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"The near-ubiquitous use of algorithmically driven software, both visible and invisible to everyday people, demands a closer inspection of what values are prioritized in such automated decision-making systems."

— Dr. Safiya Umoja Noble, Algorithms of Oppression: How Search Engines Reinforce Racism

"We have seen that algorithmic bias doesn't always lead to fair outcomes. So what can we do about it? It starts with people.. Who codes matters..how we code matters...and finally, why we code matters."

— Dr. Joy Buolamwini, TedX

RESPONSIBLE AI AND TECH JUSTICE: A GUIDE FOR K–12 EDUCATION

A guide designed for K-12 educators and students, to support the critical interrogation of artificial intelligence and its implications on individuals, communities, and the world.

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RESPONSIBLE AI & TECH JUSTICE: A GUIDE FOR K–12 EDUCATION

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BACKGROUND



The advancement and proliferation of artificial intelligence (AI) technologies continue at a rapid pace, with both promise for positive impact and potential for exacerbating harm. In K-12 education, there is an urgent need to ensure all students and teachers are equipped with the knowledge, skills, and resources to move beyond simply the adoption of AI tools.

Advances in generative AI have captivated the attention of students, teachers, parents, investors, entrepreneurs, corporate leaders, activists, and policymakers alike—and led to polarizing debates about its utility and impact. AI's potential for breakthroughs in areas including education, science and medicine, transportation, and the environment have led to exponential growth in AI investment, with $355.9B in venture funding invested in AI startups in the first half of 2026, far surpassing the total amount of venture funding in all of 2025. Simultaneously, big tech is estimated to spend nearly $800B in 2026 on capital expenditures related to AI development and infrastructure. Estimates of AI adoption suggest approximately 30% of adults report using AI tools regularly, 40% of college students report using AI at least monthly, and more than half of U.S. teens have used AI chatbots for finding information and completing schoolwork. Yet, despite AI's potential to identify breakthroughs in disease prevention and treatment; reduce business costs and improve efficiency and worker productivity; improve efficiency in communication; and enable greater personalization to improve educational outcomes for students, advancements in AI are not without concern.

Algorithms and AI tools have contributed to increased political polarization, the proliferation of mis/disinformation, and mental health challenges among teens and young adults. There is a growing body of research on the environmental impacts of the data centers needed to power AI, including the increased energy, water usage at a time where climate change is a leading global concern, and the disproportionate impacts of pollution and rising costs on marginalized communities. Researchers have documented biases and systemic inaccuracy in facial recognition software which misidentify Black individuals at much higher rates, and have led to cases of wrongful arrest. Algorithms used to determine health care and insurance decisions have demonstrated significant bias against Black patients; mortgage-approval application algorithms disproportionately denied loans to applicants of color; algorithms widely-used in the hiring process have demonstrated bias against women and individuals with disabilities; and algorithms used as risk assessments to predict recidivism were much more likely to assess Black defendants as high risk, impacting sentencing and parole decisions. And debates rage about AI use in schools and its impacts on critical thinking and cognitive development, data privacy and protection of student data, and the use of predictive algorithms, surveillance of students, and cheating detection in education.

The economic gains from AI advancement have been far from evenly distributed: tech wages are 130% higher than the national median wage, and 16,000 new millionaires are anticipated from the IPOs of just three companies (OpenAI, SpaceX, and Anthropic). Simultaneously, AI is projected to displace entry-level and blue collar workers and Black workers and low-wage workers are at highest risk for displacement, and wealth and income inequality is widening significantly. Finally, the lack of diversity within the AI workforce and among AI company leadership, boards, and investors impacts the types of technology tools created, the problems they aim to solve, and decisions made in the development and deployment process, while risking the replication and exacerbation of societal inequality.

This concentration of power and wealth within the hands of a select few, coupled with the documented potential harms of unregulated AI development and deployment, has led to increased skepticism, dissatisfaction, and backlash. Currently, 55% of Americans believe AI will do more harm than good, a majority believe AI will worsen the ability to think critically, form meaningful relationships, and 70% believe AI will have a negative impact on their jobs/careers. In a critical moment where the excitement and potential of AI is juxtaposed with growing discontent about AI's current trajectory and impact on our everyday lives, the comprehensive understanding and critical interrogation of AI technologies must no longer be limited to a select few. In fact, building a fundamental understanding of the underlying technology, data, and algorithms and of the dynamics of power, environmental impacts, and sociopolitical impacts of AI technologies is a global imperative across all communities– and K-12 education classrooms are a central place to cultivate this knowledge.

To achieve this, we must begin by making fundamental changes in K-12 education to ensure all students and teachers are equipped with the knowledge, skills, and resources to become critical consumers and responsible producers of the next generation of AI technologies.



RESPONSIBLE AI & TECH JUSTICE



Responsible AI in K-12 education is defined as a robust and comprehensive course of study that utilizes an explicit racial and social justice lens to equip all students with the knowledge and resources to critically interrogate the ethical and equitable development, deployment, and impacts of AI, while simultaneously challenging, disrupting, and remedying the harms that these technologies can produce within individuals' lives, communities, and society at large.

Advancements in generative AI have led to increased AI utilization by students and educators, the development of new AI tools being deployed in educational settings, and a broad set of questions related to the potential for AI to improve education and potential risks to student learning and development. It is critical to articulate the difference between AI in education (the usage of AI tools in teaching and learning), AI literacy (the foundational understanding of AI, how it works, how to use it, and its risks), and AI education (AI literacy + the technical skills required to build AI). In AI education, core concepts of AI have long been a component of computer science (CS) educational standards and curriculum, just 60% of U.S. public high schools offer foundational CS courses, and disparities persist by race, gender, and socioeconomic status in which students have access. Tool adoption and usage (AI in education) is on the rise among both students and teachers, with 92% of students and 88% of educators using AI for school-related work and 79% of districts having AI adoption/procurement guidelines in place, yet questions remain about data privacy, efficacy for improving learning and risk to cognition, motivation, and development. Finally, the widespread attention on AI has led to new national efforts and initiatives to expand AI literacy for all students in K-12 education, yet challenges remain in articulating standards for what AI literacy should include, how AI literacy intersects with digital literacy and CS, and how it can be incorporated throughout K-12 education.

In 2024, we articulated a vision for Responsible AI and Tech Justice in K-12 education, as a **"robust and comprehensive course of study that utilizes an explicit racial and social justice lens to equip all students with the knowledge and resources to critically interrogate the ethical and equitable development, deployment, and impacts of AI, while simultaneously challenging, disrupting, and remedying the harms that these technologies can produce within individuals' lives, communities, and society at large."** Aligned with this vision, six core components serve as a guide for educators, parents, policymakers, and advocates seeking to design learning experiences for students across educational settings, where both the critical interrogation of technologies and the creation of more ethical and equitable solutions are prioritized.

In this updated 2026 version of the guide, we:

(a) align our vision for Responsible AI with a **shared definition of CS and AI literacy**, specifically that *"AI literacy requires a foundation in CS. AI literacy is essential, but not a substitute for, AI education: teaching only tool use leaves students able to operate AI, but not able to build or evaluate it,"*

(b) **define responsible AI literacy** as a set of skills and dispositions that all critical consumers and responsible producers of AI should develop, to cultivate agency and clarity about the purpose, limits, and consequences of AI tools,

(c) articulate a set of **six core competencies** that describe responsible AI literacy and align with the **six core components**, and

(d) provide a set of **sample interrogation questions**, segmented by grade level, and aligned to the new CSTA K-12 CS standards.

Through the practice of developing Responsible AI literacy, students will critically analyze various aspects of AI, seeking answers to both simple and complex questions about computing techniques, data sources, people and values, the creation ecosystem of AI, as well as various impacts on individuals, the environment, and communities. A definition of terms list, two AI charts adapted for K12, and additional resources begin in Appendix 1.





It is our goal that these six core components of **Responsible AI in Education**, six core competencies of **Responsible AI Literacy**, and sample interrogation questions will be used by a range of K-12 educators and advocates, including teachers, instructional coaches, administrators, and curriculum providers, to directly inform their instruction, pedagogy, policies, and curricular resources. We aim to ensure that these concepts become deeply ingrained within computer science classrooms and pathways, across other content areas and disciplines, and within outside of school time programming— ensuring that all students are critical consumers and responsible producers of future technologies.

THE SIX CORE COMPONENTS:

1. ***Examine the AI technology creation ecosystem*** from who designs and develops products and how they are developed, to who invests in their creation and benefits from their adoption.

2. ***Interrogate the complex relationship between technology and human beings,*** including human-computer interaction and topics of values, ethics, privacy, and safety.

3. ***Explore the impacts and implications of AI technologies on society,*** including positive benefits, negative consequences, and the perpetuation of exclusion, marginalization, and inequality.

4. ***Interrogate personal usage of AI technologies*** to become critical consumers of products and address misuse, exploitation, and safety concerns.

5. Build a ***critical lens in the collection, usage, analysis, interpretation, and reporting of data.***

6. ***Minimize, mitigate, and eliminate harm*** and injustice caused by AI technologies through both the responsible and ethical creation process and individual and collective right to refusal.

THE SIX CORE COMPETENCIES:

Responsible AI Literacy includes six competencies covering several dispositions and considerations. All students should understand the core technical components of AI, including **algorithmic awareness** to understand what algorithms are, the data and logic driving them, and the various impacts driven by choices made in their design and testing; and **data fluency** to understand how to collect, interpret, analyze, and critique data sources. Students must also understand design and development approaches, including **human-centered agency**, and ensuring humans have control and decision making in producing, deploying and/or refusing AI technologies, as well as the understanding of **ethical design** and choices made to ensure equitable access and accessibility in tool development. All students must also understand the societal impacts of AI, including understanding **environmental impacts** at the local and global level and the **dynamics of power** in influence, creation, and impact of AI within society.



Understanding of the existence, logic, development, and direct influence algorithms have on artificial intelligence technology.



Understanding of how to collect, interpret, analyze, infer, and effectively communicate data information in the age of artificial intelligence.



Understanding how to make ethical decisions related to artificial intelligence tools that are mindful of individuals, communities, and society at large.



Understanding about the positive and negative influence of artificial intelligence technologies on the local and global environment.



Understanding that humans should have ultimate control and decision making ability as it relates to consuming, producing, creating, refusing, and deploying artificial intelligence technologies.



Understanding the various ways artificial intelligence technologies and AI companies impact power dynamics creating inequitable hierarchies, influence, and resource distribution among humans in society.

CORE COMPONENT

1. **Examine the AI technology creation ecosystem** from who designs and develops products and how they are developed, to who invests in their creation and benefits from their adoption.

CORE COMPETENCY





Grade Band	Interrogation Questions	CSTA Standards Alignment: (ES/MS/HS)
ES	What is artificial intelligence? What is machine learning? What are the different forms of artificial intelligence? Who creates AI tools? Where are the places that AI is being used? Who are some current leaders in the world of AI? When did someone create and deploy an AI tool? Who earns money from AI tools? Who is impacted when I use AI tools? What are some positive and negative aspects of AI usage?	CSTA ES Standards
MS	Who funds the creation of AI tools? Who are some national thought leaders in the field of AI? Where are the dilemmas in AI design and deployment? Where does the money come from to make AI technologies? How was this AI tool I'm using tested? How do we create and deploy AI tools that are not biased? How am I giving up my power when I use AI tools? What is a large language model? What are neural networks? What is deep learning as it relates to AI?	CSTA MS Standards
HS	Who benefits more from using AI: consumers or producers? Who are some prominent voices in the AI field locally? Who gets dehumanized by AI tools? Who decides if an AI tool is acceptable to use for minors? Where are the dilemmas in AI tool creation? Why is capitalism a big driving force in the push for people to use AI? When do the government and military use AI technologies? Who are the anonymous workers in AI? What is agentic AI? What companies require the use of AI tools by their workers?	CSTA HS Standards

CORE COMPONENT

2. Interrogate the complex relationship between technology and human beings, including human-computer interaction and topics of values, ethics, privacy, and safety.

CORE COMPETENCY





Grade Band	Interrogation Questions	CSTA Standards Alignment: (ES/MS/HS)
ES	How do humans make decisions about AI? How are humans and computers both similar and different? How does consent work with AI technologies? When does a human control AI? Where is AI used to help with communication with other humans? How are AI tools unlike humans? Why can generative AI be dangerous for me to use? What is thinking and learning? Can computers think? Can computers learn?	CSTA ES Standards
MS	How is consent given with AI tools? Who are the techno-optimists and techno-pessimists? What are the distinct differences between AI tools and human beings? Who decides what AI should or should not do? How can AI technology impact a person's physical or mental health? When does a human or computer determine what the AI tool will do? When can an AI tool cause injustice in society? Why do generative AI tools impact human learning? What are some ways humans impact AI tools? What are some ways AI tools impact humans?	CSTA MS Standards
HS	Who are the Luddites? How can I be the lead as the human with an AI tool rather than be in the loop? How is generative AI consumer-focused? What does human-centered technology mean? What are "human-centered approaches" to AI tools? What specific purposes does AI have to help humanity? Why do some people claim AI is sentient? How can AI technology impact a person's mental and emotional health? How can humans reclaim power from AI systems? What is digital physiognomy as it relates to AI tools?	CSTA HS Standards

CORE COMPONENT

3. Explore the impacts and implications of AI technologies on society, including positive benefits, negative consequences, and the perpetuation of exclusion, marginalization, and inequality.

CORE COMPETENCY





Grade Band	Interrogation Questions	CSTA Standards Alignment: (ES/MS/HS)
ES	How can AI tools help people? How can AI tools harm people? What are some positive and negative aspects of AI usage? Why do AI tools impact the environment? How does AI usage impact climate change? How is AI technology used in everyday life? Is your community involved in making AI tools? Why should I use or not use AI? What do data centers use fresh water for? Can AI tools be unfair to some people?	CSTA ES Standards
MS	Who are the consumers of AI tools? What working conditions exist for people who moderate AI content? Do the creators of AI technologies impact the dynamics of wealth and power? Can AI tools have positive impacts on the environment? What is the energy cost of generative AI usage? How are people being exploited by AI tools? What are some societal impacts of AI usage by humans? Where in the US is AI being used the most by humans? How does generative AI impact the local environment? How do AI tools leave a carbon footprint?	CSTA MS Standards
HS	What happens during the pretraining phase of generative AI tools? What are some societal injustices created by AI usage? Who experiences the direct and indirect harms of generative AI tools? Where are the AI rules and regulations for the United States determined? Where is the line between generative AI and intellectual property for art, books, and music? How has the entertainment industry been impacted by the rise of AI tool usage? How much energy do generative AI prompts use? How does AI usage impact the Earth's carbon footprint? Are there alternative energy sources that can power AI tools that do not negatively impact the environment? What communities are not included in the AI tool creation and deployment pipeline?	CSTA HS Standards

CORE COMPONENT

4. Interrogate personal usage of AI technologies to become critical consumers of products and address misuse, exploitation, and safety concerns.

CORE COMPETENCY





Grade Band	Interrogation Questions	CSTA Standards Alignment: (ES/MS/HS)
ES	Why should I care about protecting myself from AI? What is a chatbot? When should I use AI to complete a task? How do I create AI that doesn't harm humans? Why should I use AI tools? When should I not use an AI tool? What is generative AI? Who decides if I use an AI tool? What can humans do better than AI tools? Can AI tools make mistakes like humans?	CSTA ES Standards
MS	Why should I use or not use generative AI tools? What is my personal data? How can I protect my personal data with my digital behaviors? Where is my data being collected by AI tools? When should I use an AI tool for an academic task? What cautions should I take when talking to an AI chatbot? When does generative AI hallucinate? How does my technology usage impact my social and emotional health? How are anonymous workers impacted during the AI creation process? Will AI tools make mistakes when I use them regularly?	CSTA MS Standards
HS	Why do some people claim AI is sentient? Who is impacted by AI consumption and deployment? How accurate is this AI tool I plan on using? When are generative AI creations considered plagiarism? What is an algorithmic audit? Why are regular algorithmic audits necessary with generative AI tools? When is deep learning necessary with AI tools? How is my personal data impacted when using AI tools? What is anthropomorphism, and why is it dangerous? What are some social and emotional impacts of using generative AI on my health?	CSTA HS Standards

CORE COMPONENT

5. **Build a critical lens in the usage, analysis, interpretation, and reporting of data.**

CORE COMPETENCY





Grade Band	Interrogation Questions	CSTA Standards Alignment: (ES/MS/HS)
ES	What is data? Where do AI tools get data? What are AI data centers? Where are the largest data centers located in the US? How is data necessary for AI tools to function? What is a data set? Why should I care about my personal data? Why do AI tools collect my data? How do AI tools use data centers to work? What does it mean to train data?	CSTA ES Standards
MS	What is data bias? What is data privacy? What data sources do generative AI tools use? How do data centers work? When can AI tools compromise data? How is individual data privacy impacted when using AI tools? How are data sets used by AI tools? Why is data ownership important to understand when using AI tools? How is data ownership determined? Why is math so important to the functioning of AI?	CSTA MS Standards
HS	What are the sources of data for this AI tool? How are the sources for this tool obtained? What is data sovereignty? What is data mining? How do data centers impact the communities where they are located? When is an AI recommendation an invasion of data privacy? How do data biases get magnified by AI tools? How can communities be involved in collecting and controlling their data? What are the types of data biases in AI technology? Where are the aspects of math found in AI tools?	CSTA HS Standards

CORE COMPONENT

6. **Minimize, mitigate, and eliminate harm** and injustice caused by AI technologies through both the responsible and ethical creation process and individual and collective right to refusal.

CORE COMPETENCY





Grade Band	Interrogation Questions	CSTA Standards Alignment: (ES/MS/HS)
ES	How can you create AI for good? Who determines fairness in technology spaces? How can you collect a variety of data for AI tools to use? Can humans decide when AI should/shouldn't be used? Can I refuse to use AI tools? What is bias as it relates to technology? How is data collected to run AI tools? How does AI usage impact fresh water? How do apps use AI? How do we know an AI tool is working effectively?	CSTA ES Standards
MS	What are the things I should consider in the creation aspect of the AI pipeline? What are the hidden labor costs for using an AI tool? What does tech justice mean? Why do AI tools make mistakes? How are AI tools being used to surveil US communities? Why does algorithmic bias impact AI tools? How is misinformation/disinformation spread because of AI tools? How does algorithmic thinking get impacted by the creators of AI tools? Why is there little transparency with AI tools? What are deepfakes?	CSTA MS Standards
HS	What is AI alignment? How are AI deepfakes dangerous to humans? Who has the right to refuse AI technologies? Why do data biases impact the functionality and outputs of AI tools? Do justice-centered AI tools exist? Is generative AI usage just? When should algorithmic audits be done with AI tools? Where are examples of surveillance systems that utilize AI? What is digital physiognomy? Why is a pseudoscience, like eugenics, dangerous to mix with AI systems?	CSTA HS Standards

FUTURE DIRECTIONS

The **Responsible AI and Tech Justice Guide for K-12 Education** is intended to articulate a new approach to teaching and learning in the era of rapid AI development and deployment, which prioritizes the interrogation of ethics, equity, and justice in the creation, deployment, and utilization of AI technologies and inspires the design and adoption of more equitable and just products and solutions. While this guide provides a conceptual overview of these topics, much more is needed to support the translation and adoption of these concepts. Along with aligned partners, we will support efforts to develop curricular resources, professional learning opportunities, conduct research on interventions, and implement policy change.

This guide represents an additional step towards incorporating principles of ethics, equity, and justice in the critical analysis of AI technologies within K-12 education and builds upon decades of critical scholarship and activism across disciplines ranging from computer science and machine learning, to history, political science, and sociology. As technological breakthroughs continue, as new solutions are uncovered, as new approaches are developed, and as new harms are revealed, we intend for this guide, its core components, its core competencies, interrogation questions, and resources, to also evolve. We invite feedback and collaboration from partners across disciplines to refine the guide, its core components, and its resources.



"AI tools must support human relationships, including the teacher-student relationship, using sound pedagogical practices designed to augment, rather than substitute student learning. Finally, educators and students must remain aware of both the benefits and harms these technologies present. When these conditions align, AI has the potential to meaningfully enhance educational outcomes while minimizing risks to learners." (Brookings, 2026)

APPENDIX 1: DEFINITIONS

Agentic AI: An AI system that can accomplish a specific goal with limited supervision. It consists of AI agents—machine learning models that mimic human decision-making to solve problems in real time. (IBM, 2026)

AI Bias: Occurs when a system produces results that favor or discriminate against certain types of people. This typically stems from datasets with historical inequities or skewed representation, and how they are designed and how impact is measured. (Stanford HAI)

AI Literacy: A component of computational literacy, encompasses the knowledge and skills needed to critically understand, evaluate, and use AI systems and tools to safely and effectively participate in an increasingly digital world. (Digital Promise AI Framework, 2024)

AI Model: A software program that learns from data to perform tasks like classifying images, predicting trends, analyzing language, or generating content. (Microsoft Azure, 2026)

AI Surveillance: Using AI on top of existing cameras and online tools to monitor and track people, detect activity, as well as monitor targets and places. AI surveillance is used by police and government agencies, as well as found in video doorbells, biometric screeners, and other data tracking devices. (Algorithmic Justice League, 2026)

AI Tool: An AI tool is an application or software program that leverages AI models and algorithms to perform a specified task. Using machine learning techniques and a specialized algorithm developed with a certain goal output in mind, AI tools can help with a wide variety of needs. Humans create AI tools by defining models and entering large amounts of data so that the algorithm can identify patterns and generate its own data that follows those same parameters. (Tavus, 2025)

AI Transparency: AI transparency means understanding how AI systems make decisions, why they produce specific results, and what data they're using. Simply put, AI transparency is like providing a window into the inner workings of AI, helping people understand and trust how these systems work. (Zendesk, 2026)

AI Trust and Safety: Trust and Safety (T&S) refers to the practical methods of managing emerging AI escalations, as well as approaches to identifying, defining, and mitigating risks. T&S also pertains to how policies and laws are interpreted into product designs, business operations, escalations processes, and corporate communications to achieve their intended purposes. (United Nations Development Programme, 2026)

Algorithms: Algorithms aren't just complex sets of instructions for computers. Anytime you follow a replicable step-by-step process to accomplish a task, those steps are an algorithm. (Stanford GSB, 2026)

Algorithmic Audit: A process for identifying failure scenarios for who might be harmed by an algorithmic system and determining how to monitor for them (O'Neil, 2024)

Algorithmic Bias: Algorithmic bias refers to prejudicial, discriminatory, unjust, inaccurate, or otherwise disparate performance or outcomes from algorithmic systems based on racial, gender, or other attributes of an individual or a group. The concept of algorithmic bias emerged at the intersection of computer science, artificial intelligence (AI) research, critical data studies, human–computer interaction, law, philosophy, and similar disciplines. (Birhane, 2026)

Anthropomorphism: Describing and conceiving AI functionalities and innovations as characterized by human traits (Salles et al., 2020)

Artificial Intelligence: Artificial Intelligence (AI) is a "machine-based system that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that can influence physical or virtual environments" (OECD, 2024)

Automation: Automation is the application of technology, programs, robotics, or processes to achieve outcomes with minimal human input. (IBM, 2026)

Big Data: Big data refers to the incredible amount of structured and unstructured information that humans and machines generate. Big data refers to extremely large and complex data sets that cannot be easily managed or analyzed with traditional data processing tools, particularly spreadsheets. Big data includes structured data, like an inventory database or list of financial transactions; unstructured data, such as social posts or videos; and mixed data sets, like those used to train large language models for AI. (Oracle, 2026)

Big Tech: The term 'Big Tech' refers to a group of technology companies that have dominated the industry for years due to their size, influence, and financial success. These firms are distinguished by their ability to collect, process, and monetize massive amounts of data and their global reach and impact on the economy and society. The term typically refers to the world's five largest technology companies—Amazon, Apple, Facebook (Meta), Google (Alphabet), and Microsoft, but it can also imply other large technology firms such as Alibaba, Tencent, and Tesla. (Emeritus, 2026)

Chatbot: A chatbot is a software application that communicates with people through text or voice. It uses conversational interfaces to answer questions, provide information, and help people complete tasks without navigating menus or searching web pages. Not all chatbots use artificial intelligence (AI). (IBM, 2026)

Computational Thinking: Computational thinking comprises a set of ideas and thinking skills (decomposition, algorithms, patterns and generalizations, abstraction, evaluation, data) that people can apply to design solutions or systems that a computer or computational agent can enact. (Raspberry Pi Computational Thinking Framework)

Computer Science: The study and human-centered practice of using data, algorithms, and computing systems to solve problems, make discoveries, and express ideas. CSTA (2026)

Consent: Consent is permission for something to happen or an agreement to do something. Affirmative consent relies on "yes means yes" rather than "no means no." Consent requires voluntary, informed, mutual, honest, and verbal or non-verbal agreement, shared responsibility, and can be withdrawn at anytime (Columbia Health, 2026)

Data: Data is information that can be interpreted and used by computers. It is a collection of facts, such as numbers, words, measurements, observations, or even just descriptions of things. In computing, data is typically stored electronically in the form of files or databases. Data can come from many sources, including user input (typed words or images), sensors (temperature readings), or algorithms (calculations). (Lenovo, 2026)

Data Bias: Data bias refers to systematic errors or distortions in data collection, analysis, or interpretation that can lead to misleading conclusions. This phenomenon is particularly relevant in fields such as artificial intelligence and the social sciences, where biased data can perpetuate inequalities and ethical dilemmas. (UNESCO, 2026)

Data Privacy: The principle that a person should have control over their personal data, including the ability to decide how organizations collect, store, and use their data. Data privacy focuses on the individual rights of data subjects—that is, the users who own the data. For organizations, the practice of data privacy is a matter of implementing policies and processes that allow users to control their data in accordance with relevant data privacy regulations. (IBM, 2026)

Data Science: Data Science equips students with the introductory skills and problem-solving that are necessary to collect or consider, analyze, interpret, and communicate data to answer investigative questions, drawing upon tools and methods across the curriculum, in areas including mathematics, statistics, computer science, sciences, social sciences, and other disciplines. (Data Science 4 Everyone)

Data Mining: The process of discovering patterns and trends in large datasets using statistical methods and machine learning (Stanford HAI, 2026)

Data Sovereignty: Data sovereignty often refers to the understanding that data that is stored outside of an organization's host country and still subject to the laws in the country where the data are stored. Data sovereignty is also a reference to a group or individual's right to control and maintain their own data however they see fit, which includes the collection, storage, and interpretation of their data. Indigenous sovereignty and self-determination movements see data sovereignty as claiming the rights of Indigenous peoples to use and interpret the data in a way that is representative of and in service of their communities (Jeannot, 2016, Smith, 2016)

Deep Learning: Deep learning is a subset of machine learning (ML), where artificial neural networks—algorithms modeled to work like the human brain—learn from large amounts of data. Deep learning is powered by layers of neural networks, which are algorithms loosely modeled on the way human brains work. Training with large amounts of data is what configures the neurons in the neural network. The result is a deep learning model that, once trained, processes new data. (Oracle, 2026)

Deep Fakes: Synthetic media content created by artificial intelligence. Deepfakes are digital forgeries so realistic that they can convincingly mimic a person's voice or likeness (UNESCO, 2025)

Digital Footprint: A digital footprint, sometimes called a "digital shadow," is the unique trail of data that a person or business creates while using the internet. (IBM, 2026)

Digital Justice: The basic idea that communication is a human right and prioritizes the participation of people who have been traditionally excluded from and attacked by media and technology. The four pillars of digital justice are access, participation, common ownership, and healthy communities. (NFCB, 2015)

Digital Physiognomy: The use of AI and technology to support a pseudoscience that believes a person's physical appearance is indicative of their character. Physiognomy served as a tool of scientific racism and eugenics over the 19th century and was discredited in the 20th century, but digital physiognomy exists today. (National Library of Medicine, 2025)

Digital Safety: Learning how to safeguard your privacy and protect yourself from predators as we connect in the digital age. Common threats to digital safety include phishing, internet scams, malware, cyberstalking, cyberbullying, and online predators. (Sadiku et al. 2021)

Eugenics: Eugenics is broadly defined as the use of selective breeding to improve the human race. The main principle behind the early eugenics movement was the assumption that all human characteristics are borne of simple inheritance. The assumption that all characteristics are genetically determined led to the widespread belief that desirable traits should be selected for. Additionally, the eugenics movement sought to eliminate undesirable traits in society—forcibly sterilizing people with unwanted characteristics to prevent their contribution to the gene pool. (National Institutes of Health, 2021)

Ethics: Seeks to determine how and why one should behave in a way that is most virtuous. At its most elemental, ethics is about doing the right thing in a way that benefits the individual and society at large in a fair, just, and kind manner. (Boone, Ethics 101)

Generative AI: Generative AI, or generative artificial intelligence, refers to the use of AI to create new content, like text, images, music, audio, and videos. Generative AI is powered by foundation models (large AI models) that can multitask and perform out-of-the-box tasks, including summarization, Q&A, classification, and more. (Google Cloud, 2026)

LLM: A large language model (LLM) is a type of artificial intelligence (AI) program that can recognize and generate text, among other tasks. It is a computer program that has been fed enough examples to be able to recognize and interpret human language or other types of complex data. Many LLMs are trained on data that has been gathered from the Internet (Cloudflare, 2026)

Machine Learning: Machine learning is a subfield of AI, which is broadly defined as the capability of a machine to imitate intelligent human behavior. AI systems are used to perform complex tasks in a way that is similar to how humans solve problems. (MIT Sloan, 2021)

Misinformation/Disinformation: Misinformation is false or inaccurate information, getting the facts wrong. Disinformation is false information that is deliberately intended to mislead, intentionally misstating the facts. (American Psychological Association, 2026)

Natural Language Processing (NLP): Natural language processing (NLP) is a subfield of CS and AI that uses machine learning to enable computers to understand and communicate with human language. NLP enables computers and digital devices to recognize, understand, and generate text and speech by combining computational linguistics, the rule-based modeling of human language, together with statistical modeling, machine learning, and deep learning. (IBM, 2026)

Neural Networks: A neural network is a method in AI that teaches computers to process data in a way that is inspired by the human brain. It is a type of machine learning (ML) process, called deep learning, that uses interconnected nodes or neurons in a layered structure that resembles the human brain. (AWS 2026)

Sentient: Capable of sensing or feeling: conscious of or responsive to the sensations of seeing, hearing, feeling, tasting, or smelling capable of sensing or feeling; conscious of or responsive to the sensations of seeing, hearing, feeling, tasting, or smelling (Merriam-Webster, 2026)

Training Data: Training data is information that is used to teach a machine learning model how to make predictions, recognize patterns, or generate content. (IBM, 2026)

Web Scraping: The use of bots to gather data or content from a website. Web scraping gathers the Hypertext Markup Language (HTML) code that underlies a website, as well as the data that the site stores within a database. Then, if the scraper wants to, it can use that information to duplicate the website's content. (Fortinet, 2026)

APPENDIX 1: AI CHARTS

AI Processes

Automated Process	Explanation	Example
Decision Making	A computer making consequential decisions that impact humans	Deciding a route on a map to take while driving or screening groups of resumes for a job
Classification	A computer assigning a type or label to an input	Google photos recognizing all the images on your camera roll of your sister or deciding if inbox email should go to spam
Recommendation	A computer selecting information to show someone based on their history	Netflix watch next suggestions or social media feed content
Transcription/ Translation	A computer translating information from one format to another format	Speech transcription or translation of text from Spanish to English
Text and Image Generation	A computer synthetically generating media	Prompts to a chatbot to generate new text, images, and/or video

Adapted for K12 from The AI Con by Dr. Emily Bender and Dr. Alex Hanna

Generative AI Cost

Step	Description	Environmental Cost	Human Cost	Technical Cost	Ethical Cost
Mining	Rare earth minerals used for technology are extracted for computer hardware	Direct-habitat destruction, toxic waste, carbon dioxide emissions	Direct-dangerous labor for workers to participate in and child exploitation for labor in some countries	Direct-supply chain instabiity	Direct-exploitation of natural resources and undeveloped living communities disturbed and destroyed and lack of informed consent
Data Centers	Facility with a large amount of computers, servers and other technology equipment that stores, processes, and shares applications and data	Direct-high electricity usage and fresh water used to cool computers	Direct-workers and people who live near centers physically unsafe; workers underpaid for their work at data centers	Indirect-expensive infrastructure and energy redundancy	Direct-environmental justice concerns (location of centers in marginalized residental areas)
Data Collection	Massive process of gathering of variety of information from the internet and books	Indirect-electricity (via server use, bandwidth)	None	Indirect-requires petabyte-scale storage and processing speed	Direct-copyright infrigement, privacy violations, and ignored consent
Data Clearing and Labeling	Human workers filter, sort and annotate training data	Indirect-human mental and physical energy cost	Direct-low-paid labor and psychological impact on workers	Indirect-workflow tools and translation pipelines	Indirect-labor ethics for workforce
Model Design	Infrastructure and systems of data center computers (model) that analyze and attempt to make sense between large amounts of training data	Direct-electricity and energy for manufacturing and research and design cost	Indirect-concentrated control in few people/companies	Indirect-high experimentation and tuning costs	Indirect-lack of transparency and algorithmic opacity
Pretraining	Model learns to predict next word over massive data sets	Direct-massive energy use and carbon emissions	None	Direct-millions in GPU time, cloud computing, and storage	Indirect-amplificiation of biases in scrap data
Alignment	Human feedback helps the model become safer	Indirect-human mental and physical energy boost	Direct-psychological impact on workers	Indirect-complex feedback loops	Direct-bias in allignment goals and narrow-minded norm-setting
Deployment	Model accessed via computer software of web interfade programs	Direct-energy and water usage per query	None	Direct-load on servers and scaling challenges	Indirect-data logging, surveillance risks, moderation disputes
Maintenance	Human works provide continuous updates, fine tuning, and retraining of model	Direct-ongoing electric and water usage	Indirect-pressure on engineers and other support staff to keep systems running	Indirect-constant bug-fixing and performance tuning	Indirect-AI model drift and loss of transparency over time

Adapted for K12 from Cost of Generative AI Chart by Dr. Pontus Wärnestål

APPENDIX 3: ADDITIONAL RESOURCES

Bender, E. M., & Hanna, A. (2026). *The AI Con: How to fight big tech's hype and create the future we want*. Vintage.

Benjamin, R. (2019). *Race after technology: Abolitionist tools for the new Jim code*. Polity.

Boone, B. (2017). *Ethics 101: From altruism and utilitarianism to bioethics and political ethics, an exploration of the concepts of right and wrong*. Adams Media.

Broussard, M. (2018). *Artificial Unintelligence: How Computers Misunderstand the World*. MIT Press.

Buolamwini, J. (2023). Unmasking AI: my mission to protect what is human in a world of machines. New York: Random House.

Crawford, K. (2021). *The Atlas of AI: Power, Politics, and the Planetary Costs of Artificial Intelligence*. Yale University Press.

National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research. (1979). *The Belmont report: Ethical principles and guidelines for the protection of human subjects of research*. U.S. Department of Health and Human Services.

Noble, S. (2018). *Algorithms of oppression*. New York University Press.

Statement from listed authors of Stochastic Parrots on the "AI pause" letter by Timnit Gebru, Emily M. Bender, Angelina McMillian-Major and Margaret Mitchell

Automated Processes Chart Sources

Decision Making by Machine Learning Algorithms;
What are classifcation models? A Beginner's Guide to Classficiation in Machine Learning
Recommendation System; What is an AI Recommendation Engine?
How Today's Recommender Systems Use Machine Learning to Cater to Your Every Whim
Create video subtitles with translation using machine learning;
What is Generative AI? How it works, examples, benefits, and limitations

Generative AI Cost Sources

Rare Earth Elements Importance
Global Critical Minerals Race is Heating Up; Data center reliance on fossil fuels may delay clean energy transition
Google Data Centers; AP
What is a data center and how does it work?
Data centers, backbone of the digital economy, face water scarcity and climate risk
Why data centers fail to bring jobs to rural communities;
What is Data Scraping?
What is Web Scraping and what is it used for?
Guide to Data Cleaning: Definitions, Benefits, Components, and how to clean your data
What is data cleaning?
What are transformers in Generative AI?
What is a generative model? Generative AI Explained in 5 Minutes
What is GPT (generative pretrained transformer)?
What is GPT? Generative AI; Input & Pretraining
What is AI alignment?
Introducting AI Alignment: A Technology Point of View
How to Deploy and Scale Generative AI Efficiently and Cost-Effectively; 5 Hidden Risks in Deploying Generative AI
AI: Generative AI Training, Development, and Deployment Considerations
Generative mechanisms of AI implementation: A critical realist perspective on predictive maintenance