SCAFFOLDING

Brian J. Reiser
Learning Sciences
Northwestern University

Iris Tabak
Department of Education
Ben-Gurion University of the Negev

ISLS NAPLES Webinar  4 Dec, 2013
Driving Questions for today

1. What is scaffolding?
2. How do learning scientists use the idea of scaffolding in research on learning environments?
3. How can design-based research build scaffolding theory?
Webinar Structure

1. Introductions

2. Two time blocks, in each block:
   1. Overview by presenters
   2. Question for the group
   3. 5 min reflection/discussion (individual/group)
   4. Regroup – sites report/raise questions

3. General Q&A

Reminders:
1. Click “stop broadcasting” a few seconds after you stop talking
2. Can use emoticons to give feedback to speakers
3. Can use chat box while people are speaking
Section 1: What is scaffolding?

What are the historical roots of scaffolding?

How has this idea been used and extended in the learning sciences?
Learning to Ride a Bike?

Which Approach?

- Just Balancing
  - Riding a bike with training wheels and coaching
- Just Pedaling
  - Riding a bike with one training wheel and less coaching
- Just Steering
  - Riding a bike without training wheels
Sub-skills Approach

- **Attributes**
  - Simplify and master each sub-skill
  - Need to “put the pieces together”

- **Critique**
  - Hard to put the pieces (sub-skills) together
  - Sub-skills in whole may be qualitatively different than sub-skills in isolation
  - Hard to glean when whole-skill is applicable – inert knowledge
Whole-task Approach

- Mitigates some sub-skill critiques
  - Sub-skills learned within whole task
  - Learning takes place in application context (or an emulation of this context)
- Difficulty introduced
  - Sub-skills need to be mastered in tandem
Scaffolding

- Titrated support that helps learners learn thru whole-task activity.
- Support that enables learners to perform tasks that are outside their independent reach.
- Consequently, enables learners to:
  - Develop the sub-skills necessary to perform the whole-task independently.
  - Build repertoire of examples of the conditions where the skill or task is applicable.

(e.g., Greenfield, 1984; Rogoff, 1990; Wertsch & Stone, 1985; Wood, Bruner, & Ross, 1976)
Examples

- **Training wheels**
  - Focus on pedaling and steering ignore balance
  - Balancing slowly introduced by raising t. wheels

- **Adult-child puzzle construction**
  - External regulation & modeling
  - E.g., “Start with the edges” “Are there more edges?”

- **Weavers**
  - observation -> joint + coaching -> independent
  - Less experienced girls assigned smaller cloth, less weaving cycles, less strength
  - More “taking over” on more difficult aspects
Examples of Evidence

- **Bottom up**
  - Models gleaned from observation of effective tutoring and apprenticeship in naturalistic settings
  - E.g., Vygotsky, Greenfield, Lave

- **Top down**
  - Scaffolding more effective than modeling alone, verbalization alone or combination of modeling & verbalization (e.g., Wood, Wood & Middleton, 1978).
Extensons of scaffolding in the learning sciences

- Historical definition: “Titrated support that helps learners perform tasks that are outside their independent reach”

- Building on cognitive and sociocultural theories of learning, learning sciences investigates how and why this helps learning.

- How does scaffolding learners’ work on problems change the nature of the task to make it more productive for learning?
Shift in nature of the tasks: *academic domains*

Shift in nature of settings: *intentional learning environments* focused on the goal of learning rather than the goal of accomplishing work or other daily goals (e.g. child-parent playing a game).

So more design work is needed to “fill in” for “knowledge” that comes from the surrounding environment such as purpose, values, and norms.
How does scaffolding transform learning tasks?

- Simplify elements of tasks so they are within reach of learners.
- Help manage the process so that learners can engage in elements of the disciplinary work in real problem contexts.
- Focus learners’ attention on aspects of the problem they may take for granted.
- Prompt learners to explain and reflect.
- Enable learning by doing in context.

(e.g., Reiser, 2004; Quintana et al., 2004)
Embedding scaffolding in learning environments

- In teaching/learning interactions: teachers can model discipline-specific strategies, focus attention, prompt for reflection and explanation.
- In structure of activities and artifacts: embed expert strategies in structure of activity, supports for managing the work.
- In computational tools: support discipline-specific strategies, prompt articulation and reflection, manage problem solving.

(e.g., Guzdial, 1994; de Jong, 2006; van de Pol et al., 2010; Wu & Looi, 2011)
Distributed Scaffolding

- **What**
  - A collection of agents, artifacts, & role structures to support complex learning

- **When**
  - The target task is very complex
  - Requires coordination of multiple skill sets (conceptual, communicative, material, etc…)

- **Why**
  - A variety of material and social means can provide different affordances and constraints
  - Can work in concert over time in helping students gain facility with the relevant skill sets and their coordination

(e.g., Puntambekar & Kolodner, 2005)
Patterns of Distributed Scaffolding

- **Differentiated scaffolds**
  - Different forms of support
  - **Different aspects of learning or skills**

- **Redundant scaffolds**
  - Different forms of support
  - Different points in time
  - **Same learning need**

- **Synergistic scaffolds**
  - Co-occurring and interacting supports
  - **Same learning need**

(e.g., Tabak, 2004)
Summary

- Whole-task facilitates learning-to-practice transfer
  - Minimizes differences between learning and practice context
  - Maintains whole-task representation throughout the learning

- Scaffolding
  - Mitigates difficulty of simultaneous learning of skills
  - Involves
    - Modeling/Imitation
    - Joint action
    - May include tools and environment modifications that are not part of eventual practice or expert performance
    - Requires repeated scaffolded repetitions of task
    - On-going evaluation of learner sub-skill level
    - On-going titration of support (fading)
  - Need not be provided by a single agent or tool
Reflection

Select an example of scaffolding that is part of a learning environment you are familiar with (e.g., from your own experience as a learner or teacher, from your research, from something in the literature)

a. Explain why you consider this scaffolding.

b. How does the scaffolding transform the task to make it more productive for learning?
Section 2: Scaffolding and DBR

How can design-based research on scaffolding help build theories of learning and instruction?
Design-based research

Needs assessment → Design Goals → Design framework and principles: General strategies to achieve these goals → Learning environment design → Learning Environment implementation

Model of learning → Empirical analyses
DBR investigations of scaffolding for mechanistic explanations in science

Problem: Students view descriptions as answers, don’t push for mechanistic explanations

Design Goals

Design principles: Critique and self-evaluation prompts for mechanism (how?, why?, cause?)

LE Design: Explanatory model worksheets

LE Implementation: Classroom trials

Empirical analyses

Model of learning

IQWST (Krajcik, Reiser, Sutherland, & Fortus)
Theory building in the learning sciences

- Iterative theory development through the coordination of learning theory and design principles
  - Successful examples of scaffolding (through DBR) push learning theory
  - Expansions of learning theory drive new instructional approaches
Theoretical Precision Drives Pedagogical Theory

- “Tight” foundations-based framings
  - Keep elaborate key features salient
    - E.g, supporting process, assessment of independent performance, titrated support, fading
  - “Loose” framings obscure key features

- Saliency of key features
  - Refines and regulates design and analysis efforts
  - Drives pedagogical theory by enabling finer distinctions
  - Does not preclude variants & evolution
Productive Evolution

One-on-one Interactions – scaffolding is “in” the tutor

Many-to-many Interactions – scaffolding is distributed among people and artifacts

Intercontextual Interactions—scaffolding transcends settings

Ubiquitous Technology & Intelligent Systems

(e.g., Luckin, 2008)
Reflection

What are the next key questions in learning sciences to investigate about scaffolding?
Thank You!

Reiser@northwestern.edu
itabak@bgu.ac.il


