

## Big Idea #5: Societal Impact

Key Insights
Developing AI applications involves both technical and ethical design decisions.
AI applications have multiple stakeholders who may have different values and may be affected differently by the choices the designers made.
AI systems that make decisions about people should be engineered to adhere to societal values such as fairness, transparency, and privacy.
AI is a disruptive technology that will not only impact the economy and employment but also shape social and cultural norms
AI is becoming a component of everyone's personal and professional toolbox.

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Concept	K-2	3-5	6-8	9-12
<p><b>Ethical AI</b> <i>(Diversity of Interests and Disparate Impacts)</i></p> <p><b>5-A-i</b></p>	<p><b>LO:</b> Evaluate the ways a decision impacts people differently.</p> <p><b>EU:</b> Computers can sometimes make a decision that works for most people but harms or disadvantages other people.</p>	<p><b>LO:</b> Evaluate how an AI technology can have different effects on different groups of people.</p> <p><b>EU:</b> The decisions made when developing an AI system can impact different people and communities in different ways.</p> <p><b>Unpacked:</b> Some examples of AI technology that work differently for different groups include: speech recognition that works well for native English speakers but poorly for speakers with accents, and some facial recognition software that works well for adult white males but less reliably for women, children, or people with darker skin tones.</p>	<p><b>LO:</b> Evaluate the ways various stakeholders' goals and values influence the design of AI systems.</p> <p><b>EU:</b> The behavior of AI systems is determined by the choices of the designers, which may involve tradeoffs between conflicting goals and values. If other stakeholders' perspectives aren't given sufficient weight, there could be negative consequences for users.</p> <p><b>Unpacked:</b> Stakeholders include the designers, the users, other people concerned with the welfare of the users, and possibly advertisers or content creators. For an example of a conflict, consider app designers whose goal is to entice people to watch ads so that they can make money. This may negatively impact users who are seduced into wasting too much time viewing content, or who have their world views distorted by repeated exposure to misinformation selected for its likelihood of attracting clicks, or parents who want their children to spend their time more productively.</p>	<p><b>LO:</b> Explain how use of AI systems has led to disparate impacts on different groups.</p> <p><b>EU:</b> Different groups of people may be affected differently by AI systems.</p> <p><b>Unpacked:</b> Disparate impacts can occur when the designers of a system do not adequately consider differences among users. For example, using past medical expenditures to estimate how sick a patient is assumes that everyone has the same level of health coverage. Using this estimate to direct more aggressive care to the sickest patients will have disparate impacts on people with less health coverage. Undetected biases in machine learning systems (e.g., resume screening applications) can also have disparate impacts on some groups.</p> <p><b>Resource:</b> <a href="https://www.scientificamerican.com/article/racial-bias-found-in-a-major-health-care-risk-algorithm/">https://www.scientificamerican.com/article/racial-bias-found-in-a-major-health-care-risk-algorithm/</a></p>
<p><b>Ethical AI</b> <i>(Ethical Design Criteria)</i></p> <p><b>5-A-ii</b></p>	<p><b>LO:</b> Discuss the characteristics of systems that are fair and unfair and the impact on people when a system is not fair.</p> <p><b>EU:</b> AI systems should be designed to benefit people. Creators of these systems should make sure that their systems treat everyone fairly.</p> <p><b>Activity:</b> Facilitate an in-class exercise focused on fair distribution of limited goods, such as deciding how to share 10 pieces of candy among 15 students, to help students think personally about what fairness and unfairness feel like.</p> <p><b>Resources:</b> <a href="#">Fairness teaching guide</a>, <a href="#">Fairness &amp; Justice</a></p>	<p><b>LO:</b> Evaluate how an AI system meets the design criteria of transparency and explainability.</p> <p><b>EU:</b> An AI system is <i>transparent</i> if we know what data and decision making criteria it uses. Part of transparency is having the system provide <i>explanations</i> for its decisions.</p> <p><b>Resources:</b>  <a href="https://appinventor.mit.edu/about/terms-of-service">https://appinventor.mit.edu/about/terms-of-service</a>  <a href="https://teachablemachine.withgoogle.com/faq#Basics">https://teachablemachine.withgoogle.com/faq#Basics</a>  <a href="https://quickdraw.withgoogle.com/data">https://quickdraw.withgoogle.com/data</a>  <a href="https://experiments.withgoogle.com/quick-draw">https://experiments.withgoogle.com/quick-draw</a> (see article and video)</p>	<p><b>LO:</b> Evaluate how an AI system meets the design criteria of accountability and respect for privacy.</p> <p><b>EU:</b> Accountability in AI systems means designers and decision makers take responsibility for the system's actions. Respect for privacy means the system does not act in ways that violate people's privacy rights.</p>	<p><b>LO:</b> Analyze an AI system to determine whether it satisfies ethical design criteria.</p> <p><b>EU:</b> To ensure that AI systems are helpful and not harmful, ethical design criteria include: fairness, transparency, explainability, accountability, respect for privacy, and adherence to societal values.</p> <p><b>Unpacked</b> Fairness means treating people equally. Transparency means disclosing what information a system uses and how it uses it. Explainability means being able to justify the decisions a system makes. Accountability means being clear about who is responsible for the actions an AI system takes. Respect for privacy means not acting in ways that could undermine people's privacy. Adherence to societal values means not acting in ways counter to those values.</p> <p><b>Resources:</b> Catalog of resources on AI ethics: <a href="https://aiartists.org/ai-ethics">https://aiartists.org/ai-ethics</a></p> <p>Model Cards (promoting transparency and accountability): <a href="https://modelcards.withgoogle.com/about">https://modelcards.withgoogle.com/about</a></p>

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Concept	K-2	3-5	6-8	9-12	
<b>Ethical AI</b> <i>(Practicing Ethical Design)</i>  <b>5-A-iii</b>	N/A	<b>LO:</b> Create a model card for a classification or prediction model  <b>EU:</b> Model cards support transparency by explaining the intended use, training dataset, accuracy, and limitations of the model.  <b>Activity:</b> Students can create classifier and then create a model for it.  <b>Resources:</b> Google page on model cards: <a href="https://modelcards.withgoogle.com/about">https://modelcards.withgoogle.com/about</a>  Code.org <a href="#">AI and Machine Learning Module on Model Cards</a>  Code.org <a href="#">AI Lab Machine Learning Tool</a>	<b>LO:</b> Evaluate ways that AI system designers can learn about and incorporate the values of their stakeholders into the design process.  <b>EU:</b> AI systems need to align with the norms and values of the groups they aim to serve. Developers of AI systems need to understand that values vary across cultures and ensure these values inform the design of products they create.  <b>Activity:</b> Select an AI system and construct an ethical matrix by listing the stakeholders and enumerating their values. Then evaluate the alignment between the system and the stakeholders.  <b>Resource:</b> <a href="#">MIT AI Ethics Education Curriculum</a>	<b>LO:</b> Design an AI System using an ethical design process.  <b>EU:</b> Ethical design, at all stages of the design process, considers the values of all stakeholders and upholds the principles of fairness, transparency, explainability, accountability, respect for privacy, and adherence to societal values.	
<b>AI &amp; Culture</b> <i>(AI in Daily Life)</i>  <b>5-B-i</b>	<b>LO:</b> Identify devices in daily life that use AI technologies.  <b>EU:</b> AI technologies are part of any device that includes speech recognition or computer vision, such as smart phones, intelligent home assistants, and modern automobiles.	<b>LO:</b> Describe how AI-powered services are used in daily life.  <b>EU:</b> AI-powered services are used to look up information, to provide voice interfaces to many kinds of apps, to make recommendations based on a person's interests, and to make cars safer.  <b>Unpacked:</b> AI provides the ability to understand the meaning of people's requests and develop models of their interests and goals. Search engines use AI to understand search queries and the contents of web pages. Recommender systems that learn users' interests include Netflix for movies, Amazon for shopping, social media for news feeds, and advertising networks for ad selection. Autonomous vehicles use computer vision to predict the intentions of other drivers.	<b>LO:</b> Examine an aspect of daily life that is predicted to change due to the introduction of AI technologies.  <b>EU:</b> AI technologies are changing daily life as intelligent machines find new roles in society.  <b>Unpacked:</b> Aspects of daily life include topics such as how we communicate, how we learn, how we interact socially, and the makeup of our daily routines. Consider the many changes to transportation likely to result from the adoption of self-driving cars. Drivers will have to learn how to interact with other cars that have no driver. Parents will have to decide when it's appropriate to let their children ride unaccompanied in a self-driving car, and the cars themselves might be adapted to facilitate safe transport and dropoff of children. Automated ride-hailing services may lead to reductions in car ownership and the need to learn how to drive, and also reduce demand for parking space. New types of guided tour services may combine a chatbot with a self-driving vehicle.	<b>LO:</b> Explain the kinds of debates that might arise as AI technology continues to evolve and is further woven into our culture.  <b>EU:</b> Some new AI technologies will pose challenges for cultural norms and expectations that society must identify and wrestle with.  <b>Unpacked:</b> Some potential debates include: What is acceptable behavior when interacting with intelligent assistants or robots? How should we regard text or artwork that was created by or in collaboration with AI programs? When is it acceptable for students to use large language models for help with homework assignments? What rights should machine learning engineers have to use people's personal data, or to use publicly available data in ways the copyright holder hasn't authorized? Many more such controversies should be expected.	

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<b>AI &amp; Culture</b> <i>(Trust and Responsibility)</i>  <b>5-B-ii</b>	N/A	<b>LO:</b> Analyze deepfake images or videos and identify the flaws that reveal them as deepfakes.  <b>EU:</b> Current deepfakes have detectable flaws, but as the technology improves it will undermine our trust in digital media.  <b>Resource:</b> Deepfake faces: <a href="https://thispersondoesnotexist.com/">https://thispersondoesnotexist.com/</a>	<b>LO:</b> Critique uses of AI technology that can be used to surveil people or violate their privacy.  <b>EU:</b> AI technologies endanger privacy by reducing the cost of implementing widespread surveillance and enabling new types of surveillance.  <b>Unpacked:</b> Types of surveillance include not only face recognition in public spaces and license plate trackers on public roads, but also monitoring of search activities and behavior on web sites that can be used to build user profiles that include sensitive personal information.	<b>LO:</b> Identify areas where it is appropriate to regulate use of AI technologies and evaluate regulations that have been proposed.  <b>EU:</b> Legal regulation of AI technologies is appropriate in areas where there are societal values that require protection.  <b>Unpacked.</b> Potential areas for regulation include use of facial recognition technologies for policing or surveillance, privacy protection for customer data accumulated by AI applications, and safety of autonomous vehicles.  <b>Activities:</b> (1) Read an article about proposed legislation on AI technology and create an informed critique of the legislation. (2) Write a letter to an elected official about a legislative issue related to AI.  <b>Resources:</b> Center for AI and Digital Policy: <a href="https://www.caidp.org/resources/ai-policy-frameworks/">https://www.caidp.org/resources/ai-policy-frameworks/</a> Autonomous vehicle regulations: <a href="https://www.ncsl.org/research/transportation/autonomous-vehicles-self-driving-vehicles-enacted-legislation.aspx">https://www.ncsl.org/research/transportation/autonomous-vehicles-self-driving-vehicles-enacted-legislation.aspx</a>
<b>AI &amp; the Economy</b> <i>(Impacts of AI on Sectors of Society)</i>  <b>5-C-i</b>	<b>LO:</b> Identify current uses of AI and how they have impacted society.  <b>EU:</b> Society has undergone changes because of AI and this will continue in the future.  <b>Unpacked:</b> AI currently affects things like how we get questions answered, how we get directions, and how we find entertainment.	<b>LO:</b> Identify changes in how sectors of society operate due to the introduction of AI.  <b>EU:</b> Every sector of society is changing (or will change) as a result of the introduction of AI.  <b>Unpacked:</b> Sectors of society include manufacturing, retail, agriculture, food, hospitality, transportation, housing, environment, education, entertainment, healthcare, finance, government, public safety, social services, and law enforcement. An example of change: manufacturing is taking advantage of increased automation using AI to reduce costs and improve quality.  <b>Activity:</b> Research a story and describe how an AI transformative change impacted society positively and potentially negatively.	<b>LO:</b> Compare the changes AI is bringing to society with those of previous industrial revolutions.  <b>EU:</b> AI is causing societal advances and disruptions comparable to earlier industrial revolutions.  <b>Unpacked:</b> The first industrial revolution was based on mechanical power, the second on electricity and mass production, and the third on computers and networking. The fourth will be based on AI, robotics, Internet of Things, and genetic engineering technologies.	<b>LO:</b> Predict how a sector of society is likely to change in the short and intermediate term as a result of AI technology.  <b>EU:</b> Anticipating and planning for the changes new technology brings is important for the healthy advancement of society.  <b>Unpacked:</b> Two types of impacts associated with AI technology are increased levels of automation and new types of services. Roy Amara, past president of The Institute for the Future, coined Amara's Law which states: "We tend to overestimate the effect of a technology in the short run and underestimate the effect in the long run."  <b>Activities:</b> (1) Discuss possible new services that can evolve due to AI. (2) Identify and explain an unintended consequence in society that resulted from an AI system.

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<p><b>AI &amp; The Economy</b> <i>(Effects on Employment)</i></p> <p><b>5-C-ii</b></p>	<p><b>LO:</b> Describe some jobs that no longer exist due to advances in technology.</p> <p><b>EU:</b> New technology changes the types of jobs that are available for people.</p> <p><b>Unpacked:</b> The automobile reduced our reliance on horses, which eliminated jobs for farriers and horse trainers but created jobs for auto mechanics. Factory automation enabled mass production, which reduced the need for blacksmiths, yarn spinners, and weavers but created jobs for people who build and maintain the factories.</p>	<p><b>LO:</b> Describe how a job will change due to the introduction of AI or robotic technologies.</p> <p><b>EU:</b> As AI and robotic technologies are adopted in the workplace, the ways people perform their jobs will change.</p> <p><b>Activity:</b> Students can read grade-appropriate articles that describe jobs being updated with the use of AI technologies and robots, e.g., warehouse workers working alongside robots.</p>	<p><b>LO:</b> Predict a new type of job that might arise, or how an existing type of job might change or go away, as a result of the adoption of AI technologies.</p> <p><b>EU:</b> Cultures change as new technologies are adopted, and as a result some types of jobs are reduced and new types of jobs appear.</p> <p><b>Activity:</b> Develop a "job description" of the future for a given profession - what will working with AI and robotic systems look like? What skills will be required?</p>	<p><b>LO:</b> Investigate the skills needed for AI-enabled careers.</p> <p><b>EU:</b> AI-aligned skills will be relevant throughout the workforce, not just for programmers. Most types of work will involve some interaction with AI technologies.</p> <p><b>Unpacked:</b> As new technologies are adopted, the nature of work will change over a person's lifetime. People can expect to learn continually throughout their careers. AI-aligned skills that are becoming important include: collecting and curating datasets for machine learning; interacting with intelligent agents that help people do their jobs; training robots to complete specific tasks; use of AI-powered creative tools for image creation and manipulation; and knowledge engineering for AI systems.</p>
<p><b>AI for Social Good</b> <i>(Democratization of AI Technology)</i></p> <p><b>5-D-i</b></p>	N/A	<p><b>LO:</b> Describe and use some of the AI extensions or plugins available in a programming framework familiar to you.</p> <p><b>EU:</b> AI is becoming part of everyone's toolbox through extensions or plugins that support development of AI applications serving the needs of many different communities.</p> <p><b>Unpacked:</b> Examples for Scratch include speech to text, text to speech, face recognition, sentiment analysis, question answering, and visual classifier extensions.</p>	<p><b>LO:</b> Create a novel application using some of the AI extensions or plugins available in the programming framework of your choice.</p> <p><b>EU:</b> AI is becoming part of everyone's toolbox through extensions or plugins that support development of AI applications serving the needs of many different communities.</p> <p><b>Unpacked:</b> Examples for Scratch include speech to text, text to speech, face recognition, sentiment analysis, question answering, and visual classifier extensions. There is a similar list for MIT App Inventor. Calypso has many of these features built in.</p>	<p><b>LO:</b> Create a novel application using some of the AI tools available in the programming framework of your choice.</p> <p><b>EU:</b> AI tools are becoming commonplace and freely available, and can be used by people without advanced degrees or expensive equipment.</p>
<p><b>AI for Social Good</b> <i>(Using AI to Solve Societal Problems)</i></p> <p><b>5-D-ii</b></p>	<p><b>LO:</b> Describe how AI can be used to solve a societal problem</p> <p><b>EU:</b> AI can be used to create a classifier that solves a problem important to society.</p> <p><b>Unpacked:</b> Classifiers can be trained to distinguish wildlife from manufactured items, recyclables from non-recyclables, or healthy from diseased plants.</p> <p><b>Activity:</b> Use an AI for Social Good application to contribute to a solution to a societal problem.</p> <p><b>Resource:</b> Code.org's AI For Oceans - <a href="https://studio.code.org/s/oceans/">https://studio.code.org/s/oceans/</a></p>	<p><b>LO:</b> Design a solution to a societal problem that makes use of AI technology</p> <p><b>EU:</b> AI is being used to solve societal problems such as environmental protection, energy conservation, and improved public health.</p>	<p><b>LO:</b> Research a societal problem and describe how AI technologies can be used to address that problem.</p> <p><b>EU:</b> AI technologies for perception, reasoning, and machine learning can be applied to many types of societal problems.</p> <p><b>Resources:</b> UN's 16 Sustainable Development Goals - <a href="https://sdgs.un.org/goals">https://sdgs.un.org/goals</a> Google's AI for Social Good page <a href="https://ai.google/social-good">https://ai.google/social-good</a></p>	<p><b>LO:</b> Evaluate an AI for Social Good project in terms of the problem it is addressing and the project's actual or potential impact.</p> <p><b>EU:</b> "AI for social good" is the use of AI technologies to solve societal problems.</p> <p><b>Unpacked:</b> "Social good" or common good seeks to provide the greatest benefit to the greatest number of people, to make the world a better place. This includes goals such as energy conservation, environmental protection, protection of endangered species, better public health, and prevention of human trafficking.</p> <p><b>Resources:</b> Google blog post on social good projects: <a href="https://blog.google/technology/ai/30-new-ai-for-social-good-projects/">https://blog.google/technology/ai/30-new-ai-for-social-good-projects/</a> Nature article on AI for social good: <a href="https://www.nature.com/articles/s41467-020-15871-z">https://www.nature.com/articles/s41467-020-15871-z</a></p>