COMMUNICATING DESIGN-BASED RESEARCH

A Workshop for Creating and Interpreting Design Arguments

Pryce Davis, Stina Krist, Daniel Rees Lewis, Mike Tissenbaum, Freydis Vogel and Matt Easterday

LOGISTICS, TECHNOLOGY, & NORMS

Webpage: https://tca2.education.illinois.edu/icls2020-dbr

If you have technology issues:

- Chat feature in Zoom (Mike will monitor & help)
- Email: miketiss@illinois.edu

Stay muted when not speaking

Registered participants have been assigned to breakout groups with some logic, and a facilitator will be part of your group

Waitlist/"Listening in" participants will also be sent to (randomly assigned) breakout groups with no facilitator -- feel free to choose your level/degree of participation there

WORKSHOP SCHEDULE

9:00
INTROS
- Framing the problem
- Breakout group introductions

9:30
UNPACKING
- Introducing the framework with examples

10:00
APPLYING
- Using the framework on examples of DBR in breakout groups

11:30
LUNCH
- 45 min break for “lunch”
- Rooms available for questions or networking

12:15
SHARING
- Share out from small group work, general discussion

1:30
WRAP-UP
- Summary of workshop
- Rooms available for questions, individual meetings, networking

Times in US CDT

Los Angeles Times via Getty Images

1 INTROS

WHAT IS DESIGN-BASED RESEARCH (DBR)?

DBR is a methodology to study, develop, and test learning theories through iterative design and implementation of interventions—tools, environments, etc—in real world contexts using a variety of data collection and analysis strategies.

FRAMING THE PROBLEM

DBR IS A CENTRAL METHOD FOR THE LEARNING SCIENCES

- Researchers have made strides in defining DBR in both its practice and philosophical underpinnings (e.g. Easterday, Rees Lewis & Gerber, 2016; McKenney & Reeves, 2018; Sandoval, 2014)
- Begun the process of standardizing DBR as a methodology

LACK OF SPECIFICITY IN *COMMUNICATING* DBR

- Learning sciences has moved from defining what DBR is to detailed descriptions of how to do it, but we still struggle with how to talk about it once it is done
- To make decisions about “what works” (for whom and under what conditions) from a highly contextualized methodology, we need the ability to unpack the logic of the study to pull out key pieces of information

FRAMING THE PROBLEM

TOO MUCH STORY TO TELL

Complexity of real-life contexts, Iteration, Multiple data sources, Unexpected outcomes

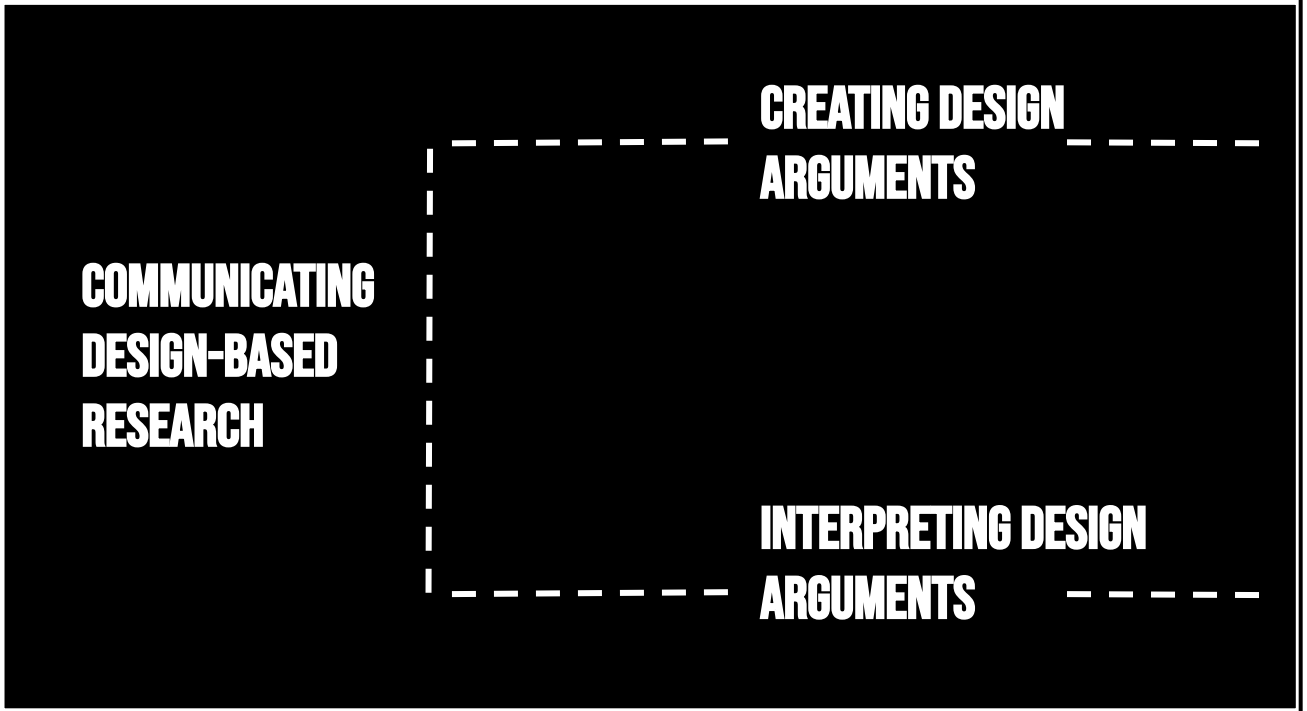
IMPLICIT ARGUMENTS

Making “big picture” connections between theory and design often buries the logic of crucial small scale decisions

NO PRESENTATION STANDARDS OR EVALUATION HEURISTICS

“It seems to me that what gets published is just good writing.” - An NSF PO

FRAMING THE PROBLEM



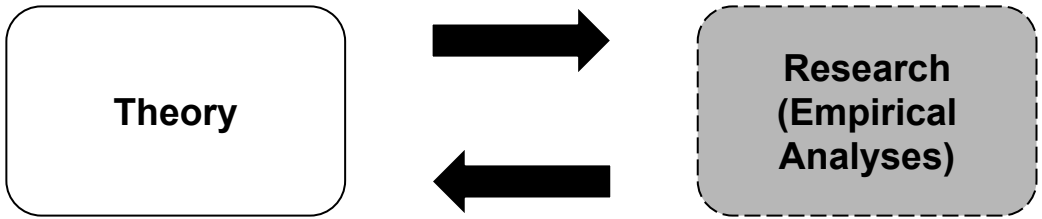
WHAT IS A DESIGN ARGUMENT?

- A description of “the features of a design necessary to promote a desired learning effect in a given context” (Easterday et al., 2016 p. 133; c.f van den Akker, 1999).

- Means of “opening up” the black box of learning—

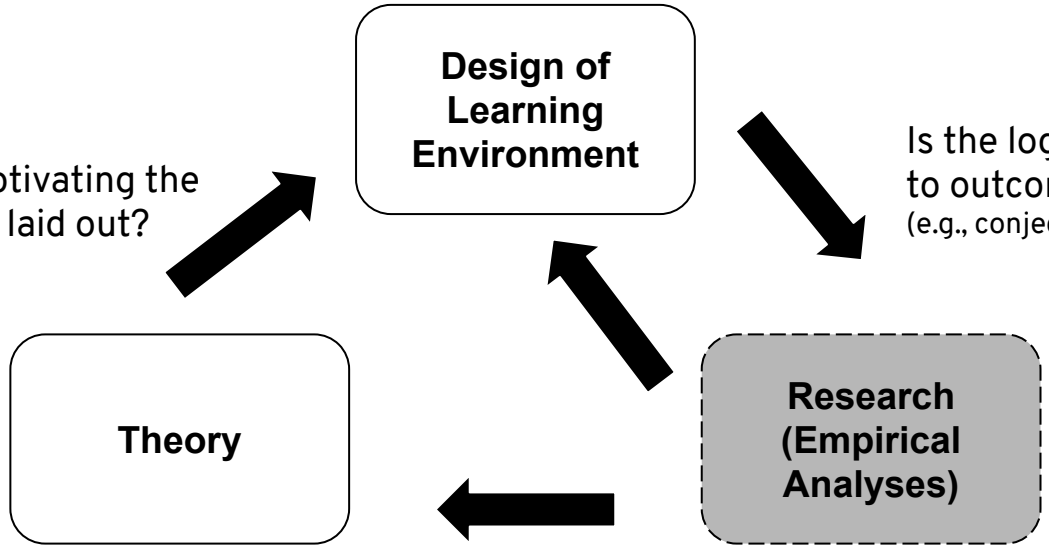
- Aims to communicate *local instructional theory* (Cobb ref) via *storied truths* (Gee, 2013; see Barab, 2016)

- Involves reporting complex interactions that both “illuminat[e] process insights while at the same time demonstrating local outcomes,” not simply reporting outputs (Barab, 2016, p. 158)


Theory
Research
(Empirical
Analyses)

If someone wanted to design something similar, is there enough information present?

If I'm presenting one piece of the research (e.g., second iteration) is the larger context of the research clear?



IF "YES": A GOOD DESIGN ARGUMENT

ACTIVITY 1: GROUP INTRODUCTIONS

For this activity, you will be randomly assigned into breakout groups.

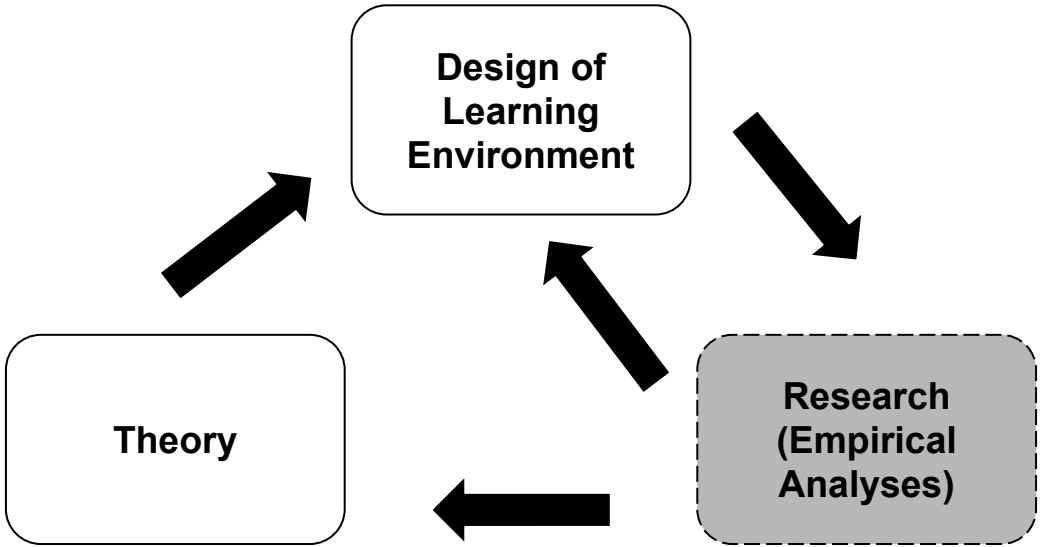
Your task is to:

1) introduce a little about yourself to your group
2) respond to what has been discussed so far, especially how it relates to your own experience.

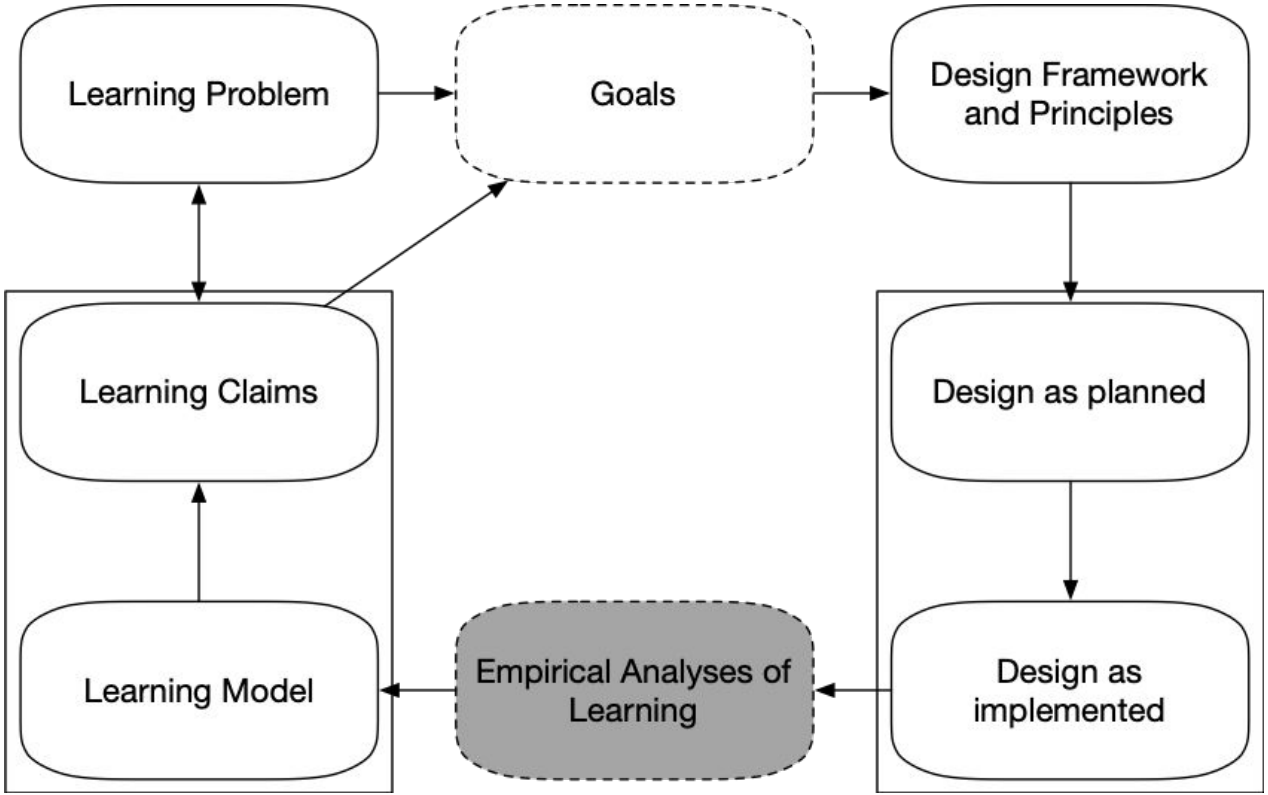
You have around 15 minutes!

2 UNPACKING

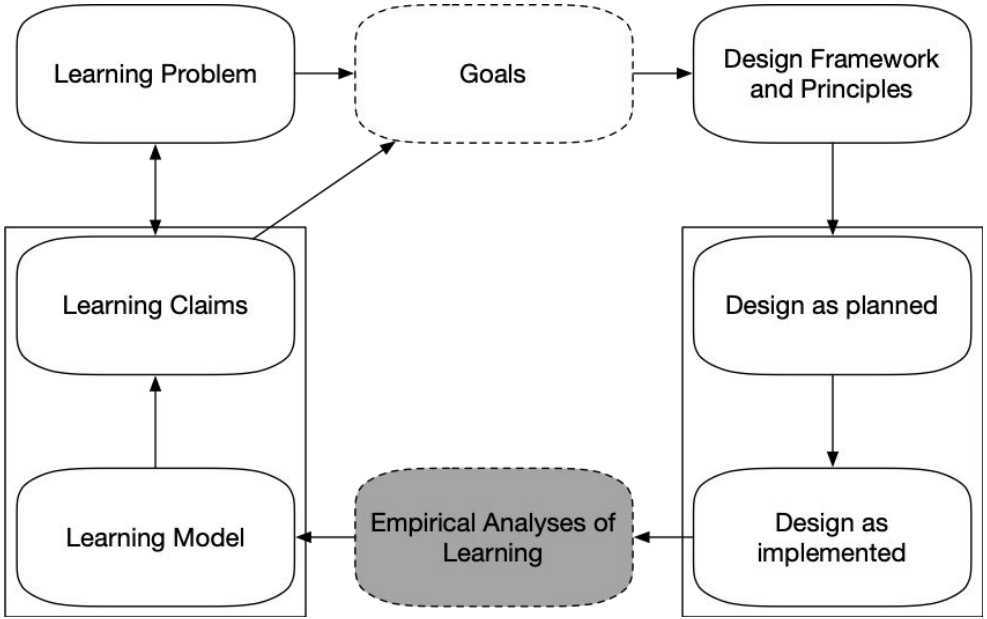
A FRAMEWORK FOR CREATING AND INTERPRETING DESIGN ARGUMENTS



A FRAMEWORK FOR CREATING AND INTERPRETING DESIGN ARGUMENTS



A FRAMEWORK FOR CREATING AND INTERPRETING DESIGN ARGUMENTS



- Our goal here is to make clear and digestible the *logic of the relationships between each component.*
- A well-communicated DBR argument attends to the alignment between components: Does one logically follow from another in a sensible way?
- This is *not* a framework for how to go about designing a research study nor does it prescribe a particular presentation format.
- There is not necessarily a “starting point.”
- A single study does not necessarily interrogate each component: Various studies and their write-ups focus on different components, but the overall argument still needs to be communicated.

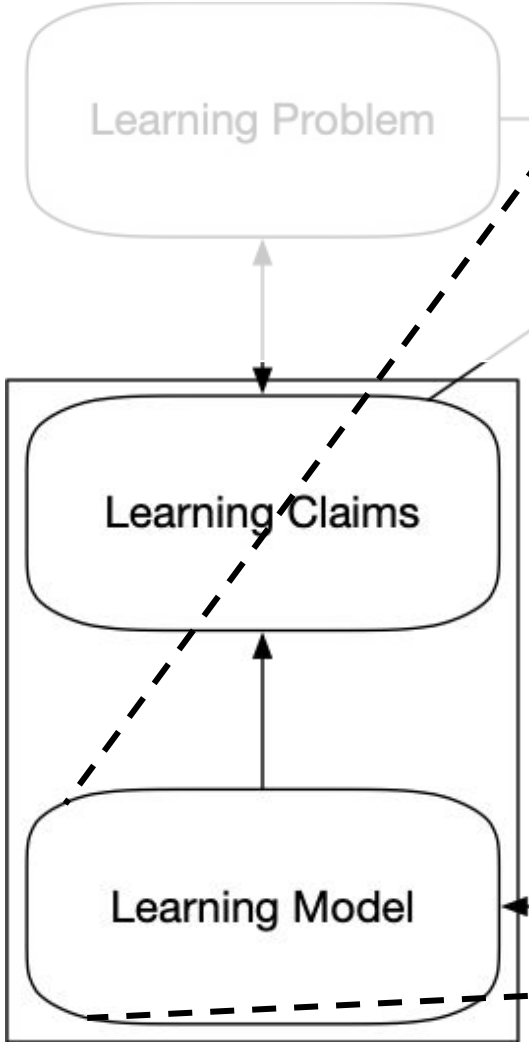
EXAMPLE: HERRENKOHL, PALINSCAR, DEWATER, & KAWASAKI, 1999

Why this piece?

- Foundational DBR work
- No tech (DBR is not constrained to designs of digital tools!)

Overview/summary of the piece:

- Design of an elementary science classroom learning environment
- Unit on floating and sinking
- Wanted students to coordinate theory and evidence

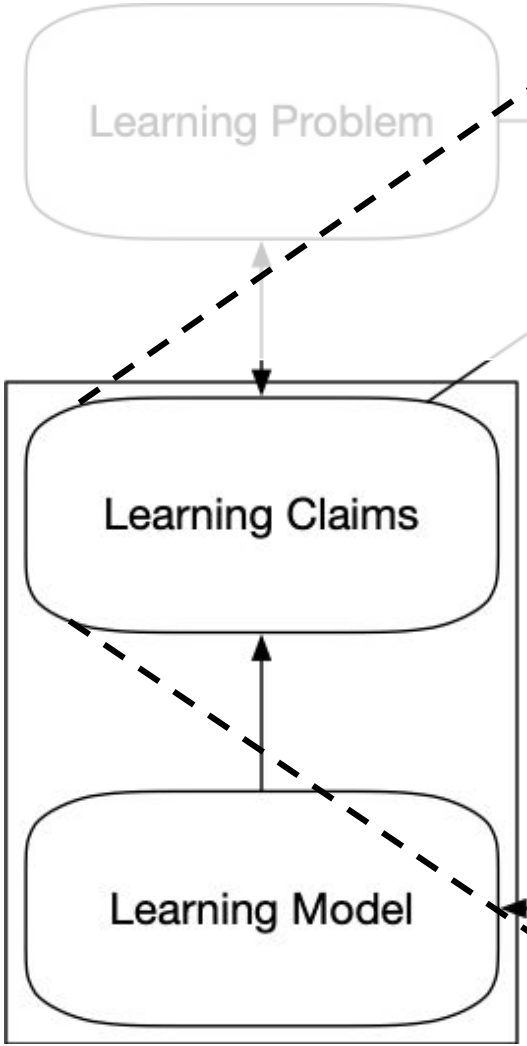


LEARNING MODEL

- General descriptions of how learning happens derived from empirical evidence
- Provide broad orienting assumptions and perspectives, but also often focuses on particular aspects of learning

EXAMPLE FROM HERRENKOHL, ET AL (1999):

- Sociocultural perspectives of learning
- “Inquiry is a complex form of human thought that has developed over thousands of years. It is a cultural legacy that prior generations have given to us to employ and change. In a Vygotskian sense, it is a "cultural tool" (Wertsch, 1985) of a psychological nature, an approach to reasoning that others before us have found useful” (p. 452)

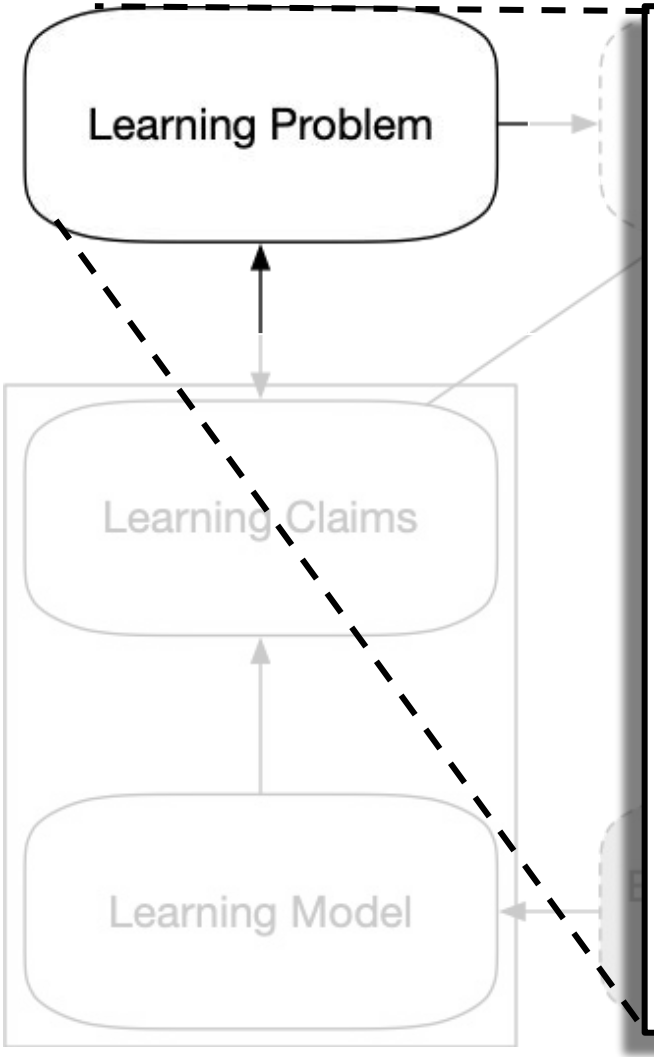


LEARNING CLAIMS

- Specific claims about how to make learning happen derived from theory
- Broad prescriptions for making learning happen, but informed by the particular learning problems under consideration

EXAMPLE FROM HERRENKOHL, ET AL (1999):

- “From this perspective, learning science is a social process of enculturation regarding the activities, conventions, and values of the scientific community” (p. 452)
- “[e]nculturation in science involves the development of understandings that reflect both the substantive and syntactic knowledge of the discipline” (p. 452).



LEARNING PROBLEM

- Definition and motivation of…
  - Population
  - Context
  - Needs
- The specific problems that need to be addressed—expressed at the appropriate grain size.
- Consider both the cognitive and broader contextual demands that make this a “problem”

EXAMPLE FROM HERRENKOHL, ET AL (1999):

- Young children’s enculturation into science include coordinating theory and evidence, which is difficult for both children and adults, who struggle with the “systematic generation and interpretation of evidence and instead tend to seek confirmation of their theories” (p. 453)

GOALS

- Desired outcomes based on a combination of learning problems and learning claims

EXAMPLE FROM HERRENKOHL, ET AL (1999):

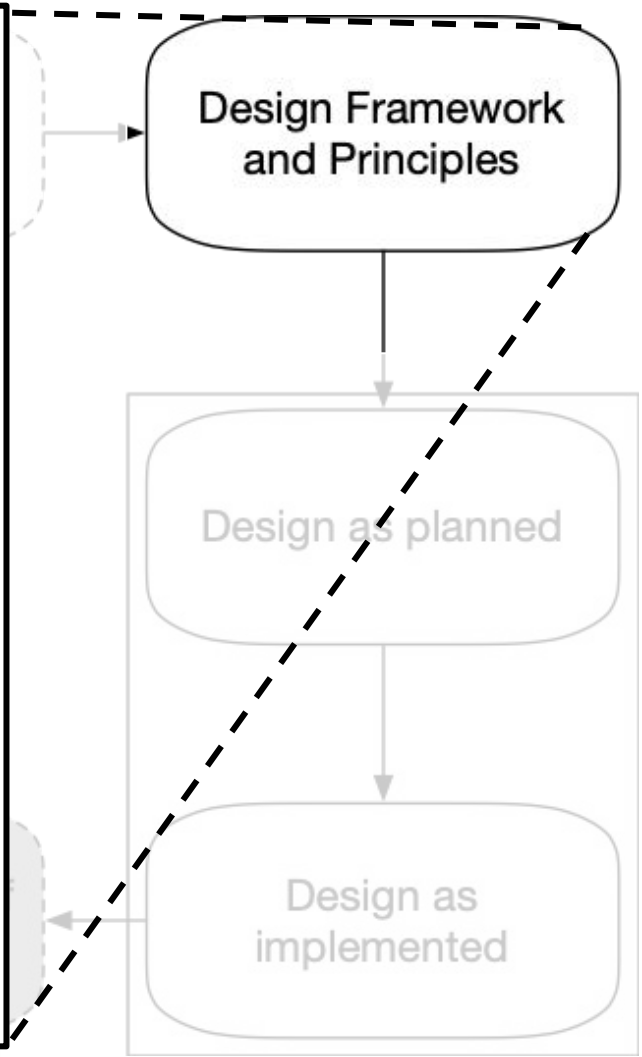
- “[f]oster the development of an intellectual community in the context of science instruction” (p. 452) by “[a]dvancing students’ ability to co-construct theories and models from the data they have collected in the course of inquiry [regarding sinking and floating]” (p. 452)

Design Framework and Principles

- Articulated strategies for achieving the goals through the design of a learning tool
- Grain size is important:
  - Should be applicable in multiple situations and not wholly tied to particular designs
  - But not so general that they ignore the contextual demands

Example from Herrenkohl, et al (1999):

- Scaffolding student discussions with various sets of tools that guided students in constructing arguments by explicitly structuring their conversations and reflections around the evidence from their investigations.
- "three strategic steps in science": predicting and theorizing; summarizing results; and comparing predictions and theories to results.

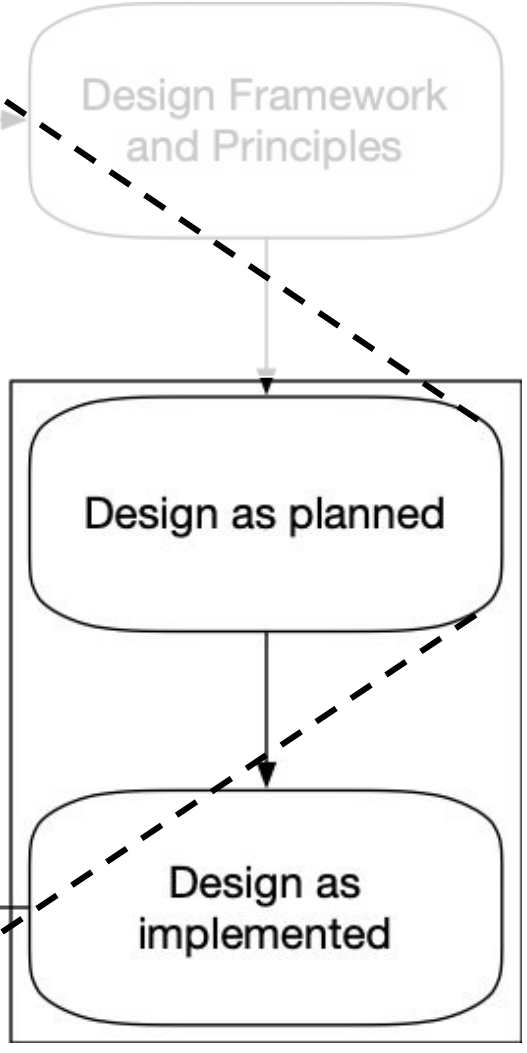


DESIGN AS PLANNED

- Description of the design of a particular learning tool derived directly from the design principles
- Description of the design stage (i.e. iteration) within the broader research agenda

EXAMPLE FROM HERRENKOHL, ET AL (1999):

- Explicit instruction on the three steps
- Supported with tools:
  - Audience roles
  - Public theory chart

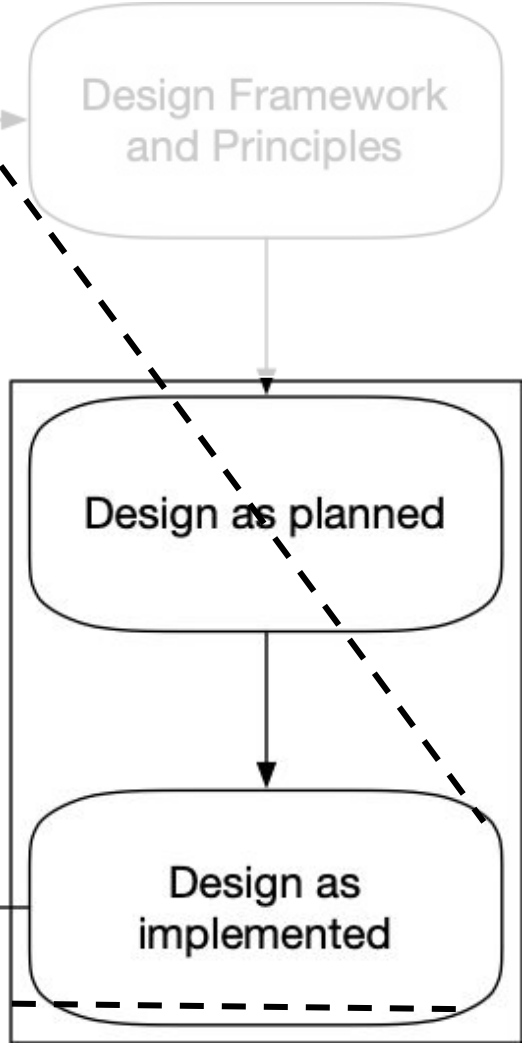


DESIGN AS IMPLEMENTED

- Description of the learning tool as it was actually enacted
- This is an important distinction that is often lost in write-ups
- How the plan differs from what actually happened in the real world
- May only involve a subset of principles or goals
- Communicates where in the “big story” the individual study lives (e.g. first iteration)

EXAMPLE FROM HERRENKOHL, ET AL (1999):

- Added reflective discussion on what counts as a theory in response to competing ways students used the term

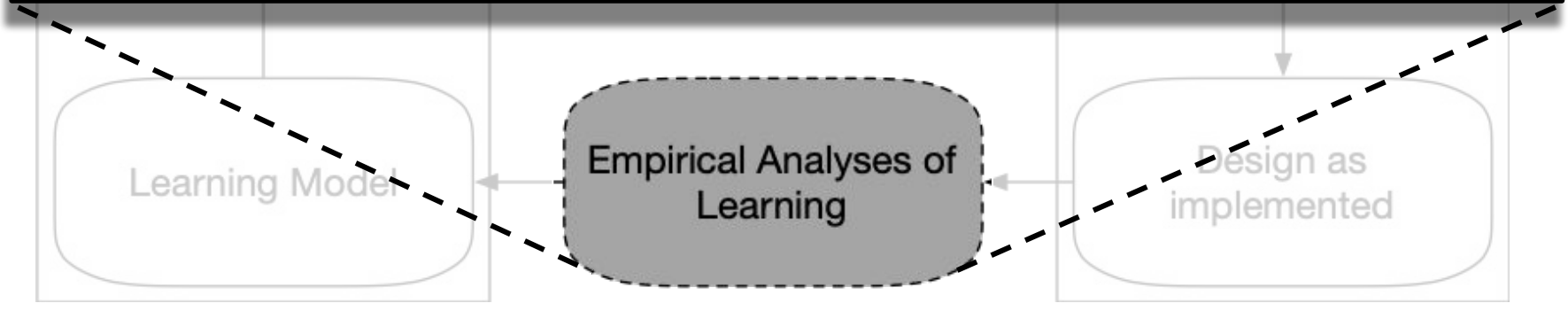


EMPIRICAL ANALYSES OF LEARNING

- Descriptions of studies of the learning tool in the real world
- No particular method of data collection or analysis is prescribed (but often multi-method)
- Should produce new or modified learning models/claims (*humble theories)*
- Can focus on any other component, but this should be made clear

EXAMPLE FROM HERRENKOHL, ET AL (1999):

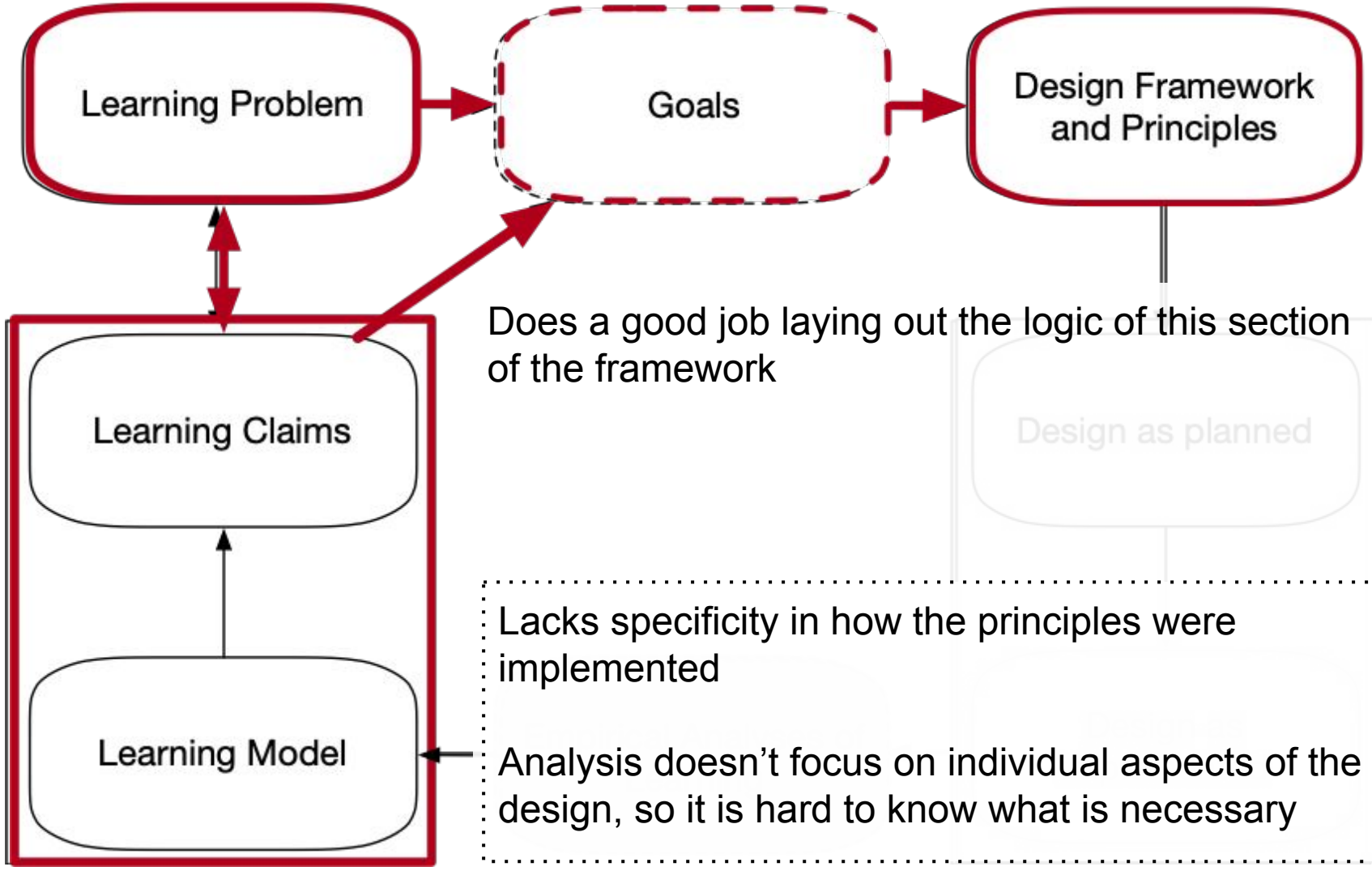
- Pre/post assessments (conceptual and epistemological)
- Video/audio recordings of class sessions
- Analysis: Comparing later discussions with “baseline” discussion during 1st lesson, before introduction of 3 steps or tools



UNPACKING HERRENKOHL, ET AL. (1999)

What did they emphasize?

What did they leave out?



Does a good job laying out the logic of this section of the framework

Lacks specificity in how the principles were implemented

Analysis doesn't focus on individual aspects of the design, so it is hard to know what is necessary

UNPACKING HERRENKOHL, ET AL. (1999)

What does this tell us about their design argument?

- Focus of argument is on theoretical takeaways (generalizations) rather than particulars of designed features
- Lack of detail on qualitative analysis might otherwise “sink” (haha) this paper (though we think that more would have been better!)
- Allows us to clearly see their thinking around the upper-left-hand corner of the framework

How should we use this paper to inform our own work?

- Convinced that the problem was addressed by the design (and it’s a hard problem!)
- Should not use this to attempt to replicate design details

3 APPLYING

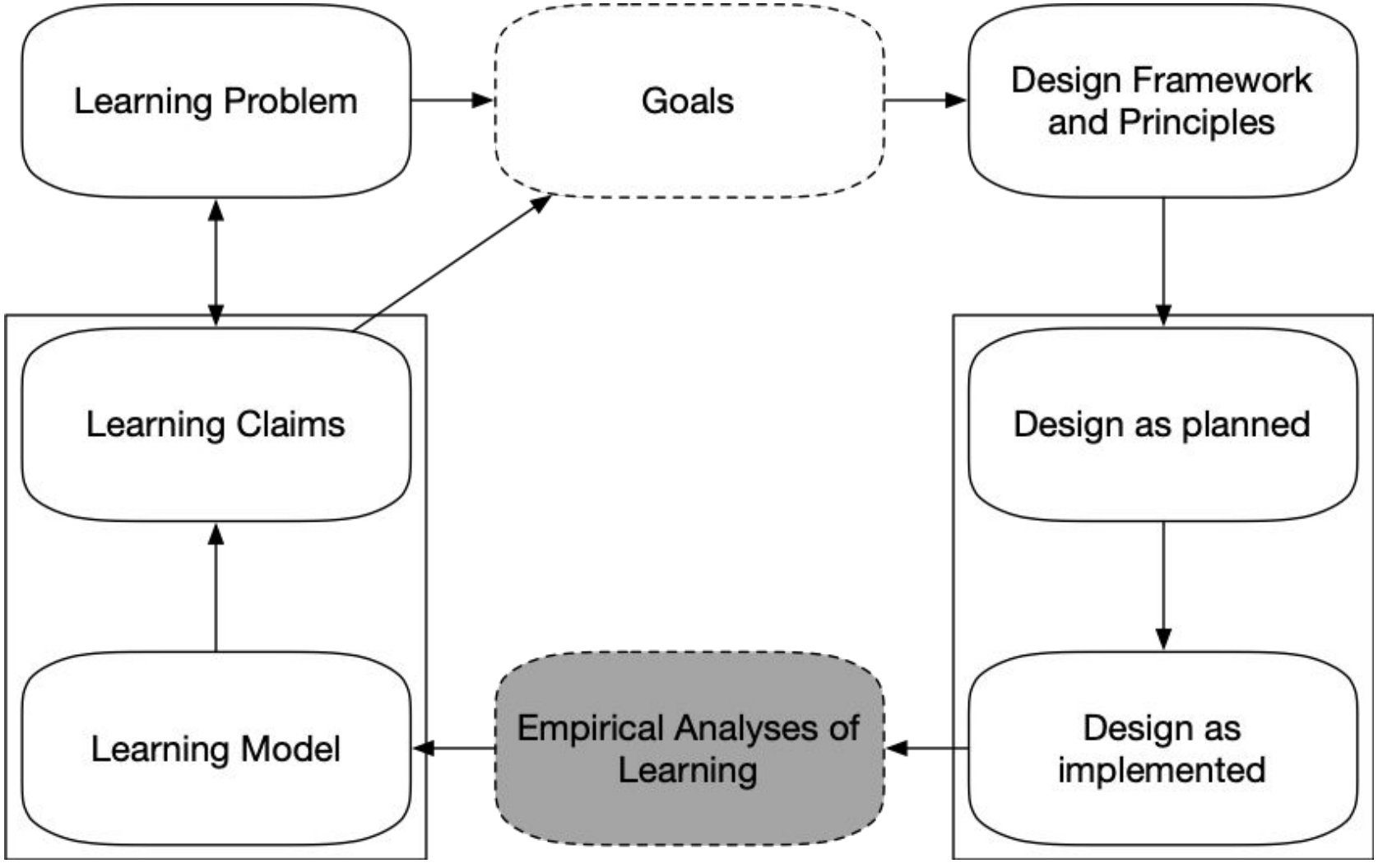
ACTIVITY 2: APPLYING THE FRAMEWORK

For this activity, you have again been placed into breakout groups

Your task is to try applying this framework by unpacking DBR.

- You may want to start by interpreting an existing piece as a whole group
- After you feel a bit more comfortable with the framework, your group can set goals for the rest of the time
- This may include unpack other published work or refining the design arguments of your own research using the framework
- Make sure you put your work in the Google spreadsheet and prepare to share what you've learned on the Google slides

You have 1 hour, 30 minutes


Learning Problem
Goals
Design Framework and Principles
Learning Claims
Design as planned
Learning Model
Empirical Analyses of Learning
Design as implemented

4 LUNCH

45 MINUTE BREAK

5 SHARING

ACTIVITY 3: REFLECT AND SHARE

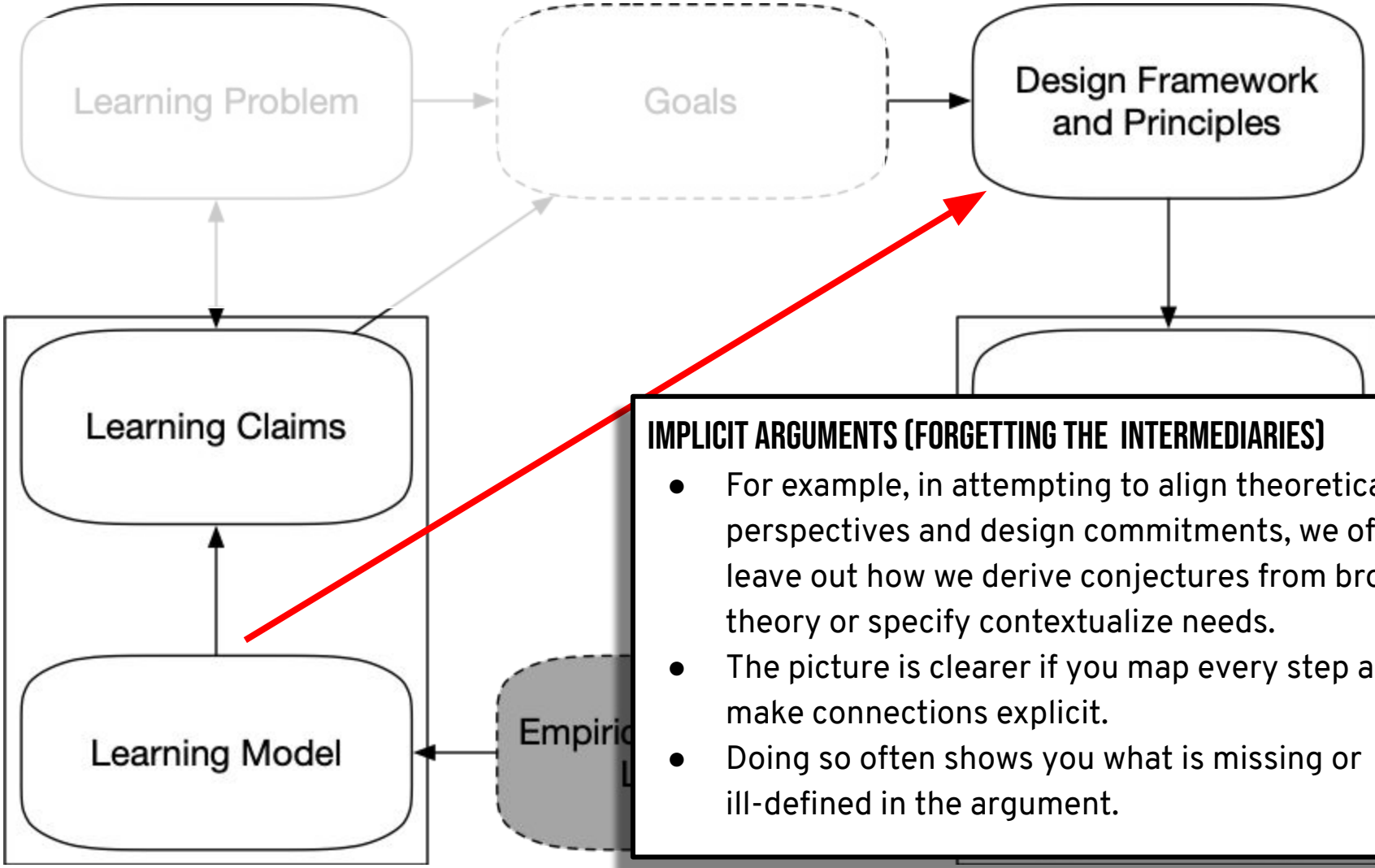
1. In your groups, reflect on what you learned and your reaction to the framework (~15 mins). www.yellkey.com/field
2. Each group share back (~3-5 mins/group)
3. Group Q&A / discussion (~20 mins)

GROUP Q&A / DISCUSSION

What questions do you have about….

A. … the framework or applying the framework in future?
B. … DBR in general?
C. … how others were using the framework and their DBR projects?
D. … Anything else you'd like to talk about :)

6 WRAP-UP



IMPLICIT ARGUMENTS (FORGETTING THE INTERMEDIARIES)

- For example, in attempting to align theoretical perspectives and design commitments, we often leave out how we derive conjectures from broader theory or specify contextualize needs.
- The picture is clearer if you map every step and make connections explicit.
- Doing so often shows you what is missing or ill-defined in the argument.

EXAMPLE FROM HARDY & SCANLON (2009)

- Design argument for the Lumosity suite of “brain training” courses and games
- Learning theory: *neuroplasticity*—the idea that the brain is able to “fundamentally reorganize itself when confronted with new challenges” (Hardy & Scanlon, 2009, p. 4).
- Learning problem: Illustrations of the needs of some specific populations, which their training system might help (e.g. older adults with cognitive decline).
- Design principles: 5 design principles in the form of “critical characteristics that make the Lumosity training programs effective” (p. 8): targeting, adaptivity, novelty, engagement, and completeness.
- Empirical analyses: Examples of experiments demonstrating improvement in a variety of cognitive functions in several populations.
- Summary: The general theory and empirical work seems to align, but the learning problem is not specific enough to understand the goals of the design beyond the most general claims. Furthermore, the analyses don’t investigate the design principles themselves, so it is unclear *how* the design leads to improvements.