

Arkansas Computer Science and Cyber Security Task Force Report

Final Report
October 1, 2020





Executive Summary

Governor Asa Hutchinson established the Arkansas Computer Science and Cybersecurity Task Force (CSCTF or Task Force) in December of 2019. The Task Force was charged with reviewing the Arkansas Computer Science Initiative and making recommendations to the Governor regarding how to build on the success of the initiative and maintain Arkansas's national leadership on computer science education. The work of the Task Force is captured in this report.

Since its inception in 2015, the Arkansas Computer Science Initiative has made substantial progress in both K-12 and postsecondary education. The second section of this report reviews the initiative's accomplishments. Through concerted, coordinated efforts the state has dramatically increased the number of credentialed computer science teachers, high school computer science course offerings, and student enrollment in those computer science courses. Arkansas's postsecondary institutions are also experiencing an increase in the number of in-state high school students who are going on to study and complete degrees/additional credentials in computer science or related fields.

Arkansas has built a strong foundation for computer science education, creating many opportunities to do even more to train a high-quality workforce, attract and retain employers, and add to the state's economic vitality. The Task Force identified several opportunities to expand and enhance the state's efforts around computer science education and training, including a continued focus on increasing diversity, equity, and inclusion. The third and final section of this report presents the Task Force's findings and twenty-one recommendations which are grouped into five categories: 1) K-12 Educational Pathways and Program Growth, 2) Postsecondary Enrollment Growth, Program Alignment, and Credential Opportunities, 3) Industry Engagement, 4) Funding and Measuring Outcomes, and 5) Computer Science Initiative Awareness, Promotion, and Marketing.

The Task Force was encouraged by the progress the state has made over the past five years and is optimistic that with continued effort the state can leverage its national leadership position on computer science education to create a dynamic source of ongoing economic strength. We hope that the findings and recommendations included in this report will help move the state closer to that goal.

Table of Contents

<i>Section I. Computer Science and Cybersecurity Task Force Overview</i>	4
<i>Section II. Computer Science Initiative Progress</i>	5
Increasing the Number of Credentialed Computer Science Teachers	5
Increasing K-12 and Postsecondary Computer Science Enrollment and Credentials	7
<i>Section III. Task Force Findings and Recommendations</i>	10
K-12 Educational Pathways and Program Growth	10
Postsecondary Enrollment Growth, Program Alignment, and Credential Opportunities	15
Industry Engagement	17
Funding and Measuring Outcomes	20
Computer Science Initiative Awareness, Promotion, and Marketing	22
<i>Appendices</i>	26
Appendix A: Progress on Prior Task Force (CSTF) Recommendations	26
Appendix B: Additional Programs Provided to Support the Arkansas Computer Science Initiative	34
Appendix C: Computer Science as a Component of the School Quality and Student Success Indicator	44
Appendix D: Task Force Members and Contributors.....	51

Section I. Computer Science and Cybersecurity Task Force Overview

Governor Asa Hutchinson established the Arkansas Computer Science and Cybersecurity Task Force (CSCTF or Task Force) by Executive Order 19-17 on December 6, 2019. The purpose of the task force was to “advise the Governor on how to best guide the continued efforts of state agencies and state partners to provide quality computer science education to students in the state, while providing information and direction for potential future state legislation, rules, and policies.”

In addition, the Governor’s executive order charged the CSCTF with providing guidance and feedback on the following:

- updated large-scale goals and strategies;
- industry pathways and relevant certifications for major areas of computer science and computing;
- postsecondary alignment strategies and goals;
- work-based learning opportunities for students;
- teacher credentialing;
- correct placement and focus on data sciences and cybersecurity in curricula;
- potential funding usage and future needs; and
- outreach and development of educational materials.

Governor Asa Hutchinson appointed 35 members to the CSCTF representing education, industry, philanthropic, entrepreneurial, and governmental entities. The Governor’s Deputy Chief of Staff, Bill Gossage, was appointed Chairman. Mr. Gossage was the primary sponsor of Act 187 of 2015, which provided the legislative foundation for Arkansas’s Computer Science and Computing Initiative.

Chairman Gossage called the inaugural meeting of the CSCTF to order on January 8, 2020. During this meeting, to better address the charges of the executive order, the task force divided itself into the following four subcommittees: Education, Industry, Economic Development, and Cybersecurity and Data Sciences

Governor Asa Hutchinson visited the CSCTF during its second meeting held on January 28, 2020. In his remarks, Governor Hutchinson asked the CSCTF to evaluate and provide feedback regarding: K-12 computer science implementation, instruction, and pathways for students, connections between industry and education, postsecondary institutional efforts, and funding for the computer science initiative.

Following the CSCTF meeting held on February 25, 2020, Chairman Gossage moved future meetings online due to the COVID-19 crisis. State Director of Computer Science, Anthony Owen, was asked by Chairman Gossage to facilitate the committees’ work in partnership with the committee chairs. The CSCTF continued to hold monthly meetings to receive input from outside experts and formalize its findings and recommendations. The subsequent sections of this report review the progress made since the Arkansas Computer Science Initiative’s inception and present the CSCTF’s findings and recommendations to maintain Arkansas’s position as a computer science leader.

Section II. Computer Science Initiative Progress

Arkansas's computer science initiative began with the passage of Act 187 of 2015, which established the Arkansas Computer Science and Technology in Public School Task Force (CSTF). On April 3, 2015, Governor Asa Hutchinson appointed the members of the CSTF and provided them with a charge to research and recommend computer science and technology courses and standards, study the computer science and technology needs of the state, and recommend strategies to meet the anticipated computer science and technology workforce needs of the state.

In its final report, the CSTF identified four general recommendations and sixty-nine specific recommendations to enhance computer science education.¹ The state acted quickly to implement the requirements of Act 187 and the CSTF's recommendations. In mid-2015, the Arkansas Department of Education (ADE) established the Office of Computer Science which immediately began crafting a strategic plan that incorporated the work and recommendations of the CSTF.² Over the course of 2016, the State Board of Education (SBE) developed and adopted computer science standards, and school-level implementation of the standards and new computer science courses began in the 2017-2018 school year.³

Many of the CSTF's recommendations centered around increasing the number of certified/qualified computer science teachers and the number of students taking computer science courses. The remainder of this section will review the progress the state has made in achieving its program growth goals.

Increasing the Number of Credentialed Computer Science Teachers

In October of 2016, the ADE Office of Computer Science implemented a statewide training and support system to:

- increase the number of certified and qualified computer science instructors;
- support teachers and schools in their regional areas;
- create and deliver appropriate professional development; and
- expand the knowledge and skills of computer science educators to provide all students with increased opportunities.

Through this strategically planned, statewide training and support system, the number of certified and qualified computer science instructors has risen significantly. Table 1 shows the number of individuals who took the Computer Science Praxis exam and their results.⁴ The number of test takers has increased substantially since 2014, particularly in the 2016-17 and 2017-18 school years. The passing rate and median score have also increased over time, potentially indicating that test takers are more knowledgeable about computer science.

¹ For a review of the progress on each of the specific CSTF recommendations, see Appendix A.

² ADE's current strategic plan for computer science can be found at <http://bit.ly/CSforARStrategicPlan>.

³ Arkansas computer science courses and standards can be accessed at <http://bit.ly/ARCSCourses>

⁴ During the fall of 2018, the licensing test changed from Praxis test number 5651 to 5652 and the passing score changed from 159 to 142.

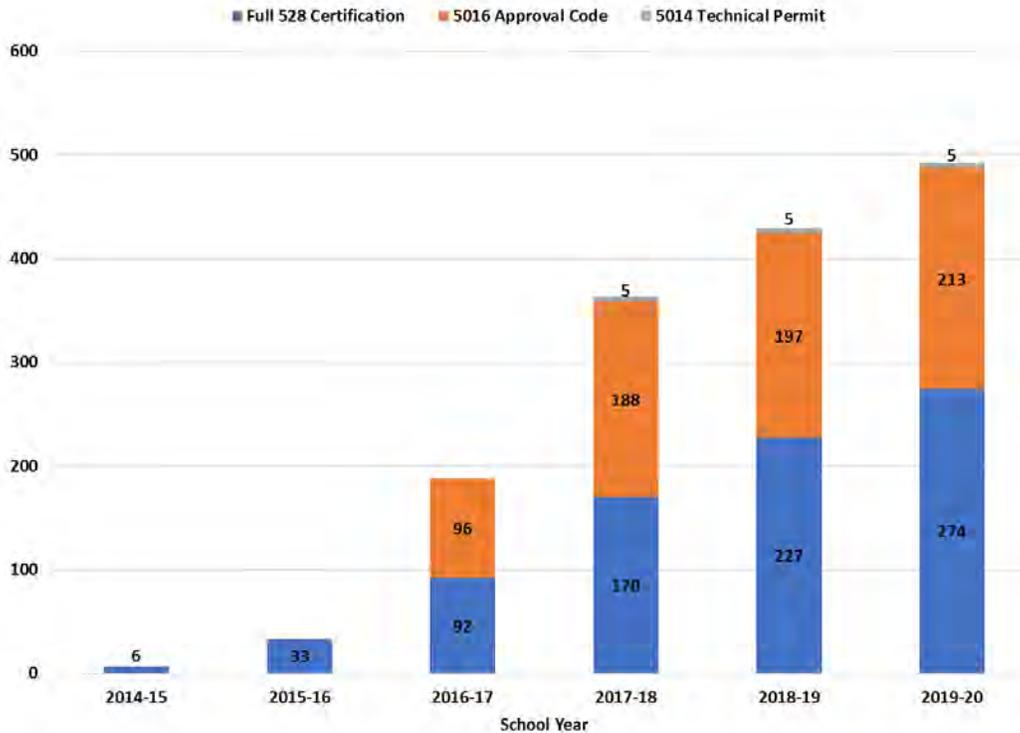
Table 1. Arkansas Computer Science Praxis Results, 2014-2020.

School Year	Number of Test Takers	Number Passing	Percent Passing	Difference between Median Score and Passing Score
2014-15	30	12	40%	-11
2015-16	68	29	43%	-6
2016-17	123	64	52%	0
2017-18	192	91	47%	-2
2018-19	73	60	82%	14
2019-20*	33	26	79%	17

* The 2019-2020 school year was interrupted by COVID 19, and as a result, there were fewer test administrations than in previous years.

Figure 1 shows that the number of credentialed computer science teachers has increased dramatically since 2014. In the 2014-15 school year, only 6 Arkansas teachers held a computer science credential, but in 2019-20, 492 teachers were qualified to teach computer science.⁵ The number of teachers who have passed the Praxis and hold a full 528 certification has also increased substantially from 6 in 2014-15 to 274 in 2019-20.

Figure 1. Arkansas Computer Science Teacher Credentials, 2014-2020.

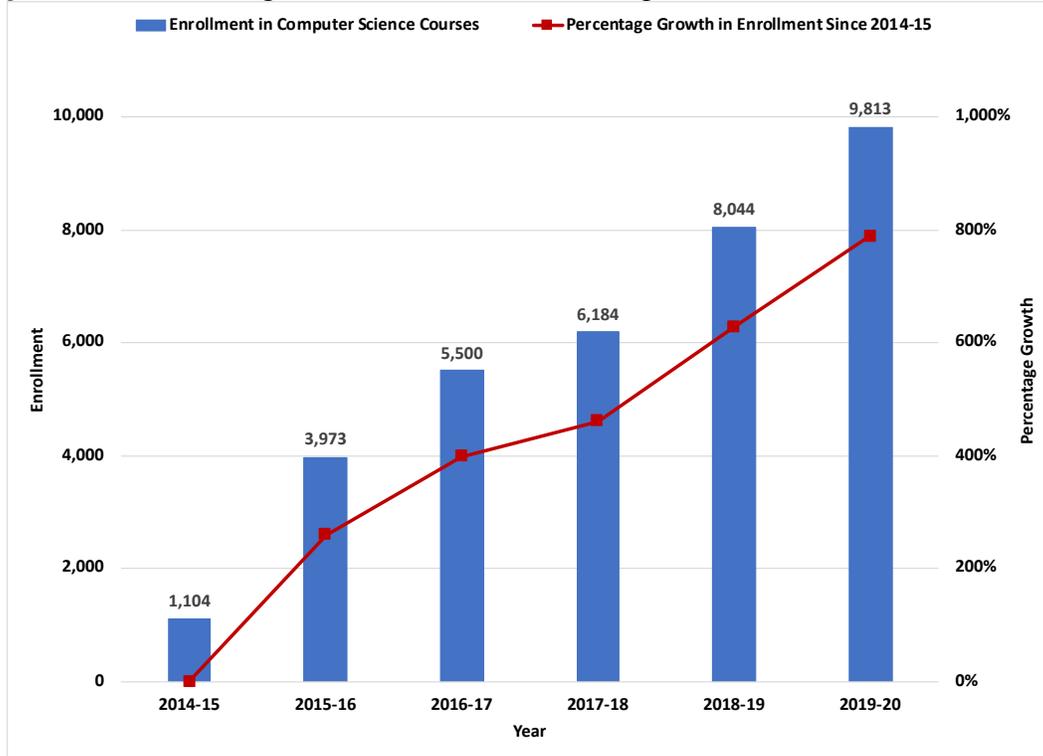


⁵ In June of 2015, the SBE adopted the PRAXIS 5651 (replaced by the PRAXIS 5652 in November 2018) Computer Science Content Knowledge assessment as the certifying test for a full high school computer science endorsement (licensure code 528) on an Arkansas Educator’s Licensure. In subsequent years, the ADE Office of Computer Science established criteria for a high school computer science approval code (5016) and a high school computer science technical permit (5014), which have been used by teachers not yet able to add the 528 full certification.

Increasing K-12 and Postsecondary Computer Science Enrollment and Credentials

As the number of credentialed computer science teachers increased, so did the number of high school students enrolling in computer science courses. As presented in Figure 2, the year before the Arkansas Computer Science Initiative began (2014-15), only 1,104 students enrolled in a baseline computer science course.⁶ In the 2015-16 school year, the first year of the Act 187 requirement, the state witnessed a 260 percent increase in student enrollment to 3,973 students. Since that initial enrollment increase in 2015-16, student enrollment has grown at an average rate of 25 percent each year. In the 2019-20 school year, nearly 10,000 Arkansas students were enrolled in computer science courses, and there were roughly 22 students enrolled for every credentialed computer science teacher in the state.

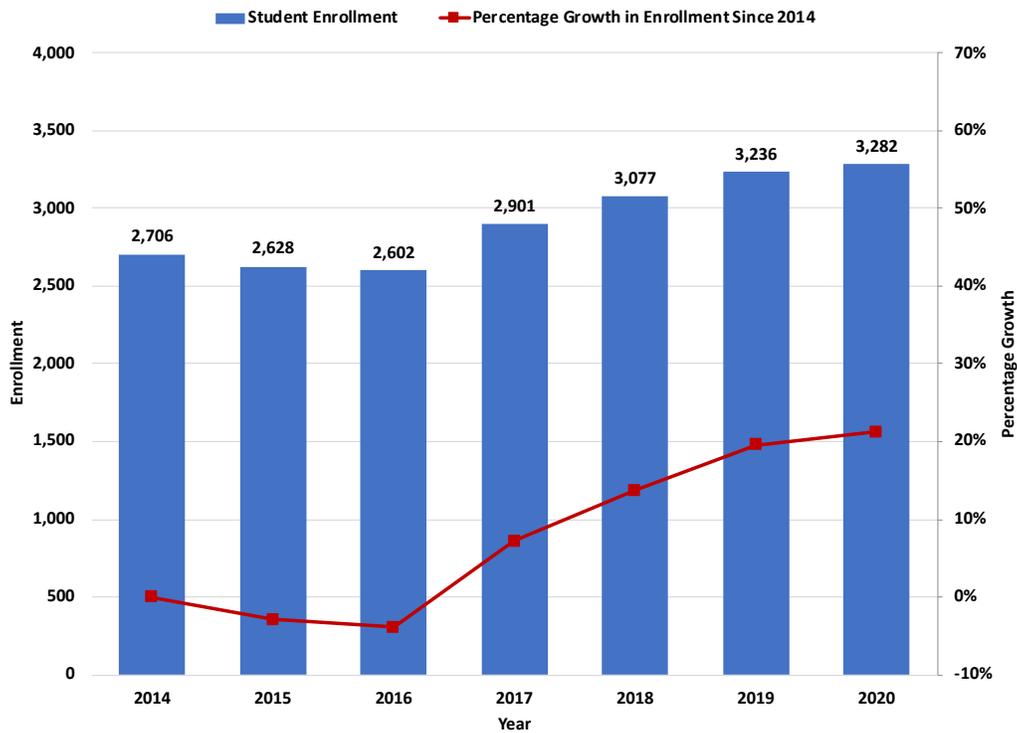
Figure 2. Arkansas High School Enrollment in Computer Science Courses, 2014-2020.



Student enrollment in computer science degree programs at postsecondary institutions in Arkansas has also been rising. As indicated in Figure 3, 3,282 students from Arkansas high schools were enrolled in a computer science degree program in 2020, a 21 percent increase from the fall of 2014. While the growth occurring in Arkansas’s higher education institutions is not as large as the high school student growth, enrollment has been climbing since 2016, and given the continued increase in enrollment at the high school level, postsecondary enrollment is likely to continue to increase in future years.

⁶ Baseline courses are defined on page 9 of the [2016 Computer Science and Technology in Public School Task Force Report](#).

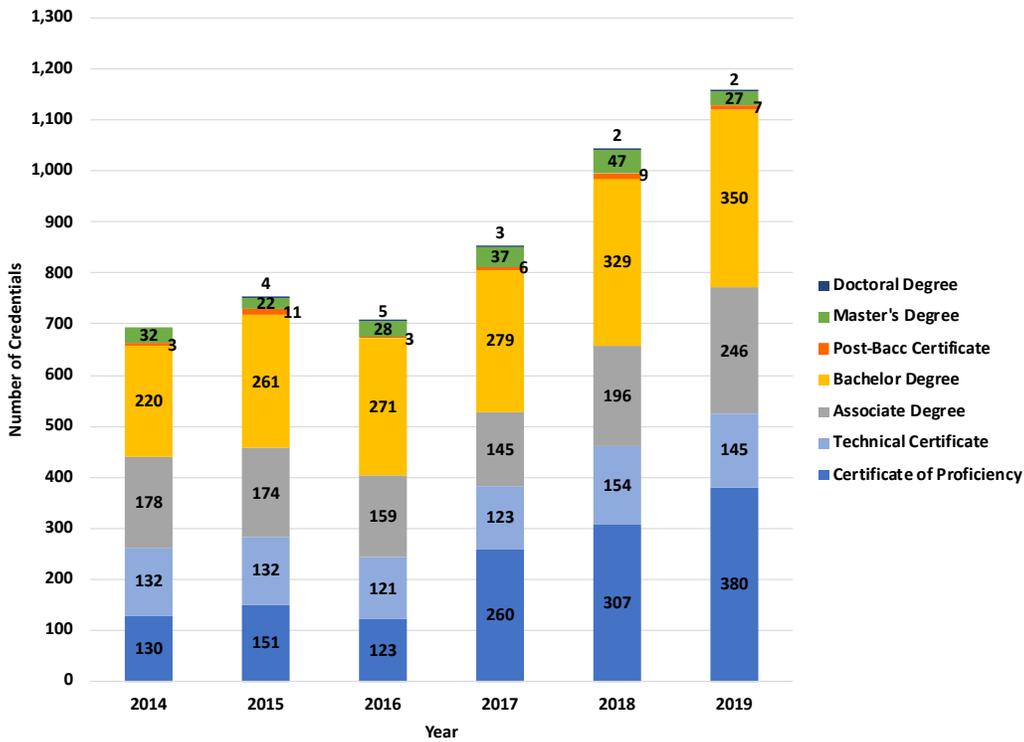
Figure 3. In-State Student Enrollment in Computer Science Degree Programs, 2014-2020.



In terms of computer science educator preparation and licensing, the Division of Elementary and Secondary Education (DESE) Office of Educator Preparation has worked with Arkansas Tech University (ATU), Henderson State University (HSU), and the University of Arkansas at Fayetteville (UofA), to develop and implement undergraduate computer science education programs. Through these programs, students can gain their initial educator’s license in computer science. Six students have completed the program, and 12 were enrolled in the 2019-20 school year.

Student computer science credential and degree attainment has also been rising in recent years. In 2019, Arkansas institutions awarded 1,157 computer science degrees or credentials to students from Arkansas high schools. As indicated in Figure 4, this total is 66 percent higher than the number awarded in 2014. The greatest increase has been in Certificates of Proficiency and Bachelor’s Degrees.

Figure 4. In-State Student Credentials in Computer Science Degree Programs, 2010-2019.



Since the beginning of the Arkansas Computer Science Initiative, the ADE Office of Computer Science has instituted a variety of programs to support and encourage teacher certification in computer science and student enrollment in computer science classes. In addition, both the Governor’s Office and the ADE Office of Computer Science have invested in marketing and outreach activities designed to increase exposure to, interest in, and the relevance of the Arkansas Computer Science Initiative. Some of the more influential programs include coding competitions, financial incentives and grants, summits and promotional videos. More detailed information about these efforts is included in Appendix B.

Section III. Task Force Findings and Recommendations

The findings and recommendations presented in this section represent the CSCTF's response to the charges provided by Governor Asa Hutchinson and Executive Order 19-17. The Task Force's twenty-one general recommendations are grouped into five broad categories:

1. K-12 Educational Pathways and Program Growth
2. Postsecondary Enrollment Growth, Program Alignment, and Credential Opportunities
3. Industry Engagement
4. Funding and Measuring Outcomes
5. Computer Science Initiative Awareness, Promotion, and Marketing

Each of the general recommendations is followed by a description of the Task Force's findings that led to the recommendation and several detailed, supporting sub-recommendations. The Task Force emphasized that the state should continue to focus on increasing diversity, equity, and inclusion around the Computer Science Initiative. Many of the recommendations include this renewed focus, but even where it is not included explicitly, the Task Force encourages the state to consider this lens when setting priorities.

K-12 Educational Pathways and Program Growth

Recommendation 1: Increase Computer Science Course Availability and Teacher Capacity

Although the number of computer science teachers has increased over the past six years, the Task Force stressed the need for Arkansas to continue increasing teacher capacity. The Task Force specifically noted the need not only to continue increasing the number of certified computer science educators but also increase diversity, geographic distribution, especially in persistent poverty counties, and knowledge beyond introductory concepts. The Task Force also stressed that there is a direct correlation between schools that employ a face-to-face certified computer science teacher and the number of course offerings, the level of those course offerings, and the number of students enrolling and completing those courses and course pathways.

To gather the perspectives of computer science educators, in April/May of 2020, the University of Arkansas's Office for Education Policy (OEP), in partnership with the Task Force, submitted a survey to the 400+ Arkansas educators that held, at that time, a computer science endorsement, approval code, or technical permit on their educator's license. The survey received 153 responses, a nearly 40 percent response rate.

The student composition in respondents' districts was relatively similar to the state as a whole. Respondents taught in districts where 41 percent of students were minority and where 57 percent qualified for free or reduced-price lunches through the National School Lunch Program, compared to 40 percent and 60 percent respectively for the state. Respondents' districts were, however, considerably larger than the average district in Arkansas. The median district in which a survey respondent teaches had an enrollment of 1,681 students, compared to the state median district enrollment of 916 students.

Sixty percent of respondents currently teaching computer science have between 2 and 4 years of experience teaching the subject, 23 percent have 5 or more, and 17 percent began teaching computer science this year. Survey respondents were nearly 90 percent white, which is equivalent to Arkansas’s overall teaching population, and were 54 percent female and 46 percent male.

Most computer science teachers reported feeling extremely or very well supported in their work, and most reported having high-quality resources available and being likely to receive funding for computer science related expenditures. Computer science teachers reported feeling that their building and district-level administrators were supportive of computer science but wanted their district’s curriculum director to do more to facilitate vertical alignment around computer science courses/concepts. The respondents also reported uncertainty about school counselors’ understanding and support for computer science courses.

Although most respondents reported feeling extremely or somewhat competent teaching computer science (78 percent), only 39 percent reported receiving a “great deal” or “a lot” of formal training in computer science, while 27 percent report receiving only a little formal training or none at all. Most survey respondents had participated in at least one CSforAR training, and 83 percent said CSforAR trainings were far or somewhat above average. Teachers reported having access to a wide array of training/professional development resources, but there were some gaps in knowledge/accessibility challenges around these resources.

When asked how to improve computer science education in the state, common answers included:

- Increase access to high-quality professional development and training – some expressed that they were not aware of some of the resources discussed in this survey;
- Rethink curriculum standards – evaluate where standards need reinforcing in multiple courses;
- Better promote computer science courses and pathways with students, especially underserved populations, in a way that aids student understanding of the subject and the opportunities the pathways present;
- Increase administrator and counselor understanding and encourage the promotion of computer science courses/pathways;
- Increase opportunities for students to get industry recognized certifications;
- Recruit and retain more highly-qualified teachers with significant formal training in computer science;
- Provide students with more experiential learning opportunities and better connection to real-world industry opportunities;
- Ensure schools have up-to-date equipment;
- Increase vertical alignment around and early exposure to computer science;
- Make computer science a graduation requirement; and
- Increase all students’ home access to high-quality internet and computing devices.

For more information about the survey results, including respondents’ suggestions for how to improve computer science education, see [Office for Education Policy Arkansas Education Report Volume 19, Issue 1](#).

To support the general recommendation above, the Task Force makes the following specific recommendations:

- 1.a Require every public high school in Arkansas to provide a pathway of at least three courses approved under the computer science and computing pathway.
- 1.b Modify the state's minimum graduation requirements to include one credit in an approved high school computer science and computing course.
- 1.c Rewrite the K-8 Computer Science Standards so that in addition to being embedded in the K-8 curriculum, a separate dedicated technology course including computer science and cybersecurity would be required for every student in each K-8 grade.
- 1.d Require every public high school in Arkansas to have a computer science endorsed or certified teacher on staff.
- 1.e Leverage and advertise the available technical permit system more widely so teachers can more easily obtain a qualification to teach CS courses.
- 1.f Consider providing additional incentives to teach CS in high-needs program areas or in traditionally underserved schools (e.g., majority minority, high-poverty, rural, etc.).
- 1.g Expedite federal student loan payoff by the state, such as \$20,000 a year for up to 5 years, for computer science and computing educators teaching in a high need geographic and/or subject area.
- 1.h Legislate a different pay scale for high school computer science and computing teachers.

Recommendation 2: Engage Computer Science Educators in Higher-Level Training

The Task Force noted that the state was lacking engagement from Arkansas educators in higher-level computer science trainings and professional development offerings. The #CSforAR / #ARKidsCanCode team currently offers advanced level training in programming, networking, and cybersecurity. Stipends of \$100 per day are provided to educators who complete these advanced trainings. Out of the 153 educators that responded to the CSCTF Educator Survey only 39 percent indicated they had significant formal training in computer science. The CSCTF hypothesized that teachers may not be participating in higher-level training because either they may not feel prepared for or perceive the need to take advanced training.

To support the general recommendation above, the Task Force makes the following specific recommendations:

- 2.a Develop an ADE policy to provide cash incentives for educators to attend advanced professional development.
- 2.b Require school districts through legislation to accept higher-level computer science training hours for salary-schedule changes.
- 2.c Increase or designate funding through the Arkansas Division of Higher Education (ADHE) Teacher Opportunity Program for current computer science teachers interested in postsecondary training and extend this funding to allow for technical certificates and master's degrees.
- 2.d Develop a system to support industries willing to share experts in computer science and computing oriented fields with schools as high-level content teachers and to serve as mentors supporting school staff working to gain higher-level content mastery.

- 2.e Provide intermediate training and mentoring through the #CSforAR / #ARKidsCanCode team for computer science educators who feel unprepared for advanced training sessions.
- 2.f Develop ADE policies that facilitate and encourage non-traditional forms of professional development relevant to computer science courses, potentially including micro-credentialing, online learning, and summer externships for teachers.
- 2.g Modify the legislation on required professional development to include computer science and computing initiative training.
- 2.h Require all principal and counselor postsecondary programs of study to include computer science and computing initiative training.
- 2.i Develop strategies to increase higher-level training participation specifically among teachers who belong to groups traditionally underrepresented in computer science fields or who teach in traditionally underserved schools.

Recommendation 3: Increase K-12 Teacher, Administrator, and Counselor knowledge about the Arkansas Computer Science Initiative

The Task Force noted that teachers, administrators, and, especially, counselors do not have enough knowledge about available opportunities/pathways in computer science and computing education, non-traditional learning opportunities, and related careers in Arkansas. The Task Force also highlighted the need for more/better resources and training around recruiting and retaining teachers and students who belong to groups traditionally underrepresented in computer science fields.

On the CSCTF Educator Survey, computer science teachers expressed the opinion that counselors do not help students understand what computer science is (54 percent), do not give the same consideration to placing students in computer science courses as other disciplines (48 percent), and do not help students understand where computer science might fit into their future studies and careers (47 percent).

While there are multiple entities in Arkansas sharing information about opportunities in computer science and computing, the CSCTF found that there is not currently one central entity that has the capacity to coordinate these connections at a sufficient scale. The Task Force noted that a new entity with significant public/private financial support may need to be established to accomplish the recommended actions.

To support the general recommendation above, the Task Force makes the following specific recommendations:

- 3.a Provide educators, including counselors, with opportunities for computer-science-related summer jobs, internships, or externships.
- 3.b Establish and maintain a speaker bureau of knowledgeable industry members to speak at meetings of counselors, teachers, and principals.
- 3.c Establish or identify an entity to help schools network and build relationships among the computer science, cybersecurity, and computing industries and ecosystems.
- 3.d Encourage companies to use internships as a front-end hiring method while working with educators.

- 3.e Facilitating public/private partnerships (i.e.; bootcamps, competitions, sponsorships) to connect students and job seekers with Arkansas industries to expand interaction and knowledge of the two environments.
- 3.f Establish a system of technology-industry virtual and in-person tours for teachers to assist in developing their understanding of what job opportunities are available in the state.
- 3.g Leverage existing state assessment systems to create proclivities and interests reports for counselors, individual students, and parents.
- 3.h Develop resources and training around recruiting and retaining teachers and students who belong to groups traditionally underrepresented in computer science fields.

Recommendation 4: Align High School Computer Science Pathways with Industry Talent Identification and Growth Best Practices

When reviewing the curriculum options for K-12 students, the Task Force noted that the initiative has opportunities for growth in getting students interested in industry-oriented pathways, and that many existing pathways are not being provided in a way that properly identifies talent and deepens the students' passion for relevant industry skill sets. The Task Force also found that the initiative could be improved by adopting industry best practices around diversity, equity, and inclusion.

The Task Force makes the following specific recommendations to better align the high school computer science pathways with industry best practices to more effectively identify and grow in-state talent:

- 4.a Create and provide a universal asynchronous curriculum and delivery system that allows students to begin training for and earning credentials in specialized fields such as computer science, cybersecurity, information technology, data science, and other high-demand areas.
- 4.b Identify industry leaders in diversity, equity, and inclusion initiatives and build partnerships to better support and create more pathways for underserved student populations.
- 4.c Increase the focus on assisting students in obtaining higher level industry-recognized certifications before leaving the K-12 system.
- 4.d Modify the state's public school accountability system (ESSA) to include indicators for computer science and computing pathway completions, with a specific emphasis on traditionally underserved student populations.
- 4.e Modify the state's public school accountability system (ESSA) to include indicators for students gaining approved computer science and computing industry-recognized certifications, with a specific emphasis on traditionally underserved student populations.

Postsecondary Enrollment Growth, Program Alignment, and Credential Opportunities

Recommendation 5: Increase Computer Science Enrollment in Postsecondary Education

According to national data, postsecondary enrollment in computer science programs is increasing.⁷ The Task Force noted that growth in computer science and computing enrollment at postsecondary institutions in Arkansas is often limited by a lack of faculty, staff, facilities, and other resources. The Task Force highlighted the need to focus particularly on increasing capacity and enrollment at community colleges and minority serving institutions to increase the computer science pathways available to all students.⁸

The Task Force makes the following recommendations to increase computer science enrollment in postsecondary programs:

- 5.a Appropriate additional funding to postsecondary institutions specifically to hire more computer science faculty.
- 5.b Expand the Computer Science Initiative's marketing efforts to focus on postsecondary opportunities.
- 5.c Develop strategies specifically targeted toward increasing computer science capacity and enrollment at community colleges and minority serving institutions

Recommendation 6: Streamline Approval Process for Standards, Courses, and Programs in Postsecondary Education

The Task Force noted that the length of time it takes to modify standards and add new programs, in both K-12 and postsecondary institutions, potentially hinders the growth of the Computer Science Initiative. For standards and programs to be reflective of evolving industry needs and advances in computer science education the process for adoption and modification of standards must be streamlined and nimble. ADE has made significant steps toward alleviating bottlenecks within K-12 by shortening the computer science standards to four years instead of seven, simplifying the course approval process, and holding micro-revision sessions for creating new standards when warranted. However, the system still results in duplicative and unnecessary work placed on those seeking approval. The Little Rock Air Force Base practice of modifying educational goals and curriculum to respond promptly based on real-time threats was cited by the Task Force as a model worthy to be emulated.

The Task Force makes the following recommendations to improve the processes and reduce the repetitiveness that educational institutions encounter when seeking approval for standards, courses, and programs:

- 6.a Identify and, as applicable, work in collaboration with the Arkansas Division of Higher Education to remove any state-imposed obstacle in the postsecondary program development approval processes.

⁷ See NCES Digest of Education Statistics [Table 318.20](#), [322.10](#), [323.10](#), and [324.10](#).

⁸ Minority serving institutions is defined in U.S. law under Title III of the Higher Education Act of 1965. <https://www2.ed.gov/about/offices/list/ocr/edlite-minorityinst.html>

- 6.b In collaboration with the Arkansas Division of Workforce Services and Office of Skills Development to identify and regularly reevaluate the most appropriate industry certifications, in terms of need and desirability, and establish course pathways that support that certification and allow additional flexibility in the state's high schools and higher education institutions' program graduation requirements to allow students to utilize related course work in place of other course requirements.
- 6.c Develop, with industry guidance, additional off-the-shelf curriculum options that schools may elect to use at no or little cost, and a parallel asynchronous online delivery system for this curriculum that allows students to independently learn at their own pace.
- 6.d Lobby for changes in the national accreditation systems utilized by Arkansas postsecondary institutions and programs to provide an easier process to certify instructors to teach specific skill sets.
- 6.e Consider allowing modifications to the state general education requirements based on students' needs and provide a system to evaluate and modify curriculum based on individual students' needs, particularly underserved minority populations.

Recommendation 7: Align Postsecondary Computer Science Pathways with Industry Needs

The Task Force noted that postsecondary educational pathways need to be established to better support talent identification and growth. The Task Force also found that postsecondary pathway and program availability needs to be communicated more effectively across local, regional, statewide, and national levels. Fewer than 10 percent of Arkansas's college graduates are earning degrees in computer science and cybersecurity compared to 20 percent nationally. To ensure that postsecondary programs are relevant to workforce needs, postsecondary pathway development must be conducted in partnership with state and regional industries.

To better align postsecondary computer science pathways with industry needs the Task Force recommends:

- 7.a Expand public and private sector partnerships to aid in program development, implementation, and in-kind support (equipment, personnel, and/or monetary).
- 7.b Increase student and teacher access to current industry hardware and software, particularly in traditionally underserved schools.
- 7.c Allow internships to count toward college credit requirements in all computer science and computing programs of study.

Recommendation 8: Expand Industry and Alternative Certifications

The Task Force noted the state should take further steps to increase the number of technology jobs in the state and ensure that its educational options are adequately preparing students for those jobs. In addition to strengthening the educational pathways at the K-12 and postsecondary levels, industry-recognized certifications, apprenticeships, endorsements, licensing, and alternative certifications should be widely utilized to increase the pool of highly qualified technology workers within the state. Arkansas and regional industries should be included in the identification of certifications and education program implementation to ensure students are gaining the necessary knowledge and skills needed to earn useful certifications and perform the associated jobs.

The Task Force makes the following recommendations regarding expanding industry and alternative certifications:

- 8.a Create, maintain, and promote a catalog of industry certifications identified in partnership with ADE (DESE, DCTE, and ADHE), educators, and industry leaders.
- 8.b Expand certification accessibility to students by establishing a system of employer and state-funded incentives for gaining high-need industry certifications.
- 8.c Establish a system through which postsecondary institutions utilize industry-recognized certifications in place of other graduation requirements.

Recommendation 9: Improve Information Sharing and Transfer of Credits

The Task Force noted that the postsecondary system of sharing credits is neither consistent nor student-friendly, often leading to its underutilization. This, along with credit transfer limits, often leads to the repetition of course work for students transferring to a different institution. In addition, the Task Force found that programs are limited at some of the postsecondary institutions because of the lack of faculty capacity or expertise in certain specialized areas.

The Task Force makes the following recommendations to improve postsecondary information sharing and student transfers of earned credits:

- 9.a Allow students to transfer all applicable credits among the state's postsecondary institutions.
- 9.b Establish and mandate implementation of a common system for all Arkansas postsecondary institutions to facilitate credit transfers and transcript evaluation.
- 9.c Establish and provide support for a system to appropriately share faculty, especially those with highly specialized skills, to support needs in other Arkansas institutions.
- 9.d Implement a state-mandated, distributed-department model for the most highly needed specialized areas, through which instruction is shared amongst various institutions and collectively contributes to a final degree.

Industry Engagement

Recommendation 10: Increase and Support Industry Engagement

The Task Force noted that industry engagement with K-16 has been limited despite their apparent interest. A lack of communication hampered the state's efforts to improve student opportunities that reflect the technological workforce needs of Arkansas. Multiple organizations are involved in the work to improve the connections between industry and education in STEM fields, but the involvement is inconsistent, and no singular entity can meet the totality of these needs.

The recommendation of the Task Force for increasing industry engagement is:

- 10.a Create, or designate, an organization with funding and support to curate, manage, and promote industry engagement by:
 - Maintaining an accessible catalog of industry certifications, apprenticeships, and internships in collaboration with the Arkansas Department of Education,

Arkansas Division of Career and Technical Education and Arkansas Economic Development Commission.

- Connecting educational entities with regional industries and assisting them in developing a partnership that is mutually beneficial.
- Connecting students with experiential learning activities such as camps, classes, and competitions.
- Identifying and communicating to schools which certifications, licenses, endorsements, and/or apprenticeships have value and are needed in the state.
- Increasing work-based learning experiences for students in computer science and computing courses by increasing business and industry partners who are collaborating to offer these opportunities; align, market, and brand this partnership with several major technology-based industry partners.

Recommendation 11: Work with Industry to Better Equip Students with Useful Skills in High-Need Areas

The CSCTF stressed the importance of equipping Arkansas students with the necessary skills in high-need areas of Arkansas and noted the recurring problem of industries recruiting out-of-state workers because of the lack of qualified candidates. The CSCTF noted that effective large-scale industry engagement is not happening, and therefore failing to properly identify the missing skills students need.

The Task Force makes the following recommendations to increase the quantity and quality of students leaving educational programs with appropriate training and skills in high-need areas:

- 11.a Increase industry engagement with state and local educational partners regarding the development of programs and requirements to create programs that can instill skill sets in students that meet the state's industrial needs.
- 11.b Expand industry-provided training programs and make those more widely available through partnerships with local educational institutions.
- 11.c Ensure scholarships are available for students to attend technical schools.
- 11.d Expand the Arkansas Futures Grant funding to be allowed to be used by students still in high school seeking associate's level training in highly specialized technical areas.

Recommendation 12: Increase Career Development and Internship Opportunities

The Task Force noted the need to improve communications and connections among industry, postsecondary education, and K-12 education. Effective communication is particularly important around internship and apprenticeship opportunities. Arkansas students and adults are under-informed about the various internship and other career development opportunities available to them, and, in turn, industries are missing opportunities to attract, recruit, and retain in-state talent.

The Task Force makes the following recommendations to increase career development and internship opportunities:

- 12.a Develop, maintain, and promote a database of internships and/or apprenticeships available to students statewide.

- 12.b Cultivate partnerships to allow for the gathering of information on and the promotion of experiential learning activities provided by industry, 2- and 4-year institutions, public libraries, maker spaces, museums, ADE, and K-12 schools.
- 12.c Develop, maintain, and promote an outreach program that utilizes social media to promote employment opportunities with Arkansas industries.
- 12.d Increase focus on and funding for career development, career choice mentoring, and marketing at the K-12 level.
- 12.e Support and encourage Arkansas-based industries to:
 - host computer science and computing events at schools;
 - assist in the development and implementation of K-8 real-world learning activities;
 - provide new internship summer job opportunities;
 - develop and support initiatives aimed at increasing workforce diversity to succeed in a global marketplace; and
 - gather and disseminate information on their workforce needs, including essential skills and certifications.

Recommendation 13: Develop Work-Based Learning Opportunities

The Task Force noted a shortage of individuals with skills in specialized technical areas of high-need in Arkansas. Industry currently must invest heavily in training new hires, resulting in significant downtime/productivity losses.

The Task Force makes the following recommendations to improve work-based learning programs:

- 13.a In collaboration with the Arkansas Division of Workforce Services and Office of Skills development, identify and update as necessary coursework and industry certification training to be aligned with industry needs.
- 13.b Encourage employers to offer compensation incentives for earned industry certifications.
- 13.c Expand K-12 and Workforce Centers capacity to offer industry-recognized certifications.
- 13.d Establish a system through which high school and postsecondary institutions utilize industry-recognized certifications in place of other graduation requirements.
- 13.e Establish a system through which the state ranks and recognizes employers of choice based on several criteria, such as training provided; compensation for certifications, licensing, and/or apprenticeships; K-12 and Technical School partnerships; and technical education.

Recommendation 14: Establish Financial Incentives to Attract and Retain Employers and Highly Qualified Workers

The Task Force noted that Arkansas has missed several job creation opportunities because many Arkansas companies have opened computer science and cybersecurity centers out of state. These industries have cited the unavailability of a sufficient talent pool in Arkansas as the motivation behind locating those jobs out of state.

The Task Force makes the following recommendations for providing financial incentives to attract industry:

- 14.a Create financial and other beneficial systems to attract and maintain talent, including:
 - Create a mechanism to pay back student loans or provide incentives to businesses to pay off student loans for their employees based on the employee's tenure working in Arkansas.
 - Focus on policies that entice remote workers to move to Arkansas.
 - Expand efforts to educate students, especially those belonging to underserved groups or who live in rural communities, about local computer science job opportunities, including both in-person and remote work.
- 14.b Establish and maintain funding for internship support for Arkansas workers to support their transition to computer science and computing jobs.
- 14.c Expand the state's tax and other financial benefits for tech companies to relocate and remain in Arkansas.
- 14.d Create a tech-focused tactical team to study applications with the state for business licenses, job postings, commercial real estate development, and development council work in other states to inform state efforts in legislation, regulation, and funding and to provide proactive outreach to attract businesses to Arkansas.
- 14.e Concentrate on developing Arkansas as a Cyber Hub for the central U.S. by creating cross-industry, collaborative cybersecurity training centers.
- 14.f Increase work-based learning experiences for students in computer science and computing courses by increasing the number of collaborating business and industry partners to offer these opportunities; align, market, and brand this partnership with several major technology-based industry partners.

Funding and Measuring Outcomes

Recommendation 15: Ensure the Continuity of Funding for the Computer Science Initiative and Career Resources

The Task Force expressed significant concern about potential negative consequences if dedicated state and federal funding for the Computer Science Initiative and other career development programs were reduced or eliminated. The Task Force acknowledged that the current COVID-19 crisis could create new budgetary challenges for local, state and federal governments; however, the Task Force believes that the Arkansas Computer Science Initiative is important to the state's long term success and that the state should take steps to ensure that the initiative can be sustained through the crisis.

The Task Force makes the following recommendations to ensure the continuity of funding for the Computer Science Initiative:

- 15.a Legislate the establishment of funding to support the increase in the number of Arkansas workers in the field of computer science and cybersecurity.
- 15.b In collaboration with other state departments, establish incentive funding for computer science and cybersecurity job creation to leverage for private industry matching.

- 15.c Establish a computer science infrastructure fund through the support of industries and the Department of Commerce to be funded over time to reach \$20 million that will be used for establishing co-investments with existing and new Arkansas tech-based industries.
- 15.d Expand the development of the Arkansas Center for Data Science as recommended by the task force on Advancing Competitiveness in Data Analytics and Computing in Arkansas.
- 15.e Expand the mission of the existing Arkansas Research Alliance organization in bringing industry and institutions of higher learning together to focus on and make recommendations for improvement of computer science worker development and research innovation in computer science for Arkansas.

Recommendation 16: Increase Connectivity along the Student Pipeline

The Task Force acknowledged the need for better connections between computer science programs/pathways as students transition from middle school to high school; high school to college or career; and college to career. The state’s longitudinal data system does not currently adequately support the analysis needed to properly identify the barriers and deficiencies in the student pipeline.

The Task Force makes the following recommendations to address the fluidity in the student pipeline:

- 16.a Reevaluate ARtechjobs.com and identify ways to improve, expand, and maintain the website to better inform users about education programs, available jobs, and to build statewide awareness of computer science and cybersecurity.
- 16.b Build a statewide longitudinal data system connecting education and workforce data to better understand the breaks and deficiencies in the student pipeline.
- 16.c Leverage the existing state assessment systems to create proclivities and interests reports for counselors, individual students, and parents.

Recommendation 17: Build a Statewide Longitudinal Data System (SLDS) Linking Education and Workforce Data and Increase Policy-Relevant Research

Arkansas has one of the best K-12 data warehouses (<https://myschoolinfo.arkansas.gov/>) in the nation as well as detailed data on students in the state’s Pre-K program and institutions of higher education. The state does not, however, routinely link K-12 student data to postsecondary activities/outcomes like higher education enrollment and completion, employment, and wages. This gap in the state data system severely limits the state’s ability to evaluate the effectiveness of various components of the Computer Science Initiative, to understand its impact on traditionally underserved student populations, or to improve effectiveness over time. The Task Force was provided with data showing an increase in postsecondary computer science and computing-related programs and enrollments, but there was insufficient information to rigorously link these increases to the state’s K-12 work.

To support the general recommendation above, the Task Force makes the following specific recommendations:

- 17.a Provide funding to expand the state's longitudinal data capacity possibly within the Division of Information Services in coordination with the state's Chief Data Officer.
- 17.b Build the state's capacity to use linked, longitudinal data to improve program efficiency and effectiveness.
- 17.c Routinely conduct research regarding the impact of the Computer Science Initiative on postsecondary outcomes including higher education and the workforce, particularly for traditionally underserved student populations.
- 17.d Routinely evaluate the effectiveness of spending on the Computer Science Initiative.
- 17.e Consider long-term funding of novel data-driven solutions including:
 - i) a state-provided and sponsored digital resume system in which educational data can be uploaded by the state K-12 and higher education systems; and
 - ii) a state-issued common access card using blockchain to provide for information sharing.

Computer Science Initiative Awareness, Promotion, and Marketing

Recommendation 18: Increase Stakeholder Awareness

Every Task Force subcommittee identified a lack of awareness of the Computer Science Initiative among stakeholder groups as a challenge. The Task Force noted the value of having different strategic partners promoting Governor Hutchinson's Computer Science Initiative but highlighted that a more methodical approach to the marketing campaign is needed to advance the goals of the initiative.

Recommendations for creating an effective awareness campaign for the Arkansas Computer Science Initiative:

- 18.a Clearly communicate/promote the ADE Office of Computer Science's role as the special projects office of ADE and the Office of the Governor leading the Computer Science Initiative and tasked with coordinating all state agency efforts supporting the initiative.
- 18.b Utilize a portion of the Office of Computer Science budget to fund a fully developed marketing campaign to better inform students, parents, and education stakeholders about the Computer Science Initiative and to promote computer science-related opportunities available both in Arkansas and beyond.
- 18.c Develop strategies to increase awareness of the Computer Science Initiative among traditionally underserved groups and to partner with and spotlight companies and industry representatives who reflect diversity.
- 18.d Create a dedicated communications and marketing position within the ADE Office of Computer Science, under the direction of the State Director of Computer Science, to coordinate Computer Science Initiative-related marketing and communication activities across state government.

- 18.e Continue, support, and grow novel awareness, public relation, and knowledge-building events about the initiative such as but not limited to:
- Governor Asa Hutchinson’s Computer Science Coding Tours
 - State-sponsored computer science and computing-related competitions
 - Computer science and computing signing days
 - Industry hosted hackathons, and
 - Statewide or regional job fairs.

Recommendation 19: Increase Cybersecurity Knowledge and Awareness

The Task Force stressed an ongoing and growing concern for the economy of Arkansas is lack of cybersecurity awareness and knowledge across multiple sectors and populations. The Task Force noted that the lack of cyber awareness partially stemmed from school administrators, especially guidance counselors, and faculty not being aware of the advantages of being instructed in cybersecurity concepts.

The Task Force makes the following recommendations to increase cybersecurity awareness in the state:

- 19.a Provide funding for regular cybersecurity training for administrator licenses, including guidance counselors and curriculum specialists.
- 19.b Expand the requirement for Security Mentor training beyond state employees to everyone that accesses a state Division of Information Services system.
- 19.c Establish the “Governor Asa Hutchinson Cyber Egg Hunt.” This cyber hunt would be a digital “Easter egg” hunt open to any Arkansas resident in which the participants would have to perform legal actions to follow a set of digital clues to find the Cyber Egg. Partner organizations, including the state, would provide a significant monetary prize along with a guaranteed paid internship with that partner organization.
- 19.d Support events that intentionally bring together diverse companies and students and serve as interactive “job fairs” where industry representatives and students can interact in person.
- 19.e Create a unified campaign to promote awareness and educate the public about cyber hygiene.

Recommendation 20: Expand Efforts to Increase Early Student Interest in Computer Science and Promote Diversity

The Task Force discussed that engaging students at an early age/grade would help increase all students’ interests in computer science and cybersecurity. The Task Force also believes that exposing students to computer science in grades K-8 would help promote diversity, equity, and inclusion in enrollment and participation and would also help students understand and work toward more diverse computer science pathways.

The Task Force makes the following recommendations to increase early student interest in computer science and computing fields and to broaden participation among traditionally underserved populations:

- 20.a Rewrite the K-8 Computer Science Standards so that they are no longer allowed to be fully embedded and require every K-8 student to take a dedicated technology course in each grade level.
- 20.b Expand the state’s efforts to promote diversity in computer science including:
 - Training teachers, administrators and counselors to recruit for diversity;
 - Developing equity focused curriculum;
 - Offering equity focus professional development;
 - Highlighting diverse students’ computer science achievements; and
 - Including diversity-related criteria in the computer science teacher awards.
- 20.c Support schools and industries to make computer science and computing as exciting as sports by, for example:
 - Hosting and promoting high-profile events/competitions showcasing students’ computer science skills; and
 - Holding “National Signing Day” style events celebrating students when they receive an internship or apprenticeship, are hired by a tech company, or receive a scholarship to study computer science.
- 20.d Support and expand immersive summer computer science and computing camps (or bootcamps) for students, especially those that belong to traditionally underserved groups.
- 20.e Establish a listing of industries offering tech tours for teachers and students, virtually or in person, to help them learn more about the computer science and cybersecurity opportunities available in Arkansas.

Recommendation 21: Connect Available Jobs and Applicants

The Task Force noted a disconnect between preparing students for a career in computer science and having the mechanisms in place to readily connect graduates to job opportunities. Numerous task force members emphasized that the state is promoting the Computer Science Initiative in K-12 and postsecondary educational systems but that those efforts may be squandered if the state does not have computer science careers available for those students upon graduation. The Task Force believes that, as a complimentary effort, the state must also work to attract computer science industries to Arkansas and to connect students to job opportunities.

The Task Force makes the following recommendations to better connect available jobs and applicants:

- 21.a Develop, maintain, and promote social media channels dedicated to listing companies that are actively seeking tech employees and/or post available tech internships available in Arkansas.
- 21.b Develop, maintain, and promote a robust career portal in partnership with an appropriate entity.
- 21.c Create an incubator or bootcamp model that identifies students, especially those who belong to underserved groups, who show talent in STEM fields and complete high

school computer science courses to receive targeted upskill training with experienced tech industry talent.

- 21.d Promote formalized internship programs as a bridge between higher education and industries, especially for students who belong to traditionally underserved groups.

Appendices

Appendix A: Progress on Prior Task Force (CSTF) Recommendations

In its final report, the CSTF identified seventy-three recommendations (see table below). The assessments of progress in the table below were compiled by the ADE Office of Computer Science.

Recommendation	Not Started	Ongoing	Met
The Commissioner of Education at ADE begin the development process for comprehensive K-12 Computer Science Standards			X
The ADE use the Computer Science Teachers Association (CSTA) K-12 Standards as a guiding document for the state's standards development			X
ETS begin the development of a multistate PRAXIS II for computer science based in modern standards as soon as possible			X
As schools are implementing first-year computer science courses/experiences that the students are engaged in actual programming as quickly as possible in the course work, instead of an extended recitation of theory before hands-on experience.		X	
Meet the Code.org 8 Policy Suggestions ⁹			X
Establish a system appropriate and continued communication about computer science and the opportunities it presents for jobs and economic development in order to sustain the momentum of the current progress. ¹⁰			X
Move from a disjunct system of courses and programs to a comprehensive systematic K-16 progression of courses. ¹¹		X	
Develop success-measurement criteria. ¹²		X	X
Increase the quantity and quality of computer science educators. ¹³		X	X
Identify resources that are most critical to the success of the initiative. ¹⁴		X	

⁹ Arkansas met numbers 2, 4, 5, 6, 7, and 8 in 2015 and numbers 1 and 3 in 2016. In 2017, when Code.org expanded its list to 9, Arkansas was the first state to implement that suggestion, and was the only state to do so until mid-2018.

¹⁰ While this communication system continues to evolve and grow, it has included numerous videos, social media buys and presence, theater advertising, listserv communications, commissioner's memos, continued state and national presentations on the initiative, support of the Governor's CS tours, etc. The ADE Office of Computer Science has procured a video production system that allows for easier ability to capture and livestream CS-related events. In 2019, the ADE Office of Computer Science worked with Eric Rob & Isaac to produce a 5-year report "[Cracking the Code: How Arkansas Became a National Leader in Computer Science & Computing.](#)"

¹¹ K-12 has been met; however, there is still work to be done with the transition from high school to postsecondary.

¹² This has been met, but will continue to be ongoing and changing as the initiative evolves.

¹³ This has been met, but will continue to be ongoing. Since the beginning of the initiative, the State has gone from about 20 CS teachers to more than 400 certified or endorsed, and have provided CS training to more than 15,000 Arkansas educators.

¹⁴ This goal does not have a definable conclusion, but remains a focus of the ADE Office of Computer Science.

Recommendation	Not Started	Ongoing	Met
Arkansas-based industries provide support for the initiative and guidance regarding their workforce needs. ¹⁵		X	
ADE begin the development process for comprehensive K-12 Computer Science Standards ¹⁶			X
ADE use the CSTA K-12 Standards as a guiding document for the state's standards development ¹⁷			X
Encourage and support the development of a multistate PRAXIS II for computer science based in modern standards. ¹⁸			X
Within 5 years that at least 20 percent of all Arkansas public high school students take at least one high school computer science course by graduation. ¹⁹			X
100 percent of all Arkansas students are shown a promotional video in school each school year supporting the taking of a computer science course. ²⁰		X	
There are at least four events around the state with statewide and/or national partners on an annual basis. ²¹		X	X
Increase the number of schools offering computer science courses face-to-face in the school with a recommendation to provide incentives to school districts to encourage participation. ²²		X	X
Provide incentives by providing/funding certification costs to teachers, stipends to teachers, scholarships to students, and student loan forgiveness for computer science teachers. ²³		X	X

¹⁵ Arkansas-based industries have played a role in the initiative by providing: funding and other in kind support, guidance on courses and standards, and promotion.

¹⁶ Developed in 2016 and fully implemented in 2017-2018 school year.

¹⁷ In addition the ISTE standards, other guidance documents, and in-person industry expert support was used to write the standards.

¹⁸ The ADE Office of Computer Science and State Director of Computer Science utilized multiple methods of encouragement. In 2016, the State Director of Computer Science served on the Praxis Computer Science National Advisory Committee which began the work. In 2018, Arkansas adopted the new 5652 CS Praxis.

¹⁹ It was calculated that based on Arkansas enrollment numbers, this would require approximately 7,500 individual students enrolling in CS each year. In 2018-2019, four years in, the state exceeded that number by having more than 8,000 individual students enrolled.

²⁰ Efforts are being made to support this; however, unless there is a regulatory requirement, it is probably not a realistic and/or measurable goal.

²¹ This is in place, but continues to be an ongoing focus for growth. Examples: Regional/State Coding Comp, Girls of Promise Coding Event, NICERCs robotic competition, Girls Who Code Camps, 4H/Girl Scout/Boy Scout Coding and Computing events.

²² In 2018-2019, out of the 294 Arkansas High Schools, 280 (95 percent) had at least one student enrolled in an ADE-adopted CS course.

²³ As of May 2020, more than \$200,000 in HS - CS incentives have been provided to Arkansas High School Teachers, more than \$200,000 in K-8 Lead CS incentives have been provided to Arkansas K-8 Teachers, and more than \$150,000 has been provided for various other incentives (e.g. CS Educator of the Year, CSTA Conference Sponsorships, Licensure and Praxis reimbursements).

Recommendation	Not Started	Ongoing	Met
Increase the number of public/charter high schools with a licensed or endorsed computer science teacher qualified to teach the measured computer science courses to 95 percent by the 2020-2021 school year. ²⁴		X	
Increase total enrollments in all other high school level computer science courses. ²⁵		X	X
Increase enrollments in concurrent computer science courses. ²⁶		X	X
Increase the number of jobs in computer science within Arkansas. ²⁷		X	
Increase the number of students graduating from computer science certificate and degree programs at Arkansas colleges and universities. ²⁸		X	
ADE should continue working with STEM Centers, Educational Service Co-ops, ACE and other entities to identify and recommend Professional Development (PD) and curriculum options for teachers who would deliver the new ADE computer science courses (Code.org, Microsoft IT Academy, etc.). ²⁹			X
ADE should start providing recommendations regarding programs/PD that are designed to help with Praxis preparation. ³⁰			X
ADE should re-evaluate the Computer Science PRAXIS cut score and consider a more flexible range for current teachers attempting to gain certification this year and next (until further recommendations for test modifications are implemented). ³¹			X
ADE and ADHE should recommend that postsecondary institutions develop teacher-specific computer science content programs as part of new teacher education. ³²			X
ADE should request that Arkansas Higher Ed institutions develop summer instructional institutes for current teachers to prepare for the PRAXIS computer science exam. ³³			X

²⁴ Still in progress; however, Arkansas now has enough secondary-certified CS teachers to have at least one in each high school.

²⁵ Have seen an increase in higher level courses including significant growth in AP; however, it is still an ongoing goal.

²⁶ Have seen an increase in concurrent enrollment and programs; however, it is still an ongoing goal.

²⁷ The Arkansas Office of Data Science continues to pull these numbers.

²⁸ Data provided by ADHE.

²⁹ The Office of Computer Science and the Statewide Specialists have built out a robust PD system in partnership with most of these entities.

³⁰ The Office of Computer Science and the Statewide Specialists created and provide training in all ESCs year round for this purpose; we have created a study pathway on ArkansasIDEAS, and have created/compiled several resources free for teachers and placed on the ADE website.

³¹ ADE did adopt a more flexible cut score for the 5651; over the life of the 5651 (06/15 through 11/2018) Arkansas had 352 test takers and 194 (55 percent) received a passing score.

³² Four CS Ed Prep Programs have been approved (ATU, HSU, UA Fayetteville, UCA). One additional is in the approval process (UAPB).

³³ UA Fayetteville has been providing this under their TACT grant from 2016 through 2019.

Recommendation	Not Started	Ongoing	Met
ADE and ACE should work together closely in implementing computer science programs and recommendations of the CSTF. Align computer science education offered through ADE and ACE grades 9-12. ³⁴			X
ADE should include AP Computer Science Principles as a course that meets the school's Act 187 legislative requirement to offer a computer science course for the 2016-2017 school year. ³⁵			X
ADE should allow districts to approve computer science PD hours that can count toward Alternate Licensing Plan (ALP) requirements for computer science certification. Determine an acceptable mix of contact hours and self-study w/ online resources (MOOCs, professional training services, summer institutes) ³⁶			X
Expand PD focus to include lower grade levels. ³⁷			X
Develop resources and training to aid teachers in integrating computer science into K-8 curriculum as well as to prepare for the 9-12 courses. ³⁸			X
ADE and ACE should solicit feedback from teachers who are currently teaching computer science in the state on the effectiveness of professional development opportunities and on what other resources are needed to prepare them to teach new courses in computer science. ³⁹			X
Create and implement a teacher professional development program utilizing the state's postsecondary and other qualified institutions to provide appropriate, yet rigorous, computer science training for 3,000 K-12 educators per year for 5 years. ⁴⁰		X	
Create and implement a workforce retraining plan for individuals already in the workforce but needing/desiring additional computer science skills. ⁴¹		X	
ADE, ACE, and ADHE work to align secondary and postsecondary standards to allow for continued growth of students transitioning from the K-12 to the postsecondary environment. This should include a reevaluation of postsecondary requirements and a push for K-12 schools to seek postsecondary credit opportunities for computer science work being completed in the K-12 environment. ⁴²		X	

³⁴ The collaborative work of ADE and ACE in creating a unified system in CS education has been recognized by Code.org as a national model and was featured in their whitepaper (co-authored by Dr. Katie Hendrickson of Code.org, Anthony Owen, and Tim Johnston of ACE).

³⁵ Since its creation, it has met the Act 187 requirement for schools.

³⁶ This was met, but not how the CSTF envisioned. It was met through the creation of the CS Approval Code system which does allow a teacher with an approval code that can be earned through approved PD.

³⁷ Met through the K-8 Standards, Coding Block for Grades 7 & 8, and the creation and implementation of the K-8 Lead Teacher Program.

³⁸ Developed and provided by the ADE Office of Computer Science and the Statewide Computer Science Specialist team.

³⁹ Collected via various surveys and other feedback loops by the ADE Office of Computer Science and the Statewide Computer Science Specialist team.

⁴⁰ The ADE Office of Computer Science and the Statewide Computer Science Specialist have provided CS standards based training to more than 8,000 Arkansas educators. This number does not include training provided by other entities.

⁴¹ Individual efforts / programs have been implemented, but a systematic plan has not been developed or implemented.

⁴² This is an ongoing effort and the postsecondary component is a focus moving forward.

Recommendation	Not Started	Ongoing	Met
Increase in-service professional development opportunities provided by ADE/ACE; Education Service Cooperatives; STEM centers; Arkansas School for Mathematics, Sciences, and the Arts; local districts, and other interested parties ⁴³			X
Increase the number of public/charter high schools with a licensed or endorsed computer science teacher qualified to teach the measured computer science courses to 95 percent by the 2020-2021 school year with the following yearly benchmark goals: 10 percent in 2016-2017; 20 percent in 2017-2018; 40 percent in 2018-2019; 60 percent in 2019-2020; and 95 percent in 2020-2021 ⁴⁴		X	
Amend ADE Licensure Competencies to include computer science, based on the adopted K-12 Computer Science Standards. ⁴⁵			X
Modify all existing K-12 teacher education preparatory programs to include pre-service in computer science education. ⁴⁶		X	
Employ a staff member, within each STEM center, designated to assist with computer science education. ⁴⁷	X		
Encourage the Arkansas STEM Coalition to develop a job posting site either as part of their website or link to one that can focus on local STEM-oriented job opportunities for Arkansas students. ⁴⁸			X
Assist in funding/expanding the annual Computer Science Summit. ⁴⁹		X	
Provide up to \$750,000.00 for teacher professional development educator scholarships payable to programs approved by ADE. Individual scholarships are not to exceed \$2,500.00. ⁵⁰			X
Make available through a grant process, up to \$375,000.00 for school curriculum development/purchase. Individual schools grants are not to exceed \$2,500.00 and should not include the purchase of equipment. ⁵¹		X	
ADE should investigate the potential impacts and benefits of changing the state's graduation requirements to include a high school credit in computer science for		X	

⁴³ The ADE Office of Computer Science and the Statewide Computer Science Specialist provide PD at no charge to teachers in all ESCs and at ASMSA yearly, at STEM Centers as appropriate, and in other locations as necessary.

⁴⁴ Inquiries into the ability to reliably and effectively pull this data have been made.

⁴⁵ CS competencies are being included in all K-8 teacher competencies and other appropriate HS teacher competencies.

⁴⁶ This is being accomplished through the changing of the teacher competencies.

⁴⁷ In 2019, ADE stopped funding STEM Center Specialists. The Statewide CS Specialists are housed within Educational Service Cooperatives across the state.

⁴⁸ The Arkansas STEM Coalition did not develop this site, but it was developed in partnership with ARCodeKids <https://artechjobs.com/>.

⁴⁹ This summit was in place in 2015 through 2018. In 2019, ADE stopped funding individual content area summits and instead absorbed this summit into the ADE Summit.

⁵⁰ This was met in 2016 with the PD program grants; however, since then more than \$1 Million per year has been spent on providing PD for Arkansas educators.

⁵¹ There have been various programs for school curriculum purchases.

Recommendation	Not Started	Ongoing	Met
all students and work with the Governor’s office to determine if and when such a requirement change is warranted for Arkansas students. ⁵²			
ADE should continue employing a Computer Science Coordinator within the Commissioner’s Office. ⁵³			X
ADE should employ a curriculum specialist and professional development specialist highly qualified in computer science. ⁵⁴			X
ADE should assign a teacher recruitment and retention specialist to focus primarily on computer science.	X		
Arkansas Career Education (ACE) should continue employing a STEM Coordinator who is highly qualified in computer science.			X
Arkansas Department of Workforce Services and the Arkansas Department of Higher Education should each designate a contact within their agency who will field computer science inquiries and direct those inquiries to the ADE Computer Science Coordinator or other appropriate entity.		X	
The state should continue efforts to expand the availability and increase statewide speed of broadband internet services for educational institutions and Arkansas residents. ⁵⁵			X
The state should actively work to attract nationally recognized coding competitions to Arkansas. ⁵⁶		X	
ADE should amend K-8 educator competencies to include computer science.			X
AETN should continue providing Arkansas educators with access to Lynda.com. Assessments required for teachers to gain recognized professional development hours should be developed. ⁵⁷		X	X
The state should expand awareness opportunities and consider a professional public relations campaign. ⁵⁸		X	X
The state should explore additional options, continue providing information on existing student loan forgiveness programs for computer science teachers, and	X		

⁵² ADE has continued conversations about graduation requirements. It is the suggestion of the ADE Office of Computer Science that we institute a credit requirement for beginning with the 2024 senior graduates.

⁵³ Title changed to State Director of Computer Science, but the position is still in place and filled.

⁵⁴ These are not state employee positions, but the goal is met through the nine statewide computer science specialists.

⁵⁵ All Arkansas schools were connected to broadband in 2018.

⁵⁶ In 2016, we did host HP’s Codewars; however, since then our State coding competition has been sponsored by Verizon.

⁵⁷ It is now rebranded under LinkedIn Learning, but is still available. Assessments for numerous CS pathways/courses have been developed.

⁵⁸ While this communication system continues to evolve and grow, it has included numerous videos, social media buys and presence, theater advertising, listserv communications, commissioner’s memos, continued state and national presentations on the initiative, support of the Governor’s CS tours, etc. Most recently the ADE Office of Computer Science has procured a video production system that allows for easier ability to capture and livestream CS-related events.

Recommendation	Not Started	Ongoing	Met
expand the funding of student loan forgiveness programs for computer science teachers who are teaching in the classroom. ⁵⁹			
Computer science should be added as a critical shortage area at the state level.			X
Teacher Opportunity Program (TOP) funding should be made available for computer science education.			X
The regulations for state-funded scholarships for students seeking STEM degrees, including computer science, should include a higher threshold for initial award, but increased flexibility to maintain the scholarship for students that continue STEM degree work. ⁶⁰	X		
Each ESC should have an individual on staff designated to assist with computer science education within their region. ⁶¹		X	
The Central Arkansas districts, that are not members of an ESC, should have an individual on staff designated to assist with computer science education within their region. ⁶²			X
All postsecondary teacher pre-service programs should include instruction in computer science education taught by a postsecondary computer science instructor. ⁶³		X	
Virtual Arkansas should continue providing computer science instruction; schools should be assessed the normal fee for services beginning once schools have had ample opportunity to improve teacher capacity in computer science. Beginning with the 2017-18 school year, any funding provided for Virtual Arkansas from the state and specific to computer science should only be provided to schools that either have a computer science licensed educator on staff instructing at least one section of computer science in a face-to-face model by the end of the school year. ⁶⁴		X	
ESCs, STEM Centers, and districts should host coding competitions for the students in their area or district. ⁶⁵			X
Arkansas industries/businesses should commit to integrating an internship/mentorship program for secondary and postsecondary students.		X	

⁵⁹ The Federal Public Service loan program and other existing loan forgiveness programs are in place; therefore, this has not been a high-priority item.

⁶⁰ Other scholarship and free postsecondary opportunities have taken the place of this goal.

⁶¹ There are nine CS specialists spread around the state. They assist all ESCs.

⁶² This is part of the Lead CS Specialist's duties as of 2019.

⁶³ This is part of the conversation the state IHEs, ADE, and ADHE, are having regarding CS requirements for postsecondary work.

⁶⁴ Funding to Virtual Arkansas is continuing, but discussions are in place to remove that funding after the 2019-2020 school year.

⁶⁵ The regional coding competitions are held in every ESC in the state each year. In addition, other competitions are being held across the state.

Recommendation	Not Started	Ongoing	Met
Arkansas Economic Development Commission should designate outreach personnel specifically employed to support Arkansas's Computer Science Initiative. ⁶⁶	X		
Arkansas businesses and industries should partner with local districts to provide students with opportunities and the support needed to elicit student solutions to real-world problems.		X	
Arkansas businesses should provide internships in computer science disciplines.		X	
Local entities should partner to provide after-school computing activities and coding workshops for students. ⁶⁷		X	
The Arkansas Computer Science Teachers Association should continue its work to provide information to Arkansas computer science educators and provide suggestions to the proper entities to assist in the growth of the initiative. ⁶⁸		X	

⁶⁶ This was in place at one point.

⁶⁷ The state has witnessed and supported some of this through the Boys and Girls Clubs, some faith-based after school programs, and other non-profits.

⁶⁸ CSTA Arkansas and its leadership continues to be great partners for the state CS initiative.

Appendix B: Additional Programs Provided to Support the Arkansas Computer Science Initiative

The state provides all #CSforAR / #ARKidsCanCode professional development at no cost to teachers or schools. In addition, numerous bonus and reimbursement programs have been provided to assist and entice educators to become fully certified in computer science and gain additional expertise.

Support for Teachers

1. Arkansas High School Computer Science Teacher Endorsement and Instruction Bonus Program - any Arkansas High School Computer Science Educator who holds the 528 Computer Science Endorsement on his/her Arkansas Educator's License and is the teacher of record of an ADE approved high school computer science course that has at least 2 percent of the total high school (grades 9-12) student population, or at least 10 students, enrolled is eligible for up to \$10,000 in bonuses over five years, up to \$2,000 per year. Initially, \$200,000 was provided by ARCodeKids to facilitate this bonus program upon its creation. Arkansas has allocated up to \$500,000, of the ADE Office of Computer Science budget, per year for this bonus program.
2. Arkansas Computer Science K-8 Lead Teacher Bonus Program - Arkansas educators, including K-8 media specialists whose standards closely align with the embedded CS standards, are eligible to receive up to \$2,000 in bonuses for: attending a 5-day professional development session provided at no cost by the ADE Office of Computer Science; gaining a 528 Computer Science Endorsement on their Arkansas Educator's License; and providing/leading ADE approved K-8 Computer Science professional development options. Arkansas has allocated \$1.4 million, of the ADE Office of Computer Science Budget, for this program since its creation.
3. Advanced Computer Science Professional Development Bonus Program - Arkansas educators holding the 528 Computer Science Endorsement, 5016 Computer Science Approval Code, or 5014 Computer Science Technical Permit on their Arkansas Educator's License are eligible for a \$100 per day bonus to attend approved advanced computer science training sessions approved by the ADE Office of Computer Science and provided at no charge to teachers or schools. Arkansas has allocated up to \$50,000, of the ADE Office of Computer Science budget, per year for this bonus program.
4. Computer Science Licensure Assessment Reimbursement - an educator who passes the approved Praxis Computer Science assessment for an Arkansas educator license in Computer Science, and submitted the requisite application, has received a one-time assessment fee reimbursement by the ADE Office of Computer Science. Arkansas has allocated up to \$20,000, of the ADE Office of Computer Science budget, per year for this reimbursement program.
5. 528 Computer Science Arkansas License Application/Renewal Fee Reimbursement - On September 4, 2018, Governor Asa Hutchinson announced that the teachers holding the 528

Computer Science Endorsement on their Arkansas Educator's License would have their first-time standard license application and the renewal application fees reimbursed. Arkansas has allocated up to \$10,000, of the ADE Office of Computer Science budget, per year for this reimbursement program.

6. Paid APPEL Program for New Computer Science Teachers - The ADE Office of Computer Science will pay full tuition for up to two years for qualified Computer Science candidates who enroll in the Arkansas Professional Pathway to Educator Licensure (APPEL) program. APPEL is an alternate route to obtaining an Arkansas teaching license for those holding at least a four-year degree in an area other than education. Arkansas has allocated up to \$30,000, of the ADE Office of Computer Science budget, per year for this program.
7. Paid Sponsorships for Arkansas Educators to Attend the CSTA Annual Conference - The ADE Office of Computer Science has provided annual sponsorships to Arkansas educators interested in attending the Computer Science Teachers Association (CSTA) Annual Conference. The purpose of these sponsorships is to provide financial assistance to Arkansas educators assisting them with expanding their knowledge of computer science and networking with other educators from around the world through the unique experience of the CSTA Conference. Arkansas has allocated up to \$75,000, of the ADE Office of Computer Science budget, per year for this program.
8. Paid CSTA + Membership for Arkansas Educators with the 528 Computer Science Endorsement - On September 4, 2018, Governor Asa Hutchinson announced that teachers holding the 528 Computer Science Endorsement on their Arkansas Educator's License would be eligible to receive a paid CSTA+ membership to the international Computer Science Teachers Association (CSTA). Arkansas has allocated up to \$25,000, of the ADE Office of Computer Science budget, per year for this program.

The state has also invested in marketing and outreach activities designed to increase exposure to, interest in, and the relevance of the Arkansas Computer Science Initiative.

Summary of Marketing and Outreach Activities

1. 2015 Startup Grants for Schools - To support districts and charters with the implementation of Act 187, a Computer Science Grant opportunity was made available. Districts/schools were able to apply for up to \$20,000 to be used to promote computer science education within individual districts/schools and to build the local capacity to provide computer science instruction. To be eligible, it was required that schools agree to offer one of the following courses on site with face-to-face instruction during the 2015-2016 school year or the 2016-2017 school year. Eighty schools received a total of \$1,641,853.74 of the Governor's original \$5 million general improvement funding grant to the ADE Office of Computer Science.
2. Governor Asa Hutchinson Computer Science Coding Tours - Since January 2015, Governor Asa Hutchinson has conducted nine coding tours of the state. During these tours, he has personally visited 76 high schools addressing each student body about the

importance of computer science and computing to our state and local economies and stressing the importance of and long-term meaning for students enrolling in computer science courses as high school students and their future potential. Governor Asa Hutchinson's Spring 2020 coding tour was placed on hold due to the COVID-19 crisis, but he is excited to continue this work in the Fall of 2020.

3. #ARKidsCanCode Computer Science Listserv - In January of 2016, the ADE Office of Computer Science launched the #ARKidsCanCode Computer Science Listserv as a communication tool for not only distribution of information from the #CSforAR / #ARKidsCanCode team to the field, but also as a collaboration tool for its members. Since it was established, more than 1,200 members have joined and more than 2,100 messages, an average of 40 a month, have been sent and received by its members. Sign up for the Computer Science listserv at <http://bit.ly/CSforARListserv>.
4. Promotional Videos and Theater Advertisements - Beginning in the Spring of 2016, the ADE Office of Computer Science has worked with various communication teams, including KATV, Arkansas Educational Television Network (AETN), ADE Communication's Team, and the Governor's Communications Team, to develop numerous promotional videos designed to be played within theaters and on social media platforms. These videos have been scheduled and played over spring break and around the back-to-school time each year. Arkansas has allocated up to \$50,000, of the ADE Office of Computer Science budget, per year for this program.
5. AR Computer Science Education Leadership Summits - CSTA Arkansas hosted Computer Science Leadership Summits in 2015, 2016, 2017, and 2018, in partnership with the ADE Office of Computer Science and other CS focused organizations. These summits were provided by grants and funding provided by the ADE Office of Computer Science. In 2019, ADE made the decision to combine all small conferences and summits, including the Computer Science Leadership Summit, into one large scale summit. The #CSforAR Team works to ensure activities and training specific to computer science continue to be a part of the ADE Summit. Arkansas has allocated up to \$20,000, of the ADE Office of Computer Science budget, per year for this program.
6. Computer Science Education Week Announcements - For each year since 2017, the ADE Office of Computer Science has worked with the Office of Governor Asa Hutchinson to plan and make a major computer science related announcement each day during Computer Science Education Week. These announcements are made via a combination of live Governor press conferences, press releases from the ADE Communications or Governor's Communications Offices, ADE Commissioner's Memos, ADE Website, #ARKidsCanCode Listserv, Social Media, and other official communications channels. Announcements, including archives of previous years, can be viewed at <http://bit.ly/ARCSedWeek>.
7. Coding at the Clinton Center - During the 2015 Head of the Class Bash at the Clinton Center, which annually provides free backpacks and school supplies for some children, participants were invited to participate in an "Hour of Code" event. Arkansas STEM

Coalition volunteers were on hand to assist students and parents and to promote the event. AT&T Arkansas provided funding for laptops for the event.

8. Girls of Promise Coding Summits - The Women's Foundation of Arkansas annually hosts coding summits focused on getting high school-aged females to develop an interest in coding. The summits are open to novices and experienced coders. Volunteers from Arkansas based industries and the #CSforAR team are on hand to assist students. Each year the ADE Office of Computer Science has provided coding devices for the approximate 200 student participants to learn on and keep after the summit is over. Arkansas has allocated up to \$10,000, of the ADE Office of Computer Science budget, per year for this program.
9. Governor's All-Region and All-State Coding Competition - The annual All-Region and All-State Coding Competition has been sponsored since 2016, by over \$200,000 in grants from Verizon to ARCodeKids. The competition consists of regional events held simultaneously at 16 regional locations around the state, in all Arkansas Education Service Cooperatives, and one location within Pulaski County. A state event is held for the top 17 teams chosen from the regional competitions. The competition is open to Arkansas public, private, and homeschooled school students in grades 8-12. Arkansas has allocated up to \$25,000, of the ADE Office of Computer Science budget, per year for this program to supplement expenditures for this event.
10. HP CodeWars Event - In 2016, Arkansas was selected to host the 5th US-based site of the Hewlett Packard Enterprise (HPE) CodeWars competition. This Arkansas event took place on Saturday, March 5, 2016, on the HPE campus in Conway. Though this event was a great success with hosting approximately 120 student participants, it was discontinued after the inaugural event due to HPE's center leaving Conway.
11. Computer Science Courses Through Virtual Arkansas Available at No Cost to Districts - Beginning in 2016, Virtual Arkansas, through funding provided by the ADE Office of Computer Science, began providing teacher-led, teacher-facilitated, or content-only delivery of the ADE approved computer science courses for schools to meet the requirements of Act 187 and provide additional options for students. In 2020, the ADE Office of Computer Science entered into an agreement and provided funding for the development and delivery of a three-year (three credits) cybersecurity pathway of courses designed around national and Arkansas standards and utilizing the CyberGym at the University of Arkansas at Little Rock and the Cyber Range at the University of Central Arkansas. This pathway of courses will be made available to students and schools beginning in the fall of 2020 at no cost to districts or students. Arkansas has allocated up to \$75,000, of the ADE Office of Computer Science budget, per year for this program and provided a one-time grant of \$94,500.00 for the cybersecurity course pathway development and delivery.
12. Computer Science Included as a Component of the Arkansas Every Student Succeeds Act (ESSA) Plan - In 2016, Computer Science began being included as a component of the School Quality and Student Success Indicators for schools under the state's federally

approved ESSA plan. A description of how effectively and widely Arkansas schools have utilized this provision is provided in Appendix C.

13. Learning Blade and Increasing Student Interest in Computer Science - In June 2016, Governor Asa Hutchinson announced a state partnership with Learning Blade. Arkansas was the first ever to deploy Learning Blade statewide with its computer coding mission, Hack Attack. Learning Blade is a system of interactive online lessons and printable at-home activities for students in grades 6 through 9. Learning Blade has celebrated a 61 percent student interest increase in STEM activities and career fields. Schools earn a 3D printer when its students complete over 5,000 lessons on the Learning Blade platform. Since its introduction in the state, Arkansas students have completed over 1 million lessons. Learning Blade offers more than 400 online lessons in twelve human-centered missions to explore. Two of these missions, Hack Attack and Flu Outbreak, are focused on computer science careers and technologies. Arkansas has provided grant funding of \$400,000 per year, of the ADE Office of Computer Science budget, to the Arkansas Public School Resource Center (APSRC) to facilitate this program and its delivery to all Arkansas middle schools.
14. Microsoft MOU Digital Strategic Alliance - On December 12, 2016, Governor Asa Hutchinson signed a MOU with Microsoft Corp. to implement a Digital Alliance intended to promote STEM education and economic development, statewide. Under this relationship, Microsoft committed to hosting a DigiCamp and YouthSpark Live event for students and a BizSpark training session. In addition, Microsoft worked with the ADE to grow the TEALS Initiative, which pairs computer science professionals with computer science teachers to teach high school computer science courses. These events and programs took place throughout Arkansas and provided participants the opportunity to learn about careers in technology, connect with STEM industry professionals, participate in hands-on computer and technology workshops, connect local businesses with digital solutions, and more. No state funding was allocated for implementation of this strategic alliance, in-kind support was provided by the #CSforAR Team.
15. Arkansas Becomes the First State to Meet all Nine Code.org Policy Suggestions - In 2017, Arkansas became the first state to meet all nine of Code.org's policy suggestions of: creating a state plan, establishing K-12 computer science standards, allocating funding for computer science professional development, establishing a clear certification pathway for computer science teachers, having a dedicated position for computer science in the state education agency, requiring all secondary schools to offer at least one computer science course, allowing computer science to count for a core graduation requirements, and allowing computer science to count as a core admission requirement at postsecondary institutions. It was 2018 before any other states met all nine policies, and, since then, only five other states have joined Arkansas in the "nine of nine" club. <https://advocacy.code.org/>
16. Arkansas is the Only State to Meet all 10 Policy Priorities in the BNY Mellon State of the States Report - This report, created and released in 2017, identified ten educational policies that support an equitable K-12 computer science education system. The report was produced by BNY Mellon in partnership with Code.org, the Education Commission of the

States, the Education Development Center, Massachusetts Computing Attainment Network, and the Expanding Computing Education Pathways Alliance, of which Arkansas is a member. In the report, Arkansas was the only state that received affirmation of having all ten of the policies in effect. These policies include: having a state plan for K-12 computer science education, implementing state-level initiative designed to address diversity in computer science education, adoption of K-12 computer science standards, providing state-level funding for K-12 computer science education, having a state computer science teacher certification, establishing state-approved pre-service teacher preparation programs at postsecondary institutions, employing a dedicated state-level computer science position, requiring all high schools to offer computer science, allowing computer science to satisfy a core high school graduation requirement, and allowing computer science to satisfy a core admission requirement at postsecondary institutions. <https://www.edc.org/sites/default/files/uploads/State-States-Landscape-Report.pdf>

17. All Arkansas High Schools Provided Virtual Reality Kits - In January 2017, Governor Asa Hutchinson announced a Facebook/TechStart Virtual Reality partnership with Arkansas. Under this partnership, which was cultivated through the ADE Office of Computer Science, Arkansas would eventually receive more than \$2.5 million of virtual reality kits and computers to be distributed to all Arkansas High Schools and regional training centers to be used by students and educators. This program was facilitated by a partnership between the Arkansas Public School Resource Center, which handled the memorandums of understanding between the schools and Facebook, and the ADE Office of Computer Science which oversaw distribution and training.
18. The ENIAC Programmers Project Documentaries Made Available Through ArkansasIDEAS - In February 2017, the ADE Office of Computer Science entered into an agreement with First Byte Productions to procure the rights to provide the ENIAC Programmers Project Documentaries to all Arkansas K-12 schools through ArkansasIDEAS in perpetuity. The documentaries share inspiring stories of women and minorities that pioneered in the field of computer science. Arkansas provided a one-time payment of \$50,000 to procure this contract.
19. #ARKidsCanCode Computer Science Student Placement Survey - In May of 2017, the ADE Office of Computer Science, in partnership with Virtual Arkansas, launched the #ARKidsCanCode Computer Science Placement Survey. This survey, which is still in use, was designed to assist guidance counselors and students in determining which computer science course would be most beneficial for the student. The survey uses the Arkansas Computer Science Standards as its basis. Students receive a completion certificate that reveals the level of course from which they would most likely benefit. Local schools were encouraged to use this certificate, in addition to a variety of information, to help make placement determination.
20. Girls of Promise, AT&T, Women's Foundation of Arkansas, AETN, Acxiom, and ADE Computer Science Enrollment Video Contest - In the Fall of 2017, the ADE Office of Computer Science formed a partnership with Girls of Promise, AT&T, Women's Foundation of Arkansas, AETN, and Acxiom to announce the launch of a student video

contest. As part of the contest, student teams created and pitched a public service announcement concept designed to promote female and minority participation in computer science classes offered in Arkansas public schools to a panel of judges. The winning pitch from Pinnacle View Middle School named “Decide to Strive, Not Hide” (<https://youtu.be/UzgJ7nebcvw>) was produced by AETN and aired in theaters across the state with funding provided by AT&T and the ADE Office of Computer Science.

21. Arkansas Advanced Placement Computer Science A Incentive Program - In the Fall of 2017, Governor Asa Hutchinson announced that the ADE Office of Computer Science would be launching an Arkansas Advanced Placement Computer Science A Incentive Program. The purpose of this program is to increase the number of qualifying scores (3, 4, or 5) on the College Board Advanced Placement (AP) Computer Science (CS) A exam. Each school year since, students who earned a 5 received \$1,000; a 4 received \$750; and a 3 received \$250. The schools of attendance for these students also received \$250, \$150, and \$50, respectively, for their students’ qualifying scores. Arkansas has allocated up to \$125,000, of the ADE Office of Computer Science budget, per year for this program.
22. #ARKidsCanCode / #RiseArkansas Coding and Reading Partnership - During Computer Science Education Week in 2017, ADE announced that its Reading Initiative for Student Excellence, or R.I.S.E. Arkansas campaign, and the Computer Science Initiative would team up to promote computer science as well as build a culture of reading in 2018. As a result, approximately 900 kindergarten through eighth-grade public school libraries received coding-related books with donation identification markers in them and coding devices. In the first year of the partnership, public school library media specialists were required to attend a free ADE Office of Computer Science-approved training on the Micro:Bit, to be eligible to receive the books and devices. These trainings were offered at every education service cooperative in Arkansas and an additional location for educators located in Lonoke county. For library media specialists who could not attend one of the in-person trainings, ADE worked with the AETN to create online training through the ArkansasIDEAS Learning Management System. In subsequent years, the ADE Office of Computer Science has sent more than 5,000 copies of computer science related books to K-8 public school libraries including: *Code Your Own Games!: 20 Games to Create with Scratch* by Max Wainewright, *Sasha Savvy Loves to Code* by Sasha A. Alston, *If I Were A Wizard* by Paul C. Hamilton, *Who Says Women Can't Be Computer Programmers: The Story of Ada Lovelace* by Tanya Lee Stone, *Hello Ruby: Adventures in Coding* by Linda Liukas, *Secret Coders Volume #1* by Gene Luen Yang, and *Journey Through The Unified Field* by Col. Cassie Barlow USAF (ret) and Sue Norrod. In addition, approximately 900 public school libraries have received Micro:Bit and Circuit Playground coding devices. Arkansas has allocated up to \$35,000, of the ADE Office of Computer Science budget, per year to supplement expenditures for this program.
23. Arkansas Coding Academy Scholarships for Adult Retraining - In December of 2017, Governor Asa Hutchinson announced a partnership between #ARCodeKids, the #ARKidsCanCode / #CSforAR Initiative, and the Arkansas Coding Academy at the University of Central Arkansas. Under this partnership, ARCodeKids would provide twelve \$6,000 scholarships to attend the twelve-week Arkansas Coding Academy training

program. In addition, Governor Asa Hutchinson allowed for four of the twelve scholarships to be provided to selected Arkansas state employees, who would also receive paid leave from the state during the academy. No state funding from the ADE Office of Computer Science budget was used to fund this program.

24. Harvard Provided Computer Science Professional Development for Arkansas Teachers - The ADE Office of Computer Science contracted with the Harvard CS50 AP team to provide its College Board Advanced Placement Computer Science Principles endorsed professional development in Arkansas in the summers of 2018 and 2019. The 2018 training was the first time the Harvard CS50 AP had provided this training somewhere other than their home campus. Over the two summers, Arkansas had more than 150 high school educators participate in this training at no charge to them or their schools. Arkansas allocated and expended approximately \$25,000, of the ADE Office of Computer Science budget, per year for this program.
25. Arkansas Becomes First State to Launch CrashCourse - Arkansas became the first to host a state-wide launch of CrashCourse, a virtual reality concussion education program. As a result of the aforementioned partnership between Governor Asa Hutchinson's Computer Science Initiative and Facebook, most high schools in the state received virtual reality equipment which is used to utilize the CrashCourse virtual reality program. TeachAids, the creator of the Crash Course, provided the program free of charge to every Arkansas high school. This announcement was made at the 2018 7A high school state football championship game in War Memorial Stadium in front of a crowd of more than 40,000. No state funding from the ADE Office of Computer Science budget was used to fund this program.
26. UPSKILL Swift Programming at Arkansas State University (A-State) - The Arkansas Department of Education Division of Elementary and Secondary Education has provided the APSRC with a grant to enroll up to 250 high school students in UPSKILL at A-State's Swift Coding program for the 2020 fall semester at no cost to the student or the school. Upskill is an online learning opportunity administered by Arkansas State University for high school students who desire to develop a variety of in-demand job skills. This program offers students an affordable, flexible, and convenient learning experience in which they can develop skills to expand their future opportunities in a growing digital world.
27. Arkansas Computer Science Educator of the Year Award Program - This award is open to anyone holding an Arkansas educator's license who is currently working in a K-12 public school and demonstrates a strong commitment to the Computer Science Initiative in their school and community. Five finalists are selected from the applicants by the #CSforAR team. Each finalist receives a \$2,500 prize. Of the finalists, one is selected by a committee of industry, education, and philanthropic leaders, as the Arkansas Computer Science Educator of the Year and will receive an additional \$12,500 cash award in addition to other conference sponsorships and awards. Arkansas has allocated up to \$30,000, of the ADE Office of Computer Science budget, per year for this program.

28. Innovation in Computer Science School Grant Program - In September of 2018, the ADE Office of Computer Science under the direction of Governor Asa Hutchinson, created the Computer Science Innovation Grant opportunity for Arkansas public K-12 schools. This grant opportunity, which was made available in the 2018-2019 and 2019-2020 school years, allowed schools to seek funding for the purchase of curriculum, software licenses, non-fundamental equipment, professional development, student incentives, and other approved expenses that directly support the instruction of the ADE K-12 Computer Science Standards. Arkansas allocated and expended approximately \$250,000, of the ADE Office of Computer Science budget, per year for this program.
29. Inaugural National Computer Science Summit for State Leaders - In the Summer of 2019, Governor Asa Hutchinson hosted the first-ever National Computer Science Summit of State Leaders. The summit was designed as an opportunity for high-level leadership of many states, including governors, superintendents, and commissioners of education, legislators, and nonprofit and for-profit leaders to share ideas on how states have and will be able to provide high-quality computer science education for all students. More than thirty states and Canada sent representatives to the summit, which was designed to encourage and educate people about computer science education in our schools and allow best practices to be shared. Attendees also included state representatives, senators, commissioners and superintendents. Aside from Governor Asa Hutchinson, keynote speakers included Hadi Partovi, co-founder with his twin brother Ali, of Code.org; and two governors—Governor Kim Reynolds of Iowa and Governor Henry McMaster of South Carolina—who are among those who have led the way in computer science education in their states. A report about the summit is available at: <http://bit.ly/CSSummitReport2019>. Arkansas spent approximately \$25,000, of the ADE Office of Computer Science general improvement funding, for this summit.
30. The Arkansas Computer Science Story Video - Governor Asa Hutchinson commissioned a video telling how Arkansas launched the computer science initiative at the start of the Governor Asa Hutchinson administration in 2015. The video features success stories detailing the teaching of computer science throughout the state. This video is available at <https://bit.ly/CSforARStory>. Arkansas spent approximately \$20,000, of the ADE Office of Computer Science general improvement funding, for this video.
31. Cracking the Code Five-Year Report - *Cracking the Code: How Arkansas Became a National Leader in Computer Science & Computing*, released in the spring of 2020, is an ADE Office of Computer Science report that provides a unique presentation of the major accomplishments of the first five years of the initiative and a glimpse at then future pursuits and plans. The report is available at <http://bit.ly/2020CSforARReport> Arkansas spent approximately \$20,000, of the ADE Office of Computer Science general improvement funding, for this report.
32. #CSforAR / #ARKidsCanCode Monthly Newsletters - Beginning in August of 2019, the #CSforAR / #ARKidsCanCode team began creating monthly *Computer Science in Arkansas* newsletters. These newsletters have computer science related highlights from

around the state for the preceding month, spotlights on computer science teachers and team members, learning opportunities for teachers and students, and great information about computer science and computing related programs and activities. All copies of the newsletter are being archived at <http://bit.ly/CSforARNews>.

33. Great Arkansas History Video Game Coding Competition - The Great Arkansas History Video Game Coding Competition, hosted by the ADE Office of Computer Science, began in January 2020. The contest is open to students in grades 4-8 and emphasizes storytelling, state history, and coding, and gives students the ability to use their coding abilities while supporting literary growth and expanding their knowledge of Arkansas history. For the 2019-2020 competition cycle, the theme for the Great Arkansas History Video Game Coding Competition was the Role of the Civilian Conservation Corps within the creation of Arkansas State Parks. Additional information regarding the competition may be found at: <http://bit.ly/ARCSHistComp>. Arkansas allocated and spent approximately \$30,000 for the inaugural year of the contest and has allocated \$10,000 of the ADE Office of Computer Science budget for each subsequent year of this contest.
34. Arkansas Students of Distinction in Computer Science Recognition Program - In its inaugural 2020 year, the ADE Office of Computer Science sought to recognize outstanding students who demonstrated their commitment to computer science education. Through the Arkansas Students of Distinction in Computer Science Recognition Program, up to 50 public and private school, as well as homeschool students, currently in grades 11 or 12 will be recognized for their efforts in computer science education. ADE partnered with the Arkansas Academy of Computing (AAOC) to facilitate the identification and selection process for this program. ADE and AAOC have agreed upon the following criteria to be used to choose the recipients of this award: Computer Related Academic Achievement, Competitive Achievement, Personal Achievement, and Service Achievement.

Appendix C: Computer Science as a Component of the School Quality and Student Success Indicator



Prepared by the Office of Innovation for Education at the University of Arkansas

Overview of Indicator and Components

The School Quality Student Success (SQSS) indicator is one of several indicators in the Arkansas ESSA School Index Score. SQSS indicators were required by ESEA Statute to allow for meaningful differentiation, as well as be valid, reliable, comparable, and statewide for the grade span(s) to which it applies.

Through stakeholder input and meaningful consultation with the ESSA Accountability Advisory Team, a large initial set of desired, potential SQSS components was generated and then evaluated for fit with the required criteria. In general, the SQSS indicator consists of components that provide information on the extent to which students have access to and complete college and career readiness opportunities and the extent to which students are achieving important milestones such as reading at grade level and achieving and growing in achievement in science.

To achieve comparability across schools within grade spans, given that schools can have different grade-level configurations even within a grade span, the calculation starts at the student level to determine whether points are possible for the student and whether the student received any points for a component. The final School Quality and Student Success indicator score is the percentage of points earned per student based on the points possible per student across all components in the grade span.

All schools have four components: Student Engagement, Science Achievement, Science Value-Added Growth, and Reading at Grade Level.

High schools with a terminal Grade 12 have seven additional components: ACT Composite, ACT Readiness Benchmark, On-Time Credits, High School GPA, Computer Science Course Credit, Advanced Placement/International Baccalaureate/Concurrent Credit Course Credit (AP/IB/CC), and Community Service Learning Credit. A student is given a point for the Computer Science Credits Earned component and for the AP/IB/CC Credits Earned component as indicated in Table 1.

Table 1. Business Rules for Points Possible and Points Earned for Component

SQSS Component	Grade Level or Cohort for Points Possible	Points for Student
Computer Science Course Credit Earned	Grade 12 students enrolled in school in SIS Certified Cycle 7	Credits earned $\geq 1 = 1.0$ Point Credits earned at any time Grades 9 – 12
Advanced Placement/International Baccalaureate or Concurrent Credit Courses (including CTE)	Grade 12 students enrolled in school in SIS Certified Cycle 7	Credits earned $\geq 1 = 1.0$ Point Credits earned at any time Grades 9 – 12

Note: High schools have a total of 11 components in SQSS with each component contributing approximately 1.36 percent to the ESSA School Index Score with all indicators included.

State Summary of Computer Science Credits Component of SQSS 2016-2019

Table 2 provides summary data for Arkansas students and indicates the number of students in Grade 12 SIS cycle 7 who were included in the Computer Science Credits component of SQSS each year. Only students who are not highly mobile are included as per ESEA statute.

Table 2. State Summary of Computer Science Credits Component of SQSS 2016-2019

	Computer Science Credits - Possible Points (# of Grade 12 Non-Mobile Students)	Computer Science Credits - Earned Points (# of Grade 12 Non-Mobile Students with one or more Computer Science credits)	Computer Science Credits – Percent of Points Earned	Total SQSS – Percent of Points Earned
2016	29,995	1,361	4.54	54.28
2017	30,521	2,129	6.98	55.40
2018	30,949	2,902	9.38	54.56
2019	31,825	3,527	11.08	55.10

Table 2 and Figure 1 indicate the consistent increase in points earned by students for the Computer Science Credits Earned component in SQSS. In comparison, the Total SQSS score remains relatively flat with slight year to year variation. Other components may impact the Total SQSS in a given year, raising or lowering the Total Score.

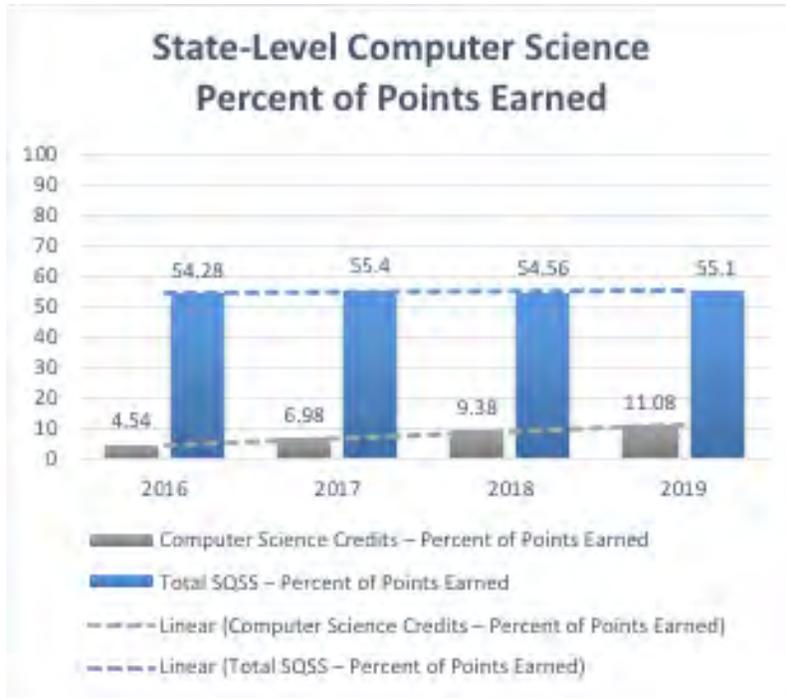


Figure 1. Arkansas Computer Science Credits component scores and Total SQSS scores.

Summary of School-Level Computer Science Credits Component of SQSS 2016-2019

Table 3 provides the Computer Science Credits component scores for high schools averaged across all high schools in Arkansas with a Grade 12.

Table 3. Average of School-Level Computer Science Credits Component Scores 2016-2019

Year	Number of Schools with Computer Science Component Included (# schools with a Grade 12)	Number of Schools with Computer Science Component with at least 1 Earned Point	Average School Computer Science Percent Points Earned
2016	281	173	4.66
2017	283	226	7.39
2018	290	241	9.70
2019	297	261	11.45

Table 3 and Figure 2 indicate the consistent increase in the average school Computer Science Credits component score.

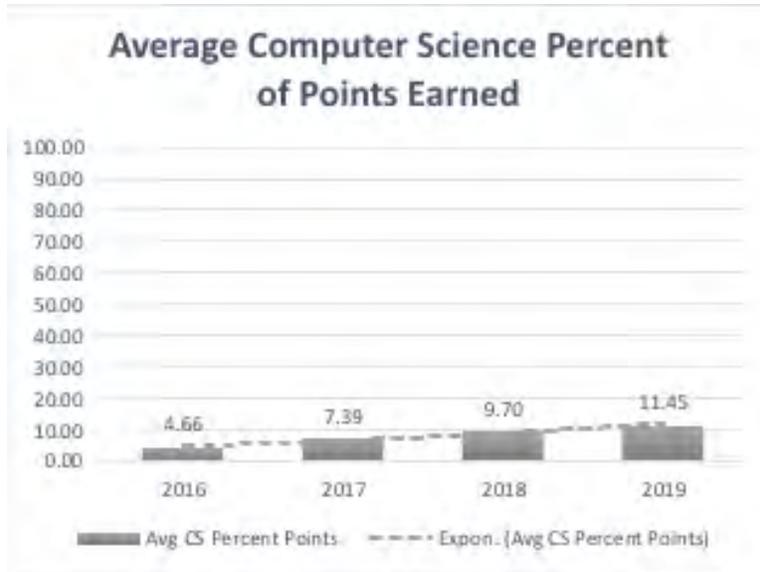


Figure 2. Average of school-level Computer Science Credits component scores.

The average may mask how school Computer Science Credits component scores are distributed. The variation in school component scores for Computer Science Credits is an important data view for understanding the variation associated with the averages. Figure 3 provides the distributions of schools' Computer Science Credits component scores for all schools with at least 10 students in the Grade 12 cycle 7 data. Note the distributions demonstrate a consistent increase for most of the schools year over year. Some schools decline in points earned.

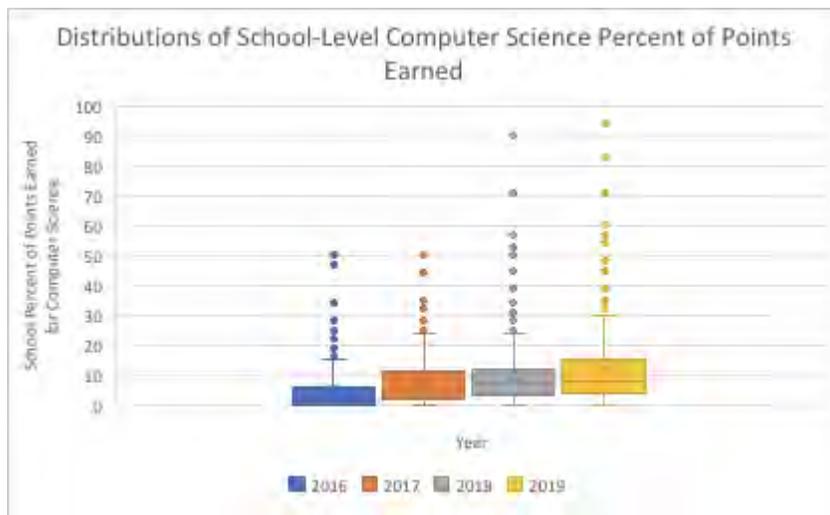


Figure 3. Distribution of school-level Computer Science Credits component scores.

For smaller schools, this percentage may vary more from year to year due to the small number of students in the denominator. The average increase in percentage points for Computer Science Credits component from 2017 to 2018 was 2.06 percentage points (range = -35.19 to 85.89 percentage points). The average increase in percentage points for Computer Science Credits component from 2018 to 2019 was 2.36 percentage points (range = -21.27 to 55.00 percentage points).

AP/IB/CC Component Benefits

Schools also benefit from Computer Science course credits earned in the AP/IB/CC component if the Computer Science course is an AP, IB, or concurrent credit course. The number of students with at least one credit earned that contributed to the AP/IB/CC component are provided in Figure 4.

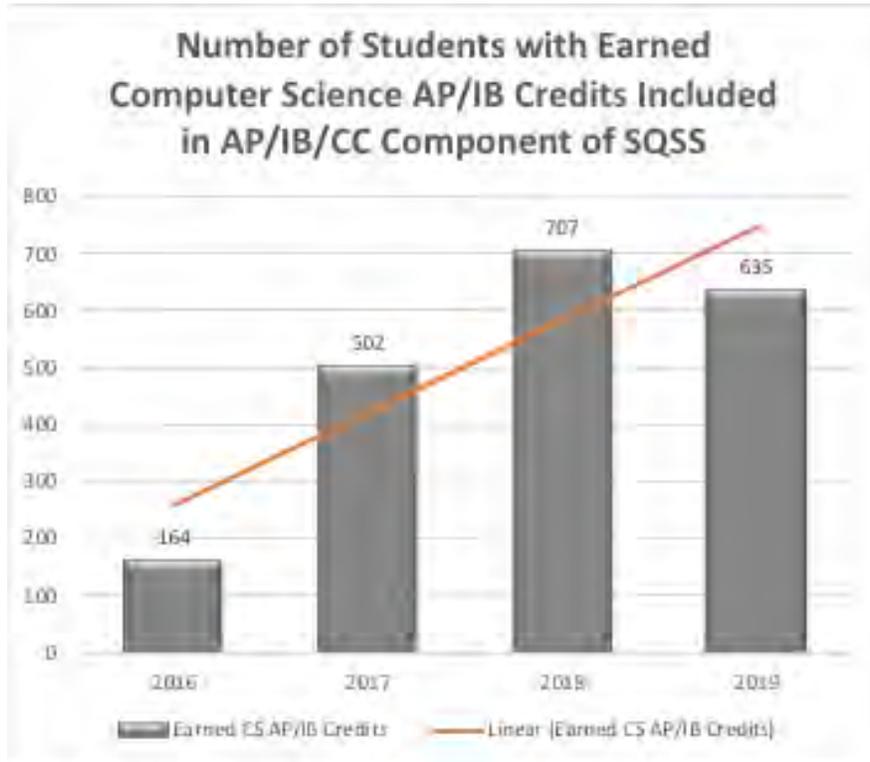


Figure 4. Number of students with AP and IB Computer Science course credit included in the AP/IB/CC component in addition to the Computer Science Credit component.

The contribution of students with a computer science concurrent credit course to the AP/IB/CC component of SQSS is provided in Figure 5.

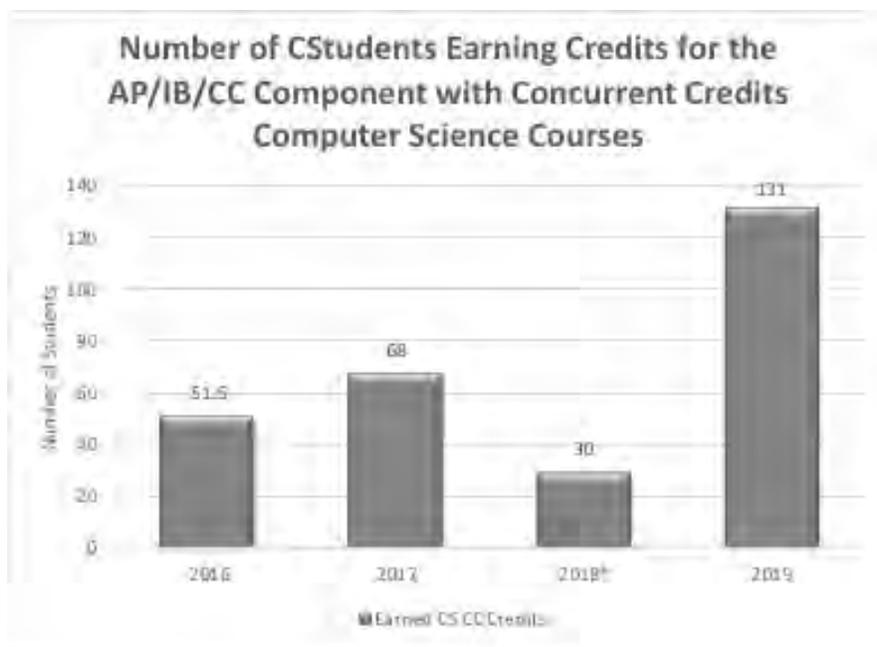


Figure 5. Number of students with concurrent credit Computer Science course credit included in AP/IB/CC component in addition to the Computer Science Credit component.

*2018 included a change in course codes for Computer Science Concurrent Credit Courses which may explain the change in the trend for 2018 only.

Impact of Computer Science Credits on the ESSA School Index Score

Increasing the Computer Science Credits component score may make a difference for schools in federal and state accountability in that, with all other components and scores remaining equal, this component contributes to 1.36 percent of the ESSA School Index score. For federal accountability, the relative ranking of Title I schools is used to determine the ESSA School Index score used to identify those schools in need of comprehensive support and improvement, targeted support and improvement, as well as additional targeted supporting and improvement. Increasing any component may impact the ESSA School Index score which may impact a school’s relative ranking.

For state accountability, changes in a component score, with all other scores remaining equal, may contribute to incremental ESSA School Index score increases that may mean the difference between School Ratings (A-F Letter Grades) assigned to schools, particularly; those on the border of a cut score.

For example, the School Rating cut scores given in Table 4 indicate the sensitivity of the cut points down to the hundredths place. The average difference from 2018 to 2019 in Computer Science Credits component scores would have resulted in an average 0.03 increase in points in the ESSA School Index score. If other indicators and components are held constant, that increase would push a school above the cut score for the higher letter grade if a school is that close. At the other end of the spectrum are schools who might lose points overall because the component score decreases, leading to a drop in letter grade. Given the range of differences, schools experienced a point impact

ranging from -0.29 to 0.75 which would have an impact on a schools rating if close to the margin between ratings.

Table 4. Cut Scores for School Ratings for High School Grade Span

School Rating	Cut Scores
A	$73.22 \leq \text{Score}$
B	67.96 - 73.21
C	61.10 - 67.95
D	52.95 - 61.09
F	$\text{Score} < 52.95$

Appendix D: Task Force Members and Contributors

Task Force Members

Name	Company	Title
Adam Holland	Glaxo Smith Kline	Director
Allison Nicholas	Metova, Inc	Director of Recruiting
Dr. Allison Roberts	Office of Governor Hutchinson	Education Liaison
Dr. Angela Kremers	Division of Career Education	Director
Ann Clemmer	Division of Higher Education	Senior Associate Director
Anna Beth Gorman	Women's Foundation of Arkansas	Executive Director
Anthony Owen	Arkansas Department of Education	State Director of Computer Science
Bill Gossage	Office of Governor Hutchinson	Deputy Chief of Staff
Bill Yoder	Arkansas Center for Data Sciences	Executive Director
Britt Cagnina	Elyxor	Software Engineer
Dr. Bryan Hill	University of Arkansas at Fayetteville	Associate Dean of Engineering
Carl Frank	Arkansas's Computer Science Teachers Association	President
Dr. Charisse Childers	Division of Workforce Services	Director
Dr. Cheryl May	CJI - University of Arkansas System	Director
Dave Wengel	iDatafy	Founder and CEO
Errin Stanger	Arkansas Regional Innovation Hub	Deputy Director
Dr. Gary Stark	Walton Family Foundation	Senior Program Officer
Gopala Krishnan	DXC Technology	Executive Director
Dr. Hung-Chi Su	Arkansas State University	Chair, Department of Computer Science Associate Professor of Computer Science
Dr. James Hendren	Self Employed - Little Rock**	Technology Startup Consultant
Jeston George	Apptegy	President/Founder
Joel Gordon	The Scott Family Amazeum	Tinkering and Making Manager
John Ciesla	Greenwood School District	Superintendent
Karma Turner	Lake Hamilton School District	2018-19 Computer Science Educator of the Year
Lee Watson	Forge Institute	Founder
Michael Armstrong	N/A	Financial Executive
Mike Rogers	Tyson	Senior Director Maintenance and Refrigeration
Phillip Young	Arch Ford Education Service Cooperative	Director
Richard Howe	Inuvo	CEO
Dr. Rick Massengale	North Arkansas College	Vice President
Dr. Sarah Moore	Arkansas State Board of Education	
Dr. Stephen Addison	University of Central Arkansas	Professor and CNSM Dean
Susan Norton	Arkansas Academy of Computing	President
Tom Chilton	Arkansas Economic Development Commission	Division Director - Science and Technology
Yessica Jones	Division of Information Systems	Director and State CTO

Regular Contributors

Name	Organization
Daniel Moix	Arkansas School for Mathematics, Sciences, and the Arts
Dr. Phillip Huff	University of Arkansas at Little Rock
Eli McRae	#ARKidsCanCode / #CSforAR
Emily Torres	#ARKidsCanCode / #CSforAR
GB Cazes	The Emory Group, LLC
Jason Green	Baldor Electric Company
Jim Furniss	#ARKidsCanCode / #CSforAR
John Hart	#ARKidsCanCode / #CSforAR
Joshua McGee	University of Arkansas, Office for Education Policy
Joshua Rodgers	#ARKidsCanCode / #CSforAR
Kelly Griffin	#ARKidsCanCode / #CSforAR
Leslie Savell	#ARKidsCanCode / #CSforAR
Lori Kagebein	#ARKidsCanCode / #CSforAR
Morgan Warbington	#ARKidsCanCode / #CSforAR
Sarah McKenzie	University of Arkansas, Office for Education Policy
Scott Anderson	The Forge Institute
Senator Jane English	Arkansas Senate
Senator Lance Eads	Arkansas Senate
Tammy Glass	#ARKidsCanCode / #CSforAR
Zack Spink	#ARKidsCanCode / #CSforAR

Presenters and Expert Advisors

Name	Organization
Dr. Claus von Zastrow	Education Commission of the States
Dr. John Lee	Southern Regional Education Board (SREB)
Janet Cintio	Axiom
Dr. Jessie Walker	Arkansas Division of Higher Education
Lauren Freemire	Education Commission of the States
Les Ross	Tyson Foods
Rachael Stephens	National Governor's Association
Randy Zook	Arkansas State Chamber of Commerce
Sarah T. Dunton	ECEP Alliance

Support Staff

Name	Organization
Emily Torres	#ARKidsCanCode / #CSforAR
Eryn Veach	Office of Governor Hutchinson
Morgan Warbington	#ARKidsCanCode / #CSforAR