# CPSX

a tool for online collaborative problem solving in OpenEdX

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Educational Testing Service

Collaborative work with Peter Halpin (NYU)

LWMOOCs II Oct 2, 2015 Teachers College

# Motivation

- Use of pairwise or small group discussion is a well-established and highly valued classroom practice
  - Webb, 1989; Topping, 2005; Smith et al., 2009

Mennonite Church USA Archives, via Wikimedia Commons

# Motivation

- Computer-mediated discussion replaces face-to-face interaction in online learning environments

# Motivation

- Most LMSs have asynchronous forums
  - but not real-time discussion for small groups
- External tools (Skype, Google, etc.)
  - do not dovetail with LMS user/author experience and logging opportunities
- Some apps wrap task creation in with the collaboration affordance
  - Bazaar (Adamson & Rosé, 2012)
  - MoocChat (Coetzee et al., 2015)
- Small group discussion applies to assessment research regarding collaboration and collaborative problem solving
  - von Davier & Halpin, 2013

# Foundations of Collaborative Assessment (FoCA) Project

I. Deploy an experimental platform for collaborative assessment with a *minimal design*
   - Groups of 2 (or more) participants communicate (possibly remotely) while solving simple, text-based items
   - Measure effect size of collaboration and explore statistical models of interdependence
   - Collect pilot data from crowd-sourcing on Amazon M-Turk
     - Study repurposed publically released NAEP math items
     - Collaboration with Peter Halpin (NYU), Jason Rarick (NYU), Patrick Barnwell (ETS)

II. Develop and release an extension (XBlock) for OpenEdX, enabling small-group, real-time chat on assignments

# Why use an open-source MOOC platform for ETS research?

- Center for Advanced Psychometrics and other groups* are interested in understanding and assessing collaboration and collaborative outcomes.
- There are proprietary developments at ETS with regard to potential future assessment products.
- At the same time, an open-source contribution to OpenEdX supports ETS's educational service mission
  - and promotes collaboration with external partners
- OpenEdX has robust existing assessment tools
  - Fast prototype to experiment

* Special thanks to Patrick Kyllonen and the Center for Academic and Workforce Readiness and Success for funding this particular project

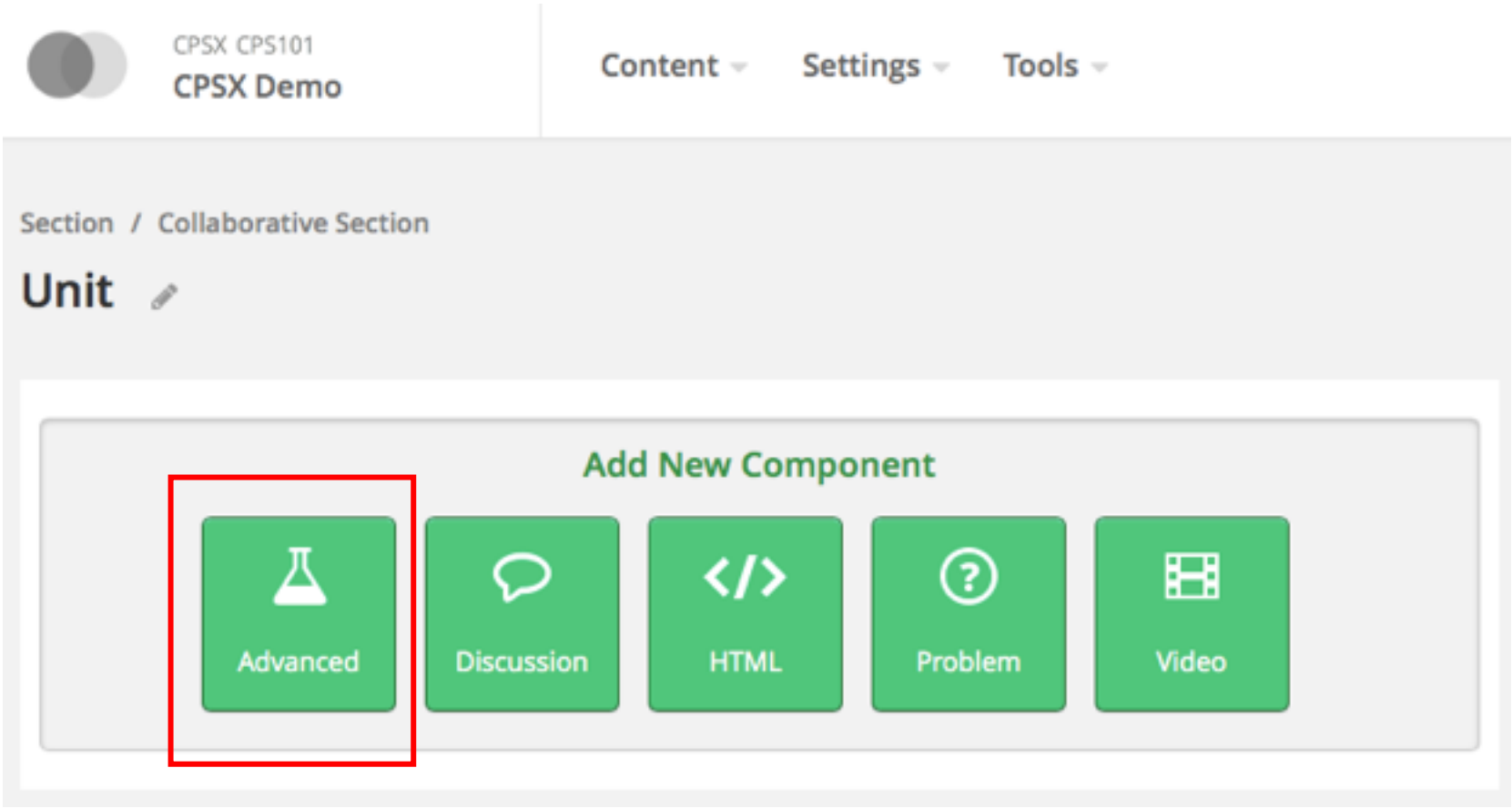
# CPSX stack

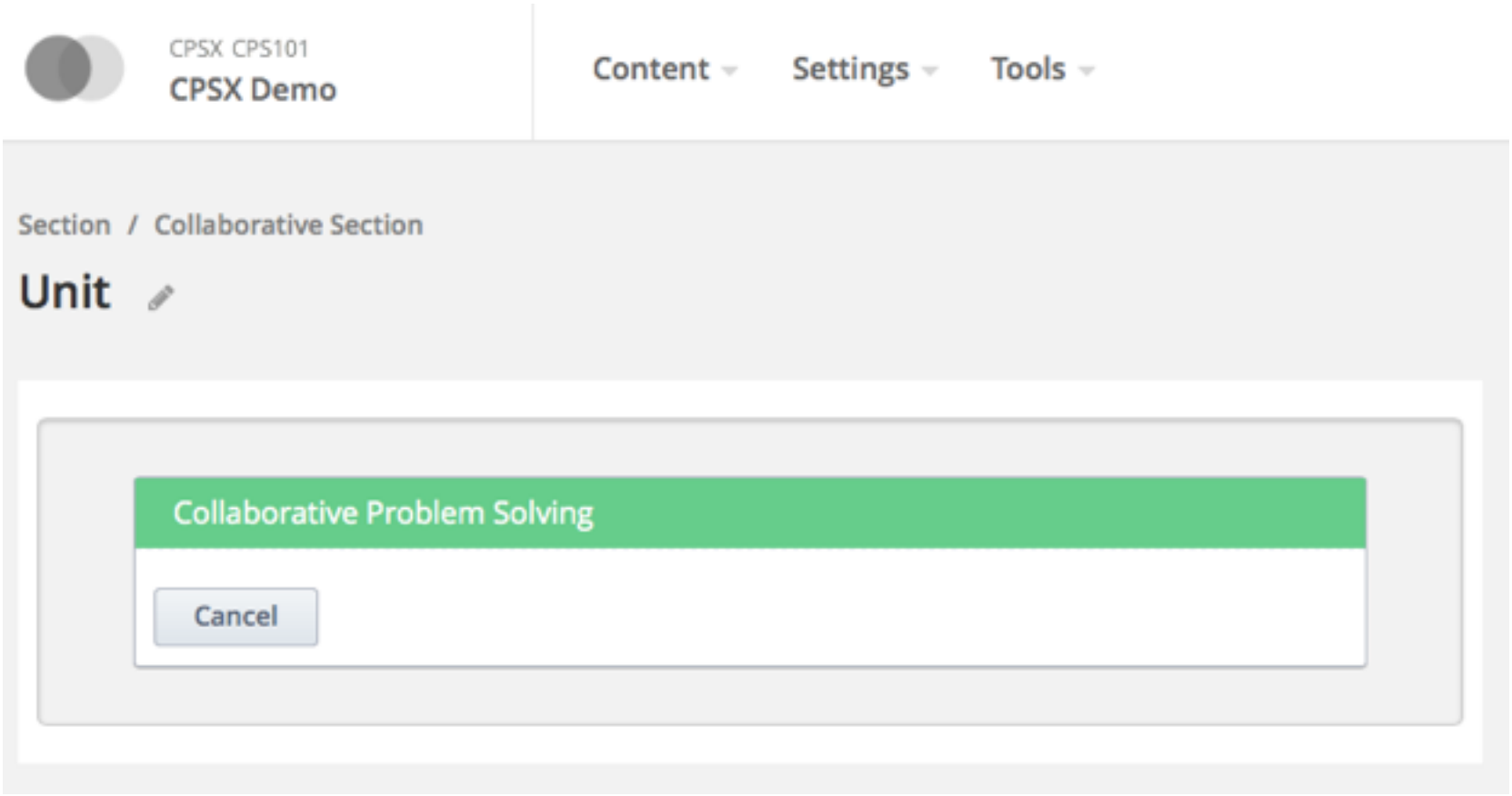
- OpenEdX
- CPSX XBlock (Python)
- Chatapp (Ajax & PHP)
  - Does not itself require OpenEdX
  - Requires LAMP (Linux, Apache, MySQL, PHP)

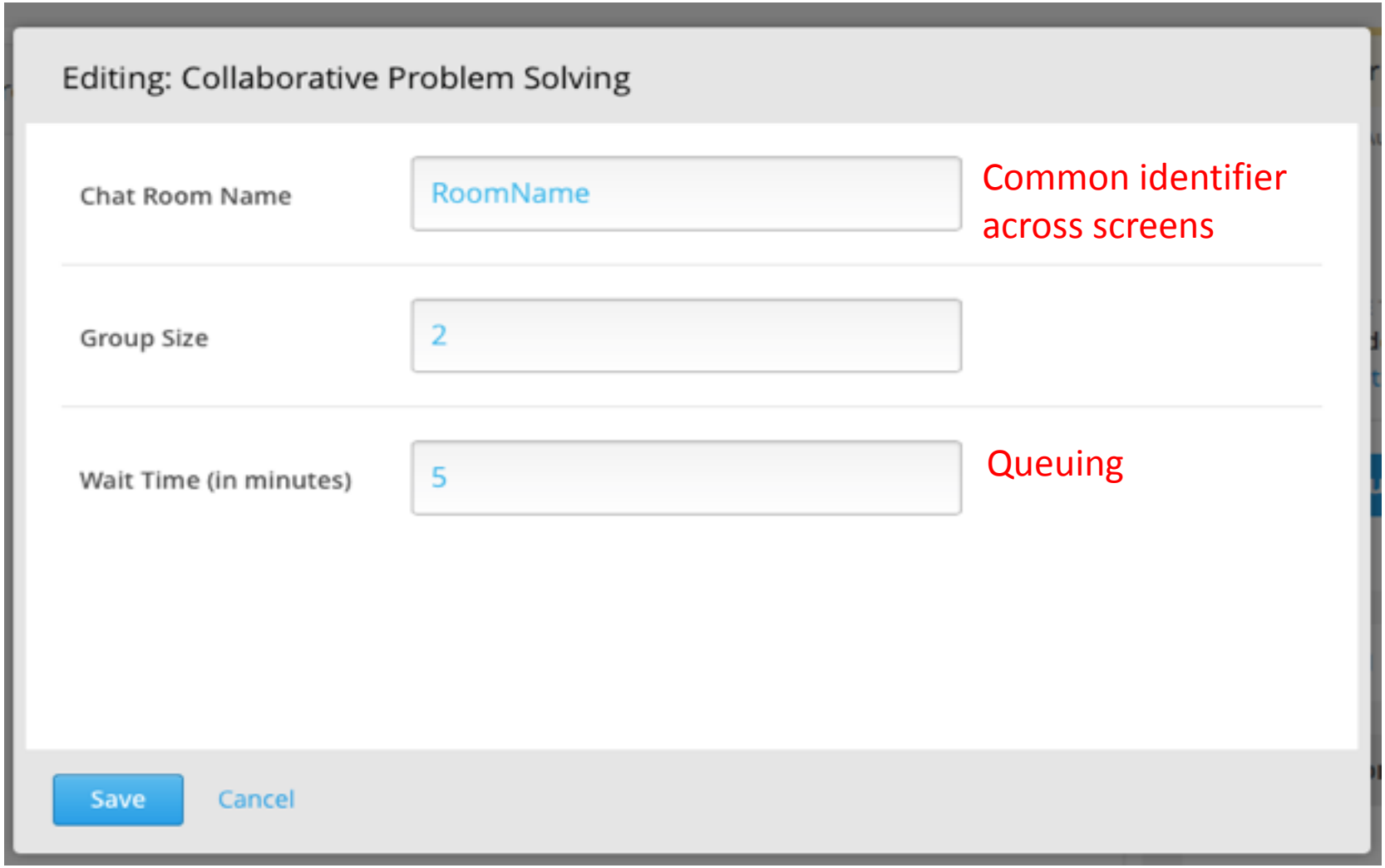
https://github.com/ybergner/cpsx

- Design considerations
  - chat sessions can be limited to small groups
  - use alongside any OpenEdX media/assessment units
  - should not require maintaining a separate server

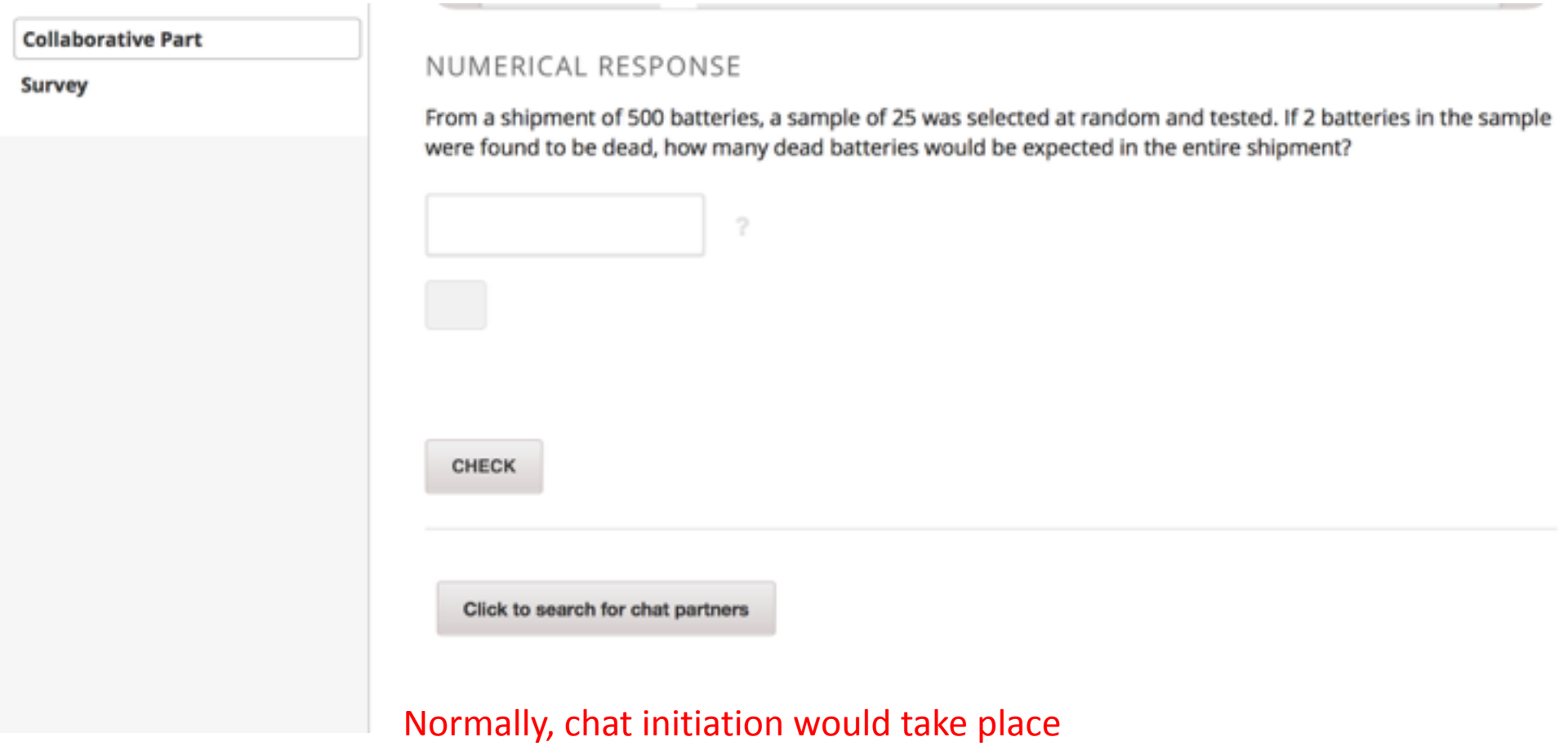
# Using CPSX as an author/instructor




CPSX CPS101
CPSX Demo
Content
Settings
Tools
Section / Collaborative Section
Unit
Collaborative Problem Solving
Cancel


Editing: Collaborative Problem Solving
Chat Room Name
RoomName
Common identifier across screens
Group Size
2
Wait Time (in minutes)
5
Queuing
Save
Cancel

# Using CPSX as a student




Normally, chat initiation would take place before the presentation of the assignment

Collaborative Part

Survey

NUMERICAL RESPONSE

From a shipment of 500 batteries, a sample of 25 was selected at random and tested. If 2 batteries in the sample were found to be dead, how many dead batteries would be expected in the entire shipment?

?

CHECK

Waiting for partners to chat - Time left: 04:53

Collaborative Part

Survey

NUMERICAL RESPONSE

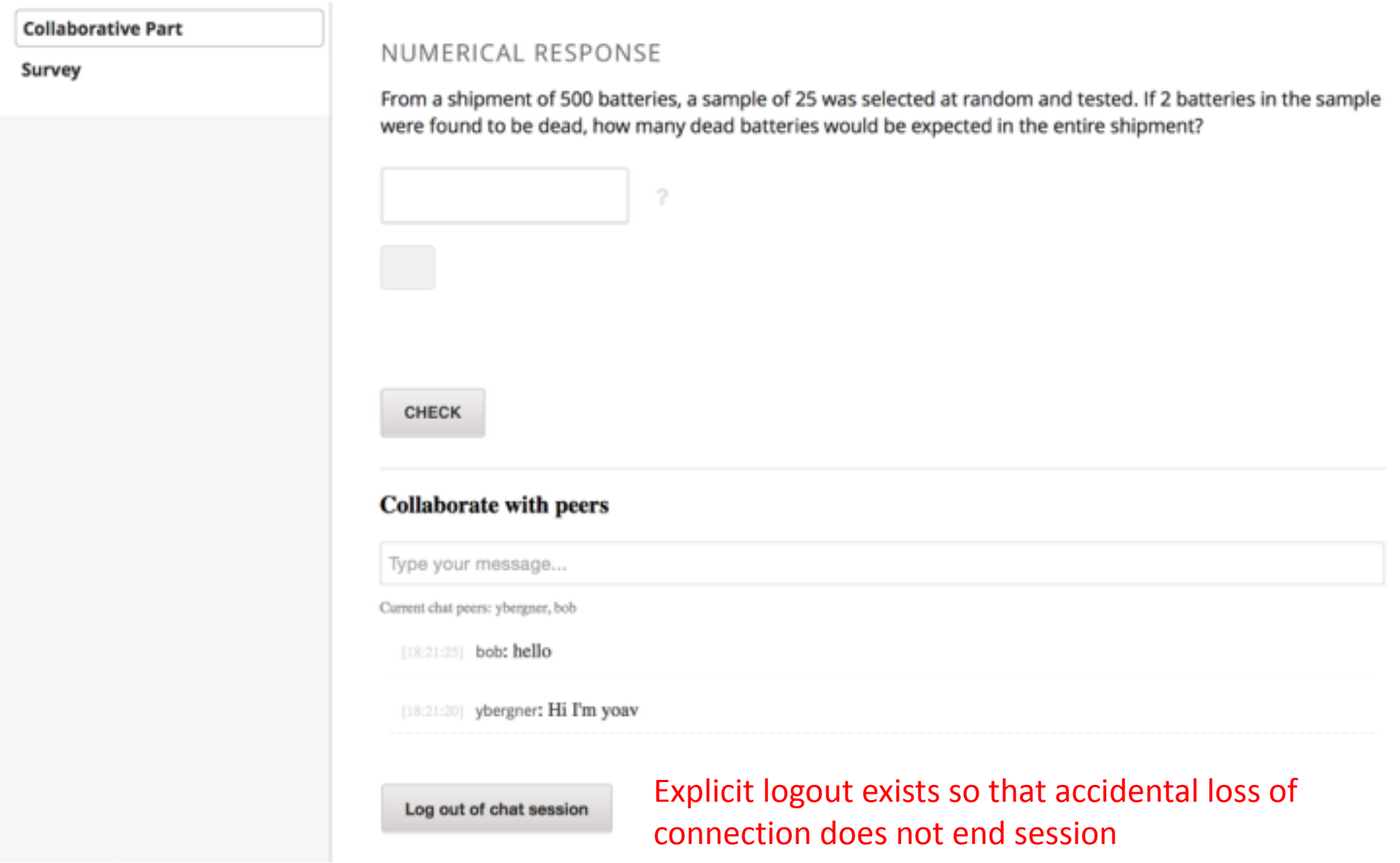
From a shipment of 500 batteries, a sample of 25 was selected at random and tested. If 2 batteries in the sample were found to be dead, how many dead batteries would be expected in the entire shipment?

?

CHECK

Ok! Your partners are ready. Click **Begin** to start the chat.

Begin



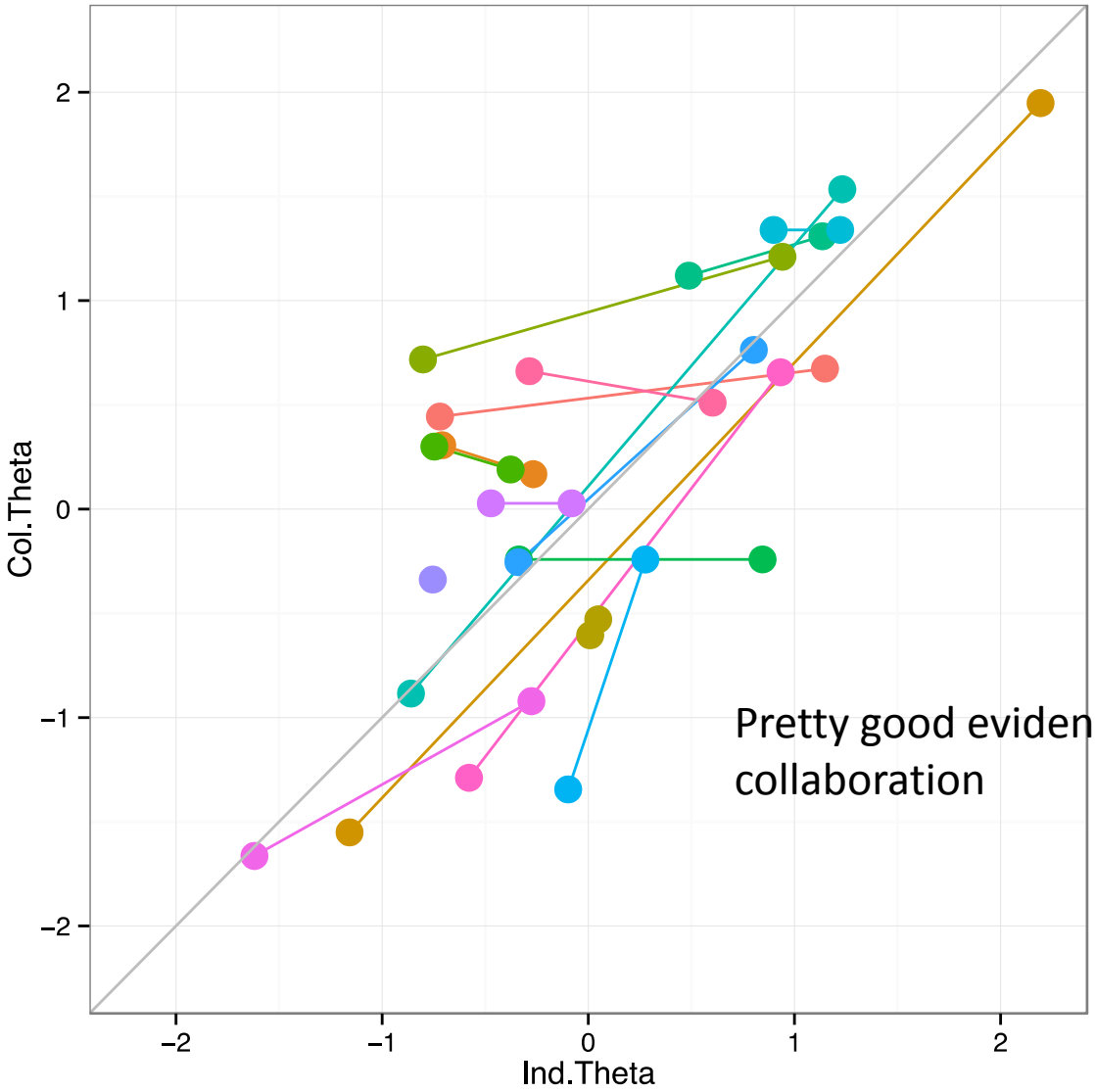

Explicit logout exists so that accidental loss of connection does not end session

# Experimental design

- Use OpenEdX platform as delivery/scoring mechanism
- Reuse 100 math items developed for NAEP Grade 12
- Calibrate items with an IRT model (2PL) based on individual performance (N > 350)
- Administer one test form individually and form collaboratively using chat interface
  - Ultimately would like counterbalanced design to avoid fatigue/ practice effects, but pilot data are not counterbalanced
- Record interaction for analysis

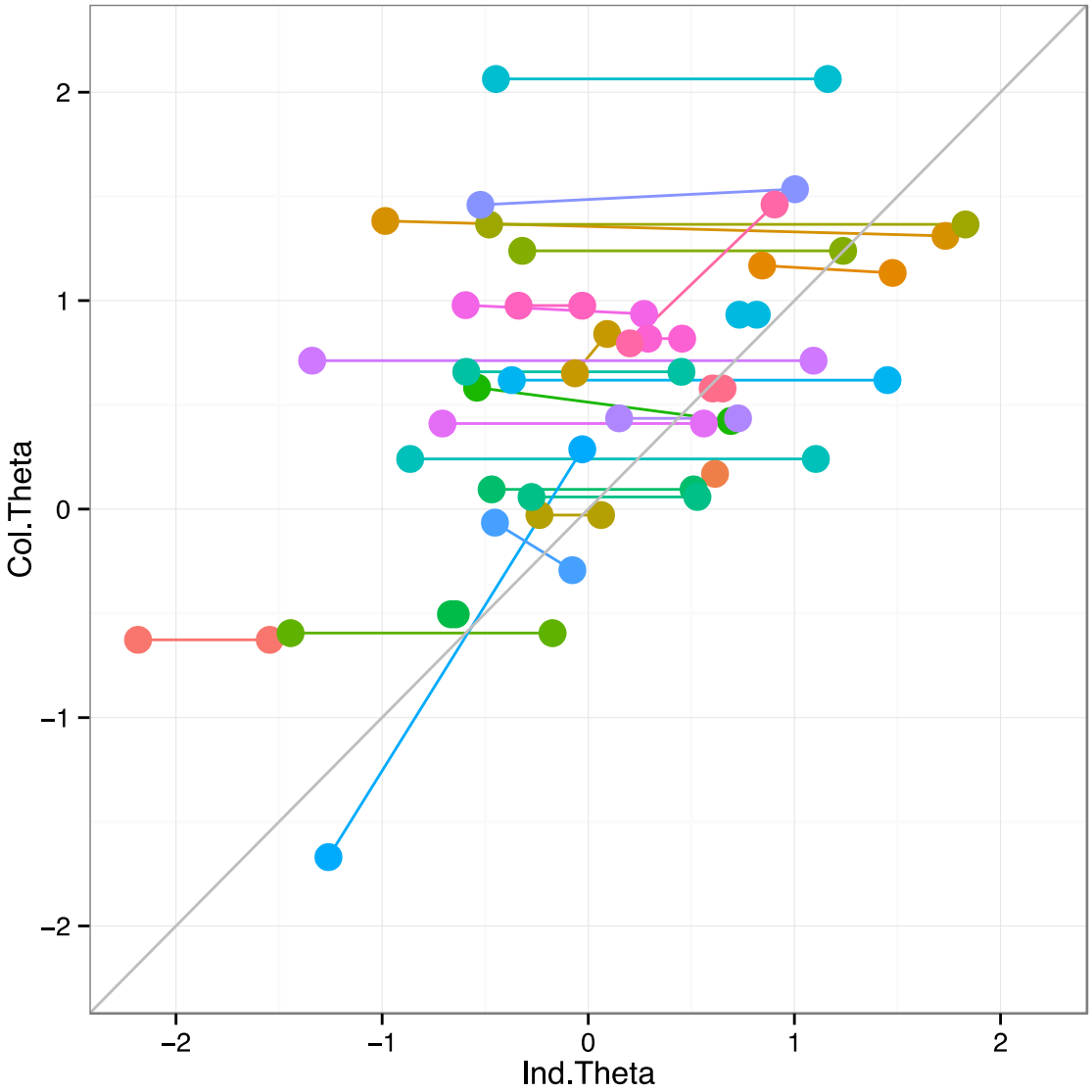
- Recruited 350 M-turkers for individual calibration and 120 more for pilot testing and collaboration study
  - 46 usable pairs

# Results: early sample

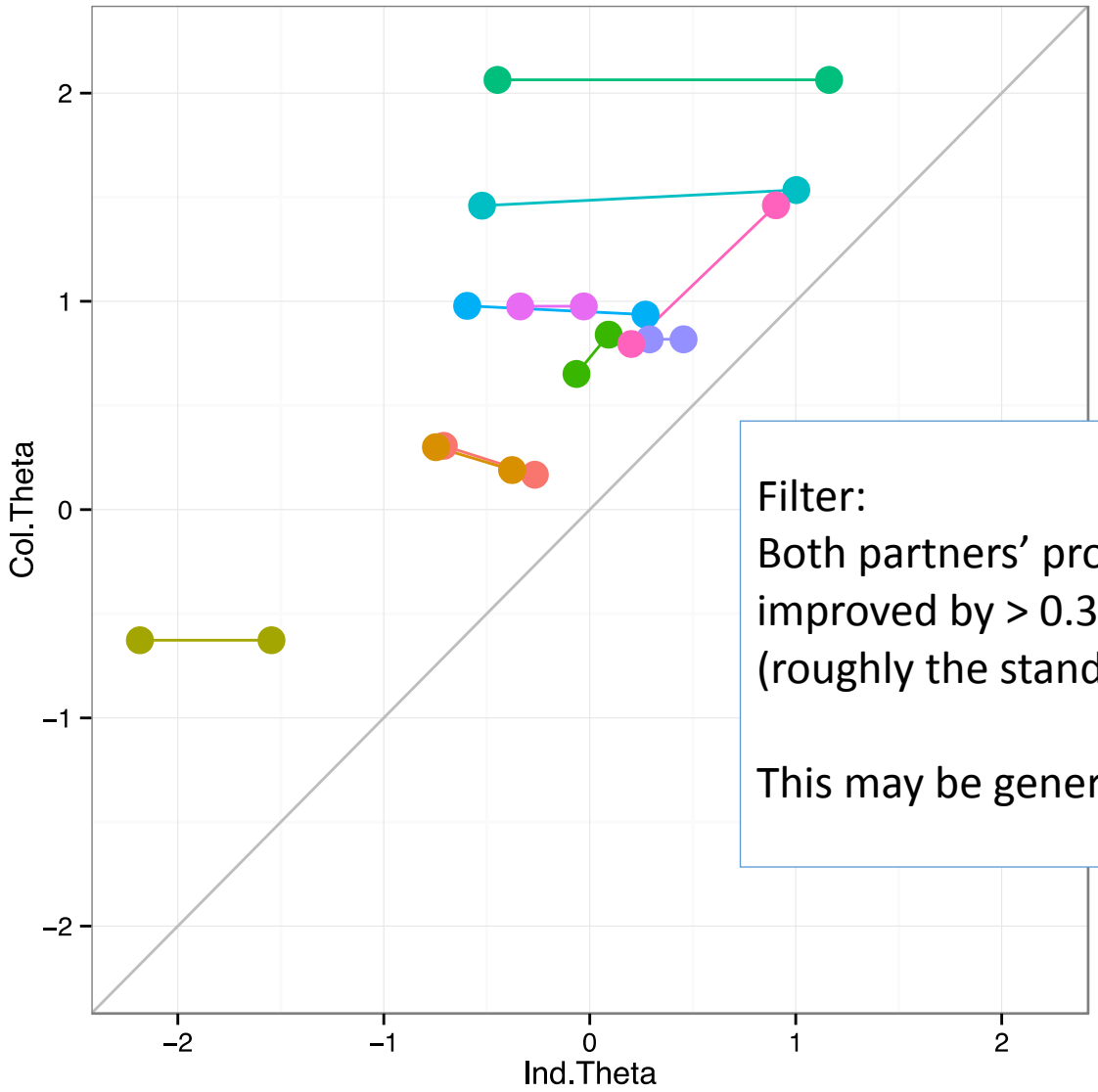



Pretty good evidence of non-collaboration

# Results: after instructions added



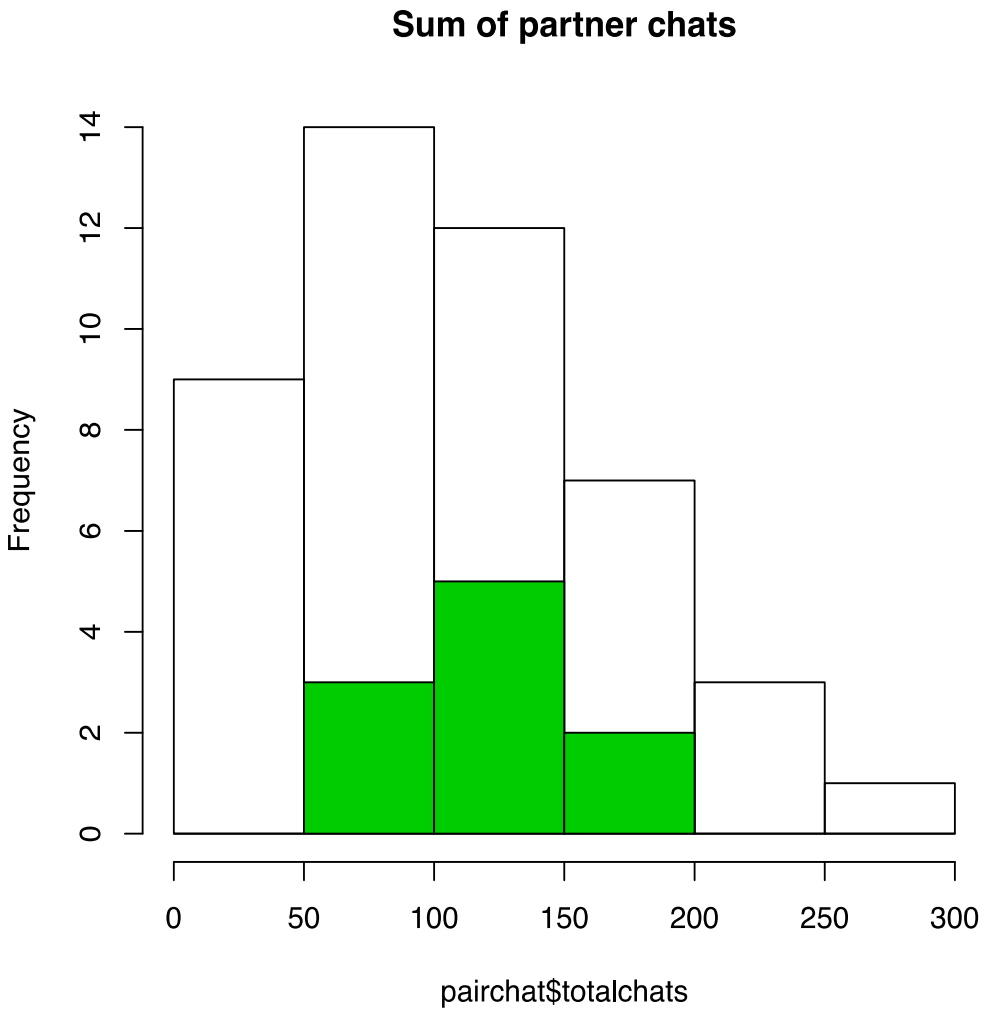
# Results: "positive" collaboration



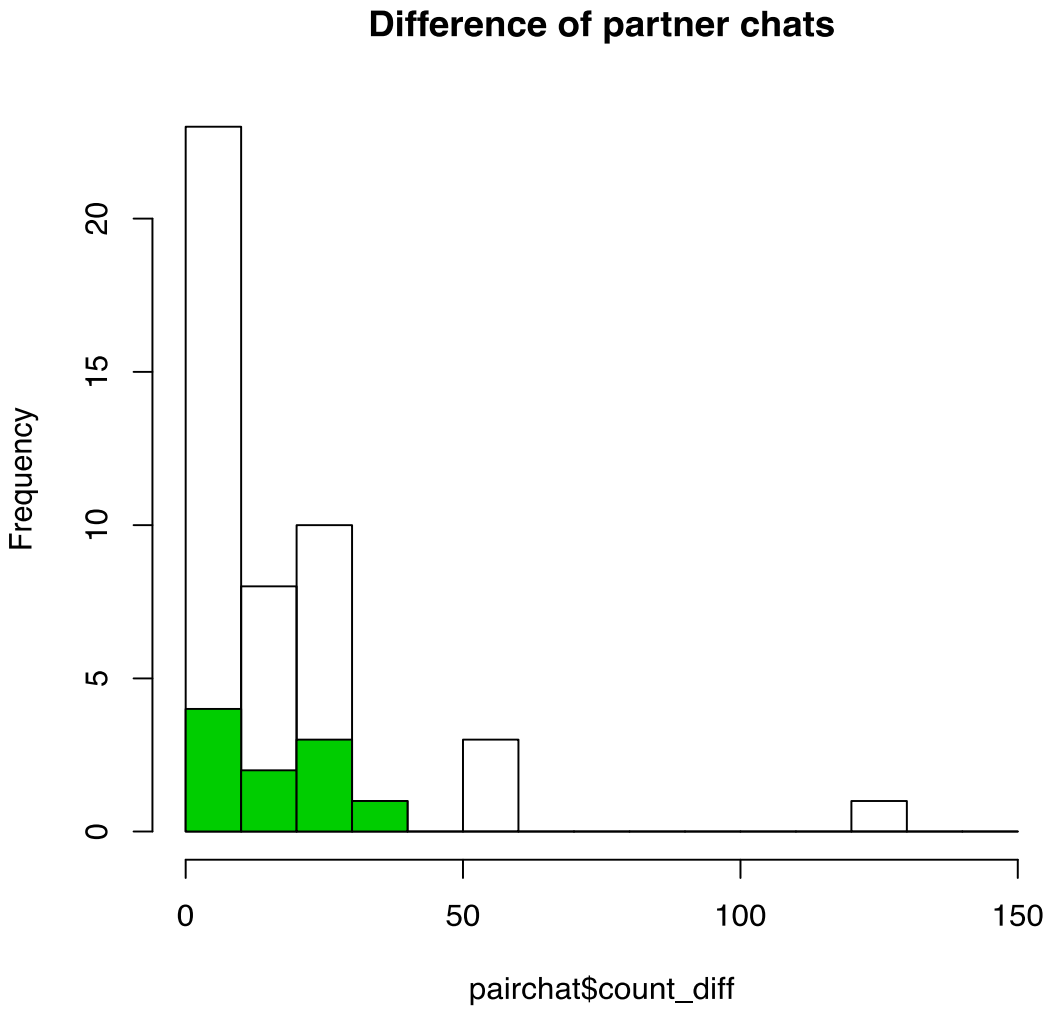

Filter:
Both partners' proficiencies improved by > 0.35 units (roughly the standard error)

This may be generous

# It’s not just the number of chats



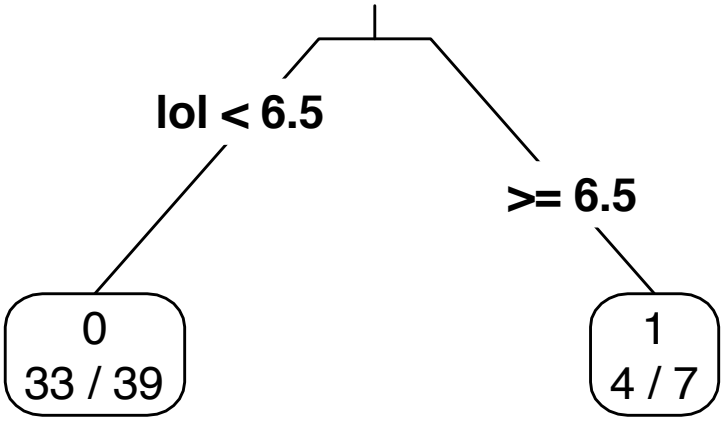
# Or the balance



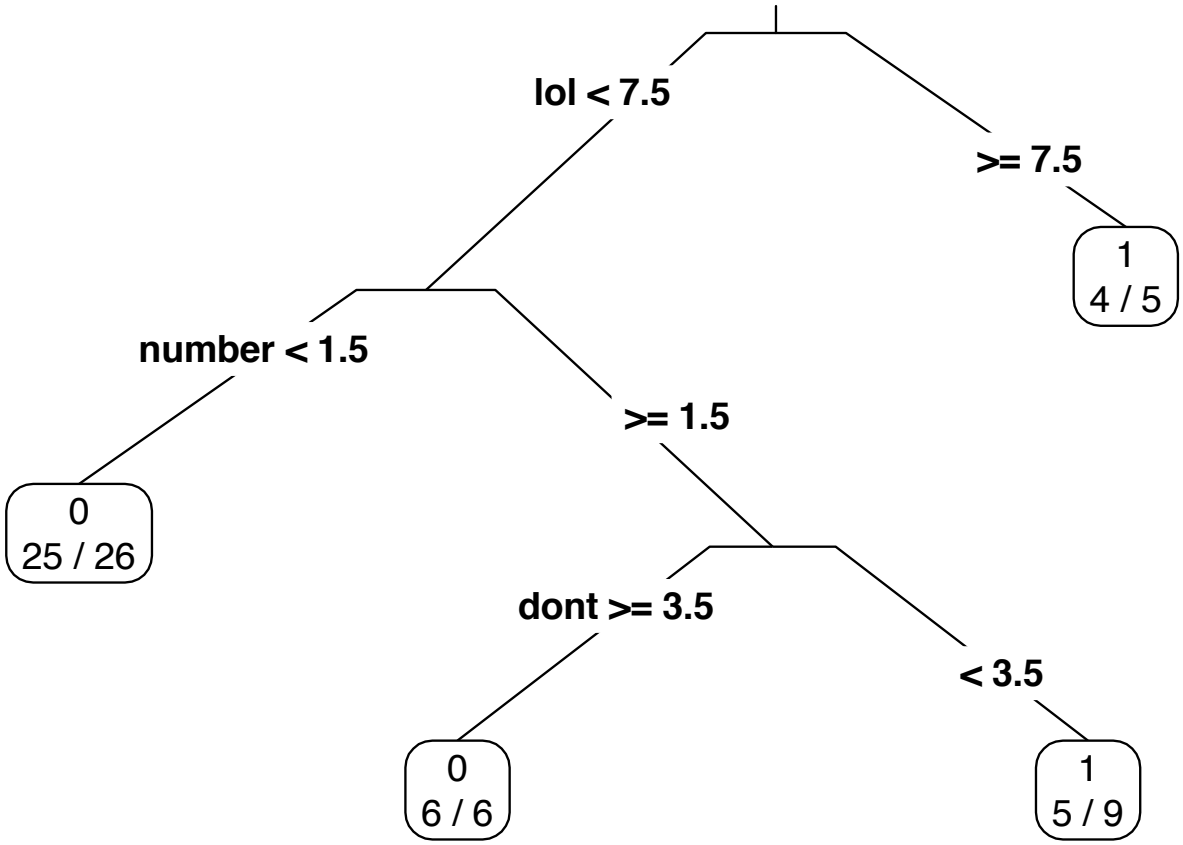
# Sample chat log

| | member_id | message |
|---|---|---|
| 5245 | 132 | If it's a dollar amount that they're asking, then yeah, 5 |
| 5246 | 132 | I think that's right |
| 5247 | 133 | yeah, wasn't quite sure if dollar amount or percentage |
| 5249 | 132 | Me either, lol :) |
| 5250 | 133 | lets go with the dollar figure, ok? |
| 5252 | 132 | Okay, 5 it is :) |
| 5254 | 132 | Last problem. |
| 5259 | 133 | doesn't seem like the graph has all the info needed. |
| 5261 | 132 | Yeah, I see that :/ |
| 5263 | 133 | if I had to guess then ... 15 |
| 5264 | 133 | 1 percent of the clocks |
| 5265 | 132 | Okay, I'll go with 15 too :) |
| 5268 | 133 | cool. we're done! |
| 5269 | 132 | That was fun! |
| 5270 | 132 | Nice working with you! :) |
| 5271 | 133 | thanks for help |
| 5273 | 132 | You too, have an awesome day :) |
| 5274 | 133 | get that money |
| 5275 | 132 | Yes, you too :D |

# Best classifier ever! LOL!



# Keep calm and talk about numbers



# Ongoing and future work

- Statistical analysis of interdependence models

$$P(X_{ijk} \mid \theta_j, \theta_k, w_j, w_k) = \quad w_j P(X_{ij} \mid \theta_j) + w_k P(X_{ik} \mid \theta_k) + (1 - w_j - w_k) P(X_{ij} \mid \theta_j) P(X_{ik} \mid \theta_k)$$

- Parse chat logs for collaboration evidence
- AMT data are not great
  - Crowd-workers were not particularly conscientious
  - Not really our target population
- Conduct small study with NYU undergraduates
- Improvements of XBlock

# Wishlist

- Cohort criteria — non-random pairing
- Synchronization control — condition each step
- Auto-completion — allow range of group-sizes
- Graphic enhancement
- Intelligent support (!)

https://github.com/ybergner/cpsx

# CPSX

a tool for online collaborative problem solving in OpenEdX

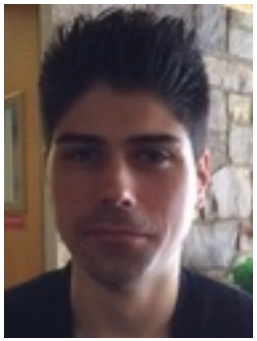
## Thank you!

ybergner@ets.org

GitHub: ybergner/cpsx

- Special thanks to CAWRS initiative
  - And Peter Halpin, Jason Rarick, and Patrick Barnwell





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