

MATH SHOULD BE FUN

But our intuitions about what works can be wrong

THE PREMIERE MATH GAME DOESN'T SEEM TO BE EFFECTIVE

The much lauded *DragonBox* doesn't produce statistically significant improvement from pre-test to post-test



	Lynnette Students	DragonBox students
Pre-test (all items)	.33 (.24)	.32 (.20)
Post-test (all items)*	.43 (.26)	.35 (.27)
Pre-test (shared items)	.35 (.27)	.32 (.21)
Post-test (shared items)*	.49 (.32)	.37 (.29)
Pre-test (game-only items)	.29 (.34)	.33 (.38)
Post-test (game-only items)	.31 (.33)	.31 (.41)

*p<.05.
(Long, & Aleven, 2017)

THE GOAL: CREATE AN ENGAGING INTERFACE THAT AVOIDS OVER-SCAFFOLDING

What is over-scaffolding?

Doing too much of the cognitive work on behalf of the student

EXAMPLE

$$2x + 3 = 7 - 3$$

Student goes to subtract out constant

$$2x + 3 - \square = 7 - 3$$

Indicator heavily hints that student should subtract from the other side

How we're avoiding that

Allowing errors and indicating them with cognitive tutor

EXAMPLE

$$2x + 3 = 7 - 3$$

Student goes to subtract out constant

$$2x + 3 = 7 - 3$$

No indicator is given

$$2x + 3 = 4$$

Student forgets to keep equation balanced and error is highlighted

Improving Affect

OLD TYPE-IN INTERFACE

OLD DRAG & DROP INTERFACE

The main problem with the old Lynnette interfaces is that they lack strong audio-visual aesthetics. They're simple and effective, but they can be improved.

MATH SHOULD BE COLLABORATIVE

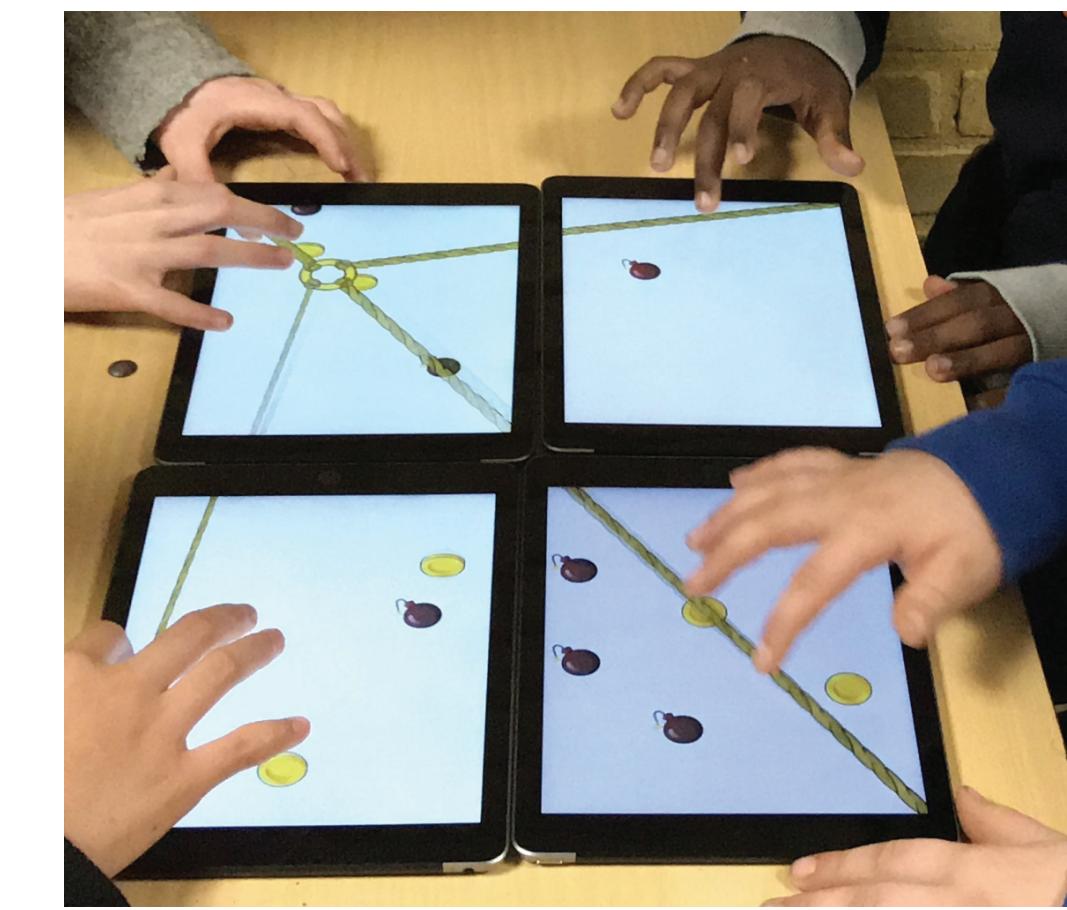
But we don't know how to make cognitive tutors team-oriented

DIGITAL TUTORS OFTEN ISOLATE STUDENTS FROM EACH OTHER

While personalized learning is effective, personalization ends up separating kids into their own digital bubbles

COLLABORATION CAN ENCOURAGE PROBLEM SOLVING

Collaboration has been shown to encourage problem solving even more so than individual or competitive learning



(Esmonde, 2009)

THE GOAL: BUILD AN INTERFACE THAT PROMOTES MEANINGFUL CONVERSATIONS



Promoting Communication

Working from the new Drag & Drop prototype, we designed a cooperative game, where students could only have access to some of the operators required to solve an equation.

Students had to communicate about who had which operators, and determine which person needed to complete which action when.

IMPROVING ENGAGEMENT OF COGNITIVE TUTORS

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TBD TESTING RESULTS HERE



CITATIONS

Esmonde, I. (2009). Ideas and Identities: Supporting Equity in Cooperative Mathematics Learning. *Review of Educational Research*, 79(2), 1008-1043. doi: 10.3102/003465430932562.

Long, Y & Aleven, V (2017). Educational Game and Intelligent Tutoring System: A Classroom Study and Comparative Design Analysis. *ACM Transactions on Computer-Human Interaction*, Vol. 24, No. 3, Article 20, April 2017.