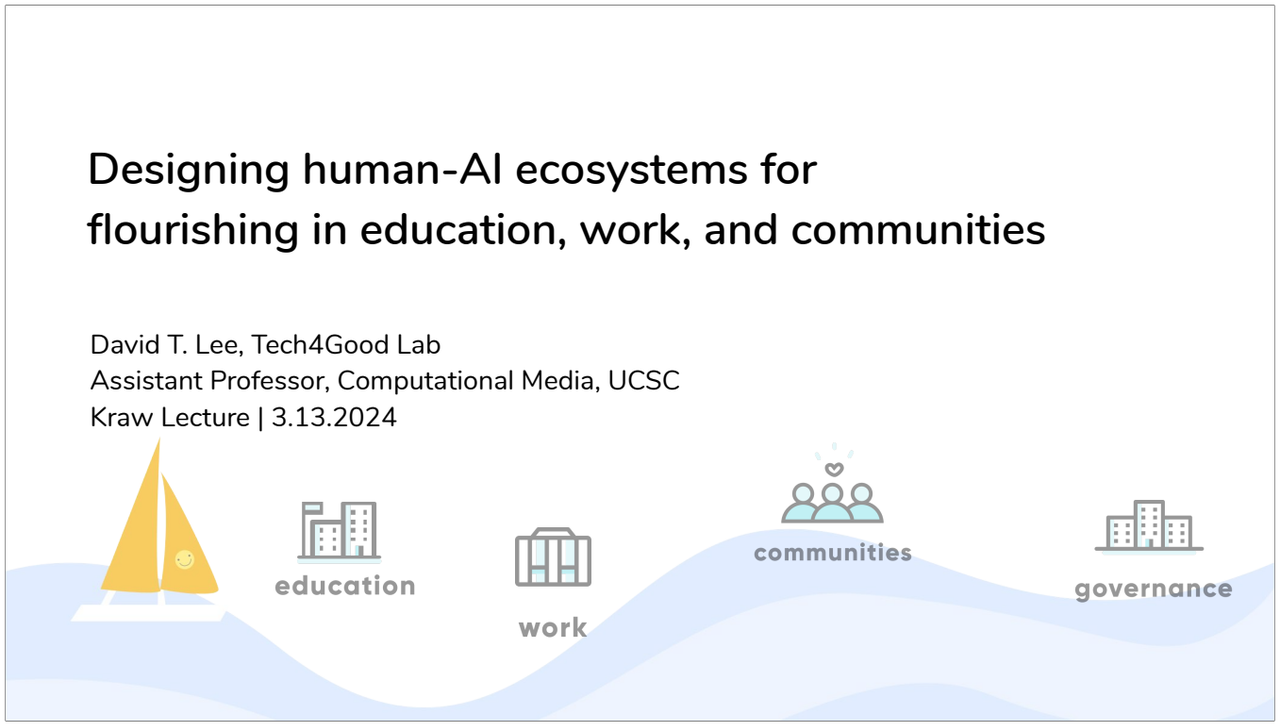


* Thank you. well it’s really great to be here and I’m really excited for this opportunity to share the journey we’ve been on in tech4good to design ecosystems for a flourishing future of education, work, and communities, and to explore the role of humans and AI in these ecosystems,

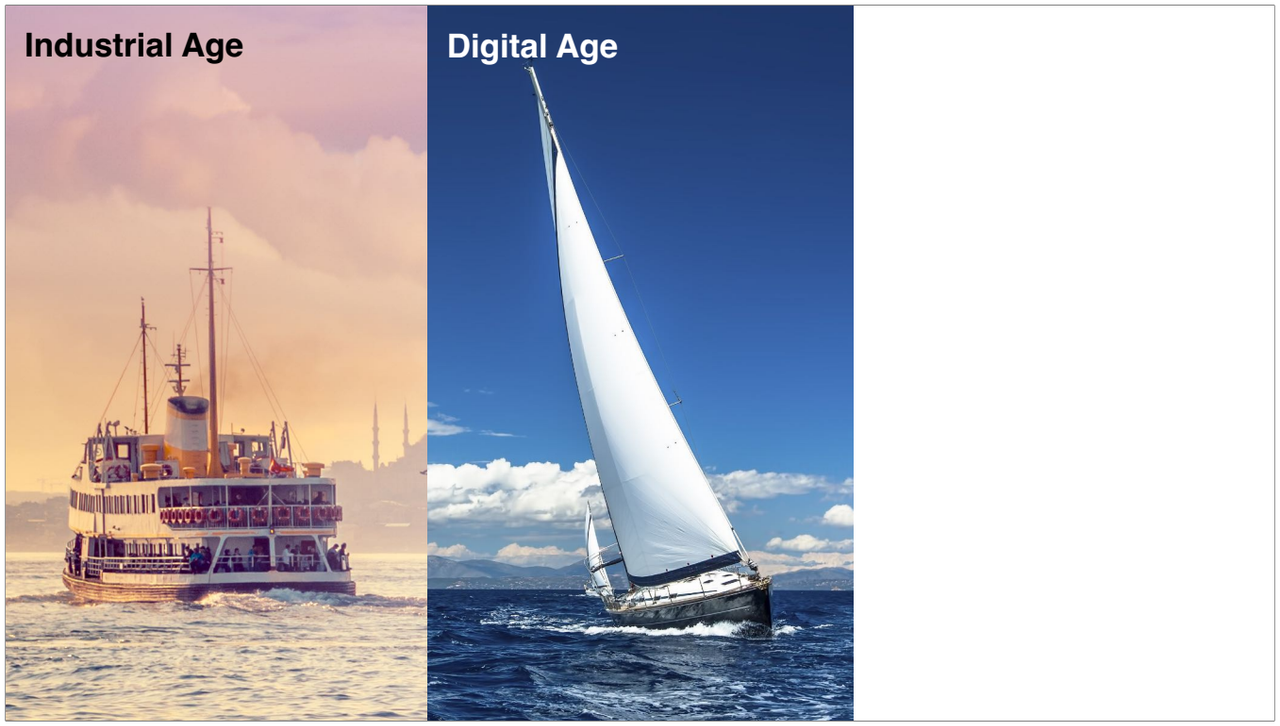
Three eras requiring different ways
in how we live, work, and learn

John Seely Brown

* John Seely Brown (JSB) describes three different eras that required different ways of living, working, and learning.

Industrial Age

* He said that when he was growing up, his father told him, “Think of your career as a steamship. Set a course for your life and power through anything that gets in the way.”



* But he found that his career was much more like a sailboat: “Let’s play with the wind. Let’s adjust to the natural forces of change to get to where we want to be.”

* Now, we’re entering an age where living, working, and learning is more like whitewater kayaking. We are constantly being buffeted by new rapids, and we, as individuals and as communities, have to continually adjust and learn and adapt to navigate our way through.

This talk is about exploring, asking, and speculating:

designing ecosystems for flourishing in a whitewater world

1 reinventing education for continuous learning

2 societal collaboration to support communities

So this talk is about exploring:

* How to design ecosystems that support flourishing in a whitewater world,
* How do we help individuals continually learn and adapt in a changing economy,
* How do we support communities in collaborating together to address challenges they face?

Two Themes

Education, work, communities

Human-AI interactions

The Journey

* I’m going to be organizing the talk around two themes, really two big questions,
* For each, I’m going to talk about three things we learned in our research and in our journey trying to build a community that reflects the future we want to see,

1

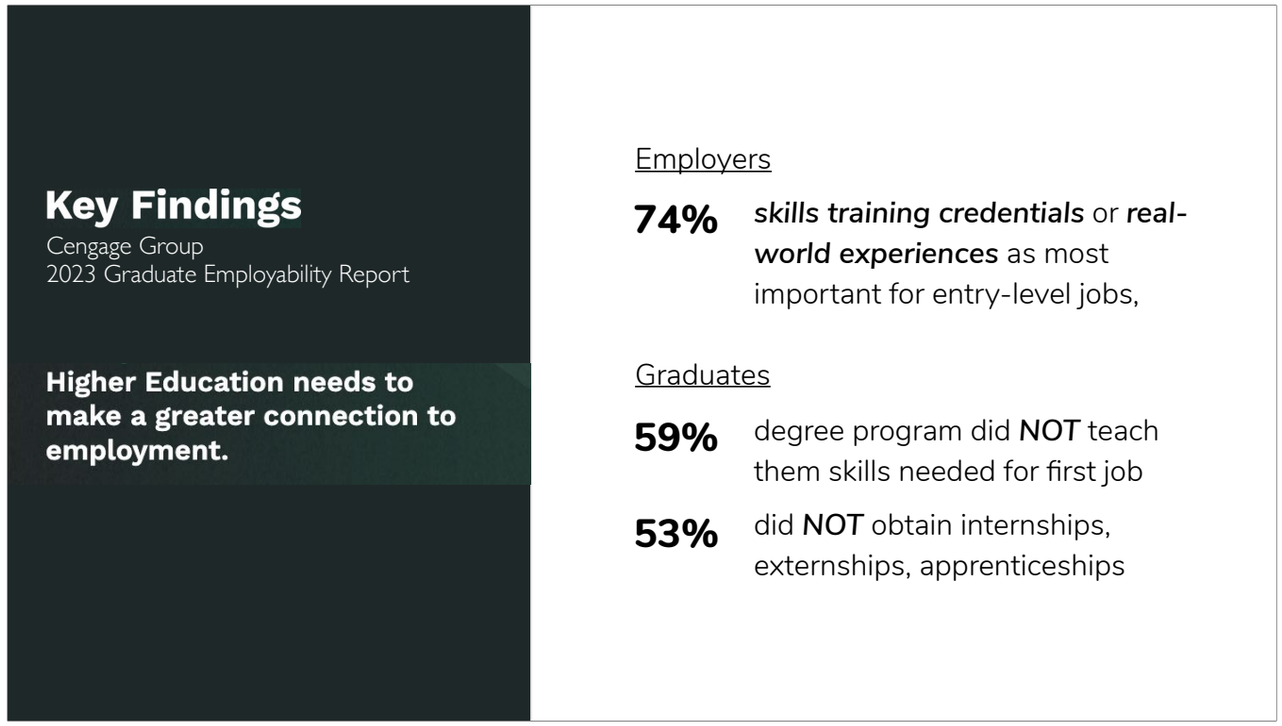
How might we imagine…

a more tightly integrated approach to education, work, and community engagement?

* The first question I want to explore is: how might we imagine, how might we work towards a more integrated approach to education, work, and community engagement?

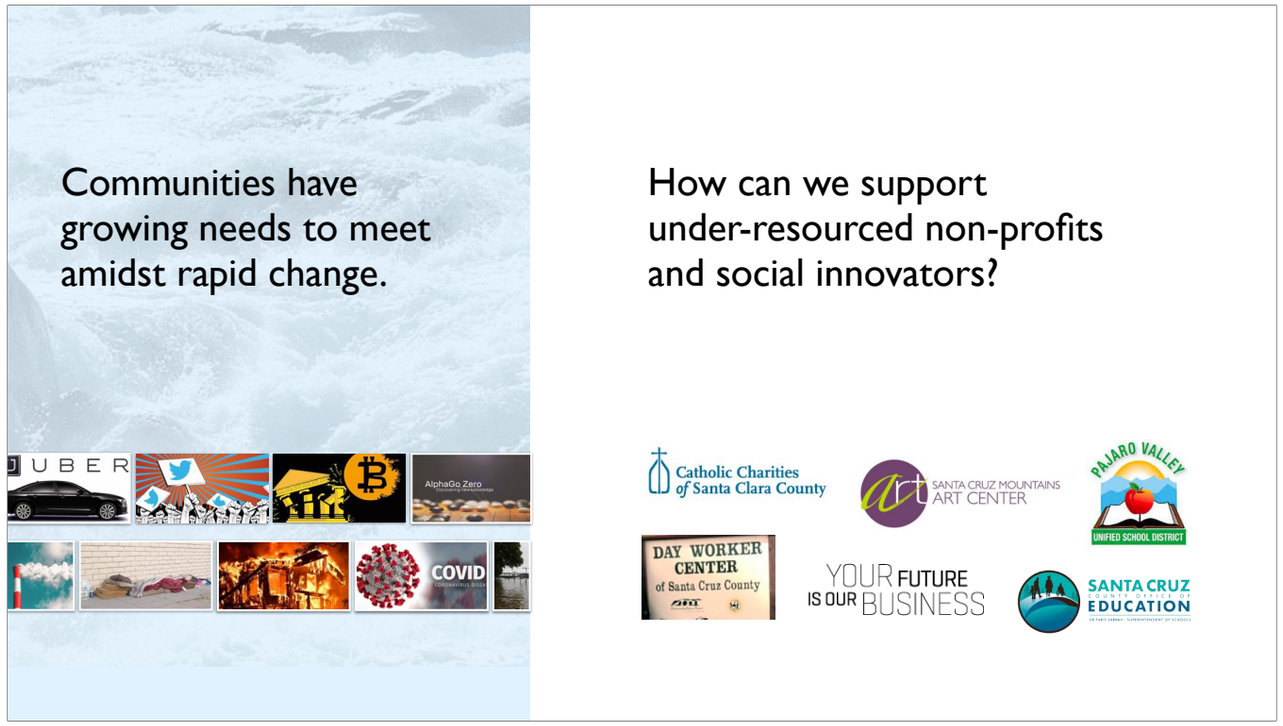
Edtech has focused on scaling access to content, but scaling **real-world experiences** remains challenging

* When you think about educational technologies, there are a lot of efforts to scale access to content — there's coursera, khan academy, YouTube videos — but if you're trying to obtain real-world learning, if you're trying to land your first internship or your first mentored project-based experience, it's a really vicious cycle.
* You need experience for people to hire you, but you need people to hire you to build the kinds of skills that come from engaging in authentic work,



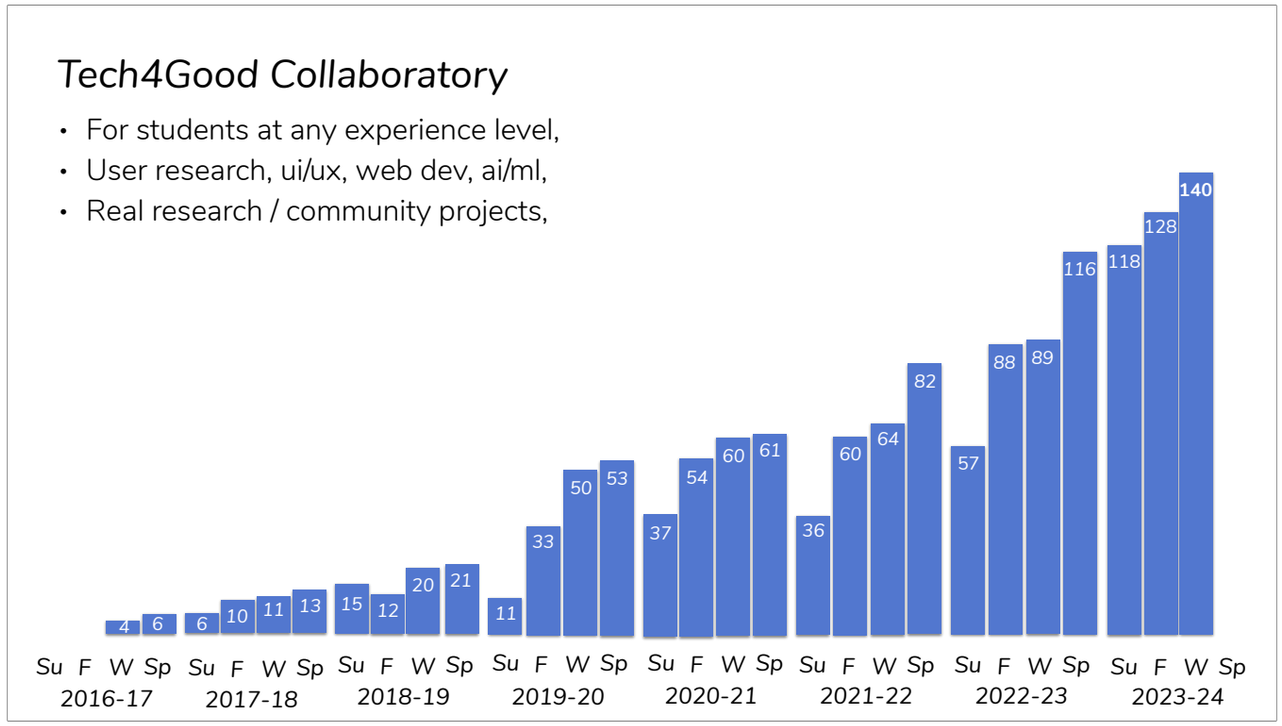
* And universities struggle to provide that kind of real-world learning too,
* In a 2023 survey, when employers were asked what they view as most important thing when considering candidates for **entry-level jobs**, 74% say either skills training credentials or real-world experiences, only 19% said college degrees,
* But 59% of college graduates said that their program did not teach them the skills they need for their first job and 53% were not able to obtain internships, externships, or apprenticeships,

https://cengage.widen.net/s/nvd6ghd8vl/final-cg-employability-survey-report-july2023



* At the same time, communities are facing more changes than ever,
* If you think about just the last few years: fires, floods, covid, all its impacts on education and work, polarization and housing issues,
* And then there's a constant stream of new technologies — social networks, the gig economy, blockchain, advances in AI — that change how we learn, work, find housing,
* And so it's really difficult for under-resourced nonprofits, social innovators, and community members to meet the changing needs that arise or to harness new technologies to support their work,
* I remember talking to a refugee resettlement agency early on in my journey that had an idea for building an app to bring the federally mandated cultural orientation process online so their clients didn't have to drive several hours to come in-person,
* It wasn't a technically complex idea, but nonprofits just don't have access to that expertise. You'd need designers, web developers, content creators, and nonprofits sometimes struggle to even support 1 or 2 full-time staff

* So one of the big things we've been thinking about since the beginning of Tech4Good is: can these two needs meet?
* Can we design a system in which community projects provide a source of real-world learning to even those with little to no prior experience, and where learners can be organized to sustainably support needs in the community?



* I thought that I should start with myself. There are a lot of students who want to join research labs, but it's usually pretty hard for faculty to have time to involve more than a few,
* So starting the first year I joined UCSC, I've been growing the number of undergraduate students I take and currently have 130 students in my lab learning user research, design, web development, and AI, many of whom join without any prior experience,

Community Consultancy

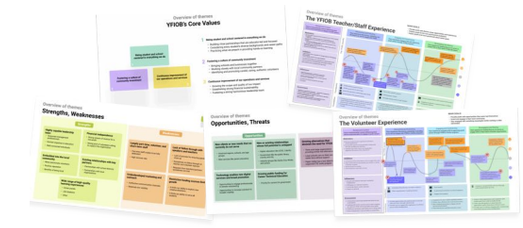
Strategic assessment and design exploration

1 **Phase One** Landscape Analysis

2 **Phase Two** Stakeholder Experience

3 **Phase Three** Future State Design

4 **Phase Four** Design Exploration



One partner that all 100+ students in the course are organized around supporting

A diverse portfolio of deliverables balancing research, no-code implementation, and digital prototyping

A foundation to build on in other courses, student orgs, or labs

* I've also been exploring this idea of a course-based community consultancy. It's usually hard to do project-based, community-engaged classes when you have a lot of students,
* But I've been trying to organize my 100+ student project-based courses around delivering a large project for a non-profit partner, with students synthesizing user research on stakeholders, and then splitting into smaller teams to implement or prototype different ideas for using digital tools to support the organization,
* I want to talk about three insights we learned in the process of developing these and other programs,

Idea #1

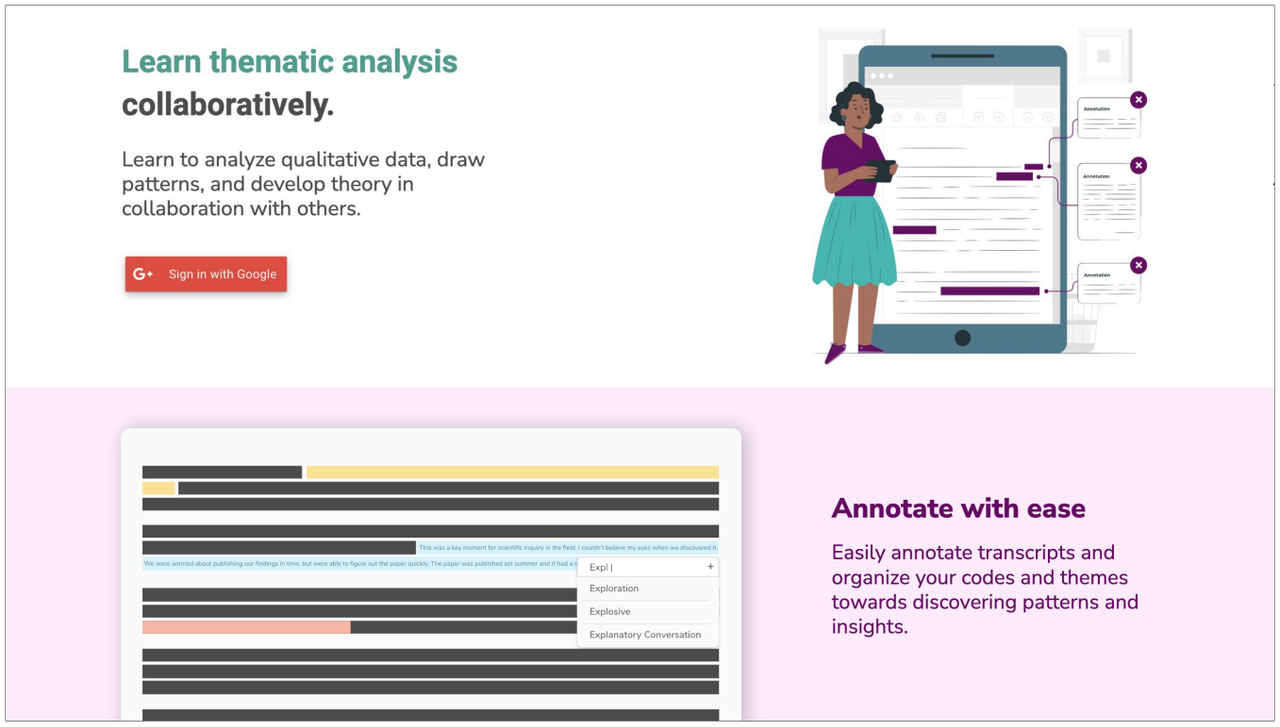
find ways to make large classes a strength rather than a weakness

* The first idea is that large classes can actually be strength rather than a weakness for experiential, community-engaged learning,
* I like to think about the entire class — or even multiple classes, student orgs, and research teams — as all part of the same collaborative organization, working to support a single non-profit partner or community initiative
* This means I sometimes have multiple teams doing the same work, and after teams submit their work, I allow teams to look at and build on the work of other teams in subsequent assignments,
* It also allows us to have a diverse portfolio of deliverables. We can have some teams working on projects that use no-code tools to deliver immediate value, while other teams are working on longer-term riskier efforts that might take a really long time or might even never produce outcomes,

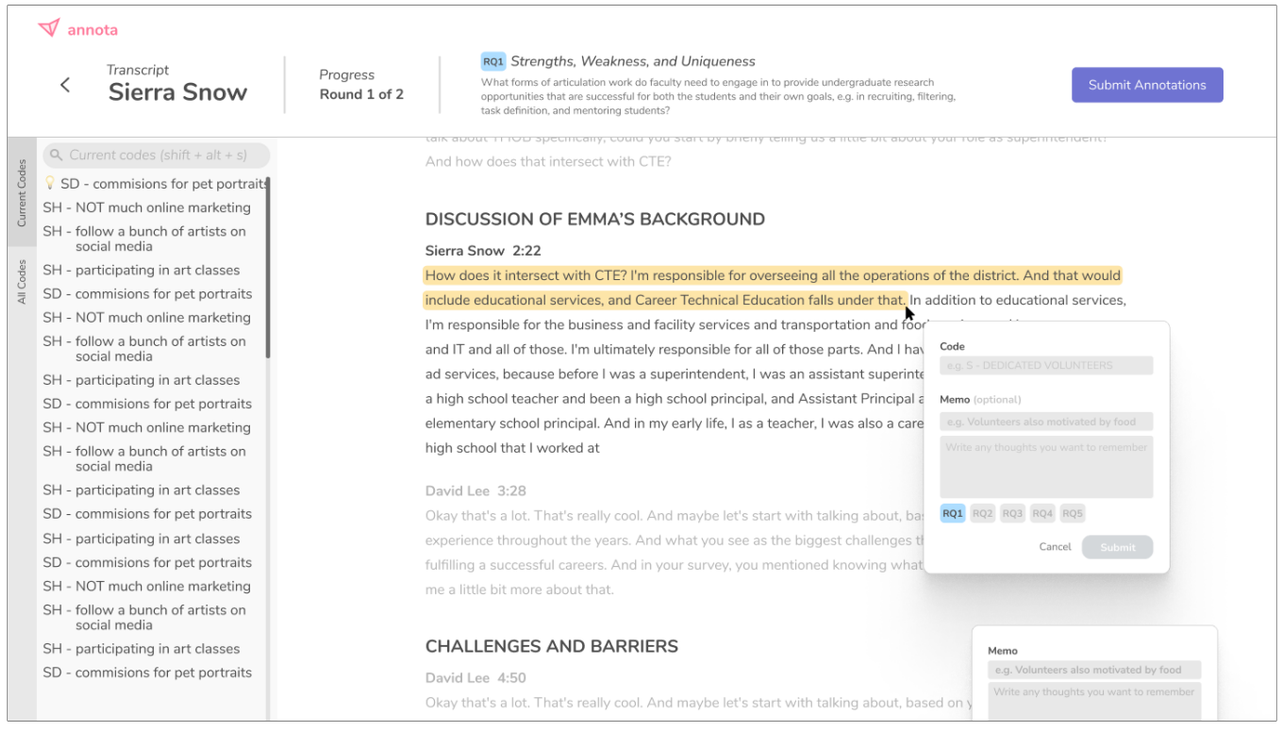
How do we scale personalized feedback to a 100+ student class?

Annota: Peer-Based AI Hints Towards Learning Qualitative Coding at Scale
Dustin Palea, Giridhar Vadhul, David T. Lee
ACM Conference on Intelligent User Interfaces (IUI) 2024
Best Poster Award at HCOMP

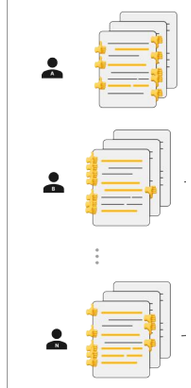
* I want to spend a little time talking about how a large class can potentially be a strength rather than a weakness for providing personalized feedback, which is one of the big challenges for supporting project-based work,



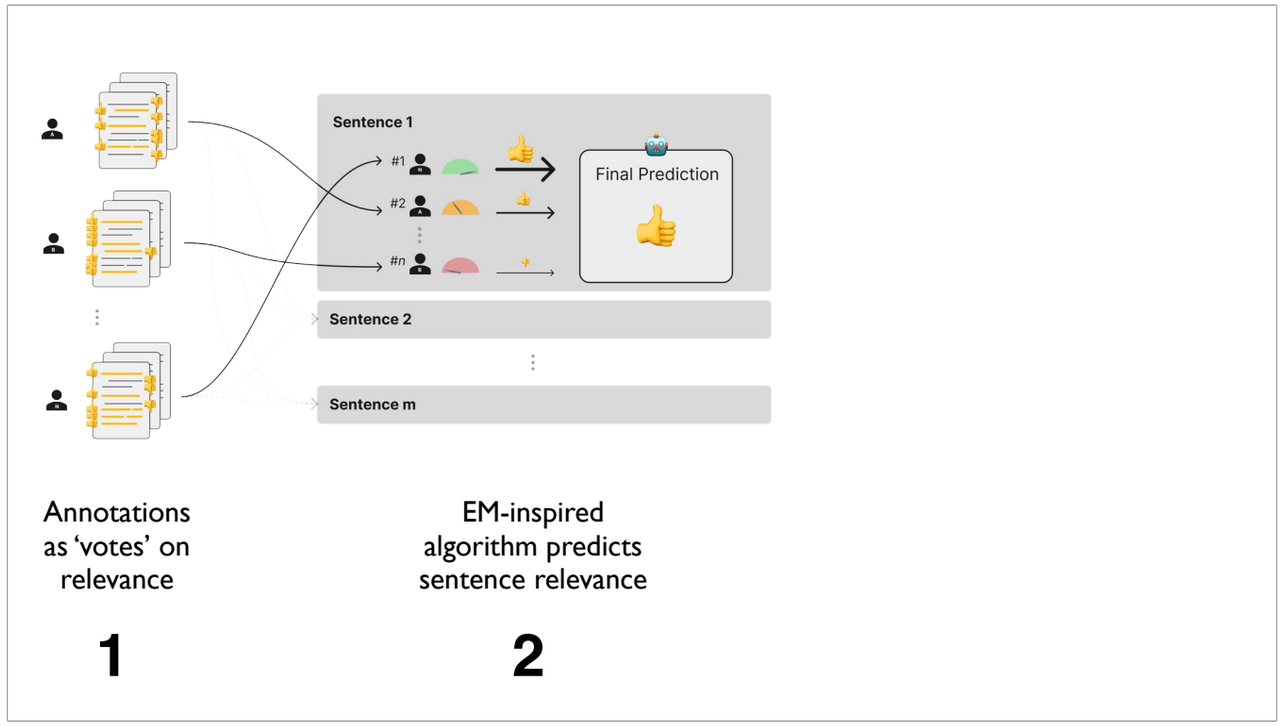
* At the beginning of our class, students are learning to conduct a thematic analysis on stakeholder interviews to understand some aspect of the organization,
* The thought we had is that, since we have many students analyzing the same interviews, maybe we can aggregate the work of peers in a smart way to provide students with personalized peer-based AI hints,



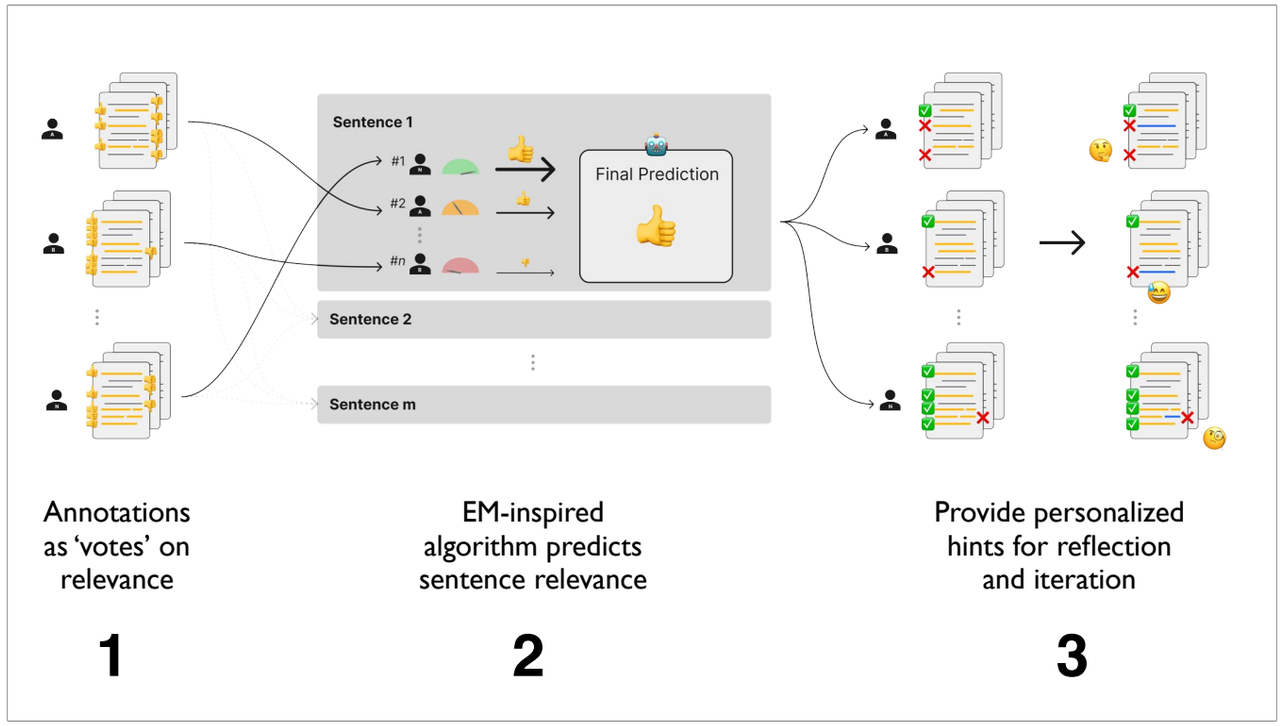
* So far, we just started with supporting the simplest part of thematic analysis, the initial annotation stage, where students are reading and annotating transcripts to identify passages relevant to the research question, and to describe how they relate,
* We built a platform, Annota, for students to do this annotation work, and after students submit their initial annotations, we run an algorithm on all submitted annotations to facilitate a feedback and discussion process,



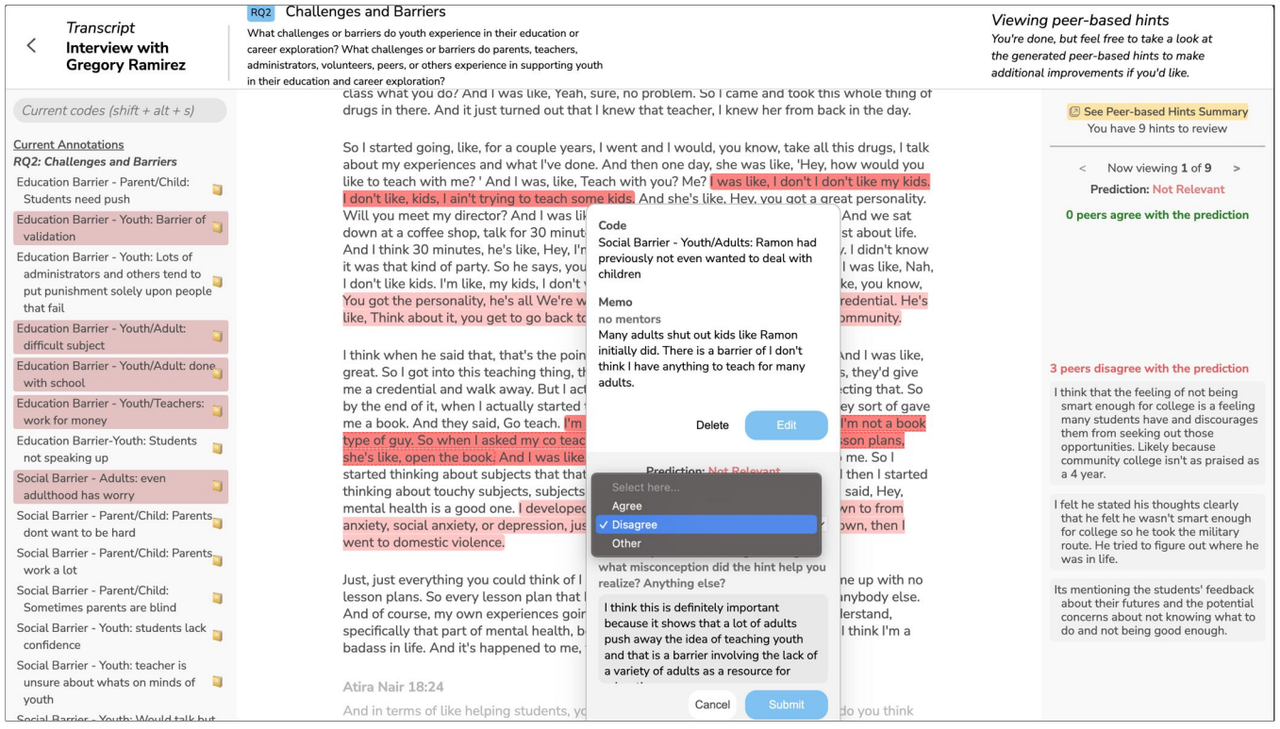
* I’m not going to go into the details of the algorithm, but basically, if a student highlights and annotates a particular sentences, we view that as a vote that the sentence IS relevant. If they didn’t annotate it, then it’s a vote against the sentence being relevant,



* The algorithm take all these annotations, all these votes, to iteratively predict which sentences are relevant and how likely each student is to make errors of different types, with the student error predictions reweighing the votes in subsequent rounds of predictions,



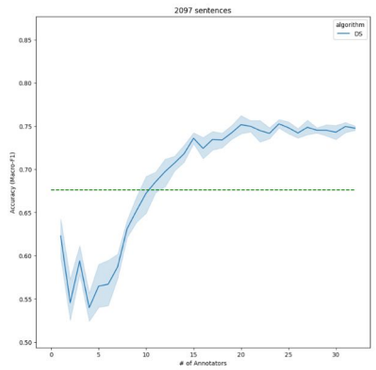
* Once you converge to a final prediction, that is then used to provide personalized prompts to students for further reflection and iteration.



* So for example, when a student navigates back into the transcript view, they might see highlighted passages that they didn't annotate, but that others in the class thought were relevant,
* The student would then decide whether they agree or disagree with others, and explain why,
* These explanations are displayed to help facilitate a class-wide conversation on why a particular sentence is or isn't relevant to the research question,

25%

of students identify a particular relevant sentence, on average



With ~15 Students, the algorithm attains an accuracy (Macro-F1) of

75%

Annota: Peer-Based AI Hints Towards Learning Qualitative Coding at Scale
Dustin Palea, Giridhar Vadhul, David T. Lee
ACM Conference on Intelligent User Interfaces (IUI) 2024
Best Poster Award at HCOMP

* We found that even though only 25% of students identify a particular relevant sentence on average,
* After just around 15 students, the algorithm achieves an accuracy of 75% that is often better than or at least as good as that of the best student,
* In other words, it is eliciting the collective expertise within the student crowd. And figuring out how to source feedback from the best students despite not knowing beforehand whose doing the best work.

Students found that the hints helped with...

Understanding the research question

"Yes I agree with this [hint]... COVID is not a weakness for the [organization], but like, COVID caused the other financial [issues] that caused the weakness."

Reflective examination of annotations

"[The AI hints] showed other team members' annotations too which helped me better understand the sentences."

Mental models of coding technique

"I didn't expect the AI to generate helpful hints. But [it] actually generates some pretty useful hints... quotes that I didn't even see... It got me to redo the rest of the next interviews in more depth and detail."

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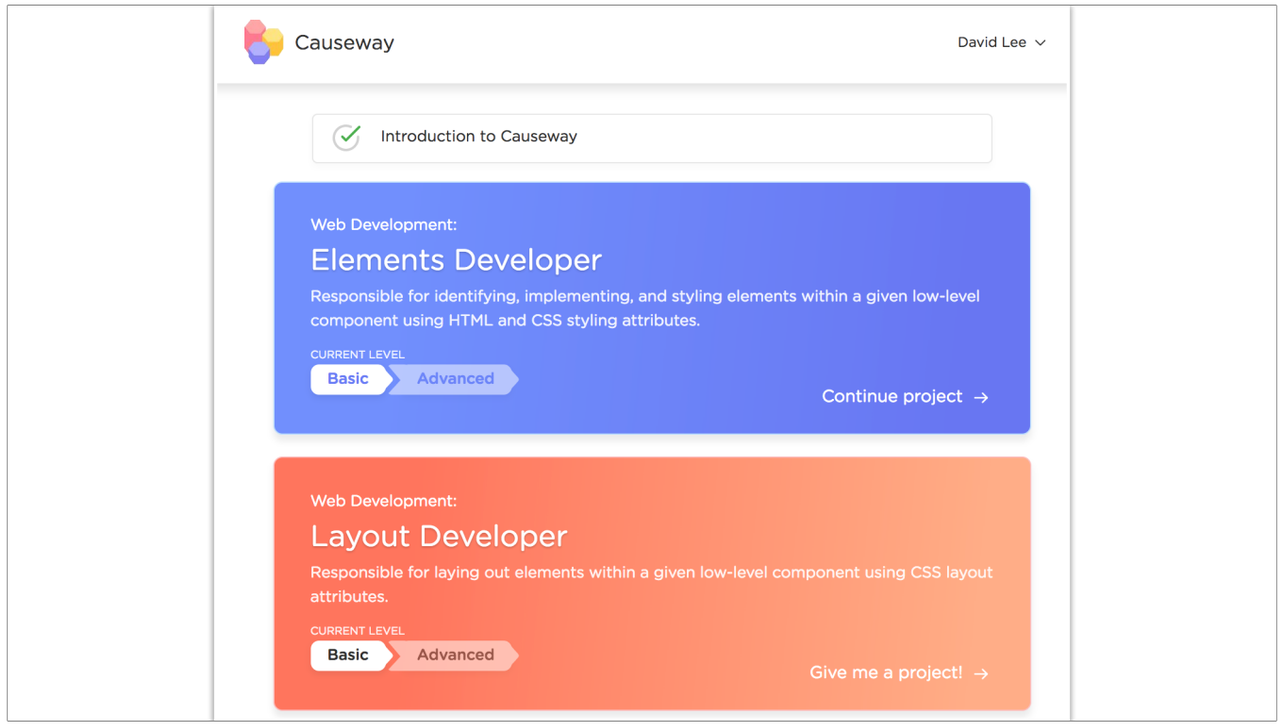
* Students described how the hints helped them identify incorrect understandings of the research question, how it helped prompt more careful reflection on the context of sentences they annotated, and how it made students realize that they needed to be more detail-oriented in their annotation work,
* Of course, this is just the simplest part of the qualitative analysis process, so we're beginning to think about how to use similar ideas to augment the more central parts of thematic analysis, when students are clustering annotations together to identify higher-level themes and subthemes,

Idea #2

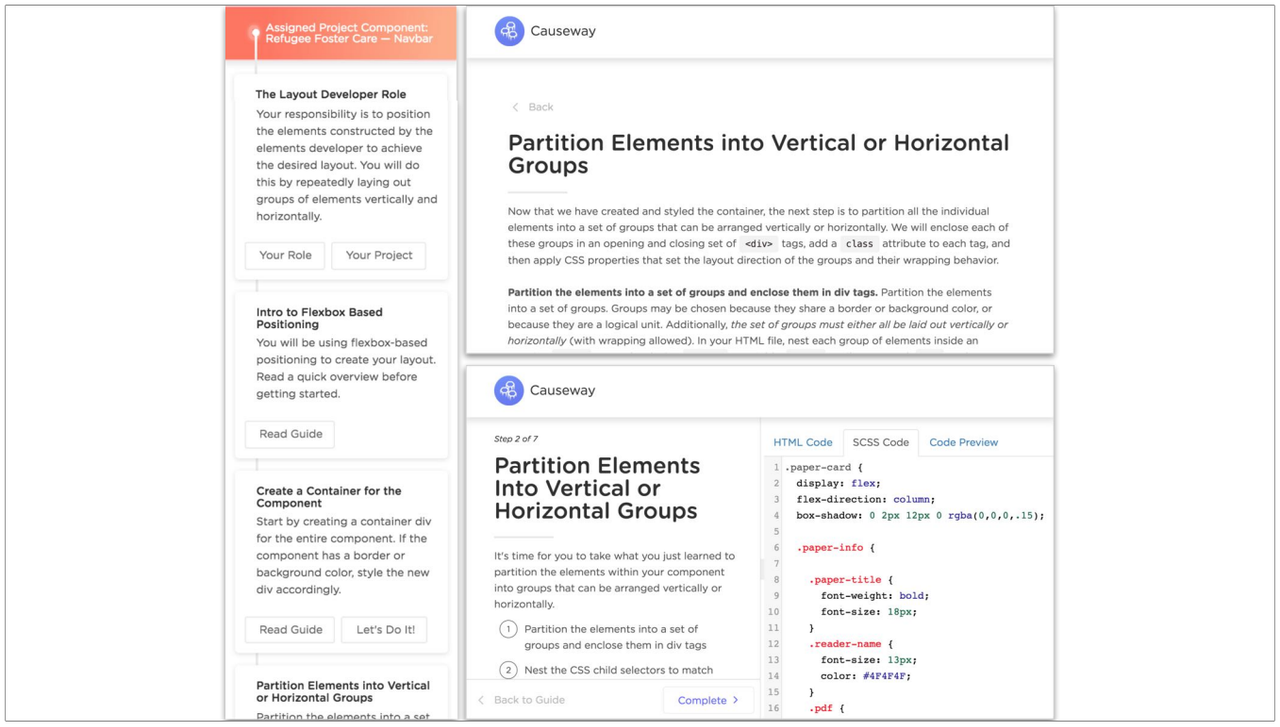
use and adapt work structures to support experiential learning

* The second thing we've learned is important for being able to provide and link real-world learning to supporting community projects is to think about how we can use and adapt organizational structures or tools used in the workplace to support experiential learning,

* I want to share one of the web applications we developed in the early days when we were just starting to explore these ideas,
* At that time, we were trying to organize volunteers around developing web applications for non-profits. We had actually scoped things down to a really simple setting, just developing the static views of the application, because we had been failing a lot,
* What finally got things to work was when we integrated learning into the process, and organized it after the workplace,



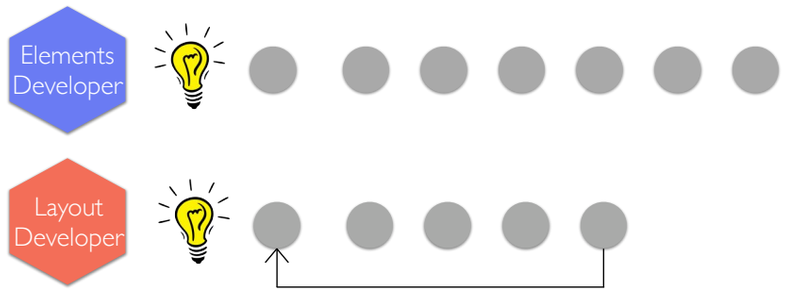
* We built an application for learning web development, but instead of the typical approach of having learning modules focused on technical topics, like HTML, CSS, Javascript, our modules correspond to micro-roles like an elements developer or a layout developer



* When you navigate into one of these roles, it's broken down into steps that alternate between learning through tutorials and practicing what you learned in an interactive coding environment,

Causeway: Scaling Situated Learning via Micro-Role Hierarchies
David T. Lee, Emily S. Hamedian, Greg Wolff, Amy Liu
ACM Conference on Human Factors in Computing Systems (CHI) 2019
Honorable Mention Award

* The main difference is that these interactive coding exercises are actual steps guiding you in completing your assigned role,
* So for example, in the elements developer, you're assigned to a single small component, and the steps guide you in declaring and styling text elements, images, and shapes for that component,



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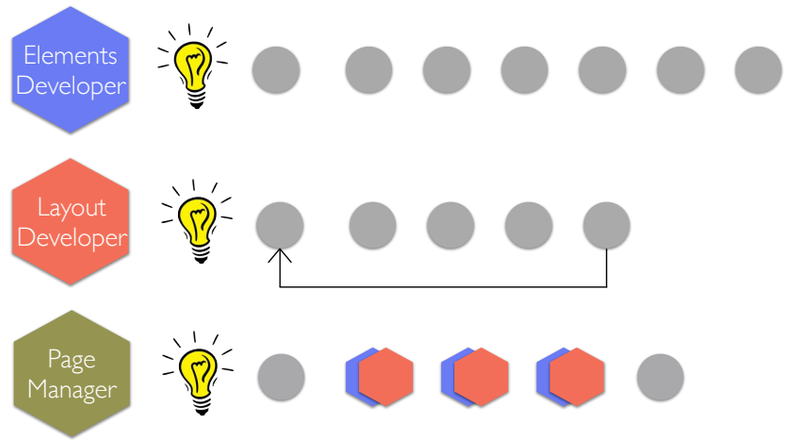
* When you finish, you move onto the layout developer role that teaches you to positioning the elements in the component to create the layout



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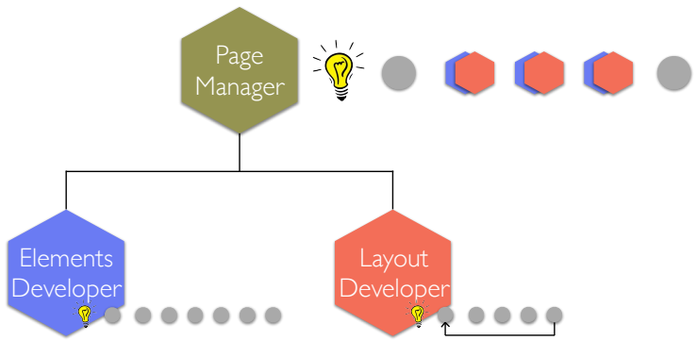
Honorable Mention Award

* As you get comfortable building components, you move on to higher-level roles like the page manager, where you are delegating, overseeing, and integrating a bunch of components to complete a single page,



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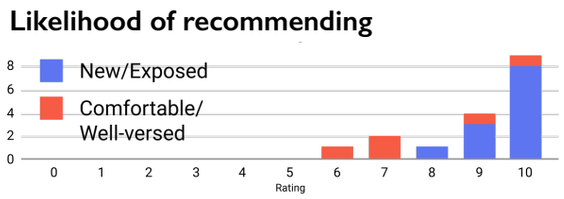
Honorable Mention Award

* So the micro-roles are providing pathways that scaffold experiential learning,
* But additionally, projects are also being broken down and organized using hierarchies of these micro-roles, so the micro-roles are the building blocks that link learning to supporting real projects for non-profits,



"The ability to learn the concepts in such a way that they are applied quickly, and then practiced on pages for real-world use is rewarding, and makes the material stick better."

Causeway: Scaling Situated Learning via Micro-Role Hierarchies
David T. Lee, Emily S. Hamedian, Greg Wolff, Amy Liu
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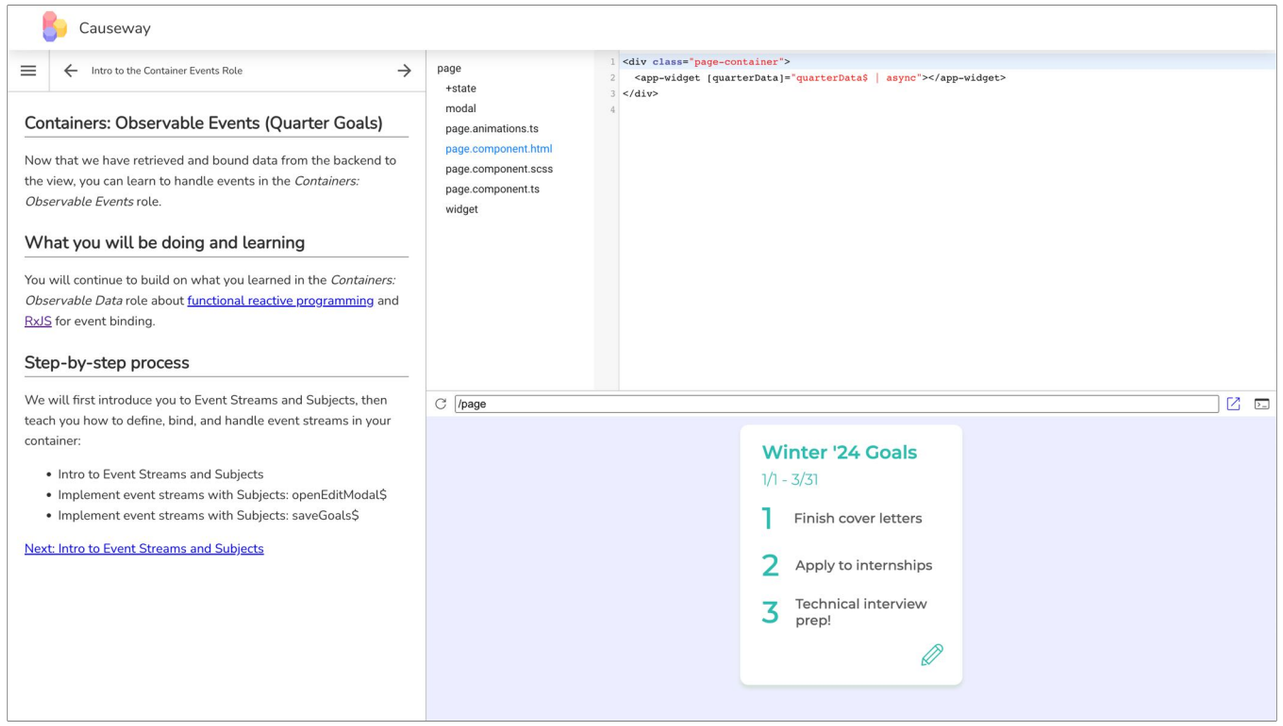
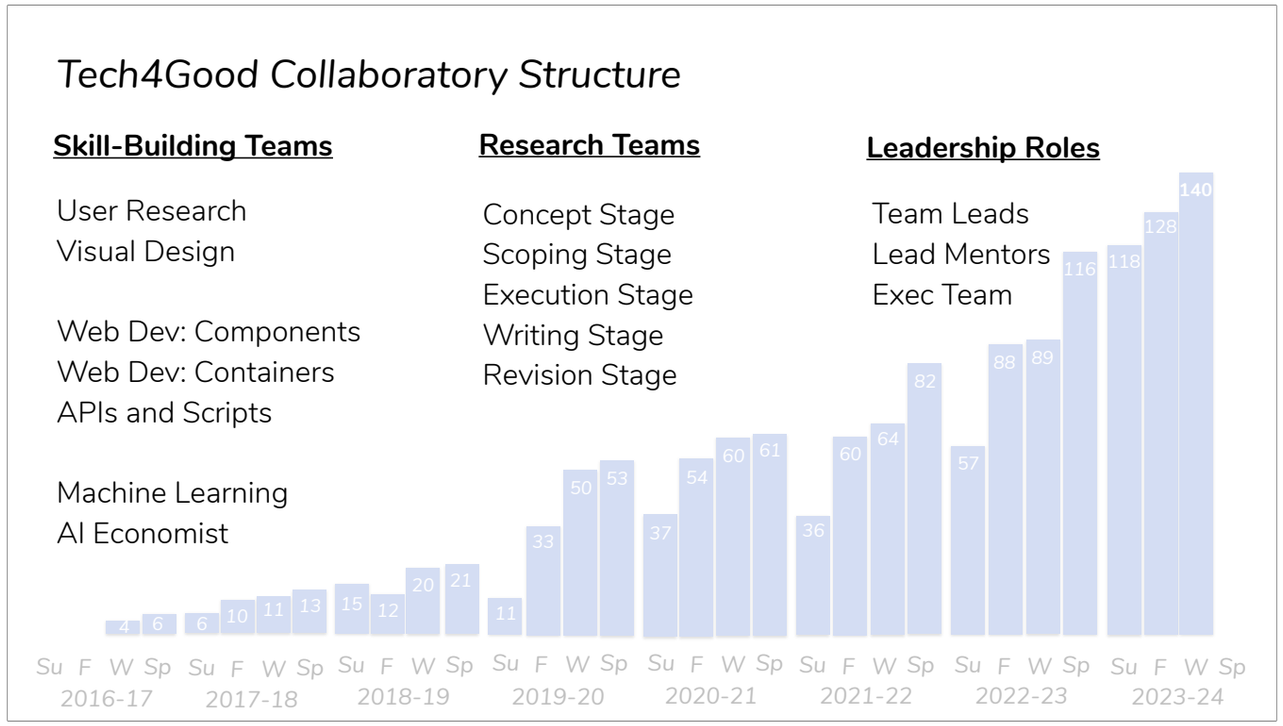
Honorable Mention Award

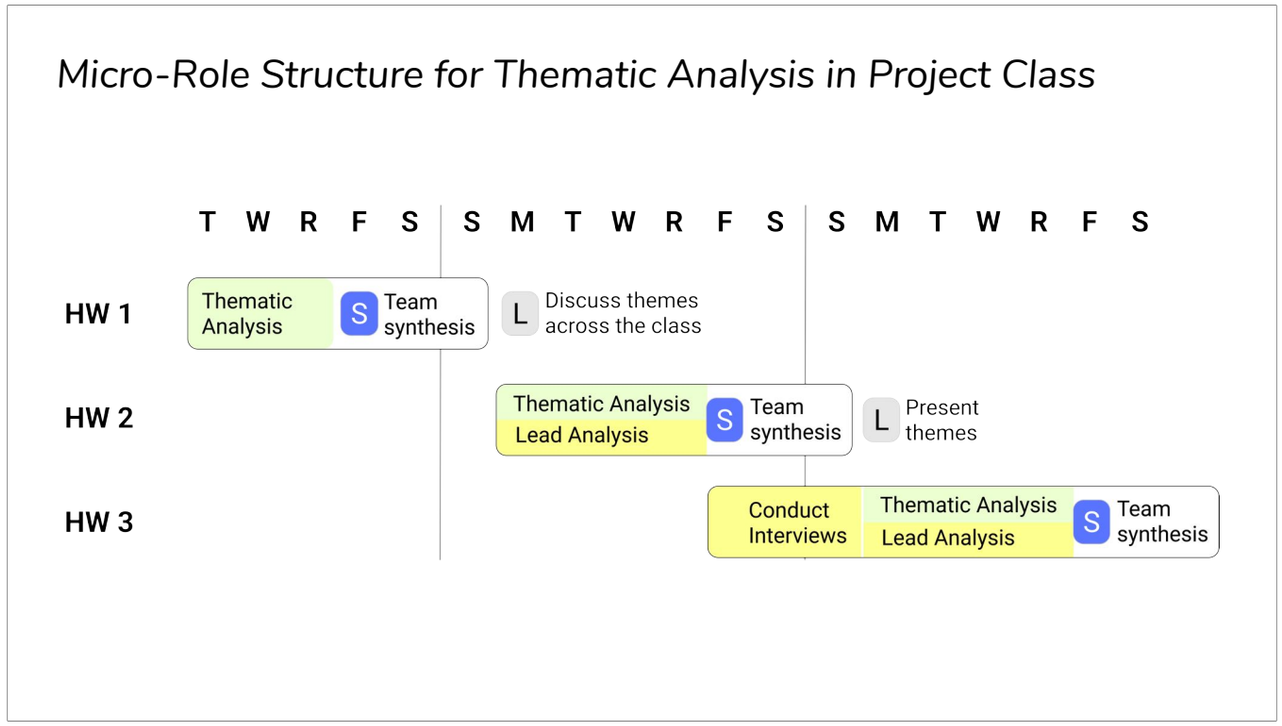
* And this worked. People who mostly had little to no past experience in HTML and CSS were able to complete the static views of applications and they really enjoyed the experience,
* One said, “The ability to learn the concepts in such a way that they are applied quickly and then practiced on pages for real-world use is rewarding and makes the material stick better”.



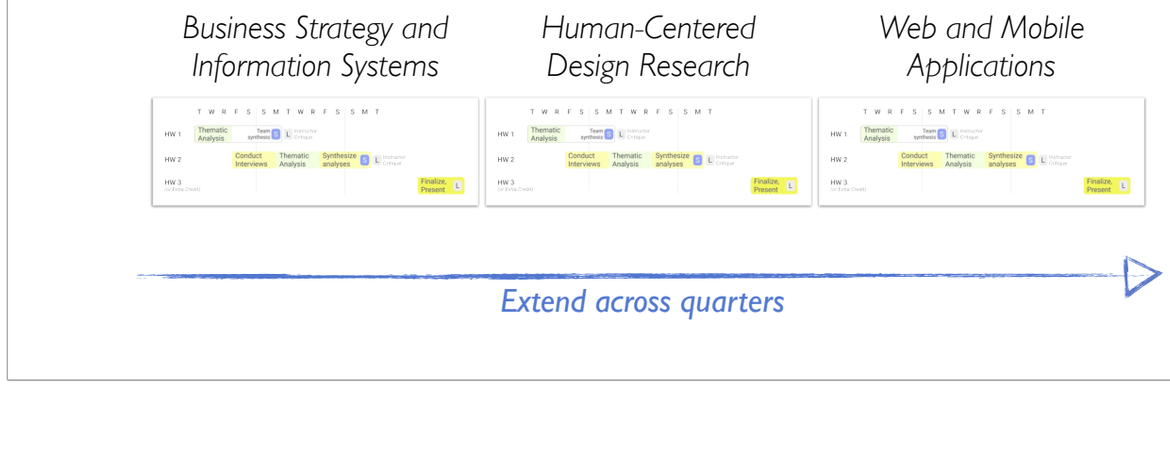
* That was just a pilot that we ran for a simple setting, but we use an expanded version as a learning resource in our web development teams,



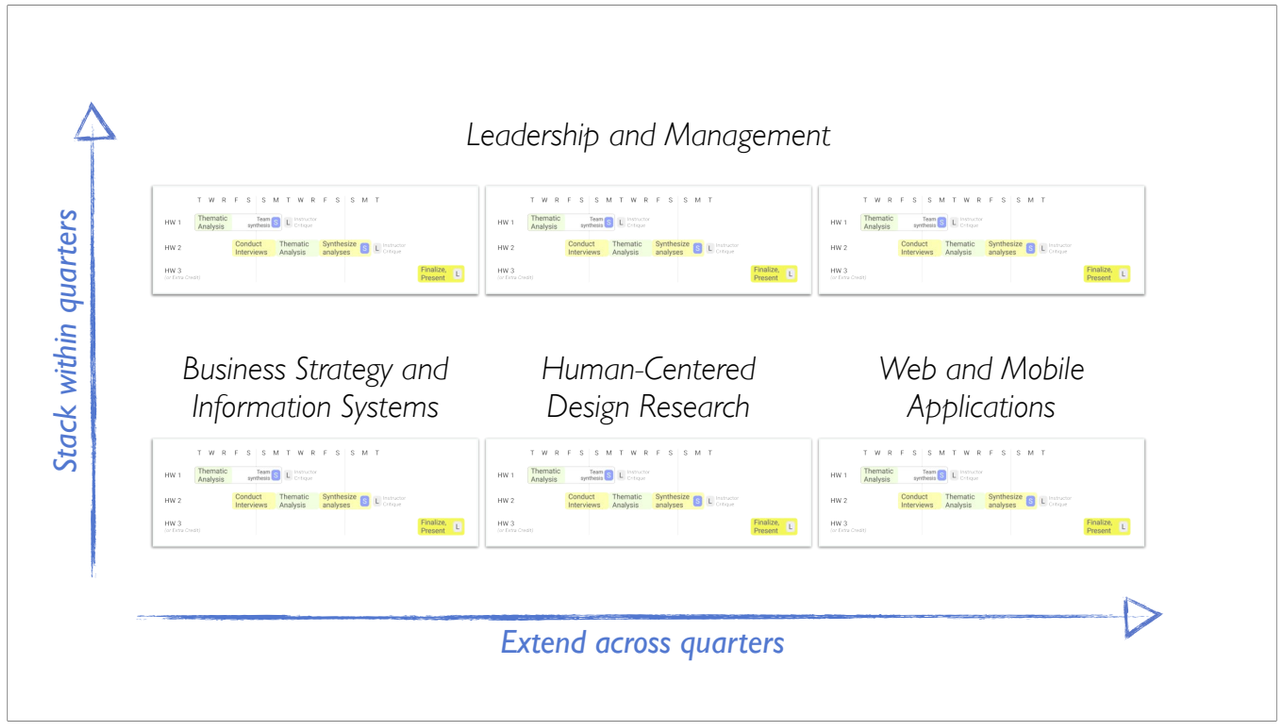
* And our research lab structure also draws from this,
* We have different skill-building teams where new members ramp up, research teams that move through different stages of research, and various leadership roles like team leads, lead mentors, and an executive team that help to advance projects, build up team members, and create lab-wide culture and process,



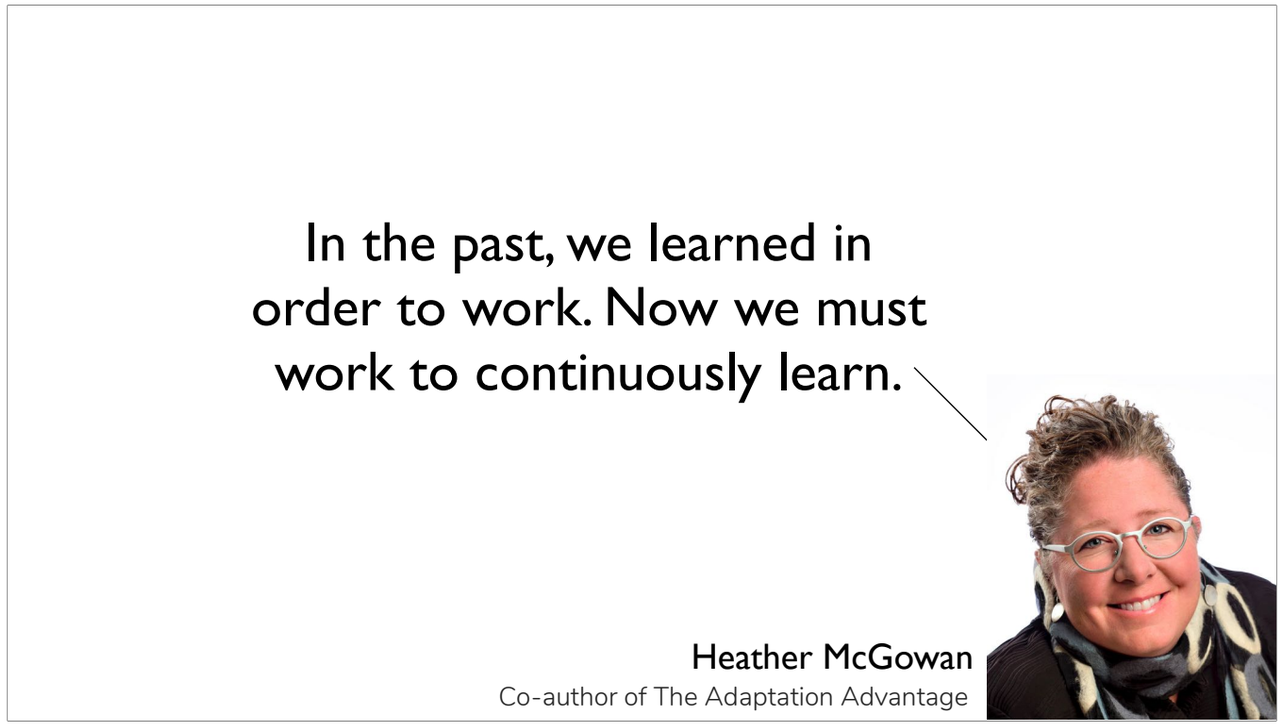
* We also use some of these ideas in my classes. So for example, when students are learning to analyze interviews of non-profit stakeholders,
* You can see that in the first week, everyone jumps in with analyzing interviews that I already conducted,
* But in later weeks, we begin to have multiple roles. Most people continue to practice thematic analysis, but those who did well in the first assignment take on leadership roles, and we sometimes have roles where people are conducting interviews for others to analyze,



* I think it'd be interesting to consider how we might restructure a series of courses or entire degree programs in ways that link learning with real-world community-engaged experiences,
* For example, you might have a sequence of classes where students can deeply understand the human and organizational context of nonprofits, and then design, prototype, and build applications to meet those needs,



* And you could have past cohorts return in a leadership class, where they take on managerial roles across the entire process,



* Heather McGowan says, “In the past, we learned in order to work. Now, in the whitewater world, we need be engaged in real-world work in order to continuously learn.”
* I think that’s going to require redesigning education around real-world work, and redesigning work in ways that intentionally consider how to integrate learning,

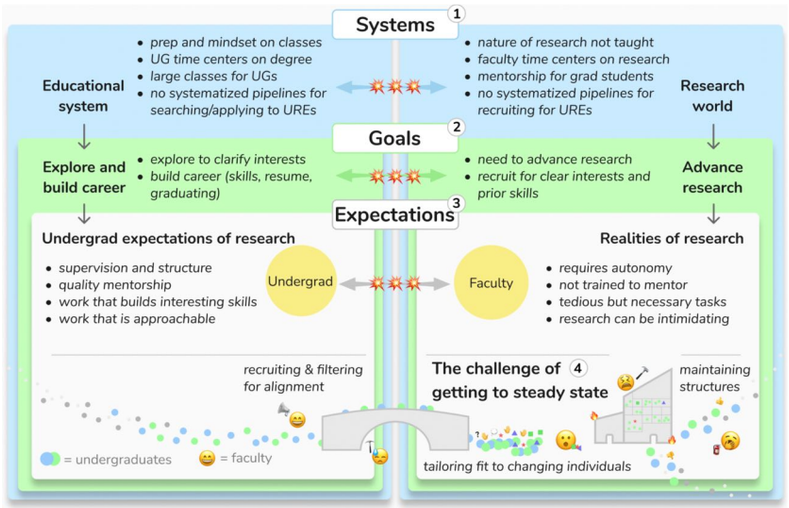
Idea #3

develop easy-to-engage experiences that build relationships

* So far we've been mostly talking at the level of designing programs or applications,
* The third idea I want to share relates to the challenge of making change within larger ecosystems, and it's to develop easy-to-engage experiences that build relationships to help overcome barriers in the larger system,

Barriers to undergrad research experiences

- *misaligned systems, goals, and expectations,*
- *significant time required to continuously create and maintain alignment.*

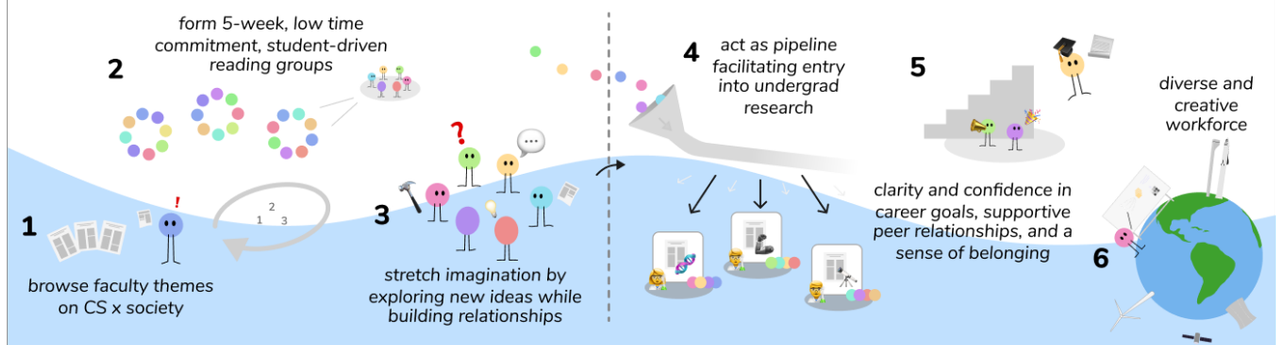


"It's usually not worth the effort unless you get really lucky": Barriers to Undergraduate Research from the Perspective of Computing Faculty
Rhea Sharma, Atira Nair, Ana Guo, Dustin Palea, David T. Lee
ACM Conference on International Computing Education Research (ICER) 2022

* Besides trying to involve a lot of undergraduate students in my lab, we've also spent time developing an understanding the different barriers in the larger system that make it difficult for other faculty to accept more undergraduate students into their labs

Exploratory Reading Groups

Fostering creative, relational, and student-driven exploration and establishing pipelines into undergraduate research experiences



Exploratory Reading Groups: A Scalable Approach to Creative, Relational, and Student Driven Exploration in CS Education
Dustin Palea, David T. Lee
ACM Technology Symposium on Computer Science Education, Research Track (SIGCSE) 2021

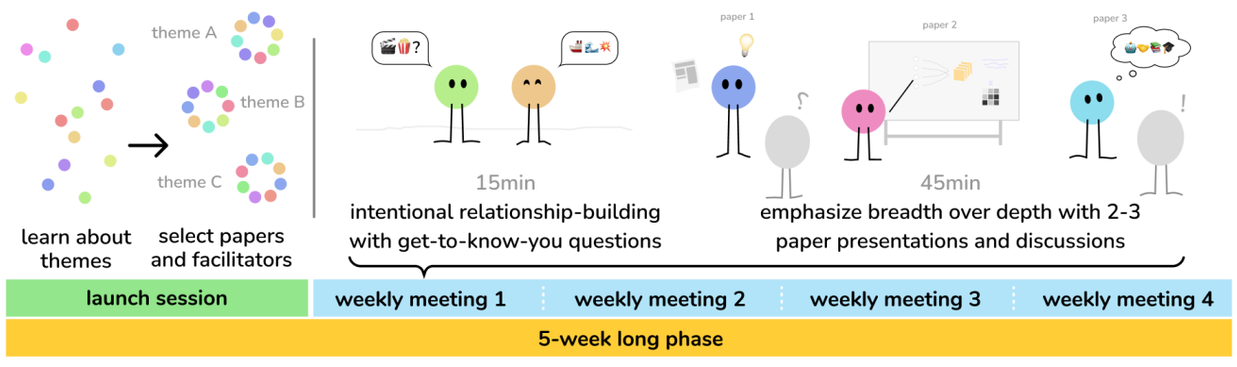
* One of the projects that I've found really interesting in relation to this is a program we started many years ago called Exploratory Reading Groups,
* The original motivation of the program had nothing to do with supporting undergraduate research. Initially, we were just trying to provide students with a really low time-commitment way to get exposed to the more creative and societally relevant aspects of computing early on,
* But as we ran the program, we found that the program design was also helping to strengthen pipelines into undergraduate research labs,

Very **lightweight** (just one-hour/week and present one paper)

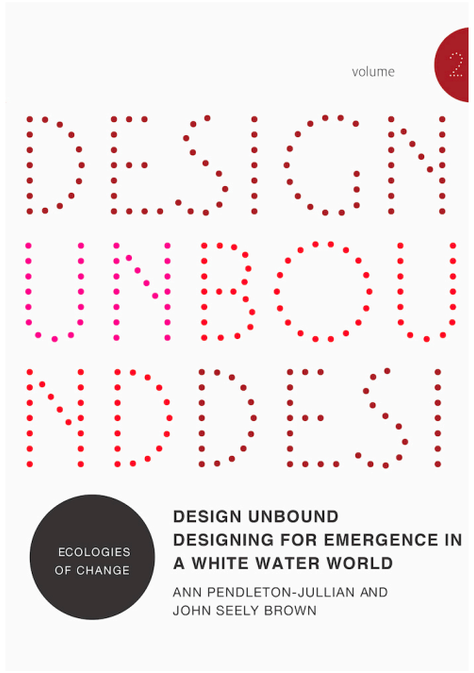
Completely **student-run** once groups are formed and launched

Time carved out for intentional **relationship building**

Designed for **broad exploration** rather than in-depth reading



* And the reason was because it was very low time-commitment for students and faculty, so it was easy to participate in,
* And we worked in intentional relationship building activities as part of the regular meetings,
* So people built supportive relationships, and these relationships smoothed different frictions in the system,
* For example, people got more confidence to apply or reach out from their peers, and they learned information from others already in research labs. We also saw an increased sense of belonging for minorities, and greater alignment in goals when students did join labs,

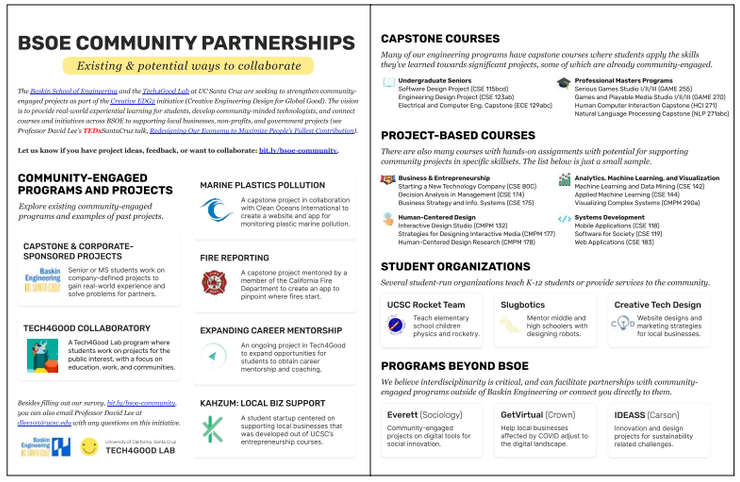


Systems of Action

"A coherent collection of interrelated action-intended components that… work systemically to **affect the context of the problem**… **They scale, enabling small actions to affect a larger social ecosystems** through work they do inside the system."

* In Ann Pendleton-Jullian and John Seely Brown's book on designing ecosystems, they discuss how ecosystems are hard to design because: 1) they're continually changing, 2) and they're often not all under your control,
* And so what you need to do is to design small scalable interventions that affect the context of the problem to affect the larger ecosystem. They call these systems of action,
* My reflection was that "designing easy-to-engage experiences that build relationships" are really great components of systems of action because they're easy to for people to participate in, and the resulting relationships that are formed can often be critical for influencing or smoothing frictions in the broader system

Pilot matchmaking program



BSOE COMMUNITY PARTNERSHIPS

Existing & potential ways to collaborate

The Baskin School of Engineering and the Tech4Good Lab at UC Santa Cruz are seeking to strengthen community-engaged projects as part of the Creative EDGE initiative (Creative Engineering Design for Global Good). The vision is to provide real-world experiential learning for students, develop community-minded technologists, and connect courses and initiatives across BSOE to supporting local businesses, non-profits, and government projects (see Professor David Lee's TEDxSantaCruz talk, Redesigning Our Economy to Maximize People's Fullest Contribution).

Let us know if you have project ideas, feedback, or want to collaborate: bit.ly/bsoe-community.

COMMUNITY-ENGAGED PROGRAMS AND PROJECTS

Explore existing community-engaged programs and examples of past projects.

CAPSTONE & CORPORATE-SPONSORED PROJECTS

Senior or MS students work on company-defined projects to gain real-world experience and solve problems for partners.

TECH4GOOD COLLABORATORY

A Tech4Good Lab program where students work on projects for the public interest, with a focus on education, work, and communities.

MARINE PLASTICS POLLUTION

A capstone project in collaboration with Clean Oceans International to create a website and app for monitoring plastic marine pollution.

FIRE REPORTING

A capstone project mentored by a member of the California Fire Department to create an app to pinpoint where fires start.

EXPANDING CAREER MENTORSHIP

An ongoing project in Tech4Good to expand opportunities for students to obtain career mentorship and coaching.

KAHZUM: LOCAL BIZ SUPPORT

A student startup centered on supporting local businesses that was developed out of UCSC's entrepreneurship courses.

Besides filling out our survey, bit.ly/bsoe-community, you can also email Professor David Lee at dlee111@ucsc.edu with any questions on this initiative.

Baskin Engineering UC SANTA CRUZ · University of California, Santa Cruz TECH4GOOD LAB

CAPSTONE COURSES

Many of our engineering programs have capstone courses where students apply the skills they've learned towards significant projects, some of which are already community-engaged.

Undergraduate Seniors
Software Design Project (CSE 115bcd)
Engineering Design Project (CSE 123ab)
Electrical and Computer Eng. Capstone (ECE 129abc)

Professional Masters Programs
Serious Games Studio I/II/III (GAME 255)
Games and Playable Media Studio I/II/III (GAME 270)
Human Computer Interaction Capstone (HCI 271)
Natural Language Processing Capstone (NLP 276abc)

PROJECT-BASED COURSES

There are also many courses with hands-on assignments with potential for supporting community projects in specific skillsets. The list below is just a small sample.

Business & Entrepreneurship
Starting a New Technology Company (CSE 80C)
Decision Analysis in Management (CSE 114)
Business Strategy and Info. Systems (CSE 175)

Analytics, Machine Learning, and Visualization
Machine Learning and Data Mining (CSE 142)
Applied Machine Learning (CSE 144)
Visualizing Complex Systems (CMPM 290a)

Human-Centered Design
Interactive Design Studio (CMPM 132)
Strategies for Designing Interactive Media (CMPM 177)
Human-Centered Design Research (CMPM 178)

Systems Development
Mobile Applications (CSE 118)
Software for Society (CSE 119)
Web Applications (CSE 183)

STUDENT ORGANIZATIONS

Several student-run organizations teach K-12 students or provide services to the community.

UCSC Rocket Team
Teach elementary school children physics and rocketry.

Slugbotics
Mentor middle and high schoolers with designing robots.

Creative Tech Design
Website designs and marketing strategies for local businesses.

PROGRAMS BEYOND BSOE

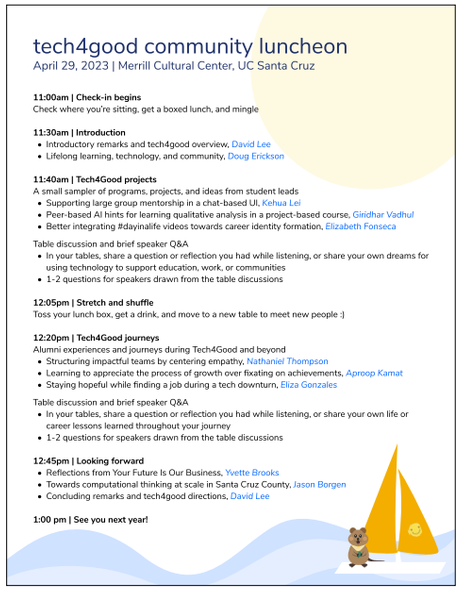
We believe interdisciplinarity is critical, and can facilitate partnerships with community-engaged programs outside of Baskin Engineering or connect you directly to them.

Everett (Sociology)
Community-engaged projects on digital tools for social innovation.

GetVirtual (Crown)
Help local businesses affected by COVID adjust to the digital landscape.

IDEASS (Carson)
Innovation and design projects for sustainability related challenges.

Annual luncheon



tech4good community luncheon

April 29, 2023 | Merrill Cultural Center, UC Santa Cruz

11:00am | Check-in begins
Check where you're sitting, get a boxed lunch, and mingle

11:30am | Introduction
- Introductory remarks and tech4good overview, David Lee
- Lifelong learning, technology, and community, Doug Erickson

11:40am | Tech4Good projects
A small sampler of programs, projects, and ideas from student leads
- Supporting large group mentorship in a chat-based UI, Kehua Lei
- Peer-based AI hints for learning qualitative analysis in a project-based course, Giridhar Vadhul
- Better integrating #dayinalife videos towards career identity formation, Elizabeth Fonseca

Table discussion and brief speaker Q&A
- In your tables, share a question or reflection you had while listening, or share your own dreams for using technology to support education, work, or communities
- 1-2 questions for speakers drawn from the table discussions

12:05pm | Stretch and shuffle
Toss your lunch box, get a drink, and move to a new table to meet new people :)

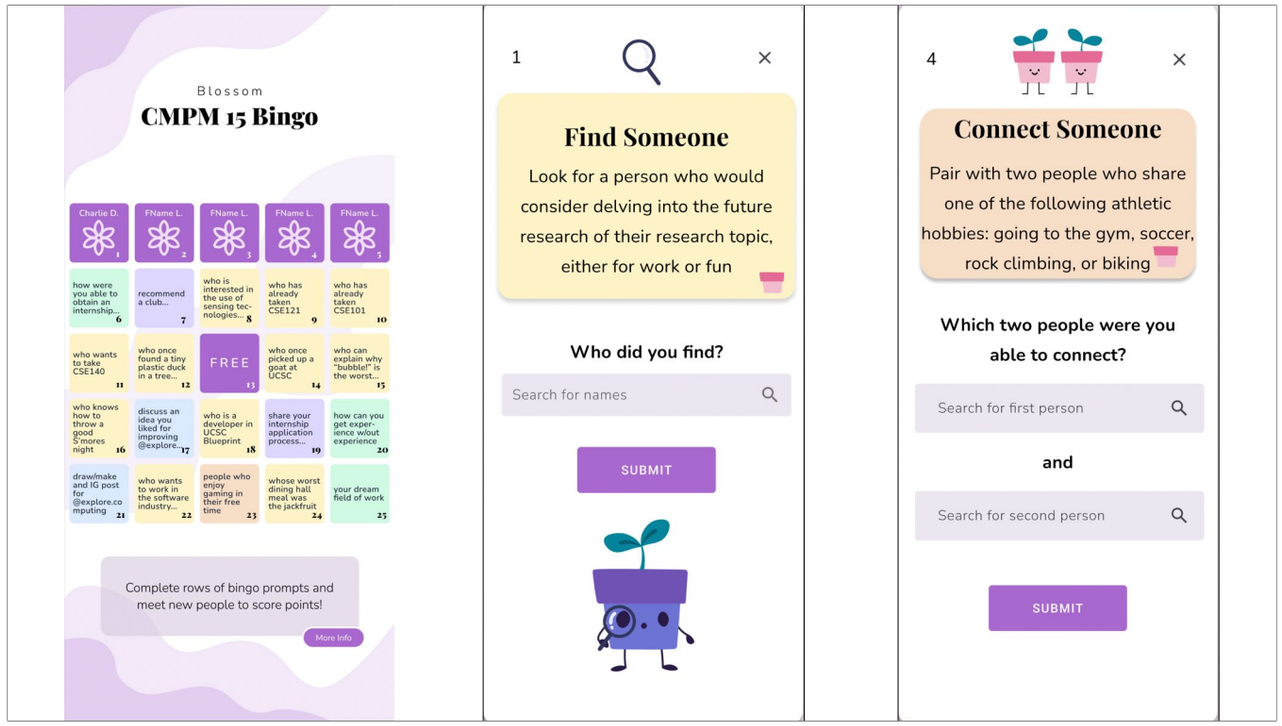
12:20pm | Tech4Good journeys
Alumni experiences and journeys during Tech4Good and beyond
- Structuring impactful teams by centering empathy, Nathaniel Thompson
- Learning to appreciate the process of growth over fixating on achievements, Aproop Kamat
- Staying hopeful while finding a job during a tech downturn, Eliza Gonzales

Table discussion and brief speaker Q&A
- In your tables, share a question or reflection you had while listening, or share your own life or career lessons learned throughout your journey
- 1-2 questions for speakers drawn from the table discussions

12:45pm | Looking forward
- Reflections from Your Future Is Our Business, Yvette Brooks
- Towards computational thinking at scale in Santa Cruz County, Jason Borgen
- Concluding remarks and tech4good directions, David Lee

1:00 pm | See you next year!

- There are many other examples of how one can create these kinds of easy-to-engage experiences that build relationships,
- For example, before we started our course-based community consultancy, we ran a pilot matchmaking program to help community members connect with existing programs on campus,
- It was easy for community members to participate since all they needed to do was to join a single interview to describe their project needs. Running this then helped us learn and established the relationships that led to our future projects,
- Another common approach is to organize community events. Last year, we ran our first tech4good community luncheon, and designed the structure to intentionally facilitate connections,



* We've also been thinking about how to design digital tools to support these kinds of experiences,
* We're working on an application called blossom based on the human bingo icebreaker activity in which you go around the room trying to get different squares on your bingo board signed off by others to complete a row, column, or diagonal,
* Normally, in human bingo, the squares just describe some attribute of a person, like "find someone who majored in anthropology", and it's just to get people to mix around.
* What we're doing is to define different kinds of squares like connecting two other people, or finding someone with similar interests to brainstorm ideas, and to define the prompts within the squares based on participant responses to pre-event surveys.
* We haven't built this out yet, but the idea is that this might help to better support mixing and relationship building based on the goals and interests people have coming into the event,

In designing ecosystems, think about **relationships** and how to support **the work of alignment**

"governments [are] composed [of] relations with constituents. It is precisely these ***relations***—not the deliberative transactions —that matter most in day-to-day civic life"

— Miriam Asad, Christopher LeDantec, Becky Nielsen, Kate Diedrick, **Creating a Sociotechnical API: Designing City-Scale Community Engagement**

* I really like the work in Christopher Le Dantec's lab on digital civics arguing that governments are not primarily built on services, they are built on relationships and trust,
* Their point is that civic tech can often focus on efficiency and scalability of services, but when that's the sole focus, it can actually end up ignoring or undermining the relationship-building that really matters, and the work of alignment that needs to be done,
* I think the same is true for designing ecosystems for education, work, and community engagement,

2

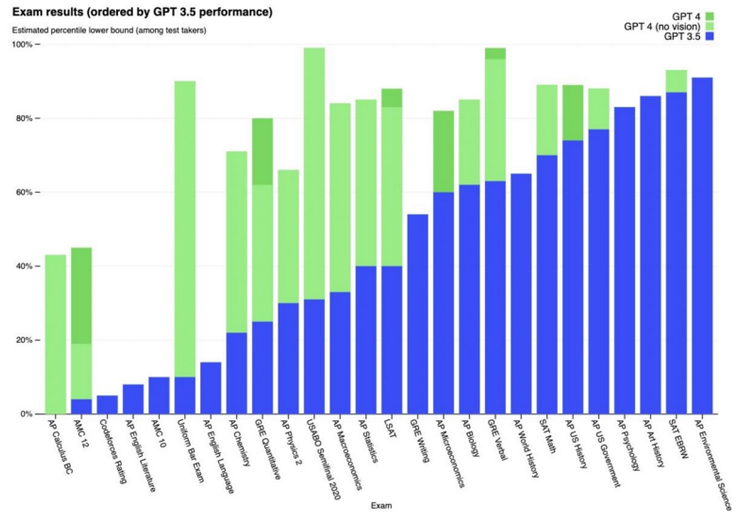
How might we imagine…

approaches to designing human-AI interactions that are more human-centered?

* Which brings us to the second question I want to explore together which is: how can we design the relationship between humans and AI to be more human-centered?
* I think many people here are aware of the pretty remarkable advances in AI recently, and the questions and concerns it raises around job displacement,
* A recent study estimated that 80% of all US occupations will have 10% of their work tasks affected and 19% of all US occupations will have 50% of their work tasks affected,

GPT-4 scored around 90th percentile in the following in 3/2023:

- SAT Math
- GRE Verbal
- Uniform Bar Exam
- AP World History
- USABO Semifinal
- ...

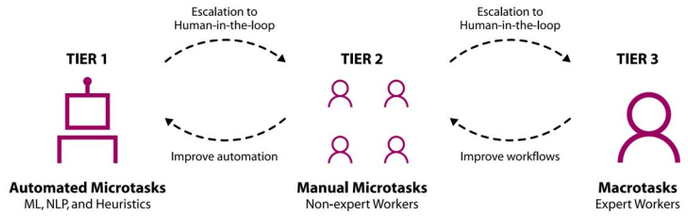


GPTs are GPTs: An early look at the labor market impact potential of large language models
Tyna Eloundou, Sam Manning, Pamela Mishkin, Daniel Rock

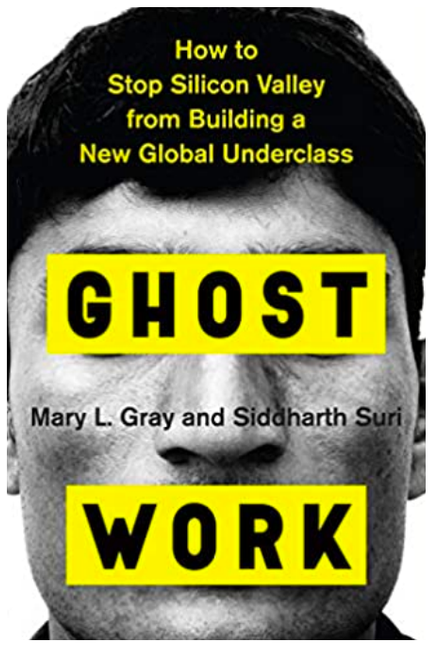
* This chart shows how GPT-4 scored on different standardized tests, and you can see that it scored around the 90th percentile or higher in almost half of these tests including SAT Math, GRE Verbal, the Bar Exam, AP World History, and so on. And the pace of improvement is very fast. The green bars represent the improvement over GPT-3.5, which was just a few months earlier, so I think it won't be long before it scores at the top of every single one of these,

Human-in-the-loop systems and micro-tasks

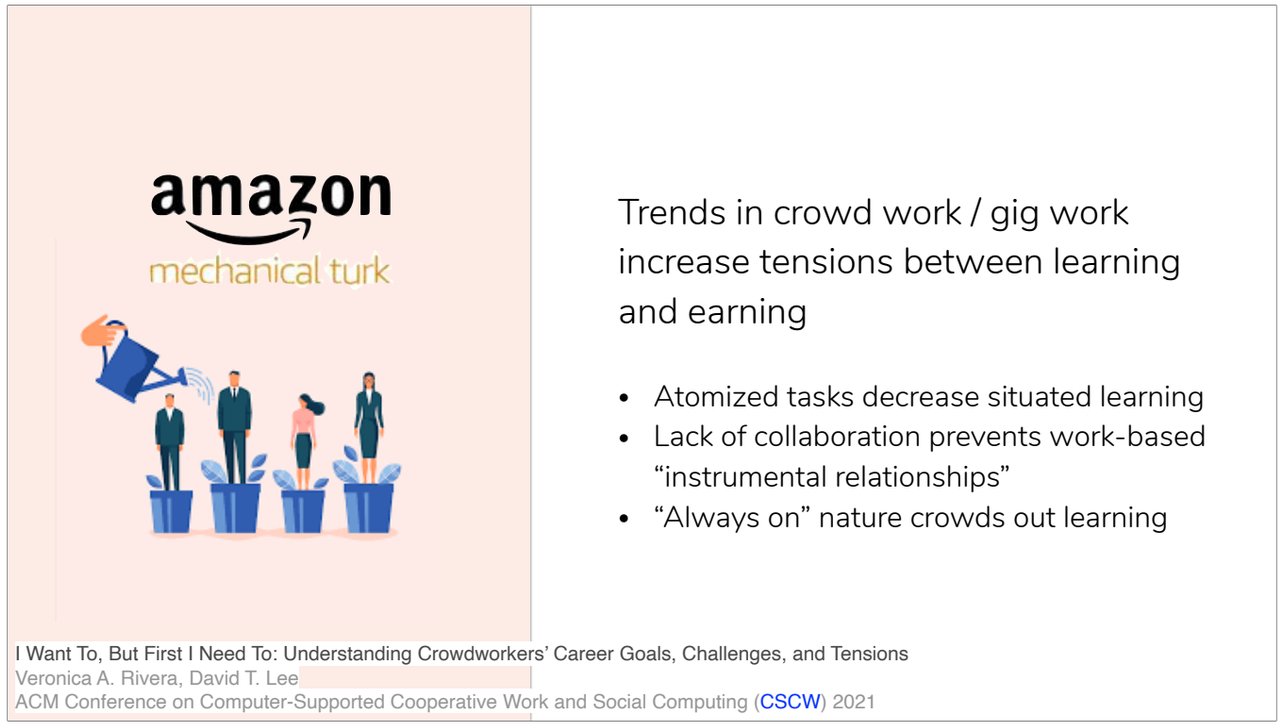
Expert work is atomized
Atomized work is automated



* But besides the problem of job displacement and the need for reskilling of the workforce, there is also a question about the type and quality of work that humans will be doing in the future, and how that's affected by how we're designing AI today, which is what I want to focus on,
* Suppose there's a task that is too complex for AI to do on its own. If you were to imagine how AI might be used to support this, you might think that it would be to support some part of the work to augment the capabilities of humans who are carrying out that complex task,
* But actually, a very common thing in designing AI systems in this scenario is to create human-in-the-loop systems, where AI is one orchestrating the overall work, and the AI system is carving out tiny micro-tasks for humans to do,
* There's a common general progression in which expert work is atomized into small micro-tasks, which are then eventually automated as AI collects data from that micro-task work,

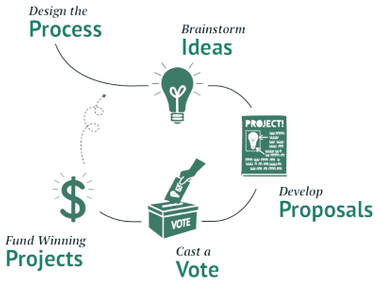


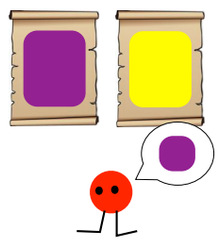
* So you have a dynamic that is pretty dystopian where humans are relegated to menial tasks that are algorithmically mediated,
* This is something that already happens. There's a book called ghost work that does an amazing job talking about how behind many of the digital or AI-powered services we use, there's actually a huge human labor force that we don't see, which has all sorts of different labor problems,
* For example, in many of these online labor markets, like Amazon Mechanical Turk, an algorithm could arbitrarily choose to reject, basically not pay, workers for completed micro-tasks that it deems to be low-quality, and there's nothing workers can do about it,



* In one of our projects, we spent some time interviewing workers on amazon mechanical turk to better understand the career goals workers had and challenges they faced working towards these goals,
* One of things we learned is that there is a really strong tension between learning and earning in these environments
    * Tasks are disaggregated from a broader project context, so you don't have the same kinds of situated learning,
    * Tasks aren't collaborative, so you're not developing the types of work-based "instrumental relationships" critical for networking and career growth,
    * And workers have to be constantly monitoring the platform for high-quality tasks, which makes it hard to pursue other goals even outside of work,

The Finnish Experiment: Crowdsourcing Off-road Traffic Law Reform





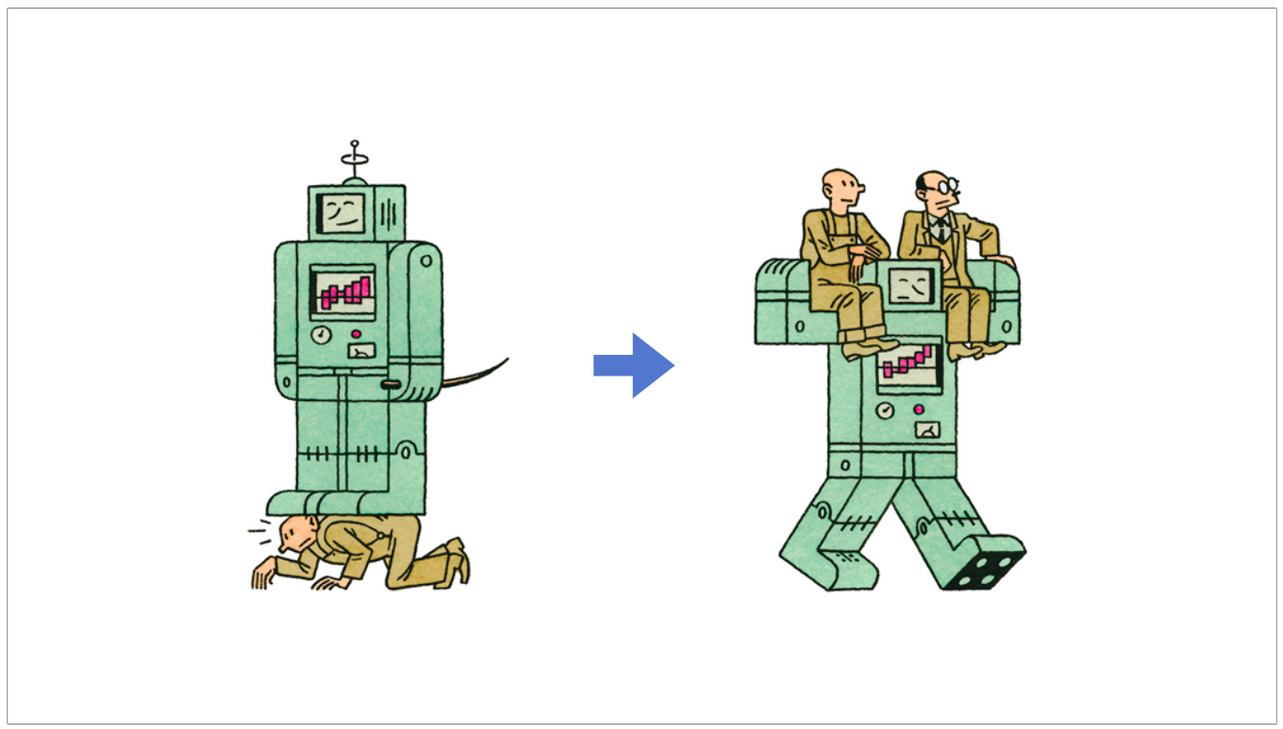
Crowdsourcing for Participatory Democracies: Efficient Elicitation of Social Choice Functions
David T. Lee, Ashish Goel, Tanja Aitamurto, Helene Landemore
AAAI Conf. on Human Computation and Crowdsourcing (HCOMP) 2014
Notable Paper Award

Efficient, Private, and eps-strategyproof Elicitation of Tournament Voting Rules
David T. Lee
International Joint Conference on Artificial Intelligence (IJCAI) 2015

Triadic Consensus: A Voting Rule for Crowdsourcing Applications
Ashish Goel, David T. Lee
Conf. on Web and Internet Economics (WINE) 2012

Towards Large-Scale Deliberative Decision-Making: Small Groups and the Importance of Triads
Ashish Goel, David T. Lee
ACM Conf. on Economics and Computation (EC) 2016

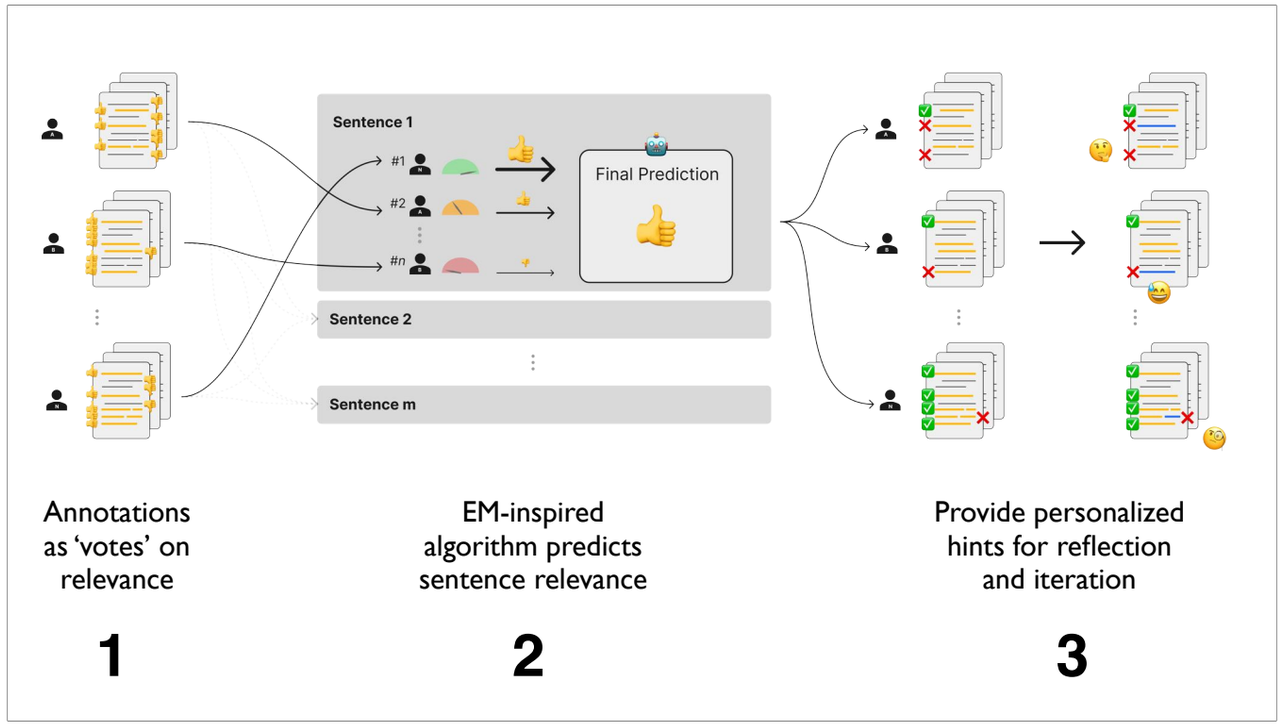
* This kind of micro-task approach to human-AI collaboration also exists outside of work contexts, for example, in participatory democracy initiatives where governments are trying to engage community members in making new laws or allocating a budget,
* I worked on these types of projects early on, and the basic idea is that if you're trying to engage everyone in proposing or voting on ideas, it's just not possible for everyone to even look at all ideas much less rank them,
* So instead of asking someone to rank all the proposals, you might instead have algorithms that elicit pairwise comparisons from people, or other types of small contributions, and the algorithms can orchestrate these towards achieving different collective outcomes,
* There are a lot of cool things that these kinds of algorithms can do, but I gradually started to feel that many issues communities face are really complex, and there need to be dynamics that go beyond just aggregating micro-task work to thinking about how to facilitate richer conversations and collaborations.



* So this is something we've been thinking about a lot in Tech4Good: how can we develop AI that augments human strengths, that promotes richer collaborative dynamics, worker upskilling, and so on.
* Like in the previous theme, I want to share three ideas from our journey so far,

Idea #1	
repurpose micro-task algorithms for use in rich collaborative dynamics	

* The first idea is that you can sometimes find contexts within large collaborative dynamics in which you can apply micro-task algorithms in ways that augment richer forms of human engagement, rather than disaggregating human contributions into tiny pieces,

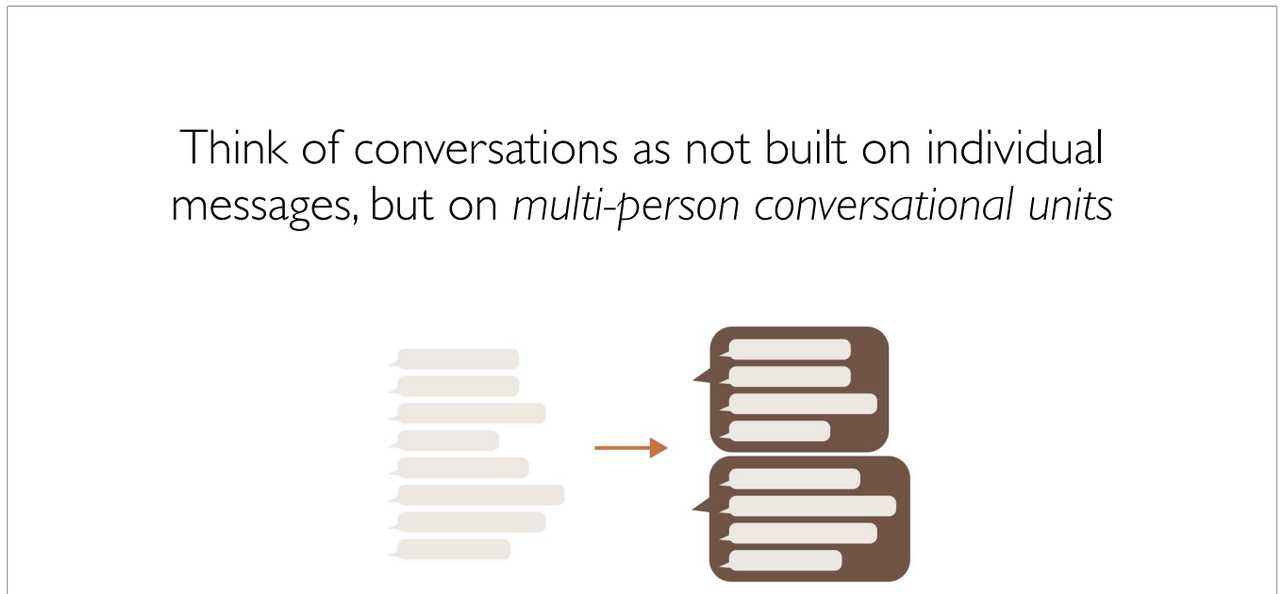


* We actually already gave an example of this earlier when I talked about providing personalized peer-based AI hints to students learning to conduct a thematic analysis on interview data,
* As you might recall, students in our class and using our platform, are engaged in the full process of thematic analysis rather than micro-task work, but by interpreting their submitted annotations as a collection of micro-task labels, of whether a student thinks each sentence is relevant or not relevant to the research question, we’re able to leverage these algorithms to facilitate a class-wide conversation,

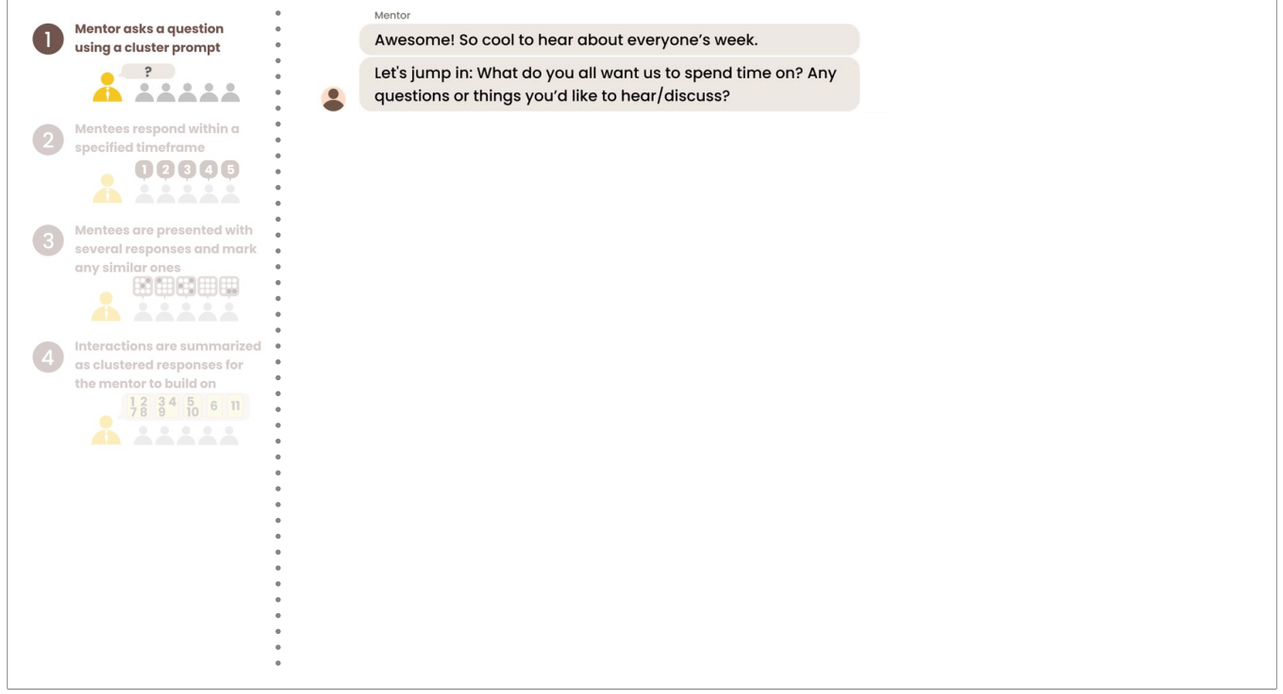
How can we provide mentorship to support our undergrads in the transition into the workforce?

How might structured chat environments help create personalized interactions that also scale?

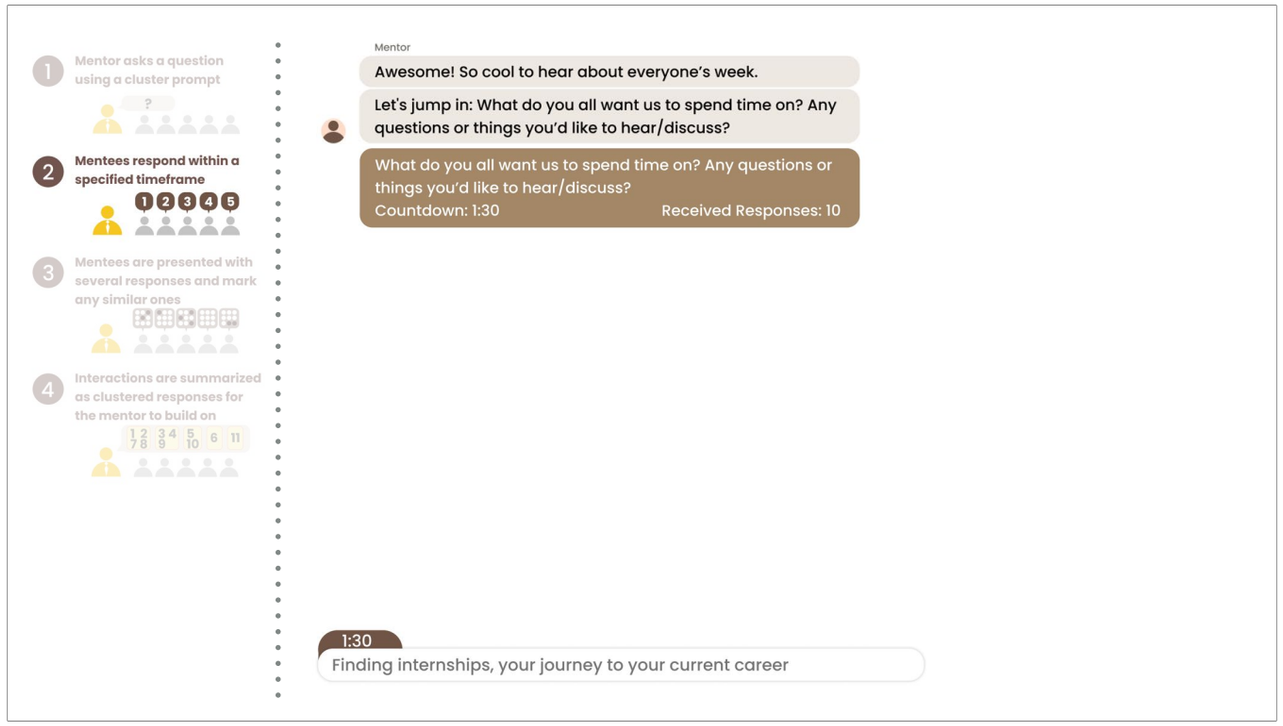
* Let me give another example of a project that demonstrates using micro-task algorithms in ways that still support rich human interaction,
* The project centers on a platform we built for large group mentorship in a chat-based UI.
* We wanted to explore whether we could enable industry professionals to mentor 30-50 students at a time in a chat interface,
* This initially sounds kind of stupid, because as we all know, if you have a lot of people in a chat conversation, either most people aren’t fully engaged or if they are, it’s completely chaotic.
* But we had the idea that maybe structured chat environments might help us address that issue, and that would help a lot of students who are looking for mentors,



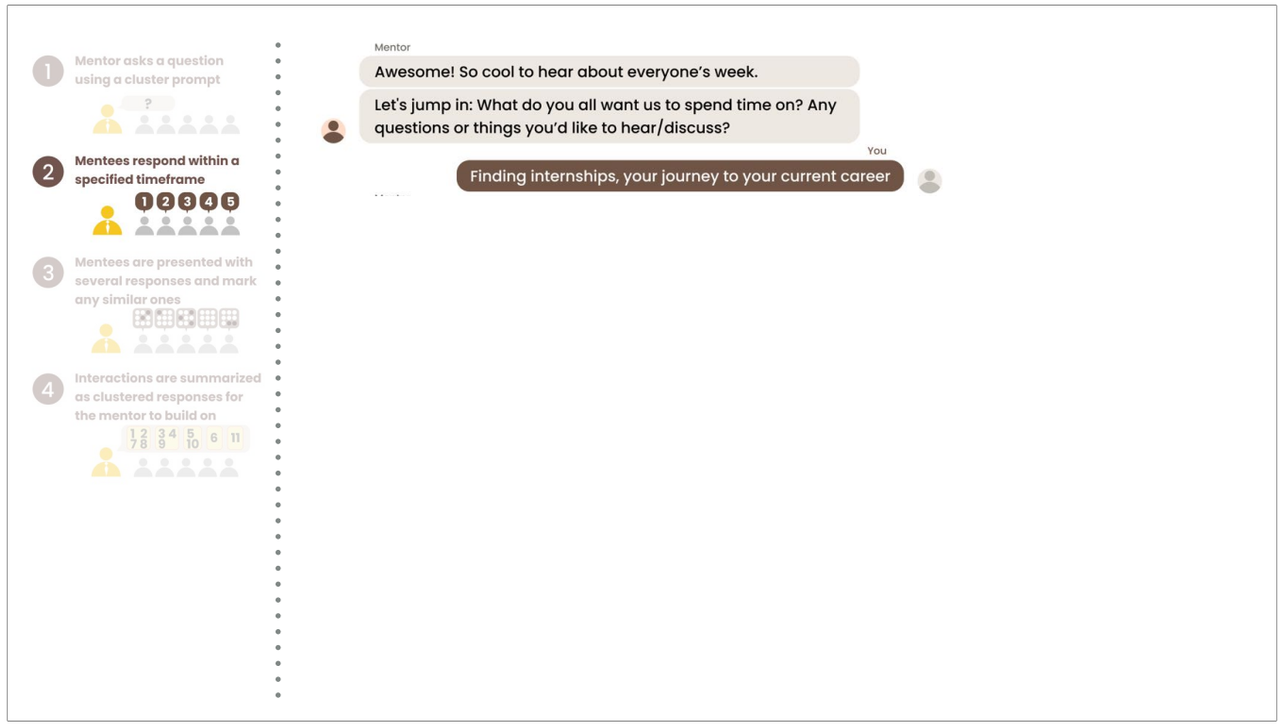
* What we ended up doing was to think about conversations, not as composed of individual messages, but as built on larger multi-person conversational units that might involve many people in small conversational exchanges, but in ways that can be summarized compactly in the main dialogue. Here's an example of what I mean:



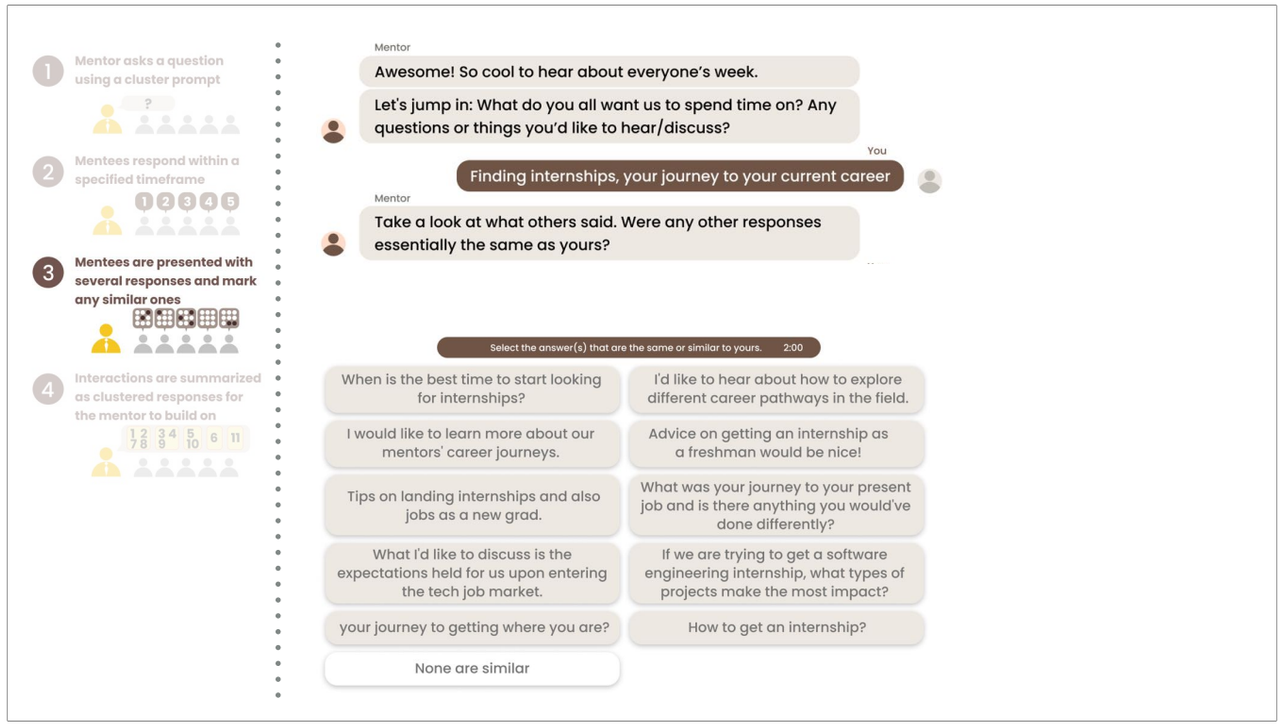
Suppose a mentor is starting their first session. They've done some introductions, and now they want to hear what everyone wants to talk about. So they ask the mentees, just as if it were a small group: "What do you all want us to spend time on? Any questions or things you'd like to hear/discuss?"



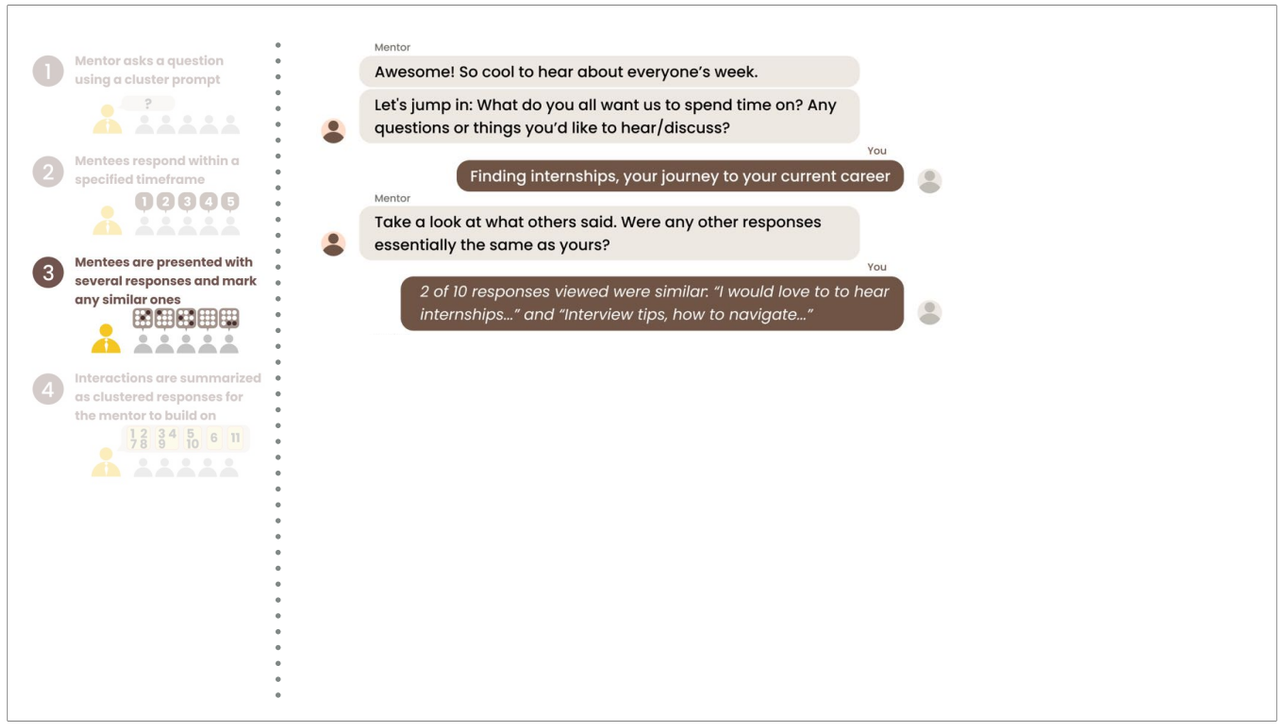
The mentees see that text and then have a certain amount of time to type a response. So for example, this person says I'd like to talk about "Finding internships, your journey to your current career"



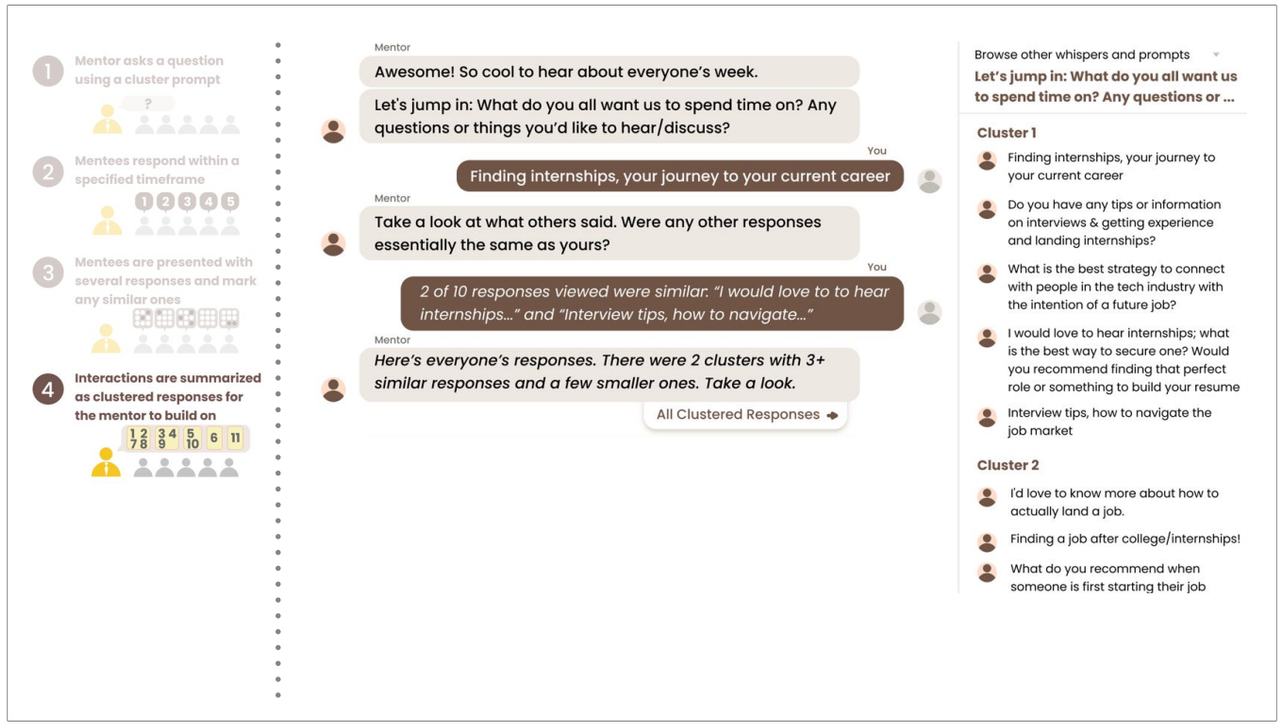
They submit and it gets added to the chat, but they don't see any responses that others type.



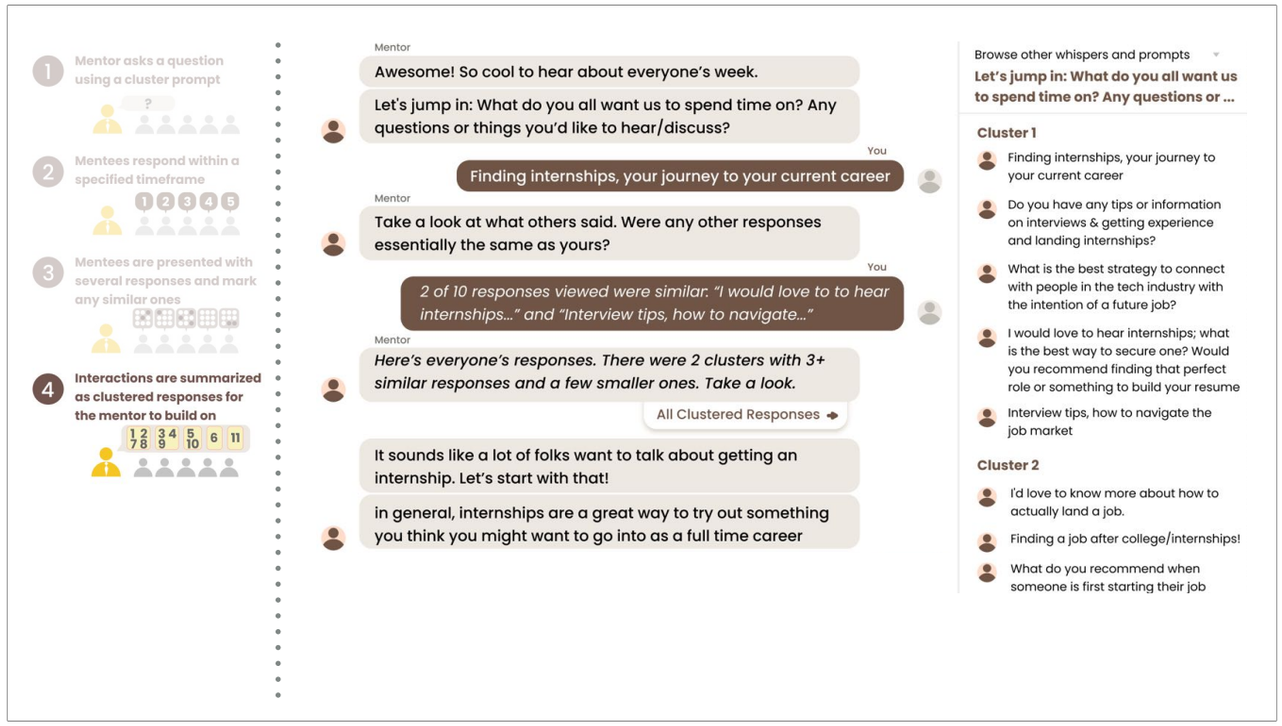
Instead, we have an algorithm that, for each person, picks 10 responses from other people in a carefully defined way, and ask them to “Select any that were similar to their own response”.



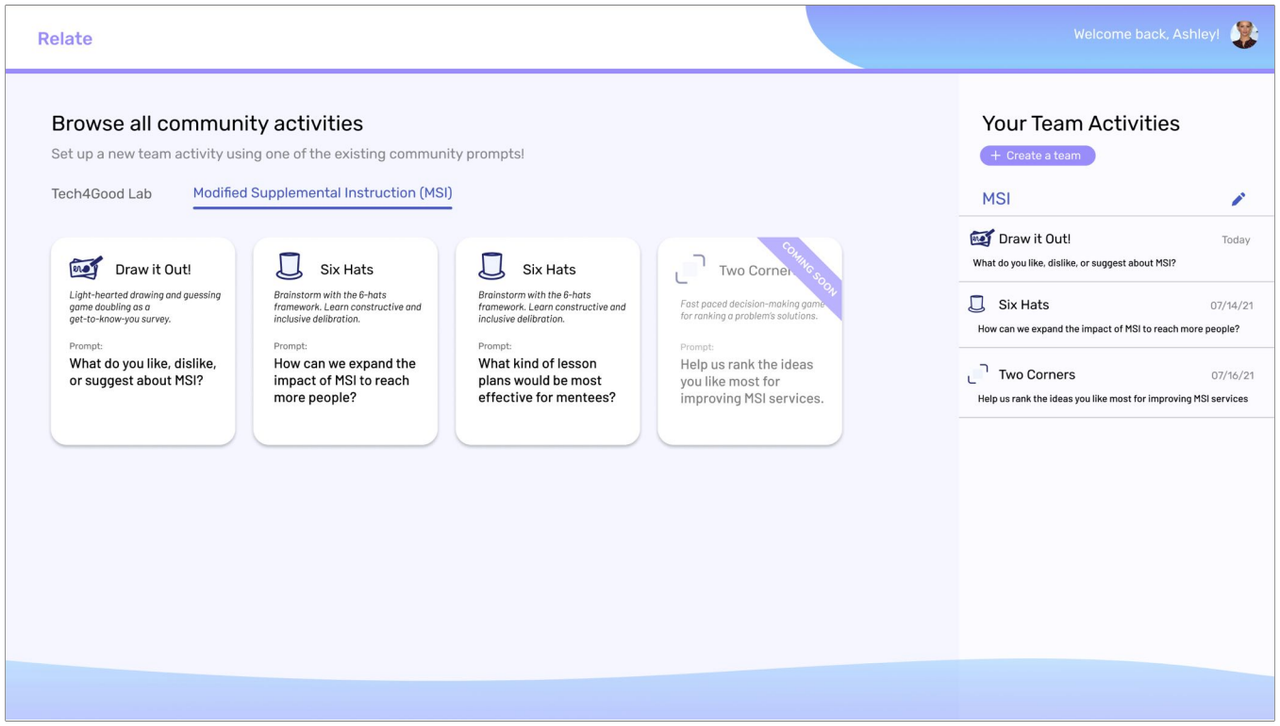
That gets added onto the chat



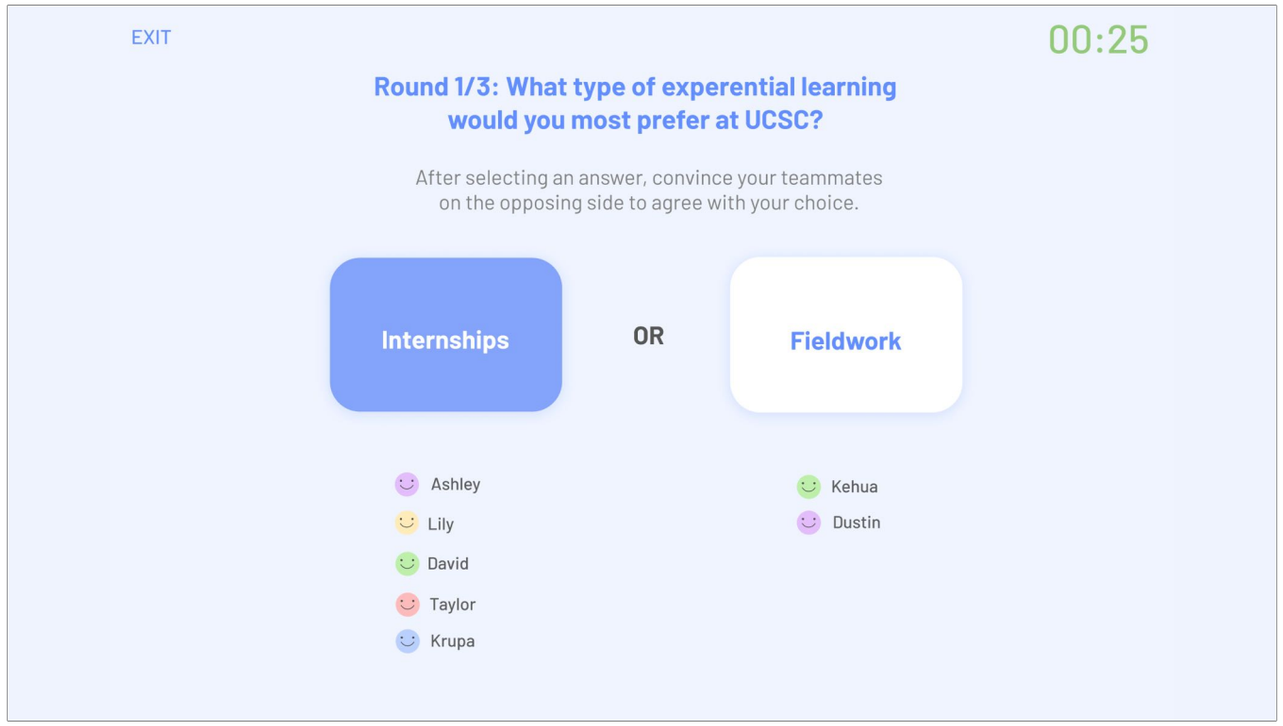
* After a set amount of time, our algorithm forms a network out of the similarity responses to identify clusters that are then grouped together so that people can browse in more detail in the side panel.
* In this way, everyone is able to engage, but that engagement is summarized so that it's easy to see that there are a bunch of people interested in understanding how to land an internship, getting your first job after graduating, understanding interview techniques, and so on.



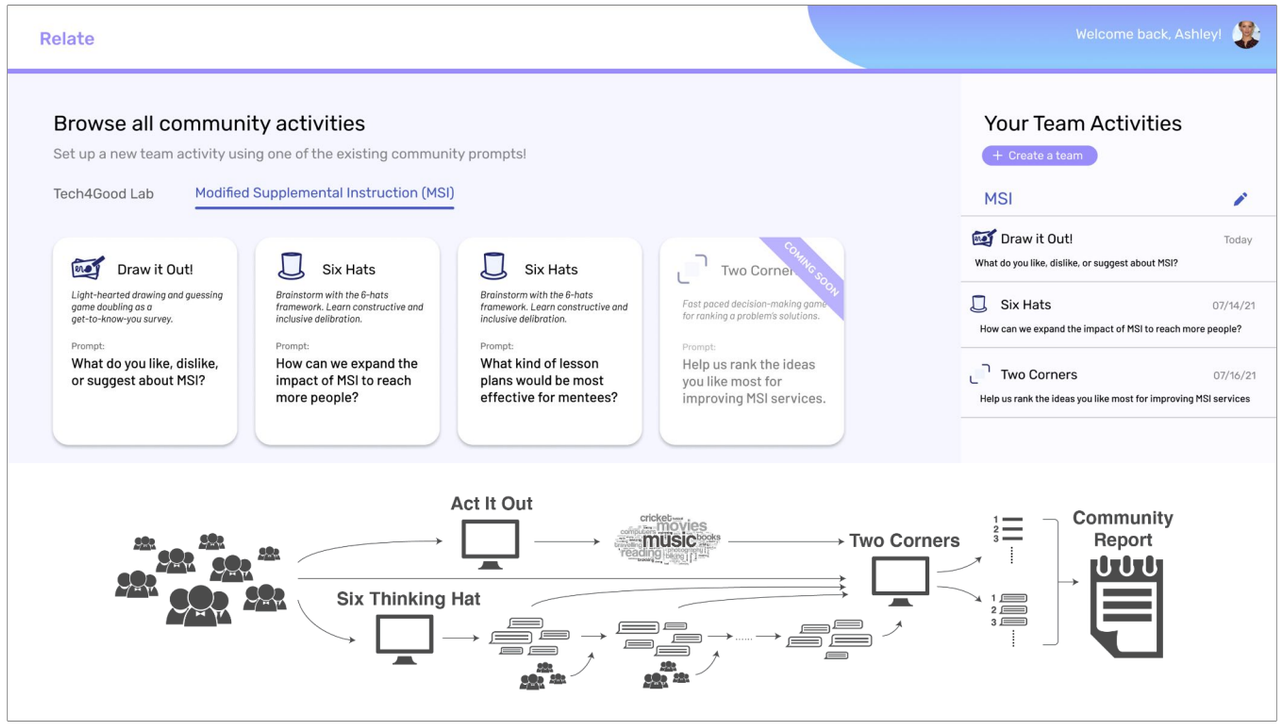
* The mentor can then build on those summarized responses in continuing the mentorship session,
* This particular multi-person conversational unit would be even easier to implement today with GPT-4, because you could use it to just directly cluster all the responses, but it illustrates how you might use micro-task interactions and algorithms to facilitate new kinds of large group conversations where everyone can be engaged, where people can find connections across the group, while still maintaining a coherent conversation, and I think there are a lot of interesting directions to take this idea,



* I'll mention one more platform we've been working on that shows a different way to repurpose micro-task algorithms,
* The platform centers on facilitating participatory engagement in a community. It has these different short team-building activities that you can play in teams or groups of friends,



* For example, one of the activities might involve comparing ideas, but instead of just reporting individual preferences, you’re doing it in a group,
* So you actually get to discuss and learn from others, maybe change your opinion,



* These group activities can then be composed just like individual micro-tasks, so certain activities elicit and flesh out ideas, while others help to rank and aggregate them, in a large-scale collaborative participatory dynamic that is importantly, also built on relational interaction,

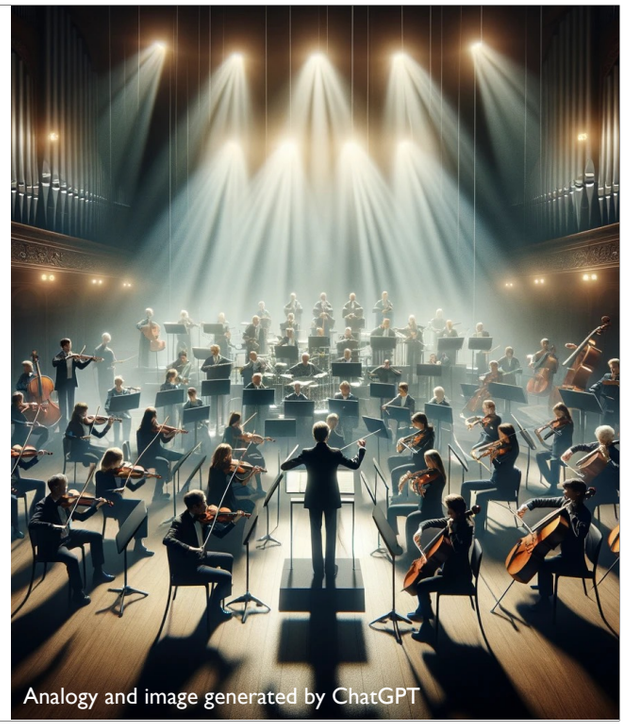
Idea #2

build new models of human-AI computation around human strengths

* The second idea for designing more human-centered human-AI interactions is to develop new models of human-AI computation that center around uniquely human strengths,
* What do I mean by “human-AI computation”? Well computation is just how you use step-by-step processes to compute or achieve some desired output or outcome,
* but the ways we think about how to organize humans and machines together to achieve outcomes (how we think about “human-AI computation”) don’t fit what makes human capabilities,

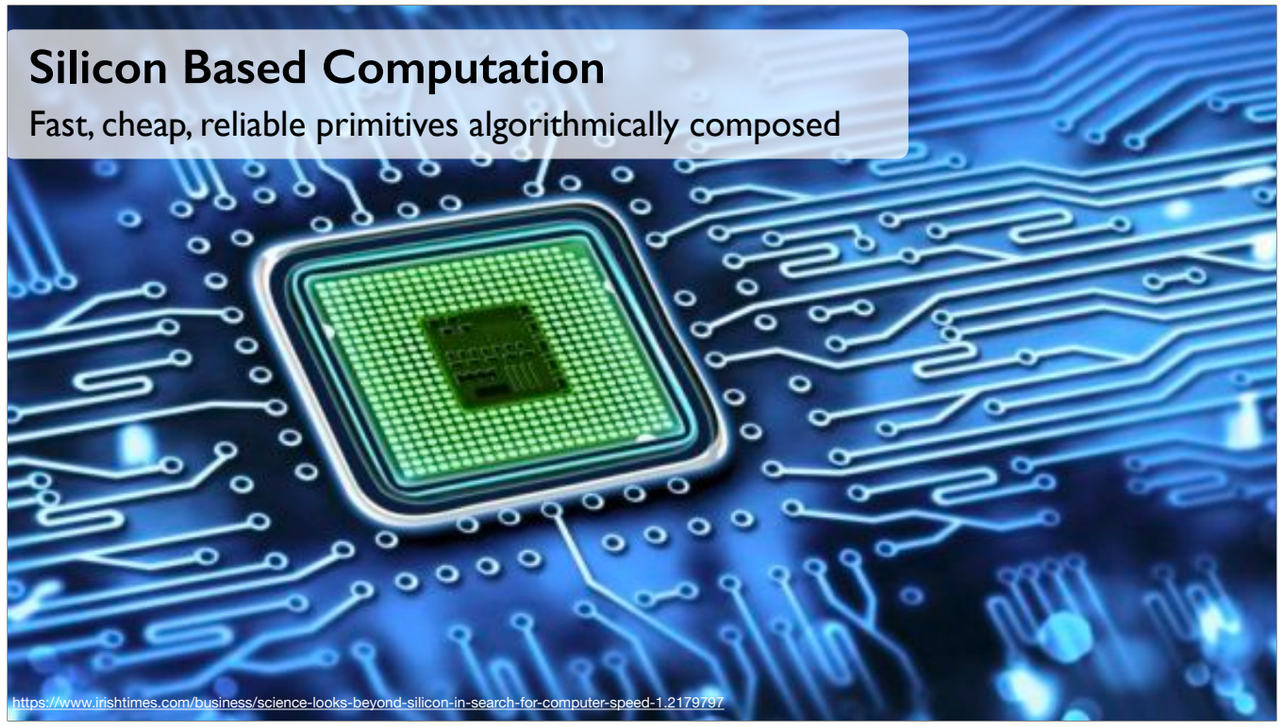
Imagine an orchestra where...

A computer assigns tiny, specific tasks to each musician like playing one note at a time. Yikes!

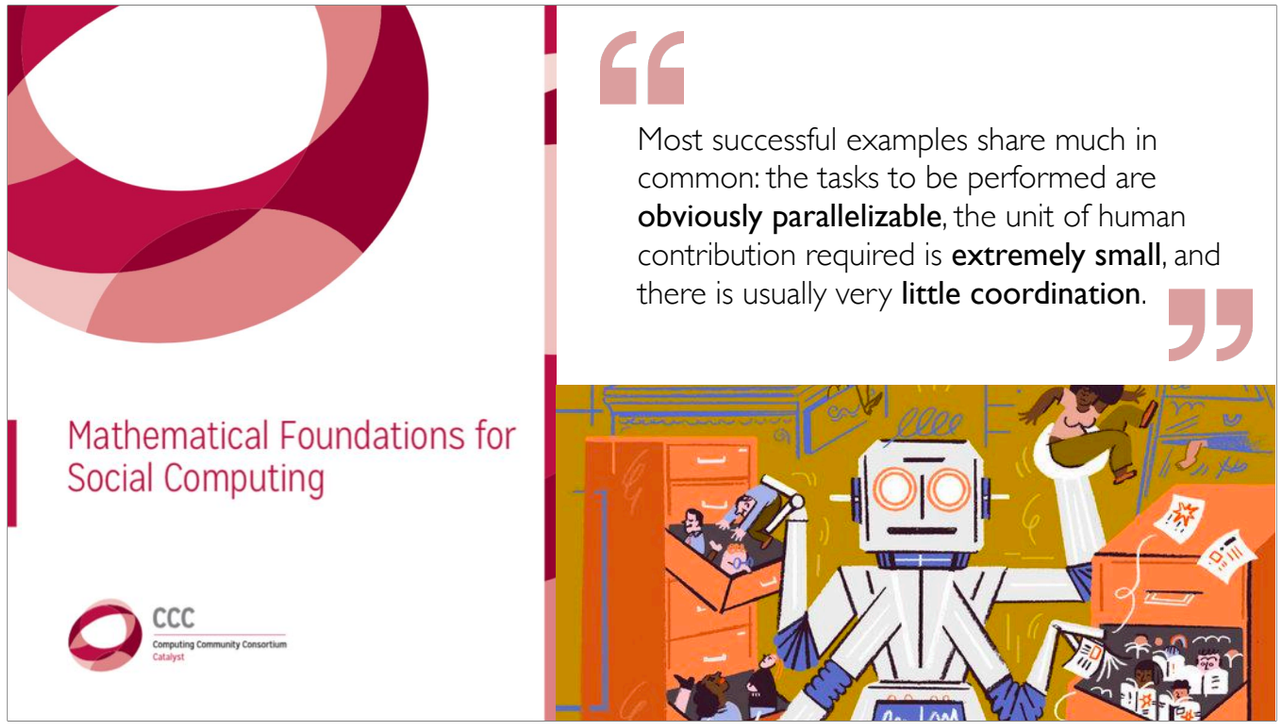


Analogy and image generated by ChatGPT

* Here’s an analogy, imagine an orchestra where each musician is directed by a computer that assigns tiny, specific tasks to each person like what note to play at any given time,
* That’s what’s happening when we think about “human-AI work” in the same way we think about writing computer programs,
* We need a completely different way of thinking about the whole process, because the real strength of an orchestra is musicians not only playing their parts but also listening to each other, adapting, and creating a harmonious and dynamic performance together,



* In normal silicon-based computation, we start from the devices we have and the really simple things they can do, the computational primitives, and build up from there with algorithms to complete complex tasks,
* But that's led us to think about human-AI work in the same way, where humans are basically devices carrying out simple computational primitives, that need to be algorithmically orchestrated towards larger collective outcomes,



* There's a challenge problem described in this vision paper on "mathematical foundations for social computing" that is basically challenging researchers to take this to the next level,
* They imagine a future in which people could write a computer program for some huge goal requiring both humans and AI, and have that program automatically produce plans and to orchestrate efforts to achieve the goal,
* But in dreaming about this future, you can see that they're mostly assuming a silicon-based micro-task model to achieving it. They talk about how, when you look at successful crowdsourcing examples today, humans are doing very simple small tasks that rarely involve coordination, and so they suggest that if we are to achieve a future in which programs that can automatically orchestrate larger human-AI efforts, they should probably also center on these same micro-task dynamics,

* But I think we can agree that the strength of humans isn’t that they’re great at carrying out tiny primitives,
* It’s that they can take really large underdefined tasks, and figure out how to break them down, delegate and collaborate to get them done,
* So we need new models of human-AI computation — ways to systematically think about how to organize many people with AI to accomplish complex goals — that can capture this collaborative ability, and hopefully, can drive the development of AI that augments humans engaged in rich collaboration rather than AI orchestrating humans in micro-task work,
* I want to talk about some preliminary steps towards this.
* First, what makes a successful model? It needs to allow us to systematically reason about how to organize around accomplish general complex tasks, and it has to incorporate key human factors in ways that capture what’s at the heart of human collaboration, what makes it challenging,

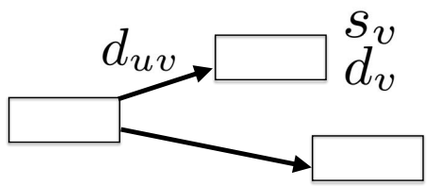
"At the core of this conception of cooperative work is the notion of **interdependence** in work."

"...by entering into cooperative work relations, the participants must engage in activities that [are] extraneous to the activities that contribute directly..., [implying] an overhead cost in terms of labor, resources, time, etc."

Schmidt, Bannon, CSCW 1992
Taking CSCW seriously: supporting articulation work

A Task Interdependency Model of Complex Collaboration Towards Human-Centered Crowd Work
David T. Lee, Christos A. Makridis
Submission Under Review

* I've been developing a model, and the key factor I've started with is the **interdependencies** central to cooperative work. Basically, when tasks are divided up between multiple people, they impose extra costs for communicating, coordinating, catching up on context, things that don't directly contribute to the services or product, but are necessary.



TASK GRAPH

$$G = (V, E, s, d)$$

WORKERS

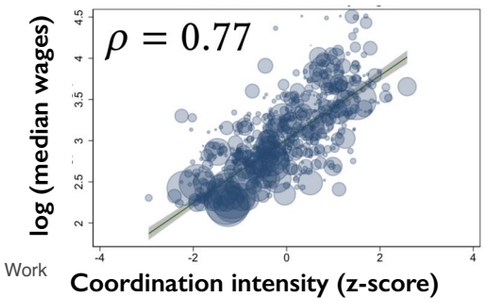
$$I$$

A Task Interdependency Model of Complex Collaboration Towards Human-Centered Crowd Work
David T. Lee, Christos A. Makridis
Submission Under Review

* Without getting into details, essentially, we model large tasks as broken down into smaller subtasks that can be divided up among workers,
* But when you divide interdependent work between different people, there are context costs determined by the graph structure and interdependency parameters,

Findings from our task-interdependency model of human-AI work

1. ***Scalability***: there are fundamental limits to feasible work even with infinite workers, and these limits give insights on trends in complex crowd work
2. ***Learning***: experiential reskilling will be limited when interdependencies are high, but situated learning also requires some interdependence
3. ***Occupations***: simple analyses on occupational coordination intensity and wages were reflected in data on the US economy



A Task Interdependency Model of Complex Collaboration Towards Human-Centered Crowd Work
David T. Lee, Christos A. Makridis
Submission Under Review

* We applied the model to different settings to see if it could recover things we already see and surface new insights. I was going to walk through some mathematical results, but my wife saved you guys after listening to an earlier version last night :)
* A question we are often interested in is what is computable, what's achievable? We showed that interdependencies can limit the amount of work that can be done, even if you have an infinite number of workers, and that the expressions for this limit help us understand why complex crowd work in the past has tended to gravitate towards micro-task work. They suggest that an important direction for the future is to find ways to reduce the context costs in collaborative work, and to support humans in the process of dividing up and delegating work,
* The model also allows us to begin reasoning about some of the challenges to supporting experiential or situated learning when interdependencies are either too high or too low. I think this is particularly important because I think that models of human-AI computation need to not only help us reason about achieving outcomes, but also whether the process is helping to provide learning and growth for the workers participating in it,
* We also applied the model to traditional work, and compared with occupational data on the US economy, which produced some analyses that were a nice validation that interdependencies are a useful way to create models that help us reason about important aspects of complex collaboration,
* There's still a long way to go, but the main point is that we need new models that allow us to reason about human collaboration, so that our visions of human-AI work are not so silicon-centric, but look more like models of computationally-enhanced organizations and cooperatives,

Idea #3

design AI to support
reflective journeys
and communities

* The third idea I want to share for designing more human-centered human-AI interactions is to consider how AI can be used to support authentic reflection, personal journeys, and communities that can support that,

How might we support people in taking time to reflect and find their center to help them navigate change?

Theories of identity development describe it:

- Providing a sense of coherence to self-knowledge and goals,
- Involving an extended process of exploration, making, and reconsidering commitments,

* First, what do I mean by personal journeys? I mean the longer-term process through which we navigate life, process experiences we've been through, and form our theory of self and identity, the goals, values, and beliefs to which we are committed around different areas of our life,
* If you're trying to support career exploration, for example, it's not just about providing information or opportunities, it's also about helping people think through what they value in work, what they enjoy doing, what they're good at, and so on.
* Theories of identity development describe developing that sense of self as something that happens through an extended process of exploring, making and reconsidering different commitments towards finding authentic commitments. It takes time.
* Researchers also describe having a sense of self as vital for people to be able to participate in social systems, basically all the different parts of society, so when we're in a whitewater world where things are continually in flux, it will be particularly important to help people find their center,

https://courses.lumenlearning.com/adolescent/chapter/identity-development-theory

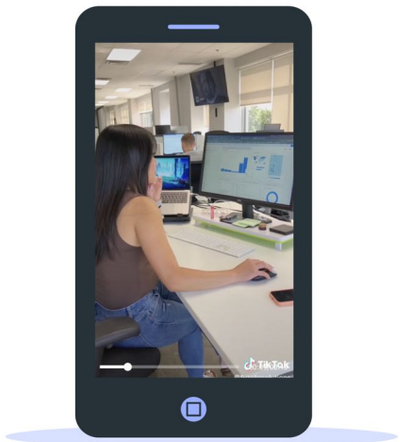
To what extent are #DayInTheLife videos helpful for career exploration?

Benefits include:

- Valuable first-hand depictions
- Digestible formats reduce barriers

However:

- Lack of integration and design of environment limits these benefits



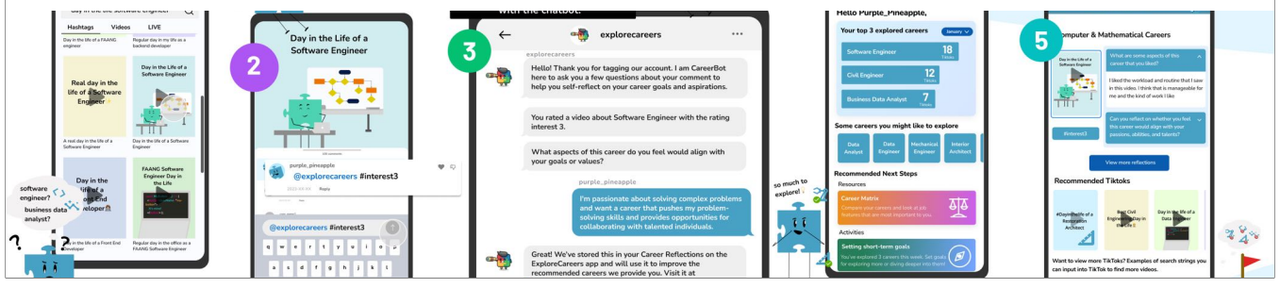
Towards Integrated Learning Experiences on Social Media: an Exploration of #DayInTheLife Videos for Career Exploration
Hayat Malik, Sonali Bhandari, Elizabeth L. Fonseca, Chiara Bonaccorsi, David T. Lee
Submission Under Review

* But most of our digital tools often aren’t designed for reflection. They’re designed to grab our attention or satisfy immediate needs and short-term tasks,
* We’ve recently started to think about supporting students in navigate their careers, and one of the formative studies we did was to explore to what extent #DayInTheLife videos on social media are helpful for career exploration. #DayInTheLife videos are these short 1-2 minute recordings where professionals provide a glimpse into their daily life,
* We found that they can provide valuable first-hand depictions of professional life, and their short and digestible format also makes them great low barrier entry points to building motivation to exploring careers,
* But this potential value is limited because social media is really distracting, so people might watch something interesting, but they’ll forget about it, or they won’t take the time to think about what made that particular career interesting or not interesting to them

How might we design AI agents that help to facilitate reflection across longer timeframes to support identity formation?

"... I feel like the chatbot helped me slow down a little bit and realize, okay, like, what are the important things in that video? Like, what did I like the best."

"... fun... way more interactive than just TikTok on its own... it gave me like a sense of agency... I felt like I was like, deciding on if this job would work out or not."



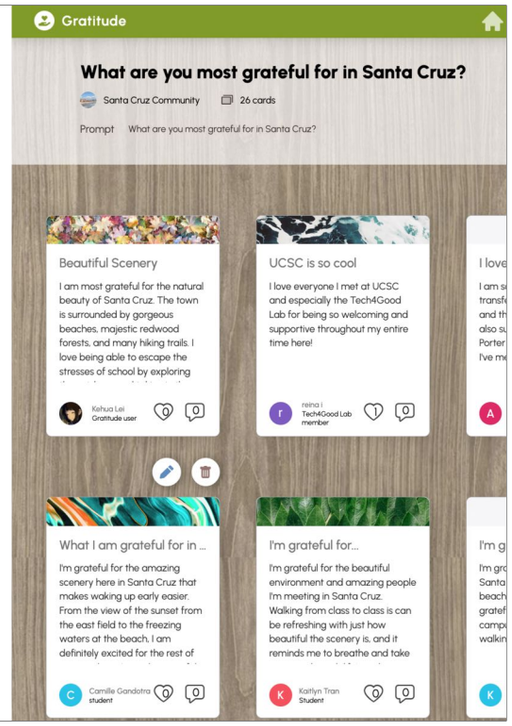
- One of the experiences we prototype in the paper is to have an AI agent that helps support reflection across the different encounters someone might have, so after a user watches and reacts to a #DayInTheLife video, they would receive a direct message later on that asks them to reflect on what aspects of the career align with their goals or values or lifestyle they want,
- And because it's integrating this support across the different #DayInTheLife videos they're watching over time, it can prompt reflection in ways that connect to previous reflections or connect to external apps outside of the social media platform that can further support them in synthesizing their reflection towards figuring out what's important to them and what they might want to work towards,
- I think there's a lot of focus on using AI to accomplish individual tasks, but I think that the agent format is actually perfectly suited for helping people integrate interactions they have across longer timelines to facilitate reflection,

How might we design communities that support authentic reflection?

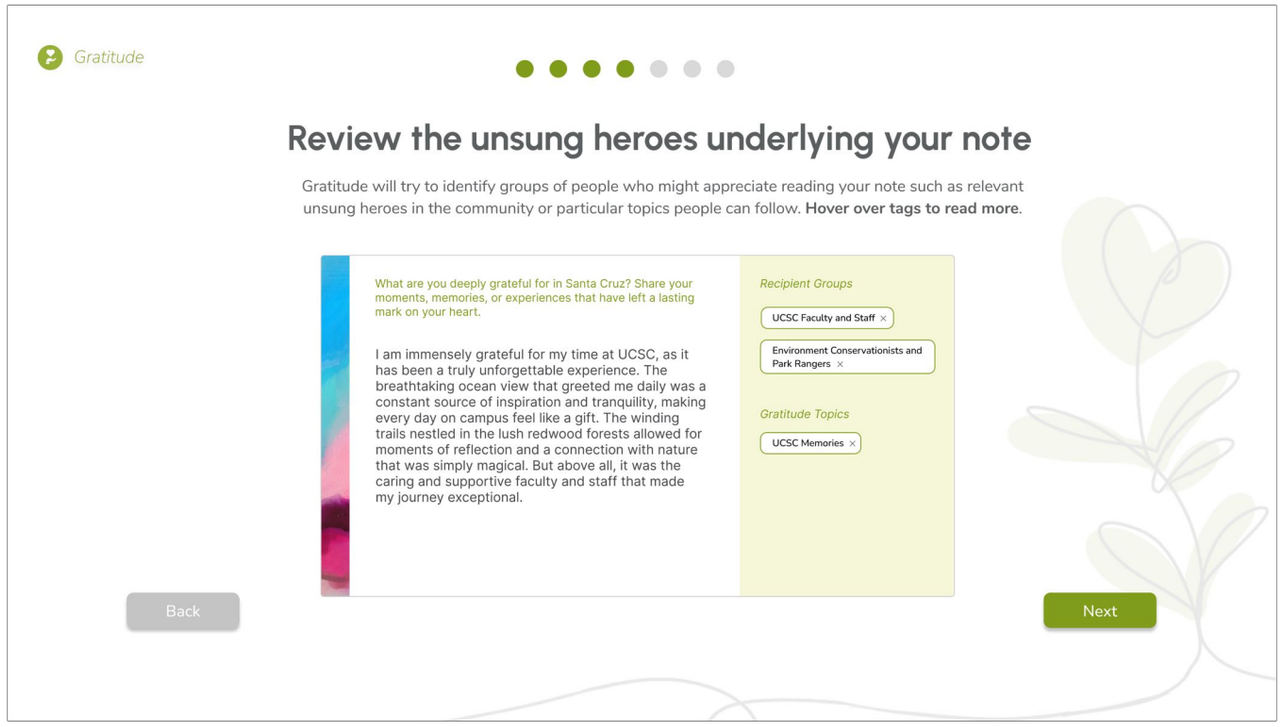
"...helped me recall things that I have complex feelings around... my most worthy failure, or how I learned to value myself... things that once made me feel extremely depressed. Gratitude provided me a platform to regain my power and encouragement by sharing these."

"...I'm grateful that it made me reflect on past experience of prejudice, bullying, and thinking about what the bullies think, and also my own cruelty to others sometimes."

Exploring Communal Gratitude in Online Communities
Kehua Lei, Kathleen Lum, Namrata Keskar, Saba Kheirinejad, Shivani Potnuru, Amy Xing, Reina Itakura, Simo Hosio, David T. Lee
Submission Under Review



* Reflection and identity formation can also be helped by a supportive community, especially when processing challenging experiences,
* One of the projects we've been exploring is to design communities centered on reflective gratitude,
* We designed a simple platform where people respond to gratitude prompts that start from simple things like what you're grateful for about your college experience to more vulnerable things that relate to identity development, like finding gratitude in difficult times or learning to value yourself, and so on,
* We were surprised how powerful it was for many of the participants. People described how it helped them regain power over things that once made them feel extremely depressed, or how it made them reflect on past experiences of prejudice and bullying and their own cruelty to others at times, or to be more tolerant and empathetic of others, and so on,
* A major part of this dynamic was the different feedback loops in the community of how people were inspired to be grateful when they saw others express gratitude or were inspired to be more authentic when seeing others sharing authentically,

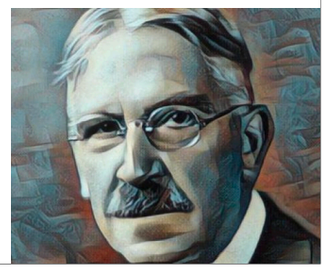


* We’re now thinking about how to use AI to augment that dynamic. For example, when people write a grateful reflection, we use AI to extract out the unsung heroes underlying different notes of gratitude. So for example, if you wrote a note describing how grateful you are for the nature in Santa Cruz, the system might identify “environmental conservationists and park rangers” as a group of people who might appreciate reading your note,
* I think there are more opportunities like this to think about how we can use AI to support reflective communities that can support personal journeys,

School must represent present life—life as real and vital to the child as that which he carries on in the home, in the neighborhood

Education proceeds by the participation of individuals in social life… shaping the individuals powers, saturating his consciousness, forming his habits, training his ideas, and arousing his feelings and emotions… to have the full and ready use of all his capacities for society.

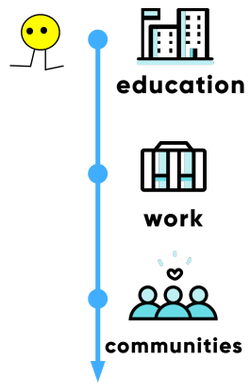
— My Pedagogic Creed (1897)



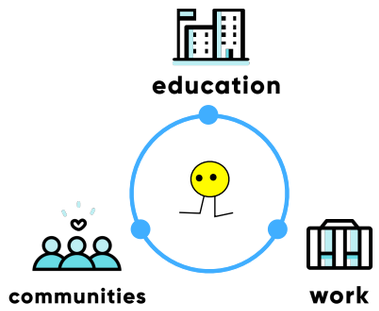
John Dewey
Philosopher and educational reformer, 1859-1952

* I want to wrap up by sharing this quote from John Dewey,
* He says “School must represent present life…” and that’s because “education proceeds…”
* John Dewey views education and engagement in society as inseparable. It’s through engaging that people learn and grow and form their identity, and it’s through people learning and growing into their full contribution that society changes,

Our system



Our vision



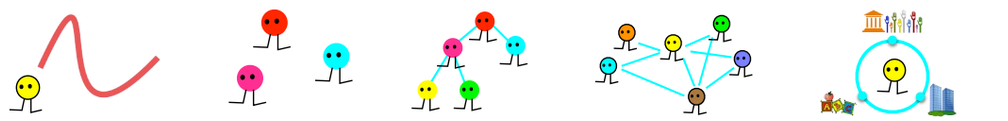
* In our system today, you go to school, you go to work, then you retire and engage in your community.
* What if we could design a system in which education, work, and community engagement blend in synergistic ways to empower individuals, advance social innovation, and enrich civic life?

This talk is about exploring, asking, and speculating:

designing ecosystems for flourishing in a whitewater world

1 reinventing education for continuous learning

2 societal collaboration to support communities



* I think that if we can create supportive communities that help people find their center, if we can provide opportunities for continuous upskilling, and if we can foster community collaboration on needs, then hopefully we can make navigating a whitewater world more of an adventure than something to be afraid of,
* Getting there requires designing ecosystems that innovate in the ways we support individual journeys, group experiences, organizational processes, community interactions, and our larger institutions,
* Technologies and AI can play an important augmenting role in these ecosystems, but we have to be attentive to how we're designing them to enhance what makes us humans: it needs to strengthen rather than take away from learning and collaboration, relationships and alignment, authenticity and identity formation, and more.

* We’re still on this journey ourselves, if anyone would like to partner with us in it and help mentor or support the amazing students in the program, don’t hesitate to reach out :) Thank you.