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TEACHER LESSONS

The Tech for Global Good: AI Inclusiveness

Objectives

Students will be able to:

- Participate in a machine learning experience in order to evaluate causes and effects of the AI inclusiveness problem.
- Design a creative and empathetic solution to the AI inclusiveness problem.
- Develop a realistic plan to influence tangible change connected to the overall problem and take action in their community.

Overview

From YouTube recommendations to suggested driving routes, we rely on artificial intelligence (AI) throughout our daily lives—and its influence is only continuing to grow. However, because AI is created by humans, the experiences and biases of its developers can influence how AI solves problems. In order for AI to be as inclusive and beneficial as possible, it's therefore crucial that people from a variety of backgrounds work together to help machines learn. In this lesson, students will explore the issue of AI inclusiveness through a series of video clips featuring AI4ALL, a program that provides educational opportunities for students to learn about AI.

To gain a better understanding of the problem, students will first participate in a hands-on machine learning activity that will help them explore and understand AI's potential for bias. They will then use design thinking to brainstorm how to bring people from diverse backgrounds together to work toward a bias-free AI. The lesson will culminate as students consider how they could help their community learn more about this problem, empathize with those whom it affects, and/or promote AI inclusiveness. They will create a brief plan that details how they will influence this change and take action in their community.

This lesson focuses on

Design Process

- Defining the Problem
- Designing Solutions

21st Century Skills

- Communication
- Collaboration
- Critical thinking
- Creativity

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Grades
6–8

Timing
190 minutes

Materials
All sessions:

- Device with the ability to project video, one for the teacher

Problem

- *Problem* video clip
- AI: What is Machine Learning? video
- Handout 1: Understand the Problem (2 pages), one per student
- Devices with Internet access, at least enough for half the class

Solution & Impact

- Handout 2: Design Thinking, enough for one-quarter of the class
- Handout 3: Solution Storyboard (2 pages), enough for one-quarter of the class
- Handout 4: Imagine the Impact (2 pages), enough for one-quarter of the class
- *Solution* and *Impact* video clips

What Can I Do?

- Three pieces of chart paper, enough for one-quarter of the class
- Markers, for students to share
- *What Can I Do?* video clip
- Handout 5: Create Change (2 pages), one per student

Background Information
The following section provides background on topics covered in this lesson. While it is designed for educators, this information may also be shared to supplement students' understanding as needed, *after* the lesson's Problem section has been completed.

Have you ever wondered...
What exactly is artificial intelligence?
Artificial intelligence or AI is when a computer is able to perform a task (or tasks) that used to require human intelligence. There are currently several different capabilities that exist within AI, and AI's definition is likely to evolve as these abilities grow. One current capability is machine learning: a type of AI that enables computers to recognize patterns in data and use these patterns to learn and make predictions.

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Another AI capability is speech recognition. When speech recognition is combined with machine learning, AI devices like Siri and Alexa can answer our questions![1] Other AI capabilities include object recognition, translation, and natural language processing (i.e. when a computer can understand human language).[2] For a more in-depth explanation, this Brookings Institution article describes AI in greater detail.

What kind of biases can exist in AI, and how do they get there?

Through machine learning, computers learn how to recognize patterns and make decisions without being explicitly programmed. They are able to do this through the training data that computer programmers provide. By analyzing data in the form of images, audio, videos, and text, computers begin to recognize patterns and make predictions based on these patterns.[3] However, computers rely on the data that *humans* provide in order to learn—so if a human's racial, ideological, or gender biases are present in the data (whether or not this is intentional), the computer learns to think this way as well. These biases then have the potential to affect decisions made anywhere AI is involved, including businesses, hospitals, universities, and governments. It's therefore important that safeguards are put in place to ensure that human bias does not affect the decisions made by AI.[4]

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Make Connections

How does this connect to students?	How does this connect to careers?	How does this connect to our world?
Students today are living in a world surrounded by AI—and AI's abilities are continuing to expand. It's therefore no surprise that demand for careers related to the AI field is increasing. While more traditional jobs may change their focus as AI's presence grows, it's predicted that AI will help the workforce and lead to millions of more jobs around the world.[5] However, an understanding of AI will benefit students regardless of their future career path. In order for students to learn how to best navigate an increasingly AI-dominated world and consume AI products to the best of their ability, it's important for students to have an understanding of not only how artificial intelligence works, but why AI machines work the way that they do. Learning about the benefits, risks, and potential biases of artificial intelligence will better equip students to understand the state of the world around them and empower them to become informed consumers, developers, creators, and programmers.[6]	**Machine Learning Engineer:** Machine learning engineers are computer programmers who create programs that guide machines in taking actions without specific directions for each task. They typically work with data scientists to ensure that data sets create accurate models for machines to learn from. **Data Scientist:** Data scientists identify, collect, and clean large data sets in order to interpret them and analyze them for patterns. They can then use their results to identify machine learning opportunities. **Research Scientists:** Research scientists who focus on AI investigate the challenges of machine learning, language understanding, and machine perception through research and experimentation.	Since the world is still in the relatively early stages of AI, it's hard to imagine what the future will bring. At the 2018 GPU Technology Conference (a global conference that focuses on tech's biggest topics), close to one thousand tech innovators, developers, researchers, and policy makers convened to discuss the future of AI. Many experts expressed concern over an increasing lack of autonomy and privacy as well as society's dependence on AI devices. Attendees tended to agree that humans' increasing reliance on technology will only go well if "close attention is paid to how these tools, platforms and networks are engineered, distributed and updated." They suggested that global good should be the top priority for artificial intelligence, with an emphasis on joining forces around the world to solve difficult problems. They also emphasized the importance of developing a value-based system to ensure that AI is ethical, empathetic, and designed to help/prioritize people.[7]

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Sources:

1. "Teaching Kids What AI Is (And Isn't)." ISTE. iste.org/explore/artificial-intelligence/teaching-kids-what-ai-and-isnt.
2. "Role of Artificial Intelligence and Machine Learning in Speech Recognition." Medium. medium.com/@venkat34.k/role-of-artificial-intelligence-and-machine-learning-in-speech-recognition-e5349873e03.
3. "AI: What is Machine Learning?" Code.org. studio.code.org/s/oceans/stage/1/puzzle/1.
4. "AI and Bias." IBM. research.ibm.com/5-in-5/ai-and-bias/.
5. "Jobs of the Future: Artificial Intelligence." Best Colleges. bestcolleges.com/blog/future-proof-industries-artificial-intelligence.
6. "Kids Are Surrounded By AI. They Should Know How It Works." MIT Technology Review. technologyreview.com/s/614306/kids-are-surrounded-by-ai-they-should-know-how-it-works/.
7. "Artificial Intelligence and the Future of Humans." Pew Research Center. pewresearch.org/internet/2018/12/10/artificial-intelligence-and-the-future-of-humans/.

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Blueprint for Discovery

PROBLEM: 60 minutes

Instructor Prep: Before class begins, create a word web on the board with an empty circle in the middle. Stemming from this empty circle, add circles with the following terms: Face ID, Social Media Feeds, Spell Check, Spam Folder, Search Engines, Google Home and Alexa, Waze and Google Maps, and Netflix/ YouTube recommendations

1. Begin class by directing students' attention to the word web. Challenge students to discuss with a partner: What do these words have in common? What terms could go in the center circle?

   Encourage pairs to share their thoughts, and eventually write the term *artificial intelligence* or *AI* in the center circle. If any of the other terms that students suggested are similar to AI, point out the connection. (5 minutes)

2. Explain that students are about to watch a video that explains AI in greater detail. Then show the *AI: What is Machine Learning?* video until 2:28. As students watch, encourage them to think about: How do machines become intelligent? Who teaches them how to learn? (5 minutes)

3. When the video is complete, arrive at the answer that people (or programmers) are responsible for teaching computers. Then challenge the class to brainstorm: What may be some of the benefits (or pros) and risks (or cons) of having people create artificial intelligence? Record students' thoughts on the board. (5 minutes)

4. Encourage students to keep this question in mind as you show *The Problem* video segment. When the video is complete, ask students to help you add any benefits or risks to their brainstorming. (5 minutes)

5. Lead the class in a full-group discussion around the following questions:

   - How does artificial intelligence and machine learning affect you?
   - How may it impact our world in the future?
   - Who *is* and who is *not* currently helping create the computer algorithms that help computers learn?
   - What problems could exist if very similar people are responsible for creating all machines with artificial intelligence?

   (10 minutes)

6. Explain that before they try to develop a solution to this problem, as the video clip challenged them to, students will complete a machine learning activity that will deepen their understanding of the issue.

7. Divide students into pairs, and pass out one copy of Handout 1: Understand the Problem to each student. Each pair will also need a device.
   Review the handout's overview section aloud, and reiterate that students must pause and answer the handout's questions at each of the pause points. Then allow students about 25 minutes to complete this activity.

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8. When the activity is complete, bring the class back together and discuss: What else did you learn that supports why it is important for AI to be trained and built by people with diverse backgrounds and perspectives? (5 minutes)

SOLUTION & IMPACT: 70 minutes

1. Now that students have a deeper understanding of the problem, explain that they are ready to tackle the question that the video clip presented: How would you solve this problem?
2. Pair partners together to make groups of four, and distribute one copy of Handout 2: Design Thinking to each group. Review the handout's directions and explain that students will be collaborating to brainstorm ways to solve the AI inclusiveness problem. Students should be creative as they ideate possible solutions.

   Allow groups about 15 minutes to brainstorm.
3. Distribute one copy of Handout 3: Solution Storyboard and Handout 4: Imagine the Impact to each group.

   First, review the instructions on Handout 3 and explain that the next step in the design process will be to select one solution that they think is most likely to help people from diverse backgrounds become involved in machine learning and artificial intelligence.

   Then review Handout 4's instructions, and reiterate the importance of designing a solution that will help AI work toward becoming bias-free. If needed, walk through the handout's layout and the way in which it demonstrates a solution's ripple effects. For instance: Inspiring more women and people from diverse backgrounds to become involved in AI could provide learning and career opportunities to students around the world, which could help people in developing countries create AI solutions to problems in their own community, etc.

   Give groups about 30 minutes to work.
4. Then bring the class back together to show the *Solution* and *Impact* video segments. Instruct students to think about how their own ideas compare to those presented as they watch. (5 minutes)
5. When the video viewing is complete, ask each group to compare and contrast the actual solution and impact with their own ideas, and challenge them to optimize their own solution in at least one way. Allow groups about 10 minutes to make edits directly to their storyboard.
6. For the time remaining in the session, discuss the following questions.

   The first two questions can be answered using a continuum line. To facilitate this, designate one wall of the classroom *more* and the opposite wall of the classroom *less*. Explain that the middle of the classroom represents equal. Students should silently indicate their answer along this continuum line before explaining their reasoning.

   - Do you believe your solution would be more or less effective than the one presented in the video? Why?
   - Do you believe your solution has the potential to reach more or less people than the video's solution? Why?

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Then regroup and discuss the final question as a class:

- How could your solution to the AI inclusiveness problem impact people around the world? Think about the developers of AI and those who are affected by AI innovations.

WHAT CAN I DO?: 60 minutes

1. As this session begins, instruct students to form back into their groups of four and distribute a piece of chart paper and markers to each group.

   Write *Educate, Empathize,* and *Act* across the board, and ask each group to write the same words on their paper in a 3-column T-chart. Explain (or—if one or more of the other Tech for Global Good lessons have already been completed—review) that these are three different steps that they, as students, can take to help create change. Then point to each word and encourage students to think about:

   - Educate: How can you help others learn more about AI and its potential?
   - Empathize: How could AI impact lives around the world?
   - Act: What actions could you and other students take to contribute toward ensuring AI is developed in a responsible and bias-free way?
     (5 minutes)
2. Explain that you will give each group about two minutes to brainstorm and record answers to each question, one category at a time. Once one category is complete, groups will switch papers with a neighboring group, read their responses, and have an additional one or two minutes to add new thoughts. The paper will then be returned to the original group and the process will begin again for the next category.
   (10–15 minutes)
3. Once the activity is complete, review what the class has brainstormed and ask each group to share their favorite idea. (5 minutes)
4. Then show the *What Can I Do?* video segment. As students watch, encourage them to listen for additional ideas that can be added to these three categories and add them when the clip is complete. (5 minutes)
5. Challenge students to consider what they can personally do now to help AI work toward being bias-free. Distribute one Handout 5: Create Change to each student, and review the step-by-step directions. Reiterate that individual students or pairs will select one way they can create change in their own community and will create a plan for carrying it out. As they develop their plan, they should consider if it could be strengthened by including technology* that either already exists or is a new invention. If so, they should incorporate this technology into their action plan.
   (15–20 minutes)

   *If your students would benefit from technology suggestions, you may share the list below. Alternatively, students could also perform their own Internet research to find tech resources or products that align with their change idea.

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- Educate:
  - Informative websites about AI, such as Google AI,
  - Online news sources: Newsela, The Learning Network
  - Videos: Ted Talks or keyword searches on YouTube
- Empathize:
  - The *Educate* websites from above can be used to better understand how AI can impact lives.
  - Use web resources such as the United Nations' Global Issues Overview to learn more about problems facing the world.
  - Use easily-accessible AI products *or* products with AI components (such as Apple Siri; Waze or Google Maps; word processing/email spell check; or Netflix, Amazon or Pandora recommendations; etc.).
  - Explore machine learning experiences like Code.org's AI for Oceans to understand how bias can influence machine learning.
- Act:
  - Use a relevant social media platform(s) to create a targeted campaign.
  - Start a blog.
  - Create a presentation for a target audience that promotes a specific action using PowerPoint, Google Slides, Prezi, iMovie, etc
  - Participate in AI courses and programs with AIClub.
  - Motivate high school students to participate in AI4ALL's open learning courses or summer programs.
  - Encourage your school to offer machine learning classes based on open source curriculum like MIT's An Ethics of Artificial Intelligence Curriculum for Middle School Students.
  - Work as a family to learn about AI and build projects with Technovation.
  - Research careers related to AI and inspire others to consider these career paths.

6. When there are about 15 minutes left in the class session, write *Thoughts, Questions,* and *Epiphanies* on the board, and guide students in writing *T, Q,* and *E* vertically on a piece of scratch paper. Explain that students are about to present their ideas. As they listen to each other's presentations, they should record at least one thought, one question, and one "aha" moment.

   Then encourage each student or student pair to share the action they selected, why this change is important, and the first step they will take toward achieving it.

   If time allows, invite students to share a few of their Ts, Qs, and Es at the very end of the class session!

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National Standards

Next Generation Science Standards

Engineering Design:

- MS-ETS1-1: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

Life Sciences:

- Cross-Cutting Concepts:
    - Interdependence of Science, Engineering, and Technology: Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS-LS4-5)
    - Patterns:
        - Patterns can be used to identify cause and effect relationships. (MS-LS4-2)
        - Graphs, charts, and images can be used to identify patterns in data. (MS-LS4-1), (MS-LS4-3)

Common Core English Language Arts Standards

Reading:

- R.7: Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.

Writing:

- W.4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Speaking & Listening:

- SL.1: Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

Standards for Technological Literacy (ITEAA Standards)

Standard 1: Students will develop an understanding of the characteristics and scope of technology. In order to comprehend the scope of technology, students should learn that:

- F. New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology.
- G. The development of technology is a human activity and is the result of individual or collective needs and the ability to be creative.

Standard 4: Students will develop an understanding of the cultural, social, economic and political effects of technology. In order to recognize the changes in society caused by the use of technology, students should learn that:

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- D: The use of technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology's development and use.
- F. The development and use of technology poses ethical issues.
- G. Economic, political, and cultural issues are influenced by the development and use of technology.

Standard 8: Students will develop an understanding of the attributes of design. In order to comprehend the attributes of design, students should learn that:

- E. Design is a creative planning process that leads to useful products and systems.
- G. Requirements for a design are made up of criteria and constraints.

Standard 11: Students will develop abilities to apply the design process. As part of learning how to apply design processes, student should be able to:

- H: Apply a design process to solve problems in and beyond the laboratory-classroom.
- J: Make two-dimensional and three-dimensional representations of the designed solution.

Understand the Problem, page 1 of 2

Overview: You and your partner are about to participate in a hands-on machine learning activity provided by Code.org. To get started:

- Visit studio.code.org/s/oceans/stage/1/puzzle/1.
- Click *Continue* and follow the onscreen instructions.
- You will be asked to help the computer sort items several times. Each time, press *Continue* after you have sorted about 30 items.
- Pause at each of the points below to discuss and jot answers to the questions provided.

Pause Point: Right *before* you watch the Training Data and Bias video

- What has your machine learned? How did your machine learn this?

Pause Point: Right *before* you watch the Impact on Society video

- Is your training data still impacting how your machine learns? How do you know?
- What is biased data? Where does it come from?
- How can people make sure a machine is trained using unbiased data?

Understand the Problem, page 2 of 2

Stopping Point: Right *after* you click "Finish"

- How is AI currently helping society?

- What are some of the risks of biased data?

- How can we help make sure artificial intelligence is used to promote good and revolutionize lives for the better?

Design Thinking

Empathize & Define

Use what you learned during your research to summarize the issue facing AI. Think about who this problem has the potential to affect, as well as who needs to be involved in the solution.

Ideate

To ensure that AI is *not* biased, people of all backgrounds, races and genders need to be involved in its development. In order for these people to become involved, they first need to be aware of AI and become interested in it!

1. What information about AI could capture people's attention and help them understand its importance?

2. Outside of school, how could youth and adults learn more about AI? Be creative as you brainstorm learning opportunities or technology tools...It doesn't have to exist yet!

3. The cost and availability of learning opportunities are two of the factors that can prevent people from learning about AI. How could you help one or more of your ideas from #2 become more accessible to people from many different backgrounds?

Solution Storyboard, page 1 of 2

Directions: Select one solution that you think will help the greatest number of people learn about AI. Then use this storyboard to elaborate on your idea and explain how your idea could help AI become more inclusive and bias-free.

As you explain your solution, illustrate how you would spread the word, who would be involved, how it would be accessible to people from different backgrounds, and how it would ultimately help AI be built by people with diverse perspectives and voices.

You may use as many squares as needed.

1	2	3

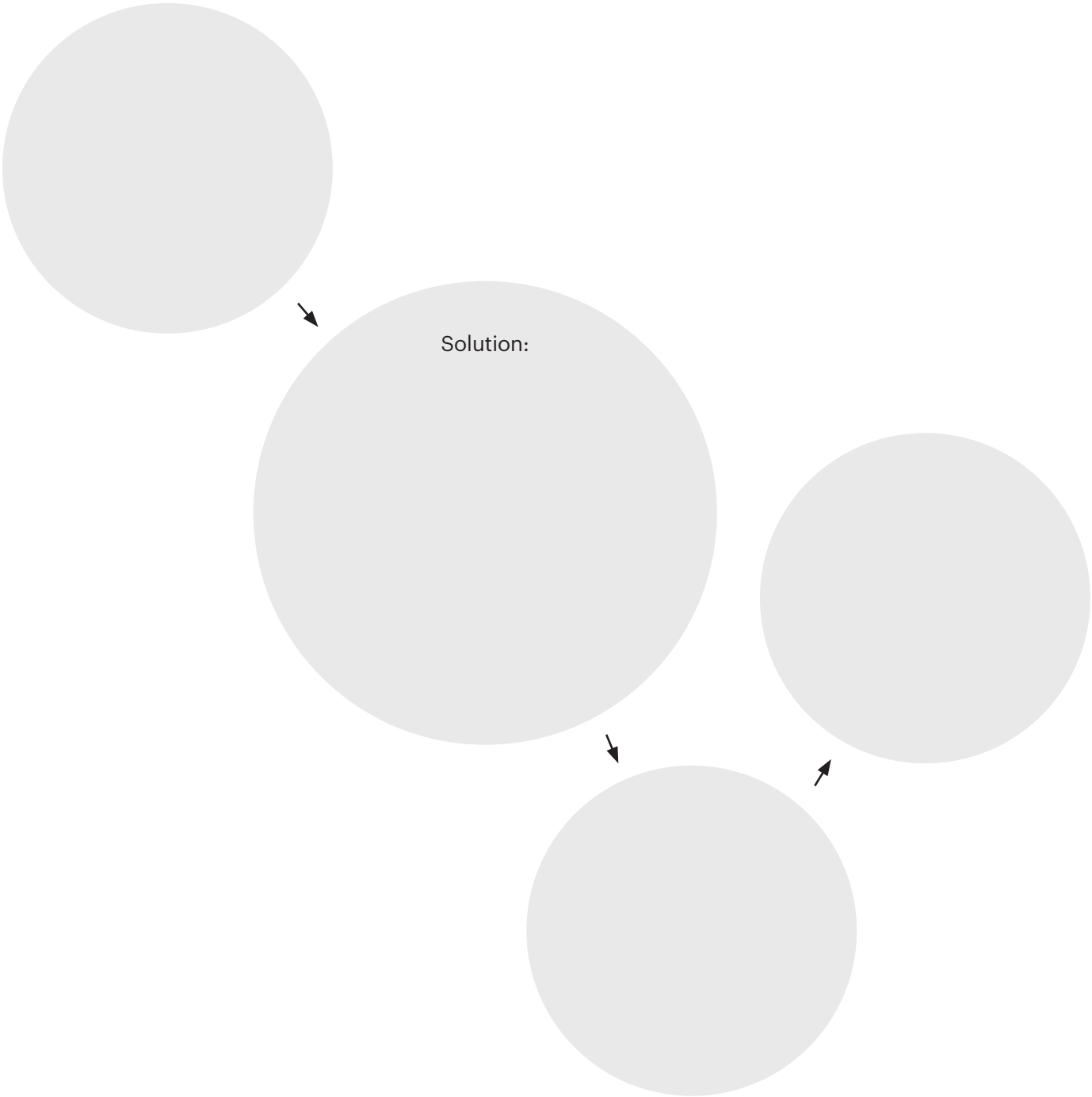
Solution Storyboard, page 2 of 2

4	5	6

Imagine the Impact

A solution to a large problem can have a ripple effect: It not only solves the problem at hand, but can positively affect people's lives in many other ways as well.

Fill in the diagram below as you consider the many effects of your AI solution. Use the circles provided as a starting point and then continue to add your own!



Create Change, page 1 of 2

Step 1: Choose an Action

Select one action you can take in your community that could help AI become more inclusive and bias-free. This action may fall into the *Educate, Empathize,* or *Act* categories. It may be an idea from the video, one that you or your classmates developed, or an entirely new idea.

I will create change by inspiring my community to:

Then explain: Why is this action important? How will it help the future of AI?

Create Change, page 2 of 2

Step 2: Create a Plan

Break your idea into at least three smaller steps. As you do, try to include at least one existing tech resource or innovation that you could use to achieve your change.

1.

2.

3.

4.

Step 3: Begin!

Now that you have a plan in place, get started on your first step and begin creating change.