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# The Emergence of New Objects in Co-Design: A Cultural-Historical Activity Theoretical Analysis

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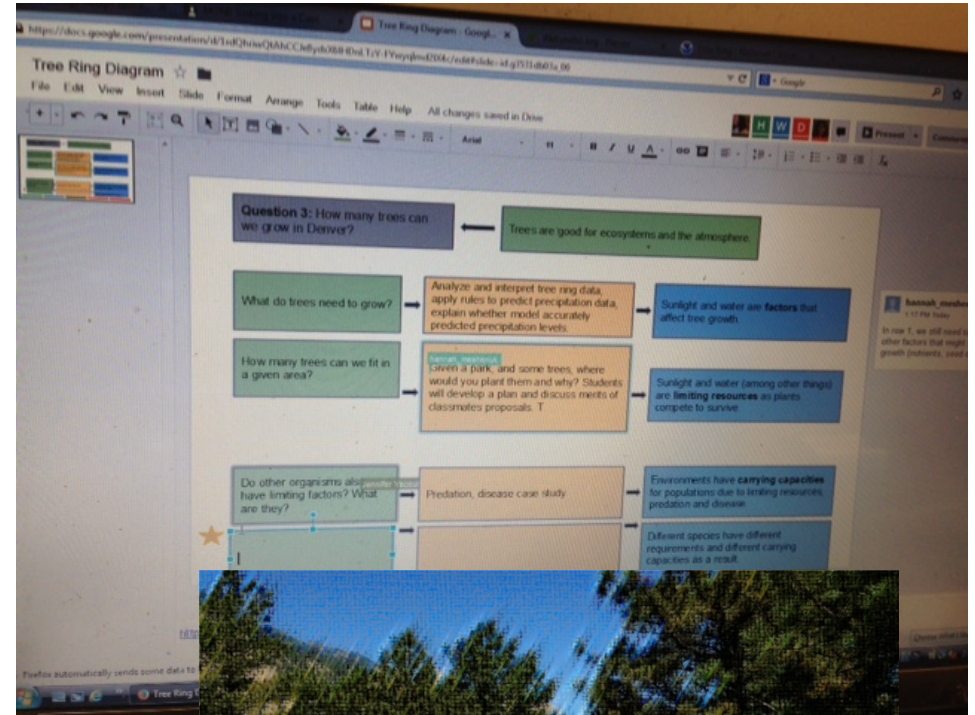
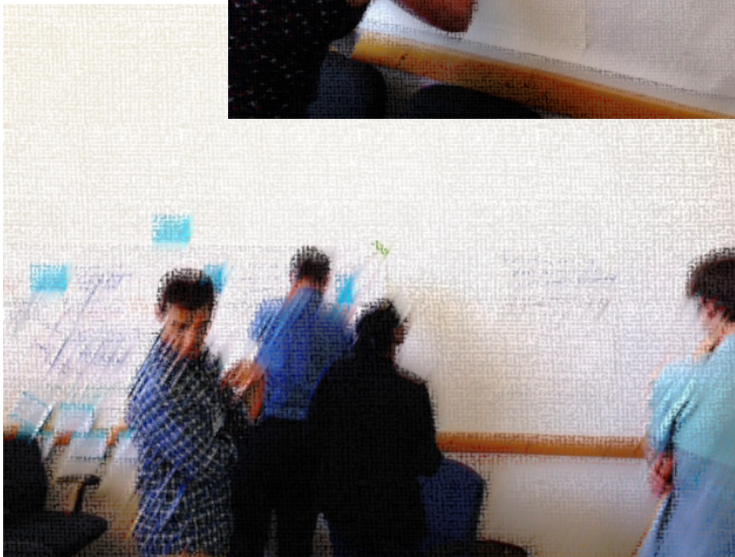
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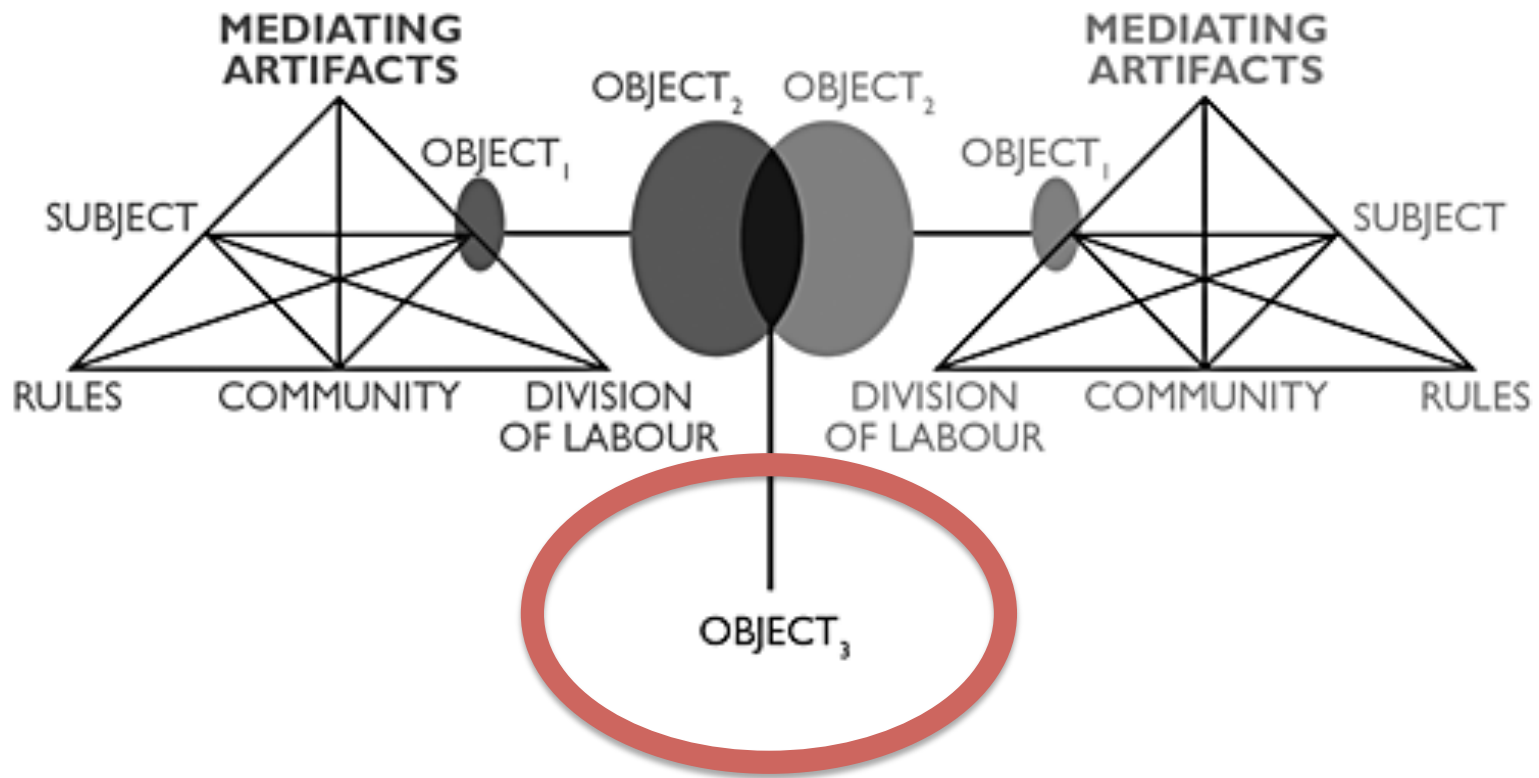
This material is based on work supported by the National Science Foundation under grant number 1147590. Any conclusions or recommendations expressed in this material are those of the author(s) and do not reflect the views of the National Science Foundation.

# Co-Design in the Learning Sciences



# New Objects in Co-Design

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# Engeström (2011)

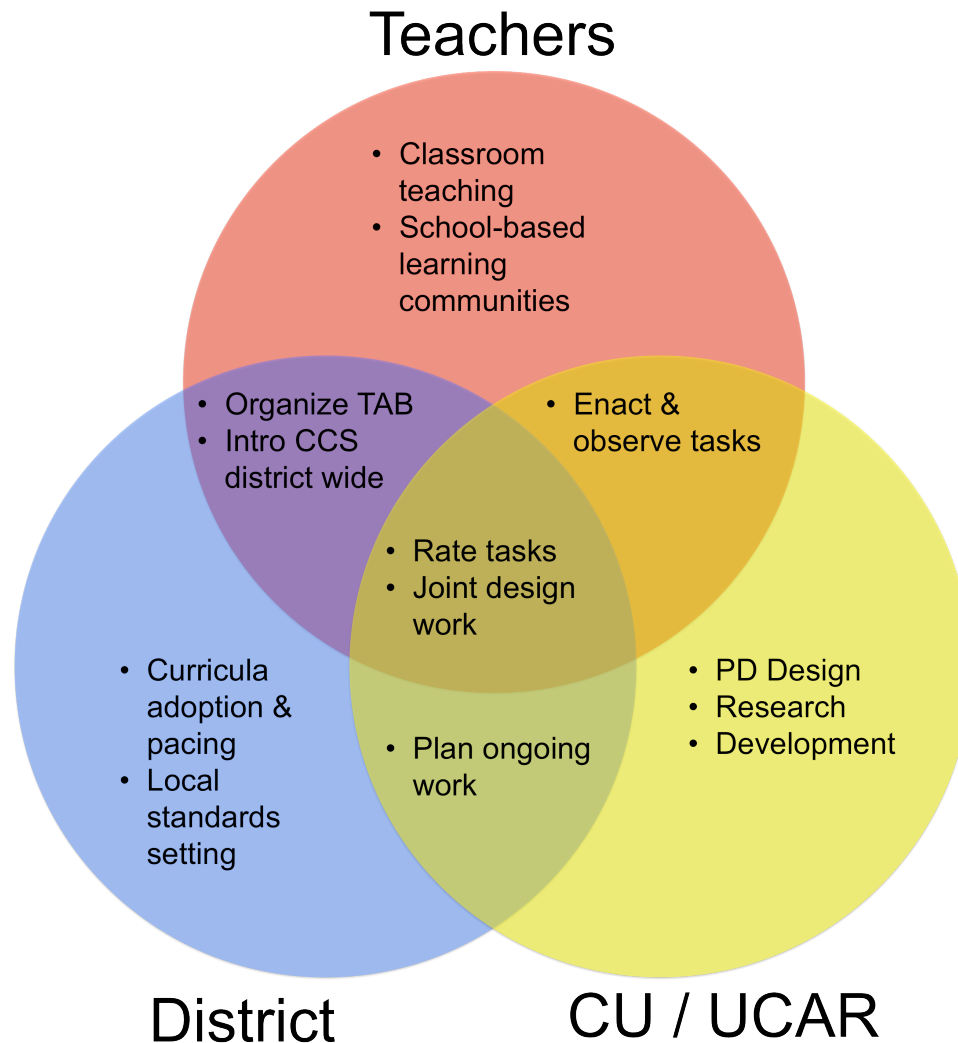
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“No terrain of activity, no matter how stable and resistant, is free of inner contradictions... When an activity system adopts a new element from the outside (e.g., a new technology or a new object), it often leads to an aggravated secondary contradiction where some old element (e.g., the rules or the division of labor) collides with the new one.” (p. 609)

Engeström, Y. (2011). From design experiments to formative interventions. *Theory & Psychology*, 21(5), 598-628.

# Context: A Research-Practice Partnership

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# Historically Accumulating Tensions

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## **Research-practice divide**

“Two communities” (Caplan, 1979) metaphor still reflective of the relation of educational research and practice

## **District-teacher divide**

Teacher voice limited in district-level decision making related to curriculum and instruction  
Principals make key decisions regarding teachers' time in district-sponsored activities.

# Task as Boundary Object

## Illustrative Mathematics

N-Q|How Much is a Penny Worth?

Alignments to C

- Alignment: N-Q.A

Tags

- This task is not yet

The price of copper pennies is lower than \$1.00 per pound. Copper pennies minted after 1982 each penny weighs exactly one cent weight.

### Curriculum Supervisors

Interpretation: Tasks add cognitive demand to intended curriculum

Work Organized: Communicating vision of curriculum

Interpretation: Tasks as context for teacher learning affecting transformation between written and intended curriculum

Work Organized: Design-Based Implementation Research

### University Researchers

### Algebra Teachers

Interpretation: Tasks as resources in written curriculum for student learning

Work Organized: Providing opportunities for student learning

### Mathematical Tasks

"standards and boundary objects [are] inextricably related, especially over time" (Star, 2010, p. 607)

Interpretation: Tasks as units of written curriculum

Work Organized: Cataloging and metadata creation

### Web Engineers

Other Helpful Information

Part a Part b Part c Scoring

opped making purchases with the er debt is paid and her credit card each month to the balance that

s referred to by its column letter this spreadsheet.

	Month	Amount owed (\$)	Monthly payment (\$)	Remaining amount owed after payment (\$)	Amount owed after 1.5% interest charge (\$)
1	1	300.00	40.00	260.00	263.90
2	2	263.90	40.00		

A3	B3	C3	D3	E3	0.015	1.015	×	÷	+	-
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# Task Rating as Boundary Practice

## Task Rating

- Home
- Chapter 1 Tasks
  - DA 1.4-11
  - DAA #9, p. 91
  - Track Stars
- Chapter 10 Tasks
  - The Titanic 2
- Chapter 2 Tasks
  - Fish in the Lake
  - How Much Is a Penny Worth?**
  - Leaky Faucet
  - Yogurt
- Chapter 3 Tasks
  - How Does the Solution Change?
  - Paying the Rent
  - Same Solutions?
  - The Balance Method
- Chapter 4 Tasks
  - Coffee and Crime
  - Golf Balls in Water
  - Penny's Birthday
  - Window Problem
- Chapter 5 Tasks
  - Best Buy Tickets
  - Car A or B
  - Dimes and Quarters
  - Fishing Adventures
  - Kimi and Jordan
  - Linear Inequalities
  - Printing Tickets
  - System Solver
  - Tickets
  - Writing Constraints
- Chapter 6 Tasks
  - Atoms of Silver
  - Cellular Growth
  - Extending the Definitions of Exponents
  - Variation

[Chapter 2 Tasks >](#)

### How Much is a Penny Worth?

N-Q How Much is a Penny Worth?

Alignment 1: N-Q.A.1  
Not yet tagged

This task is rated +1 (1 rating) • [Log in if you'd like to rate this task](#)

The price of copper fluctuates. Between 2002 and 2011, there were times when its price was lower than \$1.00 per pound and other times when its price was higher than \$4.00 per pound. Copper pennies minted between 1962 and 1982 are 95% copper and 5% zinc by weight, and each penny weighs 3.11 grams. At what price per pound of copper does such a penny contain exactly one cent worth of copper? (There are 454 grams in one pound.)

(From Illustrative Mathematics - <http://www.illustrativemathematics.org/illustrations/473>)

#### Task Rating Form

\* Required

**Your Name \***


**Email \***

**Task \***

- How Much is a Penny Worth?
- Leaky Faucet
- Yogurt
- Fish in the Lake

**Common Core Content**

If you were to search for tasks related to a Common Core standard, for which standard(s) would this task be a helpful search result?





# Emergence of New Boundaries

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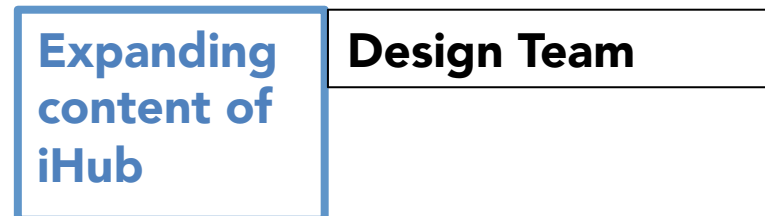
Expanding  
access to  
iHub

**Design Team**

**Other District  
Teachers**

# Emergence of New Boundaries

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**New focal object: Designing task implementation supports**

# Key Insights from CHAT Analysis

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- Analysis of boundaries help us keep tensions and difference focal within partnership.
- Collecting and analyzing data on the co-design process has helped us learn from failure:
  - In a way that subjects our own goals and position to critical analysis.
  - In a way that allows us explore the conditions for a phenomenon (its constitution) diagnose inequity in the design process (cf. Packer, 2010).

# Open Questions

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Our theories “must do real design work in generating, selecting and validating design alternatives at the level at which they are consequential for learning” (diSessa & Cobb, 2004, p. 77).

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Some possible alternatives:

- *In who leads design*
- *Different ways of organizing co-design*