

CS 293/EDUC 473: Empowering Educators via Language Technology

Dora Demszky & Rose Wang



Welcome to CS293 – the first ever class focused on the use of natural language processing to support teachers!

Your teaching team



Dora
Demszky



Rose Wang

Dora's story

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



Rose's story

Really care about community-based learning:

- Growing up in Germany - learning German with friends & teachers :)
- My interests always evolved growing up - but there was always a mentor/teacher/peer who inspired me or made me feel less intimidated jumping into something new



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/45085/discussion/>

For private matters.

Teaching team email: cs293-aut2324-staff@lists.stanford.edu

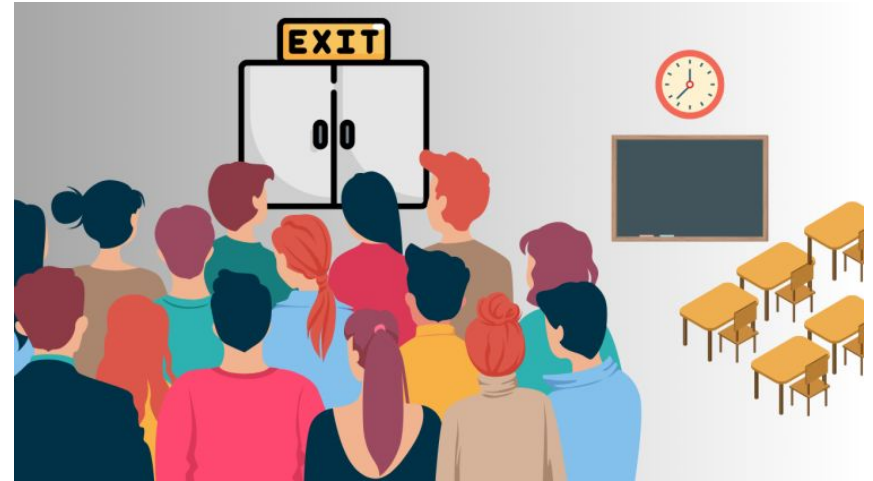
Why now?

Urgent Educational Needs

Pandemic Learning Loss

Widening Inequities

Teacher Burnout & Exodus



Why now?



Urgent Educational Needs

New Opportunity to Respond

Pandemic Learning Loss

Advancements in Generative AI

Widening Inequities


Uptake of AI in Education

Teacher Burnout & Exodus

Resources Poured into this Space



ChatGPT has blown up the education world

 Khanmigo
AI power

This conversation is recorded and viewable by your parent and teacher.


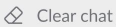

Can you just tell me the answer?

It's important that you learn how to do this yourself! What do you think you need to do to multiply 2 by 5/12?

They need the same denominator.

That's a good thought, but in this case, you don't need to find a common denominator because you're multiplying, not adding or subtracting. What else could you try?

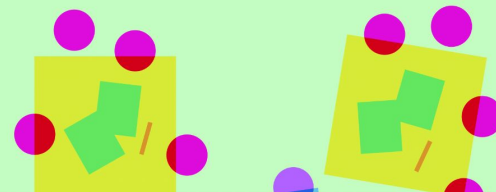
Type message (do NOT share any personal data)

  Clear chat 

Teaching with AI

We're releasing a guide for teachers using ChatGPT in their classroom—including suggested prompts, an explanation of how ChatGPT works and its limitations, the efficacy of AI detectors, and bias.

[Find additional resources in our new FAQ >](#)



MIT
Technology
Review

[Featured](#) [Topics](#) [Newsletters](#) [Events](#) [Podcasts](#)

[SIGN IN](#)

[SUBSCRIBE](#)

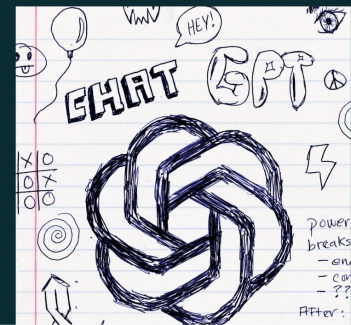
ARTIFICIAL INTELLIGENCE

ChatGPT is going to change education, not destroy it

The narrative around cheating students doesn't tell the whole story. Meet the teachers who think generative AI could actually make learning better.

By Will Douglas Heaven

April 6, 2023



More teachers are worried

Did a Fourth Grader Write This? Or the New Chatbot?

Don't be surprised if you can't always tell. Neither could a fourth-grade teacher — or Judy Blume.

By [Claire Cain Miller](#), [Adam Playford](#), [Larry Buchanan](#) and [Aaron Krolik](#) Dec. 26, 2022

They have industrialized and automated plagiarism.

— Travis Huckell, associate professor, MacEwan University

I think that the very best students will be fine. At less resourced universities than my own, I foresee an ever yawning gap between the privileged and everyone else, between those who know how to use A.I. as a tool and those who don't know that there is anything to know.

— Ricardo Galliano Court, assistant dean for academic integrity and undergraduate research, Northwestern University

The Stanford Daily

News • Science & Technology

Scores of Stanford students used ChatGPT on final exams, survey suggests

CLASSROOM TECHNOLOGY

Tech Fatigue Is Real for Teachers and Students. Here's How to Ease the Burden



By [Alyson Klein](#) — March 08, 2022 6 min read



Revolution?

- Focus on **learning process** rather than its product (e.g. finished work)
- Go beyond knowledge transfer to **empowering students, giving them agency, building positive relationships**

Why are these difficult?

1. hard to “measure” gains
2. impossible for 1 teacher to deeply understand & adapt their instruction to each individual student
3. knowing what to say to empower students is non trivial

Could language technology help overcome these barriers to change?

How can we ensure that the tools don't add burden on the teacher, but the opposite: **empower them?**



Vision: creating NLP technology to...

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

For Students: Speed or Deepen Learning

- **Create curriculum, assessments, and homework for students**
 - “Creating assessments/homework where students collaborate with language technology, where the students' effort is more into creativity, novelty and innovation” (Sharifa Alghowinem)
- **Feedback to students**
 - On math assignments, writing...sky's the limit (lots!)
 - “Community Builder AI system that provides meta-collaborative feedback to students based on recordings of their group work. Students see how they upheld co-negotiated community agreements of respect, commitment to community and pushing thinking forward.” (Jeff Bush/Sydney D’Mello)

For Teachers: Automate Routine (& Complex) Tasks

- AI Tutors
 - “particularly *in intro classes, where most questions have been asked before*, so that faculty and TAs can focus all the more human time on students who need it most” (David Malan)
- Aptitude Measurements
 - “*in-situ measures of students aptitude* could help with diagnosing student learning” (Jing Liu)
- “Teaching assistant”
 - Automating grading of student work, creation of assessments, lesson plans (Bryan Richardson, Dora, Shyamoli, others)
 - “I am wondering if there is a teachers' assistant that can listen to recordings from small group reading groups, and make suggestions of students' areas of strength and challenge in their reading development” (Laura Wentworth)
- Automate complex practice?
 - “...and ideas for instructional moves teachers could make with the group.” (Laura Wentworth)
 - “The rich interdependency of concept & skill acquisition is an enduring challenge: if a student is stuck or disengaged, what do I do next?” (Josh Frost)

For Teachers: Improving Instructional Quality

- Automated feedback
 - “*identify components of instruction that can be highlighted* and reflected back to educators as part of their ongoing, professional learning.” (Jennifer Jacobs)
- Generate data for coaching conversations
 - TeachFX “saves [teachers] time and sets them up to have more *powerful coaching conversations*” (Niah Shearer)
 - “radically reduce the cost of *teacher coaching interventions*” (Alyssa Van Camp)
- AI-based coaching or AI-supported coaching conversations
 - “Our AI Coach platform is a novel interaction model for teachers to “converse” with a computerized coach.” (Adam Geller, EdThena)

For All: Inform Educational Theory

- Embed experiments in student-facing technologies to understand...
 - What engages students in rigorous learning
 - What tasks, representations, activities lead to better outcomes for students
 - What grouping and interactive learning structures aid learning
 -
- Embed experiments in teacher-facing technologies to understand
 - What engages teachers with NLP learning technologies
 - How to give feedback that becomes “sticky” and changes teachers’ practice
 - How best to personalize learning based on current instruction and teacher background
 -

Process & course structure



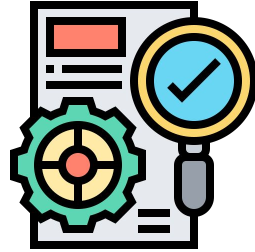
Identify
Problem

Weeks 1-2



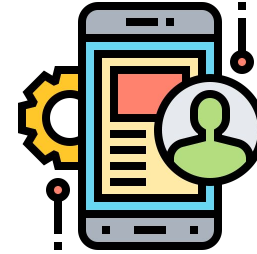
Data
Exploration

Week 2



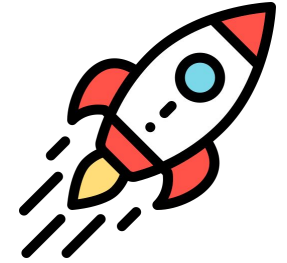
Algorithm
Development
& Validation

Week 3-5



Tool
Development

Week 7



Deployment

Week 8

Overarching Themes:



Bias &
Fairness



Working
closely with
teachers

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 an audience of educators and peers

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) or willingness to spend a LOT of time to self-teach basic NLP
- 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. Lecture (~20 mins)
2. Q&A / group work (~20 mins)
3. Student-led discussion of a paper (40 mins)

Unit Policy

- 3-4 units: same requirements
- 2 units: homeworks are optional

Grading

- Class participation (5%)
- Project (60%)
- Homework (15%)
- Reading Commentaries (10%)
- Reading Discussant (10%)

Office hours

See website for up-to-date information.

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

Project (60%)

- Group Project 1~3 people per group (we encourage groups of 3!)
- Please discuss your project idea with instructor/TA early in the course
- Components:
 - Rationale for Project [= Literature Review + Motivation] (10%)
 - Experimental Protocol (15%)
 - Practice Pitch (10%), including peer feedback
 - Final Pitch (20%)
 - Final Paper (10%)

Project = Demonstrate you know what it takes to:



Identify
Problem



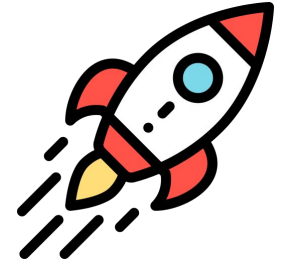
Data
Exploration



Algorithm
Development
& Validation



Tool
Development



Deployment

Overarching Themes:



Bias &
Fairness



Working
closely with
teachers

Project

- We encourage you to **bring in existing projects** if you have any
- Projects **may be at different stages** of development at the end of the course — we want to evaluate the process (progress, effort and learning) rather the stage at which your tool / study is at
- **At the minimum (if you are just starting)**, you should have designed a thoughtful plan for each step until deployment

Project Pitches

- 5 minutes + brief Q&A
- Rubric (TBA)
- **During week 6**, you'll give a practice pitch (10%) and practice using the rubric by giving each other feedback
- **During week 10**, you'll pitch your project to a group of 6 educators
- More info on website

Where to find inspiration?

- Learning Engineering Tools Competition:
<https://tools-competition.org/winners/>
- Read the Department of Ed's [AI Report](#)
- Check out Future work & Limitations sections in relevant papers
- Talk to each other
- Talk to teachers
- Talk to Dora & Rose

Some project suggestions from Dora

- Helping ELA teachers create text visualizations
- Helping monolingual science teachers facilitate multilingual students' understanding of science concepts via LLMs
- Facilitating formative feedback & assessment in math and ELA with NLP tools
- Embedding automated NLP-based feedback for teachers in existing PL programs
- Others...

Reading Commentaries (10%)

- Short commentary (~200 words) due 5pm the day before class
- Viewable to other students
- Late submissions will **not** be accepted
- We will drop 3 lowest grades at the end of the class
- **Not** a summary – propose ideas to think about
- Graded on a check minus / check / check plus scale

Although you don't need to submit commentaries on optional readings, we **highly encourage you to read them.**

Reading Discussants (10%)

- Once a quarter (sign up link [here](#))
- Work in pairs
- Summarize commentaries day before lecture
 - Identify themes, highlight quotes
 - [You can use this template](#)
- Lead discussion on reading in class

Homework (15%)

- Colab notebooks
 - HW1: Data exploration
 - HW2: Fine-tuning for classification
 - HW3: Generative LLMs
- Meant to support you with your final project
- Optional for those taking class for 2 units
- Upload full pdf to Canvas
- Graded on a check minus / check / check plus scale

Class participation (5%)

- Productive contributions to classroom discussions
- Productive contribution to the success of the project
- Responses to brief surveys (e.g. Getting to know you)



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.

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

Personas (credit: ChatGPT)

Name	Age	Role	Setting	Background
Maria Alvarez	28	High school science teacher	Urban public school with limited resources	Recent graduate, passionate about climate change, struggles with classroom management.
David Chen	40	Middle school math teacher	Well-funded suburban school	15 years of experience, technologically savvy, trying to make math engaging for all students.
Beatrice Okoye	55	Elementary school principal	Inner-city school with a diverse student population	Former English teacher, focused on improving school literacy rates, faces budget cuts.
Aaron Singh	33	Special education teacher	Rural school district	Trained in inclusive education, struggles with lack of specialized resources, keen on fostering individualized learning.
Sarah El-Khoury	29	High school history teacher	International school in a major city	Expatriate, adjusting to a new curriculum, balancing cultural sensitivities.
Liam O'Connor	47	Physical education teacher	Large public school	Former semi-pro athlete, promotes fitness amidst rising student obesity rates, struggling with students' increasing screen time.
Aisha Patel	35	Elementary school music teacher	Charter school focused on the arts	Trained in classical Indian music, integrating global music traditions, facing potential program cuts.
Samuel Akoto	52	College professor in Anthropology	State university	Published author, adjusting to online teaching, keen on fostering critical thinking in a polarized society.
Elena Rodriguez	31	School counselor	Mixed-income middle school	Passionate about mental health, overwhelmed with increasing student caseload, seeking ways to provide support virtually.
Hiroshi Takahashi	43	ESL (English as a Second Language) teacher	Community college	Fluent in multiple languages, working with diverse age groups, challenges in bridging cultural gaps.

Empathize with your persona

1. **Think & Feel:** What do you think they think and feel on a daily basis (personally and professionally)?
2. **Hear:** What does this persona hear from colleagues, students, parents, or administrators?
3. **See:** What does this persona see in their environment? This could be resources, lack of resources, technology.
4. **Say & Do:** What actions does this persona take? What do they usually say in their professional setting?
5. **Pain Points:** What challenges or obstacles does this persona face? Consider both emotional and practical aspects.
6. **Gains:** What are the aspirations, needs, or wants of this persona? What would make their job/life better or easier?

Getting to know you & Discussant sign up

You can find it on Canvas! Please fill out by **Monday, Oct 2.**



Permission codes

- We'll have to cap the class at 30 students + 3 audits.
- The class is at capacity and many students 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 with experience with NLP, those who do not have the option to take the course at a different time, and students who contribute to diverse perspectives to the course.