of the proposed rule upon affected classes of persons, including but not limited to providers of services under contracts with the state and affected small businesses, and quantifying, to the extent practicable, that impact;

(c) the probable costs to the agency and to any other agency of the implementation and enforcement of the proposed rule and any anticipated effect on state revenue;

(d) an analysis comparing the costs and benefits of the proposed rule to the costs and benefits of inaction;

(e) an analysis that determines whether there are less costly or less intrusive methods for achieving the purpose of the proposed rule;

(f) an analysis of any alternative methods for achieving the purpose of the proposed rule that were seriously considered by the agency and the reasons why they were rejected in favor of the proposed rule;

(g) a determination as to whether the proposed rule represents an efficient allocation of public and private resources; and

(h) a quantification or description of the data upon which subsections (2)(a) through (2)(g) are based and an explanation of how the data was gathered.

(3) A request to an agency for a statement or a decision to contract for the preparation of a statement must be made prior to the final agency action on the rule. The statement must be filed with the appropriate administrative rule review committee within 3 months of the request or decision. A request or decision for an economic impact statement may be withdrawn at any time.

(4) Upon receipt of an impact statement, the committee shall determine the sufficiency of the statement. If the committee determines that the statement is insufficient, the committee may return it to the agency or other person who prepared the statement and request that corrections or amendments be made. If the committee determines that the statement is sufficient, a notice, including a summary of the statement and indicating where a copy of the statement may be obtained, must be filed with the secretary of state for publication in the register by the agency preparing the statement or by the committee, if the statement is prepared under contract by the committee, and must be mailed to persons who have registered advance notice of the agency's rulemaking proceedings.

(5) This section does not apply to rulemaking pursuant to 2-4-303.

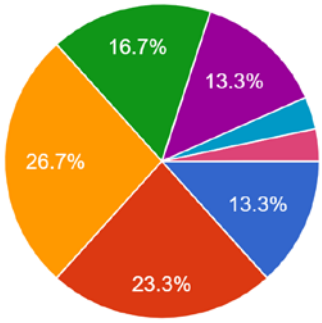
(6) The final adoption, amendment, or repeal of a rule is not subject to challenge in any court as a result of the inaccuracy or inadequacy of a statement required under this section.

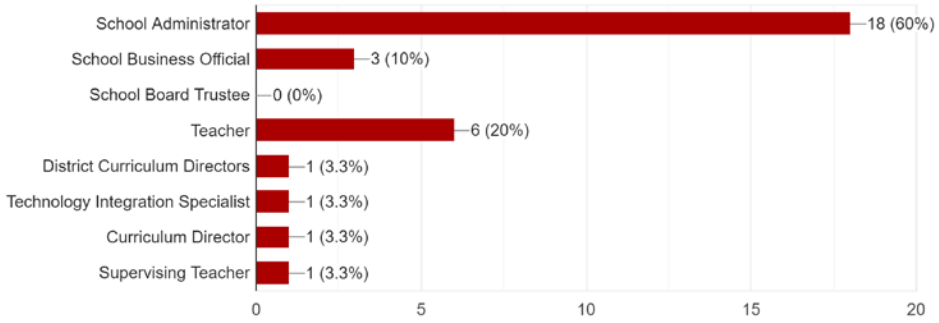
(7) An environmental impact statement prepared pursuant to 75-1-201 that includes an analysis of the factors listed in this section satisfies the provisions of this section.

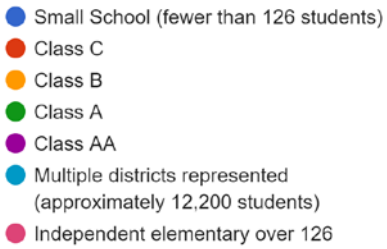
Attachment A-Computer Science Economic Impact Survey

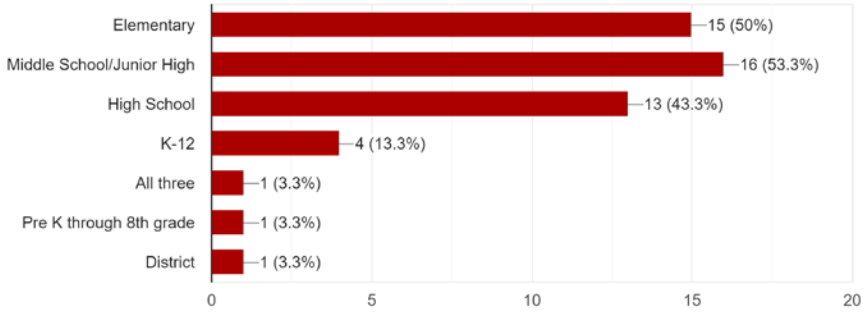
Survey Demographics (n=30*)

*many of the questions were optional



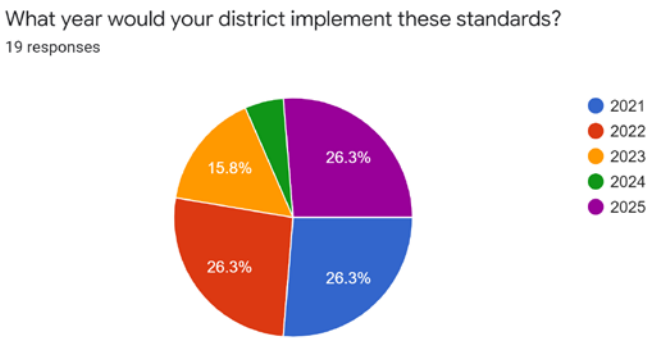






Content Standards Implementation

Question	Yes	No
Do you anticipate that your district will be able to implement the proposed standards with existing resources?	12 (40%)	18 (60%)
Will your district be able to implement the proposed program delivery standards for computer science?	11(38%)	18 (62%)



Personnel was the most significant challenge to implementation with all 18 voting "no" to the program delivery standards selecting personnel as one of the most significant challenges to implementation. Additional concerns are:
"this does not fit into the school day for teachers or students"
"We have a small school with a small, unique populations, due to factors beyond student control, many are below grade level and much of our time as teachers is spent not only teaching current core standards but attempting to fill gaps students have. I struggle with finding enough time in the day to teach the current standards, I will not be able to teach additional standards due to time and achievement gaps from my students' previous years in education."

Instructional Materials

Question	Yes	No	Maybe
Will your district have difficulty finding instructional materials to implement the proposed standards?	11 (39%)	11 (39%)	6 (21%)

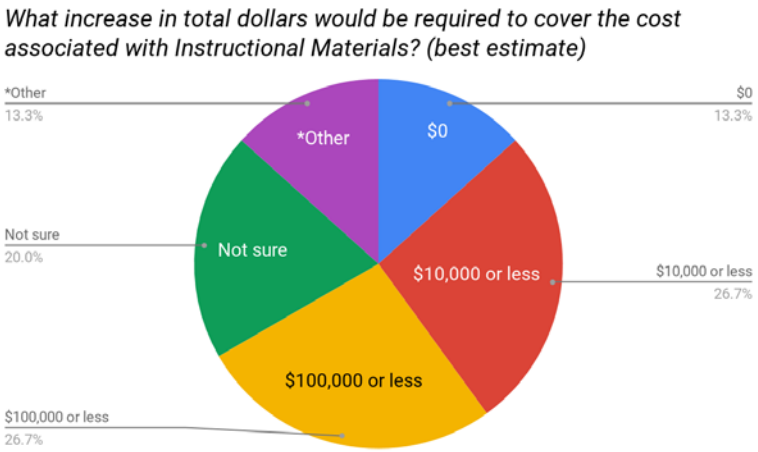
"There is plenty on the market available for CS both free and inexpensive. The question will be if those resources are ongoing digital subscriptions based on number of students or site licenses."

"Cost is the technology: code.org is free and meets all these but we don't have the time to add it to the day at the K-5 level, and 6-12 we can't afford FTE"

"We are using and will continue to use PLTW as a mechanism for computer science"

"Finding will not likely be a problem. Affording is very likely to be. Also, some of the standards appear to require hardware and programming tools and materials that no one on my team is prepared to use."

"It may be challenging to find materials that cover these standards specifically because they are so general and do not include a progression of skills such as keyboarding proficiency levels and being able to use specific programs at various grade levels."



**"1500 per year Code HS" and "300,000 every three years to rotate out Chromebooks. We have 16,000 students and they would each need access to technology of some sort."*

Personnel

Question	Yes	No
Does your district have a shortage of teachers endorsed in computer science?	24 (82%)	5 (17%)

Summary of if answered "no" or "maybe" feedback:

"Computer Science is not currently an endorsement in MT. It is my understanding that all can teach it."

"This is a difficult question that needs further clarifications at both K-8 and High School. High school we can use business and tech-ed teachers, but we have shortages in both those areas as well. If we are adding a CS program of study in the K-8, what are the requirements?"

Professional Learning

Question	Yes	No
Will your district have difficulty finding professional development opportunities for computer science educators?	11 (42%)	15 (58%)

Summary if answered "yes"

"The UM/MSU summer CS PD will be ending this summer. No opportunities after that."

"Rural location makes it difficult to receive professional development in this area."

"We need to train teachers in computer science to deliver the content and assess learning"

"There are numerous professional development opportunities on the Learning Hub, Region III and Region I."

"The problem wouldn't necessarily be finding PD for computer science educators; it would be finding computer science educators. My instinct is that people with CS degrees will not likely be in the education field."

What professional development would be needed?

"code.org can provide the K-12 support. It will be up to the district to decide the system, but it could be fulfilled with code.org"

"Train the trainer model through PLTW"

"There are a lot of options online for Professional Development. We currently use the online system."

"First, we would establish curriculum materials, hardware, and software, then there would be the task of teaching our current educators how to use it and how to instruct with it. Assessment would be very difficult because establishing a baseline for showing mastery of each individual standard would be difficult to pioneer."

"Level 1 Awareness on new standards and the pedagogy required to implement them. Level 2 Resources and implementation of new curriculum Level 3 Proficiency Based Assessments towards those standards."

Curriculum Development

Question	Yes	No	Maybe (if option)
Would the proposed standards, if adopted, require your district to substantially revise its current curriculum?	16 (55%)	5 (17%)	8 (28%)

Summary if answered "yes"

"This would require a great deal of time. Time would need to come from within the school year with PIR time allowed to work on this."

"At the K-5 level we do not have time or money to implement. 6-8 this is doable."

"Because it has been a long time since many of our districts worked on computer science curriculum, it is possible that these standards would cause substantial revisions. Some districts I represent would likely not have to make changes, while others would."

"We are a small school. We do not have Computer Science as a part of our curriculum at this time, nor do we foresee adding this course to our course offering here at the school."

"Regardless of how we integrate the standard, time will be a major fact. If we had a devoted computer science teacher it would mean sacrificing another elective (music, art, etc.) . If we taught it with our current staff, it would steal minutes from core classes."

"The area of greatest impact will be the K-5 level, but even middle and high school teachers will need to meet and revise what we are currently doing for computer programming. These new standards go above and beyond that."

General Feedback

"The addition of these new CS standards will help to delineate the grade-level requirements, but the overlap to the forthcoming Technology and Media Literacy standards revisions need to be looked over as a whole."

I am unable to answer many of the questions as we do not have computer science as a course and do not plan on adding in the near future. If students are interested in this topic area, we offer MDA Computer Science online.
There are no teachers endorsed in this area, nor is there room in the master schedule for adding another course. We are struggling with maintaining our core courses, electives (to include CTE varieties).

"These standards do not address a progression of skills at developmental age levels (with a few exceptions); therefore, districts will have a greater economic impact in developing and implementing local curriculum guides than they would if these provided more specific guidance. It would be better if these standards more closely aligned with national level expectations for things such as keyboarding proficiency and working knowledge of word processing programs, etc. "

"This is going to be a difficult position for any smaller Class C school to fill. We do the best we can with other subjects and including aspects where applicable and we readily use MTDA and Odysseyware whenever possible to help our students with this area of study. "

*"I love computer science and hope all children are computer literate, but an **unfunded mandate** will be nearly impossible to fulfill. Additionally, at the K-5 level our kids and teachers have very limited time to add anything to the day with testing and behavior issues eating up the majority of extra time. "*

*"Teachers have limited **time** available to work on this. Districts are hesitant to give time for this to happen, which means that teachers either have to use their personal time or choose not to complete the work. Time must be allocated during the school year."*

"Teaching CS is not a PD thing, no more that the training to be a math or science teacher can be done with PD. There needs to be content courses and methods courses offered at the universities. It cannot be a point at a willing teacher and say "your it". Course work needs to be developed to train CS teachers. None of the universities in Montana seem inclined to do so. No teachers qualified to teach CS means this whole curriculum is sort of a dead end. Qualified teachers cannot be made with just PD."

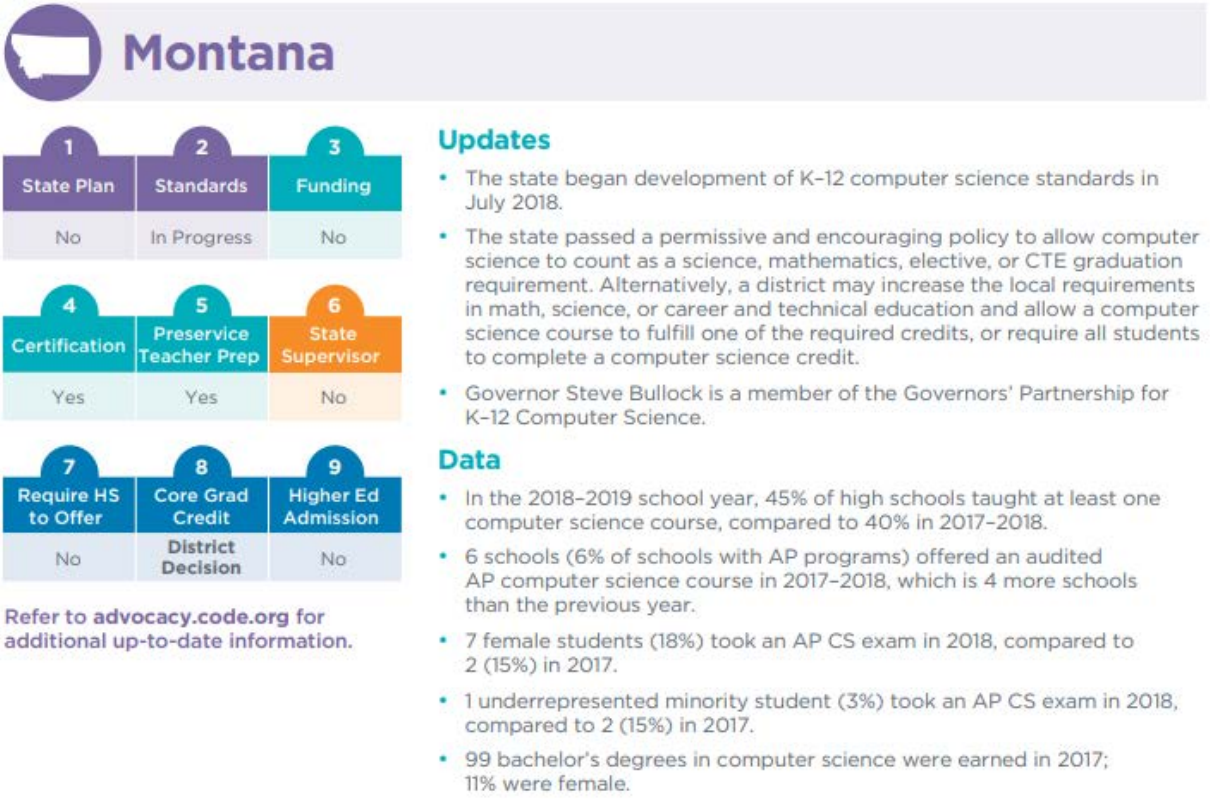
Montana Computer Science Cost Estimate from Code.org

This spreadsheet below approximates the one-time cost of expanding access to computer science to offer a basic K-12 pathway in every school in a state. This does not model teacher attrition or long-term costs. Once teachers are established, existing state/federal funding streams should address this issue.

Assumptions/limitations:
-- The cost to establish a computer science program is based on preparing an in-service teacher, NOT hiring a new teacher.
-- The major grade bands where teachers will be established are K-6 (elementary), 7-8 (middle school), 9-12 (high school) and uses NCES data (school year '14/'15, which is the most recent year) to determine how many unique schools each state has in these grade bands
-- This model assumes establishing one teacher per grade major grade band at a school using NCES data for number of unique schools at each grade band. For example, if a school has both K-6 grades and middle school grades, then the model will assume establishing two teachers. It also assumes that one K-6 teacher (such as technology teacher that reaches all students or a librarian) will be established per school. This figure may need to be adjusted (which is supported below) if states/districts want to establish more than one elementary school teacher per school.
-- Only Public and Public Charter School Districts would be eligible for this funding.
-- The model assumes some cost overhead compared to the work of private organizations such as Code.org

Approximate number of public/charter elementary schools	449
Approximate number of public/charter middle/high schools	503
Approximate % of schools that don't teach CS	55%
Assumption of number of teachers/elementary school	1
Assumption of number of teachers/middle/high school	1
Number of new elementary school CS teachers needed	247
Number of new middle/high school CS teachers needed	277
Cost to an elementary school to establish a CS teacher	$500
Cost to establish a middle or high school CS teacher	$6,000
Total cost: elementary school	$123,475

Total cost: middle/high school	$1,659,900
TOTAL COST	$1,783,375
Total new CS classrooms	524



2019 State of Computer Science Education Equity and Diversity, advocacy.code.org

Montana Computer Science Coding Endorsement and Core Graduation

Frequently Asked Questions: Computer Science in High School Graduation Requirements- March 5, 2019
Computer Science Opportunities to Satisfy a Core Graduation Requirement- March 5, 2019

Question: What are the teacher licensure requirements for a student to fulfill a credit requirement in another subject area through a computer science course? Must the teacher hold a licensure or endorsement in the subject area AND computer science?

Answer: If a district chooses to allow a computer science course to fulfill a mathematics, science, CTE or technology credit, the district must ensure the course is taught by an appropriately licensed teacher. For example, if a computer science course is assigned a mathematics course code, the teacher must hold current grade-level and subject area licensure in mathematics.
The Montana Board of Public Education recently created a high-quality pathway to certification in teaching computer science content. Specifically, ARM 10.57.421, as amended by 2018 rulemaking, permits an individual to obtain an endorsement on the Class 4 license to teach the following courses if s/he holds the qualifications below:

10.57.421 CLASS 4 ENDORSEMENTS
For health science education, engineering, computer information systems, computer coding, teacher education, EMT, or fire and disaster services, an alternative to the above requirement of 10,000 hours of work experience may be substituted as recognized by the Office of Public Instruction and the Board of Public Education as follows:
(c) For computer information systems an individual may provide verification of completion of an approved technical program in a recognized training institution and hold a professional license or industry standard certificate recognized by the Office of Public Instruction and the Board of Public Education.
(d) For computer coding:
(i) hold a Class 1 or 2 license; and
(ii) provide verification of successful completion of a blended learning professional development course of at least 80 hours by a provider recognized by the Office of Public Instruction and the Board of Public Education.

Question: What credit requirement(s) may a local board of trustees allow a computer science course to fulfill?

Answer: A computer science course that is assigned the appropriate course code and taught by an appropriately credentialed instructor may fulfill any of the following:

1. *A credit requirement in mathematics*
2. *A credit requirement in science*
3. *A local elective requirement*
4. *A local career and technical education (or technology) requirement*
5. *A stand-alone computer science credit requirement.*

Question: What are the teacher licensure requirements for a student to fulfill a credit requirement in another subject area through a computer science course? Must the teacher hold a licensure or endorsement in the subject area AND computer science?

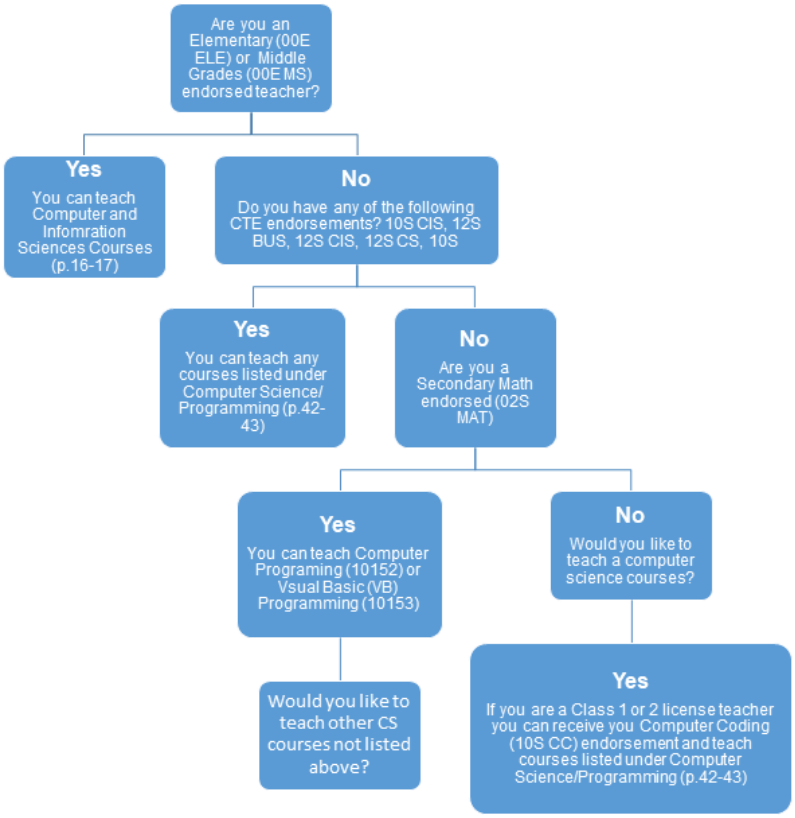
Answer: If a district chooses to allow a computer science course to fulfill a mathematics, science, CTE or technology credit, the district must ensure the course is taught by an appropriately licensed teacher. For example, if a computer science course is assigned a mathematics course code, the teacher must hold current grade-level and subject area licensure in mathematics.

Question: What course code requirements apply if a computer science course fulfills a local credit requirement in another subject, such as mathematics, science, or career and technical education?

Answer: Per ARM 10.55.911, a student's high school transcript must include the course code and credits earned for each course taken. This means that if a district chooses to allow a computer science course to fulfill a mathematics, science, CTE or technology credit, the school or district must:

- *Assign an appropriate course code for the subject area to which graduation credit will be applied (i.e., assign a math course code if the computer science course will be allowed to fulfill a math credit requirement).*
- *Denote on the student transcript that the student has met the applicable subject area requirement by completing a computer science course.*

Who Can Teach Computer Science Courses in Montana



Endorsement Codes
Montana K-12Course Codes and Descriptions
Computer Coding Endorsement: 10.7.421section 4d

2018-2019 Computer Science Course Data (TEAMS)

Prior to Secondary (PTS)

Prior to Secondary (PTS) Category	Number
Number of PTS Computer Science Courses	771
Total Enrollment of PTS Computer Science Courses	13,170
School Systems with PTS Computer Science Courses	105
Schools with PTS Computer Science Courses	134
Number of PTS Computer Science Teachers/Facilitators	139
PTS Computer Science Course Codes Available	7
PTS Computer Science Course Codes Used	7

Course Code	Prior to Secondary Computer Science Courses	Courses	Enrollment
60001	Introduction to Computer Technology	186	2872
60002	Computing Systems	9	73
60003	Computer and Information Technology	97	1702
60004	Computer Applications	366	6478
60010	Computer Literacy	83	1457
60201	Web Page Design	1	2
60202	Computer Graphics	29	586
	Total	**771**	**13,170**

Secondary Category

Secondary Category	Number
Number of Secondary Computer Science Courses	772
Total Enrollment of Secondary Computer Science Courses	8,022
School Systems with Secondary Computer Science Courses	131
Schools with Secondary Computer Science Courses	139
Number of Secondary Computer Science Teachers/Facilitators	198
Secondary Computer Science Course Codes Available	39
Secondary Computer Science Course Codes Used	25

All courses below can be taught by Computer & Information Sciences (10S CIS), Business Education(Broadfield)(12S BUS), Computer Information Systems (12S CIS), and Computer & Information Sciences (12S CS) endorsed teachers.
Highlighted Yellow are courses that also can be taught by Computer Coding endorsed teachers (10S CC). Highlighted Blue are courses that also can be taught by Mathematics endorsed teachers (02S MAT).

Economic Impact Statement for Content Standards Revision
Computer Science

Course Code	Secondary Computer Science Courses	Courses	Enrollment
10001	Introduction to Computer Technology	24	342
10002	Computing Systems	10	44
10003	Computer and Information Technology	44	447
10004	Computer Applications	292	4130
10005	Business Computer Applications	71	859
10006	Telecommunications	0	0
10007	IB Information Technology in a Global Society	1	12
10019	AP Computer Science Principles	2	16
10051	Information Management	4	30
10052	Database Management and Data Warehousing	2	2
10053	Database Applications	2	0
10054	Data Systems/Processing	1	11
10101	Network Technology	0	0
10102	Networking Systems	0	0
10103	Area Network Design and Protocols	0	0
10104	Router Basics	0	0
10105	NetWare Routing	0	0
10106	Wide Area Telecommunications and Networking	0	0
10107	Wireless Networks	0	0
10108	Network Security	4	13
10109	Essentials of Network Operating Systems	0	0
10110	Microsoft Certified Professional (MCP)	5	37
10151	Business Programming	0	0
10152	Computer Programming	134	720
10153	Visual Basic (VB) Programming	2	13
10154	C++ Programming	1	1
10155	Java Programming	12	125
10156	Computer Programming—Other Language	5	66
10157	AP Computer Science A	18	124
10159	IB Computer Science	8	24
10201	Web Page Design	60	382
10202	Computer Graphics	47	443
10251	Computer Technology	16	149
10252	Computer Maintenance	0	0
10253	Information Support and Services	0	0
10254	IT Essentials: PC Hardware and Software	0	0

10255	CISCO—The Panduit Network Infrastructure Essentials (PNIE)	6	24
10995	Information Technology—Aide**	0	0
10998	Information Technology—Workplace Experience	1	8
	Total	**772**	**8,022**

Montana course codes are a subset of the NCES (National Center for Education Statistics) Standard Codes. Along with the course code, a content description for each course is provided.
* As of 19-20 New course code: 71009 (PTS)/21009 (Secondary) Robotics, this is an open endorsement course so it can be taught be any grade-level appropriately endorsed teacher
**No longer available for Montana Schools as of 19-20.

AP Computer Science Course

During the 2018- 2019 school year two AP Computer Science courses were offered in Montana, AP Computer Science A and AP Computer Science Principles. 140 students from 16 high schools comprised of 15 school districts, including one Catholic school, offered an AP Computer Science course. Of those 16 high schools, 7 schools offered the course through Montana Digital Academy (MTDA).

Costs for offering the MTDA AP Computer Science course for 25 students is $15,000 ($7,500 per semester). Historically this course has not been full with only 10 students enrolled during the 2018-2019 school year.

This summer there is one, four day, AP Computer Science professional development training occurring in Montana hosted by School Services of Montana. The cost for this professional development is $775.

Additional funds would need to be allocated in promotion to students and training for teachers to increase the number of students enrolled in AP Computer Science courses.