COMPUTER SCIENCE

Computer Science Education Work Group
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State of Iowa
Department of Education
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State Board of Education

Contents

Introduction

Senate File 274 established the Computer Science Education Work Group and laid the foundation for strengthening computer science education in Iowa. The Iowa General Assembly passed this legislation with overwhelming bipartisan support and signaled a shared interest in addressing critical issues in expanding computer science opportunities for students statewide.

The goal of SF 274 is that by July 1, 2019, every elementary school will offer instruction in the fundamentals of computer science; every middle school will offer exploratory computer science; and every high school will offer at least one high-quality computer science course.

As Gov. Kim Reynolds has stated, computer science is a new basic skill in the technology-driven, 21st century economy. Building a strong foundation in computer science helps prepare students for personal and professional success, and strengthen Iowa's workforce talent pipeline.

The March 2017 *State of the States Landscape Report: State-Level Policies Supporting Equitable K–12 Computer Science Education* makes a compelling case for expanding computer science instruction in the nation's schools. According to the report,

> "Computer science (CS) has profoundly changed the ways that we learn, work, and play. The ubiquity of computing puts a premium on ensuring students' competencies as generators, not just users, of digital resources. Several key reasons lie behind the push to ensure that all of today's students develop these competencies:
>
> - Computer knowledge and skills are increasingly being recognized as foundational for an educated citizenry.
>
> - CS is a central component of innovation, economic growth, and employment.
>
> - The current homogeneity of the CS workforce constrains both opportunity and growth at the individual, state, and national levels."

In addition, Iowa business and industry leaders are sounding the call for expanding access to high-quality computer science instruction in Iowa's schools. In a technology-driven economy with an exponential pace of knowledge creation, strong computer science education will prepare Iowans for the demands of a rapidly changing world. Members of an Iowa business and industry panel that presented to the work group were in agreement that Iowa needs more employees and leaders with a strong computer science foundation and that the field needs to expand to include historically underrepresented groups, including women, people of color, and those from low-income backgrounds who may not have exposure to computers and other technology at home. These leaders brought a sense of urgency to the conversation and a focus on why Iowa must lead in computer science education.

Work group member Mark Gruwell stated, "Computer science is much more than just coding or programming and it is more than just digital learning." Computer science is about understanding how computer technology works and being able to create those technologies. Computer science addresses both the theory and application of important computer technologies.

The goal of this work group was to develop recommendations that will ensure all students have the opportunity to develop these skills as they progress through school. Accordingly, this report addresses the five recommendations required by SF 274 and outlines a set of strategies that will position Iowa to become a national leader in computer science education. The report is the culmination of four meetings over six months and represents the consensus of the 38 members of the work group.

Recommendations

In accordance with SF 274, the Computer Science Education Work Group developed recommendations to address the following five issues stated in the legislation:

- How computer science courses could satisfy graduation requirements for math or science.

- How these courses could be integrated into a career and technical education pathway.

- The settings in which courses could be delivered (including in traditional high school settings, concurrent enrollment classes, and online).

- Guidelines for an appropriate scope and sequence of computer science instruction at each grade level.

- How the computer science professional development fund created in the legislation could be used to meet the goals of the law.

Recommendation 1: How computer science courses could satisfy graduation requirements for math or science.

Recommendation

The work group developed a vision that computer science will eventually become a high school graduation requirement for all students. As Iowa works toward this vision, the group recommends several immediate actions.

All school districts will be encouraged to allow computer science courses that meet state computer science standards and include math content to count as math credits for students who have completed other courses covering required state math standards. This will send the message that computer science is not just an elective anymore.

In addition, school districts receiving computer science professional development funds will both offer computer science and expand the reach and rigor of math and computer science. For example, this could include requiring all students to take a fourth year of math or three years of math and a computer science course as a requirement for graduation. School districts will have discretion to design a proposal that both achieves the objective and meets local needs.

Finally, a computer science course may fulfill a mathematics requirement if the course meets state academic standards in mathematics. Also, courses designated by the Iowa Department of Education (Department) may fulfill a science or mathematics credit requirement after the required mathematics and science standards have been met through other coursework.

Context

This recommendation received the most attention from the work group and members expressed a variety of viewpoints on this issue. The work group focused on how Iowa could both expand computer science instruction while ensuring students achieved mastery of required math and science content standards. In exploring this issue, the work group examined approaches in other states.

The March 2017 _State of the States Landscape Report: State-Level Policies Supporting Equitable K–12 Computer Science Education_ describes three emerging best practices in this policy area:

1) **Make sure that students get the fundamentals in core subject areas**. Many state policies seek to ensure that students have completed foundational coursework in core subject areas (for example, Algebra I or geometry for mathematics or basic lab sciences for science) before allowing a CS course to be applied as a credit substitution. Idaho and Illinois permit CS to fulfill a mathematics credit only if the student has completed Algebra II; Oklahoma and Washington students must either have completed or be concurrently taking Algebra II to allow a CS course to fulfill a mathematics credit.

2) **Integrate mathematics or science standards (as appropriate) into CS coursework bearing mathematics or science credit.** To ensure that students' exposure to key content in the discipline for which the CS course is fulfilling a credit requirement, states such as Maryland and Minnesota specify that CS courses must meet state academic standards in the subject for which the CS course can substitute.

3) **Ensure CS course rigor.** Some states permit only Advanced Placement (AP) CS to take the place of a mathematics or science credit. Idaho additionally allows a dual credit (dual enrollment) CS course to fulfill a mathematics or science credit. Florida requires students to also earn a related industry certification for a CS course to fulfill a mathematics or science course requirement.

Other state approaches are included in the [ECS Report on Computer Science in High School Graduation Requirements.](#)

The computer science work group's recommendation builds upon the best practices of other states and utilizes the computer science professional development fund as a way to incentivize, rather than mandate, schools to expand graduation requirements in math and offer students an additional, compelling reason to take a computer science course.

Recommendation 2: How one or more high-quality computer science courses could be integrated into a career and technical education (CTE) pathway.

Recommendation

Currently, a computer science course could count toward a career and technical education information technology program if the instructor is also certified as a CTE endorsed instructor. In addition, all CTE programs allow for one unit to be shared across CTE programs. Computer science courses taught by CTE endorsed instructors could be a part of any of these CTE programs (i.e. Health Science, etc.).

To build upon this existing policy framework, the work group recommends strengthening communication between the Department, the Iowa Board of Educational Examiners (BOEE) and school districts to ensure schools know and understand how computer science courses can be integrated into a CTE pathway. Specifically, the Department and the BOEE should clearly articulate the varied approaches districts can utilize in recruiting and securing qualified computer science teachers. In addition, the work group encourages additional partnerships between schools and business and industry to help expand computer science CTE offerings.

Context

In discussing CTE pathways, the work group considered barriers, such as additional required coursework, to certification for teachers to teach a computer science course within a CTE pathway. The work group's goal is to ensure only qualified professionals teach computer science within a CTE pathway, but at the same time reduce the barriers that prevent them from teaching.

In addition the work group also requests that the computer science standards review team explore building out computer science/CTE requirements at the middle school level, which would create a key opportunity to strengthen CTE requirements in middle school and achieve the goals of SF 274.

Recommendation 3: The settings in which courses could be delivered, (including in traditional high school settings, concurrent enrollment classes, and online).

Recommendation

For districts receiving computer science professional development incentive funds, professional development will be available for those that want to offer traditional and/or blended delivery (which is a hybrid of in-person and online instruction).

In addition, if funds are available, Iowa Learning Online (ILO) will offer a computer science course. These funds would be separate from the professional development incentive funds. ILO can also serve as a resource in vetting other high-quality, online computer science content and curriculum. Dual enrollment opportunities should also be maximized.

Context

The work group believes that computer science courses can be effectively delivered in many different settings. An important consideration is ensuring access to these courses is equitable across Iowa. Given this, professional development for teachers, particularly those in rural areas, will be critical.

In addition, work group members expressed that the most scalable option for expanding computer science education to all students in Iowa is through ILO. ILO provides a unique opportunity to connect a diverse group of students while providing them with additional skills such as working collaboratively.

Finally, regional centers and shared concurrent enrollment courses provide excellent opportunities to expand computer science to more schools across Iowa.

Recommendation 4: Guidelines for an appropriate scope and sequence of computer science instruction at each grade level.

Recommendation

The Department should assemble a team to begin reviewing computer science standards immediately following the submission of the work group recommendations in November. This team should use the K-12 Computer Science Framework as a guiding document, review other state's aligned standards, adopt recommended standards, and offer aligned professional learning.

Context

In discussing a computer science scope and sequence of learning, the work group emphasized that the standards should be developed alongside a clear implementation plan that allows for districts to focus professional learning in an intentional approach. In addition, several computer science teachers on the work group had experience using the Computer Science Teachers of America (CSTA) standards and found that these standards offer a faithful implementation of the K-12 CS Framework endorsed by the Association for Computing Machinery (ACM) and International Society for Technology in Education (ISTE).

Recommendation 5: How the computer science professional development fund created in the legislation could be used to meet the goals of the law.

Recommendation

The goal of the computer science professional development incentive fund is to build the computer science teacher workforce and to significantly increase the number of computer science teachers. The districts that receive the computer science incentive funds will be able to use it to train teachers to teach computer science, which includes implementing the computer science standards, and tuition reimbursement for educators seeking endorsements and certifications in computer science.

In addition, this fund should be disbursed through a competitive application process, which will allow schools to create innovative, diverse approaches to providing professional learning and scaling high-quality computer science instruction across Iowa. Priority should be given to districts that most clearly demonstrate the proposal will expand the reach and rigor of computer science, including expanding participation for underrepresented students. In addition, the Department should distribute funds evenly across small, medium and large school districts and ensure geographic diversity among the accepted applications. Finally, the Department should invite schools to collaborate in developing approaches to professional learning.

Context

In discussing this recommendation, the work group considered whether or not the disbursement of professional development incentive funds should be prioritized by grade level and whether or not priority should be given to professional development or tuition reimbursement. Ultimately, the work group recommends that preference should be given to districts that embed professional development in the implementation of a computer science curriculum, develop a computer science implementation plan that meets the needs of the district and prioritize the use of the funds and the grade level focus accordingly.

Finally, in disbursing the funds, the Department should ensure that the funds are spread out geographically and include both urban and rural school districts.

Conclusion

Iowa has earned a national and global reputation as a leader in STEM education through innovative programming, such as school-business partnerships, and exemplary curriculum in engineering, robotics, mathematics and science. The state now has the opportunity to be a national leader in computer science education. Without swift action, however, each year more students will lack access to building critical, 21st century skills in computer science.

The recommendations set forth in this report provide a path forward as Iowa considers further policies to strengthen computer science education. In addition, as the work group learned from other states, the legislature must appropriate funds to truly bring SF 274 to life.

Membership

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