Navigating Disability in Intensive Intervention: Learner Complexity and Small Environments

CAREER: FRACTION ACTIVITIES AND ASSESSMENTS FOR CONCEPTUAL TEACHING (FAACT)

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PROJECT GOALS

Year 1: Document ways of reasoning in initial fraction concepts for 50 students with learning differences; theory building.
Years 2 & 3: Document learning pathways of three focus students with LDs; theory refinement
Years 4 & 5: Develop and test an intervention based on theory and learning pathways of focus students. Produce materials for educators.

RESEARCH QUESTIONS

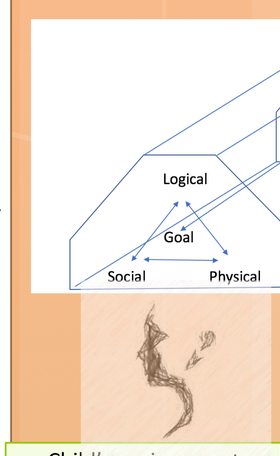
1. What initial and developing key developmental understandings of fractions do students with learning disabilities evidence through employed strategies, language, and representations?
2. How do students with learning disabilities progress in developing and solidifying conceptual understandings of fractions through their mathematical activity?
3. To what extent does an intervention reflective of a research based instructional trajectory facilitate strategic development and increased fraction knowledge in students with learning disabilities?

Introduction

- Historically, researchers define instruction for these students as intervention: the addressing of deficiencies or differences in children's mathematical knowledge (e.g., Hudson & Miller, 2006).
- Societal norms, the teacher's knowledge, or some combination thereof becomes the driving force behind mathematical knowledge as a remediation (Vygotsky, 1978).
- Yet, this literature is incomplete and at times misleading for those who do not equate *remediation* with *learning*.
  - We frame learning as adaptation (Piaget, 1951/1972/1980)
  - Because disabilities or differences in learning are far more dissimilar than they are similar (Compton et al., 2012), instruction should be based in a complex model of children's knowing and learning that we call "**small environments**".

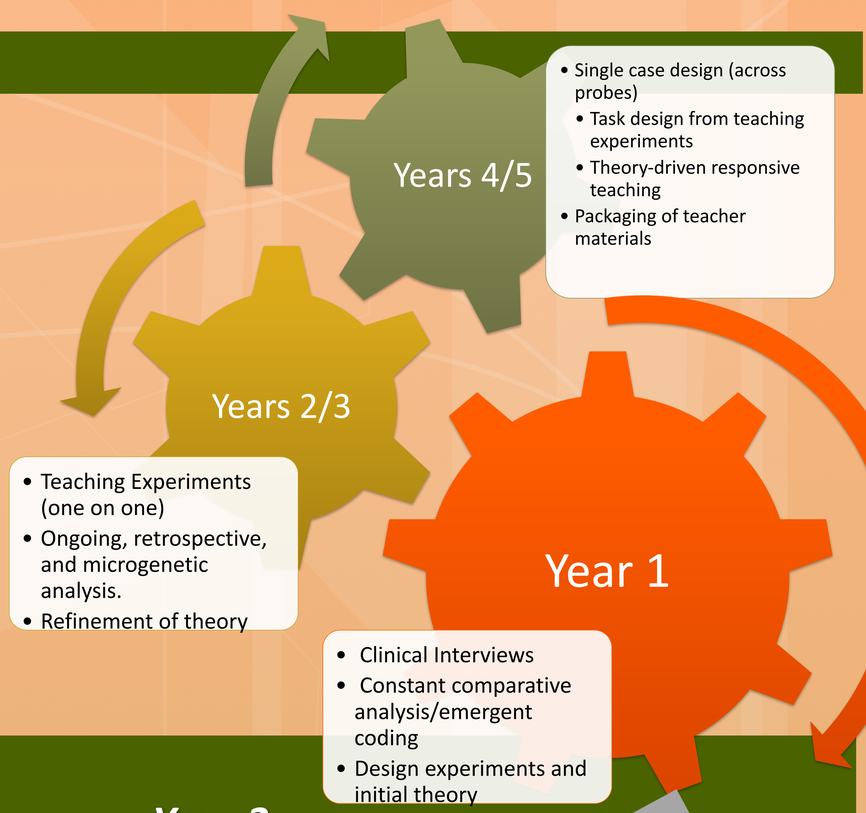
Small Environments

- **Learning as adaptation and negotiation**
  - If students engage with learning situations in unexpected ways, their knowing and reasoning cannot be conceptualized as "deficient" or, arguably, even "different." It must be conceptualized as *their knowledge-unique organisms every child uses to make sense.*
- **Adaptation supports negotiated meaning**
  - Learning occurs first as children adapt their internal cognition to the environment.
  - Learning occurs second through bi-directional reasoning and sense making defined as responsiveness from the teacher to the student's way of knowing.



Data Gathering and Analysis

Through a series of experiments that involve cycles of theorizing, design, implementation, and refinement, this project develops instructional trajectories for individual students in the area of fractions.



What are we Learning?

Year 1

Year 1: The *observable means* by which children with LDs reason does not differ significantly from other children when we hold task types constant.
Year 1: Key Developmental Understandings: Partitioning, Iterating, Unit Coordination
Year 1: Teaching and learning as complexity.

Complexity: Real-time negotiation of the goals children experience in adaptation with adult's goals for children's learning (perceived or explicated).
Learning is enabled or disabled

Year 2

Year 2: The use of memorized fact combinations or teacher taught strategies eclipsed the use of two students' natural reasoning(Author, under review) yet supported the third's. The child's full experience becomes their mathematical reality.
Year 2: Symmetric units coordinating; tacit.

Year 3

Year 3: Teaching moves showing a unique responsiveness. Supports for memory, Restate/Reshow processing, reflection
Year 3: Multiplicative reasoning continued barrier to sophisticated fractional reasoning. Facts break down as a support past tacit or two levels of units coordinating. Symmetric notions within two levels of units distinct way of reasoning (additive)

Outcomes

- A theory of knowing, learning, and teaching connected to students with LDs in the small environment.
- Three to five research-based trajectories specific to understandings of fractions evidenced by students with LD (case study format).
- A set of practices and tools for teaching in the small environment (e.g., explicated knowing and learning framework; a set of learning situations to be used for teaching and/or formative assessment in fraction concepts, and

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