

Computer Science Education Implementation



Road Shows Summer 2021

Kansas leads the world in the success of each student.

CS Employment Stats

- 410,020 open computing jobs nationwide
- 71,226 CS students graduated into the workforce last year
- Kansas
 - 2,722 open computing jobs
 - Average salary \$76,417
 - 516 CS graduates last year

(data retrieved from <https://advocacy.code.org>)



- Equity
 - 81% of Kansas tech workers are men (KC STEM Alliance)
 - Only 18% of CS BS degrees were earned by women (NSF)
 - Women make up only 28% of STEM workforce (NSF)
 - Only 11% of STEM workforce were black/Hispanic/American Indian/AK Native



Importance of CS in 21st Century

- “Learning to write programs stretches your mind, and helps you think better, creates a way of thinking about things that I think is helpful in all domains.” – Bill Gates
- “Learning to code is useful no matter what your career ambitions are.” – Arianna Huffington
- “We salute the coders, designers, and programmers already hard at work at their desks, and we encourage every student who can’t decide whether to take that computer science class to give it a try.” – Michael Bloomberg
- “Teaching young people to code early on can help build skills and confidence and energize the classroom with learning-by-doing opportunities.” – Richard Branson



Continued

- “Computer programming is quickly becoming an essential career skill. Learning to code is a fantastic opportunity equalizer—if you’re good at it, it can help you achieve your dreams.” – Sen. Cory Booker
- “Whether you want to uncover the secrets of the universe, or you just want to pursue a career in the 21st century, basic computer programming is an essential skill to learn.” – Stephen Hawking
- “Computers are going to be a big part of our future...and that future is yours to shape.” – Pres. Barack Obama
- “We need our children to learn 21st century skills for a 21st century world, and coding teaches them the creativity and problem-solving skills that are necessary for success.” – Sen. John Thune



Continued

- “I'd like to advocate for computer coding to be an institution in the public school systems right next to biology, chemistry, physics, etc.” – Ashton Kutcher
- “To prepare humanity for the next 100 years, we need more of our children to learn computer programming skills, regardless of their future profession.” – Salman Khan (Khan Academy)
- “The ability to code and understand the power of computing is crucial to success in today's hyper-connected world.” – VP Al Gore
- “support tha american dream n make coding available to EVERYONE!!” – Snoop Dogg



Kansas CS Status before 6/8/21

Statewide activity

- 55 districts teach CS.
- 95 high school buildings teach CS.
- Comp prog: 10,009 students.
- Comp prog, other language: 521 students.
- AP CS A: 1,170 students.
- AP CS P: 1,487 students.
- Particular topics in comp prog: 314 students.

National Policy

- Only KS and CT lack “Make CS Count” graduation policy.
- 22 states require CS to be taught by each high school; three have legislation pending.
- Three states require CS for graduation (NV, SC and AR).
- 39 states and D.C. require teacher certification in CS.



Recommendation: Make CS Count

- Allows students flexibility to take CS without having to forego electives such as band, CTE, or other topics (depending on IPS and district decisions)
- Reinforces importance of CS to counselors and parents
- Gives business and industry assurance of recognition of importance of CS education





CS + Math

- **Develop and use abstractions**

M2. Reason abstractly and quantitatively

M7. Look for and make use of structure

M8. Look for and express regularity in repeated reasoning

CS4. Developing and Using Abstractions

- **Use tools when collaborating**

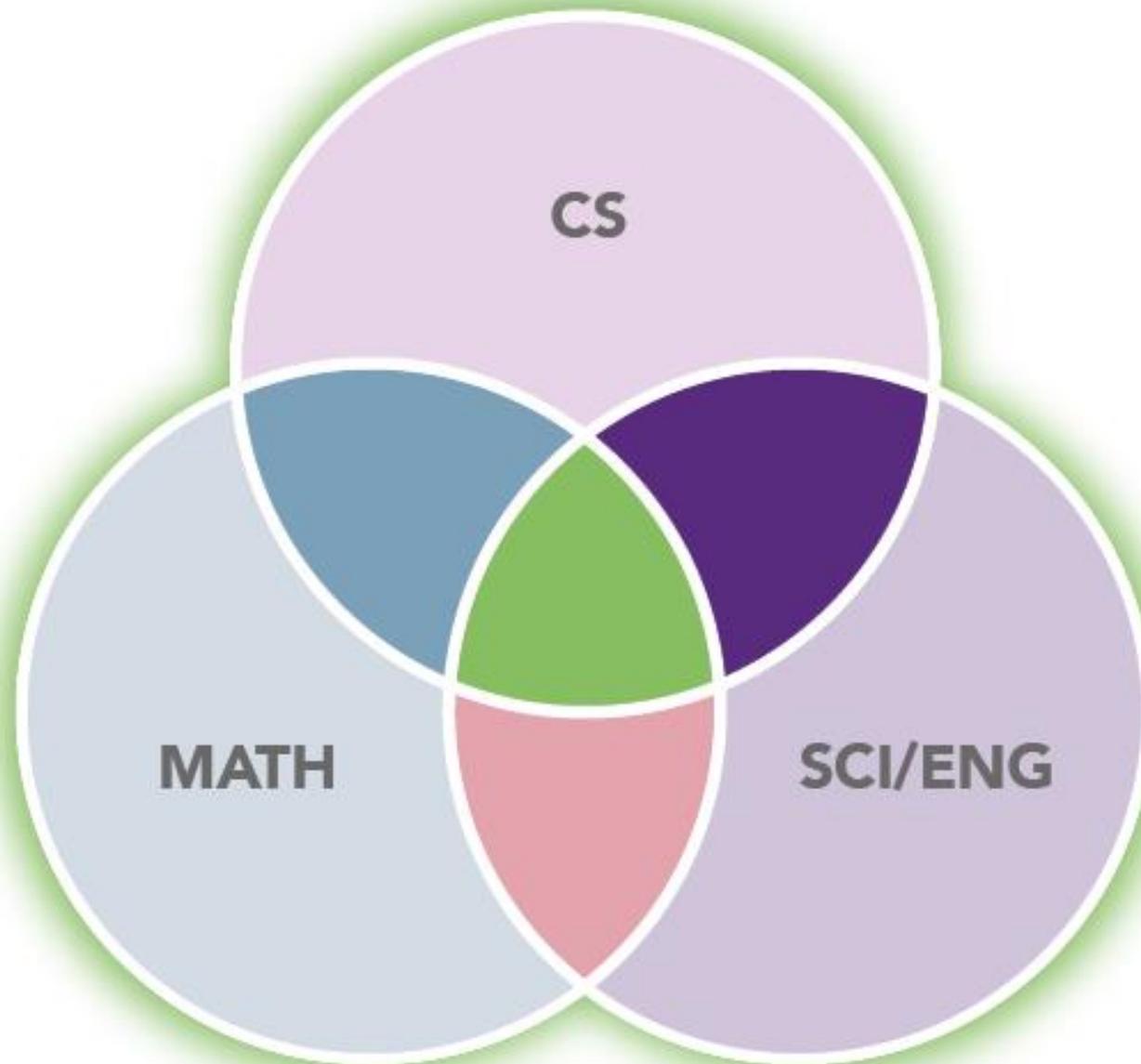
M5. Use appropriate tools strategically

CS2. Collaborating Around Computing

- **Communicate precisely**

M6. Attend to precision

CS7. Communicating About Computing



CS + Sci/Eng

- **Communicate with data**

S4. Analyze and interpret data

CS7. Communicating About Computing

- **Create artifacts**

S3. Plan and carry out investigations

S6. Construct explanations and design solutions

CS4. Developing and Using Abstractions

CS5. Creating Computational Artifacts

CS6. Testing and Refining Computational Artifacts



CS + Math + Sci/Eng

- **Model**

- S2. Develop and use models
- M4. Model with mathematics
- CS4. Developing and Using Abstractions
- CS6. Testing and Refining Computational Artifacts

- **Use computational thinking**

- S5. Use mathematics and computational thinking
- CS3. Recognizing and Defining Computational Problems
- CS4. Developing and Using Abstractions
- CS5. Creating Computational Artifacts

- **Define problems**

- S1. Ask questions and define problems
- M1. Make sense of problems and persevere in solving them
- CS3. Recognizing and Defining Computational Problems

- **Communicate rationale**

- S7. Engage in argument from evidence
- S8. Obtain, evaluate, and communicate information
- M3. Construct viable arguments and critique the reasoning of others
- CS7. Communicating About Computing



Make CS Count

- June 8, 2021: KS Board of Education voted to approve recommendation
- As long as student satisfies topical requirements (algebraic and geometric concepts or bio/phys/e&s science) the local board may allow student to count CS for a math or a science grad req, based on IPS needs
- “The study of computers and algorithmic processes, including their principles, their hardware and software designs, their applications, and their impact on society.” (*K12cs.org*)
- MUST BE RIGOROUS as measured by P-12 Model CS Standards
- List that should NOT count >> list that should count (AP CSP)



Presentation by The College Board

- Why AP CS?
- But I can't offer AP CS...no teachers for it.
- What's the difference between CSA and CSP?



A Short History of CS in KS

- March 2018 – Called for standards committee
- April 2019 – K-12 Model Standards for CS adopted by KS BoE
- June 2019 – Implementation committee formed
- February 2020 – 5 Recommendations approved by KS BoE
- February 2020 – State-wide CS position filled
- August 2020 – Work on CS endorsement standards began
- April 2021 – CS endorsement standards public comment period began
- June 2021 – “Make CS Count” recommendation approved by KS BoE



P-12 Model CS Standards

- Model, not Assessed
- Based on CSTA student standards
- 5 topics:
 - Computing Systems
 - Network & The Internet
 - Data Analysis
 - Algorithms and Programming
 - Impacts of Computing
- P-5: grade level
- MG, HS L1, HS L2 grade bands
- <https://www.ksde.org/Agency/Division-of-Learning-Services/Career-Standards-and-Assessment-Services/Content-Area-A-E/Computer-Science>



5 Implementation Recommendations

- Statewide dedicated CS position – completed Feb 2020
- Encourage all schools to offer CS – ongoing
- Allow CS to count as core graduation requirement – completed June 2021
- Create teacher licensure for CS – in process
- Fund CS education – Mixed



Recommendation #3

The Student Experience subcommittee recommended that the importance of computer science as a discipline be recognized through satisfaction of a core math or science credit.

Computer Science should satisfy a core math or science credit.

- Examined other states' policies for examples and lessons.
- Met with math and science consultants to draft a guidance document.
- Submitted draft to field for public comment.
- Compiled public comment.
- In the process of drafting white paper.



Kansas Graduation Requirements

- 4 ELA, 3 HGSS, 3 science, 3 math, 1 PE, 1 FA, 6 electives.
- Math: Must include algebraic and geometric concepts.
- Science: Must include physical, biological, and earth and space concepts.
- Many districts increase requirements.
- Kansas Scholars Curriculum and state postsecondary institutions increase requirements.
- No one set of requirements fits all graduates' needs.
- Individualized Plans of Study (IPS) are crucial to all students.



Effects of this Recommendation

- This does not change the number of 21 Credits required for graduation.
- This does not require a course in Computer Science to graduate.
- This does allow Computer Science to be counted as a core Math or Science credit as long as the student meets the Math and Science concepts required in regulations AND the school district allows it.
- This is based on what is in the best interest of each individual student.



Enter Computer Science

- **Definition:** “The study of computers and algorithmic processes, including their principles, their hardware and software designs, their applications, and their impact on society.” (*K12cs.org*)
- Rigorous, taught based on Kansas Model CS Standards.
- Applications (e.g., MS Office) courses would not meet this definition, nor would most CTE technical courses.
- Includes Computational Thinking practices.
- Teaches Technical Skills (fifth part of State Board’s definition of a successful high school graduate).
- Enhances other STEM course learning through abstraction, data manipulation, model creation.



CS Courses Taught By Whom

- CS endorsement existed until about 2000; 19 teachers in Kansas are currently endorsed.
- CS endorsement standards revision is currently out for public comment.
- Endorsement will be required for courses meeting “Computer Science” definition.
- CS courses taught by CS-endorsed teachers are CS courses, not math or science.



Potential Scenarios

- Student bound for engineering: IPS convinces them that algebraic and geometric concepts are not enough math.
- Student aiming for Kansas Scholar: IPS points out that four years of math are required, as is physics.
- Student who has taken eighth-grade algebra I, ninth-grade algebra 2, and 10th-grade geometry: has fulfilled topical requirements but not credit requirements. CS might be an option depending on future plans.
- Student who took earth and space science in middle school, then chemistry and biology in high school, has fulfilled topic requirements but not credit requirements. CS might be an option.
- CS in the latter two cases would be a CS course, taught by qualified CS teacher, not a math or a science course.



Overall



Benefits

- Explicit emphasis on the importance of computer science.
- Increased flexibility for students, counselors and administrators.

Concerns

- IPS process must be active and targeted.
- CS course offering must be broad and rigorous.

Current Work

- Increase AP/IB Course instances
- Increase understanding of CS standards
- Increase integration of K-5 CS with other topics
- Elevate visibility of current practices
- See teacher endorsement through adoption
- Develop state plan
- Knit together ecosystem



Questions?





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