

CREATING
OPPORTUNITIES
FOR STUDENTS TO
KEEP WYOMING
STRONG



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To: Joint Education Interim Committee

From: Kari Eakins, Chief Policy Officer

Date: November 14-15, 2019

Subject: Computer Science

Background

Computer Science Education was an interim priority for the Joint Education Interim Committee in 2017. At the direction of the JEIC, the Wyoming Department of Education (WDE) formed a task force to develop a roadmap, milestones, and a timeline towards achieving:

1. Access to an Advanced Placement Computer Science course or dual/concurrent enrollment equivalent for all Wyoming High School Students;
2. Access to at least two semesters of coding courses or dual/concurrent enrollment equivalent for all Wyoming high school students; and
3. Five hundred annual Advanced Placement Computer Science tests taken or dual/concurrent enrollment earned credit equivalent with broad student demographic participation.

This work was presented with recommended statutory changes in September 2017 and was the basis for the draft legislation sponsored by the JEIC which was passed by the Legislature during the 2018 Budget Session. An update on the progress of meeting these goals was requested during the June JEIC meeting.

Progress on Computer Science Implementation

The data shows student access to computer science has increased since the 2016-17 school year, and many districts have been making substantial progress toward computer science implementation. Enrollment data in Appendix B shows that of the 907 secondary students enrolled in a computer science course, only 196 are female. Similarly, females represent slightly less than one third of the students enrolled in AP computer science courses in 2018-19, despite

having a higher mean score on the AP exams than their male counterparts.

School Year	# of Districts Offering AP CS Courses	# of Colleges Offering Dual Enrollment CS Courses	# of Districts offering at least Two CS Courses	# of Students Taking AP CS Courses	# of Students Taking Dual Enrollment Courses
2016-17	5	4	9	11	86
2017-18	4	5	13	27	41
2018-19	9	7	20	142	9

The number of teachers certified to teach computer science has also increased from 34 in 2016-17 to 74 as of August 2019. Additionally, over 500 educators have been trained on computer science through various avenues. Examples of partners providing this training include: Code.org, Microsoft, Array School of Technology and Design, and the University of Wyoming.

Attachments

Appendix A

Managing Complex Change

In order to understand how to assist districts with their implementation of the Computer Science, the WDE has been using Knoster's Model for Managing Complex Change to better respond to districts concerns and requests for support (see image below). This model shows there needs to be five pieces in place in order to have successful change: Vision, Skills, Incentives, Resources, and an Action Plan. If any one of these components is missing, the purple boxes show the result. To assist districts with a successful implementation of computer science, the WDE has been putting supports in place for each area of complex change.

Knoster's Model for Managing Complex Change

Vision	Skills	Incentives	Resources	Action Plan	=	Success
Vision	Skills	Incentives	Resources	Action Plan	=	False Start
Vision	Skills	Incentives	Resources	Action Plan	=	Frustration
Vision	Skills	Incentives	Resources	Action Plan	=	Resistance
Vision	Skills	Incentives	Resources	Action Plan	=	Anxiety
Vision	Skills	Incentives	Resources	Action Plan	=	Confusion

Adapted from Knoster, T. (1991) Presentation in TASH Conference, Washington, D.C. Adapted by Knoster from Enterprise Group, Ltd.

Vision and Action Plan

- The Legislature and CS Education Task Force created a vision and roadmap for CS education at the state level.
- Through a Microsoft Philanthropies grant, the WDE is providing training to assist districts in understanding how CS fits within their vision of education. Additionally, these districts are developing [3-, 6-, and 12-month goals](#) for implementing CS. These goals are focused on materials and curriculum, leadership, teacher capacity, partners, and community. This training has had 25 districts and two private schools participate.

Appendix A

Managing Complex Change

Skills

- Professional development has been offered through a number of providers including, but not limited to, Code.org, University of Wyoming, Microsoft, and The Array School of Technology and Design.
- Several community colleges have developed online computer science 15 credit hour programs that will lead to an endorsement in computer science.
- The WDE is developing a stack of computer science micro-credentials that will lead to a CS endorsement. To support educators with preparing to earn the micro-credentials, educators will be able to take an optional online training.
- The Wyoming Computer Science Teachers Association, in partnership with the WDE, is working to expand and become a supportive professional learning network for educators.

Incentives

- The school funding model provides Career Technical Education programs in grades 9-12 with a sequence of at least 3 course in career cluster will receive an additional 29 percent full-time equivalent (FTE) ADM weight to generate additional Vocational Education teachers, lower Vocational Education class sizes, and the funding for vocational equipment and supplies.
- The WDE received a grant to work with districts on how to update their salary schedules to teachers who earn high-quality micro-credentials to receive increases in their salary.

Resources

- Funding: The Wyoming Education Trust Fund Grant has created a competitive preference for districts using the grant funds to support their CS implementation.
- Curricular: The WDE has received two grants that will support the development of curricular materials districts would have the option to use. No district would be required to use these resources. One set of resources would be available for use with middle and high school students. The other integrates CS and Indian Education for All at the elementary level.
- Curricular: The WDE has released a platform housing open education resources, including computer resources that teachers can use.

Appendix B

Wyoming Computer Science Education Data

Table 1. Number of Secondary Teachers Teaching Computer Science

School Year	# of Active Certified Teachers
2016-17	28
2017-18	34
2018-19	44

Source: WDE684 data collection.

Table 2. Secondary Student Participation in Computer Science Courses

		# Students Taking a CS Course			# Students Taking CS Advanced Placement or Dual Enrollment Course		
Reporting Category	Subgroup	2016-17	2017-18	2018-19	2016-17	2017-18	2018-19
All Students		668	775	907	133	81	150
English Learners		6	9	18	1	0	0
Gender	Female	134	162	196	19	25	33
	Male	542	623	699	114	56	117
Race/Ethnicity	American Indian/ Alaska Native	14	43	56	0	0	2
	Asian	5	11	13	0	1	6
	Black	6	10	8	1	2	2
	Hispanic	64	80	86	6	2	4
	Native Hawaiian/ Pacific Islander	1	2	1	1	0	0
	Two of More Races	15	23	29	3	1	5
	White	568	617	714	122	75	131
Students with Disabilities		59	82	98	9	3	3
Free & Reduced Lunch		199	237	256			

Source: WDE684 data collection.

Appendix B

Wyoming Computer Science Education Data

Table 3. High School Student Access to Computer Science Courses

School Year	% of students w/ CS access	% of students w/ access to 2 semesters	% of students w/ access to 1 semester	# of students enrolled in CS	# of student that took CS 2 semesters	# of students that took CS 1 semester
2016-17	52.2%	36.6%	15.6%	668	260	408
2017-18	61.6%	43.8%	17.8%	775	289	486
2018-19	67.6%	52.0%	15.9%	907	482	425

Source: WDE684 data collection.

Note: Schools with at least one student taking 2 semesters of computer science identified as "have access to CS 2 semesters." Schools with at least one student taking 1 semesters of computer science (none with 2) identified as "have access to CS 1 semester."

Table 4. Wyoming AP Performance - Computer Science A

Subgroup	# of Exams Taken			% Scoring 3 or Higher			Mean Score		
	2016-17	2017-18	2018-19	2016-17	2017-18	2018-19	2016-17	2017-18	2018-19
All Students	8	11	13	75%	45%	85%	2.88	2.82	3.31
Male	7	10	12	57%	50%	83%	2.86	2.90	3.17
Female	1	1	1	*	*	*	*	*	*

Source: The College Board

Table 5. Wyoming AP Performance - Computer Science Principles

Subgroup	# of Exams Taken			% Scoring 3 or Higher			Mean Score		
	2016-17	2017-18	2018-19	2016-17	2017-18	2018-19	2016-17	2017-18	2018-19
All Students	13	27	75	90%	89%	75%	3.23	3.59	3.13
Male	9	18	50	89%	89%	72%	3.22	3.28	3.08
Female	4	9	25	*	89%	80%	*	4.22	3.24

Source: The College Board

**Number of students tested is too small to display results.*

Appendix C

Computer Science Grants

The Wyoming Department of Education (WDE) has been actively seeking grant opportunities and partnering with grant recipients to assist with the implementation of computer science.

Boot Up Wyoming: Developing Computer Science Micro-credentials for Teachers and Students

United States Department of Education, October 2019 Grant Award: **\$481,714**

Partners: Wyoming Department of Education, Professional Teaching Standards Board, Wyoming Workforce Development Council, Carbon County School District #1, Fremont County School District #14, Uinta County School District #1

Goal: Develop professional development and stackable micro-credentials related to computer science resulting in computer science endorsed educators for secondary educators and students with industry recognized certifications.

Integrating Computer Science into the Elementary Curriculum in Culturally Relevant Ways: A Researcher-Practitioner-Partnership in Native-American Serving Districts in Wyoming

National Science Foundation, October 2019 Grant Award **\$999,748**

Partners: American Institutes for Research, Boot Up PD, Wyoming Department of Education, Fremont #14, Fremont #21, Fremont #38, Northern Arapaho Tribe, Eastern Shoshone Tribe

Goal: Develop culturally relevant curricular units and professional development that integrates Computer Science and Indian Education for All in grades 3-5.

Boot Up Wyoming: Developing Strategic CS For All:RPP - Booting Up Computer Science in Wyoming

National Science Foundation, October 2019 Grant Award **\$999,929**

Partners: University of Wyoming, Wyoming State Libraries

Focus: Providing K-8 educators with professional development on implementing computer science education and providing professional for school districts to find where computer science concepts are already being taught in their district.

***UW owns this grant. WDE will not directly receive funds, but WDE serves on their Community Engagement Advisory Board.

Boot Up Wyoming: Developing District Strategic Plans for Computer Science Implementation in K-12

National Science Foundation, March 2019, Grant Award **\$93,295**

Partners: Wyoming Department of Education

Focus: Providing professional development for districts to develop a vision of how computer science fits within their district and develop a 3, 6, 12 month goals on implementing computer science with a focus on curriculum, leadership, teacher capacity, partners, and community.

Appendix C

Computer Science Grants

As recommended by the 2017 Task Force, priority has been given to computer science in the [Wyoming Education Trust Fund](#) competitive grant. This competitive grant provides approximately \$250,000 annually to school districts. Over the last three years, \$638,334.40 has been granted specifically for computer science education implementation.

2019-20 Wyoming Trust Fund Grant Recipients:

- Fremont #24: \$49,900 for "Blockchain Innovations R&D"
- Sheridan #1: \$13,500 for "Computer Science Courses"
- Fremont #1: \$49,995 for "Reaching Forward with Computer Science"
- Laramie #1: \$41,212 for "Bringing Computer Science into Everyday Teaching Practices"
- Campbell #1: \$45,000 for "Revving Up Robotics in CCSD #1 Grades 3-6"
- Johnson #1: \$45,000 for "I³ Lab"
- Park #6: \$34,936 for "Cody Middle School MAD STEM Lab"

Appendix D

Wyoming Roadmap for Computer Science Education Update

Guiding Principles:

1. Computer science knowledge is essential for an engaged citizenry.
2. Computer science, particularly coding, is a highly valued skill for today's jobs and is projected to be even more so in the future.
3. Districts and schools have a responsibility to provide and promote access to computer science skills and knowledge, including advanced opportunities/pathways, for every Wyoming student regardless of geography, background, or circumstances.
4. Schools should provide opportunities that empower every Wyoming student to become an innovator of technology.
5. Early access to computer science knowledge and skills in grades K-8 is necessary to achieve advanced opportunities in computer science.
6. In addition to computer science being taught as a stand-alone subject, schools should take advantage of the many meaningful opportunities to integrate computer science across content areas throughout K-12.
7. The state's role is to define computer science and to support districts with resources for meeting district responsibilities.

JEIC Computer Science Goals 1 & 2

1. Access to an Advanced Placement Computer Science course or dual/concurrent enrollment equivalent for all Wyoming High School Students.
2. Access to at least two semesters of coding courses or dual/concurrent enrollment equivalent for all Wyoming high school students.

Milestone 1: Publicly elevate and highlight the importance of computer science education

Proposed Timeline: December 2017-March 2018

Milestone Met:

- Announce computer science education as a priority for the state and launch statewide informational campaign.
 - CS Ed Week Proclamation signed by Governor since 2017.
 - Boot Up Wyoming initiative launched.
- Educate districts on ways to integrate computer science education into current courses and programs.
 - UW RAMPED: Educator training on integrating computer science into their instruction.
 - UW WySLICE: Grant received by UW to provide teachers and administrators training on how to CS integrating with other content areas at the elementary level.

Appendix D

Wyoming Roadmap for Computer Science Education Update

- Increase participation in Computer Science Education Week to show public support for and celebrate computer science-related activities.
 - Public proclamation signing in 2017 during CS Ed Week.
 - WDE Hour of Code activities with support from Array.
 - 2017 Hour of Code with financial support for districts from Williams to incentivize classroom participation.
 - Partnering with industry and community organizations to provide Hour of Code activities for students outside of school.
- Partner with industry and economic development organizations to develop a long-term plan to align computer science education with Wyoming workforce needs.
 - Provide strategic planning training around CS which includes looking at how to partner with industry in local communities.
 - Workforce Development Council providing support for educator professional development related to computer science.
 - Industry partners participating in the CS content standards development.
 - Industry partners participating in developing the knowledge and skills for K-12 educators to teach CS.
 - CS endorsement program offered through four Community Colleges.
 - Wyoming Business Alliance support through partnership with Wyoming EXCELS subcommittee.
- Incorporate computational thinking/computer science into the state “basket of goods” and allow computer science to count toward high school graduation requirements.
 - Wyoming Legislative changes based on CS Task Force recommendations passed in 2018.

Milestone 2: Define computer science education and develop state content standards

Proposed Timeline: April 2018 - July 2019

Milestone in Progress:

- Create a definition for computer science education.
 - CS Standards Review Committee created a definition in proposed standards submitted to the SBE in March 2019.
- Develop a K-12 computer science education framework mapping out knowledge and skills foundation needs.
 - Knowledge and skills needed by students is incorporated into the K-12 Computer Science Content and Performance Standards related documents.
 - WDE, PTSB, School Districts, and the University of Wyoming will be developing educator knowledge and skills necessary to teach CS - Expected completion date: March 2020.

Appendix D

Wyoming Roadmap for Computer Science Education Update

- Promulgate computer science standards either as stand alone or integrated across the current content standards.
 - Draft CS Content and Performance Content Standards submitted to the State Board of Education (SBE) along with public comments. The SBE is waiting for an Attorney General's opinion that could impact the how the CS standards move forward.

Milestone 3: Train 500 teachers and assure appropriate certification to teach computer science

Proposed Timeline: August 2017-August 2022

Milestone in Progress:

- Create an educator certification pathway to allow educators to teach computer science and coding along with model professional development plan.
 - PTSB created an exception authorization to allow educators the ability to teach "slice" of computer science.
 - Reduced the amount of credit hours needed for computer science endorsement to 15 credits from 27.
 - WDE, PTSB, School Districts, and the University of Wyoming are creating micro-credentialing pathways to certification - Expected completion date December 2021.
- Provide extensive professional development throughout K-12.
 - Provided SCRIPT training options to 25 districts and 2 private schools to help strategically plan computer science rollout.
 - University of Wyoming became a Code.org Regional Partner in July 2019.
 - UW RAMPED: Summer training over two weeks on Integrating computer science into other content areas.
 - TACoS: Summer training over one week for students and teachers to learn elementary level computer science.
 - GenCyber: Summer training over one week for students and teachers to learn basic computer science and cybersecurity.
 - Multiple Code.org workshops across the state for elementary educators.
 - Multiple Code.org workshops for educators to learn how to teach computer science at the middle school and high school levels.
 - Microsoft TEALs Program: 3-year teacher mentorship program for teachers teaching Computer Science Principles.
 - UW WySLICE: Grant received by UW to provide teachers and administrators training on how to CS integrating with other content areas at the elementary level.

Appendix D

Wyoming Roadmap for Computer Science Education Update

- Support K-6 teachers with integrating computer science into other content areas.
 - UW WySLICE: Grant received by UW to provide teachers and administrators training on how to CS integrating with other content areas at the elementary level.
 - UW RAMPED: Summer training over two weeks on Integrating computer science into other content areas.
- Encourage school districts to utilize federal Title IIA funds to provide computer science professional development.
 - CS professional development was identified by districts as a top priority for Title IIA federal dollars.
 - The Wyoming Education Trust Fund grant has given competitive preference to those grants focused on supporting district CS implementations.
 - WDE has allocated Perkins Grant funds to support secondary teacher professional development. Teachers who are currently teaching in areas that are not considered high-demand, high-wage fields will have access to training leading to a CS endorsement.

JEIC Computer Science Goal 3

3. Five hundred annual Advanced Placement Computer Science tests taken or dual/concurrent enrollment earned credit equivalent with broad student demographic participation.

Milestone 1: Develop and implement programs targeted at equity in computer science education

Proposed Timeline: March 2018

Milestone in Progress:

- Establish state funding to support students in taking AP CS exams.
 - None to date.
- Introduce K-8 computing concepts to encourage early interest in each student's education pathway
 - Proposed CS standards are K-12.
 - Significant PD has been offered at the elementary level.
 - Detailed information about different curriculum programs that are available at the elementary level have been provided to districts.
 - WDE encouraged Hour of Code in elementary grades.
 - Computer science prioritized in competitive grant for 21CCLC after school programs to provide instruction and opportunities for elementary students.
- Develop and deliver intentional, targeted outreach to historically underrepresented student populations in computer science.
 - Perkins Innovation and Modernization Grant: WDE received \$1,000,000 to work with districts on the reservation and tribes to develop culturally relevant CS and Indian Education for All integrated curriculum for grades 3-5.

Appendix D

Wyoming Roadmap for Computer Science Education Update

- In partnership with the Governor's Office, WDE is supporting the Girls Go Cyberstart national competition.
- There are 9 Girls Who Code Clubs in Wyoming.
- Partner with afterschool programs to provide additional opportunities for students.
 - Computer science prioritized in competitive grant for 21CCLC after school programs to provide instruction and opportunities for elementary students.
 - Wyoming Afterschool Alliance received funds to provide CS in programs.
 - There are 9 Girls Who Code Clubs in Wyoming.
 - In partnership with the Governor's Office, WDE is supporting the Girls Go Cyberstart national competition.
 - Districts provide the opportunity for students to compete in an after school lego programming competition.

Milestone 2: Increase student engagement through industry partnerships

Proposed Timeline: September 2017 - September 2019

Milestone in Progress:

- Provide career development opportunities for students to learn where computer science is used in various industries.
 - Microsoft TEALS program partners industry professionals with teachers to teach computer science.
- Create job shadowing and internship opportunities applying computer science knowledge and skills
 - Coders of the West internship programs launched.
 - WDE offers a computer science policy internship that is open to high school and college students.
 - WDE received a grant to work with industry partners to develop a pathway to internships based on student-earned CS micro-credentials. Student micro-credentials are expected to also lead to an industry recognized certification.
- Work with communities and industry partners to create community spaces, such as makerspaces, for students, community members and industry to meet and collaborate.
 - Microsoft TEALS program offers students to work alongside industry partners while learning CS.
- Support industry-sponsored opportunities where students can compete using their computer science knowledge and skills.
 - TaTa Consulting Services (TCS) provides design and computational thinking opportunities for districts. Outstanding student projects will be part of a statewide competition at the end of the school year.