AI for Education

AI's Impact on the Environment

Classroom Guide + Discussion Questions

Development and demand for AI tools comes with a growing concern of their environmental cost. Recent research shows AI's significant need for energy, including electricity and water consumption.

Use the following classroom guide and original sources to engage your students in a discussion on the potential impact of Generative AI (GenAI) on the planet.

What the Research Says

Data centers, which are crucial for powering AI, already account for about **1–1.5% of global electricity** use. The rapid growth of artificial intelligence may significantly raise this percentage.

GenAI operation involves two energy-intensive phases: the **training phase**, where the model learns from data, and the **inference phase**, where it generates new content based on it's training and a user's input.

Building Large Language Models (LLMs), like ChatGPT, requires extensive data analysis, consuming vast amounts of electricity and generating substantial heat.

To cool these data centers, huge quantities of water are used – about **16 oz. for every 5-50 AI prompts**.

Researchers estimate that creating ChatGPT used 1,287 megawatt hours of electricity and produced 552 tons of CO2, **equal to driving 123 gas-powered cars for a year**.

But the energy consumption isn't just confined to training these models; their usage also contributes significantly more.

Generating an image can be especially energy-intensive, requiring as much power as fully charging your smartphone.

Some models are even more demanding. Producing 1,000 images with Stable Diffusion XL is responsible for **as much CO2 as driving 4.1 miles** in a car.

Predictions indicate that by 2027, NVIDIA could be releasing 1**.5 million** AI server units annually. These servers could use **over 85.4 terawatt-hours** of electricity each year, **more than the annual consumption of many small countries.**

Some researchers estimate that the carbon footprint of an AI prompt is **4 to 5 times higher** than a search-engine query. If Google's 9 billion searches per day were instead AI chatbot queries, it would require **as much power to run an entire country like Ireland.**

Discussion Questions

1. What is the environmental impact of GenAI?

Encourage students to think about the direct and indirect effects of AI technology on the environment, including energy consumption, carbon emissions, and resource utilization.

2. How does the energy consumption of GenAI models compare to everyday activities with technology?

This question can help students relate the abstract concept of energy consumption to more familiar activities, like driving a car or charging a smartphone.

3. How does the design and complexity of an AI model affect its energy consumption?

This can lead to a discussion about the technical aspects of AI models, including the relationship between model complexity, computational requirements, and energy use.

Discussion Questions *(cont'd)*

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4. What are some ways to offset the energy consumption of AI?

This can lead to a discussion on current strategies and innovations aimed at making AI more sustainable, such as optimizing cloud service settings, using renewable energy sources, and improving hardware energy usage.

5. What ethical considerations arise from the high energy consumption of AI?

This question can spark a debate on the ethical implications of using high-energy-consumption technology, balancing technological advancement with environmental responsibility.

6. What role do individuals and organizations play in reducing the carbon footprint of AI?

Discuss the responsibilities of different stakeholders, including AI developers, users, and policy makers, in addressing the environmental impact of AI.

7. What are the trade-offs between the benefits of AI and its environmental impact?

This question encourages students to weigh the advantages of AI in various fields against its energy consumption and environmental footprint.

8. How can we balance the growth of AI technology with sustainable practices?

This can spark a conversation on sustainable development in the field of AI, including ideas for making AI more energy-efficient and environmentally friendly.

9. What is the significance of measuring and reporting the carbon footprint of AI models?

Discuss the importance of transparency and accountability in AI development and its implications for environmental sustainability.

Sources & Further Reading

Artificial Intelligence technology behind ChatGPT was built in Iowa - with a lot of water

Making an image with generative AI uses as much energy as charging your phone

The AI Boom Could Use a Shocking Amount of Electricity

A Computer Scientist Breaks Down Generative AI's Hefty Carbon Footprint