



Transforming Learning and Education in the Era of AI

Cynthia Breazeal

Professor, Media Lab; Director Personal Robots

Director, MIT RAISE

Dean for Digital Learning

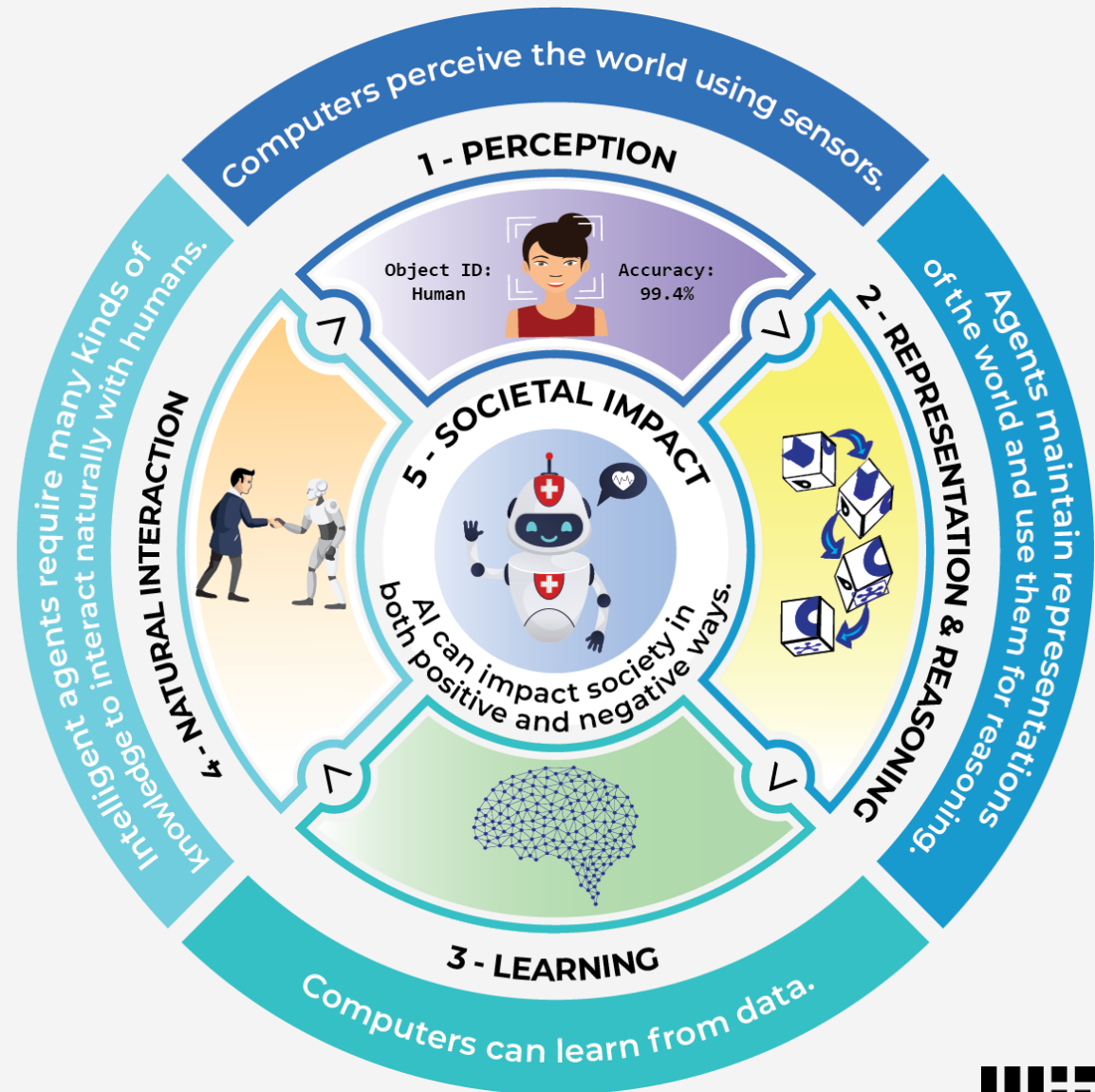


RAISE Initiative
Responsible AI for Social
Empowerment and Education

What is AI?

- Artificial Intelligence, refers to computer systems that can perform tasks typically requiring human intelligence.
- The field of AI aims to create machines and technologies that sort of mimic human cognitive abilities, such as perceiving, reasoning, learning, and interacting with people and the environment.
- Unlike traditional programming where you explicitly tell the computer what to do, AI enables machines to learn and make decisions without being directly programmed for every scenario.
- There are many algorithmic methods advanced in the field of AI. Machine learning, planning, reasoning, search, etc.
- The ethical design, responsible use, and societal implications of AI have become important areas of study and advancement, too.

AI4K12 5 Big Ideas of AI



Preparing kids for today & the future



AI could affect income and wealth inequality within countries with workers who can harness AI seeing an increase in their productivity and wages—and those who cannot falling behind. Younger workers may find it easier to exploit opportunities.

International Monetary Fund (2024)



There is a significant talent shortage in AI both domestically and globally.

81% of 1,200 executive and IT professionals surveyed think that they can use AI, but only 12% actually have the skills to do so. And 70% of workers likely need to upgrade their AI skills

Pluralsight AI Skills Report (2024)



While AI could likely take away 85 million jobs globally by 2025, it could also generate 97 million new jobs in fields ranging from big data and machine learning to information security and digital marketing.

World Economic Forum (2020)



Automating labor ultimately unlocks less value than augmenting it to create something new.

*The Turing Trap: The Promise & Peril of Human-Like AI
E. Brynjolfsson (2022)*



Up to 2/3 of kindergarten students will eventually work in jobs that do not exist due to scientific and technological advancement.

*Careers of the Future Report (2014)
UK Commission for Employment & Skills*

2024 Nobel Prize

2024 Nobel Prize in physics
awarded to John J. Hopfield,
Geoffrey E. Hinton for
discoveries that 'enable
machine learning with artificial
neural networks'



John J.
Hopfield



Geoffrey E.
Hinton

October 8, 2024 Source: Princeton.edu, Toronto.edu



FORBES > INNOVATION > AI

Nobel Prizes Show How AI Is Shaping History: 5 Reasons You Should Care

NEWS AND ANALYSES

A New Precedent—A.I. Gets the "American Nobel" Prize in Medicine

AlphaFold was the first A.I. to receive the Lasker Award since these began in 1945

ERIC TOPOL
OCT 01, 2023

AlphaFold—for predicting protein structures

2023 Albert Lasker Basic Medical Research Award



Demis Hassabis
Google DeepMind



John Jumper
Google DeepMind

Why K12 AI Literacy?

70% of teens have used at least one type of genAI tool

Common Sense Media (2025)

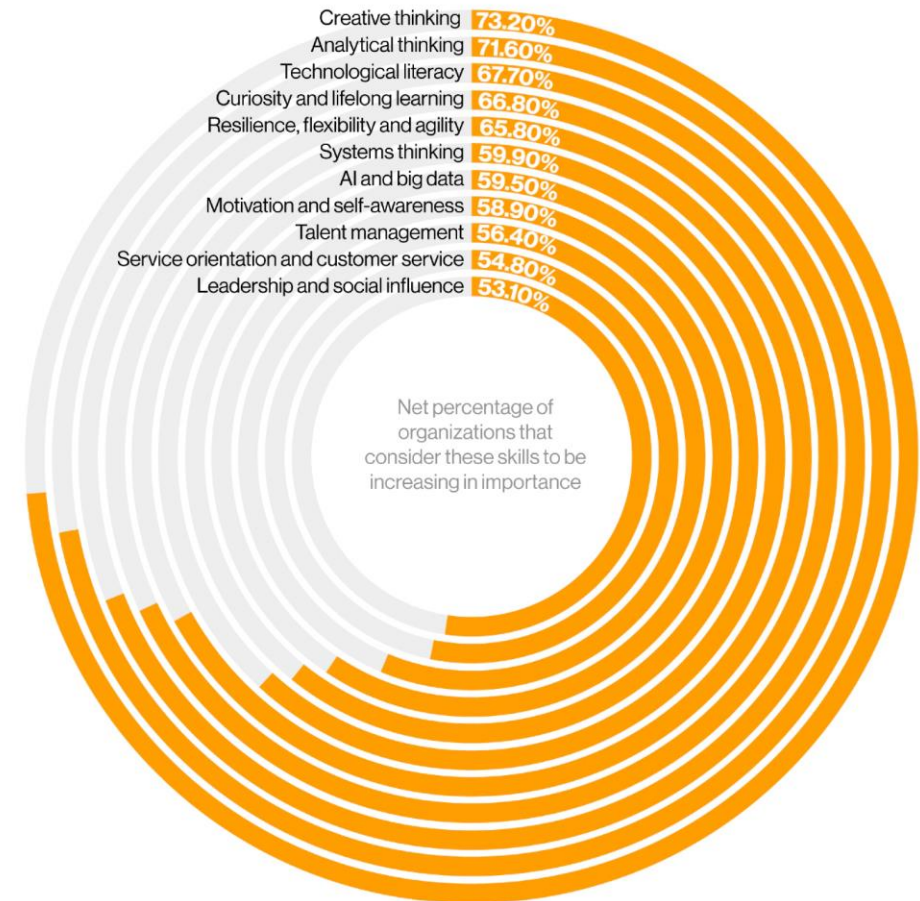


AI is transforming personal, civic, & professional life **starting in childhood**

Holistic preparation for success in the era of AI

- Creative & Analytical Thinking
- Curiosity & Lifelong Learning
- Resilience & Agility
- Self-Efficacy & Motivation
- Teamwork & Social Skills
- Ethical Judgement

AI effect on workforce skills



Source: World Economic Forum

Misuse and Consequence

The New York Times

We Teach A.I. Systems Everything, Including Our Biases

Researchers say computer systems are learning from lots and lots of digitized books and news articles that could bake old attitudes into new technology.

BUSINESS NEWS OCTOBER 9, 2018 / 11:12 PM / A YEAR AGO



Amazon scraps secret AI recruiting tool that showed bias against women



CLEARING THE PR POLLUTION THAT CLOUDS CLIMATE SCIENCE

YouTube's Video Suggestion Engine Boosted Climate Science Denial as World Warmed, Study Finds

The Guardian

'Disastrous' lack of diversity in AI industry perpetuates bias, study finds

Report says an overwhelmingly white and male field has reached 'a moment of reckoning' over discriminatory systems

Tech Policy / AI Ethics

MIT
Technology
Review

AI is sending people to jail —and getting it wrong

Using historical data to train risk assessment tools could mean that machines are copying the mistakes of the past.

Two US lawyers fined for submitting fake court citations from ChatGPT

Law firm also penalised after chatbot invented six legal cases that were then used in an aviation injury claim

SAG-AFTRA is worried about AI, but can it really replace actors? It already has.



RAISE Initiative

Responsible AI for Social Empowerment and Education

To advance equity in learning, education, and empowerment through AI

by rethinking and innovating how to holistically and equitably prepare diverse K-12 students and an inclusive workforce

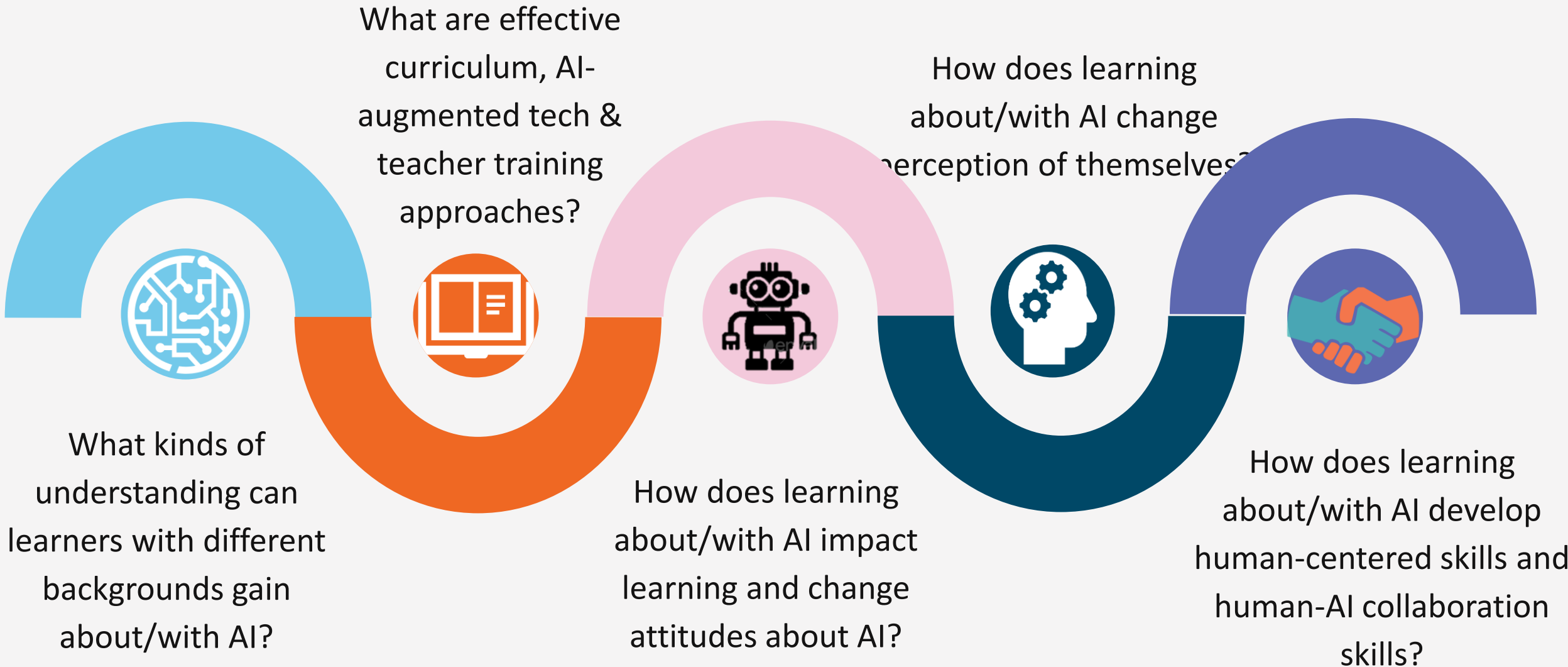
to be happy, engaged, and successful in an increasingly AI-powered society.



Open Learning



AI + Education Research Questions



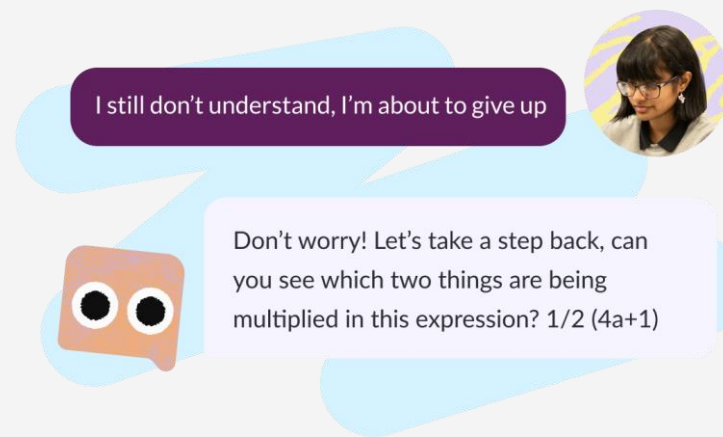


AI Supported Learning for Early Childhood

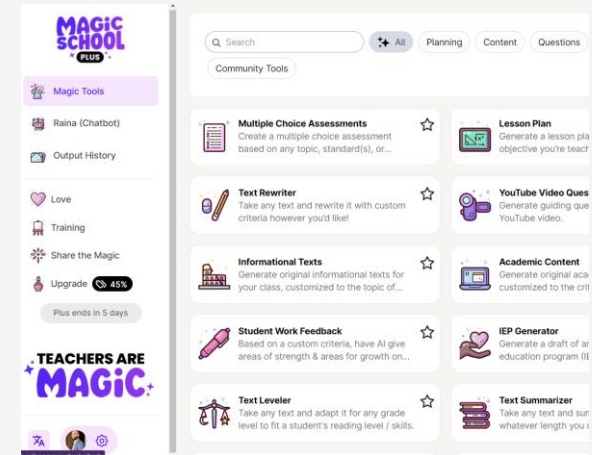
AI tools are proliferating in the classroom



Social robots that provide personalization



Chatbots that provide learning instruction and support



GenAI that supports educators in lesson planning

AI-Supported Learning

- AI-powered **learning companions** as a **playful practice partner** for early literacy and language skills. **Supplements, does not compete with teacher's role.**
- Augment and enrich how young children learn through **socio-emotional interaction with the robot & people**
- **Models Peer-like interactions** that socially includes teachers, parents & peers.
- **Adaptively personalizes** content and behavior through AI during real-time interaction to maximize engagement & learning

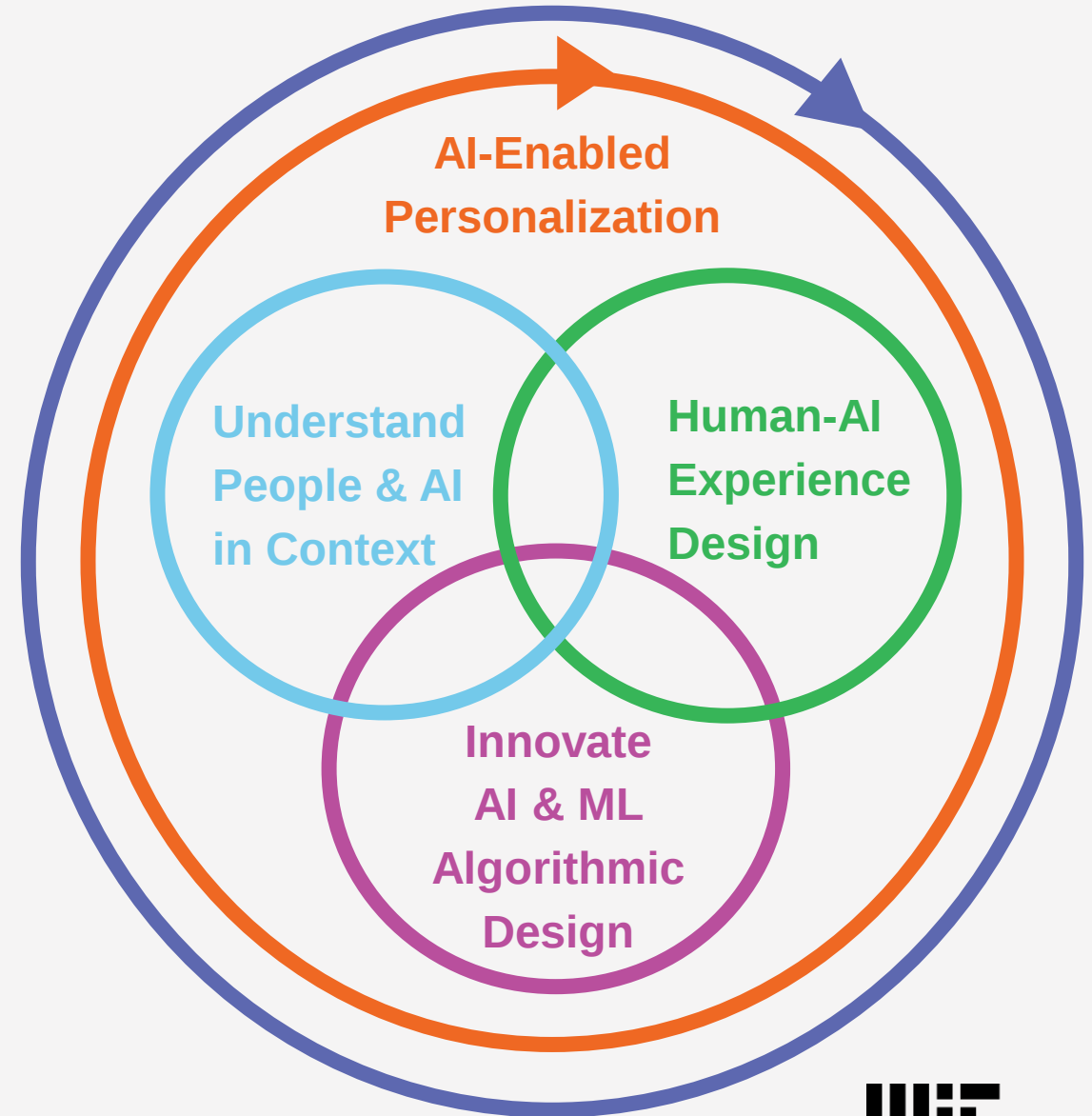


AI + Co-Design

With teachers, parents & children of at-risk schools (Boston, Atlanta)



Co-design with
Stakeholders in Context

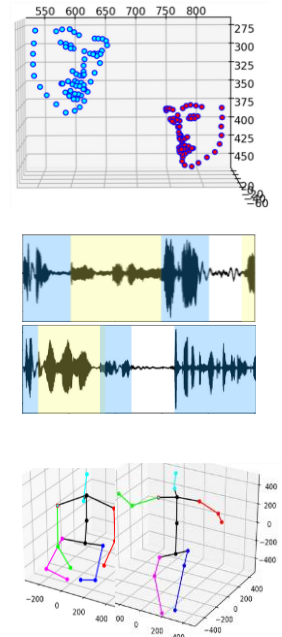


Personalized, Real-World Socially Situated Learning



Personalized, Playful Practice Partner

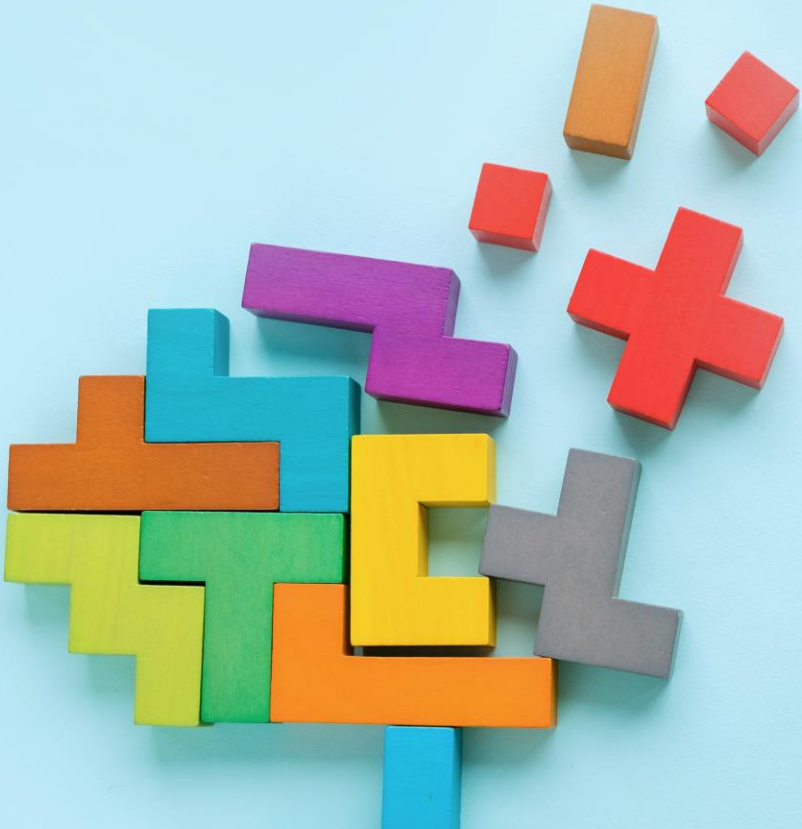
- Increased learning (skills, knowledge)
- Greater emotional engagement
- Social emulation: attitudes & mindsets
- Personalization + stronger relationship enhances outcomes



Social Catalyst for Child-Parent Storytime

- Increased parent-child conversational time
- Parents discuss/converse more with child
- Adaptation benefits higher-needs parents (e.g., ESL) the most

AI Literacy & Fluency

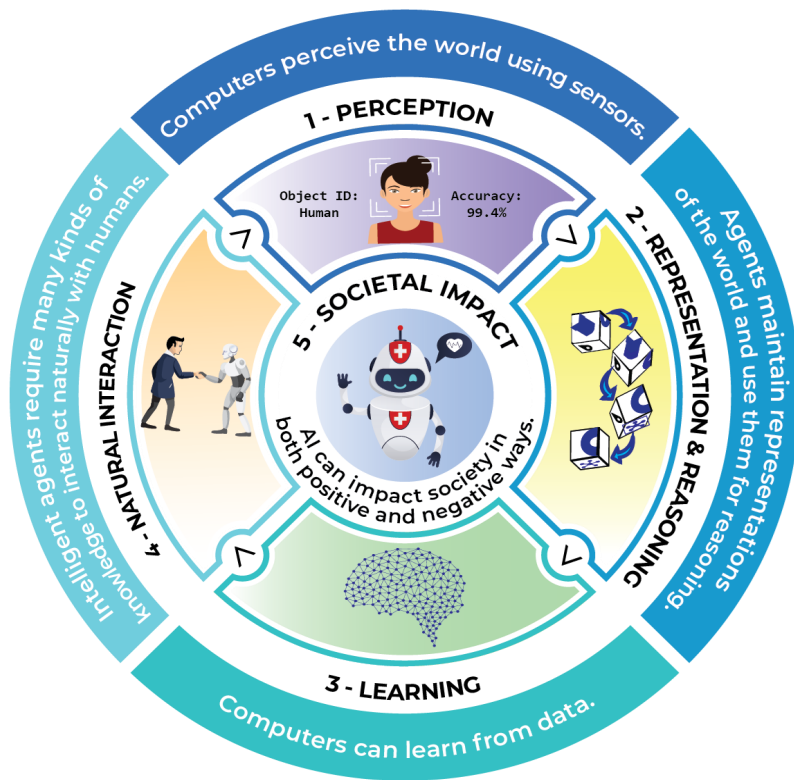


Students as co-creators and responsible citizens

Demystify AI: Understand how it works, and how to design responsibly

AI + Digital Citizenship: Responsible user & informed citizen

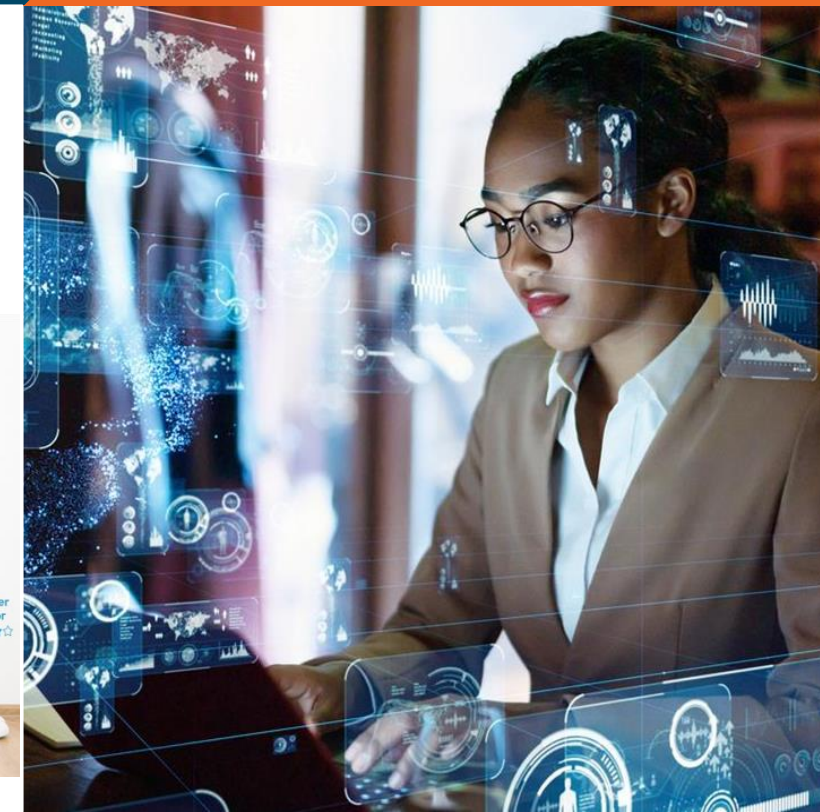
Self-Efficacy & Empowerment
Creative AI makers and solvers



Boston Bans Use Of Facial Recognition Technology. It's The 2nd-Largest City To Do So

Updated June 24, 2020

By [Ally Jarmanning](#)

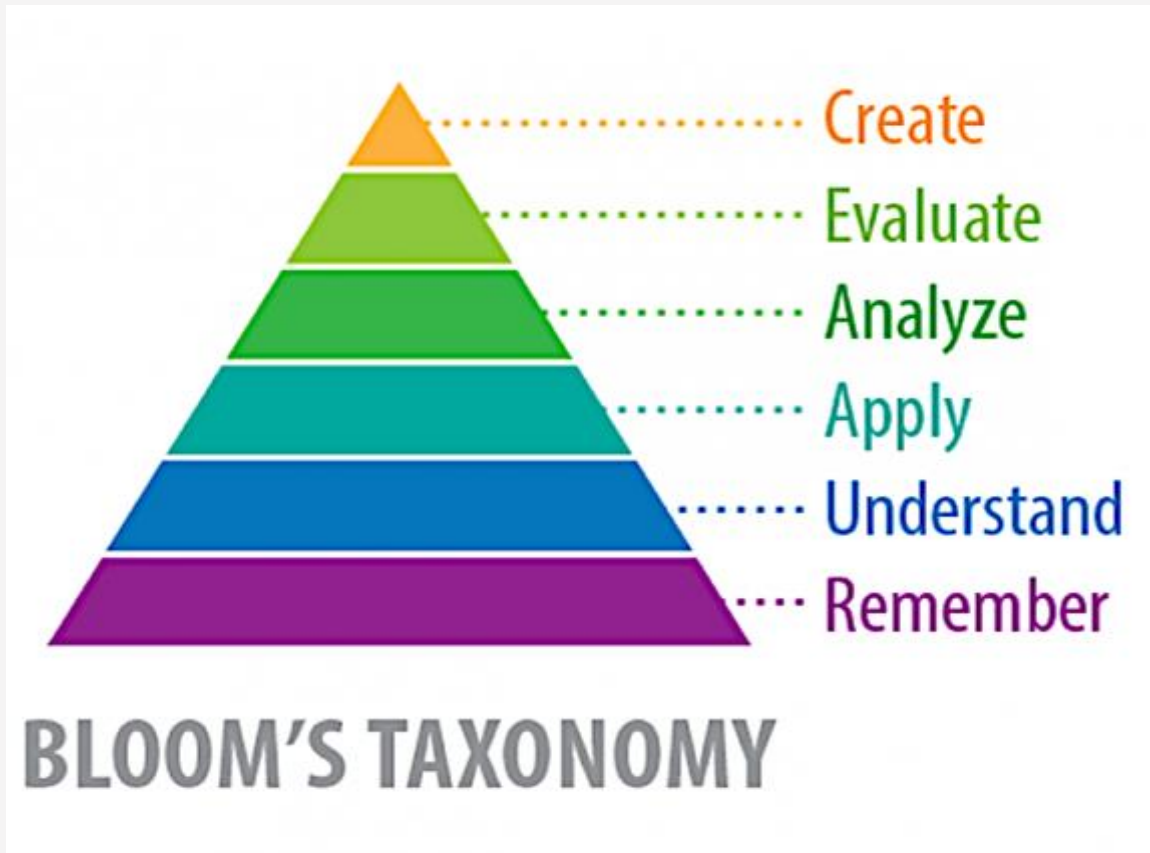


Foundational AI knowledge &
Critical Judgement of AI Solutions

Awareness of Citizenship
Responsibilities in the era of AI

Inclusive, Sustainable AI Design

AI Fluency Framework: 3 progression levels



3. Evaluate and Create AI

2. Use and Apply AI

1. Know and Understand AI

Our Pedagogical Philosophy



**Seymour Papert
(1928-2016)**

Constructionist Learning: Students draw their own conclusions through creative experimentation and making objects that others can see and use

Envision an educational system in which technology is ... something children themselves learn to manipulate, to extend, to apply to projects

... and to make the world a better place

Innovative Tools & Pedagogy: Learning by Making & Solving with AI

Computational Action

THE COMPUTATIONAL ACTION PROCESS

5. Planning and making a long-lasting impact

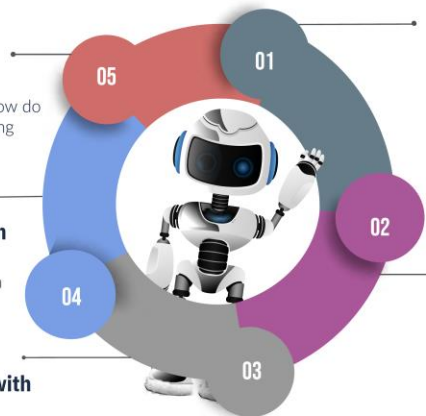
What do you want to put into the world? How do you get it into the hands of people? Validating your project in the world with users.

4. Teamwork, project management, and implementation

How do you keep on top of tasks and deadlines? Organize your project and team with the agile method.

3. Designing responsibly for and with users and communities

What are the key things you're creating? Design with users, wireframe, and rapidly prototype.



1. Defining a real-world problem

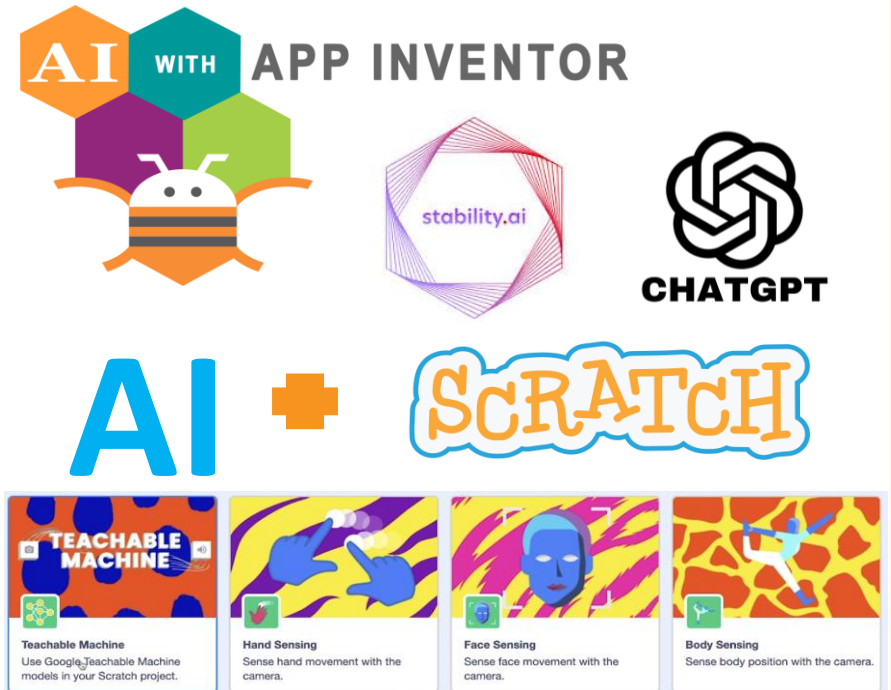
What is a problem you want to explore? Who are affected? What currently exists and what is needed? Brainstorm ideas and seek inspiration from community and your passions.

2. Understanding users and communities

What does a day in the life look like for the user? What are their issues and concerns? Conduct user research with surveys and interviews to understand and validate your ideas for solutions.

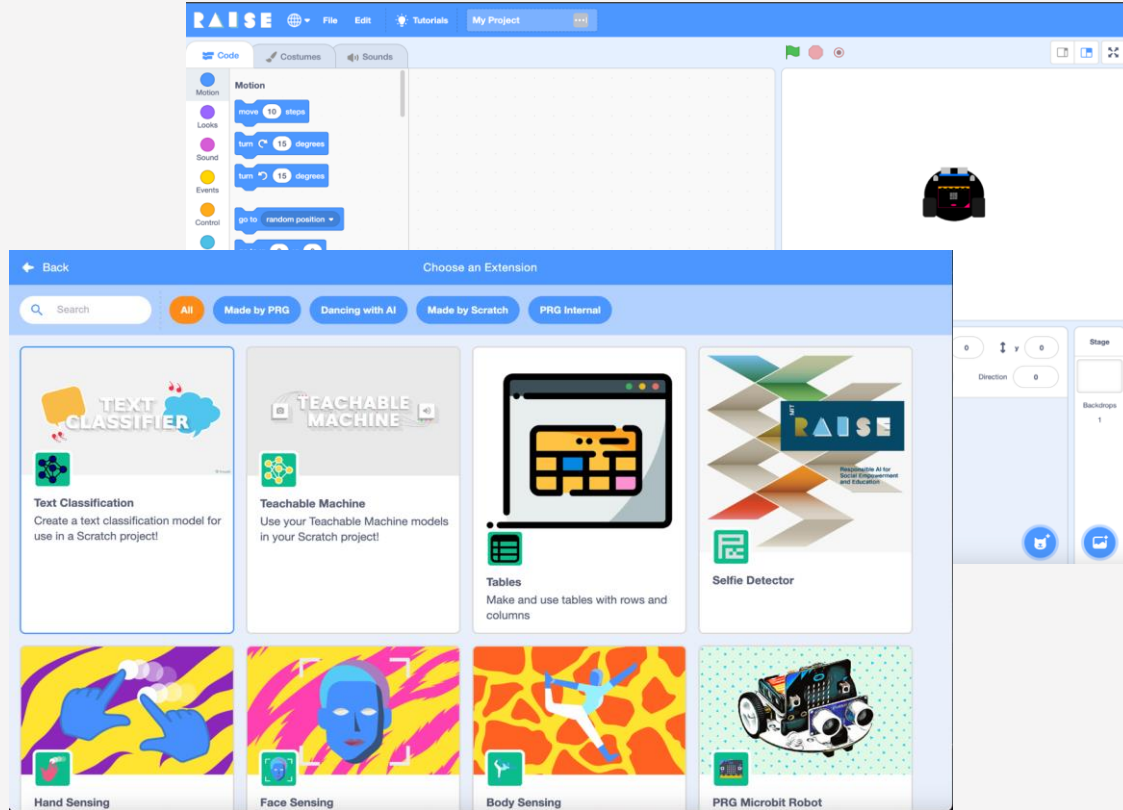


AI + Programming Toolkits



Computational action: Using the power of AI to make a meaningful societal impact.

RAISE Playground



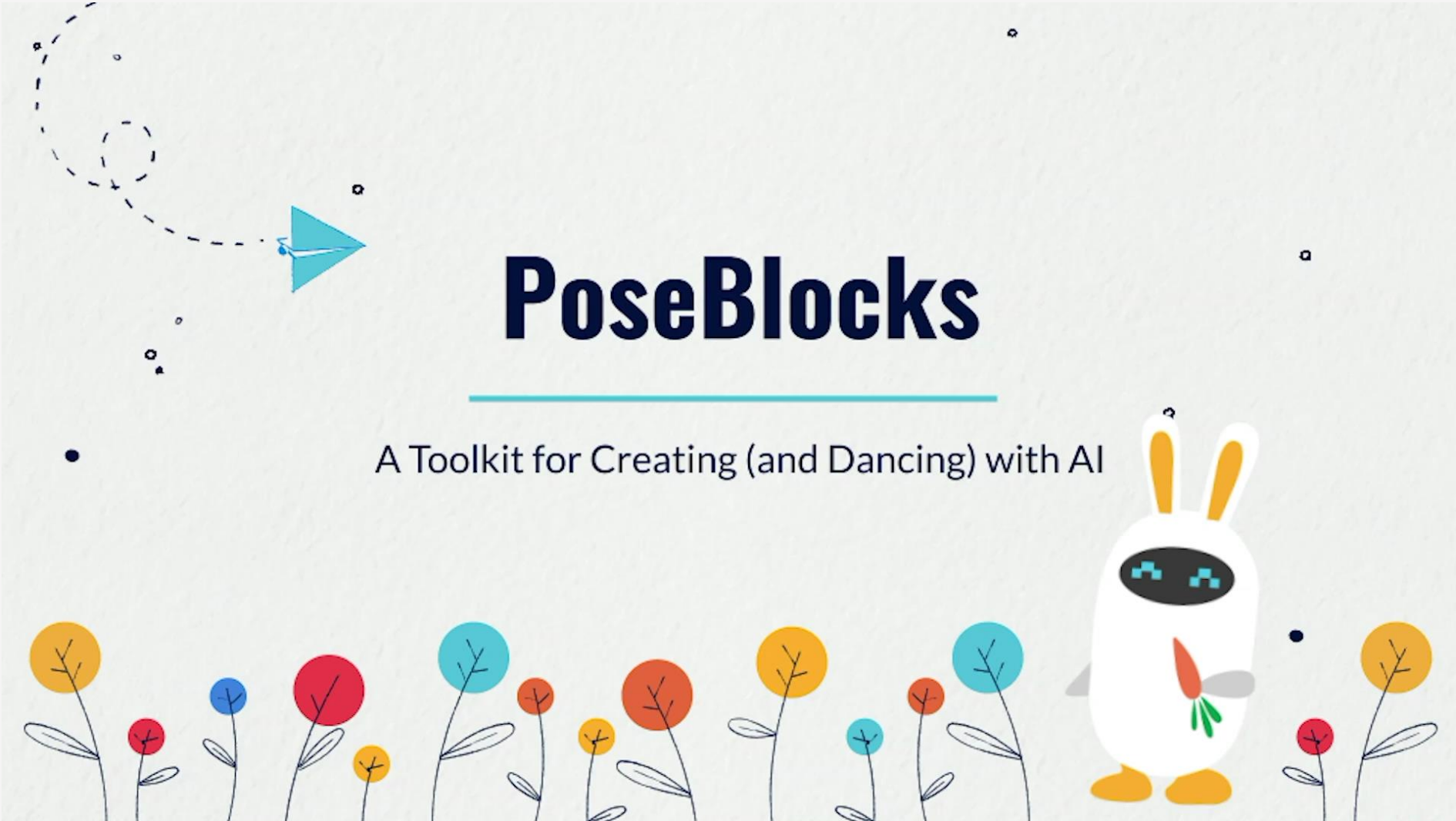
Scratch¹-based block programming environment that exposes students to machine learning models, robotics, and AI capabilities directly in the browser.

- Image classification
- Text classification
- Natural language processing
- Music generation
- Affective computing
- Gesture recognition
- Reinforcement learning
- Social robotics
- Microcontroller robotics
- ...and more!

playground.raise.mit.edu

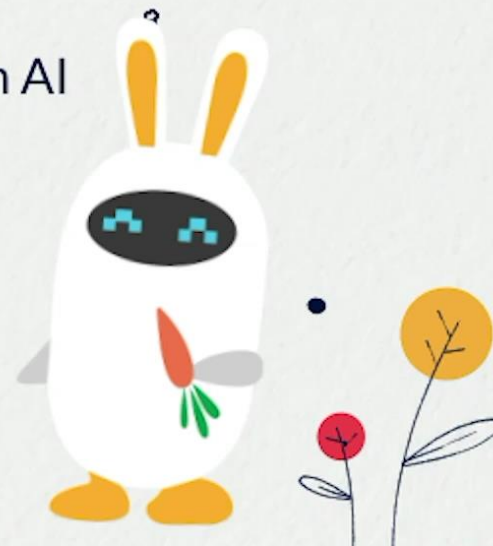
1 - The RAISE Playground is NOT affiliated with the Scratch Foundation





PoseBlocks

A Toolkit for Creating (and Dancing) with AI



“Show and Tell” Book Recommender

The screenshot displays a Scratch project titled "Show and Tell" Book Recommender, running in a web browser. The browser's address bar shows the URL `mitmedialab.github.io/prg-extension-boilerplate/video-source/`. The project is a "Teachable Machine" model, as indicated by the "Teachable Machine" tab in the Scratch interface. The code is written in Scratch blocks, featuring a "when model detects" trigger for different book categories. The code includes "say" blocks for recommendations and "switch costume" blocks to change the character's appearance. The browser window also shows a Zoom meeting window in the background, indicating the project is being demonstrated in a live session.

The Scratch project interface shows the following code blocks:

- when model detects Land of Stones**
 - switch costume to nano-c
 - say This book is part of a series! for 2 seconds
 - say You should really read this if you like mysteries and candy! for 3 seconds
 - say I give it a 5 out of 5! for 2 seconds
 - switch costume to nano-a
- when model detects Baby Sitters Club**
 - switch costume to nano-b
 - say This book is part of a series! for 2 seconds
 - say You should definitely read it if you like fairy tales and magic! for 3 seconds
 - say I give it a 3 out of 5! for 2 seconds
 - switch costume to nano-a

The Scratch project also includes a "Backpack" section with various blocks, including "say", "think", "switch costume", "switch backdrop", "change size", "set size", "change color", and "set color".

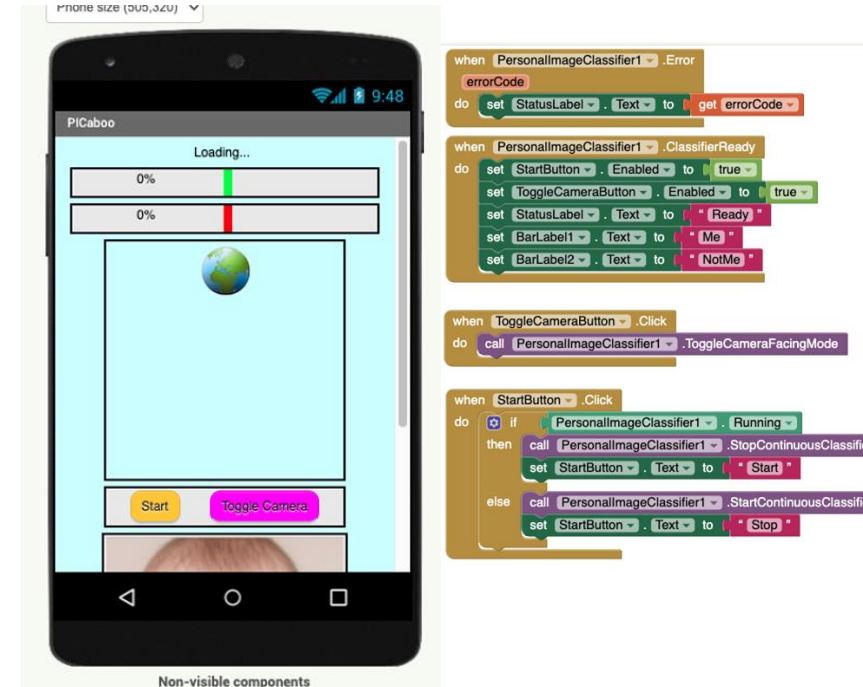
Kid Power & AI



empowering and preparing youth to make a positive difference with AI... right now!

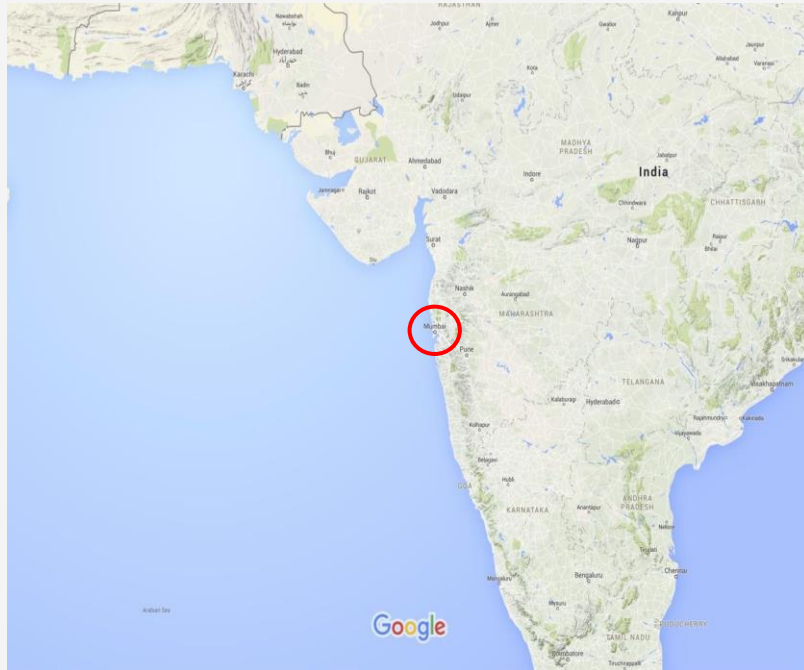
MIT App Inventor is one of the most widely used educational platforms

- **Free open-source** web platform that allows anyone to create mobile apps, the most accessible modality for under-resourced populations.
- Backed by **10+ years of research** from MIT and Google.
- 18 million users in 195 countries since launch in 2012
- 47% users in low-/middle-income countries in 19 languages
- 84.6 million projects created

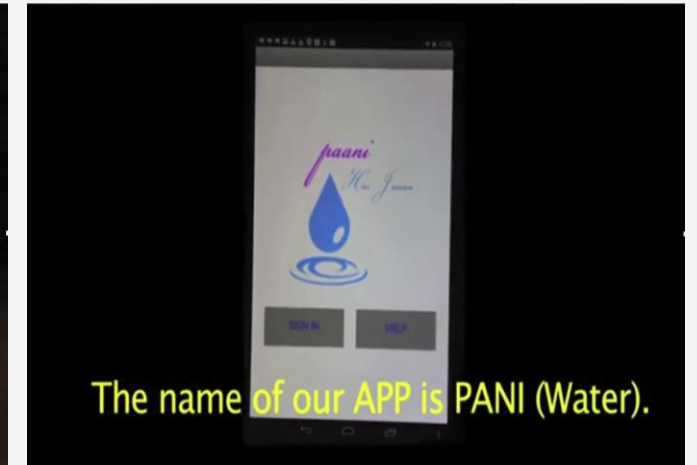
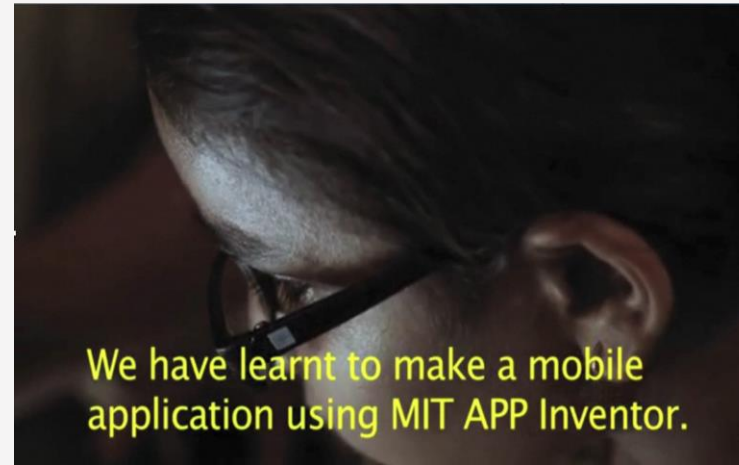


Anyone can create apps with global impact

Dharavi Girls created an app for one of India's largest slums



MIT App Inventor & Technovation



Even children in the poorest communities can create tools to improve life for people around them

Innovative K12 Curriculum, Pedagogy, & Tools

Hundreds of hours of innovative curriculum from Kindergarten to High School. Open and Free.

- Hands-on, Minds-on, Hearts-on creative learning and solving
- Age and grade appropriate learning and activities
- Student-relatable, multidisciplinary use cases. Spans a range of AI topics with up-to-date AI tools and technologies
- Responsible design and ethical use of AI in the classroom to support learning
- Assessments & aligned with learning standards. Both-And: learn AI literacy skills while using AI to learn academics.
- Teacher professional development for in-classroom instruction
- Research and Evaluation

Examples: Developed and under development. Used globally

- **Day of AI program.** Short format K—12 AI literacy
- **Interactive AI storybooks** for US grade 1-3
- **DAILY.** Full-semester project-based learning curriculum from US grade 5 – 12
- **MIT FutureMakers.** Summer 6-week technical and entrepreneurial intensives for high school

School-Aligned Curriculum Under Development

- Short-format, cross-subject, hands-on curriculum (Math, Science, Art, English, Social Studies, Computing) US grades 6—8
- Short-format AI curriculum for computing class US grades 3 – 12



Day of AI

all K-12

4—8 hrs for in-classroom learning on AI literacy, digital citizenship, and responsible AI design



Data Activism

high school

6-week intensive on data science & critical participatory action research



MIT FutureMakers

Middle, high, early undergrad

6-week technical AI & entrepreneurship summer intensive

1. Learn the Basics

AI is for everyone.

Empower students with the knowledge and skills to understand how they responsibly use and create with these technologies.



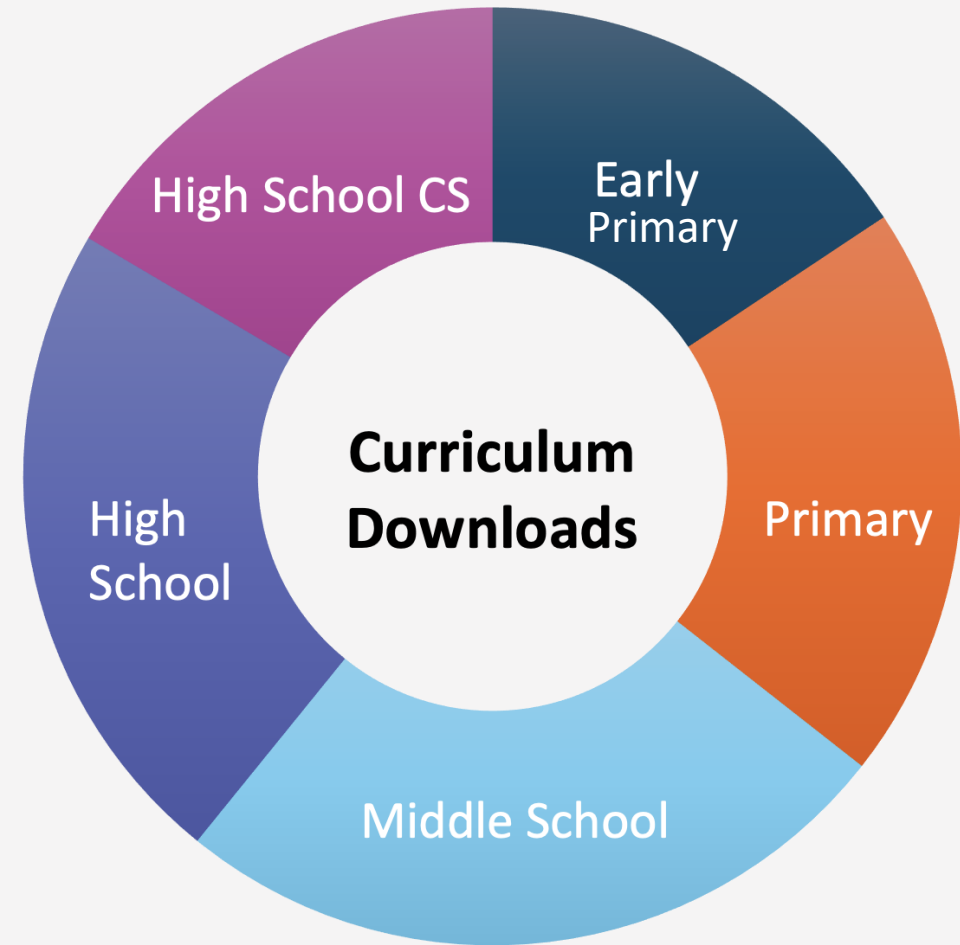
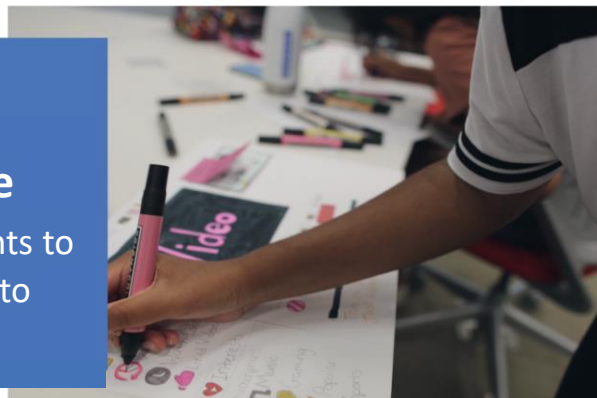
2. Identify the Benefits and Risks

AI should be designed responsibly. Give students the knowledge to make informed decisions about AI in their lives.



3. Design and Create

Kids will shape the future. Inspire students to use these technologies to create a better world.



■ Early ■ Primary ■ Middle ■ High ■ AP High

Example: Day of AI

- **All K-12 students & their teachers** (any subject or tech experience) for in-classroom learning
- **Short-format, multi-disciplinary** across student-relevant themes. Relevant to different **academic subjects**, too
- **Accessible** “plugged” and “unplugged” activities to for varying levels of tech readiness and coding experience
- **Free + Open** curricula & professional development, **Educators can adapt** to their students and educational context.

ChatGPT in School <i>What is ChatGPT? How should it be used (or not) in schools?</i> Chatbot • Creativity • Natural Language Processing 4 Lessons Total time: 3+ hours	AI + Arts (2025)	High School <i>Personal Image Classifier: PICaboo</i> Computer Science Track Grades 9-12
	Data Science & Climate (2024)	Machine Vision
K-2 What Can AI Do?  <i>What Can AI Do and Not Do?</i> robots • sensors • algorithms 4 Lessons Total time: 4 hours	AI and Policy <i>How might AI cause unwanted discrimination? Is AI ever safe?</i> privacy • advertising • transparency • human rights 7 Lessons Total Time: 5 hours	High School <i>Social Media and Misinformation</i> Grades 9-12
		Social Media
Game AI <i>How does AI learn to play games? How do machines learn new skills from experience?</i> reinforcement learning • rule-based programming • accountability 5 Lessons Total Time: 2+ hours Reinforcement learning	Intro to Voice AI  <i>How does voice artificial intelligence (like Alexa) work?</i> AI in popular culture • algorithms • natural language understanding • creativity 1 Lesson Total Time: 1-2 hours	Middle School <i>Can Machines Be Creative?</i> Grades 6-8
		Generative AI
Data Science and Decision Making <i>How can computers help us make decisions using data?</i> data analysis • data visualization • bias 10 lessons Total time: 7+ hours	Data in Action <i>What is data science? How can we use data for social change?</i> data science • data visualization • data activism 10 Lessons Total Time: 7+ hours	Upper Elementary <i>Teachable Machines</i> Grades 3-5
		Deep learning

UNESCO AI competency framework for students

Competency aspects	Progression levels		
	Understand	Apply	Create
• Human-centred mindset	• Human agency	• Human accountability	• Citizenship in the era of AI
• Ethics of AI	• Embodied ethics	• Safe and responsible use	• Ethics by design
• AI techniques and applications	• AI foundations	• Application skills	• Creating AI tools
• AI system design	• Problem scoping	• Architecture design	• Iteration and feedback loops

Day of AI Celebration Events in Boston, MA



Museum of Science, 2024
AI, Data Science and Climate



@Edward Kennedy Institute, 2023
AI Policy: AI and Human Rights



@Dearborn STEM Academy, 2023
ConvoAI with Amazon Future Engineer



MassEducation @MassEducation · May 13
Today, @MassLtGov and her fellow co-chair of the STEM Advisory Council Jeff Leiden participated in @MitRaise's #DayofAI event. The #STEM Advisory Council supports STEM initiatives and courses of study through programs like Innovation Pathways and #EarlyCollege.



WBUR CitySpace, 2022 (inaugural event)

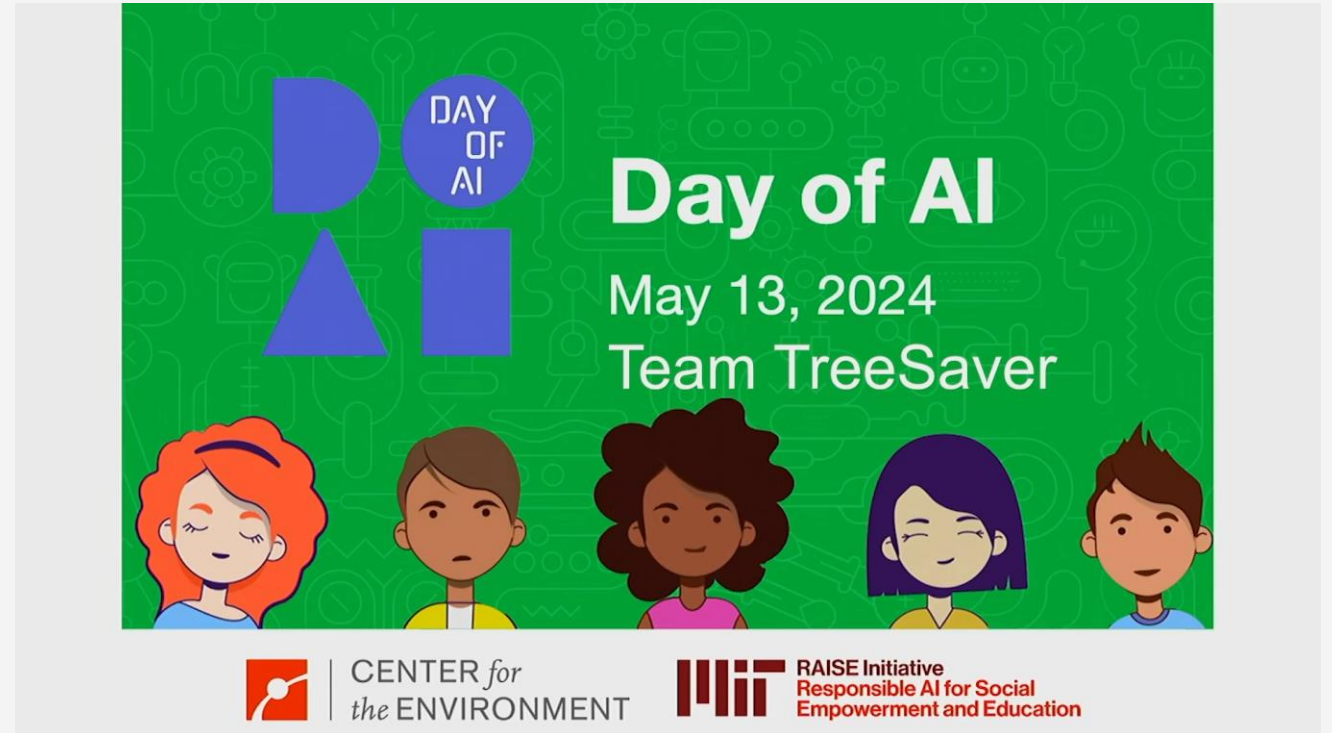
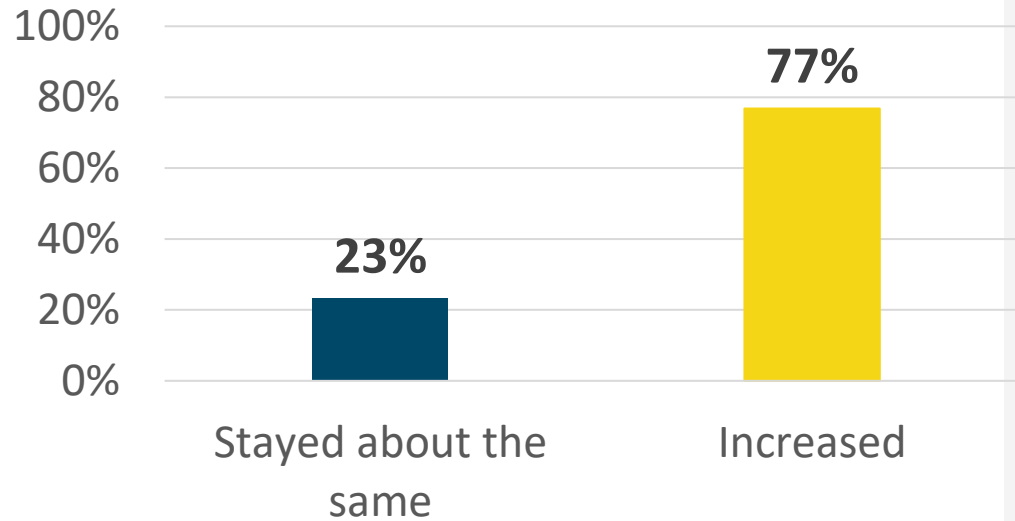


@MIT Media Lab, 2021 Launch event with MA Governor



Student Agency & Empowerment

Teachers' (n=151) report of change in student agency:
ability to contribute to the future of AI after learning
more about AI



What do kids solve with AI?



Just Society



Thriving Planet

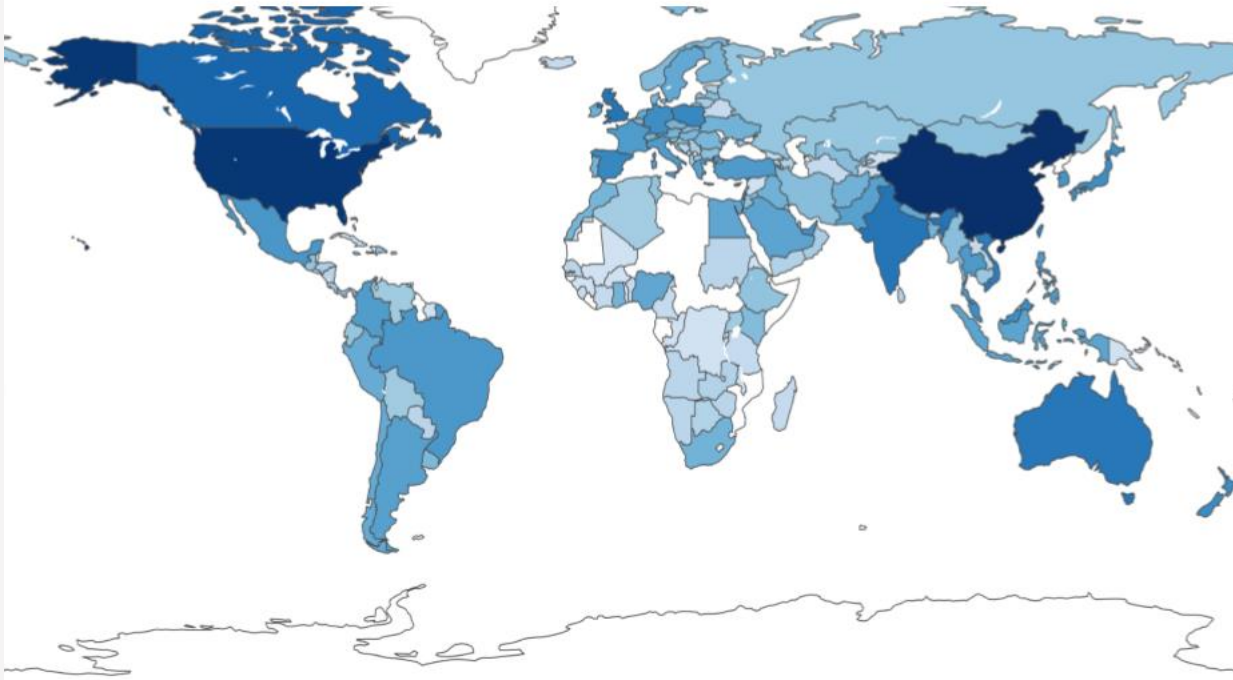


Flourishing People

Day of AI "Grassroots" Global Growth

Worldwide Map Showing Day of AI Online Curriculum Users

Our curriculum is used by teachers in 170+ countries
as of April 2025



Day of AI has brought AI literacy to

1M students

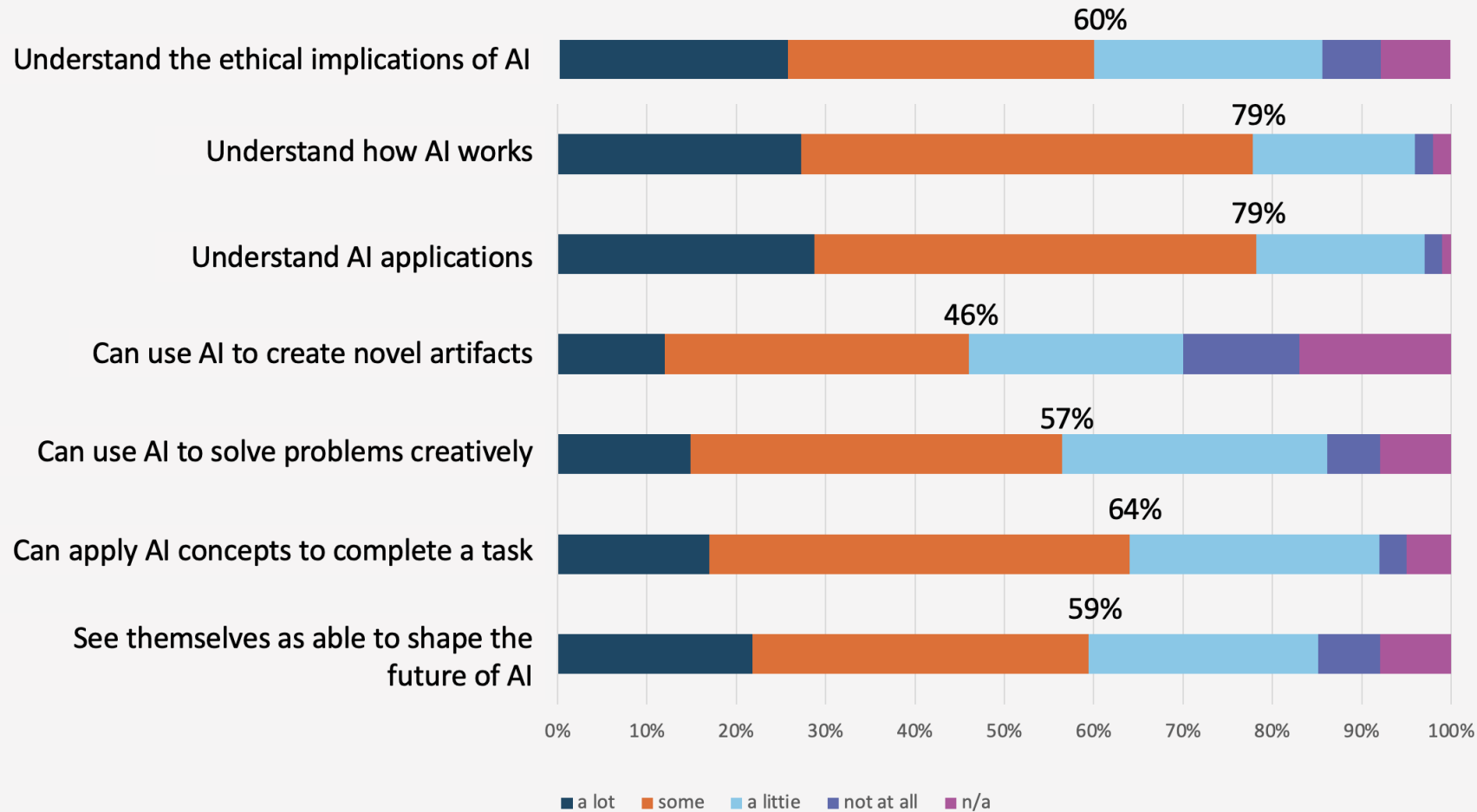
30K teachers

170 countries



- Open & Free materials
- Adaptation/ Localization/ Translation
- In-Classroom Implementation
- **Teacher Training + Train-the-trainer**
- **Research & Evaluation**

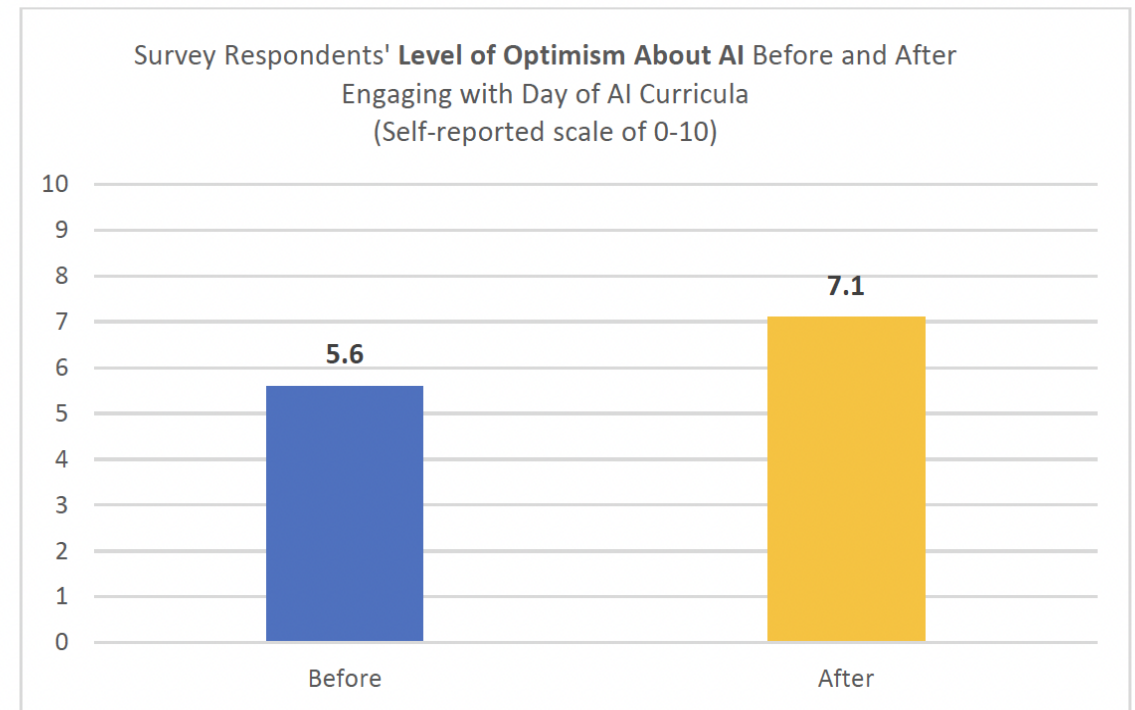
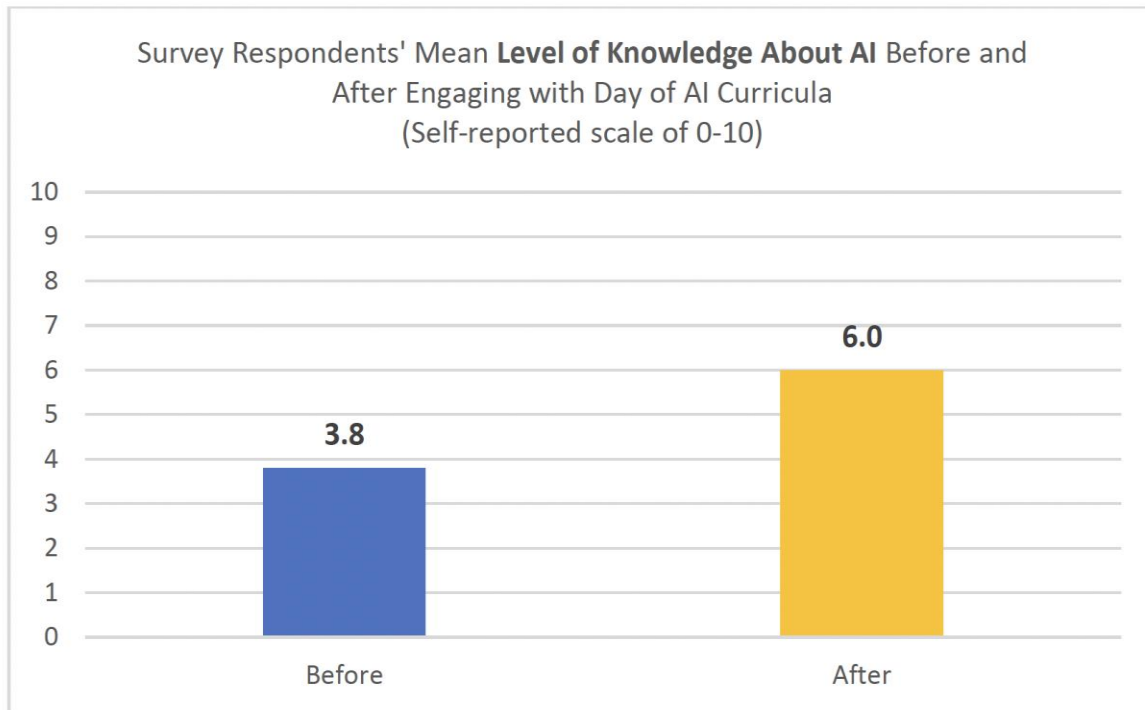
Students' Learning AI Fluency



Surveys & Interviews
190 teachers,
38 countries,
12K students,
K-12 Day of AI Curriculum In
Classrooms

Teachers Learning about AI

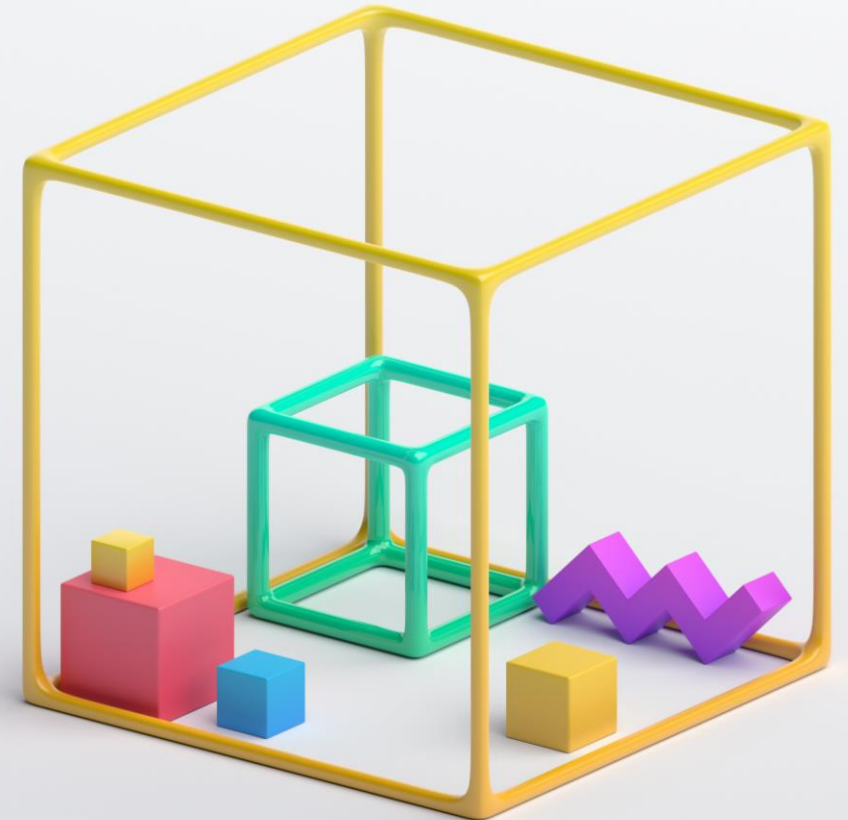
“I feel more optimistic about the spread of AI now that I know there is a concerted effort to teach our youth about how it works, the benefits and risks, and how it could be effectively and ethically used in the classroom.”



2025 Day of AI Projection

- **Educate 1.8M students**
- **Train 75,000 K12 teachers**
- **150 countries**

Day of AI expands outreach through grassroots, direct-to-user efforts, complemented by strategic, large-scale collaborations with ministries of education and education non-profits



PISA 2029

Core B Media & AI Literacy



What's Next: Cross-Grade, Short-Format Approach

AI and Citizenship in our AI-Powered Society (middle school)

MATH

Social Media: Data
Viz & Analysis
(Privacy)

5 lessons

Responsible AI
Fluency
Common Core

SCIENCE

How Brains and
Machines Learn,
Sensing +
Perception (Bias)

5 lessons

Responsible AI
Fluency
Common Core

ENGLISH

GenAI, Creative
Writing
(Responsible use
in school)

5 lessons

Responsible AI
Fluency
Common Core

ART

GenAI and Self
Expression, Self
Portraits
(DeepFakes,
Bias)

5 lessons

Responsible AI
Fluency
Common Core

SOCIAL STUDIES

AI, Human
Rights, & Society
(AI Policy)

5 lessons

Responsible AI
Fluency
Common Core

CS / TECH

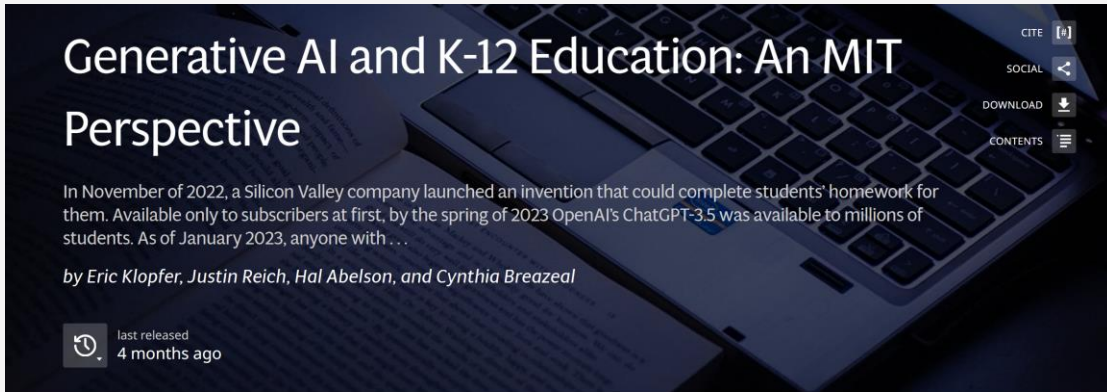
Computational
Action Project

12 lessons

Responsible AI
Design
Common Core

Capstone Project

Power of Sharing Free, Open Resources



Generative AI and K-12 Education: An MIT Perspective

In November of 2022, a Silicon Valley company launched an invention that could complete students' homework for them. Available only to subscribers at first, by the spring of 2023 OpenAI's ChatGPT-3.5 was available to millions of students. As of January 2023, anyone with ...

by Eric Klopfer, Justin Reich, Hal Abelson, and Cynthia Breazeal

last released 4 months ago

ABSTRACT

In November of 2022, a Silicon Valley company launched an invention that could complete students' homework for them. Available only to subscribers at first, by the spring of 2023 OpenAI's ChatGPT-3.5 was available to millions of



By 2022,
only
15 countries
had included AI
learning objectives
in their national
curricula



Free & Open
K12 Curriculum
& Professional
Development
dayofai.org

UNESCO AI Competency
Framework for Students

<https://unesdoc.unesco.org/ark:/48223/pf0000391105>

Power of Sharing Free, Open Resources

TOPICAL POLICY BRIEF

How Policy Can Help Ensure the Proper Use of AI in K-12 Education

MIT Responsible AI for Social Empowerment and Education (RAISE) Initiative

Daniella DiPaola
Andrés F. Salazar-Gómez
Hal Abelson
Eric Klopfer
David Goldston
Cynthia Breazeal



- Research on AI in K-12 Education
- Technical Standards and Auditing
- Procurement Assistance
- Educational Guidance
- AI Literacy

Power of Sharing Free, Open Resources

Grow with Google

Career Certificates ▾ AI Courses ▾ More Resources ▾ For Partners ▾ About ▾

Enroll now

Generative AI for Educators

Developed by AI experts at Google in collaboration with [MIT RAISE](#), this course will help you bring AI into your practice. You'll also gain a foundational understanding of AI — you'll learn what it is, the opportunities and limitations of this technology, and how to use it responsibly.

You'll learn how to use generative AI tools to:

- Save time on everyday tasks like drafting emails and other correspondence
- Personalize instruction for different learning styles and abilities
- Enhance lessons and activities in creative ways





Flexible AI training designed for teachers

This self-paced course fits into a teacher's busy schedule with flexibility in mind. It offers hands-on, practical experience for teachers across disciplines.

100%

2 hours

<https://grow.google/ai-for-educators/>

 MIT RAISE

Thank You

