Towards Socializing Intelligence in Urban Classrooms
and other even more wicked problems…

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Where
in the **solution**
is the **technology** we build?

Important Scientific Gaps

- **Problem:** Fragmentation of research societies
- **Need:** Cross community transactive memory systems
  - Respecting our own and other expertise
  - Knowing the boundaries of what we know
  - Knowing where we should defer to other expertise
- Continue bridge building between Computer Science and the Behavioral Sciences

What can we build → What is worth building?

- *How do we build community and communication among researchers in the Learning Sciences and related fields?*

Attempted Solutions and Enduring Problems

- The structure of disciplines itself serves to perpetuate the problems
  - Positive and negative implications of the peer review system
  - *Problem is that interdisciplinarity is always vulnerable to cutbacks*
- Cross cutting funding goes a huge way towards solutions
  - Science of learning centers is a great example
  - Research on some large, interdisciplinary programs shows that this doesn't always work
- Workshops like this are extremely productive
  - Huge progress in big data for education
  - But we all go back to our departments and labs

- *We have not explored how we can use technology to fundamentally change how disciplines are structured*

Big Problems in the Education Space

Faulty Beliefs about Learning and Learners → Unproductive Classroom Culture → Lack of engagement or dysfunctional engagement

- Productive classroom culture fosters efficacious, engaged learners
  - Valuing the voice of the learner, taking time for interactive mental model refinement
- Focus on efficiency, economy, and scale threatens classroom culture
- "Blame game" reinforces the problem
- Infrastructure and usability issues exacerbate the problem

- *How do we build community in learning spaces in the face of the current emphasis on scaling up?*

Research Context

District Context: (2008-2010)

- 63% of district students performing below proficient in READING

- 56% below proficient in MATH, a large % of which are African American students

- Multiple schools and multiple teachers

School Context:

- Failed to meet Adequate Yearly Progress on standardized tests for 5+ years

Subject Area: Focus on 9th Grade Biology

- 9th grade Biology Years 1-4

- Added Math in years 3-4

Empirical Support for Accountable Talk

Asterhan, C., Clarke, S., Resnick, L (2015). *Socializing Intelligence through Academic Dialogue*, AERA Press.

- When teachers of math, science, and reading use structured teacher-lead discussion methods...

  - steep changes in student **achievement** (Bill, Leer, Reams & Resnick, 1992; Chapin & O'Connor, 2004)

  - **Retention** for up to 3 years (Adey & Shayer, 1993, 2001; Shayer, 1999; Topping & Trickey, 2007a, 2007b)

  - **Transfer** across domains for up to 3 years (Bill, Leer, Reams & Resnick, 1992; Adey & Shayer, 1993, 2001; Shayer, 1999; Chapin & O'Connor, 2004)

  - Students perform better on **non-verbal reasoning** tests e.g. Ravens (Mercer, Wegerif & Dawes, 1999)

  - **Reasoning** itself improves (Kuhn & Zillmer, in press; Lin et al 2012)

Study Structure: Macro Study with Embedded Micro Studies

- **Macro study:** Year long interventions with multiple sessions coaching teachers on Accountable talk practices
- **Micro study:** Embedded studies within individual units, run as controlled experiments to test specific aspects of designed support for dialogic instruction
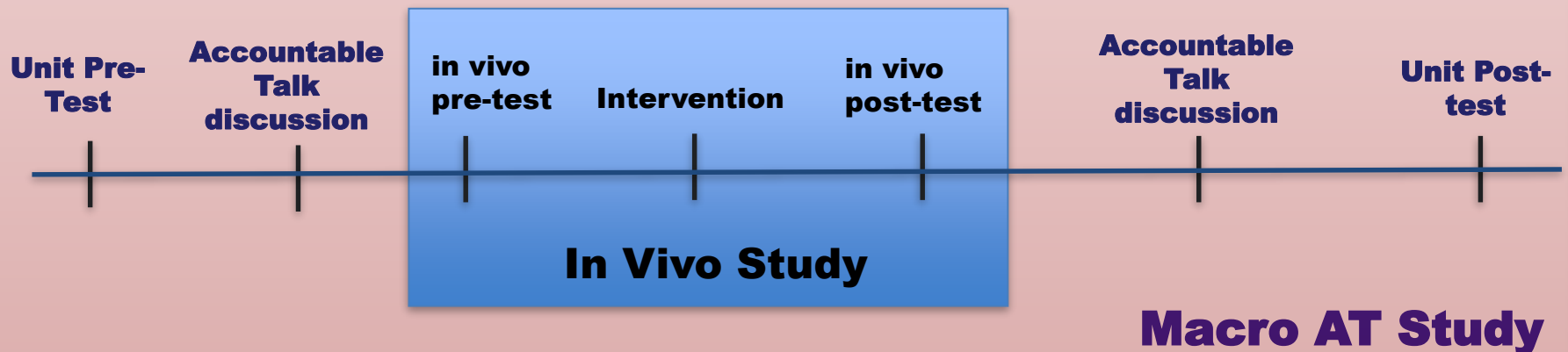
Conversational Agent Based Support in Computer Supported Collaborative Learning
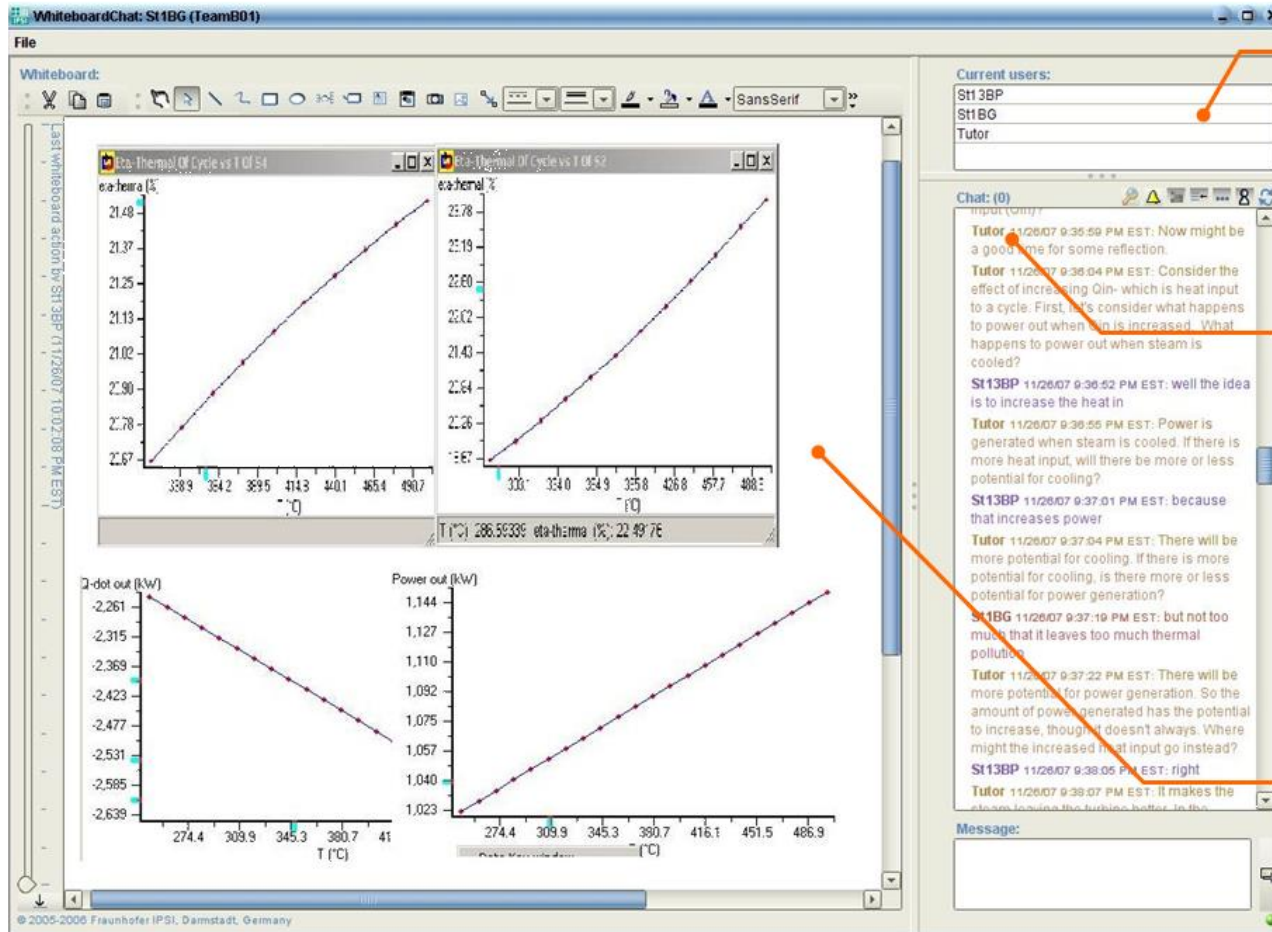
Students learn 1.24 s.d. more when working with a partner and automated support than students working alone (Kumar et al., 2007)

# Positive Effect on Student Learning

Automatic Analysis Of Conversation → **Conversational Interventions** → **Positive Learning Outcomes**

- **Study 1**: Year 1, Diffusion Lab
  - Students learn more on explanation questions in supported conditions (effect size 1 s.d.)
  - Students in supported conditions more active in whole group discussion (effect size .75 s.d.)
- **Study 2:** Year 2, Diffusion Lab
  - Students learn more on immediate post test in Revoicing Agent condition (effect size .51 s.d.)
- **Study 3:** Year 2, Punnett Square Lab
  - Students learned marginally more ($p < .1$) on delayed post-test in Revoicing Agent condition

Positive Effect on
Future Learning Opportunities

Does Teacher Uptake of Accountable Talk increase over time?
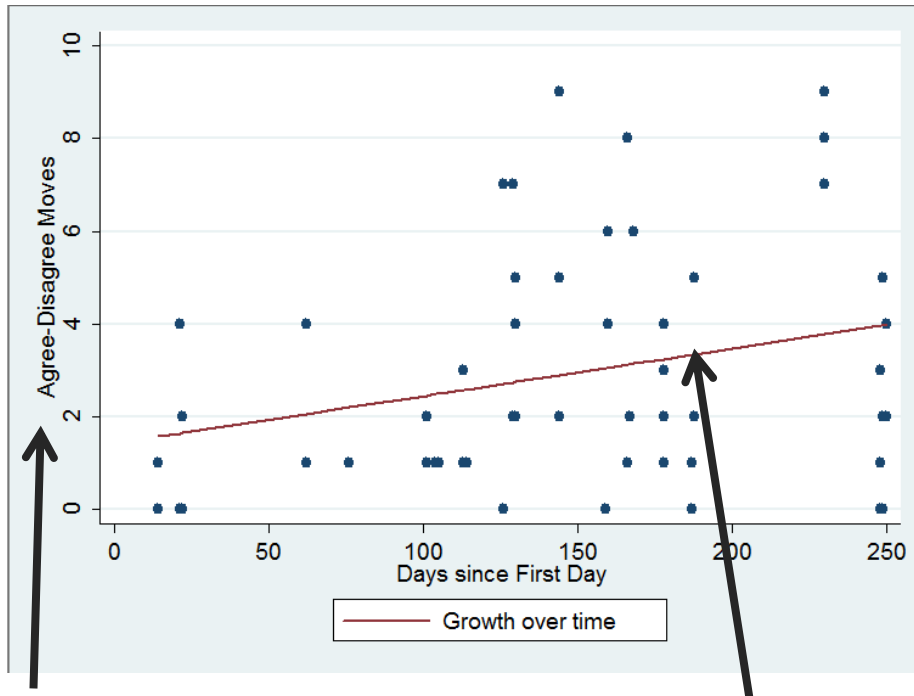
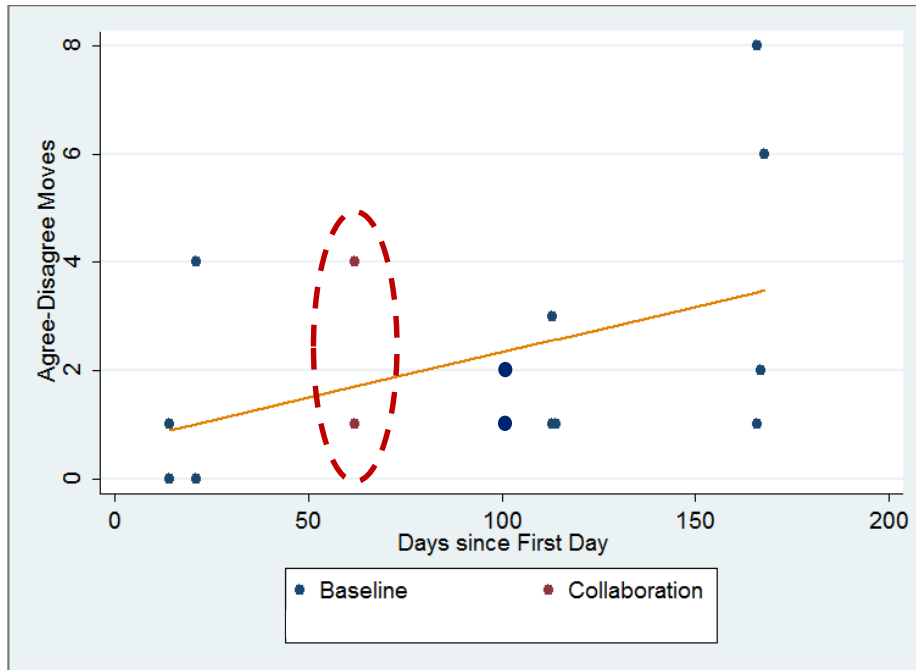**Proxy for Teacher Uptake of Accountable Talk**

Teacher growth trajectory

Observations of whole class teacher led discussions throughout 2 years of professional development

- Dependent Variable: Accountable Talk moves by teacher
- Independent Variables:
  - Baseline: Effect of time

Positive Effect on Future Learning Opportunities

How is Teacher Uptake of Accountable Talk Affected by student participation in collaborative activities?
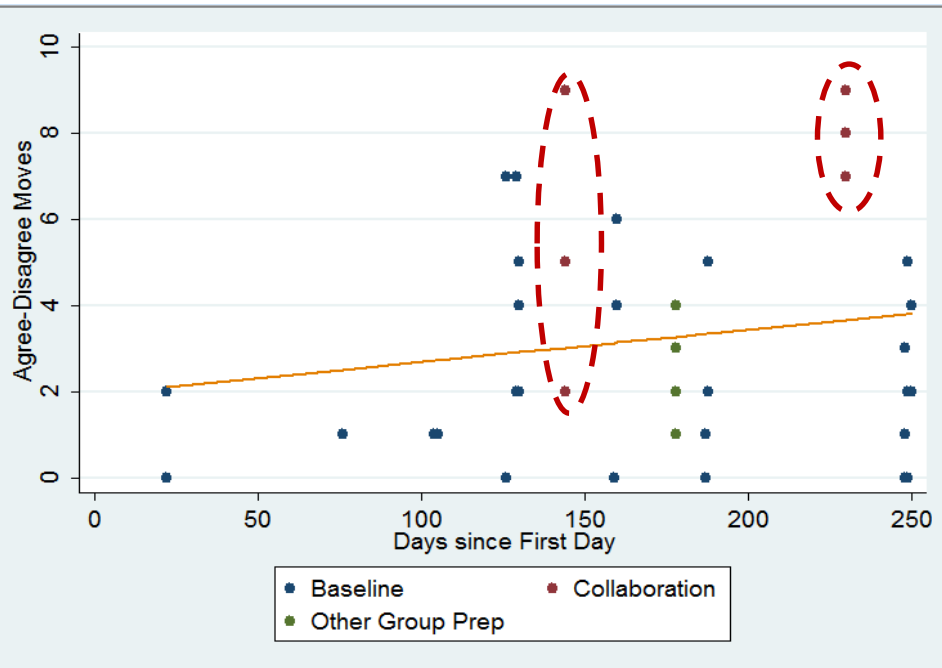

Year 1

Observations of whole class teacher led discussions throughout 2 years of professional development

- Dependent Variable: Accountable Talk moves by teacher
- Independent Variables:
  - Baseline: Effect of time
  - Discussion type: After CSCL activities vs Other
    - Post-CSCL sessions significantly higher than Other (effect size *1.7 s.d.*)

Positive Effect on
Future Learning Opportunities

How is Teacher Uptake of Accountable Talk Affected by student participation in collaborative activities?

Year 2

Observations of whole class teacher led discussions throughout 2 years of professional development

- Dependent Variable: Accountable Talk moves by teacher
- Independent Variables:
  - Baseline: Effect of time
  - Discussion type: After CSCL activities vs Other
    - Post-CSCL sessions significantly higher than Other (effect size *1.7 s.d.*)

Reflections

- Technology solution is only as good as the infrastructure will support
  - Can't assume community college systems use a common platform
- Human resources are needed to integrate CSCL activities into classrooms
  - Teachers don't have the time to think about where in their lesson plans to integrate new kinds of activities
- Underserved learners struggle with usability issues