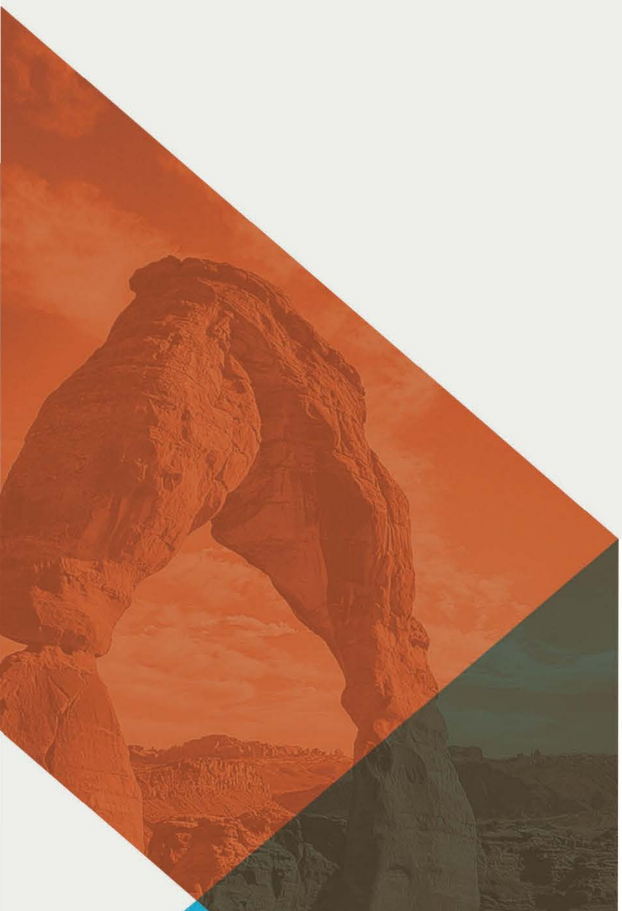

UTAH COMPUTER SCIENCE EDUCATION MASTER PLAN

To give every student access to robust computer science education by 2022

ADA Compliant: July 2019

UTAH COMPUTER SCIENCE EDUCATION MASTER PLAN

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I. EXECUTIVE SUMMARY

In the 21st century computing and technology touch our lives daily in a variety of ways. They are so seamlessly integrated into our daily routine that it is hard to imagine life without them. Computer science (CS), the discipline that makes the use of computers possible, has driven innovation in every industry and field of study. It is also powering novel solutions to many of our world's toughest challenges. Computer science helps students get on the path toward some of the highest-paying and fastest-growing jobs in America. It also helps inculcate crucial thinking skills, encourages students to think critically, develop problem-solving skills, and prepares our next generation of learners, teachers, thinkers, and innovators. Educating students in CS provides them with highly valued skills in the 21st century workplace: creativity, collaboration, and an understanding of how to use technology.

As computing and technology have permeated our lives, there has been a high demand for availability of CS education. Most parents want their child's school to offer computer science (Google & Gallup, 2015), and most Americans believe computer science is as important to learn as reading, writing, and math (Horizon Media, 2015). Many of today's students will be using computer science in their future careers, not only in science, technology, engineering, and mathematics (STEM) fields but also in non-STEM fields (Change the Equation, 2015).

However, the demand for CS has far exceeded the availability of quality education opportunities and equal access to them across the nation. Most U.S. schools do not offer a single course in computer science and programming (Google & Gallup, 2015), and many existing classes are not diverse and representative of our population (College Board, 2016). Most students have to wait until high school before being able to access CS course offerings. Additionally, the tech industry is currently dominated by a narrow subset of the population, that does not equitably represent the diversity of society. Offering CS education to all students in Utah, including African Americans, Latinx, Native Americans, Pacific Islanders, women, English language learners, LGBTQIA, and students with special needs, is an important step to achieving equity and ensuring that children have a full range of opportunities in their future.

Computer science is not only important for the tech sector, but for almost all industries, including agriculture, transportation, healthcare, education, and financial services. In 2019, there are more than 5,000 open computing jobs in Utah—jobs that come with an average salary of over $81,000, nearly double the state's average salary. But there are not enough qualified workers in Utah to fill many of these positions and the skills gap is continuing to widen. Only 16 percent of Utah's high schools offer intermediate and advanced computer science. An important aspect of educating and training our future entrepreneurs and innovators is that equitable access to CS has to begin in the K-12 space. The earlier students

are presented with quality CS courses, the better chance they have of closing the opportunity gap. Students who are exposed to computer science during their early years of education are much more likely to choose it as a major. Women are 10 times more likely to get a degree in computer science if they take an AP class in the subject, and minorities are seven times more likely if they do the same (Code.org).

Investment in, and expansion of Computer science education has emerged as a bipartisan issue across the United States. In Utah, Governor Gary Herbert, alongside the state's burgeoning tech industry set the goal of having computer science taught in every school by 2022. Two holistic methods of achieving the Governor's goal are: (a) the creation and implementation of a statewide Utah Computer Science Master plan, and (b) the professional development of teachers funded through the Utah Computer Science Grant program. Creating a state plan helps provide roadmaps to address a number of policy and implementation issues to integrate computer science as a new subject into Utah's existing K-12 system. HB227, the Utah Computer Science Grant Act sponsored by Representative John Knotwell and Senator Ann Millner, will assist in providing grant monies to school districts. Utah needs more Computer Science teachers to provide high-quality and accessible CS education for all. Currently, Utah lacks enough teachers to teach additional computer science courses and elementary teachers need additional support to integrate the newly adopted computer science standards into their instruction. Through the grant process, school districts will have the opportunity to use funding for professional development and training of teachers. This will include increasing the number of teacher endorsements in CS, and resources for learning opportunities for all teachers, supported and approved by the Utah State Board of Education (USBE).

In this document, we use the National Science Foundation's definition of computer science, "the study of computers and algorithmic processes and includes the study of computing principles and theories, computational thinking, computer hardware, software design, coding, analytics, and computer applications." CS includes computer programming or coding as a tool to create software, including applications, games, websites, and tools to manage or manipulate data; or development and management of computer hardware and the other electronics related to sharing, securing, and using digital information. CS education is broader than just coding; the expanding field of CS emphasizes computational thinking and interdisciplinary problem-solving so students can apply computation in our ever increasingly digital world.

This Master plan was created and compiled by the authors over two months of interviews and meetings with key stakeholders. This report built upon years of work by the Utah State Board of Education, the Talent Ready Utah Board, Expanding Computing Education Pathways Utah, the

State legislature, the Governor's Office of Economic Development and the Utah CS Task Force. This plan articulates the goals for computer science, strategies for accomplishing the goals, and timelines for carrying out the goals, along with identifying lead entities to implement each one.

The recommendations in this plan are not meant to be implemented all at once but are meant to serve as guidelines to meet the 2022 goal of having CS taught in every school in Utah. We offer actionable steps for educators, policymakers, industry, and other partners who – with appropriate resources and expertise available – can achieve the vision of providing equal access to Computer science to all students in the state of Utah.

The Utah CS Master plan is divided into six sections summarized in the figure below.

FOCUS AREAS OF UTAH COMPUTER SCIENCE MASTER PLAN

1. Data and Reporting

Measure the state of computer science, education and technology in Utah across demographics and regions to inform the state's goals.

2. Teacher Development

Provide a professional development pipeline for all teachers in Utah to have access to learn the concepts of computer science at the elementary, middle, and high school levels, to include pedagogy, and standards to meet updated licensure requirements.

3. Curriculum and Standards

Develop or adapt K-12 Computer Science standards and integrated computer science resources, lesson plans and computer science courses at each appropriate grade level/grade band for implementation and delivery across the K-12 system.

4. Diversity

Computer science for every student requires that equity and diversity be at the forefront of any transformative effort. When equity prevails, there is appropriate support based on individual students' needs so that all have the opportunity to achieve similar levels of success.

5. Outreach and Communication

Increase awareness of the current computer science work and resources available in the state, communicate the state plan, and incorporate feedback from a variety of stakeholders.

6. Funding

Secure funding dedicated to expanding computer science education efforts, including professional learning for existing and future teachers from state, federal and local sources.

Focus Area 1: DATA & REPORTING

Currently, there is a need for relevant data on availability of Computer Science (CS), enrollment, and courses offered. This will help to measure the state of CS education in Utah (UT) across all demographics and regions. We recommend developing and publishing a UT CS Education Landscape Report which is updated annually.

The implementation of the Utah Computer Science Master Plan will require ongoing and evolving management, coordination, accountability and oversight to achieve the ambitious and necessary goals outlined here. A statewide CS Specialist position should be created to provide crucial leadership for statewide coordination in promoting and implementing the Master Plan. We also recommend organizing the reporting of student and teacher outcomes across current grants to clearly understand the efficacy of grants and programs to inform future investments in CS.

Focus Area 2: TEACHER DEVELOPMENT

An important goal of this plan is for all teachers to have access to learn CS concepts for K-12. Presently, there is a shortage of high school teachers proficient in CS, a lack of ongoing support for teachers, and roadblocks to access for teachers in rural areas. In order to resolve this, the plan (and appendix A) suggests pathways for professional development for teachers and incentivize and support teacher development. Coordinating grants and funding opportunities will play a huge role in incorporating professional development. We recommend that a teacher certification assessment be adopted and the process to develop a single subject computer science education credential be initiated. We also suggest using microcredentials to help address any current gaps in earning teacher endorsements.

Focus Area 3: CURRICULUM & STANDARDS

Currently, K-12 CS standards are being developed and integrated across the school system and ultimately curriculum will be linked to the Utah CS framework. We found that there is a need for quality lesson plans, since teachers lack time and training to determine which CS activities align with curricula and which have been shown to be effective. We recommend that a central hub for teaching resources be created and made easily accessible to educators, specifically resources that integrate CS curriculum into other subjects in elementary schools. Also, the statewide CS Specialist should advise the Talent Ready Utah Board on CS graduation requirements and recommended CS courses, annually. Additionally, Grades 6-12 curricula should be created and curated by Feb 2020, in partnership with industry programs to co-

create lesson plans. A system of accountability should be established by publishing an Annual Report which is made publicly available. We recommend empowering local leads to implement curriculum and develop champions for CS education.

Focus Area 4: DIVERSITY

Successful implementation of Utah's CS plan should ensure all students have the opportunity to achieve similar levels of success and equal access to high quality CS curriculum. Currently, female-identifying students, racial and ethnic minority groups, and people with disabilities are underrepresented in CS classes. Lower income districts and schools in rural Utah also lack equal access to CS.

In order to increase diversity in K-12 CS education we recommend partnering with organizations who offer "unplugged" curriculum, and curriculum to engage young girls and women, and people with disabilities. We also recommend tailoring nationally validated strategies and best practices to increase diversity and meet the needs of all students in Utah. The goal is to ensure that the demographic composition of secondary computer science courses reflects the demographic composition of each school by 2022.

Focus Area 5: OUTREACH & COMMUNICATION

Increasing awareness of CS jobs and CS education resources available in the state will be crucial for the success of this plan. We recommend communicating and receiving feedback from a variety of stakeholders and teachers, creating a plan to reach folks from each Local Education Agency (LEA) who will disseminate information from the state level down to each school in their district. We advise that a portal be created to keep stakeholders informed and keep information up to date. Partnering with organizations to implement best practices for outreach and communication will be crucial to generate buy in from educators, funders, parents, policymakers, students, and industry.

Focus Area 6: FUNDING

There is a need for sustained and dedicated funding streams for CS within all LEAs. Working with the state legislature and industry partners will be essential to ensure that there is funding for various programs and initiatives outlined in this plan. In the short term, dedicated funding for computer science should be allocated and the funding should emphasize the professional development of existing teachers for the purpose of expanding computer science education efforts. In the long term, funding streams from state & federal sources, as well as from

public/private partnerships should support a system of high-quality computer science education. Realistically, lack of adequate funding will jeopardize successful implementation of the CS Master Plan. We recommend building in accountability metrics to ensure that only programs that result in positive teacher and student outcomes receive sustained funding.

Securing funding would support the professional development for existing teachers, administrators, and counselors, develop model curricula and standards, and expand CS offerings statewide.

In conclusion, implementation of a statewide computer science education plan is a bold undertaking but a necessity if the education system hopes to keep pace with the needs for a well-prepared workforce. Students in Utah will benefit from the vision and commitment of today's leaders to prepare children for the rapidly changing needs of the workplace. The leadership of teachers, adequately supported and resourced, will make this vision a reality in the classroom and Utah will stand ready to meet the challenges ahead.

II. BACKGROUND

For several years Utah has been moving deliberately towards increasing access and equity in computer science education for all K-12 students. Leaders in government, business, education, and non-profits have pushed forward to increase commitment and investments in educational innovation for students. Preparing the students of Utah for the rapid technological advances in the workplace of today and tomorrow drives the vision to achieve a coordinated effort for computer science education implementation.

A strong foundation was laid in 2016 with Senate Bill 93 providing funding for teachers to receive computer science endorsements, and in 2017, Senate Bill 190 created the Computing Partnerships Grants program to develop K-16 computer science pathways. At the 2018 Silicon Slopes Tech Summit, Governor Herbert joined forces[1] with 1,200 business leaders who signed on to a letter of support for universal computer science education for all of Utah's students. [2]

The Governor led with his Tech Pathways Program and the STEM Action Center forged partnerships with computer science education specialists. The Utah State Board of Education has undertaken a strategic planning process, and the Talent Ready Utah Board has been dedicated to developing an implementation plan to achieve the vision of computer science for all students. 2019 marks another milestone for Utah with Governor Herbert's commitment of funding and the signing of H.B. 227 into law, which establishes the process for adopting a computer science implementation plan and the launching of the Computer Science for Utah Grant Program.

Many dedicated classroom teachers and educators are on the frontier of bringing this vision to reality for the students of Utah, embracing additional education and professional development to lead the way with computer science instruction in the classroom. These educational leaders and the teaching workforce of Utah will bring the plan to life as they are supported in taking on this immense challenge. Utah has the opportunity to launch and establish sustainable, locally

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[1] Menino, Holly. "Utah Tech Leaders Pledge Millions to Computer Science." *KUTV*, KUTV, 1 Feb. 2019, kutv.com/news/local/utah-tech-leaders-pledge-millions-to-computer-science.

[2]Cox, Spencer, Skonnard, Aaron, "It's Time to Bring Computer Science Education to All Utah Students." *Silicon Slopes*, Silicon Slopes, 6 Dec. 2018, newsroom.siliconslopes.com/its-time-to-bring-computer-science-education-to-all-utah-students/.

based teacher capacity building with the implementation of the Utah Computer Science Grant Program.

It is essential that the plan has consistent and dedicated leadership to achieve cohesion and collaboration among the many stakeholders. Full transparency and accountability are also essential to successfully achieve coordinated statewide implementation. The plan is not the end, but rather the beginning of building a strong base of educational stakeholders who will turn the vision into a reality for every student in Utah.

UTAH HAS IMPLEMENTED FIVE OUT OF NINE POLICY RECOMMENDATIONS TO MAKE COMPUTER SCIENCE FUNDAMENTAL TO K-12 EDUCATION

Source: Code.org

Industry partners have played a crucial role in raising funds and collaborating with existing efforts to increase CS education and availability. The creation of the statewide plan was funded by Pluralsight One. Recommendations 2 and 3 (see figure) were accomplished in collaboration with the state through public private partnerships.

Definition of Computer Science

As the foundation for all computing, computer science is defined as “the study of computers and algorithmic processes, including their principles, their hardware and software designs, their [implementation], and their impact on society”
For more information visit: https://k12cs.org/defining-computer-science/

Why Computer Science is Essential

Computer Science is a foundational skill and should be taught to all students born in the 21st century. They need to learn the practical application of technology, apps and the use of the internet, just as they learn about photosynthesis or the periodic table. In this digital age, no matter what field of work students want to pursue, CS is rapidly changing industry for the better. The integration of computing and technology into every aspect of our daily lives makes it necessary that students have a foundation in CS for a well-rounded general education. Additionally, there is a very high demand for computer science jobs however, the supply of students (and teachers to educate them) is not adequate.

According to research compiled by Code.org, a nonprofit dedicated to expanding access to computer science in schools:

- Computing jobs are the #1 source of new wages in the US with over 500,000 current openings across the country.
- 90% of parents want their child to have an opportunity to learn CS but only 35% of high schools teach CS.
- Students who learn CS in high school are 6 times more likely to major in CS and women are 10 times more likely to major in CS.
- 58% of all new STEM jobs are in computing but only 10% of new graduates are in CS.
- Utah currently has 4,838 open computing jobs (2.6 times the average demand rate in Utah).
- The average salary for a computing occupation in UT is $84,395, which is significantly higher than the average salary in the state ($46,460). The existing open jobs alone represent a $408,304,848 opportunity in terms of annual salaries.
- In Utah, only 54% of all public high schools teach computer science.
- Only 376 exams were taken in AP Computer Science by high school students in Utah in 2018 (120 took AP CS A and 256 took AP CSP).
- Only 32 schools in UT (16% of UT schools with AP programs) offered an AP Computer Science course in 2017-2018 (8% offered AP CS A and 11% offered AP CSP). There are fewer AP exams taken in computer science than in any other STEM subject area.

Utah’s economy and workforce depend on ensuring that more students have access to computer science education. Computing jobs span across all sectors of the economy. For example, in the past several years, the impact of computer science within the agriculture

industry has grown tremendously. The emerging field of e-agriculture utilizes computing technology such as wireless sensors, smartphones, and GPS in order to optimize farm productivity. Teams develop software that brings efficiency, automation, and analytics to all aspects of the agricultural pipeline. Throughout the season, mobile tools and smart devices collect data on what is being planted, where it's being planted, and how it's being managed. In manufacturing, a 2018 analysis[3] of job postings in the sector revealed that openings for software jobs are outpacing production jobs for the first time. Even more dramatic is the shift in the auto industry. Four years ago, the demand for software developers matched the demand for mechanical engineers. In 2017, there were twice as many job openings for software developers as there were for mechanical engineers. The increased demand for software developers is concerning for many industries as they discover how difficult it is to find qualified candidates to fill these jobs. Modern visual effects in television and film depend on computing power. Computing has become central to the automobile industry, the practice of medicine, and finance. By 2026, there will be an estimated 3.5 million such jobs that rely heavily on computing open in the United States[4].

Computer science is no longer a "nice to know" elective but rather a "need to know" core subject. K-12 education systems across the nation need to start preparing graduates for rapid growth in computing jobs in every industry and every state. Despite the growing demand for software developers, fewer than half of K-12 U.S. schools teach computer science. With high demand from students and parents for computer science classes and changing job skills needed in most industries, every student in every school in Utah should have the opportunity to learn computer science. Starting early with the introduction of computer science principles in Kindergarten and the elementary grades, will demystify computer science expanding and deepening the learning experience for all children and help prepare them to engage with computer science as they grow and develop their interests and passions.

[3] "Manufacturing Shift: Software Jobs Now Outpace Production Openings." Burning Glass Technologies, 5 Sept. 2017, www.burning-glass.com/blog/manufacturing-shift-software-jobs-now-outpace-production-openings/.

[4] By the Numbers." National Center for Women & Information Technology, 10 May 2019, www.ncwit.org/resources/numbers.

Strategic Priorities of Utah's Computer Science Task Force

The Utah State Board of Education (USBE) formed a Computer Science Task Force to establish a vision for computer science in the Utah Public Education System. The Task Force identified a strategic plan, including six recommendations, to successfully implement computer science education within the K-12 education system. In June 2018, the strategic priorities (six steps) established by the Task Force to accomplish this vision were presented to the Utah State Board of Education and were subsequently approved. The priorities are:

1. Develop and implement statewide K-12 framework for computer science
    - Define computer science for elementary, middle, and high school levels
    - Follow the USBE steps for standards development
    - Engage with industry advisory councils to establish job ready standards at secondary level
2. Start early by engaging students at the elementary level
    - Promote exposure to problem-solving, logic, mathematical reasoning, and coding opportunities
    - Engage teachers in integrating content with productivity tools
    - Work early and often with students/parents/teachers on internet and digital safety
3. Develop a statewide strategy to communicate the value of computer science
    - Engage with variety of audiences including parents, students, teachers, school and district leaders, industry, etc.
    - Provide transparent data on job market and use of computer science skills in Utah
4. Build capacity among educators at pre-service and in-service levels
    - Work with Utah Council of Education Deans to ensure teachers are prepared to teach with requisite computer science and digital literacy skills
    - Provide pathways to engage variety of current teachers in earning computer science credentials
    - Compile a list of vetted, open educational resources that teachers can easily adopt to teach computer science in their classrooms
5. Improve upon current course requirements to scaffold computer science learning K-12
    - Require, not recommend, keyboarding in K-5, including competency exam by 5th grade
    - Add computer science courses to middle school offerings
    - Provide competency route to middle school digital literacy course
    - Develop computational thinking as integral part of elementary education experiences, (i.e., analyzing and decomposing problems, identifying patterns, utilizing abstraction, developing algorithms).

6. Ensure students can access a majority of the 19 computer science courses currently offered, (33 including IT courses); regardless of geography
    - Provide multiple options for student access to coursework, including face to face, blended model, and distance learning.
    - Work with industry to support computer science coursework and delivery

III. VISION

Each student in Utah secondary public schools will have access to robust and varied computer science courses by 2022. All students will enter secondary schools with exposure to computational thinking and competencies in digital literacy. This begins in our elementary schools with competencies in keyboarding, appropriate and responsible use of technology, and basic coding principles.

This Computer Science Master Plan is a tool that stakeholders should use to accomplish this vision. The following six focus areas summarize the Key Issues, outline Goals to address them, and suggest Recommendations and resources to help achieve success.

IV. DATA & REPORTING

Measure the state of computer science and computer education and technology in Utah across demographics and regions to inform the state's goals.

Key Issues

- Need for accessible data on availability of CS by region
- Need for accessible data on enrollment in CS by demographic percentages in middle and high school
- Need for accessible data around elementary schools: what CS content is being taught
- Need for accessible and relevant information to implement a statewide collaboration of CS education efforts
- Accountability and determining the entity responsible for this new scope of CS statewide implementation work
- Inconsistency of data collection and analysis among stakeholders

Goals

1. Measure the state of computer science and computer science education in Utah across demographics and regions to create a clear baseline upon which measuring a successful CS implementation plan will stand. Identify usable data for collection and analysis
2. Finalize, publish, and share the Utah Computer Science Education Landscape Report
3. Update the Landscape Report annually and ensure easy accessibility to the online version on the USBE website
4. Display and track Teacher Endorsements within CS Education on USBE website
5. Gather information of how many teachers who have received CS PD are continuing to teach CS over the course of 5 years after receiving training
6. Create a permanent Computer Science Specialist position to lead implementation in K-12
7. Transition from reporting output to reporting and analyzing outcomes based on Key Performance Indicators
8. Develop an online assessment system aligned to CS standards to measure student progress and growth in mastery of CS standards and concepts

Recommendations

1. Annually updated report of disaggregated student data outcomes that includes measures of low income, race, disability status, and CS enrollment. Non-identifiable student data already being collected by USBE includes:
    a. Income: ESEA, Free and reduced priced lunch
    b. Race/Ethnicity: Hispanic/Latino Ethnicity, American Indian/Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, White, Multi-Race
    c. Special Education
    d. English Language Learners
    e. Course Enrollment
    f. Data on Schools (i.e. how many, location, type)

2. Create an accountability measurement tool for schools based on access to CS and completion of coursework by priority populations.

3. Create a permanent Computer Science Education Specialist position within the Utah State Board of Education who will provide leadership for cohesive statewide coordination and collaboration in promoting and implementing the Utah Computer Science Master Plan.

    There are several reasons that the CS Specialist position needs to be created and funded within the USBE. The implementation of the Plan will require ongoing and evolving management, coordination, accountability and oversight to achieve the ambitious and necessary goals laid out in the legislation. Successful implementation will require leadership and authority to effectively coordinate the functions of entities tasked with advancing different sections of the master plan.

    The CS Specialist will:

    - Eliminate silos of practice
    - Oversee execution and coordination of the CS Master Plan
    - Create a strategy to achieve cohesion of purpose for CS implementation
    - Collaborate with K-12 Career Technical Education (CTE) Specialists on the development of CS standards
    - Achieve coordination of practice by clearly distinguishing the roles and responsibilities of each partner organization and how they can best interact to achieve the implementation goals

- Oversee the organization of necessary and required data collection from all partners and conduct ongoing evaluation of the implementation plan to guide future adaptations, changes, or decisions as the initiative matures
- Advise on future policy initiatives related to computer science implementation
- Analyze the coordination of various current grants, such as SB 190, H.B. 227 (Talent Ready Utah grant), and other computer science funding streams to create optimal opportunities for school districts to access grants
- Develop a statewide communications plan to relay the value of computer science and resources available

4. Organize the reporting of student and teacher outcomes across current grants to achieve a clear understanding of the efficacy of ongoing investments and to inform future investments in computer science implementation.

DATA & REPORTING		
TIMEFRAME	**STRATEGY & GOAL**	**LEAD**
October 2019; Annually	Measure the state of computer science and computer science education in Utah across demographics and regions	Utah State Board of Education
August 2019; Annually	Finalize, publish, and share the Utah Computer Science Education Landscape Report, updating it annually	Expanding Computing Education Pathways (ECEP) Utah Industry support
Annually	Display and track Teacher Endorsements within CS Education	USBE LEA
Annually	Track how many teachers who have received CS PD are continuing to teach CS five years post training	USBE LEA
Annually	Create a permanent Computer Science Specialist position to lead implementation in K-12	USBE State Legislature
Annually	Move from reporting output to reporting and analyzing outcomes	Third party impact evaluation Talent Ready Utah (TRU) Board
September 2020	Develop an online assessment system aligned to CS standards to measure student progress and growth in mastery of CS standards and concepts	USBE

V. TEACHER DEVELOPMENT: Creating Effective CS Teachers

Professional development for teachers of other subjects is required to leverage the existing pool of teachers and provide a short-term approach for increasing the number of CS opportunities in schools. Long term sustainability will include steps towards a certification or license endorsement to teach computer science, and adding a pipeline of new teachers graduating from pre-service programs with the ability and desire to teach CS.

Key Issues

- Shortage of CS teachers
- Inadequate K-12 teacher training/professional development
- Need for Key Performance Indicators to use for measuring success
- Current endorsements do train teachers in concepts but not in creating relevant lessons
- Many teachers have to find and pay for certifications themselves
- Need to develop ongoing support and learning communities for teachers
- Reaching and supporting teachers in rural areas is challenging

Goals

1. Provide a professional development program accessible to all teachers in Utah to learn the concepts and pedagogy of computer science at the applicable elementary, middle, or high school levels
2. Provide professional development for teachers in Utah to learn the Utah Computer Science Standards/ Framework and how to apply them at the elementary, middle, and high school levels
3. Update teacher endorsements and certifications for computer science to include successful instructional methods, an understanding of the students' learning process, and ongoing support to increase confidence and mastery
4. Work with Higher Education to include computer science education fundamentals within the technology course(s) of teacher preparation programs
5. Direct additional resources to support rural districts in teacher professional learning and ongoing support of computer science instructional practices; Focus on developing relevant and unique applications of computer science education in rural settings

6. Utah Education Network (UEN), Utah State Board of Education (USBE) and Computer Science Teachers Association (CSTA) partner to host one central database that lists professional development opportunities
7. Incentivize teachers to teach Computer Science

Recommendations

1. Grants to support teacher professional development (see appendix A)
2. Dedicated staff in USBE (1 FTE) to help in the outreach, review, and development process, as well as reporting outcomes
3. Coordination of various grants and funding opportunities
4. Provide ways to communicate these professional development opportunities to all teachers, with intentional and targeted outreach to teachers in rural districts
5. STEM Action Center (STEM AC) should release annual reports of professional development with Key Performance Indicators (KPI) including: (a) How many teachers did we educate? (b) How are they using the training in class? (c) How many teachers continue to teach 1-2 years after the training?
6. USBE should create a map of what licenses teachers can earn what endorsements in the Bottega tool (flowchart or pathway resource for teachers) and updates the pathway annually
7. USHE should help create more pre-service CS teacher preparation programs
8. Help create and maintain local communities of practice (COPs) modeled on CSTA.
9. In person and district level professional development modeled on UEN and BootUpPD offerings
10. Online and virtual learning experiences learning experiences modeled on Code.org's Virtual Academic Year Professional Learning Program
11. Update teacher endorsements and certifications for computer science annually
12. Use micro-credentials to address gaps in the endorsement pathways; refer to Code.org's "Micro-Credentials: A Pathway for Certification and Professional Learning" for more information
13. Adopt an assessment for teacher certification in CS (Praxis exam)
14. Work with Higher Education to update in service teacher education programs to include computer science
15. Implement professional learning trainings that include counselors, administrators, principals, and school board; refer to Appendix E for resources
16. Initiate the process to develop a single subject computer science education credential (license) New teacher candidates in Utah must complete Computer Science for Educators coursework

17. Incentivize and support teacher development; examples *could* be:
    - Count CS endorsement for Teacher Salary Supplement Program (TSSP). Allow TSSP eligible teachers to add a CS class to their course load without losing TSSP
    - Recognize industry experience in credential attainment process
    - Reimbursement to teachers for higher education computer science course work
    - Stipends for teachers for professional learning, computer science specialists or teacher leads, and for time out of regular classroom time to work on computer science implementation
    - Stipends for rural LEAs to cover costs associated with travel, substitutes, and time out of class for professional learning
    - Paid summer internships for teachers within technology industry
    - Recognition of distinction for LEAs that achieve computer science implementation

TEACHER DEVELOPMENT		
TIMEFRAME	**STRATEGY & GOAL**	**LEAD**
October 2019; Annually	Provide a professional development pipeline accessible to all teachers in Utah	USBE
March 2020; Annually	Train teachers in how to apply the Utah Computer Science Standards/Framework at the elementary, middle, and high school levels	USBE Utah Education Network
August 2019; Annually	Update teacher endorsements and certifications for computer science to include successful instructional methods, an understanding of the students' learning process, and ongoing support to increase confidence and mastery	USBE
September 2020; 2021	Include computer science education fundamentals within the technology course of teacher preparation programs	Utah System of Higher Education (USHE) Board of Regents USBE
January 2020; Annually	Direct additional resources to support rural districts in teacher professional learning and ongoing support of CS instructional practices	USBE STEM Action Center State Legislature
January 2020; Annually	UEN, USBE and CSTA partner to host one central database that lists professional development opportunities	UEN
March 2020 Annually	Incentivize teachers to teach CS	USBE Industry partners

VI. CURRICULUM & STANDARDS

Develop or adapt K-12 Computer Science standards and integrated computer science resources, lesson plans and computer science courses at each appropriate grade level/grade band for implementation and delivery across the K-12 system.

Key Issues

- Linking curriculum to UT CS Framework
- Need for quality lesson plans that are clearly articulated throughout different grades
- LEAs do not have the capacity to make decisions around CS curriculum
- Some courses (like digital media, web dev) lack adequate CS content
- Several CS classes are being taught as half year courses truncating valuable content
- Educators are inundated with coding activities and curricula and lack the time and guidelines to review and vet the material for quality and efficacy
- Need for shared language to eliminate duplication of effort across stakeholder groups
- Difficult for industry to navigate which courses map to which skills
- Inconsistency in course hours

Goals

1. Develop K-12 Computer Science framework/standards at each grade level
2. Revise K-12 Computer Science standards based on an accelerated revision cycle
3. Recommend courses and curriculum aligned to the state standards framework and establish a repository with easy access by teachers and ongoing communication to all teachers. Update annually
4. Create resources to guide LEA implementation of the standards with ongoing support from USBE
5. Create and curate resources for K-12 Computer Science standards to be integrated into other subjects in elementary school. Update annually
6. Allow computer science to satisfy a high school graduation requirement and corresponding post-secondary admissions requirements
7. Sequence new CS courses with CTE courses
8. CS Specialist will make advise Talent Ready Board on CS graduation requirement and recommended CS courses

Recommendations

1. Create and curate standards and curriculum – model process after the K-5 standards that are going through review in May 2019. Complete 6 – 12 standards by Feb 2020.
2. UEN should build and maintain a central hub that includes resources for teaching (lesson plans), curriculum, and learning communities, and manage a teacher bulletin board for feedback and discussion, and evaluation of lessons efficacy
3. Establish a system of accountability; USBE should publish annual report which is publicly available which includes (a) courses offered by district along with course code (b) number and demographics of students taking the courses (c) if courses map into stackable credentials
4. Use Inter video conferencing and other technical tools to facilitate instruction to underserved districts
5. Expand dual enrollment opportunities for students; learn from best practices
6. Address diversity of school scheduling (trimester versus semester) in plans
7. Partner with industry programs such as TEALS (Technology Education and Literacy in Schools) to help co-create lesson plans for teachers remotely.
8. Prepare and develop teachers to become CS specialists or CS leads to inform and support local LEA implementation of curriculum
9. Develop courses with adequate CS content such that students spend at least half the course learning and applying fundamental CS concepts in order to receive CS credit (e.g., variables, loops, conditional logic, functions)
10. Consider developing a Guidance Document similar to Nevada's; Update annually
11. Examples of elementary curriculum from SFUSD CSinSF.org/K-2 and CSinSF.org/3-5
12. Examples of integrated units (CS + math) from U Chicago (see canonlab.org/actionfractionslessons), and teacher created lessons/units available at http://cs4allkids.org/index.php/lessons-for-teaching-integrated-computational-thinking/.
13. Adopt definitions for clarity and direction of courses and curriculum
    a. Computer Literacy: the general use of computers and programs, such as productivity software, examples include performing an internet search and creating a digital presentation.
    b. Educational Technology: the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources. Educational technology is the process of integrating technology into education in a positive manner that promotes a more diverse learning environment and a way for students to learn how to use technology as well as their common assignments.

c. Digital Citizenship: refers to the appropriate and responsible use of technology, such as choosing an appropriate password and keeping it secure
d. Computer Science: the study of computers and algorithmic processes, including their principles, their hardware and software designs, their applications, and their impact on society
e. Computational Thinking: is a way of solving problems, designing systems, and understanding human behavior that draws on concepts fundamental to computer science… a fundamental skill for everyone, not just computer scientists
f. Keyboarding: The Goal of keyboarding is to enable proficient and accurate digital input. By grade 5, students should be able to key by touch. Key by touch is determined through proficiency, proper technique with associated keys and fingers, and not speed
g. Computing Education: The study of computer science or related activities. Includes the act of scripting, coding, web development, or computer programming. Does NOT include non-coding uses of computer technology to solve problems (i.e., multimedia development, desktop publishing).

CURRICULUM & STANDARDS		
TIMEFRAME	**STRATEGY & GOAL**	**LEAD**
November 2019; July 2020	Develop K-12 Computer Science framework/standards at each grade level	USBE ECEP CSTA
May 2020; Annually	Revise K-12 Computer Science standards based on an accelerated revision cycle	USBE
January 2020; Annually	Recommend courses and curriculum aligned to the state standards framework and establish a repository with easy access	USBE UEN
June 2020; Annually	Create resources to guide LEA implementation of the standards with ongoing support from USBE. Consider developing a Guidance Document.	USBE ECEP Code.org
June 2020; Annually	Create and curate resources for K-12 Computer Science standards to be integrated into other subjects in elementary school to be updated annually	USBE ECEP CSTA
November 2020	Allow computer science to satisfy a high school graduation requirement and corresponding post-secondary admissions requirements	State Legislature USHE USBE
June 2020; Annually	Sequence new CS courses with CTE courses	USBE Utah CTE
Fall 2019	Include new CS course on master schedule for 2020-2021 school year enrollment	LEA
November 2019; Annually	CS Specialist to advise the Talent Ready Board on CS graduation requirement and recommended CS courses	USBE

VII. DIVERSITY

Computer science for every student requires that equity and diversity be at the forefront of any transformative effort. When equity prevails, there is appropriate support based on individual students' needs so that all have the opportunity to achieve similar levels of success. A successful plan will ensure that every student in Utah has equitable access to high-quality computer science curriculum and instruction aligned to the UT K–12 CS Framework.

Key Issues

- Lack of access to CS in rural UT
- Low income school districts have fewer resources and capacity
- Female students are underrepresented in CS classes
- Racial and ethnic minority groups are underrepresented in CS classes
- People with disabilities are underrepresented in CS classes
- Best practices to support diversity equity and inclusion are not readily available
- Low diversity in the teacher population
- Parental support and programs are lacking

Goals

1. Expand CS access to schools that serve rural populations and low-income populations
2. Establish and/or increase the exposure to diverse communities about what CS is and why it matters
3. Increase numbers of female students, as well as racial and ethnic minorities
4. Ensure that all curriculum and course content is accessible to people with disabilities
5. Ensure access to Native American tribes including the Goshute, Shoshone, Ute, Navajo, and Paiute
6. Implement successful strategies for increasing diversity in K-12 CS
7. Expand programs to include parents and counselors in the learning process

Recommendations

1. Expand access to rural schools
    a. Define minimum standards for networking, hardware, software and maintenance needed for CS education
    b. On a regular basis, assess infrastructure needs (i.e. broadband) and technology needs (i.e. devices) to inform state and private investment in infrastructure

c. Partner with organizations, such as BootupPD and CSUnplugged, who offer "unplugged" curriculum

2. Expand access to low income students
    a. Develop a dedicated source of funding program that prioritizes CS in schools with more than 60% students who qualify for free lunch
    b. Develop parent support and education forums

3. Triple enrolled female population in secondary computer science courses, especially advanced CS, by 2022
    a. Partner with organizations such as girlswhocode, blackgirlscode, and code.org for curriculum to engage girls and young women
    b. Partner with organizations such as womenwhocode to build mentoring relationships and highlight pathways to successful CS careers

4. Ensure that the demographic composition of secondary computer science courses reflects the demographic composition of each school by 2022
    a. Publish demographic data by school district semi-annually to enable corrective solutions and tools for resolving lack of sufficient enrollment and access.
    b. Implement district trainings to address unconscious bias and provide culturally relevant tools

5. Establish guidelines to ensure that all curriculum and course content is accessible to people with disabilities by 2022 and increase enrollment
    a. Annually evaluate curriculum used in UT for accessibility
    b. Meet CSForAll (accessible curricula and tools for K-12 computing education) guidelines, including WCAG 2.1 AA compliance for websites, screen reader support, keyboard customizability, and other accessibility considerations.
    c. Implement best practices for mentoring such as AccessComputing (High school, college, and graduate students with disabilities connect with mentors and professionals)
    d. Utilize *Ally* by Blackboard or a similar product as a way to measure and improve the accessibility of course content in an online course such as Canvas

6. Identify and implement successful strategies for increasing diversity in K-12 computer science education
    a. Use CSTA and National Alliance for Partnerships in Equity (NAPE) best practices to develop a model plan for improving diversity

b. Improve access through family and community engagement programs (ex. Family Code Night, Utah PTA, as well as groups like 4-H, Girl Scouts, and FIRST Robotics)
c. Improve access through teacher and counselor training that focuses on outreach to priority populations and provides best practices
d. Fund learning in informal environments and after school programs
e. For detailed information refer to the *Computer science professional development guide: How education leaders can build teacher, school counselor and administrator capacity to support equitable computer science education*. https://query.prod.cms.rt.microsoft.com/cms/api/am/binary/RE2I7uT

DIVERSITY		
TIMEFRAME	**STRATEGY & GOAL**	**LEAD**
March 2020; Annually	Expand CS access to schools that serve rural populations and low-income populations	UEN USBE LEAs
November 2020; Annually	Increase numbers of female students, as well as racial and ethnic minorities	STEM AC USBE
November 2020; Annually	Ensure that all curriculum and course content is accessible to people with disabilities	USBE UEN LEAs
November 2020; Annually	Ensure access to Native American tribes including the Goshute, Shoshone, Ute, Navajo, and Paiute	USBE Utah Department of Heritage and Arts
November 2020; Annually	Implement successful strategies for increasing diversity in K-12 CS	USBE LEAs
September 2020; Annually	Expand programs to include parents and counselors in the learning process	STEM AC USBE ECEP
September 2020; Annually	Increase enrollment and diversity in AP Computer Science and similar advanced CS courses	USBE ECEP

VIII. OUTREACH + COMMUNICATION

Increase awareness of the current computer science work and resources available in the state, communicate the CS Master plan, receive dynamic feedback from a variety of stakeholders, and communicate best practices for implementation across the state.

Key Issues

- Need for a statewide communication plan that educates everyone about the importance of CS
- How to get information out to school administrators and career counselors
- Higher education institutions often do not count high school CS courses
- Create an easy feedback loop that allows teachers to communicate with each other in a community-oriented way
- Need for easily accessible progress reports regarding implementation
- Develop communication across sectors (industry, agency, legislature, nonprofits)
- Outreach to teachers whose primary focus is not CS. (i.e. K-8 teachers often don't identify primarily as CS teachers and will miss out on information as a result.)

Goals

1. Increase awareness of the importance of computer science across the state
2. Communicate the state plan, and receive feedback from a variety of stakeholders on its implementation
3. Create a network for proactive communication at the state, LEA, and K-12 school level
4. Create a plan to reach folks from each LEA who will disseminate information from the state level down to each school in their LEA. Include an accountability plan/process.
5. Create a plan to specifically address outreach to rural, low income and Native American populations

Recommendations

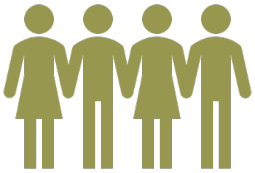
1. Increase awareness of the current computer science work in the state, communicate the state plan, and receive feedback from a variety of stakeholders
2. Increase awareness with external partners to identify and expand internship/apprentice opportunities for students
3. Create professional development hubs within regional education centers that are training and supporting K-12 computer science educators specifically

4. Create a Computer Science Cadre of individuals/community leaders from each LEA to disseminate information from the state level down to each school in their LEA
5. Create a computer science education portal/website/social media presence to keep stakeholders informed (maintained by UEN and informed by USBE CS committee, TRU CS committee) and keep information up to date
6. Publish state plan on state computer science web page. Include information such as the state's vision, key implementation milestones, standards, certification requirements, advocacy materials, curriculum resources, and a FAQ page updated every 6 months
7. Partner with code.org to implement best practices for outreach to rural districts
8. Partner with CSTA to implement best practices for outreach to teachers across the state
9. Partner with BootUp PD to implement best practices for outreach to administrators and districts
10. Create a feedback loop that allows teachers to communicate with each other and that is responsive to educator input and evaluation on the quality and usefulness of professional learning, lessons learned, integrated lesson plans, and courses that are on the curated CS resource site

OUTREACH		
TIMEFRAME	**STRATEGY & GOAL**	**LEAD**
June 2020; June 2021	Increase awareness of the importance of computer science across the state	STEM AC Industry partners Silicon Slopes
June 2020; Annually	Communicate the state plan, and receive feedback from a variety of stakeholders on its implementation	USBE CSTA
March 2020	Create a network for proactive communication at the state, LEA, and school level	USBE UEN
January 2020	Create a plan to reach each LEA to disseminate information from the state level down to each school in their LEA	USBE CSTA Service Centers
March 2020	Create a plan to specifically address outreach to rural, low income and Native American populations	USBE Code.org

IX. FUNDING

Funding is required to achieve many of the goals in this Utah Computer Science plan. In the short term, dedicated funding for computer science should be allocated and the funding should emphasize the professional development of existing teachers for the purpose of expanding computer science education efforts. In the long term, funding streams from state and federal sources, as well as from public-private partnerships, should support a system of high-quality computer science education.



Key Issues

- Need for sustained and dedicated funding streams for CS education to demonstrate the state's long-term commitment to achieving the goals of full implementation of K-12 CS education in Utah which will encourage the building up of the CS teaching corps. within all LEAs
- Rural districts have a difficult time receiving matching funds in addition to other obstacles they face
- Need for stronger coordination with institutions of higher education regarding computer science course articulation at the secondary level and college admission requirements
- Need for data on which interventions have been successful and where gaps in funding remain. Data will help connect funding to the most effective efforts and can inform future funding efforts to achieve maximum investment value in CS education
- Need for coordination and increased tracking of outcomes between existing grants aimed at expanding CS education to maximize effectiveness for implementation in every LEA
- Need for accountability that demonstrates outcomes of grant investments in terms of student progress and increase teacher CS proficiency instead of outputs that may not result in sustained efforts towards the grant goals

Goals

1. Secure multi-year state-level funding dedicated to CS professional development
2. Secure funding to develop model curricula and standards
3. Secure state-level funding dedicated to expanding CS course offerings
4. Secure state-level funding dedicated to support low income & rural populations

5. Secure funding for institutions of higher education to partner with schools and the USBE
6. Talent Ready Utah Board will make recommendations on the need for additional CS implementation funding, and will review the efficacy of past investments to improve the return on investment going forward
7. Grant funding to develop an online assessment system for grade level CS standards

Recommendations

1. Secure multi-year state-level funding dedicated to computer science professional development for existing teachers, administrators, and counselors
    a. Work with a legislative champion on the house or senate education committee and leadership to propose a bill to fund computer science professional development and continue funding thereafter.
    b. Design grants to exclude rural districts from matching requirements, and include technical assistance to rural districts on grant applications
    c. Fund an online computer science curriculum hub that is managed and curated to meet the specific needs of teachers for integrated CS lesson plans to meet the grant requirements

2. Secure funding from federal programs and local industry to develop model curricula and standards.
    a. Partner with industry to fund development of classroom lesson plans and teacher training on how to use them, particularly in rural LEAs
    b. Partner with researchers and apply for National Science Foundation (NSF) grants to implement rigorous computer science courses in LEAs along with developing best practices for teaching them
    c. Explore the use of 3% of Title II set aside funds for computer science professional development and evaluation planning for administrators and school site leaders, for a five-year period

3. Secure state-level funding dedicated to expanding CS course offerings in districts
    a. Expand access to computer science courses to all districts (distinct from computer literacy courses)
    b. Require that all secondary schools offer one CS course and build towards a fully articulated CS curriculum K-12

4. Secure state-level funding dedicated to support priority populations in Utah: low income and rural
    a. Direct funding to rural districts that will help establish a sustainable infrastructure for ongoing professional learning support and regional partnerships to achieve viable teacher learning communities and sustainable economies of scale
    b. Example: Washington State CS grant program prioritized low income/ resource poor schools by an industry match program administered through the Office of Superintendent of Public Instruction

c. Example: State of Virginia partnered with CodeVA to prioritize rural schools [here]

5. Recognize the need for planning and implementation funding for institutions of higher education to partner with secondary schools and the USBE
    a. Develop clear computer science course articulation
    b. Revisit higher education admission requirements related to computer science
    c. USHE to participate in communities of learning with secondary CS teachers
    d. Consider the opportunity for USHE to conduct early recruitment for students in the CS field and encourage USHE to develop plans to retain students in the CS field, in collaboration with secondary teachers of CS
    e. Pursue diversity and inclusion in higher education CS courses

FUNDING		
TIMEFRAME	**STRATEGY & GOAL**	**LEAD**
December 2020; Annually	Secure multi-year state-level funding dedicated to CS professional development	State Legislature Superintendent, USBE
December 2020; Annually	Secure funding to develop model curricula and standards	State Legislature Industry partners
December 2020; Annually	Secure state-level funding dedicated to expanding CS course offerings	State Legislature Superintendent, USBE
December 2020; Annually	Secure state-level funding dedicated to support low income and rural populations	State Legislature Superintendent, USBE
December 2020; Annually	Secure funding for institutions of higher education to partner with schools and USBE	State Legislature Industry partners
November 2019; Annually	Talent Ready Utah Board will make recommendations on the need for additional CS implementation funding, and will review the efficacy of past investments	TRU Board Talent Ready Utah
January 2020	Grant funding to develop an online assessment system for grade level CS standards	State Legislature Industry Partners

X. FUTURE IMPLEMENTATION GOALS

1. Create a statewide CS Data analyst and evaluator position (2019)
2. Design the Computer Science for Utah Grant to fund local LEA stakeholder planning, as the first phase of the grant disbursed, in addition to funding professional development
3. Develop a curated CS integrated lesson plan resource hub that aligns integrated lessons for each grade level with the computer science standards (2020); update annually
4. Develop an online assessment system that includes student portfolio development to measure student outcomes in CS (2020)
5. Develop a bank of formative and summative assessments aligned to CS grade level standards. Require LEAs to report student growth and progress with CS standards as part of grant deliverables (2020)
6. Increase CS teacher development to demonstrate the power of CS concepts and instruction for learning through multiple opportunities for training, observation, and coaching (2020-2022)
7. Annual third-party assessments and evaluation of data and grant deliverables (2021)
8. Proactively seek out industry dollars to supplement state funds in alignment with the Master plan and clarify amounts committed; Ensure input from and accountability to industry partners
9. As the implementation gains momentum, revisit the need for a Computer Science Education Director placed in the Governor's office with the authority to lead broad based collaboration and coordination from stakeholder groups who do not report to the USBE
10. We recommend that a clear strategy to increase access to CS endorsements be developed by USBE that includes recruitment of a diversity of teachers, communication strategies with teachers, and supports and resources
11. To accurately measure outcomes, every LEA in Utah should be required to report to USBE the enrollment totals and percentage demographics (for gender, race, ethnicity, socioeconomic status, students with disabilities and English language learners) of students enrolled in every middle school and high school computer science course offered

XI. APPENDICES

Appendix A Computer Science for Utah Grant Program: Grant Design Recommendations

Appendix B Utah CS Master Plan Implementation Checklist

Appendix C List of CS courses available in UT

Appendix D Flowchart of certification & licensure for teachers

Appendix E Resources: lesson plans, curriculum, crosswalks, implementation plans etc.

Appendix A: Grant Design Recommendations

Introduction:

H.B. 227 (Knotwell) established the Computer Science for Utah Grant Program in 2019 for purposes of implementing the Utah Computer Science Master Plan. The grants are for the express purpose of "improving computer science outcomes and course offerings, demonstrated by the creation and implementation of a local agency computer science plan and the effective implementation of approved courses and the provision of effective training opportunities for licensed teachers." H.B. 227 (63N-12-506)

Details of the CS Utah Grant Program state that eligible local education agencies can apply for the grant, submit it to the state board of education for review and recommendation to the talent ready board for approval based upon the following criteria:

Local Education Agencies (LEA) shall submit a written four year "computer science plan that addresses the recommendations in the Utah CS Master Plan, identifies targets for improved computer science offerings, student learning and licensed teacher training; describes a professional development program and other opportunities for high quality professional learning for licensed teachers or individuals training to become teachers. Includes a detailed budget, communication, and reporting structure for implementing the computer science plan." H.B. 227

H.B. 227 LEAs will:

1. Commit to provide one computer course offering approved by the Talent Ready Board in every middle and high school within the local education agency
2. Commit to integrate computer science education into the curriculum of every elementary school within the LEA.
3. Meet any other requirement established by the state board in consultation with the Talent Ready Board and submit a written report annually to the state board and the Talent Ready Board.

PURPOSE: Improved computer science outcomes for students and improved course offerings

- Creation of a LEA computer science plan
- Effective implementation of approved courses for students
- Providing effective training opportunities for teachers

Recommendations for Educator Led Planning Grant

Goal: Creation of a LEA computer science plan

Planning lays the foundation upon which the successful achievement of goals can be realized. The planning process itself is educational, deepens understanding, allows for an inclusive experience, and forges commitment among the stakeholders. As H.B. 227 calls for a four-year plan to be included in the grant application, it is recommended to provide applicants with a planning template, that will also initiate a more thorough and in-depth teacher driven specific planning process within the LEA to achieve maximum effectiveness. It is suggested that the first portion of the application planning template include the commitment to a unique, specific, and locally driven planning process and lists the participants who will develop the educator driven specific plan within the LEA.

It is recommended that the grant RFP encourage LEAs to apply jointly or through a regional consortium where economies of scale can be achieved. It may be beneficial for rural districts to form a consortia or partnership with other LEAs within their region to make the planning and implementation process feasible. The general plan, submitted in the application, can also specify the details of the district collaborations.

Planning grant: The first round of grant awards, funds a four to six month local teacher driven planning process (October 2019 - June 2020) During this portion the LEA or Regional Consortia is funded to develop the specific plan that will assess the current, local situation of computer science education and what steps are needed over the next three and a half years to achieve the goals of the CS Utah Master Plan.

Initiating the planning process: Administrators and School Leaders

- Administrators and school leaders submitted the grant application and now need to initiate the in-depth specific planning process with teachers within the LEA or a larger consortium coordinated to submit the grant application.
- Develop participant ownership - Identify teacher's needs and interests in CS education and begin to form a learning community that will grow to include all teachers over time.
- Practice distributed leadership - actively identify teachers, site/LEA/regional personnel, site administrators and counselors to begin forming the CS cohort that will stay together over the period of the grant and hopefully into the future.
- Allow for adequate time for a thoughtful and inclusive planning process.
- Conduct a LEA landscape analysis to set the CS baseline for both students, teachers, and administrators.

- From the baseline and with the active involvement of teachers, begin the planning process informed by state CS goals, regional distinctions and workforce needs.
- Access basic professional development for the planning team, administrators, school board members that introduces the value and usefulness of CS education to the student (learning critical thinking skills, computational thinking, problem solving), and creates the rationale and imperative for this investment in a major system change that will require an ongoing investment of time and energy.
- Focus on planning a process to achieve teacher confidence in content and expanded instructional skills.
- Design a plan that will capture the investment in professional learning by developing teachers who will become computer specialists, teachers of teachers, work to achieve a CS elementary endorsement, or pursue endorsements to teach CS as a course. Develop an LEA or regional corps of teachers who are able to lead professional learning, especially at the K-8 level.
- Plan to demonstrate persistence of effort in CS implementation, by continuously increasing and growing the number of teachers trained and the number and depth of CS offered to students.
- Recommend that the grant-funded LEA plans that are developed in the first phase of the grant be presented to the Talent Ready Board for review and feedback prior to a second grant being allocated.

Creating Adequate Teacher Supports for the planning process

Grant funding is needed to cover release time or out of class time for teachers who, as part of a cohort or planning team, are doing the intensive work of:

- Developing meaningful collaborations with other teachers
- Gathering the resources and materials to use in the classroom
- Evaluating curriculum and resources that will produce desired classroom outcomes and achieve vertical integration through grade levels and from middle school, high school, and higher education
- Developing curriculum for each grade band that is integrated into core curriculum
- Development of mastery and confidence in CS fundamentals
- Grow as coaches and mentors for other teachers on school sites
- Plan evaluation and data collection strategy to track student participation and progress in computer science

- Time to observe instructional practices in other classes that are implementing CS fundamentals and courses
- Plan for school-site professional development for computer science fundamentals and supported integrated lesson plan introduction

We recommend that between $15,000 - $30,000 (depending upon the size of the LEA or regional consortia) be allocated for direct educator stipends for the first phase of the grant for a LEA CS Specific Planning process of four to six months. This lays the foundation and plan for an ongoing grant for the development of integrated and articulated curriculum by grade band and segment (elementary, middle school, and secondary).

We recommend that the state continue educator stipends and reimbursements to build sustainable teacher capacity for the next three and a half years of the ongoing grant for the total of four years. Ideally, $7,000 - $13,000 will be allocated annually in years two, three, and four of the grant to continue the development of continued teacher learning, development of teacher CS specialists, strong local collaborations and cohort support as the process of curriculum integration and course development and implementation continues.

Recommendations for Computer Science Education Community of Learning Grant

Goal: Providing effective professional learning opportunities for teachers, developing CS specialists within each LEA and school for the purpose of ongoing and increasing CS teacher PD and CS course implementation

Professional development and lesson and course implementation take place over the next three and a half years until roughly June 2023. It is strongly encouraged that in the planning process applicants will consider utilizing a teacher cohort model that employs a strategy of increasing capacity within Utah by equipping teachers to be Computer Science Specialists or Team Leads who feel confident in leading professional development with and coaching teachers within their school, LEA, or region. This achieves several benefits such as, developing regional or school site teacher learning communities that will offer ongoing support to achieve subject mastery and a greater likelihood for sustainable capacity building. Rather than developing dependence upon external trainers, districts will be able to see a long-term return on investment by developing a strong network of CS Specialists and professional development leaders in-district and on-site.

With the adoption of the Utah Computer Science Master Plan, there is a need to identify and target the instructional shifts and improvements that need to occur for implementation to be successful. Supporting teachers with well-resourced professional learning opportunities is

essential to building teacher mastery of the content and self confidence in their ability to be instructional leaders. As professional learning occurs, the number and capacity of computer science educators will increase resulting in the growth of computer science courses at the secondary level, and CS fundamentals being integrated across the curriculum at the elementary and middle grade levels.

Successful professional development will be delivered:

- Grounded in the needs of the teacher and the student as demonstrated by data
- Focused on content and instruction
- Designed to ensure equitable outcomes
- Ongoing, intensive, and embedded in practice
- Collaborative with an emphasis on shared accountability
- Coherent and aligned with other standards, policies, and programs
- Supported by adequate resources

For more information visit: https://cacompcenter.org/wp-content/uploads/2015/03/CA-Quality-Professional-Learning-Standards_Revised-March-2015.pdf

Professional Development for K-5: Computer Science Integrated Across the Curriculum

Typically, the major hurdle to additional professional development is the lack of time that a teacher has in a very busy schedule full of considerable demands. Therefore, it is imperative to consider the needs of the classroom teacher when considering introducing additional professional development. A clear pathway of courses and experiential learning for the teacher to follow is essential. Inviting the teacher to join a supportive cohort learning community and providing accessible and easily introduced classroom lessons and resources is also a priority. Teachers already have unaccounted costs that they personally assume on behalf of serving their students and new professional development will be more effective if it includes a plan to cover the time teachers are investing in new lesson development, adapted instruction, and student evaluation.

Early adopters will embrace the opportunity to engage their students through the integration of computer science fundamentals in their lessons and will most likely self-identify as being interested in becoming CS Specialists or CS Teacher leads. Professional development for these lead teachers should consist of:

- Summer intensives
- Monthly in person learning

- Ongoing and easily accessible support and coaching
- Dedicated time for regularly scheduled cohort meetings

In years two through four, professional development should expand to include all teachers within the LEA to achieve the goals of H.B. 227. Ideally, this expansion can be achieved by building upon the development of LEA and school site CS Teacher Leaders who will be involved in the expansion of professional development with support from experts, through continued intensive summer classes, quarterly CS learning courses, ongoing in-person cohort meetings, and virtual support.

In the interest of achieving the challenging task of supporting the professional learning of teachers, administrators, and counselors in rural districts it is important for the grant to be designed to account for the additional resources necessary to cover the cost of extended travel, substitute teachers, and additional work time required to achieve full implementation.

Professional Development and Endorsements – Building capacity for middle and high school teachers

Teachers from across the curriculum in middle and high school, can benefit from learning computer science fundamentals. They can be encouraged to integrate the practice of these fundamentals in the courses they teach from math to language arts to history. Issues of privacy, digital literacy, and the use of data for analysis are transferable to many subject areas and will serve to reinforce the relevance of basic computer science skills for all students.

It is recommended, in order to increase capacity and expand the computer science course offerings, that this grant is designed to offer tuition reimbursement to teachers who pursue the computer science endorsements one and two. It is also recommended that this grant consider allowing stipends for teachers who step into a lead role in developing middle school or high school computer science course offerings and engage in student recruitment to build the course enrollment. Ongoing support for teachers to increase content level expertise is essential as is development of the ongoing improvement of instructional strategies.

Course and Curriculum Implementation

Goal: Effective implementation of approved courses for students

One additional new approved CS course added to the master schedule by September 2020 for the 2021 school year

It is recommended that schools be incentivized to exceed the minimum requirement of one additional approved CS course added to the master schedule. It is encouraged that the state adopt the definition of computer science as, "the study of computers and algorithmic processes, including their principles, their hardware and software designs, their applications, and their impact on society[5]" and recommend that 50% of instructional time in the class is devoted to computer science and computational thinking. Currently, the computer science courses that are being adopted are articulated and build upon one another to prepare a student for a STEM pursuit in higher education, or in post-secondary job training focused upon computer science.

Diversity and Recruitment of students

Student recruitment to computer science classes, at the middle school and high school level, is essential to reaching every part of the student population and also to sustaining new course offerings and ensuring that teachers are assured that pursuing computer science training will result in ongoing courses for them to teach. Recruitment is an effort by school leadership and where administrators and counselors play an important role in elevating the value of computer science courses to both students and parents. It would be ideal to see recruitment of students as part of the local specific plan detailing how the LEA will encourage increased enrollment and expansion of computer science.

A clear and well supported inclusive recruitment plan will also ensure that a diversity of students will have the opportunity and be encouraged to enroll in computer science classes. The planning process should include clearly articulated goals and strategies to intentionally include and retain students who are currently underrepresented in computer science classes. Unique applications of computer science can be beneficial for students with special needs and plans should include professional development designed for special education teachers.

- Clear plan and goals for inclusive student recruitment that includes committed involvement from teachers, administrators and counselors

[5] Tucker, A., Deek, F., Jones, J., McCowan, D., Stephenson, C., & Verno, A. (2003). A model curriculum for K-12 computer science. Final Report of the ACM K-12 Task Force Curriculum Committee, CSTA. 3 Wing, J. M. (2006). Computational thinking.

- Counselors to commit to professional development so they can be advocates for a diversity of students to engage in computer science education and career pathways
- Include a communication plan for all parents (value of problem solving and critical thinking skills not about increasing screen time)
- Include data collection: goals and growth of diverse CS enrollment

Articulation of CS from 6 - 12

It is critical that the specific plan developed by the LEA include details for the clear articulation of future computer science classes. The recommended goal is to offer a full array of computer science classes at the high school level from Computer Science Discoveries, Computer Science Principles, Computer Science Fundamentals, AP Computer Science A, Introduction to Data Science, among other courses.

Ideally articulation plans will include agreements and partnerships with institutions of higher education to work with secondary education to fully implement computer science curriculum that will meet admission requirements.

Technical Assistance

The Utah Department of Education is the lead for providing technical assistance to LEAs and grant recipients. This includes, assisting in the application process, with evaluation templates, and curating the various resources that may assist LEAs in accessing all available grant funds. As the implementation of the Utah Computer Science Master Plan commences it will be greatly aided by not only hiring a grant manager for the H.B. 227 Computer Science for Utah Grant Program, but also by establishing a permanent position of a Computer Science Specialist.

The Computer Science Specialist will play a critical role that extends beyond the scope of managing the grant. The specialist will coordinate the various opportunities for professional learning, help districts access the various funding streams and grants that can help them achieve CS implementation, and coordinate collaboration and accountability between the many different computer science initiatives to build a cohesive and collaborative network of resources and supports for teachers and school districts.

The person in this position will work to:

- Eliminate silos of practice
- Create a strategy to achieve cohesion of purpose for CS implementation

- Achieve coordination of practice by clearly distinguishing the roles and responsibilities of each partner organization and how they can best interact to achieve the implementation goals
- Oversee the analysis of necessary and required data collection and conduct ongoing evaluation of the implementation plan to guide future adaptations, changes, or decisions as the initiative matures.
- Evaluate future policy initiatives related to computer science implementation
- Analyze the coordination of various current grants, such as S.B. 190, H.B. 227 (Talent Ready Utah grant), and other computer science funding streams to create optimal opportunities for school districts to access grants.
- Report up to USBE and Talent Ready Board showing activities and outcomes of grants and evaluate the use and efficacy of current grant funding
- Coordinate with CTE Specialists K-12
- Advise Talent Ready Utah Board on ongoing and future CS funding needs

Accountability

Goal: Produce a clear picture of the evolving and growing implementation of computer science from integrated fundamentals to articulated high school course work

Accountability, for the purposes of meeting the requirements of H.B. 227, can only be achieved with data collection and reporting to the Utah Department of Education at regular intervals. This approach to accountability sometimes drives a compliance mindset that misses the benefits of well informed and participatory accountability at the local level. It can be that the accountability that the state requires is different from what will be relevant in the local setting. LEAs and consortiums should be encouraged to articulate meaningful and specific accountability for their local setting and situation.

It is also more meaningful to participants if the accountability flows in both directions. It would also be refreshing to see accountability provide a feedback loop from educators that will help inform the continuation of the implementation. Providing teachers opportunities to shape the ongoing implementation through evaluation and suggestions, respects their role as educators who are entrusted with the success of the CS implementation for all students in Utah. Suggested accountability measures are grouped in three categories below.

Report Outputs:

- Number of administrators and counselors who have taken CS Professional Learning

- Number of CS Teacher Leads that have been newly developed
- Number of Elementary and Secondary CS endorsements that have been added within the LEA
- Number of CS Integrated lessons that have been used by elementary grade bands. Require that there be several math lessons that integrate CS fundamentals taught in each grade level by the end of year two of the grant. Add more integrated lessons at the elementary level for year three and year four reaching the goal of all CS standards clearly integrated at each grade level.
- Number of shared integrated lesson plans at each grade band
- Number of lesson plans accessed, used, and evaluated by teachers from UEN resource hub
- LEA technology infrastructure landscape

Desired Outcomes:

- Introduce CS vocabulary in the elementary grades and check students for comprehension and fluency
- Develop basic CS vocabulary that will be introduced in the elementary grades and check students for fluency of this vocabulary
- Develop CS concept and vocabulary pre and post assessments by grade band, include student growth performance in annual report
- Include teacher use of formative assessments throughout the school year to identify student progress of comprehension of CS concepts, Include formative assessments and grade band artifacts with annual grant report
- Develop summative assessments using project-based learning (PBL) applications that use real world problem solving to demonstrate mastery of grade band CS concepts
- Create Student Digital CS Concept Portfolios that include their PBL products. Maintain the portfolios from year to year (for example: from grades K-6, 7-8, grades 9 and 11) and Evaluate PBL products against CS grade level standards. Share a sampling of student portfolios with annual grant report.

Participation & Feedback

- Have a cohort survey that will provide meaningful feedback to the local CS effort
- Collect responses from teachers on the CS professional learning that they take and have the responses reviewed by CS Lead Teachers.
- Allow flexibility for changes or corrections to the specific plan if needed

- Demonstrate continuity of effort in implementation of CS through perseverance of teacher commitment in instruction and administrative commitment through expanded integration of CS across the curriculum in grades K-8 and increased numbers of articulated CS courses in grades 9-12
- Ask teachers and administrators to respond to the effectiveness of their collaboration on the CS implementation
- Seek feedback from teachers and administrators on the effectiveness of incentives, reimbursements, and support that the grant is providing

Appendix B: Implementation Checklist

DATA & REPORTING	1. Measure the state of computer science and computer science education in Utah across demographics and regions ☐ Planning ☐ Acting ☐ Completed 2. Finalize, publish, and share the Utah Computer Science Education Landscape Report updating it annually ☐ Planning ☐ Acting ☐ Completed 3. Display and track Teacher Endorsements within CS Education ☐ Planning ☐ Acting ☐ Completed 4. Track how many teachers who have received CS PD are continuing to teach CS five years post training ☐ Planning ☐ Acting ☐ Completed 5. Create a permanent Computer Science Specialist position to lead implementation in K-12 ☐ Planning ☐ Acting ☐ Completed 6. Move from reporting output to reporting and analyzing outcomes ☐ Planning ☐ Acting ☐ Completed 7. Develop an online assessment system aligned to CS standards to measure student progress and growth in mastery of CS standards and concepts ☐ Planning ☐ Acting ☐ Completed

TEACHER DEVELOPMENT	
	1. Provide a professional development pipeline accessible to all teachers in Utah ☐ Planning ☐ Acting ☐ Completed 2. Train teachers in how to apply the Utah Computer Science Standards/ Framework at the elementary, middle, and high school levels ☐ Planning ☐ Acting ☐ Completed 3. Update teacher endorsements and certifications for computer science to include successful instructional methods, an understanding of the students' learning process, and ongoing support to increase confidence and mastery. ☐ Planning ☐ Acting ☐ Completed 4. Include computer science education fundamentals within the technology course of teacher preparation programs ☐ Planning ☐ Acting ☐ Completed 5. Direct additional resources to support rural districts in teacher professional learning and ongoing support of CS instructional practices ☐ Planning ☐ Acting ☐ Completed 6. UEN, USBE and CSTA partner to host one central database that lists professional development opportunities ☐ Planning ☐ Acting ☐ Completed 7. Incentivize teachers to teach CS ☐ Planning ☐ Acting ☐ Completed

CURRICULUM & STANDARDS	
	1. Develop K-12 Computer Science framework/standards at each grade level ☐ Planning ☐ Acting ☐ Completed 2. Revise K-12 Computer Science standards based on an accelerated revision cycle ☐ Planning ☐ Acting ☐ Completed 3. Recommend courses and curriculum aligned to the state standards framework and establish a repository with easy access ☐ Planning ☐ Acting ☐ Completed 4. Create resources to guide LEA implementation of the standards with ongoing support from USBE. Consider developing a Guidance Document. ☐ Planning ☐ Acting ☐ Completed 5. Create and curate resources for K-12 Computer Science standards to be integrated into other subjects in elementary school to be updated annually ☐ Planning ☐ Acting ☐ Completed 6. Allow computer science to satisfy a high school graduation requirement and corresponding post-secondary admissions requirements ☐ Planning ☐ Acting ☐ Completed

	7. Sequence new CS courses with CTE courses ☐ Planning ☐ Acting ☐ Completed 8. Include new CS course on master schedule for 2020-2021 school year enrollment ☐ Planning ☐ Acting ☐ Completed 9. CS Specialist will advise Talent Ready Board on CS graduation requirement and recommended CS courses 10. ☐ Planning ☐ Acting ☐ Completed

DIVERSITY	
	1. Expand CS access to schools that serve rural populations and low-income populations ☐ Planning ☐ Acting ☐ Completed 2. Increase numbers of female students, as well as racial and ethnic minorities ☐ Planning ☐ Acting ☐ Completed 3. Ensure that all curriculum and course content is accessible to people with disabilities ☐ Planning ☐ Acting ☐ Completed 4. Ensure access to Native American tribes including Goshute, Shoshone, Ute, Navajo, and Paiute ☐ Planning ☐ Acting ☐ Completed 5. Implement successful strategies for increasing diversity in K-12 CS ☐ Planning ☐ Acting ☐ Completed 6. Expand programs to include parents and counselors in the learning process ☐ Planning ☐ Acting ☐ Completed 7. Increase enrollment and diversity in AP Computer Science and similar advanced CS courses ☐ Planning ☐ Acting ☐ Completed

OUTREACH	
	1. Increase awareness of the importance of computer science across the state ☐ Planning ☐ Acting ☐ Completed 2. Communicate the state plan, and receive feedback from a variety of stakeholders on its implementation ☐ Planning ☐ Acting ☐ Completed 3. Create a network for proactive communication at the state, LEA, and school level ☐ Planning ☐ Acting ☐ Completed 4. Create a plan to reach each LEA to disseminate information from the state level down to each school in their LEA ☐ Planning ☐ Acting ☐ Completed 5. Create a plan to specifically address outreach to rural, low income and Native American populations ☐ Planning ☐ Acting ☐ Completed

FUNDING	1. Secure multi-year state-level funding dedicated to CS professional development ☐ Planning ☐ Acting ☐ Completed 2. Secure funding to develop model curricula and standards ☐ Planning ☐ Acting ☐ Completed 3. Secure state-level funding dedicated to expanding CS course offerings ☐ Planning ☐ Acting ☐ Completed 4. Secure state-level funding dedicated to support low income & rural populations ☐ Planning ☐ Acting ☐ Completed 5. Secure funding for institutions of higher education to partner with schools and the USBE ☐ Planning ☐ Acting ☐ Completed 6. Talent Ready Board will make recommendations on the need for additional CS implementation funding, and will review the efficacy of past investments ☐ Planning ☐ Acting ☐ Completed 7. Grant funding to develop an online assessment system for grade level CS standards ☐ Planning ☐ Acting ☐ Completed

Appendix C: CS courses available in Utah

COURSE NAME AND CODE	DESCRIPTION
3D Animation 35.02.00.00.075	3D Animation is a one-semester course using 3D graphics software to produce 3D models and animations. This course will introduce students to 2D and 3D, animation planning, storyboard development, and the animation process.
3D Graphics 35.02.00.00.070	3D Graphics is a one-semester course. Students will use 3D graphics software to produce 3D models. This course will introduce students to 2D and 3D modeling, the creation and application of textures, mapping, lighting, camera techniques, and rendering of 3D models.
AP Computer Science 35.02.00.00.041	The AP Computer Science course is rigorous programming course in computer science. The major theme of the course is problem solving.
A+ Computer Maintenance and Repair 35.01.00.00.040	Students will learn necessary competencies for an entry-level IT professional including installing, building, upgrading, repairing, configuring, troubleshooting, optimizing, diagnosing, and performing preventive maintenance of basic personal computer hardware and operating systems.
Advanced Computer Programming 35.02.00.00.040	This is an advanced course in computer programming/software engineering and applications. It reviews and builds on the concepts introduced in Computer Programming 1 and 2. It introduces students to dynamic data structures, advanced utilization of classes, and applications of recursion through the application of mathematical concepts. This course will also highlight the differences between the many different languages of computer programming.

Algorithms and Data Structures 35.02.00.00.037	This course builds on the object-oriented programming principles taught in Computer Programming 1, 2, and 3. A solid understanding of these concepts is assumed and required in this course. This course presents the ideas, tools, structure, syntax, libraries and object-oriented design techniques for developing well-formed programs using data structures. Students study and strengthen their concepts such as problem solving, program structure, classes, methods, data types, control constructs, file and console I/O. Students will also learn other important principles in designing object-oriented programs containing data structures. Students will design and use common data structures including arrays, hash tables, stacks, queues, linked lists, binary trees, multiway trees, graphs. Students will define and use common algorithms including traversals, searching, sorting, compression and paths. Students will write several programs that demonstrate their understanding of these concepts using an appropriate programming language including C++, C#, Java, Python, and Swift.
Augmented Realty and Virtual Reality 35.02.00.00.014	Separating hype from reality is hard, especially in the fast-growing and evolving space of augmented and virtual reality (AR/VR). Recent advances in technology has allowed AR/VR systems to become extremely sophisticated and realistic. This course introduces students to the technologies that underpin AR/VR systems. Then the course walks through 5 applications of AR/VR and how they will change and impact numerous aspects of our lives and the economy. Students will also learn about and discuss the risks and side effects of these systems, including health, privacy, and ethical implications.
Certified Linux CNA Admin CE 35.01.00.13.001	The CCNA Routing and Switching curriculum consists of seven courses, with four courses that make up the recommended learning path and three additional courses that support the transition of CCNA Exploration instructors and students to the new CCNA Routing and Switching curriculum. No transitional courses are needed for CCNA Discovery instructors and students. Students will be prepared to take the Cisco CCENT® certification exam after completing a set of two courses and the CCNA Routing and Switching certification exam after completing a set of four courses. CCNA Routing and Switching teaches comprehensive networking concepts and skills, from network applications to the protocols and services provided to those applications by the lower layers of the network. Students will progress from basic networking to more complex enterprise and theoretical networking models later in the curriculum.

Cloud Computing 35.02.00.00.042	Understanding cloud technologies tops the list of most important skills for any developer, system administrator or network computing professional seeking a lucrative career in technology. However, getting started and researching all things related to cloud infrastructure technologies can be complicated and time-consuming. This course maps out the entire cloud landscape and explains how various tools and platforms fit together. This course gives you a primer on cloud computing and the use of open source software to maximize development and operations.
Computer Programming 1 35.02.00.00.030	An introductory course in computer programming/software engineering and applications. The course introduces students to the fundamentals of computer programming. Students will learn to design, code, and test their own programs while applying mathematical concepts. Teachers introduce coding concepts and problem-solving skills to beginning students through a programming language such as C++, C#, Java, Python, or JavaScript. The course that follows this course is titled Computer Programming 2. This follow-up course reviews and builds on the concepts introduced in the course. This second course introduces students to more complex data structures and their uses, including sequential files, arrays, and classes. Students will learn to create more powerful programs. Note: Computer Programming 2 explains topics using language specific concepts and practices.
Computer Programming 2 35.02.00.00.032	This course reviews (Strands 1-6) and builds on the concepts introduced in Computer Programming 1. Beginning in Strand 4, and then Strands 7-10, this course introduces students to more complex data structures and their uses, including sequential files, arrays, and classes. Students will learn to create more powerful programs within a specific programming language: Java, Python, C++, C#, Swift.
Computer Science and Software Engineering 35.02.00.00.036	The course does not aim to teach mastery of a single programming language but aims instead to develop computational thinking, to generate excitement about the field of computing, and to introduce computational tools that foster creativity. The course also aims to build students' awareness of the tremendous demand for computer specialists and for professionals in all fields who have computational skills. Each unit focuses on one or more computationally intensive career paths. The course also aims to engage students to consider issues raised by the present and future societal impact of computing.

Computer Science Applications 35.02.00.00.038	Computer Science A (CSA) builds on the basic skills learned in Computer Science Principles (CSP) to teach students authentic AndroidTM app development. Students in this course continue to hone their communication and collaboration skills while learning to use a variety of tools. The primary goal of the course is to create independent- thinking app developers; every unit in this course builds on students' prior knowledge and skills until they are able to complete an app development cycle independently from the ground up.
Exploring Computer Science 1 35.02.00.00.007	Exploring Computer Science 1 is designed to introduce students to the breadth of the field of computer science through an exploration of engaging and accessible topics. Rather than focusing the entire course on learning particular software tools or programming languages, the course is designed to focus the conceptual ideas of computing and help students understand why certain tools or languages might be utilized to solve particular problems. The goal of Exploring Computer Science 1 is to develop in students the computational thinking practices of algorithm development, problem solving and programming within the context of problems that are relevant to the lives of today's students. Students will also be introduced to topics such as interface design, limits of computers and societal and ethical issues.
Exploring Computer Science 2 35.02.00.00.007	Exploring Computer Science 2 is designed to introduce students to the breadth of the field of computer science through an exploration of engaging and accessible topics. Rather than focusing the entire course on learning particular software tools or programming languages, the course is designed to focus the conceptual ideas of computing and help students understand why certain tools or languages might be utilized to solve particular problems. The goal of Exploring Computer Science 2 is to develop in students the computational thinking practices of algorithm development, problem solving and programming within the context of problems that are relevant to the lives of today's students. Students will also be introduced to topics such as interface design, limits of computers and societal and ethical issues.

Computer Science Principles 35.02.00.00.035	Computer Science Principles is a new course that follows a project to develop a computer science course that seeks to broaden participation in computing and computer science. The course places emphasis on the principles of computer science rather than just programming. Big ideas and concepts include: 1. Computing is a creative activity. 2. Abstraction reduces information and detail to facilitate focus on relevant concepts. 3. Data and information facilitate the creation of knowledge. 4. Algorithms are used to develop and express solutions to computational problems. 5. Programming enables problem solving, human expression, and creation of knowledge. 6. The Internet pervades modern computing. 7. Computing has global impacts. Note 1: CSP course is currently a 1.0 credit course. There is a need to collect the most relevant concepts and include them into a semester of the course to match the Digital Studies requirement. Note 2: AP CSP is currently a 1.0 course with the test weighted as a 1.0. CSP has the option to be taught as a 1.0 or a 0.5 semester course but the test weight is only given at a 0.5 no matter the duration of the course. This will facilitate the need for the CSP concurrent enrollment credit as well as the goal to accomplish the Digital Studies graduation requirement.
Creative Coding 35.00.00.00.003	Creative Coding through Games and Apps is a first-semester course for introduction to programming for the early secondary grades. The course is designed to attract and reach a broad and diverse range of students, including those who may have never considered programming. Students learn how to code by working in a real software development environment to design, program and publish mobile apps and games. Learning to code by creating real products, students discover how to make amazing things and have an impact on their world.

Cybersecurity Ethical Hacker 35.01.00.00.036	This course will immerse you into the Hacker Mindset so that you will be able to ethically defend against future attacks. The security mindset in any organization must not be limited to the silos of a certain vendor, technologies or pieces of equipment. This course puts you in the driver's seat of a hands-on environment with a systematic process. Here, you will be exposed to an entirely different way of achieving optimal information security posture in their organization; by hacking it! You will scan, test, hack and secure your own systems. You will be taught the five phases of ethical hacking and the ways to secure and approach your target to succeed! The five phases include Reconnaissance, Gaining Access, Enumeration, Maintaining Access, and covering your tracks.
Cybersecurity Forensics 35.01.00.00.038	Computer hacking forensic investigation is the process of detecting hacking attacks and properly extracting evidence to report the crime and conduct audits to prevent future attacks.
Database Development 35.02.00.00.021	This course is designed to teach the fundamentals of database and to prove introductory knowledge of and skills with databases, including relational databases using SQL.
Digital Graphic Arts Intro 40.10.00.00.040	This course is designed to provide students with the basic knowledge and skills related to the graphic design industry. It is intended to serve as a starting point for several pathways including Digital Media, Graphics and Printing, 3D Animation and Game Development. This includes instruction and hands-on assignments in the following areas: creative design and layout, typography, color, related software, and computer and professional skills.
Digital Literacy 32.02.00.00.170	This course is an introduction to computer literacy. Students will have opportunities to use technology and develop skills that encourage creativity, critical thinking, productivity, and collaboration in the classroom and day-to-day life. Skills will be demonstrated by creating a project for a different content area. This course is aligned with national and international standards and the Utah Core to prepare students across multiple levels of skills. Students will complete this course with a prerequisite to move into high school computer literacy courses.

Digital Media 1A/1B 35.02.00.00.010	Digital media is the process of analyzing, designing and developing interactive media. Digital Media 1 is the first-year digital media course where students will create and learn digital media applications while using elements of text, graphics, animation, sound, video, and digital imaging for various formats. These abilities will prepare students for entry-level multimedia positions and provide fundamental 21st Century Learning skills beneficial for other occupational/educational endeavors.
Digital Media 2 35.02.00.00.011	Digital Media 2 is a course designed to teach the process of planning, instructional design, development, and publishing of digital media and interactive media projects. Digital Media II is the second year course within digital media pathway where students will focus on developing advanced skills to plan, design, and create interactive projects using the elements of text, 2-D and 3-D graphics, animation, sound, video, digital imaging, interactive projects, etc. These skills can prepare students for entry-level positions and other occupational/educational goals.
Exploring Computer Science 1 35.02.00.00.007	Exploring Computer Science 1 is designed to introduce students to the breadth of the field of computer science through an exploration of engaging and accessible topics. Rather than focusing the entire course on learning particular software tools or programming languages, the course is designed to focus the conceptual ideas of computing and help students understand why certain tools or languages might be utilized to solve particular problems. The goal of Exploring Computer Science 1 is to develop in students the computational thinking practices of algorithm development, problem solving and programming within the context of problems that are relevant to the lives of today's students. Students will also be introduced to topics such as interface design, limits of computers and societal and ethical issues.
Exploring Computer Science 2 35.02.00.00.008	Exploring Computer Science 2 is designed to introduce students to the breadth of the field of computer science through an exploration of engaging and accessible topics. Rather than focusing the entire course on learning particular software tools or programming languages, the course is designed to focus the conceptual ideas of computing and help students understand why certain tools or languages might be utilized to solve particular problems. The goal of Exploring Computer Science 2 is to develop in students the computational thinking practices of algorithm development, problem solving and programming within the context of problems that are relevant to the lives of today's students. Students will also be introduced to topics such as interface design, limits of computers and societal and ethical issues.

Gaming Development Fundamentals 1 35.02.00.00.045	This course is designed to provide students with knowledge and project-based experience of fundamental gaming development concepts relating to STEM. These concepts include game design, scripting, creation of digital assets, graphic resources, animations, understanding hardware, problem solving, critical thinking, collaboration, and project management.
Gaming Development Fundamentals 2 35.02.00.00.046	This course is designed to provide students with knowledge and project-based experience of fundamental gaming development concepts relating to STEM. These concepts include game design, scripting, creation of digital assets, graphic resources, animations, understanding hardware, problem solving, critical thinking, collaboration, and project management.
Geographic Information Systems Remote Sensing 35.02.00.00.005	This course is designed to introduce remote sensing of the environment through digital image processing (photography, multispectral scanning and microwave imagery) from airplane, satellite (Landsat), and manned-spacecraft data. The goal is to develop an understanding of inventorying, mapping, and monitoring earth resources through the measurement, analysis and interpretation of electromagnetic energy emanating from features of interest. Image interpretation, practical applications in earth science, and use of remotely sensed data in geographic information systems (GIS).
HTML5 Application Development Fundamentals 35.02.00.00.055	This course is designed to provide students with an assessment of their knowledge of fundamental HTML5 application development concepts. It can also serve as a steppingstone to additional exposure to web development careers. Students will explore core HTML5 client application development skills that will run on today's touch-enabled devices (PCs, tablets, and phones). Although HTML is often thought of as a web technology that is rendered in a browser to produce a UI, this course focuses on using HTML5, CSS, and JavaScript to develop client applications. After successful completion of this course, students should have solid foundational knowledge of HTML5, CSS and JavaScript. It is recommended that students be familiar with the concepts of and have some hands-on experience with the related technologies.
IB Computer Science HL 1 35.02.00.00.052	The IB DP Computer science SL course requires an understanding of the fundamental concepts of computational thinking as well as knowledge of how computers and other digital devices operate. The course, underpinned by conceptual thinking, draws on a wide spectrum of knowledge, and enables and empowers innovation, exploration and the acquisition of further knowledge. Students study how computer science interacts with and influences cultures, society and how individuals and societies behave, and the ethical issues involved. During the course the student will develop computational solutions.

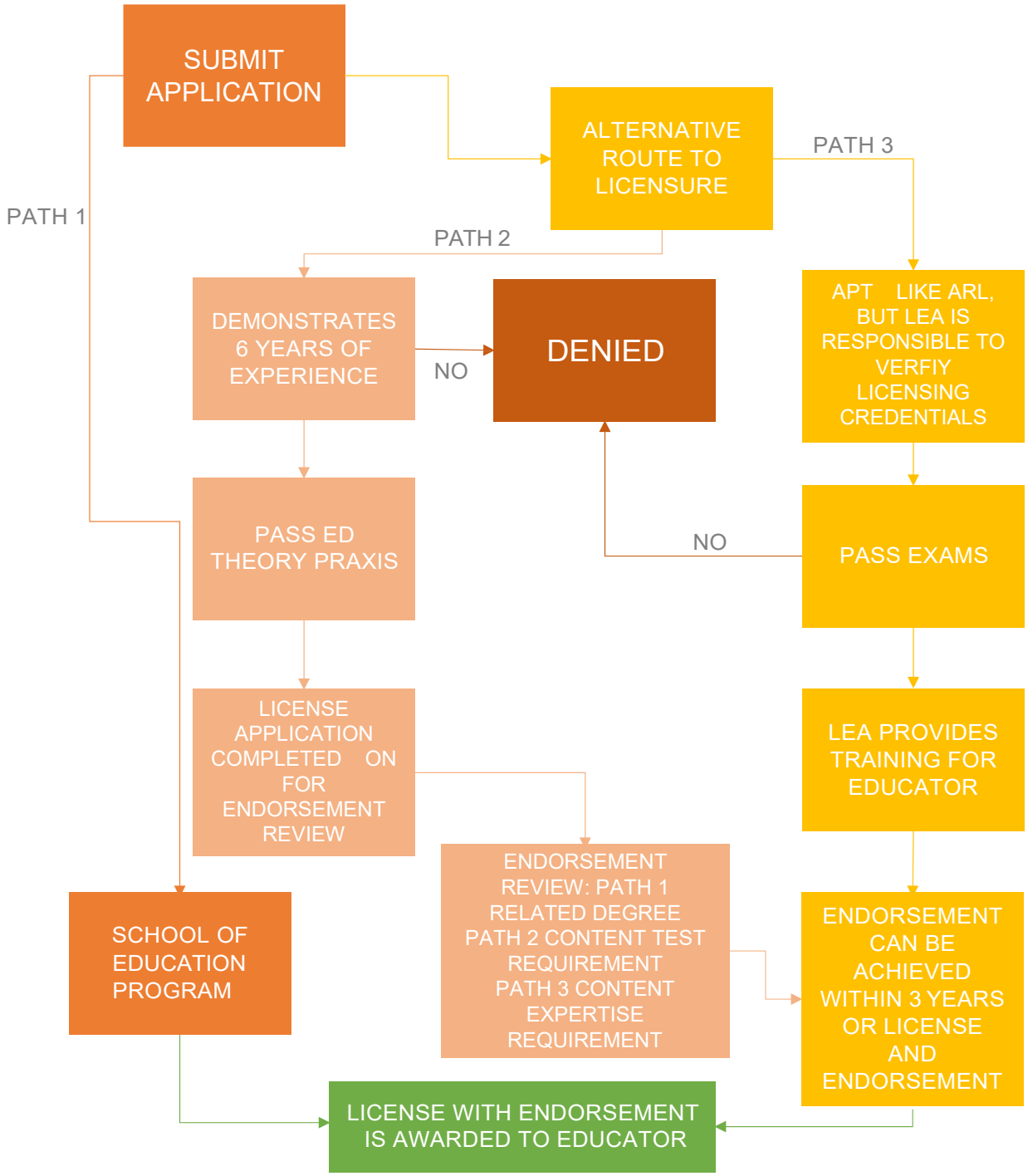
Intro to Python 1 35.02.00.00.004	Python is a language with a simple syntax, and a powerful set of libraries. it is an interpreted language, with a rick environment, including a robust debugger and profiler. While it is easy for beginners to learn, it is widely used in many scientific areas for data exploration. This course is an introduction to the Python language for students without prior programming experience.
Intro to Python 2 35.02.00.00.006	Python is a language with a simple syntax, and a powerful set of libraries. it is an interpreted language, with a rick environment, including a robust debugger and profiler. While it is easy for beginners to learn, it is widely used in many scientific areas for data exploration. This course is an introduction to the python language for students with only a preliminary exposure course, Intro to Python 1, and programming experience.
Introduction to Geographic Information Systems 35.02.00.00.080	This course introduces fundamental concepts of geographical information systems (GIS) and the major functionality contained within professional GIS software. In course exercises, you will follow the GIS analytical process and work with a variety of tools to solve realistic problems. This course emphasizes practical GIS software skills.
Introduction to Information Technology 35.02.00.00.005	The Introduction to Information Technology course is for students interested in pursuing a career in the field of information technology (IT). Students will be introduced to the different aspects of information technology to determine where their interests. Students will complete assignments and projects in IT careers, digital media, hardware and operating systems, communications and networks, software development, databases, and new and emerging technologies.

Linux Fundamentals 35.01.00.00.025	The CompTIA Linux+ [Powered by LPI] certification is a vendor neutral credential. In order to receive CompTIA Linux+ certification, a candidate must pass two exams. The successful junior level Linux administrator should be able to: • Work at the Linux command line; • Perform easy maintenance tasks including assisting users, adding users to a larger system, executing backup and restore, shutdown and reboot; • Install and configure a workstation (including X) and connect it to a LAN, or a stand-alone PC via modem to the Internet. The first exam is CompTIA Linux+ [Powered by LPI] exam number LX0-101. This exam measures a portion of the competencies required by a junior level Linux administrator, as described in the exam objectives below. This examination blueprint includes domain weighting, test objectives, and sample content. Candidates are encouraged to use this document to guide their studies. The contents of the examination blueprint help prioritize topics and provide a guide of what to expect on this CompTIA Linux+ [Powered by LPI] exam. The table within the standards lists the domains measured by this examination and the extent to which they are represented.
Microsoft Certified Professional (MCP) 35.01.00.00.020	Candidates for this exam are seeking to prove Windows Server administration knowledge and skills. Before taking this exam, candidates should have a solid foundational knowledge of the topics outlined in this preparation guide. It is recommended that candidates become familiar with the concepts and the technologies described here by taking relevant training courses. Candidates are expected to have some hands-on experience with Windows Server, Windows-¬·based networking, Active Directory, account management, and system recovery tools and concepts.
Mobile Development Fundamentals 35.02.00.00.048	This course is designed to teach skills to develop apps for phones, tablets, and other devices that run on a variety of operating system. Students will learn core mobile development skills. Before taking this course, students should have solid foundational knowledge of the following topics: C#, Visual Studio, .NET, HTML5, SQLite, CSS, Javascript, ASP.NET MVC, Swift, and other phone operating system tools.
Network Fundamentals 35.02.00.00.030	Utah's Network Fundamentals are based on CompTIA 2011 Network+ Objectives. The CompTIA Network+ certification is an internationally recognized validation of the technical knowledge required of foundation-level IT network practitioners.

New and Emerging Technologies 35.02.00.00.199	This course is designed to allow teachers to explore and teach new and emerging technologies in the area of computer science and information technologies. This course provides an opportunity for teachers to propose possible a course and pilot it in their classroom.
Security Fundamentals 35.01.00.00.036	This course will provide students with information on network security including industry wide topics on communication security, infrastructure security, cryptography, access control, authentication, external attack and operational and organization security. This course will also prepare students for the MTA Security Fundamentals and the CompTIA Security+ IT industry certification exams.
Web Development Capstone 35.02.00.00.067	Web Development Capstone is a course designed to guide students in a project-based environment in the development of up-to-date concepts and skills that are used in the development of today's websites. Some concepts for discovery and mastery include: front-end (HTML5, CSS3, Bootstrap, JavaScript, jQuery, jQuery mobile), foundation paradigms (OOPS, Design Patterns, Object Modelling, JSON, AJAX), MEAN Stack (MongoDB, Express Framework, AngularJS, Node.js), data exchange (HTTP, websockets), development environment and tools, DISHA (resume and interview prep package).
UX/UI New course	User Experience and User Interface (UX/UI) is a course designed to encourage a more diverse set of students to learn tech skills. UX/UI is an attempt to show students how important learning to research, plan, design, create, and code are by empowering them to build their own tech products. This course teaches students how to turn ideas into real products using design, story board, coding, and prototyping while using data analysis, human behavior, and consistent design practices. Throughout the course students will work in teams, experiencing different industry roles found within a career of UX/UI, from idea generator and project manager to developer and tester. The course culminates in a final working technical prototype that teams will present to an audience of end users, investors, and other potential interested parties.

Web Development 1 35.02.00.00.060	Web Development 1 is a course designed to guide students in a project-based environment, in the development of up-to-date concepts and skills that are used in the development of today's websites. Students will learn the fundamentals of how the internet works. They will learn and use the basic building blocks of the World Wide Web: HTML5 coding, Cascading Style Sheets (CSS), and JavaScript. They will follow the steps to create a website by planning, designing, developing, deploying, and maintaining of website projects. Students will learn and use different scripting technologies to create more dynamic and interactive websites. They will learn what it takes for a career in web development as they complete projects and create their own website.
Web Development 2 35.02.00.00.065	Web Development 2 is a course designed to guide students in a project-based environment in the development of up-to-date concepts and skills that are used in the development of today's websites. Students will learn the fundamentals of how the Internet works. They will learn and use the basic building blocks of the World Wide Web: HTML5 coding, Cascading Style Sheets (CSS), and JavaScript. They follow the steps to create a website by planning, designing, developing, deploying, and maintaining of the website projects. Students will learn and use different scripting technologies to create more dynamic and interactive websites. They will learn what it takes for a career in web development as they complete projects and create their own website.

Appendix D: Teacher Certification and Licensure



Appendix E: List of Resources

CS Content Standards

The ISTE Standards for Students are designed to empower student voice and ensure that learning is a student-driven process.

https://www.iste.org/standards/for-students

Utah Computer Science K-12 Framework

https://www.schools.utah.gov/file/46d4ca37-9d23-414e-91fd-6640b6be9df6

California's CS standards are based on the revised International Computer Science Teachers Association (CSTA) standards. The CSTA standards were modified to fit California's educational context and include introductory material and appendices to explain the standards to educators, identify areas of alignment between the CS standards and other content standards, and provide recommendations for implementation.

https://www.cde.ca.gov/be/st/ss/computerscicontentstds.asp

Administrators + Teachers

CS Equity Guide is an administrator's guide to implementing equitable K-12 computer science education in California

http://access-ca.org/wp-content/uploads/sites/4/2019/04/CSforCAguide-opt.pdf

The National Digital Inclusion Alliance is a unified voice for home broadband access, public broadband access, personal devices and local technology training and support programs.

We work collaboratively to craft, identify and disseminate financial and operational resources for digital inclusion programs while serving as a bridge to policymakers and the general public.

https://www.digitalinclusion.org/

CSforALL is using a process and toolkit called the SCRIPT (Strategic CSforALL Resource and Implementation Planning Tool) to help schools create implementation plans for CS education. The tools include rubric areas for leadership, as well as providing support for administrators who supervise or evaluate teacher performance. To successfully prepare administrators for

these roles, schools of education can support administrator knowledge through the use of case studies of CS education implementation and supervision.

https://www.csforall.org/projects_and_programs/script/

Computer science professional development guide: How education leaders can build teacher, school counselor and administrator capacity to support equitable computer science education.

https://query.prod.cms.rt.microsoft.com/cms/api/am/binary/RE2I7uT

Virtual Professional Learning Program

The Code.org Virtual Academic Year Professional Learning Program will support selected CS Discoveries and CS Principles teachers with a set of online activities that replace in person academic year workshops.

https://docs.google.com/document/d/1IX_jgewtUmPxfCqCdNopaylvnNKnolIkIknoSJtZ4Zc/edit

Closing the STEM Gap: Why STEM classes and careers still lack girls and what we can do about it

https://query.prod.cms.rt.microsoft.com/cms/api/am/binary/RE1UMWz

Center on Great Teachers & Leaders

Resource to support states and districts in their efforts to grow, respect, and retain great teachers and leaders for ALL students, especially those from disadvantaged backgrounds.

https://gtlcenter.org/

Assessing Computational Thinking and Learning

https://www.sri.com/work/publications/assessments-computational-thinking-k-12

https://dl.acm.org/citation.cfm?id=2591713
https://dl.acm.org/citation.cfm?id=3017779

Counselors for Computing (C4C)

Educators and students alike look to professional school counselors for ways to encourage girls, women, and underrepresented groups to pursue computing. Knowing where to start

is hard, even for the most experienced counselors. National Center for Women & Information Technology (NCWIT) helps counselors remove the barriers so students choose to learn computing, consider pursuing technical career paths, and believe their voices can be heard in the tech industry.

https://www.ncwit.org/project/counselors-computing-c4c

Utah Certification & Licensure Available to Teachers

Computer Science – Level 1

https://schools.utah.gov/file/1ed0069b-028e-49d8-8881-4a8a895175f1

Computer Science – Level 2

https://schools.utah.gov/file/bdc16bb8-dd04-4b63-943c-d37549fcc970

Exploring CS

https://schools.utah.gov/file/f4a70aa0-9f21-4912-afc4-633dbc1452a3

Web Development

https://schools.utah.gov/file/32cb182f-2b4e-46f6-a88c-b1a981690579

Note: These endorsements are changing SY 2020-2021. Reference USBE website under endorsements for the latest.

Curricula, Pedagogical Strategies

Elementary curriculum examples from San Francisco Unified School District

(SFUSD) CSinSF.org/K-2 and CSinSF.org/3-5

~~Example of integrated units (CS + math)~~ work from University of Chicago (see canonlab.org/actionfractionslessons), and there are some teacher created lessons/units viewable at http://cs4allkids.org/index.php/lessons-for-teaching-integrated-computational-thinking/.

AccessCSForAll

https://www.washington.edu/accesscomputing/accesscsforall

https://www.washington.edu/accesscomputing/accesscsforall/resources

A project that develops resources and professional learning for computer science teachers to help them include students with disabilities in their courses.

Bootstrap

http://www.bootstrapworld.org/

Bootstrap includes research-based curricular modules for grades 6-12. Materials reinforce core concepts from mainstream subjects like Math, Physics and Data Science, enabling non-CS teachers to adopt introductory materials while delivering rigorous and engaging computing content.

Code Studio

http://studio.code.org/

Code Studio is a combined set of tools and guided lessons to get students in kindergarten through high school interested in the underlying concepts behind coding, with an interface for teachers to monitor where their students are in the lesson progression.

Code.org 3rd Party Educator Resources

https://code.org/educate/curriculum/3rd-party

A repository of CS curricula and professional development providers curated by Code.org that a school or school district can access to provide an in-school offering for their students.

CS Teaching Tips

http://csteachingtips.org/

A repository of tips to help CS teachers anticipate students' difficulties and build upon students' strengths.

CS Unplugged

https://classic.csunplugged.org/

https://classic.csunplugged.org/teachers/

CS Unplugged is a collection of free learning activities that teach Computer Science without computers through engaging games and puzzles that use cards, string, crayons and lots of running around. They also provide links to other resources related to teaching CS and CS outreach.

CS4AllKIDS

http://cs4allkids.org/

http://cs4allkids.org/index.php/lessons-for-teaching-integrated-computational-thinking/

A repository of integrated computational thinking lessons for grades K-8 curated by educators in Washington state. Tips from teachers are also provided.

EngageCSEdu

https://www.engage-csedu.org/

A repository of assignments, tutorials, labs, assessments, lecture notes, exercises and projects. Materials focus on introductory-level college or upper-level high school CS and on engaging a diverse population of students.

Family Code Night

http://www.familycodenight.org/

A family engagement event where parents and their children do their first hour coding together. An event kit is provided to support organizations in hosting a Family Code Night.

Nifty Assignments

http://nifty.stanford.edu/

A repository of CS assignments gathered at the annual SIGCSE meeting. Descriptions of assignments are provided along with related materials. Materials focus on introductory level CS.

Project Quantum

http://bit.ly/projectquantum

A crowd-sourced repository of multiple-choice assessment items. Questions cover programming, computational thinking, information technology and digital literacy.

Scratch and Scratch Jr.

https://scratch.mit.edu/

http://www.scratchjr.org/

A block-based programming environment and online community students can use to code their own interactive stories, animations, and games. Scratch targets learners aged 8 and older. Scratch Jr. targets learners ages 5 to 7. To support teachers, Scratch provides a community for educators, in-person gatherings, and guides and tutorials. Scratch is designed and maintained by the Lifelong Kindergarten group at the MIT Media Lab. A list of other block-based programming environments is provided on the Scratch Wiki.

Educator Communities

Computer Science Teachers Association

https://www.csteachers.org/

A membership organization that supports and promotes the teaching of computer science at the K-12 grade levels.

CS for All Teachers

https://csforallteachers.org/

A virtual community of practice, welcoming all teachers from PreK through high school who are interested in teaching computer science.

CSforAll Consortium

https://www.csforall.org/

A hub for the national Computer Science for All movement. Provides information on providers, schools, funders, and researchers focused on the goal of providing quality CS education to every child in the U.S.

Broadening Participation in Computing

With grants from the National Science Foundation, the ECS team has been exploring the state of computer science education and developing evidence-based programs for nearly ten years. ECS projects and teams are housed at UCLA and University of Oregon.

http://www.exploringcs.org/for-researchers-policymakers

Outside of School

Various online courses, Massive Online Open Courses (MOOCs), and summer programs that expose students to new programming languages or ways they can use CS. Here are some ideas to explore (Brooks & Elliott, 2017):

The Connectory: This website identifies out-of-school STEM learning opportunities, including computer science. Search by age, opportunity, and topic.

Maker Faire: Maker Faires are a good place for students to experience the creative potential of computer science, connect with makers, and get ideas for what they can develop.

MIT App Inventor: The tutorials can get students started on developing apps on their own.

The Clubhouse Network: This out-of-school program for kids 10- to 18-years-old encourages students to explore web design, programming, video game design, and creating 3D models.

Technovation: Teams of girls from around the world learn how to code and create apps that address problems in their own communities.

Level the Playing Field SMASH Academy: This program is a three-year STEM-intensive residential college prep program for underrepresented students.

Utah Computer Science Course Information

Computer Programming 1

https://schools.utah.gov/file/730a5598-fa5c-4fca-b1d5-f121055f11df

Computer Programming 2

https://schools.utah.gov/file/2ae197d8-d291-49e9-8b75-266f68a82bd6

Advanced Computer Programming

https://schools.utah.gov/file/7806593f-4759-4547-801e-dea71baf9edd

Computer Science Principles

https://schools.utah.gov/file/de03f212-f90a-4f2c-bda7-2c51e0d2da70

Game Development Fundamentals 1

https://schools.utah.gov/file/3117d474-9a6f-49a4-a44f-a80aad89da1d

Game Development Fundamentals 2

https://schools.utah.gov/file/e630277b-352b-4fbd-8c8f-43733ec4feb7

Mobile Development Fundamentals

https://schools.utah.gov/file/b081924c-04d1-4306-8059-42370d5a369b

Web Development 1

https://schools.utah.gov/file/0dbbb614-8af0-41ce-b3d9-6de72841d1c4

Web Development 2

https://schools.utah.gov/file/55ff6d1d-6ca2-4376-a51e-168aeaf91101

Web Development Capstone

https://schools.utah.gov/file/12a456d6-d366-42c3-989d-71e463f366b4

Exploring Computer Science 1

https://schools.utah.gov/file/3a1fc6d3-5e41-42bb-9268-3c71ee5ea231

Exploring Computer Science 2

https://schools.utah.gov/file/1f8d60c1-0f7e-4d89-9a95-5d471164e05b

Creative Coding

https://schools.utah.gov/file/45a97db2-5911-473a-93d6-28ba0fe3cf1a

Algorithms and Data Structures

https://schools.utah.gov/file/ab5c0f0d-0eb0-4a0e-be23-04fb3ed203ed

Augmented Reality and Virtual Reality

https://schools.utah.gov/file/d72a7e21-7445-4895-9bb1-d249a0656b62

DRA

Computer science is no longer a “nice to know” elective but rather a “need to know” core subject. The K-12 education system needs to start preparing graduates for rapid growth in computing jobs in every industry. The CS Master Plan is a tool to help address this need.

PLURALSIGHT one

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REIMAGINING SCIENCE, TECHNOLOGY, ENGINEERING + MATH EDUCATION

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