Design-Based Research (DBR)

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Overview

- What is design-based research?
- What are the key assumptions?
- How to do DBR?
- Challenges and Criticisms
What is Design-Based Research?

• Theory driven design of learning environments combined with empirically driven research
• Understand under what conditions innovations work in authentic contexts

Key Assumptions

• Design
  – Design of an innovation; engineered learning opportunities
  – Hypotheses are embedded in the design
  – Underlying assumptions or conjectures about teaching and learning
  – Test-beds for innovation
Key Assumptions

• Iteration
  – Iterative cycles of design-enactment-analysis-redesign
  – Multiple trajectories, each project may follow a different trajectory (e.g., FCL)
Key assumptions

• Context
  – Understand how the design functions in authentic contexts, i.e., learning ecology
  – More than one variable
• Use of qualitative and often inductive techniques
• How and why questions

• But what is so unique about this?
• Closely intertwined goals integrating the refinement of the design/innovation and developing theories of learning
• Pragmatic as well as theoretical
• Theories generated are humble: domain-specific and related to the designed innovation
How To Do DBR?

- Iterations: Trajectories
- Specific to a project
- Choices need to be made in each iteration about grain size
- *Informing Cycles*: Each cycle of studies informs the next
Example: FCL

- Reciprocal teaching experiments: Individual students
- Small groups of students
- Classroom settings
- FCL phases
- Community of learners, communities of practice, diverse expertise, design of materials, across different grades
Example: CoMPASS Project

• Motivating principle
  
  To enable an in-depth, cohesive understanding of life sciences content, rather than multiple disconnected topics, especially through digital text
  
  Integrate science text in the context of classroom science

• Key Learning Principle
  
  For a cohesive understanding of science content, students need to learn science as a connected body of knowledge, see and understand connections between science ideas, concepts and principles students to understand
CoMPASS Project

• Key Design Principles
  • Enable students to see connections between science ideas
  • Enable students to revisit big ideas
  • Conceptual representation and textual representation - change dynamically
  • Maps are dynamic and zoom in and out in the form of a fisheye (Furnas, 1986)
  • Levels of coherence
  • The most related concepts are closest to the focus
  • Students can “switch views” between topics

Embedded
Iteration 1

- Usability studies, lab based
- Small group studies, for usefulness, with students of different abilities
- Outcome
  - Refinement of the representations
  - Revision of text

Puntambekar, Stylianou, & Goldstein (2007)
Iteration 2

Study 1: Comparing maps vs. no-map versions

• Understanding the role of structure and coherence provided by concept maps
  – How do students learn from multiple, digital text?
  – How does system structure affect student navigation and learning?

• Outcome
  – Maps helped students understand more connections, deeper connections on a concept mapping test
  – But some needed more support

Iteration 2

Study 2: Designing metanavigation support

• Understanding the role of metacognitive support: metanavigation support in digital text
  – How does metanavigation support affect student navigation and learning?

• Outcomes
  – Providing metanavigation support enabled students to make coherent transitions among the text units
  – Students’ reading comprehension ability, presence of metanavigation support and prior domain knowledge significantly predicted students’ understanding of science principles and the relationships among them
  – Initial understanding of curriculum needs and teacher facilitation

Outcomes: Iteration 1 and 2

- For a cohesive understanding of science content, students need to learn science as a connected body of knowledge, see and understand connections between science ideas, concepts and principles students to understand
- Text promoting connections
- But....curriculum and teacher facilitation
- Redesign of curriculum materials
- Teacher professional Development to facilitate making connections

Needed to be embedded in tools
Iteration 3

- Understanding the role of teacher facilitation; understanding enactments
  - How can digital text and design activities be integrated? What can we learn from classroom enactments?
  - How do teachers facilitate classroom discussions to enable students to make connections between the activities?
  - How does the nature of teacher’s facilitation support (or not) students’ understanding of the connections between science concepts?

- Outcomes
  - Successful facilitation strategies

Puntambekar, Stylianou, & Goldstein, (2007)
Along the way…

- Smaller lab based studies
- Helped with classroom iterations
- Back and forth between classroom based and more controlled studies

“As well-formulated questions arise, for example, about which alternative activities or changes in an applet are most likely to lead to a desired outcome, a small, randomized trial might be used within a classroom”

Shavelson, Phillips, Towne, & Feuer, (2003), p. 28
Iteration 4

- Multiple contexts: rural, urban, suburban
- Variations in resources, teacher prep and student populations
- Students’ knowledge building in groups
Trajectory of Studies

• Each iteration of the design-enact-redesign cycle led to hypotheses that are tested in the next cycle
• Refinement of design
• Confirming and Refining underlying assumptions
• Understanding issues in context
• Different types of data and different grain sizes
Trajectory of studies

- Design research is about
  - a trajectory of studies
  - about multiple studies along a trajectory in a research program, not about a single study
• How can we plan a trajectory?
• What are the underlying theoretical assumptions?
• How are these embedded in the tools: software, curricula, practices, discourse of the classroom?
• Questions: design, theory, implementation
• What sequence of studies can we plan?
• Conjecture Mapping

Sandoval, (2013)
• Questions, Reflections
• Criticism of DBR
Criticisms

• Characterizing Implementations
• Huge amounts of data collected
• What about rigor?
• What about replication and generalization?
Characterizing Implementations

- Social Infrastructure
- *Existence proof*—stability and feasibility of an innovation for the context in which it was developed
- *Practical implementation*—how the innovation works in very different classroom contexts

Bielaczyc (2013)
• Double design matrix: Developer/teacher
  – Points of divergence
  – Variations across iterations
  – Increased detail of dimensions
    • Factors impacting teachers’ design choices might help refine the underlying educational model
THANK YOU!!


