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

The Design-Based Research Collective (2003); Cobb, P., Confrey, J., Lehrer, R., & Schauble, L. (2003)

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

Tabak, (2004); Collins, Joseph, & Bielaczyc (2004); Cobb et al., (2003)

- 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

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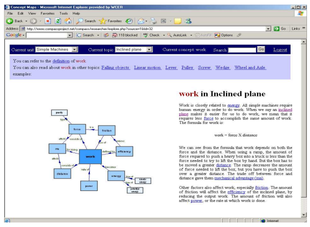
CoMPASS Project

- 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



Screen shot from CoMPASS

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

Puntambekar, Stylianou, & Hübscher (2003)

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

Stylianou, (2003)

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

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THANK YOU!!

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