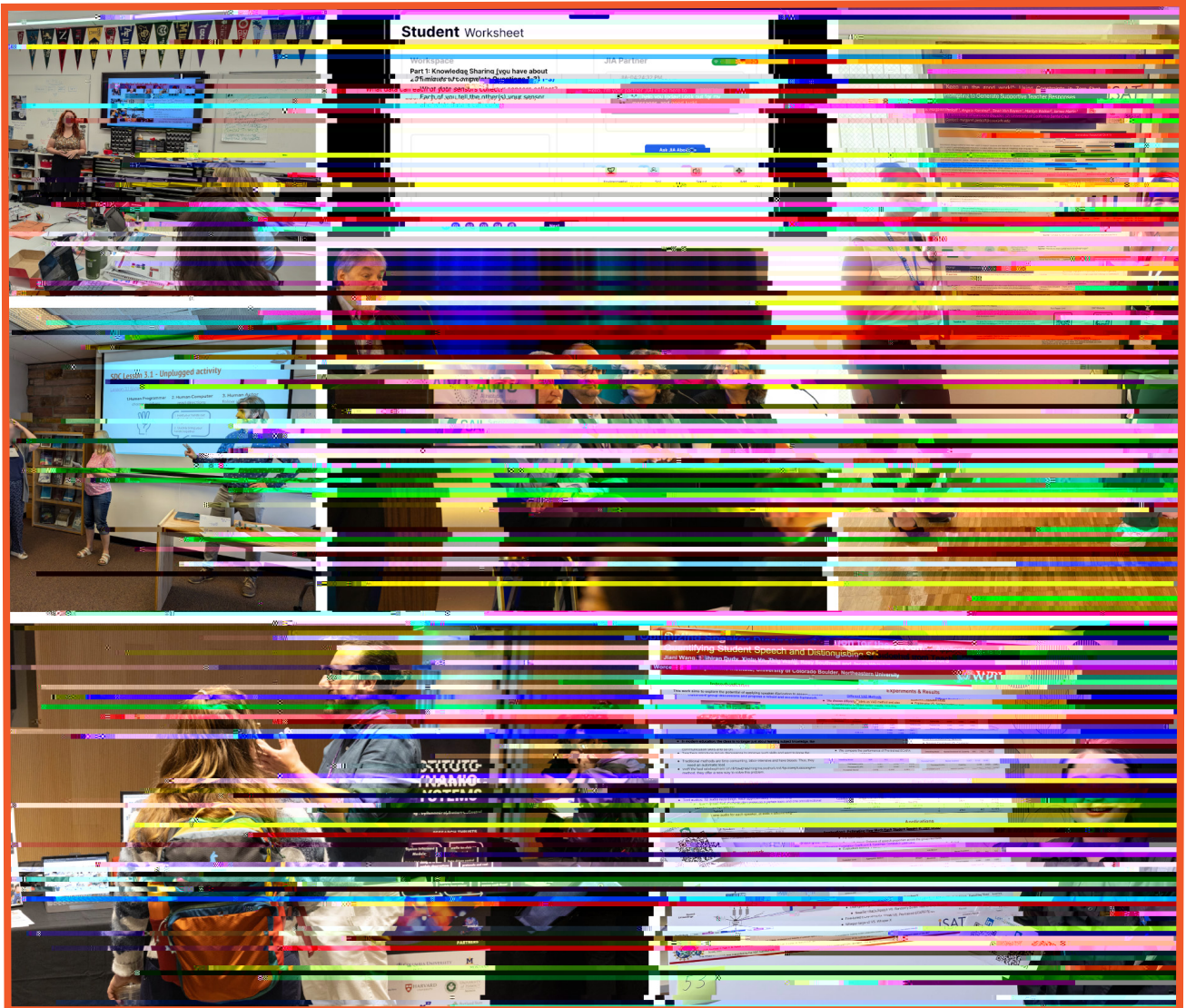


# iSAT Snapshot

NSF AI INSTITUTE FOR STUDENT-AI TEAMING

Fall 2024



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## In Brief . . .

A quick look at our activities this quarter!

1. EdHeads host AJ Gutierrez conducted one-on-one interviews with iSAT's Acting Director Tamara Sumner and Director Sidney D'Mello on AI in Education with illustrative examples and lessons learned from iSAT and other Institute of Cognitive Science research efforts. Both episodes will be aired in late 2024 and can be listened to at [edheadspod.com](https://edheadspod.com).
2. A delegation of Strand 3 team members attended a workshop at Stanford University entitled AI For Collaborative Learning.
3. iSAT team member and Professor at University of California, Berkeley (UCB) Thomas M. Philip was appointed to a UC system-wide faculty workgroup on AI.
4. iSAT has launched its new [weekly blog series](#) featuring a range of topics relating to AI in education and the technology behind it. The blog posts cater to the different interests and needs of diverse stakeholders in AIED including students, parents, educators, researchers, and developers.
5. iSAT PI Sidney D'Mello has been traveling internationally sharing iSAT's work across the globe.

## From the PI

Now in its fifth year, the Institute for Student-AI Teaming (ISAT) has been on a mission to develop the theories and know-how for next-generation collaborative learning environments powered by AI technologies. Through our work, we help grow a diverse workforce of future AI researchers and practitioners, and our institute serves as a national nexus point for empowering diverse stakeholders—researchers, K-12 educators, community members, and industry affiliates—to envision and work towards a future where AI technologies are viewed as a social, collaborative partners that help students and teachers make learning more effective, engaging, and equitable. For year 5, it's all about putting the pieces together!

### We've Scaled Up!

Over the summer, our team has been hard at work seeking out more school districts to partner with. The outcome of this effort was that between years 4 and 5, we have more than doubled the number of district partners. A growing number of students are using CoBi in the classroom, learning about programmable sensors, and—new this year—self-driving cars, and online moderation. We are grateful to our cohort of teachers who are navigating novel collaborative learning curricula and an AI partner designed to help students become even better collaborators.

Our work this year is supported by a new study protocol that has been approved by our University's Institutional Review Board and the research evaluation boards of each participating school district. Through their participation, students help us better understand their perceptions of collaboration in general, and AI partner support in particular. We are guided by research that look at (1) how and in what ways are teachers and students using curricular tasks in conjunction with CoBi to support the goals of promoting more effective and equitable collaboration and STEM learning?; (2) how does the use of the CoBi AI partner in the classroom shape students' collaborative problem-solving skills?; (3) does the repeated use of CoBi and its associated instructional routines—*Establishing Community Agreements* and *Revisiting Community Agreements*—in the classroom affect students' perceptions of their own collaborations?; and (4) we also want to know if the use of CoBi affects students' learning outcomes?

### Implementing the Community Builder AI Partner (CoBi) v2 with Three Curriculum Units

In Year 5, we are excited that we're not only getting the change to study CoBi in the Sensor Immersion (SI) curriculum in which students learn about and then use programmable sensors to investigate local scientific phenomena—we are also testing CoBi in two novel curriculum units: Self-Driving Cars, which grew out of and is an extension of the SI curriculum unit, and the Moderation Unit, which covers how and when AI can be used to help people establish and maintain inclusive online communities.

### Testing the Jigsaw Interactive Agent (JIA) in Middle School Classrooms

Version 1 of the Jigsaw Interactive Agent (JIA) is the new kid on the block in year 5. Researchers in Strands 2 (see page 6 for our Strand 2 update) and 3 (see page 7 for our Strand 3 up

## Feature: Fall Conference Recap

One of the ways iSAT team members share and disseminate their knowledge gained through research is by attending various conferences and workshops throughout the year. iSAT is represented at many prestigious events where we share and showcase our own progress as an Institute as well as learn from others in the industry. Below is a brief overview of three of the many conferences and workshops attended recently.

### Special Interest Group on Dialogue & Discourse Conference (SIGDIAL 2024)

Strand 1 team members, Margaret Perko and Angela Ramirez, attended the Special Interest Group on Dialogue & Discourse conference held at Kyoto University, Japan. This conference provides a regular forum for the presentation of cutting edge research in discourse and dialogue to both academic and industry researchers and was attended by over 160 participants. Their poster titled “Keep up the good work!': Using Constraints in Zero Shot Prompting to Generate Supportive Teacher Responses” was a collaborative effort with iSAT members Sean von Bayern, Jim Martin, and Marilyn Walker; it examined how to include constraints in prompts to a Large

iSAT PI Sidney D'Mello presents at The Summit for AI Institutes Leadership (SAIL) in Pittsburgh, PA.



# Orchestrating Effective Interactions

## Strand 2

Strand 2 is guided by the foundational question: What advances in theories, interaction-paradigms, and frameworks are needed to orchestrate effective student and teacher interactions with AI partners? The three research themes identified to help Strand 2 answer this question are: *Dynamic Framework & Measures of Collaboration*, *Collaborative Learning (non-verbal and verbal communication; peer scaffolding)*, and *UX Design & Multimodal Modeling*.

collaborative engagement and identifying peer scaffolding moves, we hope to better understand how student peers support each other during collaborative learning activities.

Our team out of the University of Wisconsin - Madison has been training six researchers from CU Boulder on how to use the Nonverbal Interactions in Collaborative-Learning Environments (NICE)gic sixcoll19.5 0 0 Cup862 Tm[en

### Dynamic Framework & Measures of Collaboration

For this theme, we work on identifying and measuring the basis of collaborative problem-solving skills in social, affective, and cognitive processes, and how to promote equitable and trusted interactions in team problem-solving.

Currently, iSAT team members out of Arizona State University have been busy developing an experimental design to test four research questions: (1) Does the valenced nature of AI partner communication influence a group's shared emotional states (via objective measures physiological indicators such as heart rate and respiration as opposed to self-reports) during a collaborative problem-solving task? (2a) Does the valenced nature of AI partner communication impact role-specific communicative influence, and (2b) is this relationship mediated by changes in the extent and/or dynamical structure of shared emotional states? (3a) Can measures of team-level physiological synchrony as well as the distribution of role-specific communicative influence predict team task performance, and (3b) are these relationships moderated by the valenced nature of AI feedback? (4a) Do individual measures of perceived rapport, satisfaction with collaboration, performance, and self-reported emotional states reflect team-level task performance, and (4b) is the relationship between team performance and these measures of subjective appraisal mediated by the distribution of role-specific communicative influence and shared emotional states?

In addition, our team has been creating scripts for a Wizard of Oz (WoZ) AI teammate that are slated for testing these research questions along with validating the emotional content of these scripts using latent semantic analysis tools. We have also generated and refined the experimental protocol involving physiological data collection (EDA/GSR and ECG) and questionnaires to assess subjective experiences of collaborating students. Lastly, the team conducted the first two full pilot sessions and integrated feedback into the development of this new study.

### Collaborative Learning

By identifying verbal and non-verbal modes of

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# Engaging Youth

## Strand 3

Strand 3 is guided by the foundational question: In what ways can inclusive co-design processes empower stakeholders with diverse identities to envision, co-create, critique, and apply Artificial Intelligent learning technologies for their schools and communities? The research themes identified to help Strand 3 answer this question are: *Learning Futures Workshop*, *Moderation Unit*, and *Sensor Immersion/Self-Driving Cars Units*.

### Learning Futures Workshop

These are annual workshops consisting of a diverse group of high school students and result in crucial feedback from the participants including what youth want and need the AI partners to be able to do in the classroom, and—just as important—what they don't want them to do. These workshops are also used to understand parents' hopes and concerns around the use of AI in schools. After hosting a new workshop last spring, which consisted of a series of so-called pláticas—focus groups that center relationship and trust-building through reciprocal sharing between facilitators and participants—with Spanish-speaking parents to explore their concerns and hopes about how AI is used within schools, the team spent the summer analyzing the data.

Currently the team is working on broadening the voices that are included in the design and implementation, and will do this by expanding the Learning Futures Workshops (LFWs) to include school district technology leads. In addition, after analyzing LFW data from 2023 and 2024, the team has contributed to seven new manuscripts, which are currently under review at the International Conference on Learning Sciences (ICLS).

### Moderation Unit

This unit focuses on how and when AI can be used to help people create welcoming and inclusive online communities, and the role that moderation plays in online communities.

Our new Moderation Unit was part of a high school class this October. One more enactment will begin in December in a middle school English Language Arts classroom. They will be analyzing the implementation in Spring 2025. Two of the team's graduate researchers have been busy supporting an analysis of the professional learning workshops and student data that was collected last Spring.

### Sensor Immersion & Self-Driving Cars Units

The Sensor Immersion (SI) curriculum teaches students how to program a sound, a soil-moisture, and an environmental sensor using a micro:bit controller. Students gain a deeper understanding of how sensor systems work and how they can be used to collect, analyze, environmental sensor using a micro:bit controller. and how they can be used to collect, analyz





## Learn more about our members!

**M** Meet Thomas M. Philip, Professor, University of California - Berkeley. As one of our research leads in Strand 3, he primarily focuses on conceptualizing, designing, implementing, and analyzing the Learning Futures Workshops (LFWs).

**Q:** What does your research focus on?

**A:** All learning is inherently ethical and political. With this premise, I study how ideology shapes learning and how learning is a site of ideological contestation and becoming. In relation to iSAT, I'm particularly interested in the assumptions about technology, students, teachers, race, and the purposes and processes of learning that go into the design of AI tools. In turn, I am intrigued by how these AI tools create or close off particular human relationships, shape how students learn and interact, and who they then become as learners and human beings.

**Q:** What is the coolest thing about your research?

**A:** In my research, I spend a lot of time in conversation with teachers and students about society and their place within it, which always entails profound ethical and political questions. I get to have in-depth conversations in interviews and witness lively discus-

sions in classrooms. They talk about their hopes for the world, how they perceive their purpose within it, and the challenges and opportunities to realizing their hopes. I get to see how they make sense together and

become increasingly difficult to find such places of authentic communication about significant matters. My research lets me witness (and sometimes participate in) these rich exchanges, which affirms the power and

**Q:** What has been a turning point or defining moment in your career?

anti-war movement during the Iraq War of 2003. I became intrigued by the complex and highly context-dependent ways in which people made sense of the war, whether they supported or opposed the

defined my graduate school years got me interested in ideology and how the learning sciences might illuminate the interactions through which ideological stances are repho contested, and transformed

**Q:** What do you like to do outside of work?

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# New Quarter, New Faces!

## Growing our team and our impact.

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We're excited to welcome new members to our team! Some of our new faces include:

Systems Engineering at Arizona State University, studying modeling techniques to understand and enhance complex

Michael Buchanan is a first year PhD student in Computer Science at CU Boulder who is interested in AI development, human-AI teaming, and planning. Before coming to Boulder, Michael conducted research with Dr. Nancy Cooke in the Center for Human, AI, and Robot Teaming at Arizona State University, and he holds a B.S. in mathematics.

Lucrezia Lucchi is a Psychology PhD student in the Dynamics of Perception, Cognition, & Action Lab directed by Dr. Nia Amazeen. Their research interests involve uncovering the dynamical structures which underlie the emergence of flow & insight experiences—especially in the contexts of collaborative problem-solving, learning (inside and out of the classroom), and motor skill development. Lucrezia also has a background in Exercise Physiology and Human Movement Sciences.

Ray Hao is a PhD student and Fulton Fellow in Human

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# iSAT Publications and Outreach

## Published / Accepted

Dey, I., Doherty, E., Zhang, R., Hoang, N., Bush, J. B., Hirshfield, L., Puntamekar, S. (2024). MOSAIC-AI: Moment of Support Analysis with AI Partners. Accepted to American Education Research Association (AERA 2025).

Reitman, J. G., Harrison, J. L., Gorman, J. C., Lieber, R., & D'Mello, S. K. (2024). Communicative influence: A novel measure of team dynamics that integrates team cognition theory with collaborative problem solving assessment. *Journal of Educational Psychology*. Advance online publication. <https://dx.doi.org/10.1037/edu0000904>

Sun, C., Shute, V., Stewart, A., & D'Mello, S. K. (in press). The Relationship between Collaborative Problem-Solving Skills and Group-to Individual Learning Transfer in a Game-based Learning Environment. In *Proceedings of the 2025 International Conference on Learning Analytics & Knowledge (LAK25)* ACM.

## Submitted / Under Review

Bush, J. and Bidy, Q. Curriculum Routines to Support Collaborative AI Partner Deployment in Classrooms (2024). Submitted to the International Society of the Learning Sciences (ISLS 2025).

Chandler, C., Raju, R., Reitman, J. G., Penuel, W. R., Ko, M., Bush, J. B., Bidy, Q., D'Mello, S. (2024). Improving the Generalizability of Language Models for the Identification of Collaborative Discourse Across Diverse Educational Contexts. Submitted to the International Conference on Learning Analytics & Knowledge (LAK 2025).

Chang, M., Philip, T., Penuel, W. (2024). Developing Reciprocal Care within Intergenerational Co-design Spaces. Submitted to the International Society of the Learning Sciences (ISLS 2025).

Dey, I., Doherty, E., Zhang, R., Hoang, N., Bush, J., Hirshfield, L., Puntambekar, S. (2024). Examining support moments with a conversational AI partner. Submitted to the International Society of the Learning Sciences (ISLS 2025).

Dey, I., Ko, M., Puntambekar, S. (2024). Visualizing collaboration using multiple modalities. Submitted to the International Society of the Learning Sciences (ISLS 2025).

Doherty, E. and Hirshfield, L. (2024). Re16 (.S708 Tm[boty]45 (.)27.1 angnIETEM2r3en- (202ed to the