SCAFFOLDING

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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:

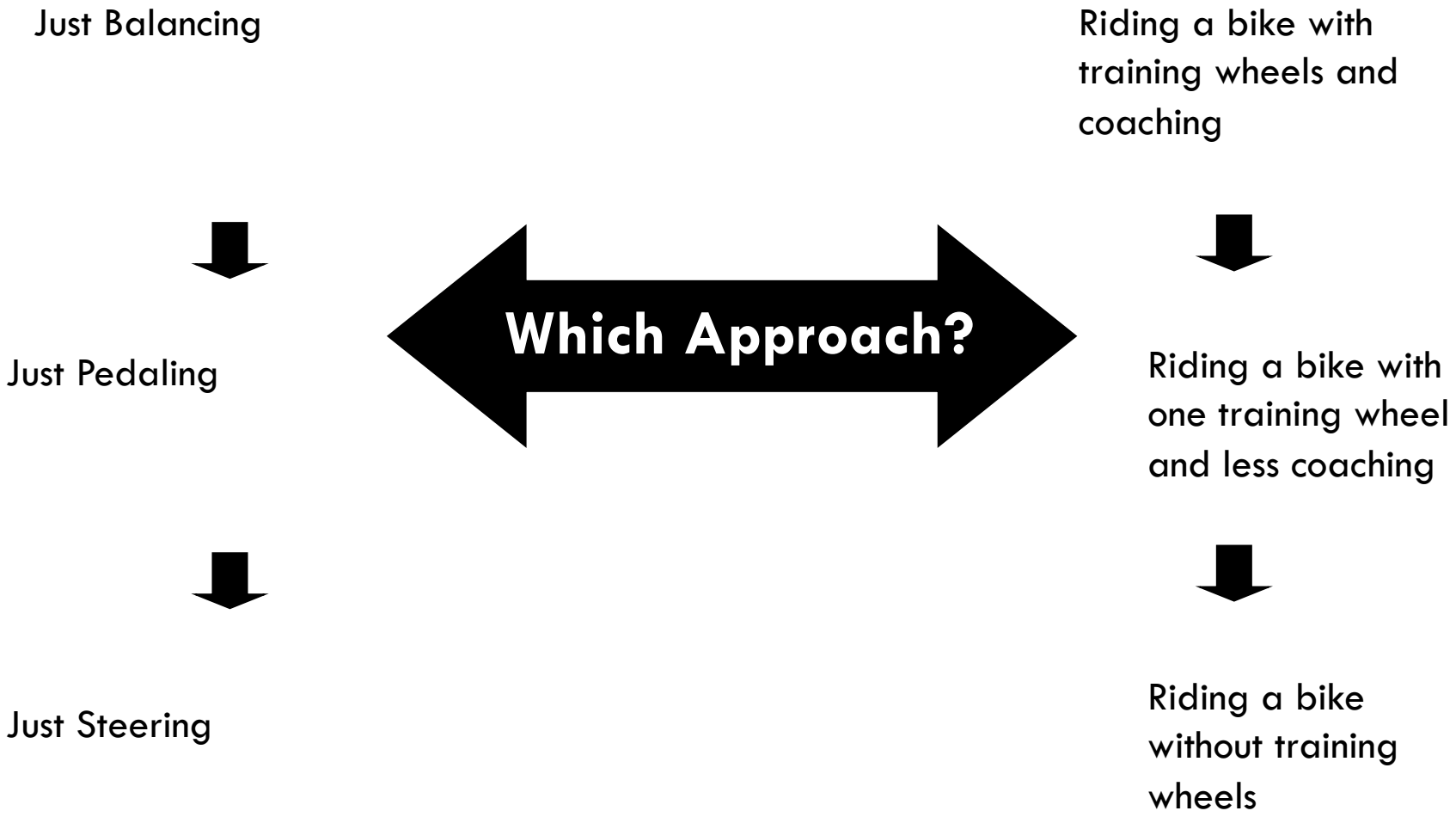
1. Click "stop broadcasting" a few seconds after you stop talking
2. Can use emoticons to give feedback to speakers
3. Can use chat box while people are speaking

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?



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).

Extensions 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?*

Scaffolding as studied in the learning sciences

- 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

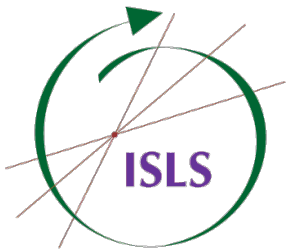
- Whole-task facilitates learning-to-practice transfer
  - Minimizes differences between learning and practice context
  - Maintains whole-task representation throughout the learning
- Scaffolding
  - Mitigates difficulty of simultaneous learning of skills
  - Involves
    - Modeling/Imitation
    - 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?*



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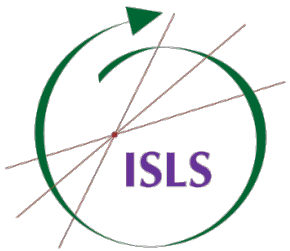
Section 2: Scaffolding and DBR

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



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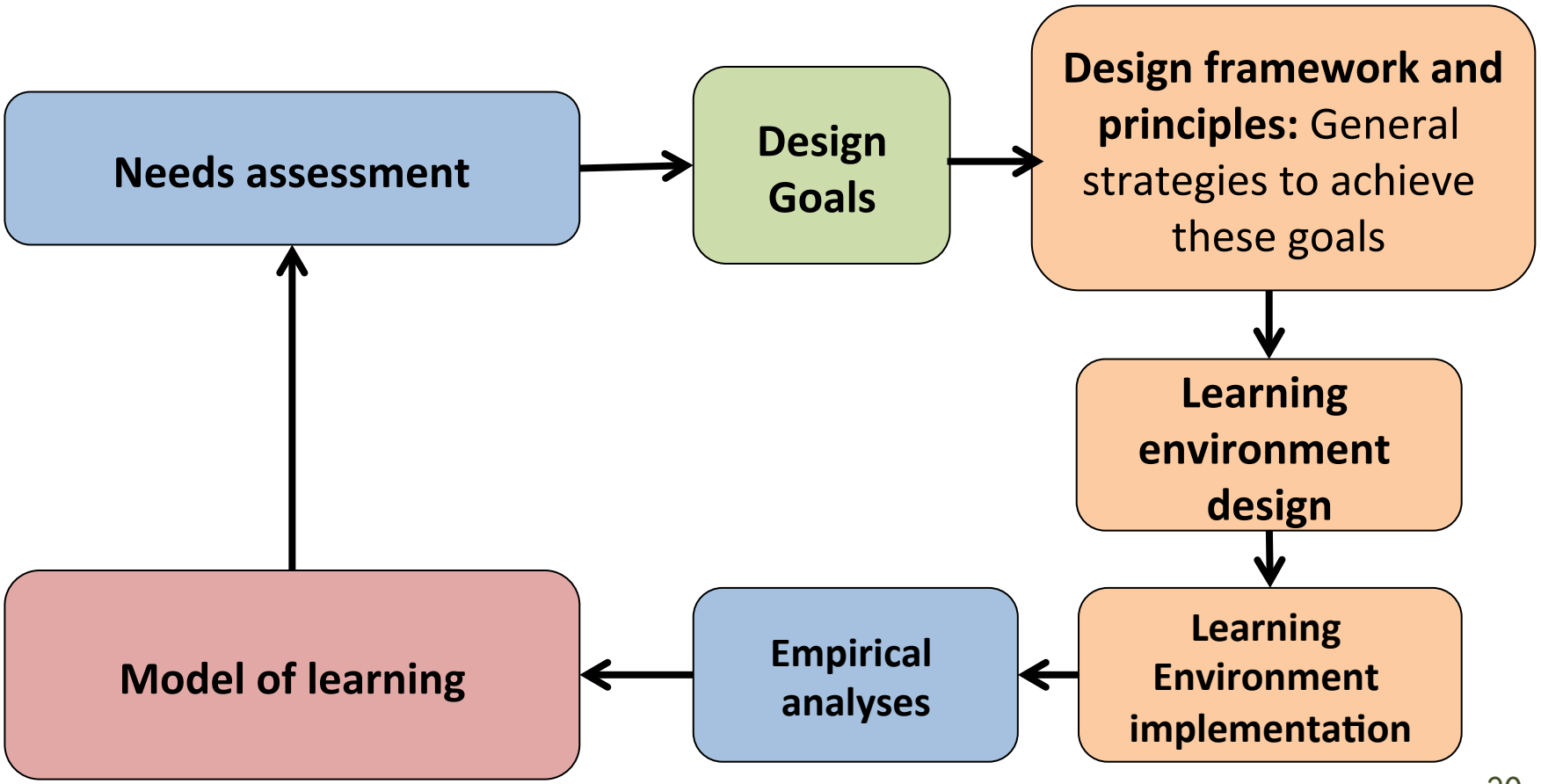
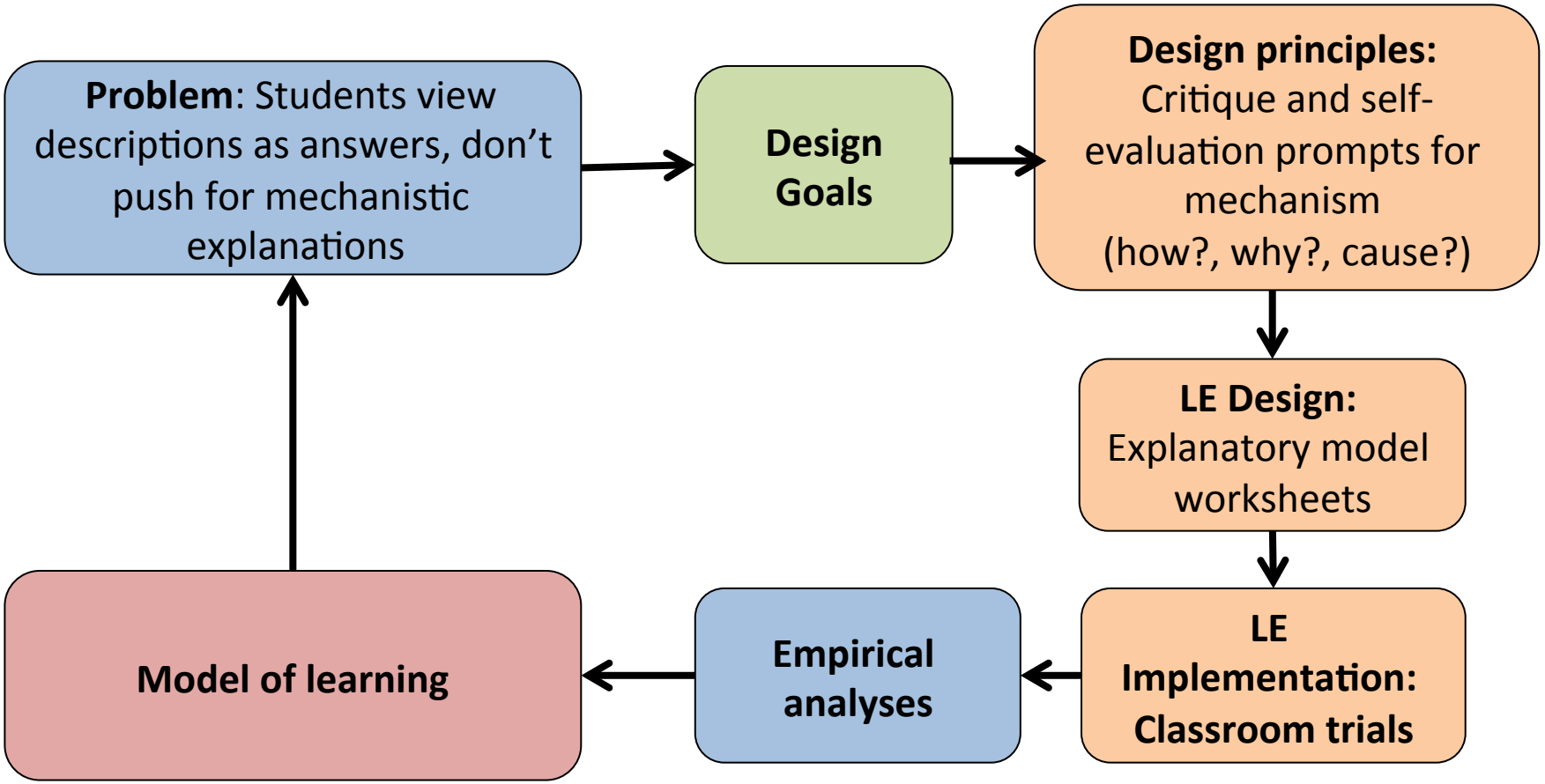
Design-based research



DBR investigations of scaffolding for mechanistic explanations in science



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

Ubiquitous Technology & Intelligent Systems

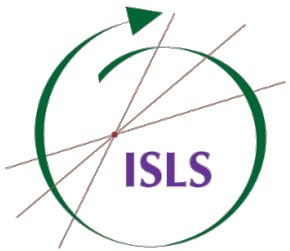
Many-to-many Interactions – scaffolding is distributed among people and artifacts

Intercontextual Interactions– scaffolding transcends settings

(e.g., Luckin, 2008)

Reflection

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



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Thank You!

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