



Artificial Intelligence in California Learning with AI, Learning about AI September 2023

Introduction

*Please note: This document is meant to provide helpful guidance to our partners in education and is, in no way, required to be followed. The document is intended to be informative rather than prescriptive. The information is merely exemplary, and compliance with any information or guidance in this document is not mandatory. (See **Educ. Code § 33308.5**.)*

Emerging technologies often lead to new and exciting learning opportunities for students, particularly in increasing personalization and accessibility options. While Artificial Intelligence (AI) can be a valuable learning tool for educators and students, it must be evaluated according to usage terms, and clear guidelines for data collection should prioritize student safety.

The California Department of Education (CDE) considers human relationships crucial in education, particularly when incorporating generative AI tools such as ChatGPT into schools. This is particularly vital in light of school closures that occurred in the recent past due to the COVID19 pandemic and other natural disasters, that left many educators and students physically isolated. AI or any other technology cannot replace the value of a student's relationship with a caring educator who can connect on a human level.



In accordance with State Superintendent of Public Instruction Tony Thurmond's professional learning initiative, CDE is committed to supporting AI-focused professional learning for administrators and educators, to educate them about AI's benefits and limitations. The Professional Learning Initiative can keep educators up-to-date on emerging technology tools for the classroom. CDE's Computer Science Coordinator has participated in numerous AI panels across the state and has led CDE's STEAM (Science, Technology, Engineering, Arts, Mathematics) workgroup in introducing AI to CDE. The department hosted an AI panel discussion in May of 2023 entitled "Artificial Intelligence: Demystifying AI for CA Students," and the Computer Science (CS) Coordinator regularly collaborates with members of the Computer Science Teachers Association and CSforCA AI workgroup to remain current on educational trends in the field of AI and other emerging technologies in respect to their impacts on education. CDE is preparing additional resources to support educators, including the implementation of an AI webinar series "Artificial Intelligence: Learning with AI, Learning about AI," which features educators from K12 and postsecondary spaces, as well as industry professionals, complete with actionable resources for schools with a learner centered focus. CDE is participating along with multiple organizations including Code.org, Educational Testing Services, International Society for Technology in Education, Khan Academy, and World Economic Forum, in the TeachAI project (teachai.org), to engage in conversations with a goal of empowering educators to teach with and about AI.

CDE encourages educators to approach AI with a lens of equity. As educators and students learn about potential inaccuracies, bias, and social impacts of AI, they build capacity to promote ethical use of technology. The department supports educators who adapt their teaching methods to incorporate emerging technologies effectively in line with student needs.

Resources

Information and resources related to AI in education are available on the California Educators Together Statewide AI group at

<https://www.caeducatorstogether.org/q/group/JM45qd3n>.



Where is AI in the world of today and tomorrow?

AI is an integral part of our daily lives, from virtual assistants to recommendation algorithms that determine the content on social media feeds. At its core, artificial intelligence (AI) refers to computer systems designed to perform tasks that typically require human intelligence, such as understanding natural language, recognizing patterns, making decisions, and learning from data. AI systems start by ingesting vast amounts of data. This data can be in various forms, such as text, images, or numbers. For instance, in a language translation application, the input could be a sentence in one language. Once the data is inputted, AI systems employ algorithms to process and analyze it. Algorithms are akin to sets of instructions that guide the AI in making sense of the data. These instructions can involve complex mathematical operations, data transformations, and statistical modeling. After processing the data, the AI system generates an output, which could be a translation of the input sentence into another language in the case of the language translation example. AI systems often have a learning component, improving their performance over time by learning from new data, a process known as machine learning.

In this age of AI, it is essential that both educators and students demystify this technology and grasp how it produces output. A conceptual knowledge of the benefits and potential risks of computing technologies is increasingly relevant for our students and educators alike. A growing knowledge about AI improves safety and efficiency when utilizing AI systems and supports understanding of potential inaccuracies and biases that may exist in their outputs.

While we cannot predict the future, it appears certain that technology will continue to influence our personal and professional lives. A report by the World Economic Forum in 2023 indicates that 1.1 billion jobs are likely to be radically transformed within the next decade. Skills the workplace of the future will call for include artificial intelligence and machine learning, cloud computing, product management, and social media. According to the 2023 AI Index report by the Stanford Institute for Human Centered Artificial Intelligence, demand for AI related professionals is increasing in nearly every sector of the economy. As such, AI literacy is foundational for a well-rounded education to prepare students for today and tomorrow. California's fundamental AI skills (addressed further in this document) for educators and students address both learning with and about AI, to promote efficient and ethical use of these emerging technologies in and outside of the classroom.



Where might AI fit within California schools?

As is the case with all technologies utilized in educational settings, student safety concerns underscore the importance of evaluating terms of use, data collection guidelines, and ethical use policies. Educators are encouraged to engage in professional learning regarding the capabilities and limitations of AI so that they may guide students in navigating a world in which AI permeates personal and professional lives. Professional learning can guide educators to supporting safe environments in which **students learn with AI**. Learning with AI can enhance academic learning in any content area, when implemented with safety and ethical use in mind. Educators and students learning with AI may have conversations regarding appropriate use of AI in and outside of the classroom, crafting ethical use guidelines together to ensure students build skills in leveraging the benefits of AI while maintaining academic integrity and maximizing learner responsibility.

Educational leaders are encouraged to provide access to computer science education for all K-12 students so that **students learn about AI** equitably. As educators and students demystify AI systems, as they see past the perceived “magic” of these technologies and deconstruct them to build a conceptual understanding of their inner workings, they are better able to engage as responsible, ethical citizens of emerging technologies.

In accordance with the concepts in the California computer science standards, a comprehensive computer science foundation for students includes conceptual understanding and skills of the five concept areas of the standards which include computing systems, networks and the internet, data and analysis, algorithms and programming, and impacts of computing. AI touches upon each of these concept areas. Computer science is referred to as a core subject in the state board adopted California computer science standards, designed for all K-12 students. In alignment with these K12 standards, as students gain the ability to navigate computing systems, utilize networks and the internet responsibly, analyze and interpret data with an antibias lens, solve problems using algorithms and programming, and carefully consider the ethics of computing technologies, they become informed digital citizens who can leverage AI and other technologies to promote social justice and equity. The importance of computer science is recognized at a national level, with Every Student Succeeds Act including computer science as part of a “well-rounded education” (2015). Computer science



concepts permeate nearly every industry in our midst, with the California computer science standards emphasizing its interdisciplinary nature and relevance in our digitally connected society. The appendix of the California computer science standards provides example models for providing access for computer science education in K12 systems, which are to be based on local capacity and context rather than as a one size fits all approach.

Fundamental Skills for Educators and Students

Safe Use

Engage in safe use by reviewing AI data collection, user privacy

Data collection, in the context of AI, refers to the process of gathering and storing information from various sources, such as user interactions, sensor data, or online behavior. This data serves AI systems, enabling them to learn, adapt, and make informed decisions. Data collection for AI systems may encompass a wide range of information, including personal details, preferences, browsing history, and more. Educators and students are encouraged to build awareness of data collection activity of AI systems, in order to safeguard personal information and adhere to data privacy regulations.

User privacy refers to safeguarding individuals' personal information and ensuring that it is handled in a responsible and ethical manner. It entails protecting data from unauthorized access, breaches, and misuse. In the educational context, user privacy is of paramount importance to protect students' sensitive information and maintain trust within the learning environment. For example, while educators can leverage AI to support them in developing lesson plans, individual education plans, and analyzing assessment data, it is vital that they omit identifiable student information when inputting data to AI systems. It is important that educators and students review when and if data they input into an AI system is collected, and if that data will be stored to further its learning or be deleted.

Educational leaders are encouraged to build trust by fostering transparency. Trust is the cornerstone of safe AI use in education. When educators and students know that their data is handled with care and transparency, they are more likely to embrace AI technologies for learning and teaching. Compliance with privacy laws is not just a legal



requirement but may be considered a moral obligation for educational institutions. Districts and educators must consider COPPA (Children's Online Privacy Protection Act) and FERPA (Family Educational Rights and Privacy Act) when considering AI use in the educational setting.

The integration of AI into California's education system presents immense opportunities for innovation, increased accessibility, and personalized learning. However, it also underscores the critical need for educators and students to engage in safe AI use by rigorously reviewing data collection and user privacy practices. By adhering to ethical principles and staying vigilant in safeguarding personal information, California's educational community can harness the power of AI while preserving individual privacy and security.

Pros and Cons

Leverage AI capabilities, critique inaccuracies

A commitment to providing equitable teaching and learning environments for all students aligns perfectly with the potential of AI to help bridge the digital divide. By supporting educators and students in leveraging AI effectively and addressing inaccuracies, we can enhance the quality of education and ensure that every student, regardless of their circumstances, has access to a meaningful education that prepares them for the world of today and tomorrow.

The "Closing the Digital Divide Initiative," led by State Superintendent Thurmond and his Closing the Digital Divide Task Force, aims to eliminate disparities in access to computing devices and connectivity among California students. This initiative recognizes the profound impact that the digital divide has on educational equity. Educators and students who have the skills to leverage AI safely and efficiently will benefit from increased productivity. Conversely, communities who lack access to skill building experiences with AI at home may not have the opportunity to gain proficiency with this emerging technology if the skills are not also addressed in the school setting.

Educators and students are encouraged to leverage AI capabilities. AI can facilitate personalized learning experiences, enabling teachers to create custom-tailored lessons, and provide personalized support to students. AI can analyze student data to tailor lessons, adapt to individual learning styles, and provide targeted interventions, thereby addressing educational disparities. AI tools can increase access for marginalized populations. Examples include language translation support for multilingual students,



voice typing for students with disabilities, and organizational tools for executive processing support. AI can expedite administrative tasks and automate workflow for both educators and students. This may allow educators to focus more on instruction and student support, freeing up time to build connections with students. AI can support students with after-hours tutoring/resource support to support academic learning. This support may be of value to students who do not have access to academic support outside of the classroom.

It is important that educators and students learn to critique AI inaccuracies, to support media literacy. AI systems may perpetuate biases or generate inaccurate results. AI systems may hallucinate information or provide incorrect citations. Educators can integrate lessons on AI ethics, bias detection, and fact-checking into the curriculum. As students are encouraged to question AI-generated information and engage in constructive discussions about AI's role in education, they build their skills in utilizing AI responsibly. Learning AI skills fosters digital literacy, a fundamental requirement for participating in an increasingly digital world. Educators have a unique opportunity to leverage AI capabilities and address inaccuracies within the "Closing the Digital Divide Initiative." By integrating AI skills into our educational approach, we not only bridge the digital use divide but also prepare our students for a future where AI is an integral part of their lives. By fostering critical thinking, ethical considerations, and technical proficiency, we empower our students to navigate the digital landscape with confidence. By embracing AI as an ally in this endeavor, we embark on a path toward a more inclusive and digitally proficient educational landscape.

Social Impacts

Consider presence of bias and social impacts of AI

The fundamental skill of recognizing the impacts of algorithmic bias and considering the social consequences of artificial intelligence (AI) fit within State Superintendent of Public Instruction Tony Thurmond's "Antibias Education Initiative." Algorithmic bias refers to the presence of unfair and discriminatory outcomes in machine learning algorithms and AI systems due to the data used to train them or the design choices made during their development. As educators and educational leaders, our commitment to confronting hate, bigotry, racism, and bias aligns seamlessly with the need to raise awareness about algorithmic bias and its far-reaching societal effects. By integrating these concepts, we can empower educators and students to become informed advocates in the fight against bias and discrimination.



Algorithmic bias in AI systems can perpetuate and amplify societal biases, leading to discriminatory outcomes, particularly affecting marginalized communities. Educators and educational leaders play a crucial role in raising awareness about algorithmic bias. By communicating its impacts, we equip students to recognize and address bias in AI systems, fostering critical thinking and empathy. Educators are encouraged to integrate discussions about algorithmic bias into existing curriculum, emphasizing real-world examples of bias in AI applications. Students can be guided to explore the ethical implications and societal consequences of algorithmic bias.

AI technologies have a profound impact on society, including their influence on employment, access to resources, and decision-making processes. Educators can incorporate lessons on the societal implications of AI into the curriculum and encourage students to analyze how AI affects various aspects of society, from healthcare to criminal justice, and explore strategies to mitigate bias and discrimination.

By understanding the social impacts of AI and algorithmic bias, students can become more empathetic and better equipped to advocate for fair and equitable AI systems. Equipped with knowledge about AI bias, students can make informed ethical decisions in a world increasingly shaped by AI technologies.

Incorporating the fundamental skill of communicating algorithmic bias impacts and considering the social consequences of AI in alignment with the "Antibias Education Initiative" presents a unique opportunity to empower educators and students to confront hate, bigotry, racism, and bias. AI education can be utilized as a powerful tool to help address bias and discrimination, creating a future where our students are not only informed but also engaged advocates for a more inclusive and tolerant society.

Demystify

Build understanding of how AI systems work

The continued growth of artificial intelligence (AI) and its impact on various facets of society necessitates equipping our students with the knowledge and skills to engage with AI systems thoughtfully and responsibly. AI technologies are becoming pervasive across industries, making AI understanding a core competency. As AI continues to shape various industries, students who understand AI fundamentals will be better prepared for future careers. AI literacy is becoming a valuable skill across many fields. Building a foundational understanding of how AI systems work and produce output not only prepares students for future careers in computer science and technology-related



fields, but it also ensures that all students enter the workforce as knowledgeable, resourceful consumers of AI. A strong conceptual understanding of AI empowers students to adapt and contribute to an evolving workforce.

Today's students are digital natives, but they must also be digitally literate to thrive in the AI era. Knowing how AI processes data and generates outputs enables students to think critically about the results AI systems provide. They can question and evaluate the information they receive and make informed decisions. This is of particular significance as students utilize AI in the classroom, to maintain academic integrity and promote ethical use of AI. Educators and students are urged to leverage AI to foster and not inhibit critical thinking. An understanding of the inner workings of AI supports learners in identifying inaccuracies, questioning AI outputs, and recognizing potential bias. Ethical considerations are paramount in AI development and usage. As educators and students build an understanding of how data collection feeds AI outputs, educators and students become ethical technology users and potential creators who prioritize fairness, accountability, and transparency.

Building AI understanding for all students, regardless of zip code, race, gender, or socioeconomic status, can help to diversify the STEM pipeline by breaking down barriers and biases in tech fields. AI can be a powerful tool for solving complex problems. Students with knowledge of AI can harness this technology to address real-world challenges and innovate. Ensuring that all students have access to AI education promotes inclusivity and reduces the risk of a digital divide.

Educators and students who build skills in understanding how AI systems work is essential for equipping them with the skills and knowledge needed to navigate the digital landscape responsibly, think critically, and thrive in a technology-driven future. It empowers them to become not just consumers but active participants and ethical stewards of AI technology.

Utilizing AI in Schools

What might it look like to utilize AI in California schools? Artificial intelligence technologies, tools, and applications can be utilized in the educational environment to enhance and improve various aspects of teaching and learning. This integration can take several forms and serves multiple purposes. Implementation may be customized to meet local context and needs of each school community.



WHY:

Planning and workflow support

AI-powered tools can enhance productivity and empower educators to provide more personalized and effective learning experiences. By embracing AI, educators can optimize their workflows, save time, and elevate the quality of education they deliver. As the educational landscape evolves, educators are tasked with managing increasingly complex teaching environments. AI offers to meet this challenge by providing tools that streamline administrative tasks, enhance instructional planning, and support educators in adapting to diverse student needs. AI can automate routine administrative tasks such as data analysis, generating practice sets, unpacking standards, scheduling, content generation, and more. This can allow educators to allocate more time to teaching and supporting students. AI is not a replacement for educators but a powerful ally in the pursuit of educational excellence. By utilizing AI for planning, automation, and workflow support, educators can optimize their time and resources, ultimately improving the quality of education they provide. The integration of AI-driven tools empowers educators to address individual student needs, promote engagement, and make data-informed decisions.

Accessibility & personalization

In alignment with the neuroscientifically backed principles of Universal Design for Learning, inclusive learning environments empower students to become expert learners, equipped with tools that increase accessibility and personalize the learning experience to meet their unique needs. Additionally, connecting content to students' lives furthers the personalization process and supports culturally responsive pedagogy. AI tools can support educators and students in the endeavor to tailor learning experiences to the students in their midst.

AI can generate personalized learning materials, such as worksheets, quizzes, and reading assignments, aligned with students' learning goals, strengths, and interests. AI analytics can provide educators with insights into student progress and areas that require additional support, allowing for educators to provide targeted interventions during small group instruction. AI-powered tools can enable text-to-speech and speech-to-text capabilities, ensuring that all students, including those with visual or hearing impairments, can access educational content. AI-driven closed captioning and transcription services can enhance accessibility by making multimedia content, such as videos and podcasts, accessible to individuals with hearing impairments. AI-driven language translation tools can break language barriers, making educational content



accessible to multilingual learners. AI-powered assistive technologies, such as screen readers and voice recognition software, can empower students with disabilities to engage fully in the learning process.

College/career readiness

As students utilize AI responsibly in K12 schools, they gain skills that support thinking processes, organization of workflow, ethical technology use, and abilities to communicate effectively in a digitally connected world.

AI-driven tools encourage students to think critically and approach complex problems analytically, a skill highly valued in both higher education and the workforce. Students exposed to AI tools are adept at automating routine tasks and managing their time efficiently, which is invaluable for college success. As we teach students about AI ethics, we help to ensure they make responsible decisions in both personal and professional lives. Proficiency in AI technologies gives students a competitive edge in the job market and positions them as valuable assets in a technology-driven workforce. AI integration promotes digital literacy, enabling students to effectively navigate the digital landscape, a skill required in both academic and professional settings.

Address the digital use divide

As technology becomes increasingly integral to education, educators and educational leaders must harness AI's power to ensure equitable access, enhance digital literacy, and prepare all students to thrive in an AI-driven world. The digital use divide, characterized by disparities in access to and effective use of technology, is a pressing concern in modern education. AI, when thoughtfully integrated, offers a powerful means to bridge this divide and promote equitable opportunities. Infusing AI into curricula enables students to develop digital literacy skills, empowering them to navigate technology effectively and responsibly. AI-powered language translation and accessibility tools can break down language and physical barriers, supporting more inclusive learning environments.

HOW:

Evaluate terms of use, enact data collection guidelines

As school districts consider the integration of AI systems into their educational environments, it is essential to thoroughly evaluate the terms of use to ensure the



responsible and effective deployment of AI technology. Local education agencies may wish to consider the following steps as they evaluate safety of AI systems:

1. Data Privacy Compliance:

- **Legal Framework:** Ensure that the AI system complies with federal and state data privacy laws, including the Family Educational Rights and Privacy Act (FERPA) and the Children's Online Privacy Protection Act (COPPA).
- **Data Handling:** Review how the AI system collects, stores, and manages student data. Ensure it adheres to privacy protocols and encryption standards.
- **Data Ownership:** Clarify who owns the data generated or processed by the AI system and establish rights and responsibilities regarding data access and sharing.

2. Security Measures:

- **Data Security:** Assess the AI system's security measures, including encryption, authentication, and authorization protocols, to safeguard against data breaches and cyber threats.
- **Access Control:** Verify that the AI system has robust access controls to restrict data access to authorized personnel only.

3. Transparency:

- **Algorithm Transparency:** Seek clarity on how the AI system's algorithms make decisions and whether the vendor can provide insights into the system's decision-making processes.

5. Data Retention:

- **Data Retention:** Determine how long the AI system retains student data and whether it aligns with your district's data retention policies.

6. Accessibility and Inclusivity:

- **Universal Design:** Confirm that the AI system adheres to universal design principles, making it accessible to all students, including those with disabilities.

7. Educational Partner Involvement:

- **Community Engagement:** Involve parents, students, educators, and administrators in the evaluation process to gather their input and address their concerns.

8. Continuous Monitoring:

- **Ongoing Assessment:** Establish procedures for ongoing monitoring and evaluation of the AI system's compliance with the terms of use and data privacy standards.



Ethical use policies

In today's technology-driven world, students are exposed to digital tools and platforms from a young age. It is important to provide them with ethical use guidelines that promote responsible, respectful, and safe online behavior. Involving students in the creation of these guidelines not only ensures their relevance but also empowers them to be active participants in shaping their digital learning environment. This is true of all technologies and is of particular need as emerging technologies such as AI become more prevalent in society.

The following steps may be helpful in developing ethical use policies for AI use with students. It may be beneficial to involve students in the process of creating ethical use guidelines from the beginning. Their input is invaluable in shaping rules that resonate with their experiences. Provide students with educational resources and discussions on digital ethics, covering topics like online privacy, cyberbullying, plagiarism, and responsible sharing. Facilitate brainstorming sessions or focus groups with students to collect their thoughts, concerns, and ideas regarding online behavior. Work with students to draft the ethical use guidelines collaboratively. Encourage them to express their views and concerns and guide them in turning those ideas into actionable rules. Integrate real-world scenarios and case studies into discussions to help students apply ethical principles to practical situations. Encourage students to review and provide feedback on the drafted guidelines. Peer review fosters a sense of ownership and accountability. Launch the guidelines formally, communicate them to all educational partners, and provide training or workshops to help students understand and embrace them. Establish a process for continuous review and updates to keep the guidelines relevant and responsive to evolving digital challenges.

Creating ethical use guidelines for students, with a focus on valuing their voices, is a powerful way to empower them to navigate the digital world responsibly and ethically. These guidelines can provide a framework for fostering a positive digital learning environment, where students can thrive academically and personally while upholding principles of respect, responsibility, and safety. By involving students in this process, we not only teach them valuable life skills but also instill a sense of ownership and shared responsibility for their digital community.

Support mental health: emphasize human connection

While AI offers numerous benefits, it is vital to ensure that the technology enhances rather than replaces the human touch in education, promoting student well-being and emotional development. The introduction of AI into K-12 education has the potential to



revolutionize learning experiences. However, it is essential to strike a balance between technological advancement and the preservation of essential human elements, including human connection and mental health support.

Encourage educators to maintain strong, personal relationships with students despite the integration of AI. AI should complement, not replace, these connections. AI can be used to facilitate peer collaboration, allowing students to work together, discuss, and learn from one another, fostering social connections.

As educational communities integrate AI, they are encouraged to ensure that it intersects with the spirit of State Superintendent of Public Instruction Tony Thurmond's Mental Health Support Initiative. It is important to educate students about the role of AI data collection in shaping their online experiences. For example, biased data collection can perpetuate stereotypes and discrimination. When data collected reflects biases, it can lead to unfair treatment or exclusion of certain groups. For students, this can result in feelings of marginalization and can negatively affect their mental health. Further mental health challenges may arise outside of the school setting as students indicate preferences on social media platforms and streaming services. The AI algorithms behind these platforms may lead individuals to narrow views. This can hinder constructive dialogue and understanding between students, leading to feelings of isolation and frustration, both of which can negatively impact mental health. Building healthy relationships and connections with peers is fundamental to mental health. If AI algorithms steer students toward divisive content, it can impede their ability to engage in open, empathetic conversations and form diverse social connections. Therefore, conversations regarding the impacts of AI on mental health are paramount for students and educators to navigate the digital world. The integration of AI into K-12 education offers immense potential for enhancing learning experiences. However, it is imperative to prioritize human connection and consider mental health implications as we adopt these technologies. By emphasizing strong teacher-student relationships, promoting peer collaboration, and incorporating social-emotional learning, educators can create a nurturing environment that fosters both academic and emotional growth.

Developing AI in Schools

What does it mean for K-12 students to develop AI in schools? This means students actively engage in the creation, programming, and understanding of artificial intelligence within their educational environment. This concept goes beyond merely using AI tools or applications; it involves students becoming creators and innovators in the field of AI.



Students are encouraged to not only learn with AI but also to learn about AI through hands-on exploration. This opportunity can be provided to students through engagement with computer science concept areas, each of which can align with AI. The national computer science framework, which provided a foundation to guide the development of California's computer science standards, indicates that in early childhood education, "computer science supports play-based pedagogy, extends what educators are already doing in their classrooms, and guides young learners to notice, name, and recognize how computing shapes their world." This concept extends to developing AI in schools as well. Students of all ages may explore data collection via unplugged activities, experience concepts of algorithm design by experimenting with AI prompts and discuss the impacts of AI on society. The student activities align to the California computer science concepts of data and analysis, algorithms and programming, and impacts of computing. Resources for educators to embed AI lessons into their classrooms is available on the California Educators Together statewide AI group, at <https://www.caeducatorstogether.org/q/group/JM45qd3n>. Flexible implementation ideas for providing access to computer science education in K12 systems are included in the California computer science standards appendix and may be customized according to local context and community needs.

Developing AI in K-12 schools is about empowering students to become active participants in the technology of today and tomorrow. It equips them with the knowledge, skills, and ethical understanding needed to contribute to the responsible and innovative development of artificial intelligence, both during their educational journey and in their future endeavors.

WHY:

Expand access for traditionally underrepresented groups

Developing artificial intelligence (AI) in K-12 schools, which may occur through computer science pathways, may act as a powerful means to address systemic bias and expand access for traditionally marginalized groups in computer science, technology, and STEM (science, technology, engineering, mathematics) fields. By integrating AI education with a focus on diversity and inclusion, we can pave the way for a more equitable future in these disciplines. A lack of diversity and representation in computer science, technology, and STEM fields has long been a concern. In April of 2021, Pew Research Center indicated that LatinX and Black workers are underrepresented in the STEM workforce, while White and Asian workers are overrepresented. Women were reported to make up a mere quarter or less of all computer and engineering jobs. To address this issue, it is crucial to start early in the



educational pipeline, which makes K-12 schools an ideal setting for nurturing diversity, inclusion, and equal access.

Computer Science is akin to a gateway to STEM for the post-secondary level, particularly for underrepresented populations. College Board reports that in 2019, the Advanced Placement (AP) Computer Science Principles course was a first AP course for 68% of Black students, 59% of LatinX students, and 60% of first-generation college students. Furthermore, students who take AP computer science principles are more likely to major in computer science or another STEM major in contrast with similar students who did not take the course. The likelihood is further increased for LatinX and women.

AI education in K-12 schools introduces students from all backgrounds to the world of computer science and AI, providing early exposure and demystifying these fields. The introduction of California's computer science standards highlights the importance of inclusionary computer science opportunities:

"The standards are designed for each and every student, including underserved populations: girls, low-income students, homeless students, rural students, African American and LatinX students, students who are English learners, students with disabilities, and foster youth. Students' access to and achievement in computer science must not be predictable on the basis of race, ethnicity, gender, socioeconomic status, language, religion, sexual orientation, cultural affiliation, or special needs."

California Computer Science Standards Introduction

As educators model diversity in computer science opportunities and emphasize the importance of recognizing and mitigating bias in AI systems, they promote fairness and teach students about ethical AI development.

Empower learners to design systems to solve challenges

By fostering student voice, motivation, and problem-solving skills within AI education, we can equip students to become active contributors to technologies of today and tomorrow. As we incorporate AI education in K-12 schools in a way that provides opportunity for students to not only understand AI but to actively engage with it, we demystify AI, promote critical thinking, and instill motivation to design AI systems that tackle meaningful problems. As K12 systems empower students to see AI as a tool they can wield to solve problems, this challenges the perception that AI is the realm of experts. As student voice is welcomed in AI education, this fosters a sense of ownership



over learning experiences. This allows students to infuse creativity into AI projects, exploring innovative solutions to real-world issues. As students voice their concerns and interests, education in developing AI can help them to propose technological solutions to relevant challenges in their lives. Engaging with AI in meaningful ways taps into students' intrinsic motivation, as they see the direct impact of their work on solving authentic problems. By embracing student voice, promoting problem-solving, and providing opportunities for hands-on learning, we can equip the next generation with the skills and confidence needed to shape the future of AI for the better. This approach not only enriches their educational experience but also prepares them to tackle complex challenges in a rapidly evolving technological landscape.

HOW:

Integrate AI skills & California computer science standards into curriculum

Incorporating AI skills and computer science standards into K-12 education can equip students with the knowledge and abilities necessary to navigate and contribute to an increasingly AI-powered world. This integration fosters computational thinking, problem-solving, and innovation, paving the way for students to become AI developers and creators. Infusing AI skills into the curriculum ensures that students are prepared to engage with and contribute to emerging technologies that are reshaping industries and society. California's computer science standards provide a comprehensive foundation that includes essential concepts such as algorithms, data analysis, and programming—key components of AI development. The computer science standards emphasize interdisciplinary learning, connecting AI with various subjects and applications, from healthcare to engineering to agriculture to art and more.

Infusing AI skills and computer science standards into K-12 education aligns curriculum with the needs of the modern world, fosters critical thinking and creativity, and prepares students to become active contributors to the AI revolution. As we provide educators with the professional learning and resources needed to integrate AI, we provide all students with the opportunity to gain the skills and knowledge required to navigate and shape the AI-driven future. This approach not only enriches educational experiences but also empowers students to innovate and create in an increasingly AI-powered world.

integrate 5 big ideas of AI (ai4k12.org)

The field of artificial intelligence (AI) is rapidly evolving, and its impact on society is profound. To ensure that K-12 students are well-prepared to navigate this AI-powered world, the 5 Big Ideas of AI can be integrated into the curriculum to meet students'



developmental levels. These ideas serve as a foundational framework that aligns with educational goals and enhances students' cognitive, computational, and ethical skills.

The 5 Big Ideas of AI:

- **Perception:** Understanding how AI systems perceive the world is fundamental. This includes image and speech recognition, natural language understanding, and sensory data processing. Integrating this idea into education enables students to comprehend how AI systems interact with the environment.
- **Representation:** AI relies on data and information representation. Teaching students how data is structured and organized empowers them to work with AI models and make informed decisions about data usage and manipulation.
- **Reasoning:** AI systems use reasoning to make decisions and solve problems. Integrating this idea helps students develop critical thinking skills, algorithmic reasoning, and the ability to assess the logic behind AI decisions.
- **Learning:** Machine learning is at the core of AI. Teaching students about machine learning algorithms, training models, and the concept of learning from data prepares them to understand the AI systems that surround them.
- **Societal Impact:** Recognizing the societal impact of AI, including ethical considerations and bias, is essential. This idea encourages students to engage in discussions about AI's role in society and its ethical implications.

Integrating the 5 Big Ideas of AI into K-12 education is a forward-looking strategy that supports educational goals by fostering critical thinking, creativity, problem-solving, ethical awareness, and career readiness. This approach not only equips students with AI knowledge but also prepares them to be informed and responsible citizens in an increasingly AI-driven world. The 5 Big Ideas of AI provide a solid foundation for AI education that aligns with the broader educational mission of preparing students for success in college/career for today and into the future.



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