CS 293/EDUC 473: Empowering Educators via Language Technology

Dora Demszky & Mei Tan

Stanford
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EDUCATION

Stanford
EduNLP Lab

Welcome to CS293 – first (and only?) course focused on the use of natural language processing to support teachers!

Your teaching team

Dora Demszky

Mei Tan

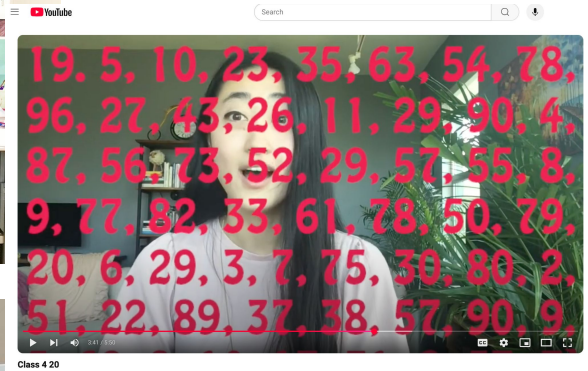
Dora's story

- Commitment to education
  - STEM mentorship
  - NGO in Hungary
- Linguist by training & at heart
  - Linguistics PhD
  - + NLP starting w/ computational linguistics olympiad (ILO) through Dan Jurafsky's lab to EDS!
- Now: lead the EduNLP lab

Stanford
EduNLP Lab

Mei’s story

- Edtech software developer @ MicrosoftEDU
- HS CS teacher
- MS in EDS (first cohort!)
- 3nd Year PhD Student in EDS
- Projects: classroom management, writing feedback
- Office hours in ANKO lobby:
  - Tues 10:30 AM (after class)
  - Thurs 2PM



Course overview

Website

http://web.stanford.edu/class/cs293

Ed Discussion

For all course related questions, sharing resources and asking for help with assignments.

https://edstem.org/us/courses/89796/discussion

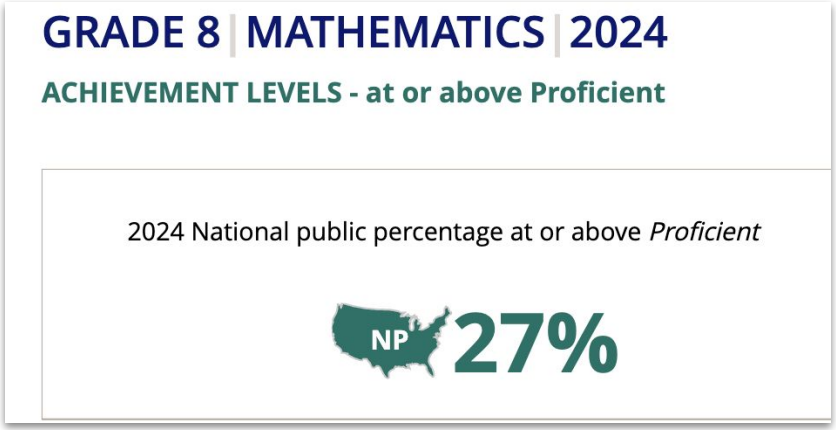
For private matters.

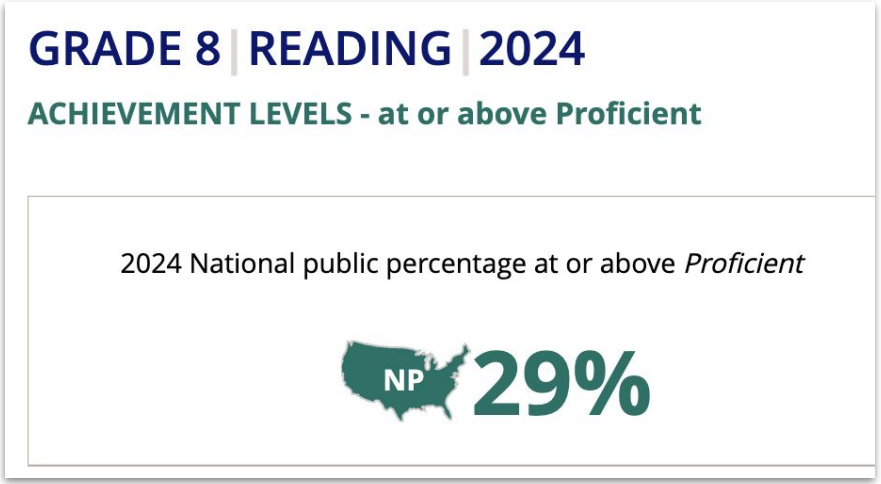
Teaching team emails: ddemszky@stanford.edu and mxtan@stanford.edu

Why now?

Urgent Educational Needs

Historic decline in reading and math proficiency (NAEP)





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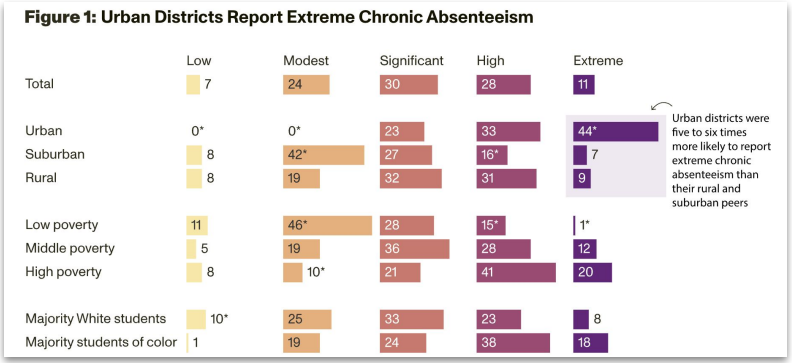
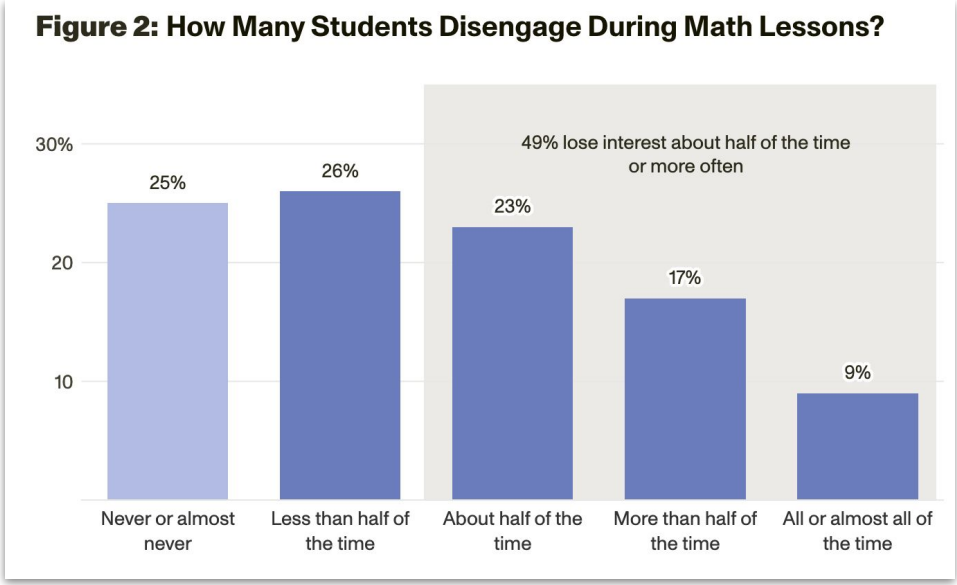
Chronic absenteeism, disengagement (RAND)





Why now?

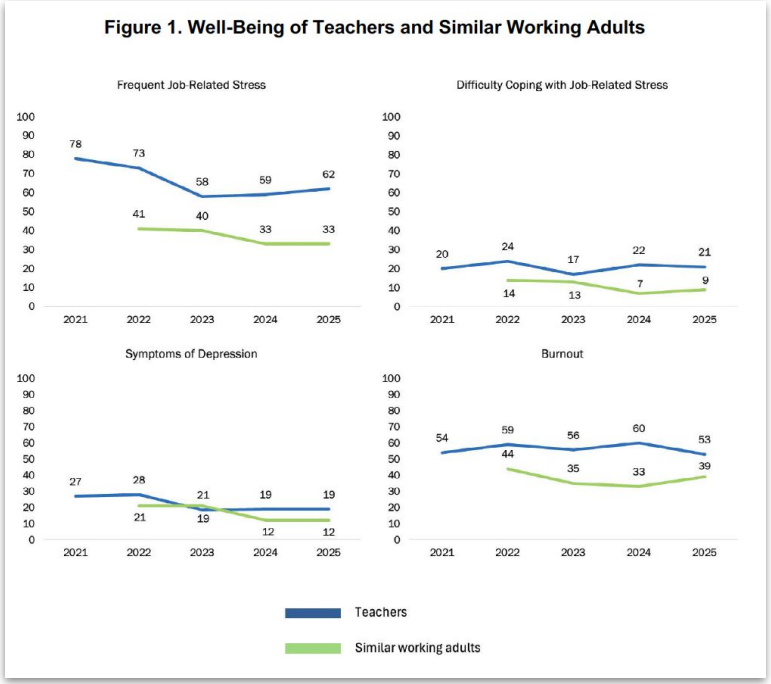
Urgent Educational Needs

Historic decline in reading and math proficiency (NAEP)

Chronic absenteeism, disengagement (RAND)

Teacher burnout, turnover (RAND)

> **"Teachers serve multiple roles other than being responsible for teaching curriculum. We are counselors, behavioral specialists, and parents for students who need us to fill those roles. We sacrifice a lot to give all of ourselves to the role as teacher." — Elementary School Teacher, Pew Research Center Survey**



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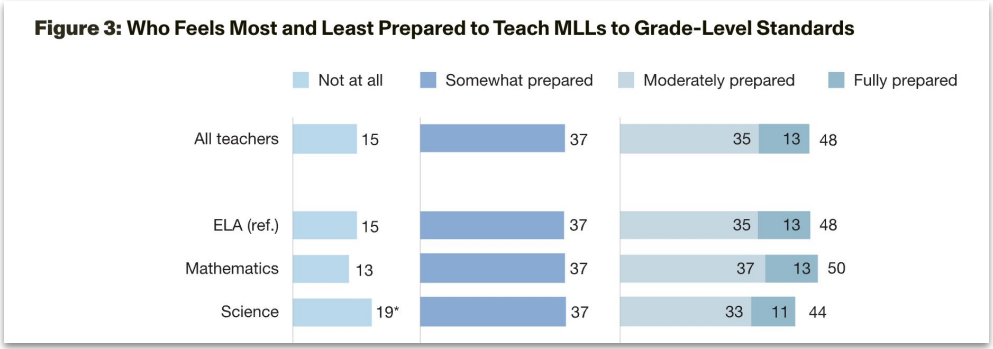
Teacher burnout, turnover (RAND), feeling unprepared to teach MLLs



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New Opportunity to Respond

Advancements in Generative AI

Uptake of AI in Education

Resources Poured into this Space

Lots of excitement LLMs in classrooms

The New York Times

How A.I. Can Revive a Love of Learning

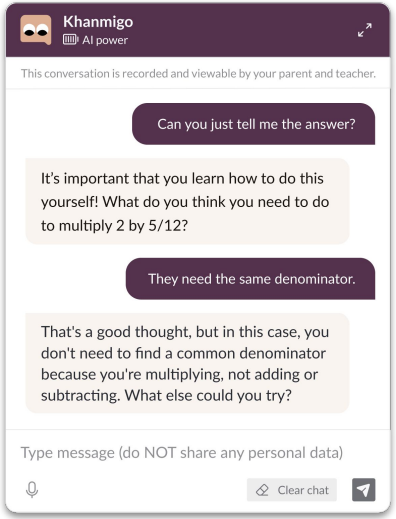
Modern technology offers new possibilities for transforming teaching.

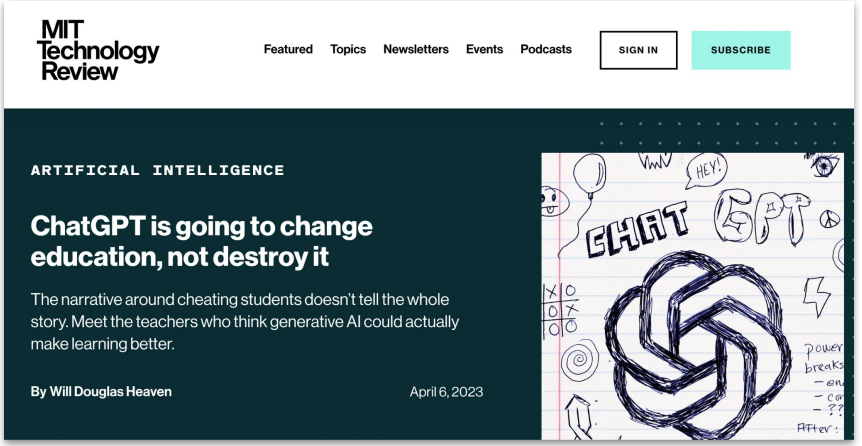
HAI Stanford University Human-Centered Artificial Intelligence

Education

AI Will Transform Teaching and Learning. Let's Get it Right.

Mar 9, 2023





Frontier labs have just introduced new education products

BREAKING: Google introduces Guided Learning

Some thoughts on what could make Google's AI tutor stand out

CLAIRE ZAU
AUG 6

OpenAI

July 29, 2025 Product

Introducing study mode

A new way to learn in ChatGPT that offers step by step guidance instead of quick answers.

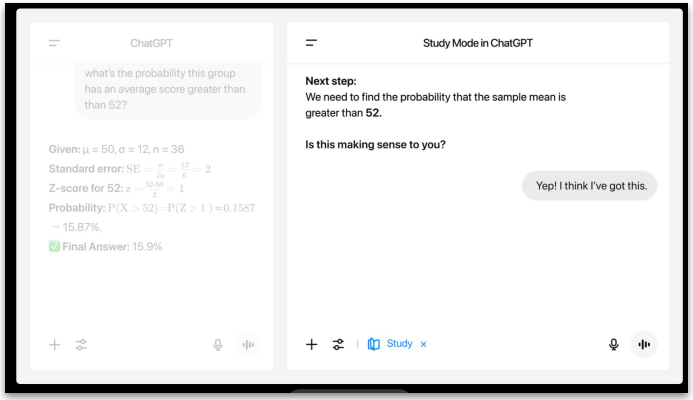
Try in ChatGPT ↗

Education

Introducing Claude for Education

Apr 2, 2025 • 5 min read

Claude for Education



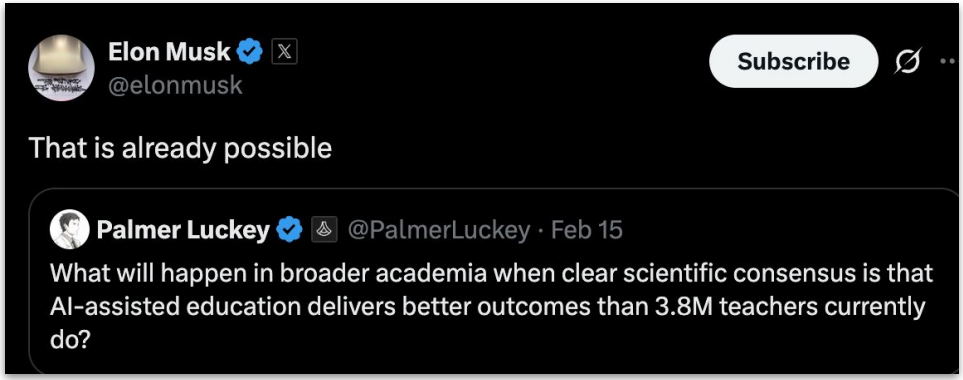
Some think AI is better than teachers

TECH· AI

Duolingo CEO says AI is a better teacher than humans—but schools will still exist 'because you still need childcare'

BY IRINA IVANOVA
DEPUTY US NEWS EDITOR

May 20, 2025 at 5:13 AM EDT



Elon Musk @elonmusk

Subscribe

That is already possible

Palmer Luckey @PalmerLuckey · Feb 15

What will happen in broader academia when clear scientific consensus is that AI-assisted education delivers better outcomes than 3.8M teachers currently do?

Better than teachers **in what?** And where's the evidence?

Let’s look at some examples…

Claude
Education

Chat 1

(Gemini **Guided Learning**):
https://gemini.google.com/share/9429f7c432e0

- Does not build common ground

Chat 2

(Claude **Education**):
https://tinyurl.com/yckdc3w9

- Wall of text; way too many questions

Many teachers are worried

Teachers: "These AI Resources Are Not Classroom-Ready."

The "80-20 rule" is more accurately a "20-80 rule."

DAN MEYER
OCT 30, 2024

35 18 4 Share

In my recent article about AI's "delivery problem," I claimed that AI-generated resources like lesson plans, assessments, and presentations, leave significant work to teachers, not just to customize them to their local context, but to make them even minimally viable for classroom use.

Hallucinations → unreliability
Lack of "scaffolding" → cognitive offloading

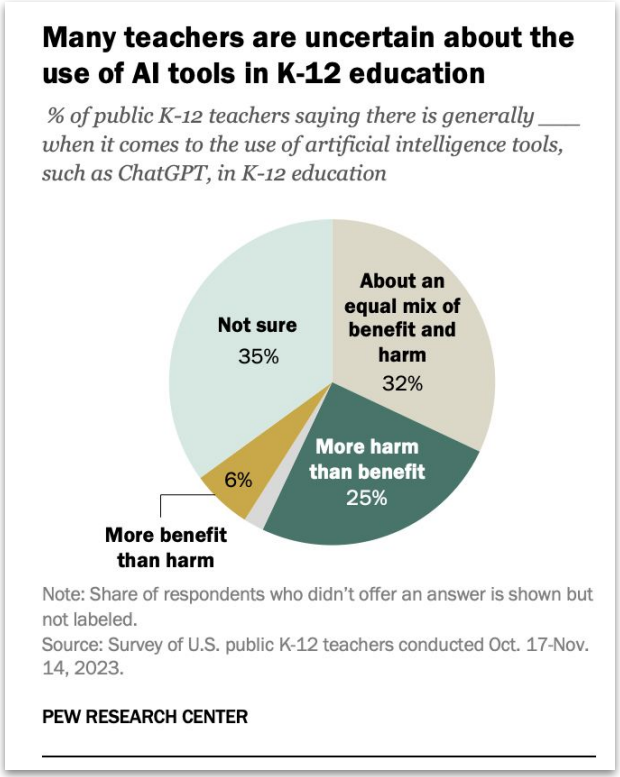
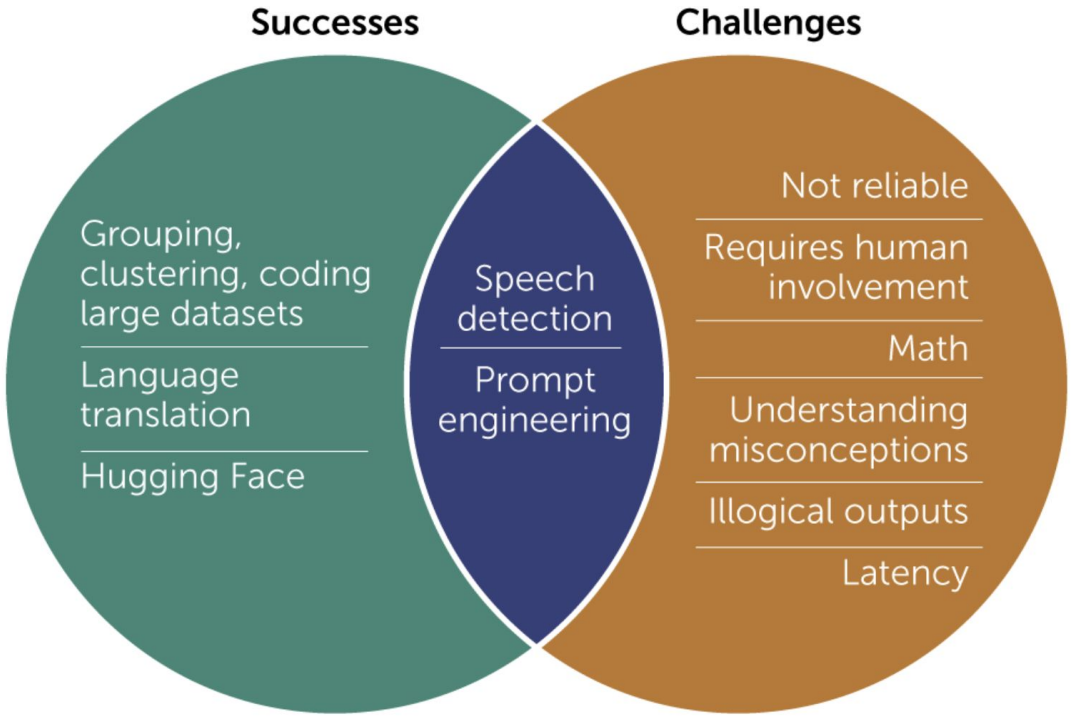


Figure 2. Overview of the successful and challenging tasks for AI during this project.



Report from Digital Promise (28 AI pilot projects)

Our vision: Empowering, not replacing teachers

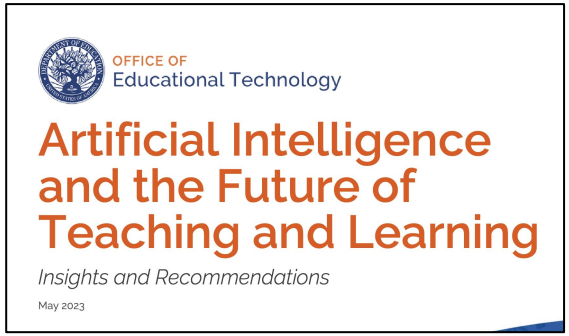
- focus on learning process (rather than product)
- building student agency, persistence, positive relationships

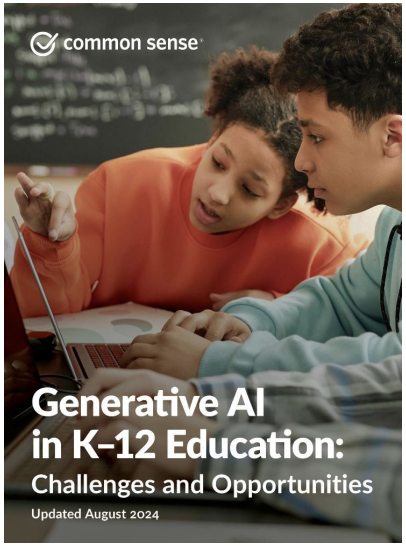
Visions from the field (May 2023 Forum)

1. Speed or deepen student learning
2. Automate routine (and complex) classroom tasks
3. Improve instructional quality
4. Inform educational theory

Source: Whitepaper from Stanford 2023 Forum

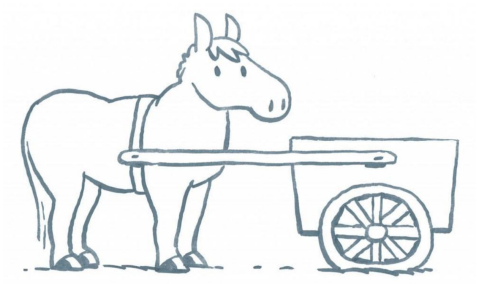
Check out some of the recent AI Education reports!



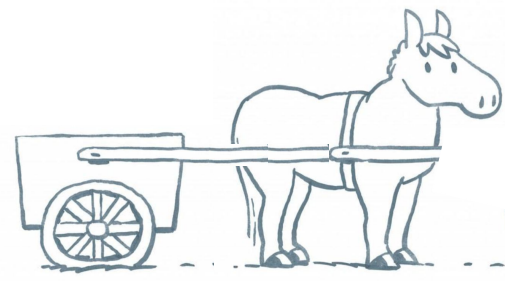


linked from week 1 of the syllabus!

Our metaphor

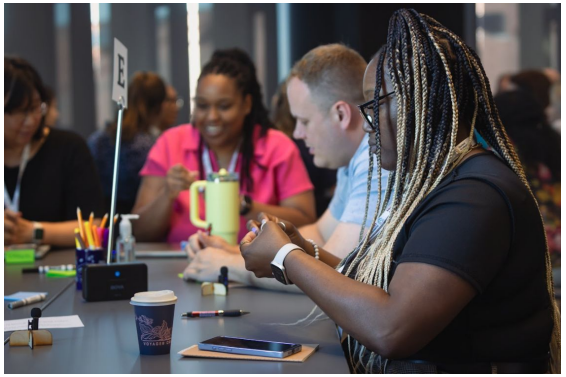


Often, **educators are given tools** that have been developed and give feedback post hoc



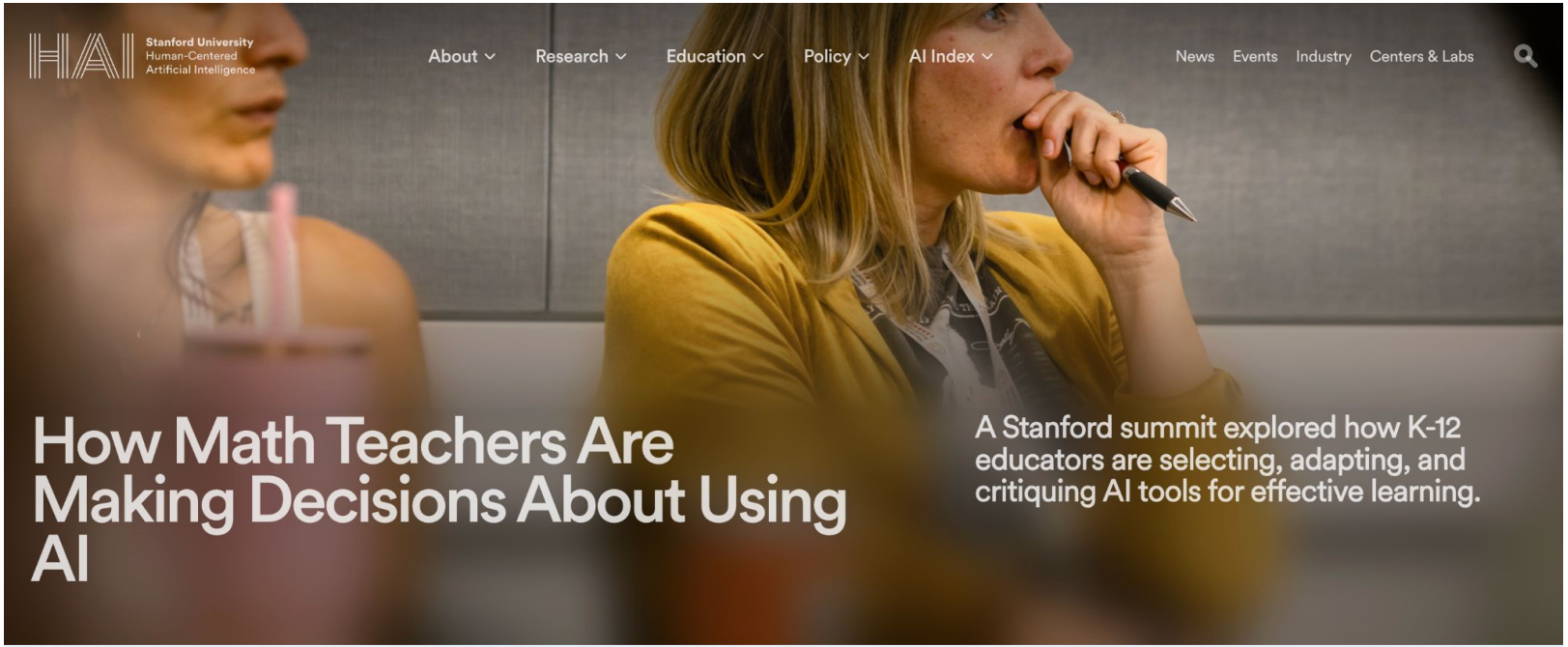
We want to provide **educators with a platform to create the vision and direction** for ed tech research and development (R&D)

Practitioner Voices Summit (Stanford, 2025 June)



From 22 states; all grade levels of Math; varied experience with and attitudes towards AI

Check out the HAI blog post on what we learned!



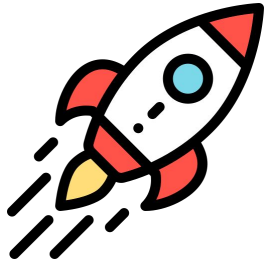
This class

Identify Problem

Data Exploration

Algorithm Development & Validation

Tool Development



Deployment

Weeks 1-2 | Week 2-4 | Week 3-6 | Week 6-7 | Week 8-9

Overarching Themes:

Bias & Fairness

Working closely with teachers

Exciting guests!

Dan Meyer,
Amplify/Desmos

Rakiya Brown,
TeachFX

Brian Veprek
Google Learn LM Team

Jennifer Meyer,
University of Vienna

Rene Kizilcec, Cornell

Julie Cohen, UVA

Riz Malik, Coteach.ai

Applied Learning Goals

By the end of the course, you will be able to

1. Identify relevant, impactful areas of intervention
2. Analyze text, and their relationship to other forms of data, with quantitative methods
3. Take steps towards developing a solution (algorithm / app) that leverages NLP to empower educators
4. Communicate your solution to practitioners and academics

Research Learning Goals

By the end of the course, you will be able to

1. Read and understand research papers on the topic
2. Present concise and informative summaries of research
3. Execute computational social science research

Prerequisites

- Coding expertise
- Experience with NLP (CS 124 at the minimum)
- Passion for helping teachers
- Readiness to participate!

This is *not* an introductory Python / NLP class

- The goal of the course is to **apply NLP** to make a difference for teachers
- We will *not* be able to provide low-level technical support for coding in Python
- We will be able to provide pointers to libraries and toolkits, and self-learning materials for basic NLP tools (e.g. Dan Jurafsky's textbook), but we will not have the time to go over these methods in the weeds

Class setup

1. Reading quiz (5 mins) - begins at 9am sharp
2. Lecture (~20 mins)
3. Q&A / group work (~20 mins)
4. Student-led discussion of a paper (~40 mins)

Unit Policy

- 3-4 units: same requirements
- 2 units: being a discussant is optional

Grading

- Class participation (5%)
- Reading Discussant (10%)
- Reading Quizzes (10%)
- Project-Related Assignments (50%)
- Final Write-up (10%)
- Final Presentation (10%)
- Peer Review Quality (5%)

Office hours

See website for up-to-date information.

https://web.stanford.edu/class/cs293/

Assignments

- Group Project 1-3 people per group (we encourage groups of 3!)
- Choice among four datasets (details on website & in next class)
- Please discuss your project idea with instructor/TA early in the course
- Components:
  - A0: Form teams, recruit teacher buddy, peruse data
  - A1: Identify dataset, scope problem, prepare data
  - A2 and A3: Two tracks
    - Track 1: Validate existing measure, develop tool
    - Track 2: Develop and validate new measure

Teacher buddy – see details in A0

- Recruit an educator from the context represented in your chosen dataset (e.g. secondary ELA, middle school math)
    - Someone who's willing to collaborate with you (over 2-3 total hours throughout the quarter)
    - We can offer a $100 gift card as compensation (one per project team)
- Sample outreach language included in A0
- Come to us if seriously stuck!

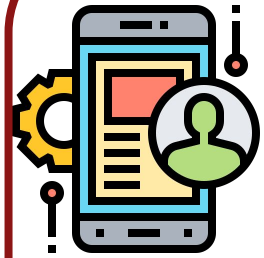
Project = Demonstrate you know what it takes to:

For Track 1 only

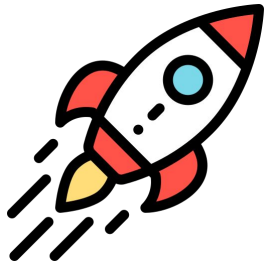
Identify Problem

Data Exploration

Algorithm Development & Validation



Tool Development



Deployment

Overarching Themes:

Bias & Fairness

Working closely with teachers

Where to find inspiration?

- Talk to Dora & Mei
- Read the AI Ed reports/whitepapers linked in week 1 on the website
- Check out Future work & Limitations sections in relevant papers
- Talk to each other
- Talk to teachers

Reading Quizzes (10%)

- Short quiz (2-3 questions) on Canvas that mean to ensure everyone arrives ready to discuss the readings
- Focused on required readings only
- Not meant to trick you
- 5 mins, will start at **9am sharp**
- Will drop 3 lowest scores, including absences/late arrivals

Although you won’t be quizzed on optional readings, we **highly encourage you to read them.**

Reading Discussants (10%)

- Once a quarter (sign up link here)
- Work in groups of 2
- In class (~40-45 mins, depending on available time)
  a. Summarize the reading in no more than 3 minutes
  b. Share one or more questions or comments based on the reading that can serve as a launching point for discussion.
  c. Facilitate an **interactive** class discussion
- See rubric on course website

Final presentation (10%)

- 12 mins talk, 3 mins Q&A
- **Content**: problem & use case; data; what you built/measured; validation/evaluation; error analysis; educator input (what changed based on practitioner feedback); and ethics/limitations
    - avoid too much jargon
- **Broad** audience; imagine you were giving this presentation at the Stanford AI Ed summit (for practitioners, developers, funders, researchers)

Final write-up (10%)

- Structured like an NLP/computational social science conference paper
- Use template provided on course site

Potential outlets for your final paper!

Venue	Deadline
ACL BEA workshop	March 5, 2026
Learning at Scale	Feb 16, 2026 for full papers, including works in progress
AIED	Feb 2, 2026
Education Data Mining	Feb 9, 2026
LAK	Sometime in Sep/Oct, 2026

Class participation (5%)

- Productive contributions to classroom discussions
- Productive contribution to the success of the project
- Completion of brief tasks (e.g. getting to know you survey)

Peer feedback (5%)

- For assignments 1-3
- Not based on “correctness”
- Good feedback:
  - specific
  - evidence-based
  - actionable
  - respectful
- Include at least two strengths and two high-impact suggestions

Diversity & Inclusion

This course will be challenging and we all need to feel safe and included if we are to embrace that challenge. As such, it is essential that we create a positive learning environment where diverse perspectives are recognized and valued as a source of strength. I ask that you join me and your fellow students in creating a classroom culture based on open communication, mutual respect, and inclusion. Disagreements and debates are fine and can often be constructive and enlightening. But I ask that you focus on the arguments, not the person, and that you seek to understand, not characterize.

Credit: David Yeager

AI Policy

- Feel free to use to brainstorm ideas, debug code, explain a concept
- Be aware of limitations & inaccuracies
- Assignments should represent your own work. Any use of AI should be **cited** as any other source, in accordance with Stanford's Honor Code

Let’s get to know each other!

Please limit to 3 sentences per person! (~20-30 seconds)

1. Who you are
2. One thing that *excites* you about language technology/natural language processing (NLP) in classrooms
3. One thing that *troubles* you about NLP in classrooms

Please read the required readings by **this Thursday** as the class discussion will heavily build on them.

- Nguyen, D., Liakata, M., DeDeo, S., Eisenstein, J., Mimno, D., Tromble, R., & Winters, J. (2020). How We Do Things With Words: Analyzing Text as Social and Cultural Data. Frontiers in Artificial Intelligence, 3.
- Dowell, N., & Kovanovic, V. (2022). Modeling educational discourse with natural language processing. Education, 64, 82.

First quiz and reading discussion next Tuesday

Discussion: Liu, J., & Cohen, J. (2021). Measuring teaching practices at scale: A novel application of text-as-data methods. Educational Evaluation and Policy Analysis, 43(4), 587-614

Tasks to complete by **Friday, Jan 9**

1. Respond to the brief, **Getting to know you survey** (on Canvas)
2. Sign up to be a discussant for a paper
3. Get started on A0, especially teacher recruitment!

Class enrollment

- The class is capped at **30 students** including auditors.
- The class if at capacity and many students, including those who would like to use it as a requirement, are on the waitlist. **If you know you won't take the class, please drop asap to give the spot to others**.
- If you're not in the class yet but know that you want to take it, please email me and explain why you want to take the class, and the perspective you will add to the course. I'll give priority to students who
    (i) are using it for a degree requirement (e.g. EDS masters),
    (ii) who do not have the option to take the course at a different time,
    (iii) who have more NLP experience,
    (iv) who contribute to diverse perspectives to the course.