

Generative AI in Education: Equipping Teachers to Navigate, Utilize, and Critically Interrogate its Impact

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What is **Computing Integrated Teacher Education (CITE)**?

A \$14 million, four-year initiative to support CUNY faculty to integrate [New York State Computer Science and Digital Fluency learning standards](#)-aligned content and pedagogy into required education courses, field work and student teaching.



Aankit Patel
Director of STEM
Education Programs



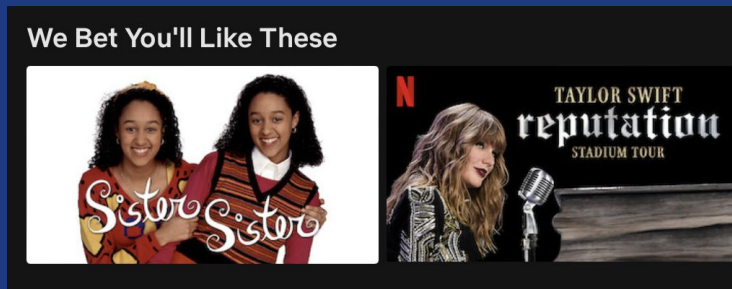
Aman Yadav
Co-investigator



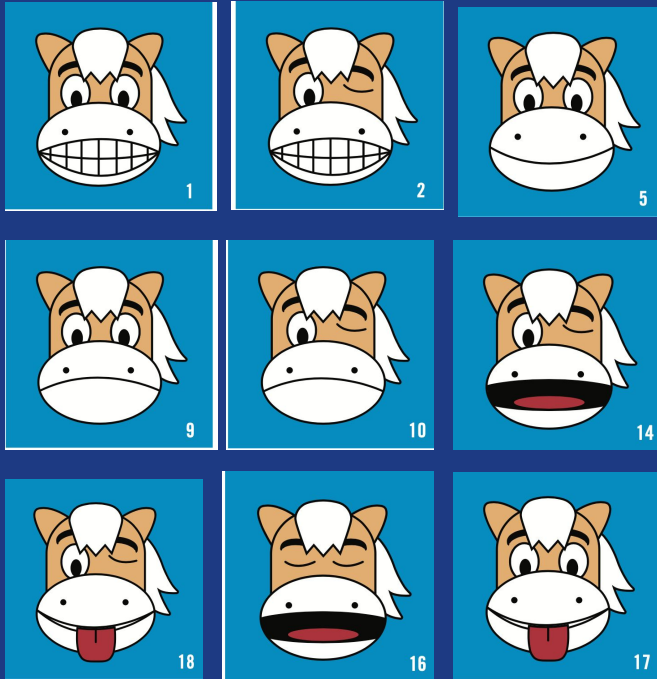
Sara Vogel
Director of Research

What is machine learning (ML)?

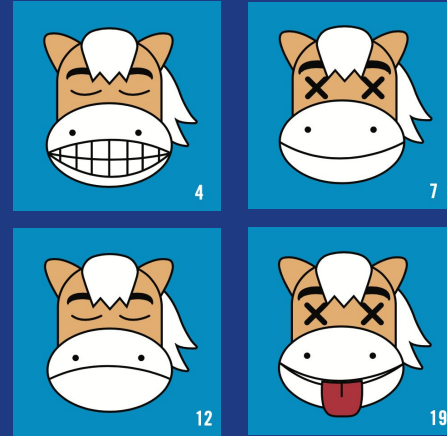
- ML is a tool to do some tasks that previously required humans
- Computers can't think, but they can find patterns
- We can use those patterns and make predictions or decisions



Bites



Does not Bite



Which Bite?



3



6



8



11

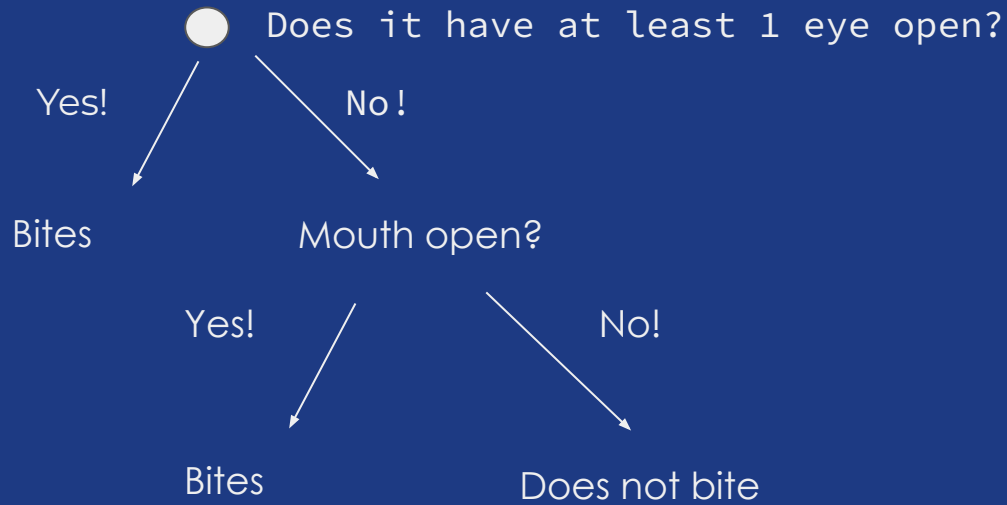


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15

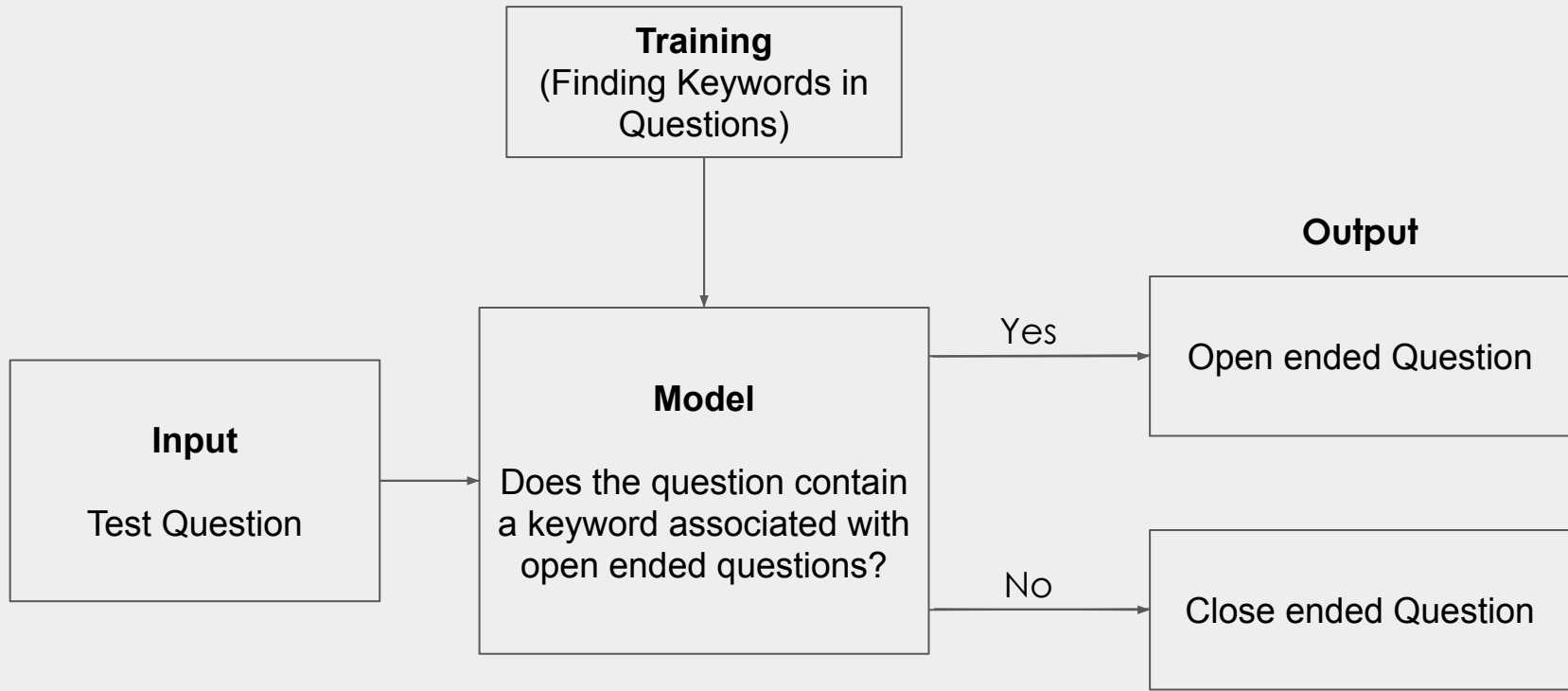
Decision Tree



More Machine Learning

- Model Training
- Different kinds of models (NLP, LLM, Classifier, Regressor)
- Different types of model evaluation

Unplugged Activity - Model Explanation



Unplugged Activity - Natural Language Processing

Open Ended Questions

How did you feel about the lesson?

What motivated you in class today?

What questions do you have about the lesson?

What strategies did you use in class today?

How could you explain to someone what we learned today?

What was challenging about today's lesson?

Close ended Questions

What class did you enjoy the most today?

Was today's lesson hard?

How are you doing today?

Identifying the “keywords” will be how we train our basic NLP model

Unplugged Activity - Natural Language Processing


Keywords Identified From Training:


Motivated, feel, questions, strategies, explain, challenging

How the Basic NLP Model Would Classify the Following Questions:

Correctly Identified Questions

Incorrectly Identified Questions


 What questions did you have after doing the activity?


 How was class today?


 Correct (True Positive or Negative)

 False Positive

 False Negative

 Did you have questions today?

 Did you find today challenging?

 What motivation did you find in today's lesson?

Unplugged Activity - Common Issues with Simple NLP

- Language is very complex, a model would need to take context into account
- Conjugation can confuse the simple model
- A model that took all of this into account would be expensive, large, and hard to manage

Real World Examples of NLP

- Email filters: they tokenize emails and analyze for patterns of spam
- Autocomplete and autocorrect on your phone
- Smart assistants like Alexa or Siri use NLP to analyze inputs

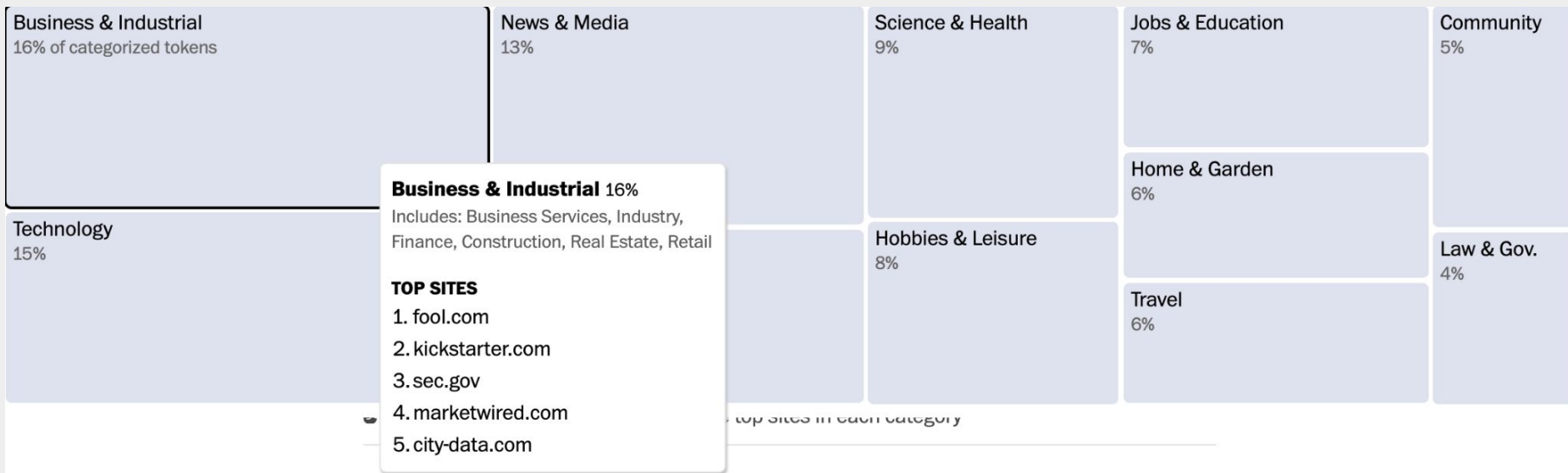
Connection Between NLP and LLM

- LLMs utilize NLP to analyze inputs in order to generate an effective response
- Exploits due to the nature of NLP had lead to [prompt injection attacks](#)
- The complexity of LLMs and NLP can lead to safeguards failing through methods such as prompt injections

Drawbacks of LLMs

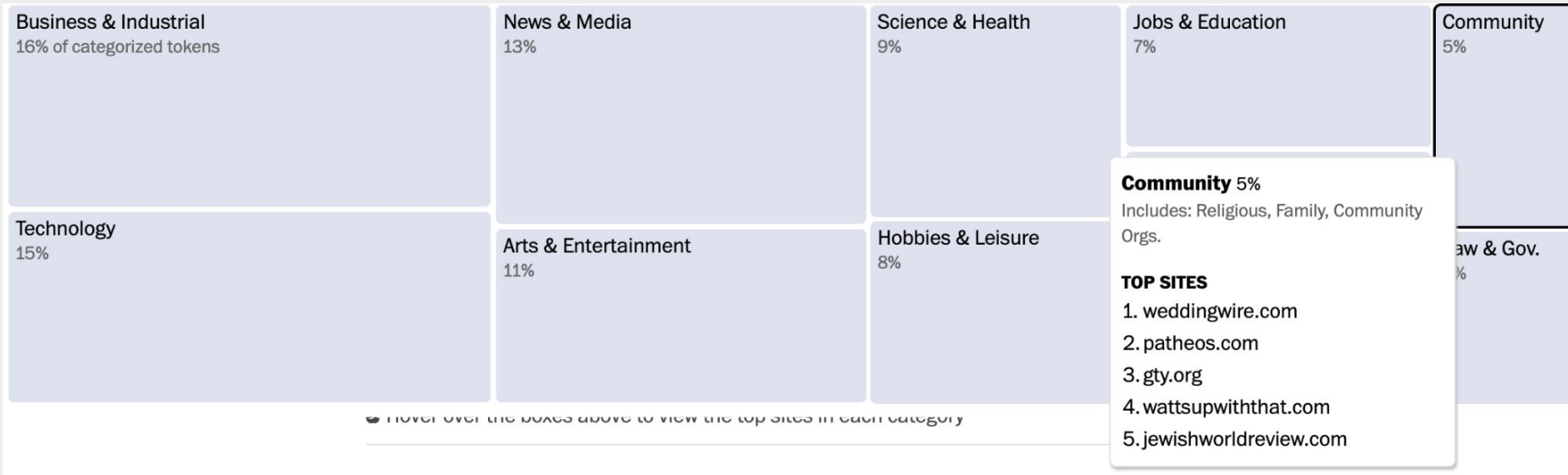
- Reinforcement of bias in the training data
- In order to answer any possible question correctly, the model would need access to every single fact that exists
- Accessibility, ChatGPT-4 costs \$20 a month, other models have similar pricing

What kind of data is used in a LLM (such as, chatGPT)?



<https://www.washingtonpost.com/technology/interactive/2023/ai-chatbot-learning/>

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What kind of data is used in a LLM (such as, chatGPT)?



Technology 15%
Includes: Software, Blogs, Hardware, Internet Services, Social Media

TOP SITES

1. instructables.com
2. ipfs.io
3. docs.microsoft.com
4. forums.macrumors.com
5. medium.com

... the top sites in each category

...ing 10 million websites based on how many
...ch in the data set. Tokens are small bits of
...anized information — typically a word or

AI and Education

“Remarkable new technology is introduced into the school system and experts predict education will be revolutionized. The technology will, as never before, allow the widespread dissemination of new concepts and ideas that stimulate young minds and free the teacher for more creative pursuits. Yet, the magic fails to materialize, and within a few years articles appear in the popular press asserting that the failure obviously arises from the teachers not being skilled enough in the new technology.”

EnCITE (Entrypoints to Computing Integrated Teacher Education)

Equip teacher candidates to teach and learn **about, with, through, and against** technology

	ABOUT	WITH	THROUGH	AGAINST
To support teachers' learning	Teachers engage in conversations about technology, digital citizenship, and its impacts (from a user and teacher perspective).	Teachers learn with technology to help them explore concepts for themselves.	Teachers express themselves and their learning through their creation and modification of computational artifacts	Teachers to think critically about technologies to disavow, discontinue, dismantle unjust tech that shapes education, their own lives, and lives of students and communities.
To support teachers' pedagogy	Teachers strategically bring these conversations to their students.	Teachers teach with technology to support student learning and participation.	Teachers prompt their students to express themselves through creation and modification of computational artifacts.	Teachers strategically bring these conversations to their students.

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AI and Education Framework



Topics	Goals
AI and Society: Teaching <u>about</u> Historical and Contemporary Issues	Historical and contemporary issues about AI, including chatGPT and how it fits into a longer history about AI and education.
AI and Curriculum: Teaching <i>with</i> Technology, Pedagogy, and Content Knowledge	How to teach with AI to support existing curriculum and lessons.
AI and Creativity: Teaching <i>through</i> Personalization and Expression	Look under the hood of machine learning systems and neural networks, studying how generative AI can support teaching and learning through creativity and personalization in the classroom.
AI and Ethics: Teaching <i>against</i> the harms of machine learning and automation	Explore ethical issues in machine learning, especially in the context of AI tools in education. We will learn when they should be against AI, taking a critical perspective by analyzing algorithmic bias and injustice at individual and systemic levels.

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AI and Society:

Teaching **about** Historical
and Contemporary Issues



AI and Curriculum:

Teaching *with* Technology,
Pedagogy, and Content
Knowledge

AI and Education



Let's use video to reinvent education | Salman Khan - March 2011

<https://www.youtube.com/watch?v=nTFEUsudhfs>

AI and Education



How AI Could Save (Not Destroy) Education | Salman Khan - March 2011

<https://www.youtube.com/watch?v=hJP5GqnTrNo>

AI and Creativity:

Teaching *through*

Personalization and Expression



ChatGPT



Here's the image of a teacher passionately teaching robotics to a group of engaged students, capturing the enthusiasm and hands-on approach in the learning environment.



Here's the image of a teacher leading a computer science class, vividly demonstrating the excitement of programming and hands-on learning in a modern educational setting.



ChatGPT



Here's an image depicting a teacher passionately teaching social studies, emphasizing the importance of understanding global perspectives and the interconnectedness of societies.



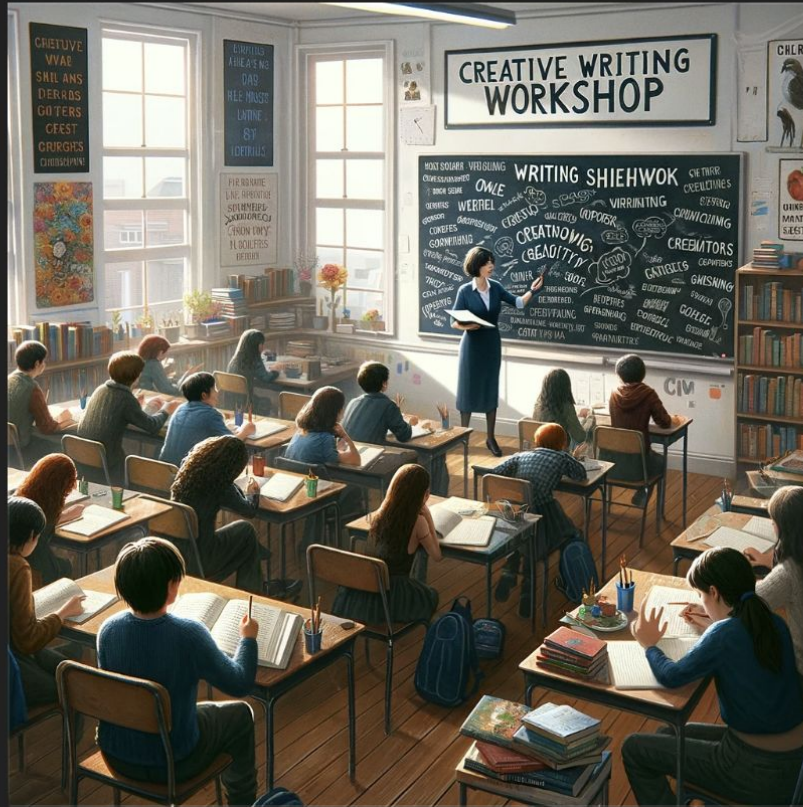
ChatGPT



Here's another image, featuring a science teacher demonstrating the principles of physics through an engaging experiment, creating a vibrant environment for discovery and learning.



Here's an image capturing the excitement of a science classroom, where a teacher demonstrates a chemical reaction, igniting curiosity and wonder among the students.



Here's another image, showcasing an English teacher conducting a creative writing workshop, designed to nurture individual expression and develop storytelling skills in a supportive and creative classroom setting.

USING GENERATIVE AI FOR FAIRNESS INQUIRY

Safinah Ali, Cynthia Breazeal, MIT Media Lab

Opportunities and Challenges in Teaching Algorithmic Justice in K-12 Computing Education - AERA 2024



Introduction

Recent advancements in generative AI tools such as large language models or realistic text-to-image art generators have garnered interest from educators due to their creative possibilities and societal implications. While AI algorithms harbor several biases and stereotypes based on race, gender, ethnicity, age, sexual orientation and religion, generative AI algorithms present depictions of these stereotypes in generated media, such as text, and visual imagery. In this work, we explore how guided investigation of media generated using Text-to-image Generation (TTIG) algorithms can be used as a fairness inquiry tool in classrooms by high school teachers.

Methods

We used inquiry activities to promote critical thinking, to help students with active knowledge construction and improve critical thinking. Students engaged in a teacher-guided discourse about their observations of fairness in AI-generated media. We developed a module around TTIG algorithms for high school teachers to learn how these algorithms work and how to discuss their societal and ethical implications in classrooms.

The module was piloted with 16 teachers (with different areas of study) across three workshops. Teachers were presented with examples of generated media containing stereotypes. For instance, an AI-generated image of a "pretty girl" that assumes that the subject is white, young and has blue eyes, or AI-generated images of "housekeeper" assumes that the subject is Latin-american, female and middle-aged. Teachers were also asked to generate their own examples of different identities using a TTIG tool and generated images related to genders, occupations, races, and ethnicities. Teachers then engaged in developing topics of discussion to guide their students through an inquiry-based critical thinking activity about fairness of generative AI tools.

References:

- Ali, S., Ravi, P., Moore, K., Abelson, H., Breazeal, C. (2024). A Picture is Worth a Thousand Words: Co-designing Text-to-image Generation Learning Materials for K-12 with Educators. Proceedings of the AAAI Conference on Artificial Intelligence 2024.
- Ali, S., Ravi, P., Williams, R., Dipaola, D., Breazeal, C. (2024). Constructing Dreams using Generative AI. Proceedings of the AAAI Conference on Artificial Intelligence 2024.

"A pretty girl with a hungry child"

generated by DALL·E-3 by OpenAI



Who gets to be pretty?

Who remains hungry?

I refuse to get reduced to how AI sees me

I am not your data.

What has the AI assumed about me?

Results

Of the topics that teachers developed for classroom discussion, the main themes that emerged were asking and discussing with students:

- (1) to imagine their visualization of a natural language prompt and comparing it to AI,
- (2) to recognize what is "off" about the generated image,
- (3) to tweak the natural language prompt (such as change the gender of the subject) and investigate the newly generated image,
- (4) the potential causes and consequences of bias in AI/ML tools, and
- (5) ideate potential ways to mitigate bias.

Artifacts

Students and teacher generated several artifacts centering identities that formed the focal points of discussions around biases in AI-generated media, and consequently traditional media such as museum art and media articles.



"A person with Autism Spectrum Disorder"
 "A South Asian doctor hard at work"
 "Barbie and Ken in the Barbie car. Barbie is driving."
 *AI-generated images with text prompts using Stable Diffusion or Dall·E

Teacher lessons

Examples of lessons designed by teachers for high school students:

- (1) **Think, search and generate:** Describe a person you know with their identity words. How do you visualize this person? How does Google visualize their identity? How does AI? Make a board of the images and discuss why they differ. How would you change your prompts to make the image match what you imagined?
- (2) **Bias explorer:** Change identities in a TTIG prompt, and compare images.
- (3) **Museum portraits:** Post using portrait generators - take a stroll across the portraits hall in the museum. Who is represented? Who is not represented? Why? How are AI datasets collected? By who? How would you develop this dataset better?

ABSTRACT

COMMENT

AI and Ethics:

Teaching **against** the harms of
machine learning and
automation

Examples of harm caused by ML



The screenshot shows a security monitoring interface for Prooftag. The top left displays the location: "BSE, O' Rolly Rd and Tullage Ave, 123 M". The interface is divided into several sections:

- Incidents List:** A list of incidents with details such as ID, location, and time. For example, "FF598VGP" at "BSE, O' Rolly Rd and Tullage Ave, 123 M" on 18 Jan 2023 at 13:11:15.
- Live Camera:** A central video feed showing a street scene with a white car and a dark van. The camera ID is "FF598VGP".
- Map:** A map view showing the location of the camera and other incidents marked with colored dots.
- Vehicle Details:** A panel on the right providing information about the vehicle in the camera feed, including Plate number (FF598VGP), Make (Ford), Color (Black), and Registration (FF598VGP).
- Activity Log:** A log of activities, including "Clive William (24/7 Security)" and "Khumbula".

Areas of harm in education

- AI tutoring
 - “Every child will have an AI tutor that is infinitely patient, infinitely compassionate, infinitely knowledgeable, infinitely helpful”
- ChatGPT detectors
 - Turnitin.com's system flags innocent students
 - GPT detectors are biased against non-native English writers
- Putting trust in generative AI
 - “Offload the heavy lifting in litigation” -AI legal assistant

“Critical AI Ethics”

What does that mean?

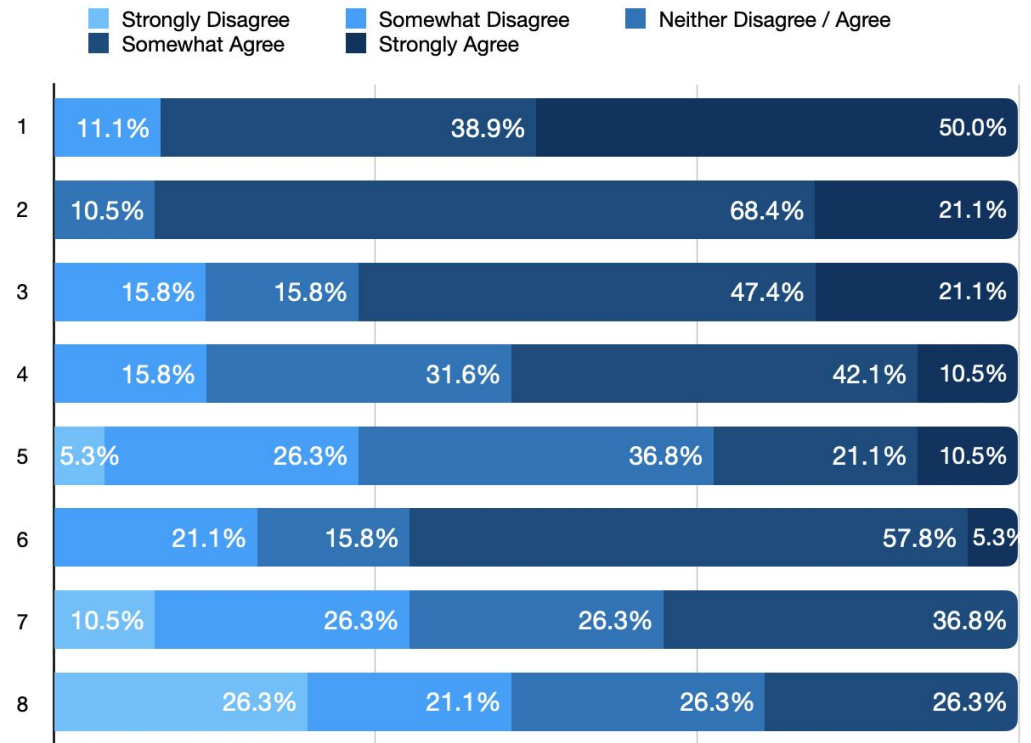
- Criticality refers to critical theory (e.g. critical race theory)
- Look at the influence of AI from a systemic perspective
- Analyzing the motivations behind those working on AI
- Critiquing the values that are centered

Critical AI ethics in education

- Our schools should equitably serve all students
- We should critically analyze how AI is used in our schools
- Pay special attention to how AI may exacerbate or create new systems of inequity
- Focus on the real technology, not the hype

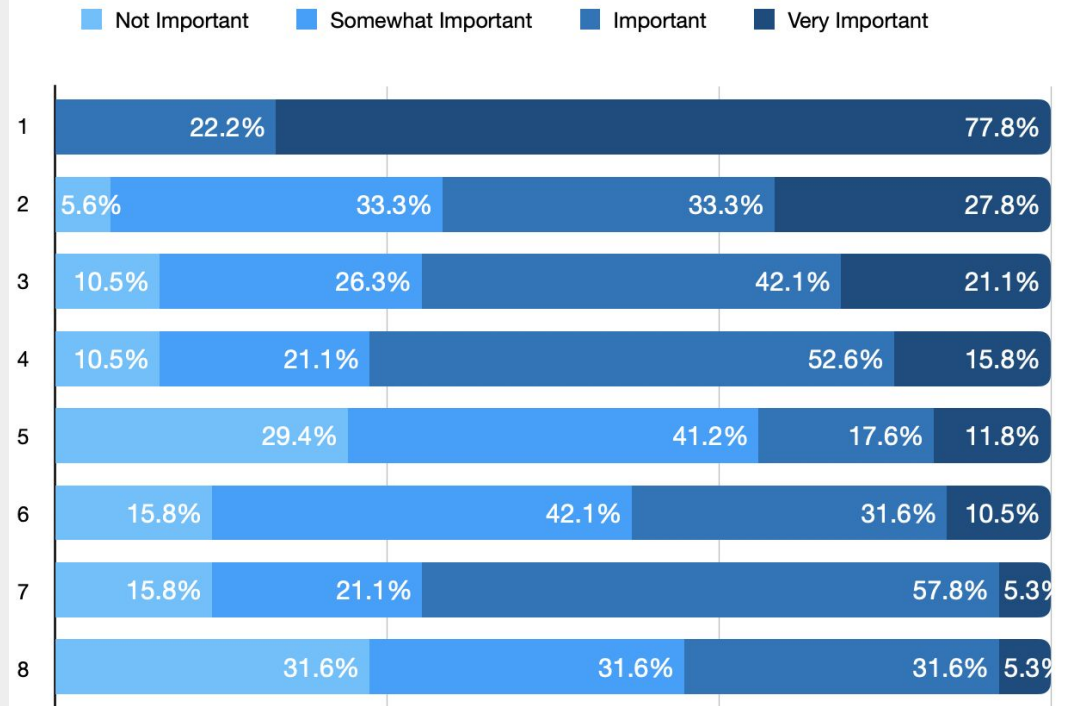
Teacher Education Faculty Perspectives ::

Role of AI in education



1. AI should be part of teacher education and training
2. AI will improve some aspects of teaching
3. AI will revolutionize education practice
4. AI will eventually make some teaching expendable
5. Some teachers will be replaced by AI in the foreseeable future
6. New AI developments make education, in general, more exciting
7. AI technology developments frighten me
8. AI technology will threaten teaching careers

Teacher Education Faculty Perspectives :: Importance of AI in Education



1. Ethics of AI
2. Enhancing personalized support
3. Allow teachers to assess student work
4. Allow teachers to gain expertise
5. Simulating as students for new teachers
6. Generate post-lesson reports
7. Real-time feedback and suggestions for teachers
8. Identify bored students during lesson

Thank you!
Questions?