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Eco-Ethics: AI Use in Climate Change Mitigation

Why?

This lesson addresses the varied role of Artificial Intelligence (AI) in addressing environmental challenges and climate change, highlighting both its potential benefits and the ethical dilemmas it presents. Through a video, a case study, and a simulation activity, students will explore how AI can contribute to sustainable practices, such as wildlife conservation and energy efficiency, while considering the implications of increased energy consumption and the need for transparency and community involvement. The lesson is designed to encourage critical thinking and informed debate among students about the integration of technology in environmental efforts, encouraging them to consider how future innovations can be guided by ethical and sustainable principles.

Materials Needed	Time needed
• Printouts of simulation handout • Printouts of case study (optional)	• Approximately 45 - 60 minutes

Objectives

- Students will be able to explain how Artificial Intelligence (AI) can contribute to climate change mitigation and environmental conservation.
- Students will be able to identify ethical considerations and potential challenges associated with the use of AI in various aspects of society and the environment.
- Students will be able to analyze the potential impact of AI technology on energy consumption and its implications for climate change.

Key Concepts & Vocabulary

- **Climate Change Mitigation**: Actions to limit the magnitude or rate of long-term climate change, typically by reducing greenhouse gas emissions or enhancing carbon sinks.
- **Sustainable Resource Management**: The careful, responsible management and use of natural resources to meet current needs without compromising the ability of future generations to meet their own needs.
- **“Black Box” in AI**: Refers to a system or model whose operations or functions are not visible or easily understood, often describing complex AI algorithms.

Lesson Components

1. **Before You Watch**: Connect lesson to background knowledge of climate change mitigation and get students’ attention**.**
2. **Video**: Show the pedagogy.cloud video explaining the ethical considerations in the topic of AI use in climate change mitigation.
3. **Case Study**: Detail a real-world scenario that relates to the issue of AI use related to climate change.

4. **Simulation**: Lead students through an interactive activity exploring the possible ethical considerations.
5. **Discussion**: Ask whole-class questions to reflect on experience and consider perspectives.
6. **Assessment**: Verify student understanding with an exit ticket.

1. Before You Watch

Guesstimation Quiz: Read the questions below and have students guess the numerical answers. (The bolded answers are the correct ones.) Citation linked in Sources section at bottom of lesson plan.

1. How much power does it take to generate one AI-generated image?
    a. Enough to charge a cell phone 3%
    b. Enough to charge a cell phone 24%
    c. Enough to charge a cell phone 100%
2. Generating 1000 images this way would be equal in emissions to how many miles driven by an average gas-powered car?
    a. Half a mile
    b. 1.6 miles
    c. 4.1 miles
3. How many text prompts could you perform on ChatGPT using the same power used in completely charging your phone one time?
    a. 333
    b. 777
    c. 1,000
4. According to Google's own reporting, how many gallons of water did the company use in 2023?
    a. 700 million gallons
    b. 5.6 billion gallons
    c. 10.8 billion gallons
5. AI-generating servers are estimated to use about the same amount of energy as which size of population?
    a. About the same as the city of Houston (about 6.8 million people)
    b. About the same as the state of Florida (about 21.5 million)
    c. About the same as the country of Argentina (about 46 million)

While You Watch: Mention these topics and questions for students to look out for as they watch the video:

- Find an instance in the video where AI helps in fighting climate change.
- What is a 'black box' in the context of AI, as explained in the video?
- Notice when AI's impact on local communities and environments is discussed. What are the concerns?

2. Video Summary

In a world increasingly influenced by Artificial Intelligence (AI), this animated video explores AI's ubiquitous presence in our daily lives, from smartphones to smart homes,

and its promising role in addressing climate change through predicting weather patterns and protecting endangered species. However, the video also delves into the ethical concerns AI brings, including its energy consumption, control by a few large companies, transparency issues, and the potential for biases, underscoring the importance of responsible AI development and use. Ultimately, the narrative encourages a balanced approach towards harnessing AI's potential for societal and environmental benefits while being mindful of the challenges, aiming for a future where AI contributes to a fair, sustainable, and inclusive world.

3. **Case** Study

Distribute or read Case Study handout.
Summary: In the town of Greenfield, the AI system TerraTracc was introduced to optimize resource use for climate change mitigation, but led to unintended ecological damage and community concerns about autonomy. The case underscores the need for a balance between AI-driven efficiency and human oversight, suggesting solutions like community-guided AI, adaptive learning, and sustainability education. TerraTracc's story emphasizes the importance of integrating AI with community input and transparency to ensure technology serves both the environment and local populations effectively.

4. Simulation

Explain the simulation scenario – A state government wants to institute the use of an AI system in a state park that tracks wildlife and provides data to park officials on how to run the park to help animals and the environment in a climate change mitigation effort. The process includes public meetings to discuss the plan, and offers concerned citizens a chance to voice their concerns.
Distribute the Simulation handout to groups of students (approx. 4 - 5 students.) Each group should choose which student will represent each role. Give students some time to understand their roles and to determine how they will approach the conversation. Roles are listed on the simulation handout.

Teacher leads the conversation, bringing up each of the four areas of concern. Below are some bullet points that offer the teacher some suggestions in giving students in various roles hints on what sort of topics to bring up in the conversation.

AI and Conservation:

- State Park Official presents EcoTracc as a means to gain better insights into animal behaviors and environmental changes, facilitating proactive conservation strategies.
- Eco-Conscious Citizen acknowledges AI's benefits but raises the issue of increased energy use by AI systems, highlighting the need for sustainable energy sources to mitigate this concern.

Impact on Park Experience:

- Neighbor expresses concerns that AI technology could disrupt the park's natural beauty, possibly deterring visitors.

- Technology Advocate argues that AI's mostly invisible monitoring methods and potential educational opportunities for visitors about conservation technology can enhance the park experience.

Reliability of AI in Nature Conservation:

- Skeptical Citizen voices concerns about the reliability of AI, emphasizing the complexity of natural ecosystems and the risk of over-reliance on technology.
- State Park Official reassures that AI data will complement traditional conservation methods, with human experts making final decisions.

Transparency and Energy Efficiency:

- All parties discuss the importance of transparency in EcoTracc's operation and decision-making process, with a special focus on ensuring the AI system's energy efficiency and the use of renewable energy sources to power it, addressing the Eco-Conscious Citizen's concerns.

After giving time for groups to discuss each topic, offer groups the opportunity to mention topics brought up in their conversation. These questions may help in leading this discussion:

- What were the significant concerns of each role in the conversation?
- Considering the energy consumption of AI systems like EcoTracc, how can the state park balance the benefits of AI with the need for environmental sustainability?
- What steps can be taken to ensure EcoTracc's energy use does not counteract its conservation benefits?
- How can the community be engaged in a dialogue about the responsible use of technology in natural settings to preserve both the environment and the visitor experience?

5. Discussion

These questions are designed to be used in whole-class discussion. Ask questions that relate most effectively to the lesson.

1. How does AI's role in weather prediction and conservation affect climate change efforts?
2. Can AI's benefits in environmental conservation outweigh its potential negative impacts?
3. How can ethical considerations guide the development and use of AI technologies?
4. Why is public transparency and involvement crucial in AI's adoption in public areas?
5. How do we maintain natural integrity while leveraging AI's efficiency in state parks?
6. What measures can mitigate AI's concerns regarding reliability, ethics, and energy consumption?
7. Envisioning the future, how will AI, humanity, and the environment collaborate in climate action?

6. Assessment

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Exit Ticket: Provide a prompt for students to reflect on their learning, such as:

- How can AI contribute to combating climate change, and what are some examples from the lesson?
- What are two ethical considerations mentioned in the lesson when using AI for environmental purposes?
- Describe one potential drawback of implementing AI in wildlife conservation efforts.

Sources to Learn More

- **Sources for Guesstimation Quiz** - https://futurism.com/the-byte/power-generate-single-ai-image2021 study exploring various ethical aspects of AI in climate change mitigation - https://www.emerald.com/insight/content/doi/10.1108/JICES-11-2021-0106/full/pdf?title=artificial-intelligence-and-climate-change-ethical-issues
- 2023 article on how AI can help deal with climate change - https://hub.jhu.edu/2023/03/07/artificial-intelligence-combat-climate-change/
- 2021 article about getting AI systems to work together with climate change efforts - https://hal.science/hal-03368037/file/Kaack_2021_Aligning.pdf

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Case Study: Greenfield's Climate Effort

Introduction

In the town of Greenfield, a new AI system, TerraTracc, was introduced to optimize water usage and energy consumption based on weather predictions. This AI promised to revolutionize the town's efforts against climate change by reducing waste. However, as TerraTracc began dictating when and how much to water the parks or power the street lights, concerns arose.

Background Information

TerraTracc uses complex algorithms to predict weather changes and adjust the town's resource use accordingly. Artificial Intelligence, or AI, allows machines such as TerraTracc to learn from vast amounts of environmental data, making automated decisions to maximize efficiency and reduce carbon footprints.

Problem Analysis

Despite its initial success, TerraTracc's control over resource allocation led to unintended consequences. A prolonged, AI-imposed restriction on park watering during a dry spell resulted in significant damage to local flora, disrupting the habitats of several species. Additionally, the community felt sidelined in decision-making processes, leading to debates about the ethical implications of surrendering such control to an AI, no matter how well-intentioned it might be toward climate change mitigation.

Possible Solutions

Community-Guided AI: Implement a system where TerraTracc's recommendations are reviewed by a community board before being executed. This approach ensures that AI assists rather than dictates, keeping the community involved in environmental stewardship.

Adaptive Learning and Transparency: Upgrade TerraTracc to better adapt to unexpected scenarios and be transparent about its decision-making process. This involves the AI learning from past mistakes and the community having access to understand the AI's logic.

Sustainability Education: Empower residents with knowledge about sustainable practices and the role of technology in climate change mitigation. This education can foster a collaborative environment where technology and human insight work hand in hand.

Conclusion

TerraTracc's journey in Greenfield highlights the delicate balance between leveraging AI for climate change mitigation and maintaining community trust and ecological integrity. While AI can play a pivotal role in conserving resources and fighting climate change, it's crucial to ensure these technologies complement human wisdom and local ecosystems.

Reflective Questions

How would you feel about an AI system like TerraTracc managing resources in your community?

What steps would you take to ensure that AI aids in climate change efforts without compromising the local environment and community involvement?

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Simulation Activity: Public Meeting on EcoTracc

The state government has proposed introducing "EcoTracc," an AI system, in a state park to monitor wildlife and assess climate change impacts. Public meetings are convened to discuss this proposal, attracting citizens with varied concerns and interests related to the project.

Roles

- **State Park Official**: Promotes EcoTracc, emphasizing its potential to enhance conservation efforts and monitor climate change impacts.
- **Eco-Conscious Citizen**: Supports AI in conservation but is concerned about the additional energy consumption required for AI operation and its paradoxical impact on climate change.
- **Neighbor**: Worried about the impact of visible AI technology (like drones or sensors) on the park's natural ambiance and visitor experience.
- **Technology Advocate**: Highlights the efficiency and advancements AI can bring to conservation, believing the benefits outweigh the energy consumption concerns.
- **Skeptical Citizen**: Questions the accuracy of AI and its potential to lead to misguided conservation efforts based on incorrect data or predictions.

Discussion Points

- AI and Conservation
  - How do you see the AI being used in the effort to help endangered animals?
  - What other concerns exist?
- Impact on Park Experience:
  - How will the AI use impact parkgoers' experience visiting the natural area?
  - What concerns do different people have?
- Reliability of AI in Nature Conservation:
  - In what ways will this effort impact people's lives?
  - What happens if AI predictions are inaccurate, or even cause harmful outcomes?
- Transparency and Energy Efficiency:
  - How do we make sure that AI use will only produce positive outcomes for people and animals?
  - How will we understand the suggestions put forward by the AI?

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Video Script for Animator

Hello Young Innovators! Today we're discussing the ethics of AI in climate change mitigation.
Title screen

In a world where technology touches every part of our lives, Artificial Intelligence, or AI, stands out as a groundbreaking force. From smartphones to smart homes, AI is everywhere, making decisions, learning from data, and even visualizing possible future events!

[Visuals: Socrat narrating throughout, facing the viewer.
Socrat is showing a "slide presentation" on a screen behind him. He has a clicker device in his hand, pointing it at the screen and clicking the button to make the pictures behind him change. Example image: https://i.imgur.com/73RRN2e.jpeg
Show everyday scenarios where AI is used -
a family using a smart home device - https://i.imgur.com/6TWh4Dg.jpeg
a kid playing a video game - https://i.imgur.com/By5Ndio.jpeg
a parent using a navigation app - https://i.imgur.com/vO7vBSn.jpeg]

What exactly is AI? Imagine a robot that can learn to make pancakes just by watching you do it once. That's AI in action - a blend of computer science and data enabling machines to think and learn.

[Visuals: Socrat turns the other direction, showing a high-tech kitchen. A robot is watching a person make pancakes on a griddle. The person flips a pancake, and then the robot flips a pancake. Example image - https://i.imgur.com/PheRXva.jpeg]

One fascinating use of AI is in fighting climate change. Scientists use AI to predict weather patterns, manage renewable energy, and even protect endangered species!

[Visuals: Socrat turns back to the screen, showing slides that have pictures of:
AI systems predicting weather changes - https://i.imgur.com/wCpzyLg.jpeg,
managing windmills and solar panels - https://i.imgur.com/3Cjbj1q.jpeg, and
tracking animals in the wild - https://i.imgur.com/XIPLtCq.jpeg]

However, with great power comes great responsibility. Using AI, especially in climate change, raises some tough ethical questions. For instance, AI systems require huge amounts of energy, contributing to the very problem they're trying to solve.

[Visuals: Socrat stands in a server room with a fan blowing on it. A panel indicates a huge amount of power usage with an illustration of a battery full to the brim. Perhaps a red alert light could be shining on the panel. Example image - https://i.imgur.com/DUe6jJ3.jpeg]

And who gets to decide how AI is used? Currently, only a few big companies have control over the most advanced AI technology. This can lead to inequalities and even biases in the AI systems, affecting how fair and useful they are.

[Visuals: A few large towering data centers casting long shadows over a diverse group of smaller houses and buildings, symbolizing control and inequality. Start showing the smaller buildings, with a shadow on them from the large buildings behind them. Then zoom out to show the large buildings. People look up at the buildings, concerned. Example image - https://i.imgur.com/4vOdg1j.jpeg]

There's also the question of transparency. With AI making more decisions, from what news we see to diagnosing diseases, it's crucial that we understand how these decisions are made. But AI's complex nature can make it a black box, mysterious and hard to explain.

[Visuals: In a high-tech office, an AI robot sits on a chair in front of a computer. Some humans stand nearby. The robot has a large 'black box' for a head, with question marks on multiple sides. The robot is clicking on a computer mouse, and people stand next to it, looking concerned. The computer looks at them and shrugs, indicating that it can't tell them why it's making decisions. Example image - https://i.imgur.com/qVa244U.jpeg]

Despite these challenges, the potential of AI to do good is immense. It can come up with ideas that human brains miss. By making smart choices on how we develop and use AI, we can harness its power for the benefit of all, ensuring a sustainable and equitable future.

[Visuals: A balanced scale with AI, represented by white robots and high-tech looking technology on one side and the planet with happy, diverse people on the other, slowly balancing out. Example image - https://i.imgur.com/cYW0EGa.jpeg]

So, as we venture further into this AI-powered era, let's be mindful of the possible issues, ensuring that AI remains a tool for positive change, safeguarding our planet and enhancing our lives. Remember, the future of AI is not just about the technology itself, but about how we choose to use it. Together, we can shape an AI-enhanced world that's fair, sustainable, and inclusive for everyone.

[Visuals: A vibrant park with green landscapes, clean water, and happy people co-existing with friendly AI robots, all under a clear, sunny sky. A group of kids from diverse backgrounds, together with AI robots, plant trees and installing solar panels, with the bright, futuristic city in the background. Example image - https://i.imgur.com/Ba6LUwS.jpeg]

Let’s discuss: How can we ensure that the advancement of AI and technology benefits everyone equally without harming our planet?
[Display question on screen at end of video: How can we ensure that the advancement of AI and technology benefits everyone equally without harming our planet?]

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Video Script for Narrations

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One fascinating use of AI is in fighting climate change. Scientists use AI to predict weather patterns, manage renewable energy, and even protect endangered species!

However, with great power comes great responsibility. Using AI, especially in climate change, raises some tough ethical questions. For instance, AI systems require huge amounts of energy, contributing to the very problem they're trying to solve.

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