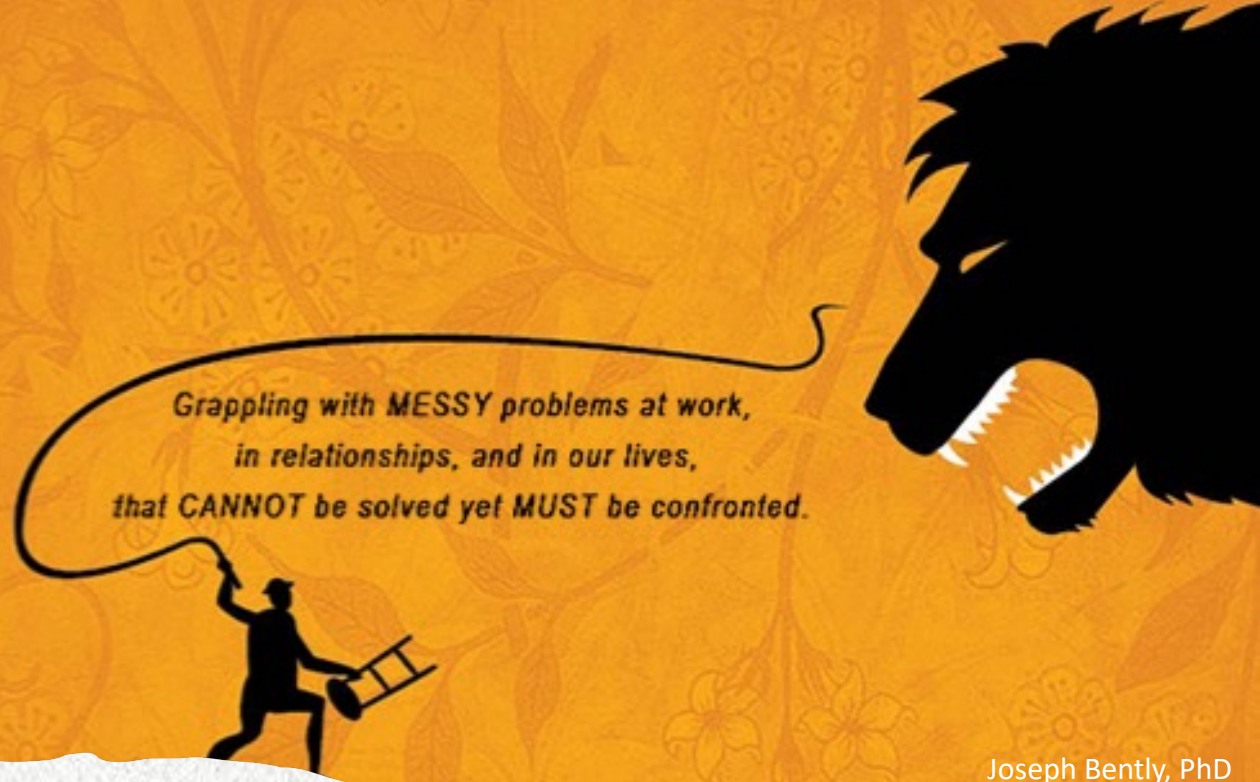
TAMING WICKED PROBLEMS



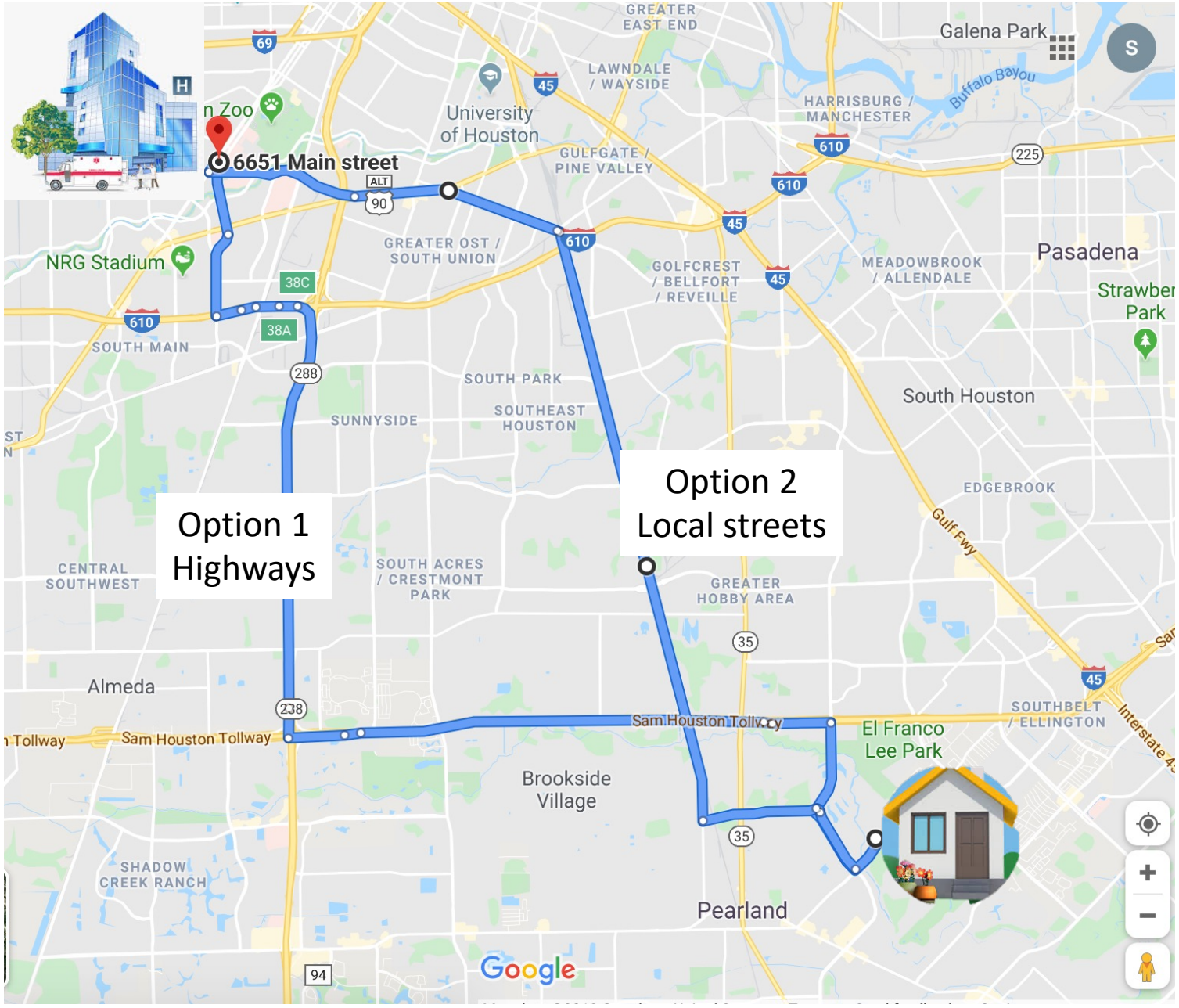
A Practical Guide to Innovations: Using Design Research to Address "Wicked Problems" in Medical Education

Satid Thammasitboon, MD, MHPE
Audrea Burns, PhD

Center for Research, Innovation and Scholarship in Medical Education

Prelude...

Which Route Should I Take?



- You are a research team
- Design a study to solve my problem

Research Question

Study Design

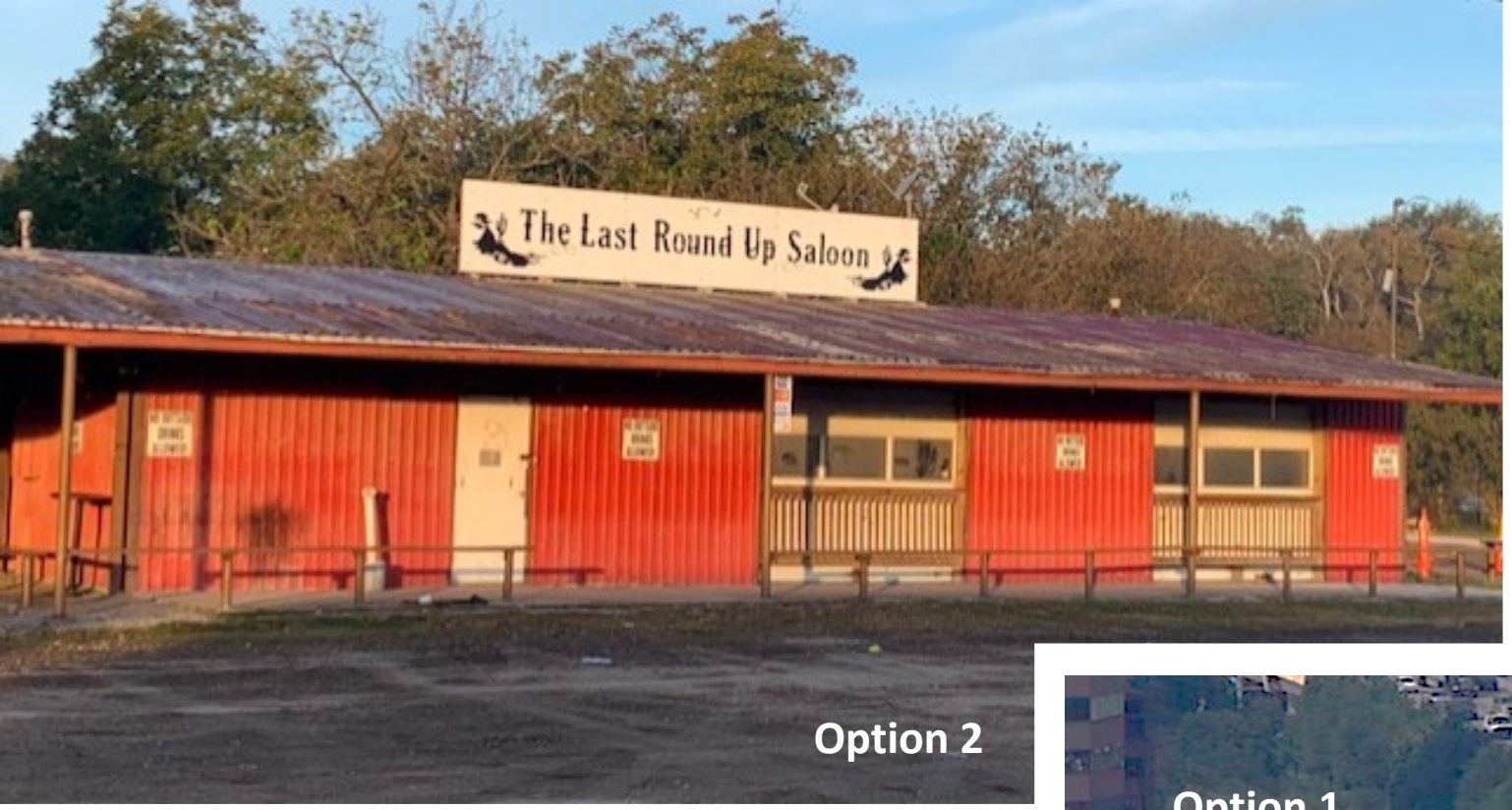
Variables/ Considerations

Independent, Dependent

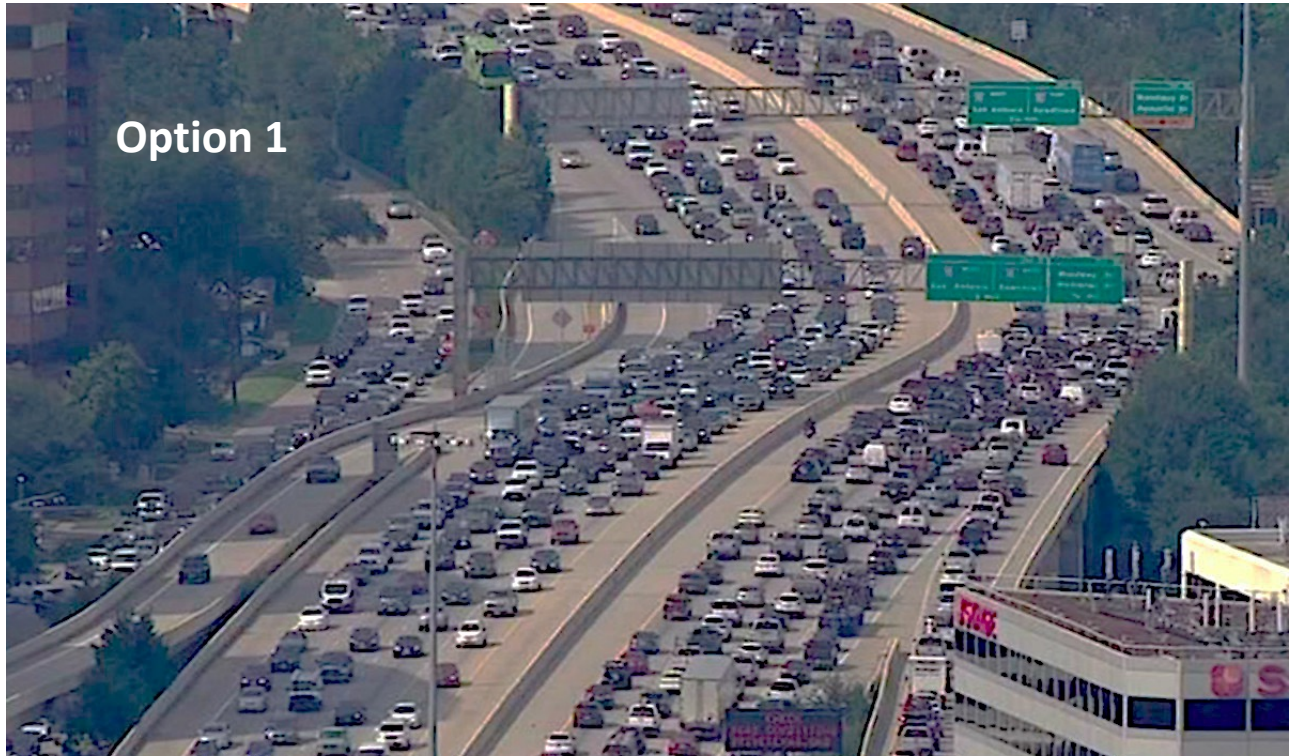
Confounders

Outcome Measures

10 min



Option 2



Option 1

Workshop Objectives

Discuss “wicked problems” as an analytical framework to address challenges within the complex medical education environment

Analyze the use of educational design research as a pragmatic approach to developing educational innovations

Discriminate program/product evaluation vs. research

PART ONE
THE COMPLEX WORLD

A Total Disruption

Life, Work, Politics and Beyond

WICKED
Problems

THEY are difficult to FIX
maybe IMPOSSIBLE
it is ADAPTABLE ever-changing
WOW
there are GRAND EXPECTATIONS for the SOLUTION
Confusion
many ideas
messy
incomplete knowledge
NO YES
There are MANY PLAYERS and many OPINIONS
It's a SYSTEM of INTER-CONNECTED Problems
WICKED Problems
E=MC²
no formula
financial BURDEN
our VALUES, BELIEFS, and our HABITS are part of the PROBLEM
GOOD
BAD
ONE SHOT SOLUTION
no trial & error
ANYTHING you do CHANGES the PROBLEM
Keep Going?

Wicked Problems

A. Send a rocket to the moon

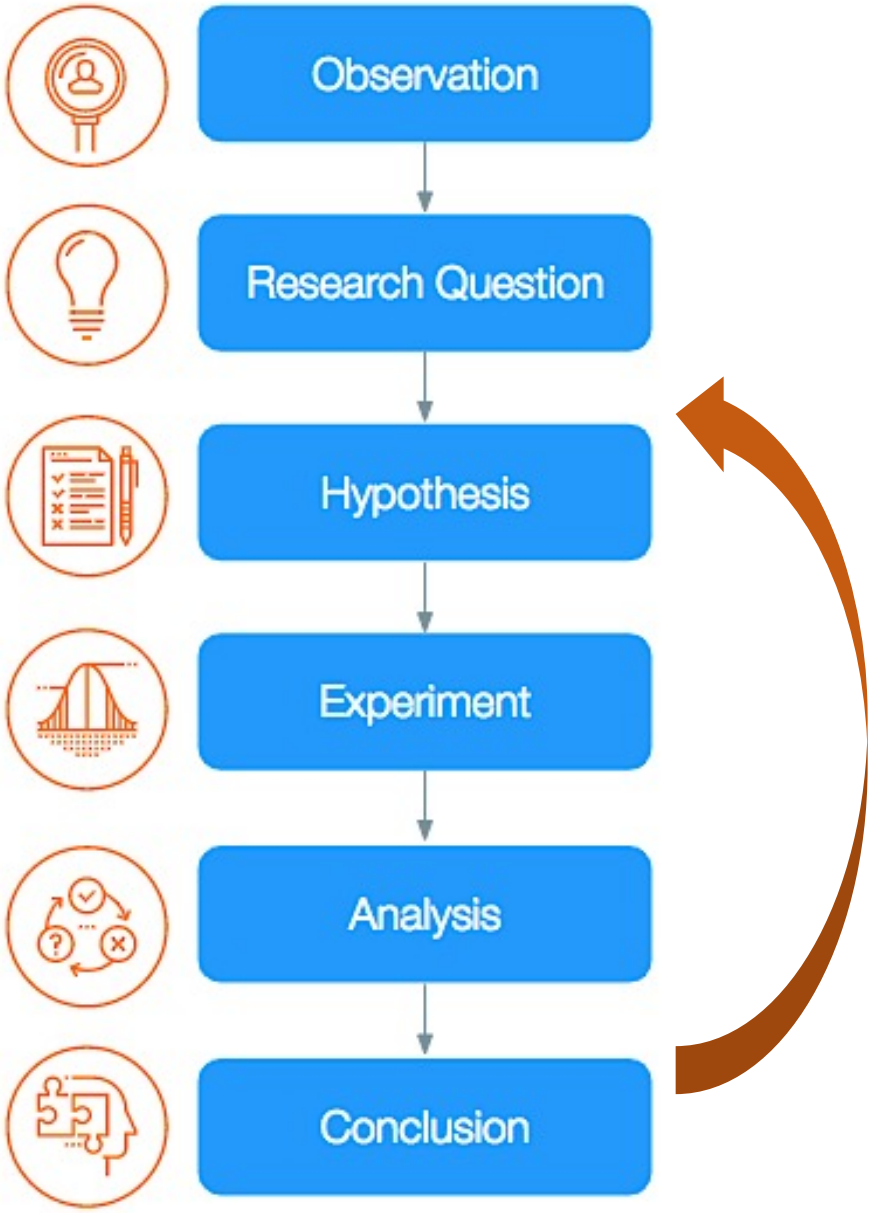
B. Raise a child

C. Bake a cake

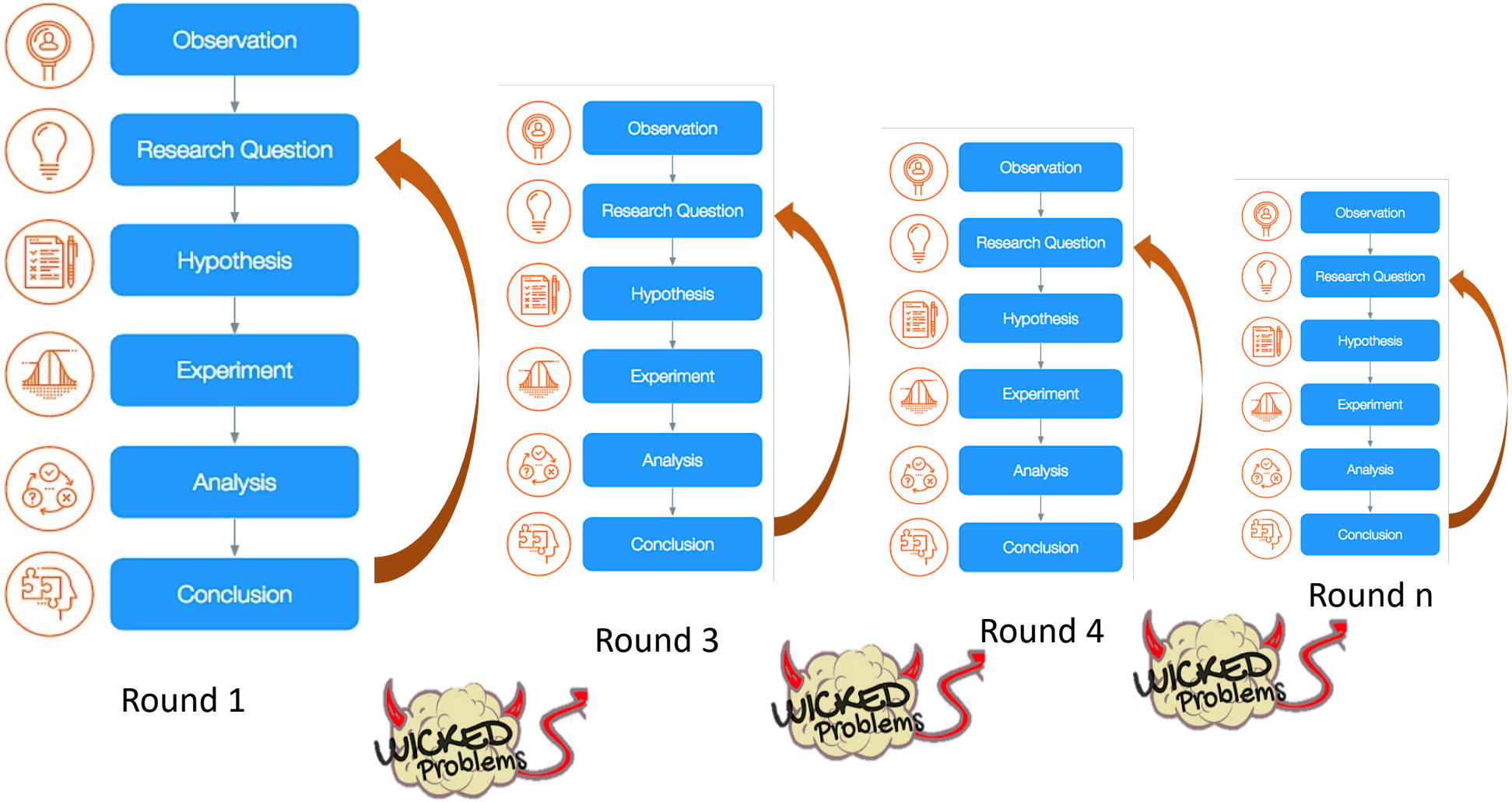
Simple, Complicated or Complex?

The Scientific Method:

‘Post-positivism’

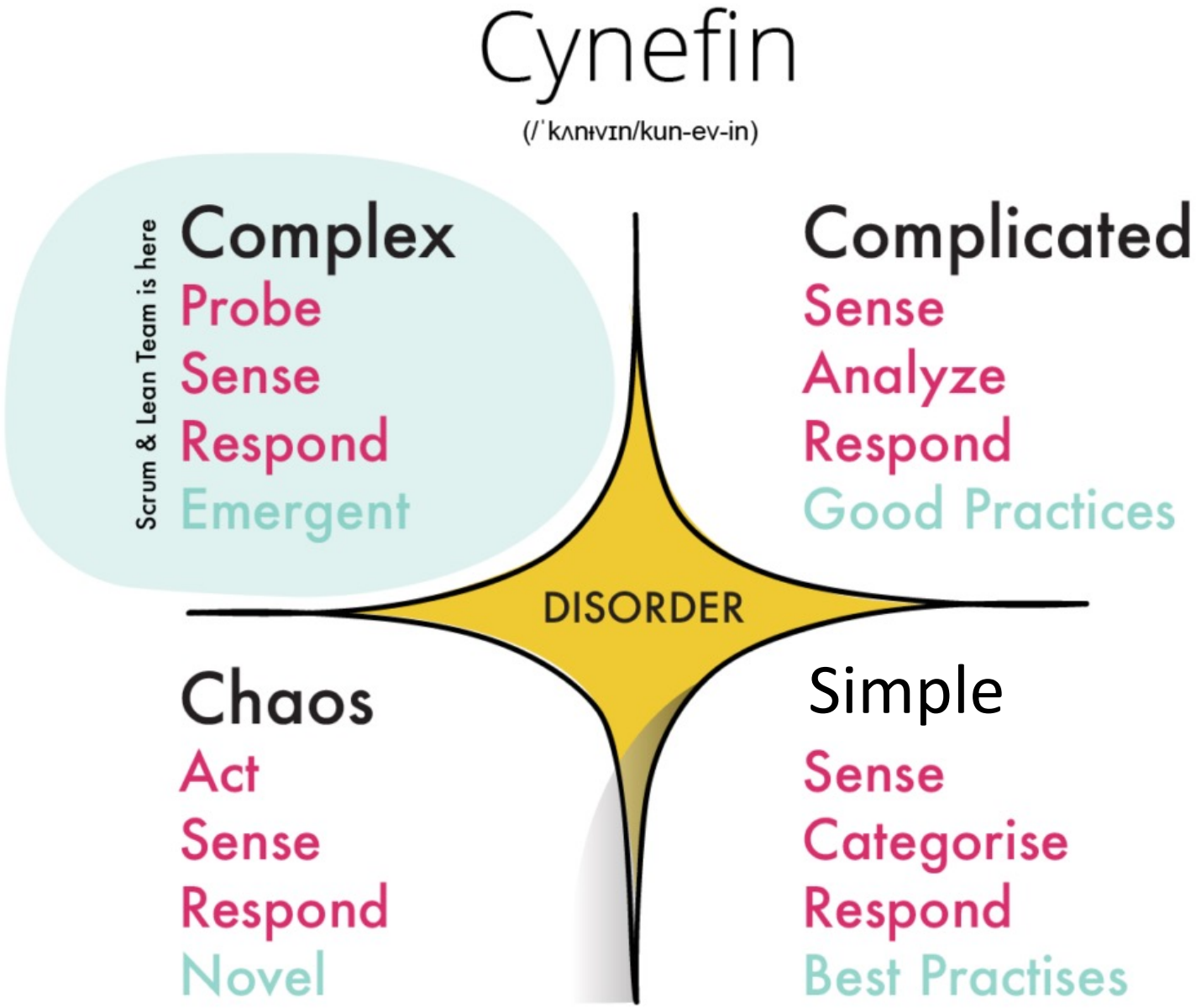


https://medium.com/indeed-engineering/qualitative-before-quantitative-how-qualitative-methods-support-better-data-science-d2b01d0c4e64



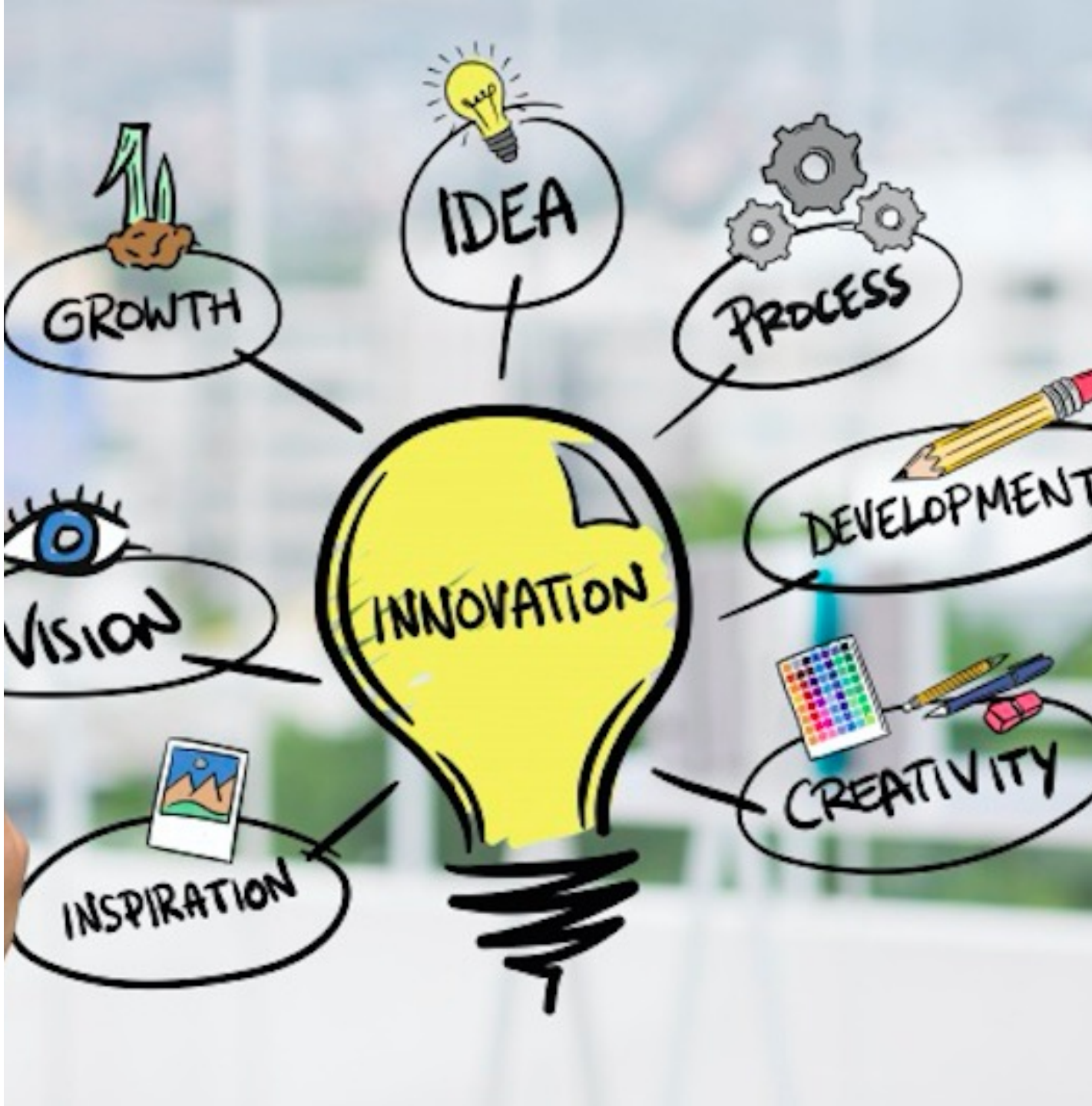
= An Innovative Solution?

Not all problems are the same.



Dave Snowden, 1999

PART TWO
DESIGNING INNOVATIONS



Diversify Your Research Paradigms

Don’t wear a Fedora when you talk to a cowboy!

		A	B	C	D
What's the nature of reality?	Reality is static and fixed.	Reality is static and fixed, but is never fully apprehended	Reality is subjective There are multiple, diverse interpretations of reality No one ultimate truth Relativism	Reality may be objective but is continually contested or shaped by structures of social, political, cultural, economic and gender factors	Reality is socially and experientially based, constantly renegotiated, debated and interpreted based on the new unpredictable situations to produce the best desired outcomes.
What's the nature of knowledge?	Objective, generalizable theory can be developed to accurately describe the world. Knowledge can be neutral or value-free description of reality	Objective knowledge of the world is not necessarily fully accessible. Findings approximate truth Knowledge is a hypothesis that has not been falsified	Knowledge is subjective There is no one ultimate or 'correct' way of knowing	Knowledge is co-constructed between individuals/groups Knowledge is based on values, mediated by power relations and therefore continuously under revision	Knowledge is constructed from objective and subjective points of view Findings are the means, change is the underlying aim
What's the nature of approach to research?	Verification Hypothesis generation and tested (deduction) Uses scientific method to develop abstract laws to describe and predict patterns	Falsification Testing if hypothesis can be disproved Emphasis on well-defined concepts and variables, controlled conditions, precise instrumentation and empirical testing	Interpretation Understanding uses inductive reasoning Gathers diverse interpretations from researcher/participant interaction in the natural environment to construct meaning	Transformation Envisioning how things could change for the better Seeks representation of diverse and under-represented views Characterized by continual redefinition of problems and cooperative interaction	Design Seek deep understanding of problem, context and participants to address problem, Cooperative, iterative process of researcher, participants, designers and stakeholders

		A	B	C	D
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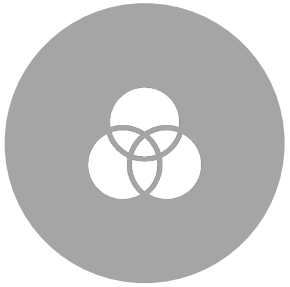
POST-POSITIVIST

Hypothesis Testing
Deductive



INTERPRETIVIST

Naturalistic/Constructive
Inductive

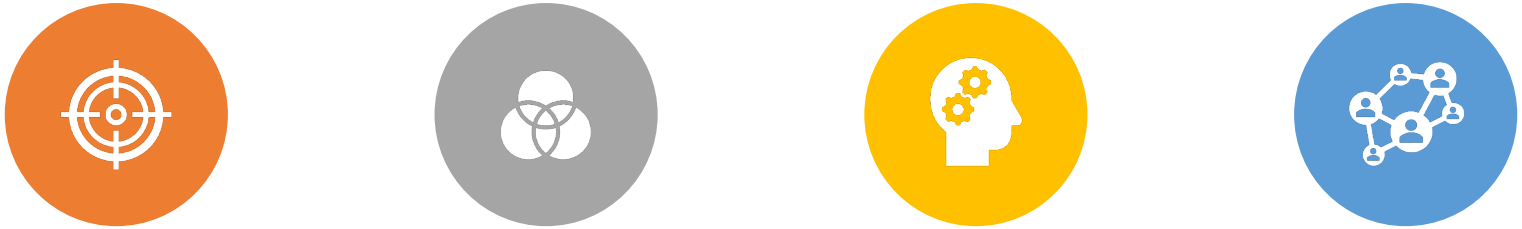
CRITICAL REALIST

Participatory
Diverse (under) Representations

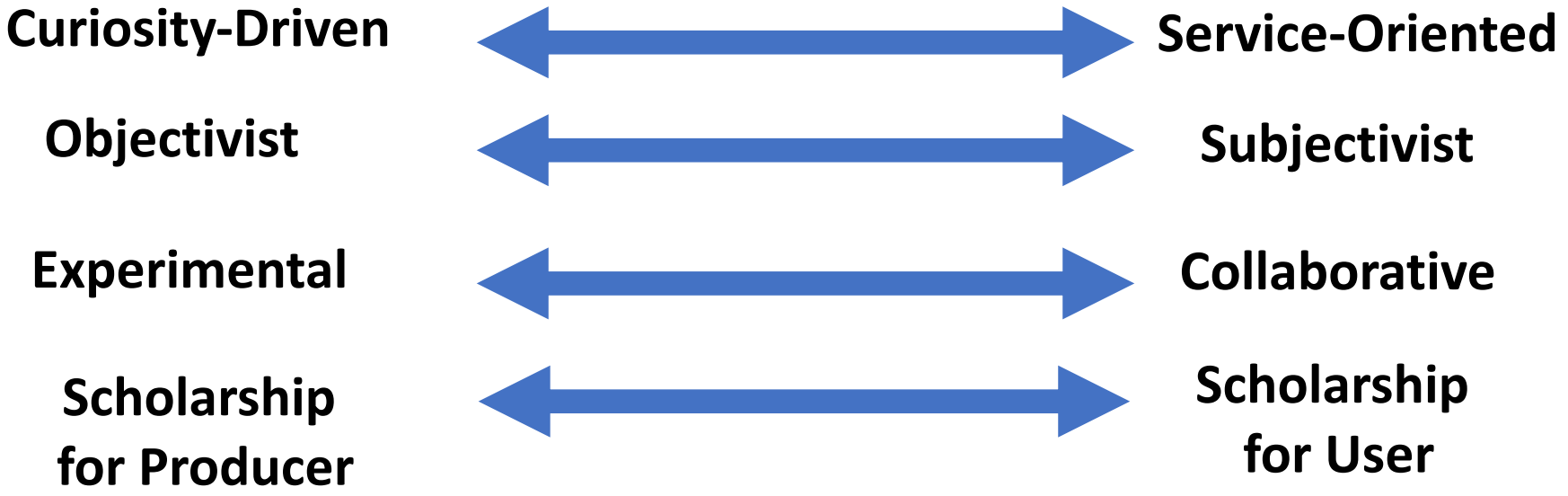
PRAGMATIST

Design & Action
Mixed Methods
Data Mining

Continuum of Research Paradigms



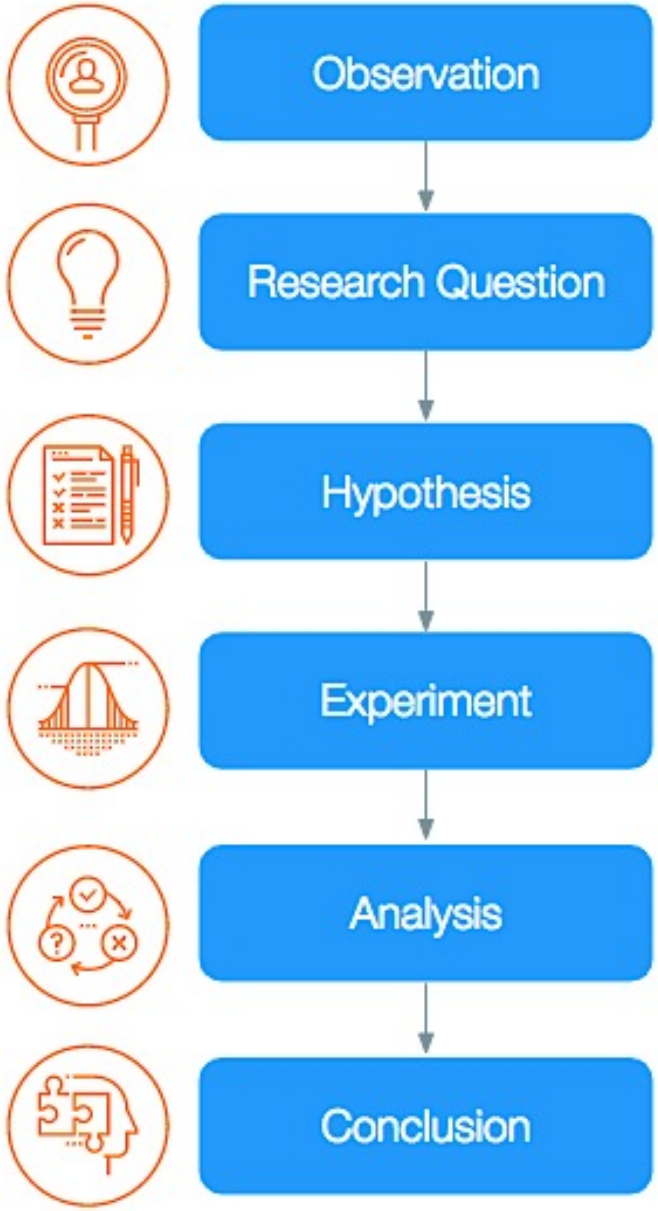
POST-POSITIVIST | INTERPRETIVIST | CRITICAL REALIST | PRAGMATIST



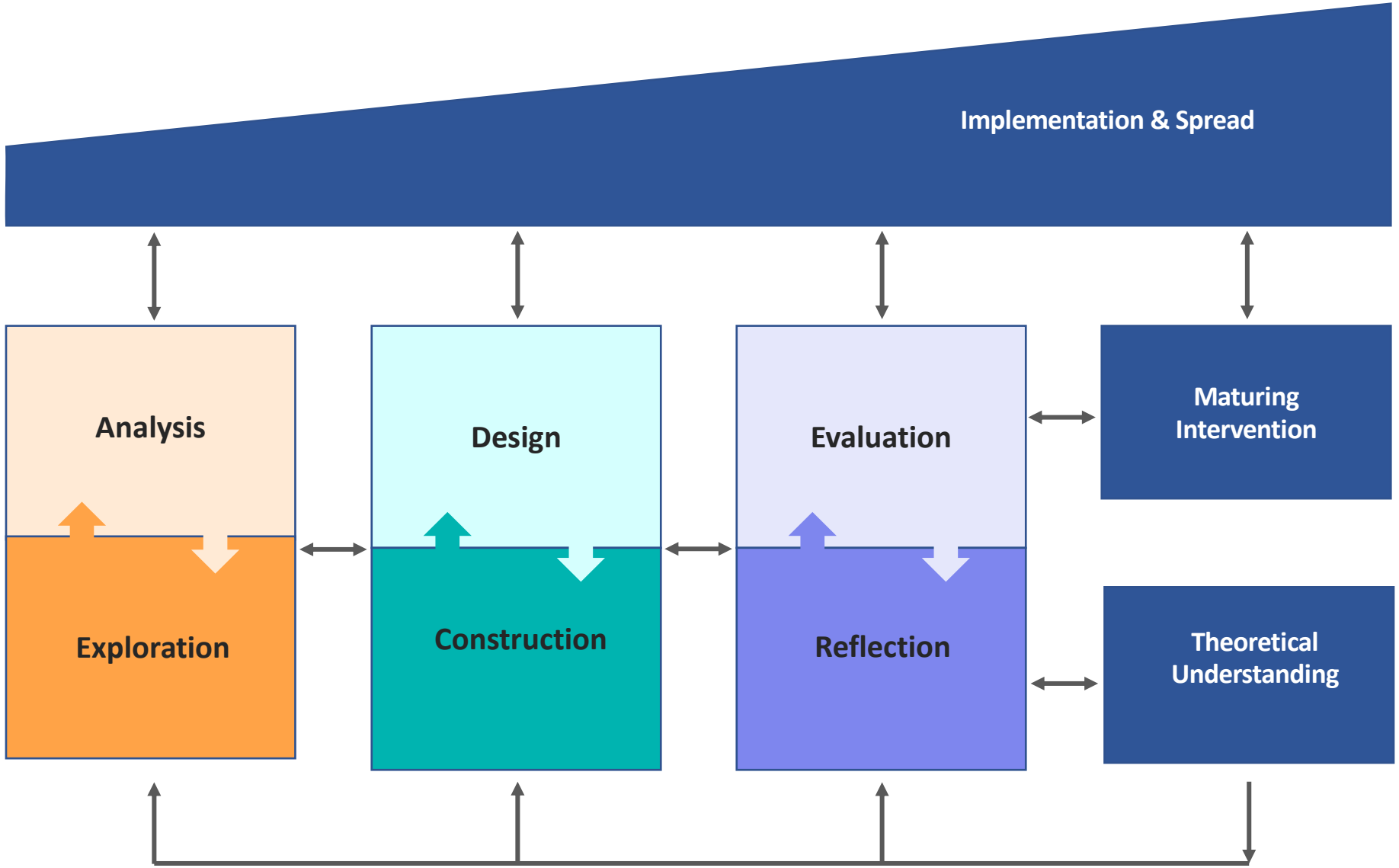
The Scientific Method:

A Linear Process

‘Post-positivism’



Educational Design Research: Pragmatist's Approach



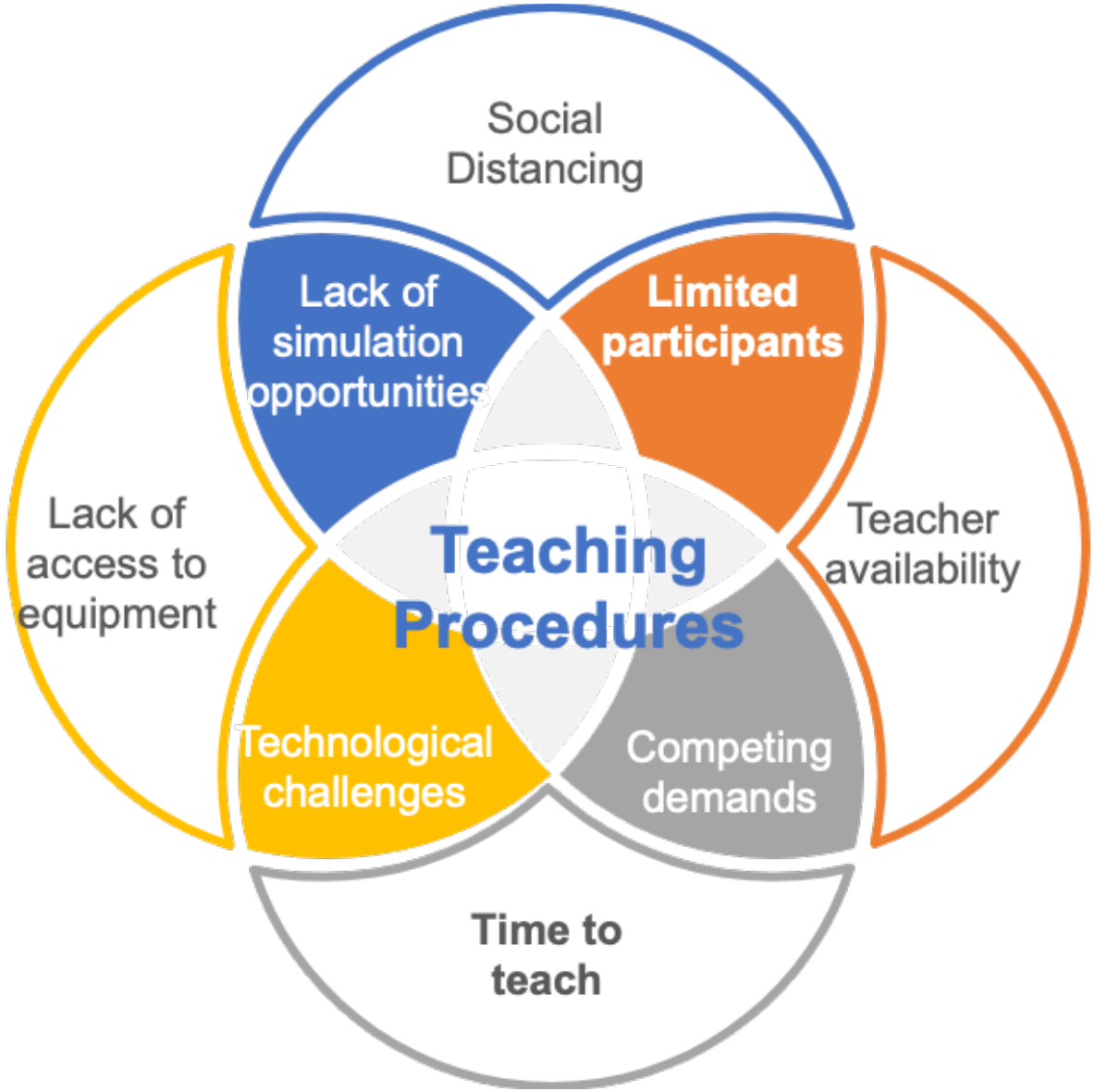
Brown, K, et al, Ped Crit Care Med 2020

(*Adapted, with permission, from McKenney SE, Reeves TC: Conducting educational design research, Second Edition. New York, Routledge, 2019.)*

Question-focused
(Traditional research)

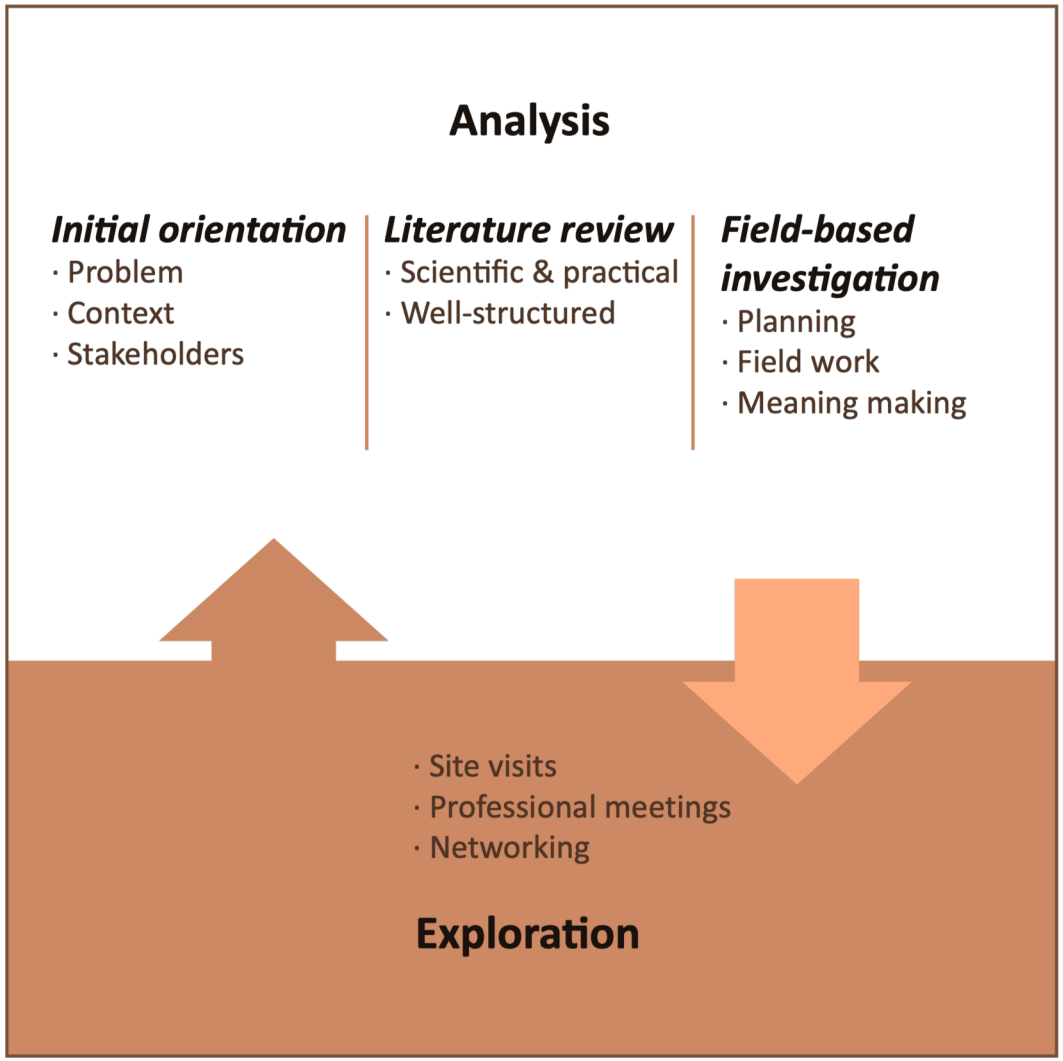
Problem-focused
(Design research)

A Case Study: Educational Problems in Pandemic



Jennifer Benjamin
Saul Flores
Parag Jain
Satid Thamamsitboon

Analysis & Exploration



Outcomes

- Enhanced problem understanding
- Strong collaborative relationships
- Conceptual Framework(s)
- Preliminary Design Principles

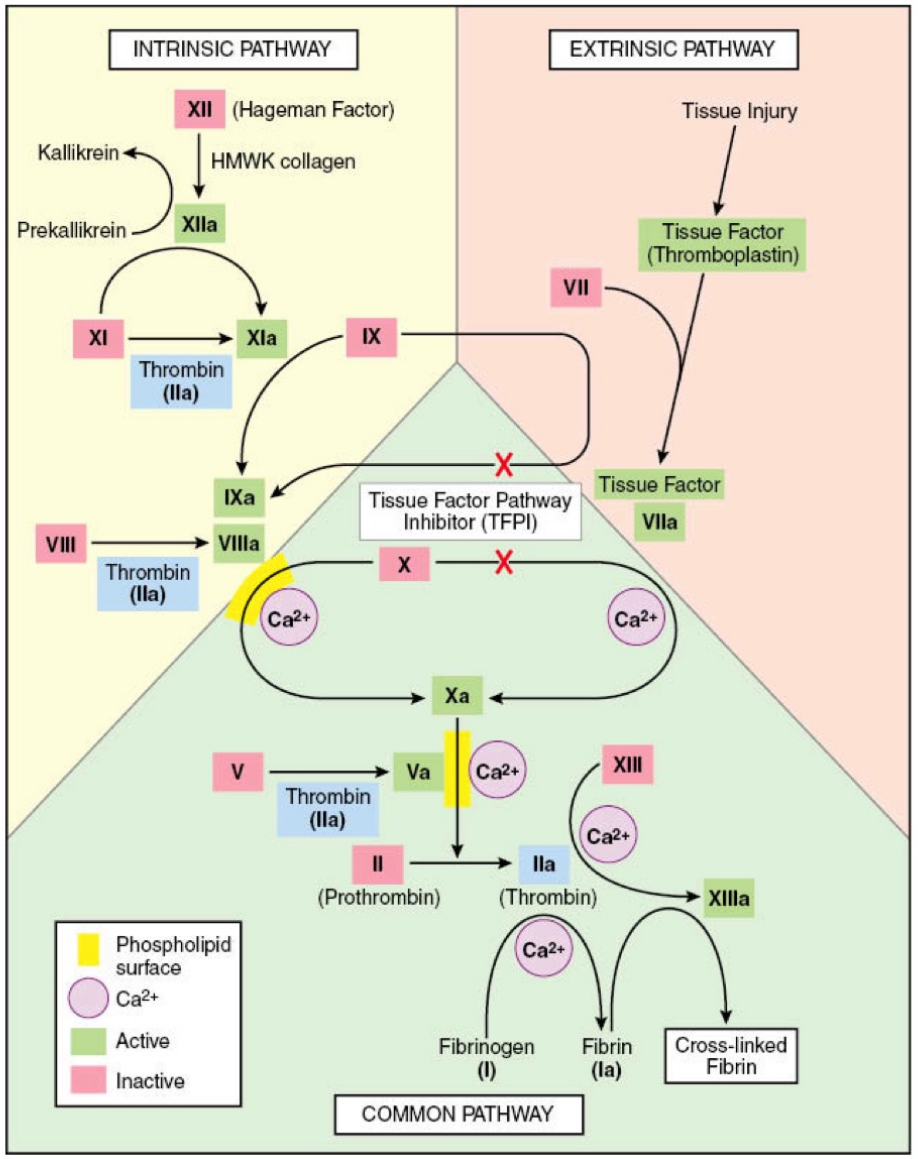
McKenney SE, Reeves TC: Conducting educational design research, Second Edition. New York, Routledge, 2019.)

Conceptual Frameworks, Defined

Are WAYS of:

- Thinking about problem or question
- Representing how complex things (may) work

Borage G, Conceptual Frameworks to Illuminate and Magnify, Med Educ 2009;43:312-319.


INTRINSIC PATHWAY
EXTRINSIC PATHWAY
XII (Hageman Factor)
Kallikrein
HMWK collagen
Prekallikrein
XIIa
Tissue Injury
Tissue Factor (Thromboplastin)
VII
XI
XIa
IX
Thrombin (IIa)
IXa
Tissue Factor Pathway Inhibitor (TFPI)
Tissue Factor
VIIa
VIII
VIIIa
Thrombin (IIa)
X
Ca2+
Ca2+
Xa
V
Va
Ca2+
XIII
Thrombin (IIa)
Ca2+
II
IIa
(Prothrombin)
(Thrombin)
XIIIa
Ca2+
Phospholipid surface
Ca2+
Active
Inactive
Fibrinogen (I)
Fibrin (Ia)
Cross-linked Fibrin
COMMON PATHWAY

Conceptual Frameworks can be:

- *Theories* with well-organized principles that have been confirmed by observations or experiments (e.g. Self-determination theory, cognitive load theory)

- *Models* derived from theories, observations or sets of concepts (e.g. Kolb's experiential learning cycle)

- *Evidence-based best practices* derived from outcome and effectiveness studies (e.g. Family Centered Care)

Borage G, Conceptual Frameworks to Illuminate and Magnify, Med Educ 2009;43:312-319.

Our case

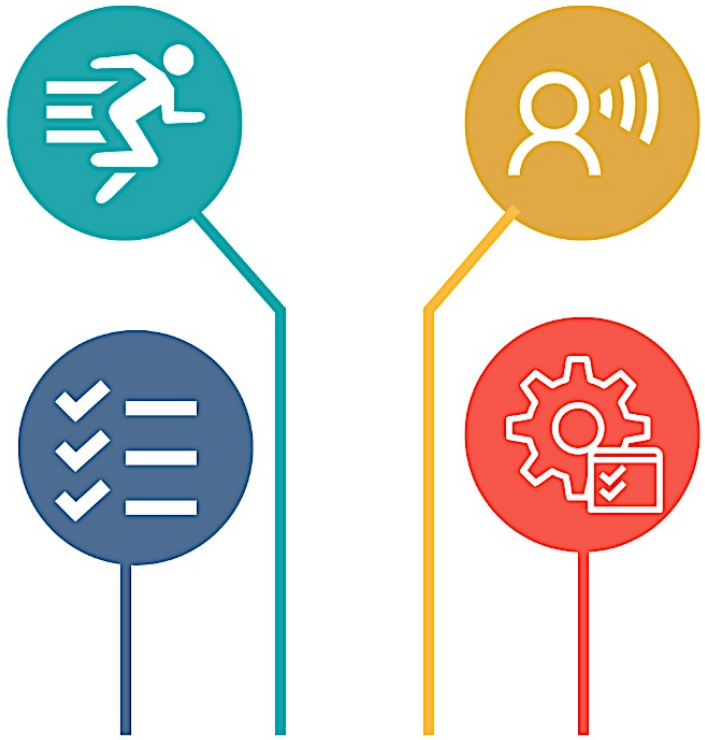
Deliberate Practice
Peyton & Walker 4-Step Coaching

Demonstration

Step 1 The instructor demonstrates the skill at her normal pace without any comments

Deconstruction

Step 2 The instructor repeats the procedure, this time describing all necessary sub-steps



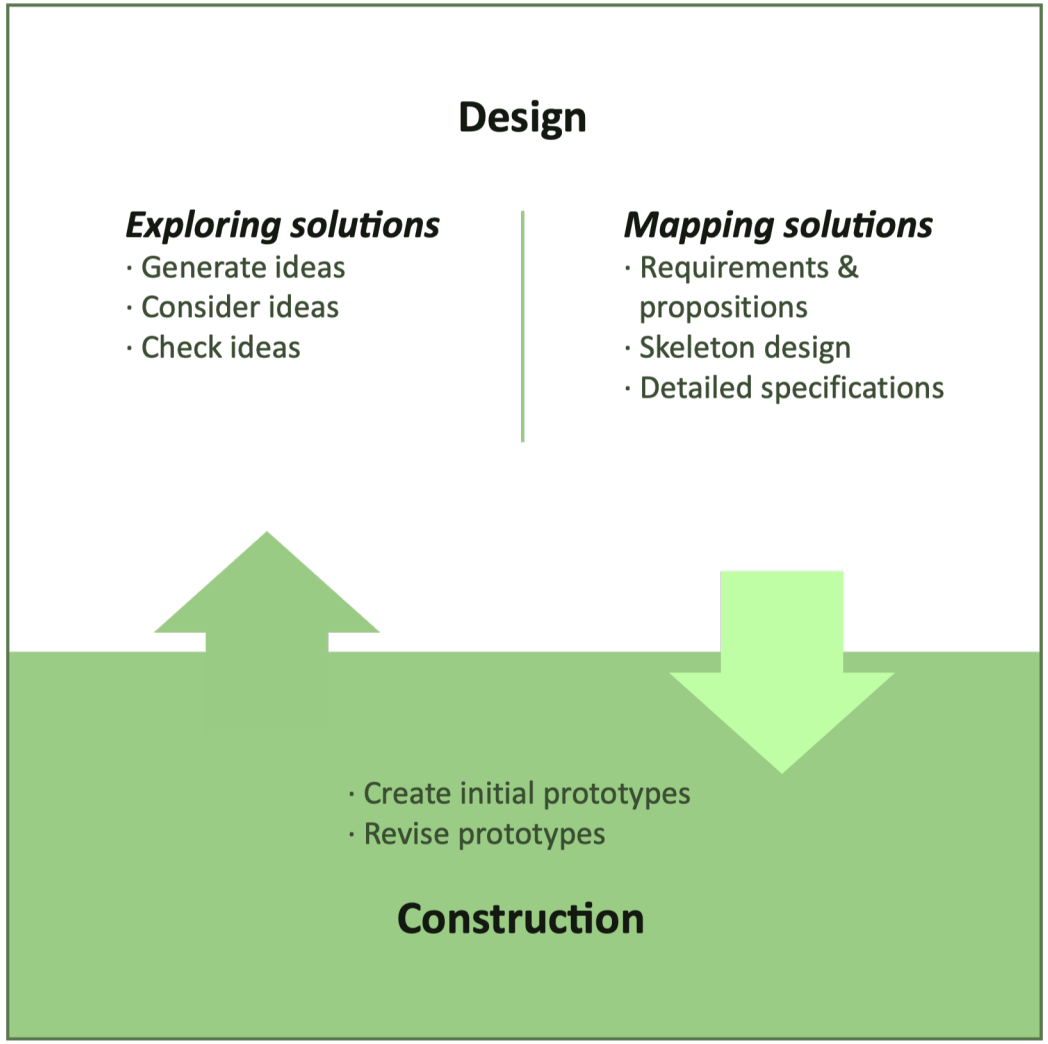
Formulation

Step 3 The learner explains each sub-step while the instructor follows the learner's instructions

Performance

Step 4 The learner performs the entire skill on their own.

Design & Construction



Outcomes

- Refined design principles
- Various types of prototype interventions

McKenney SE, Reeves TC: Conducting educational design research, Second Edition. New York, Routledge, 2019.)

The Virtual Deliberate Practice Module

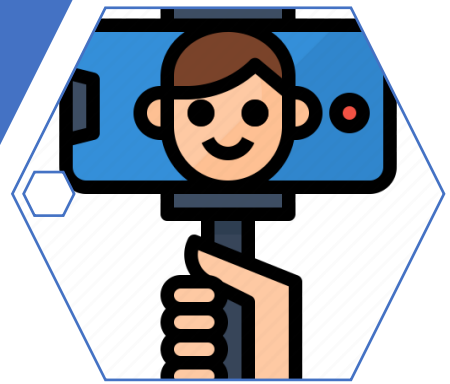
Educational Framework

4-Step Coaching

TikTok

Vlogging

Virtual Teaching Platform



Social Media-Like

Social and Collaborative

Vlogging = Video Blogging

The Educational Prototype on Voicethread

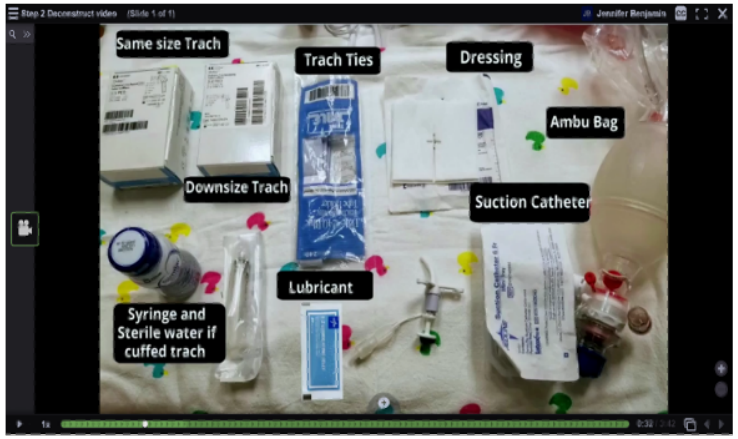
Step 1 Demonstration

Expert performs the procedure at regular speed without narration

Step 2 Deconstruction

Expert performs procedure in **slow motion**, step by step, with narration

Pauses and close-up view for pertinent steps



Step 3 Formulation

Learner records voiceover for expert video capturing details from step 2 with immediate feedback on VT

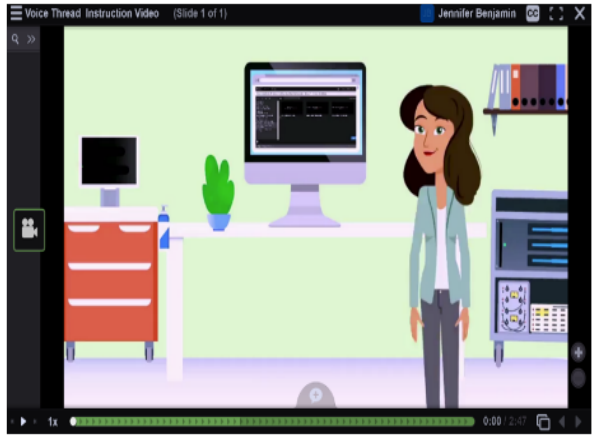
Step 4 Performance

After repetitive practice, the learner performs and records the procedure in simulation lab using a video creator kit.

Uploads video to Voice Thread on personal mobile device for feedback

Benjamin, et al

Critical Components added after Prototype Testing



Introduction to Tracheostomy Education

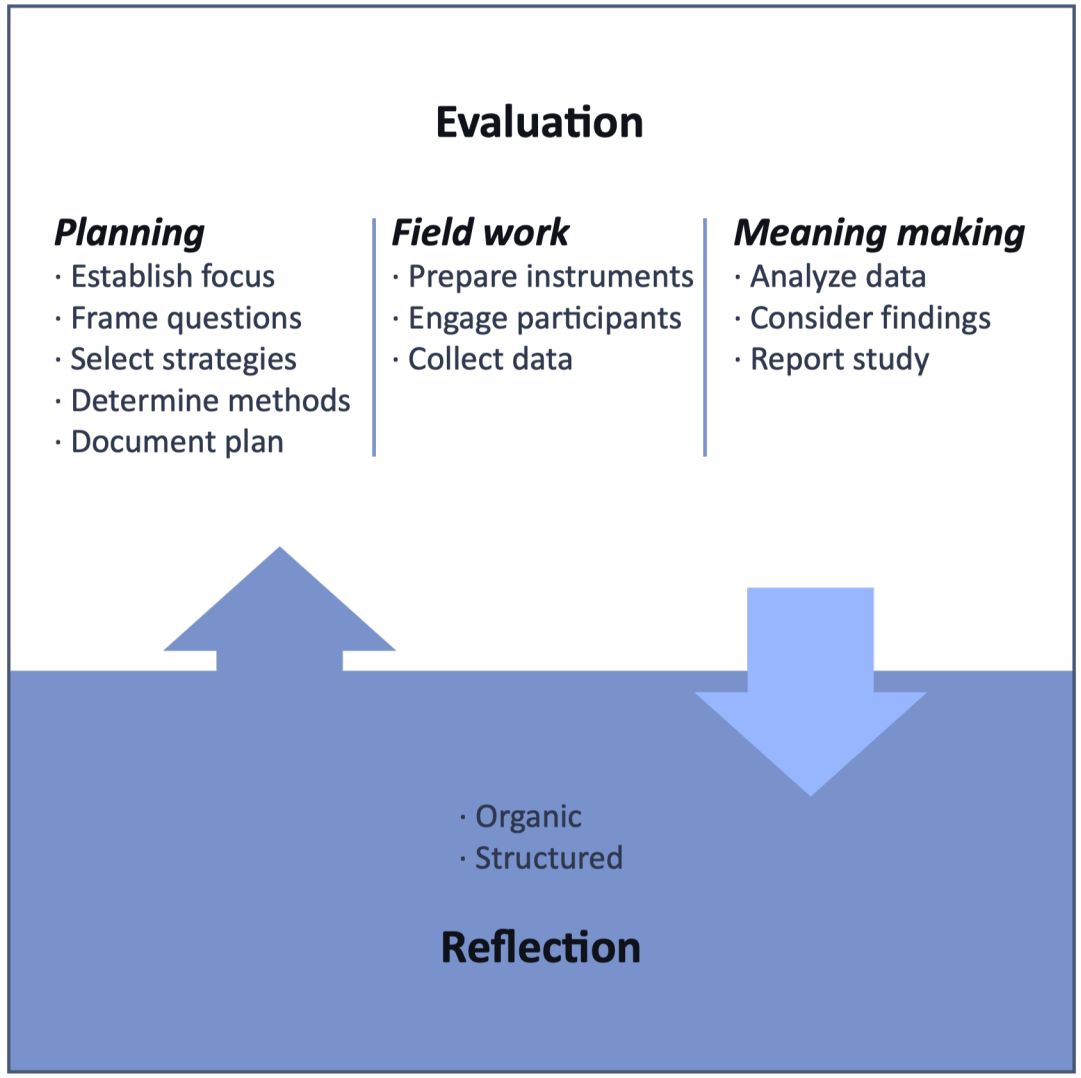
How to Navigate the Module

How to use the Video Creator Kit

Benjamin, et al

PART THREE
EVALUATING THE INNOVATION

Evaluation & Reflection



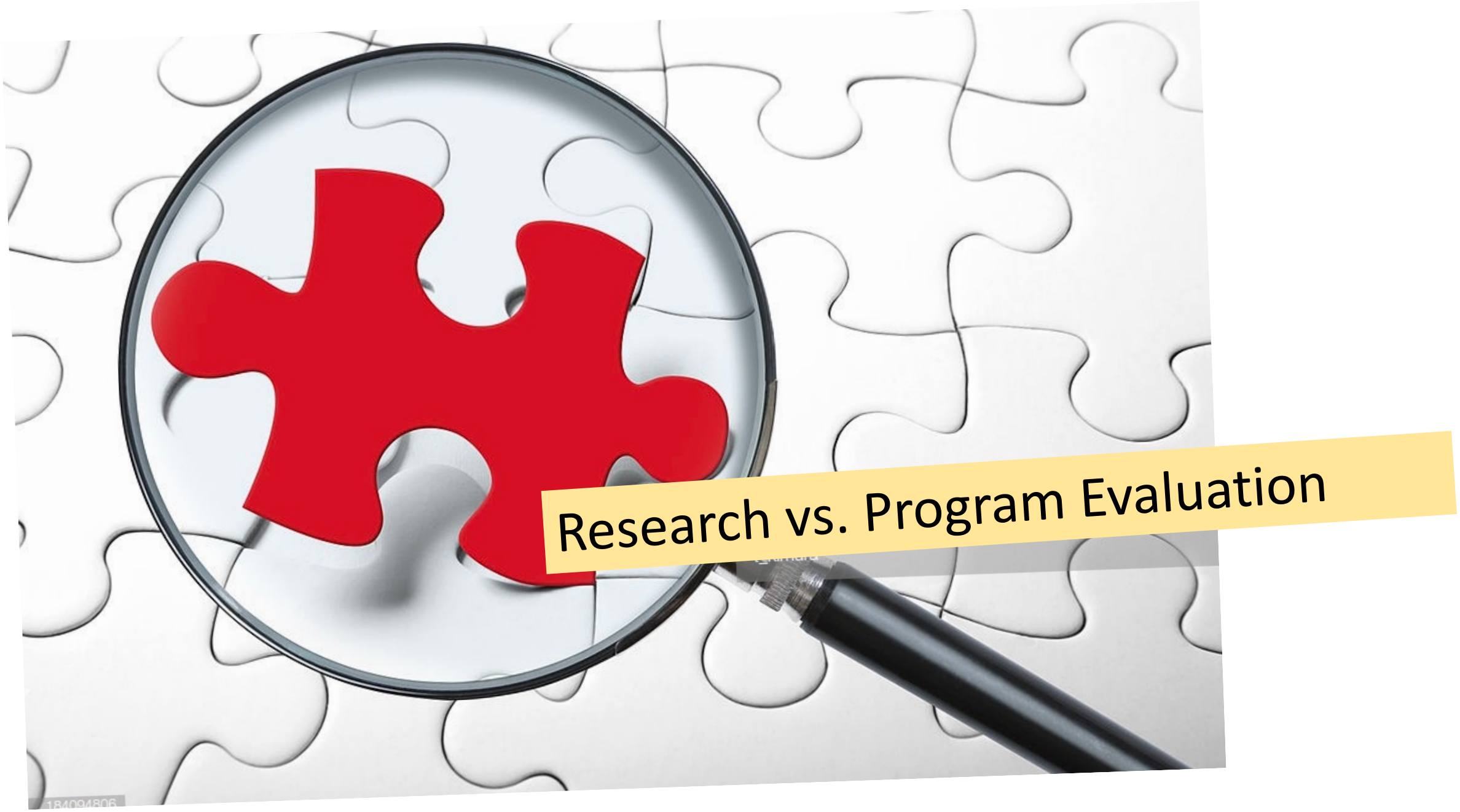
Outcomes

- More effective intervention
- Refined design principles
- Presentations and publications

McKenney SE, Reeves TC: Conducting educational design research, Second Edition. New York, Routledge, 2019.)

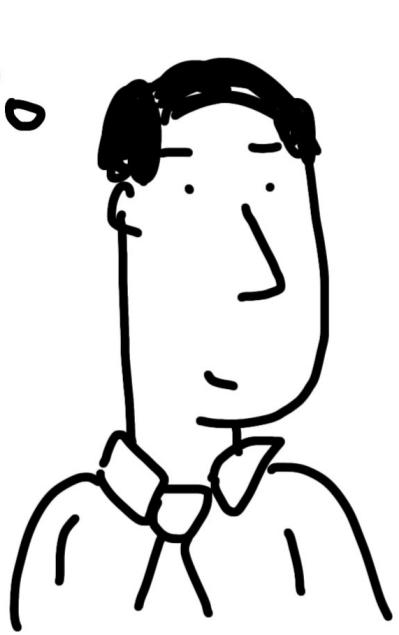
Our Case
Evaluation of Our Product

- System Usability Scale
  - 10 items, 10-point Likert Scale for ease of use and system functions
- Learner Survey: Self-efficacy
- Usage and viewing tracking
- Video Performance Rating
  - 12 items Task Checklist
- Comments/Feedback


Research vs. Program Evaluation

Research vs. Evaluation

This **research** is really going to help move our field forward.

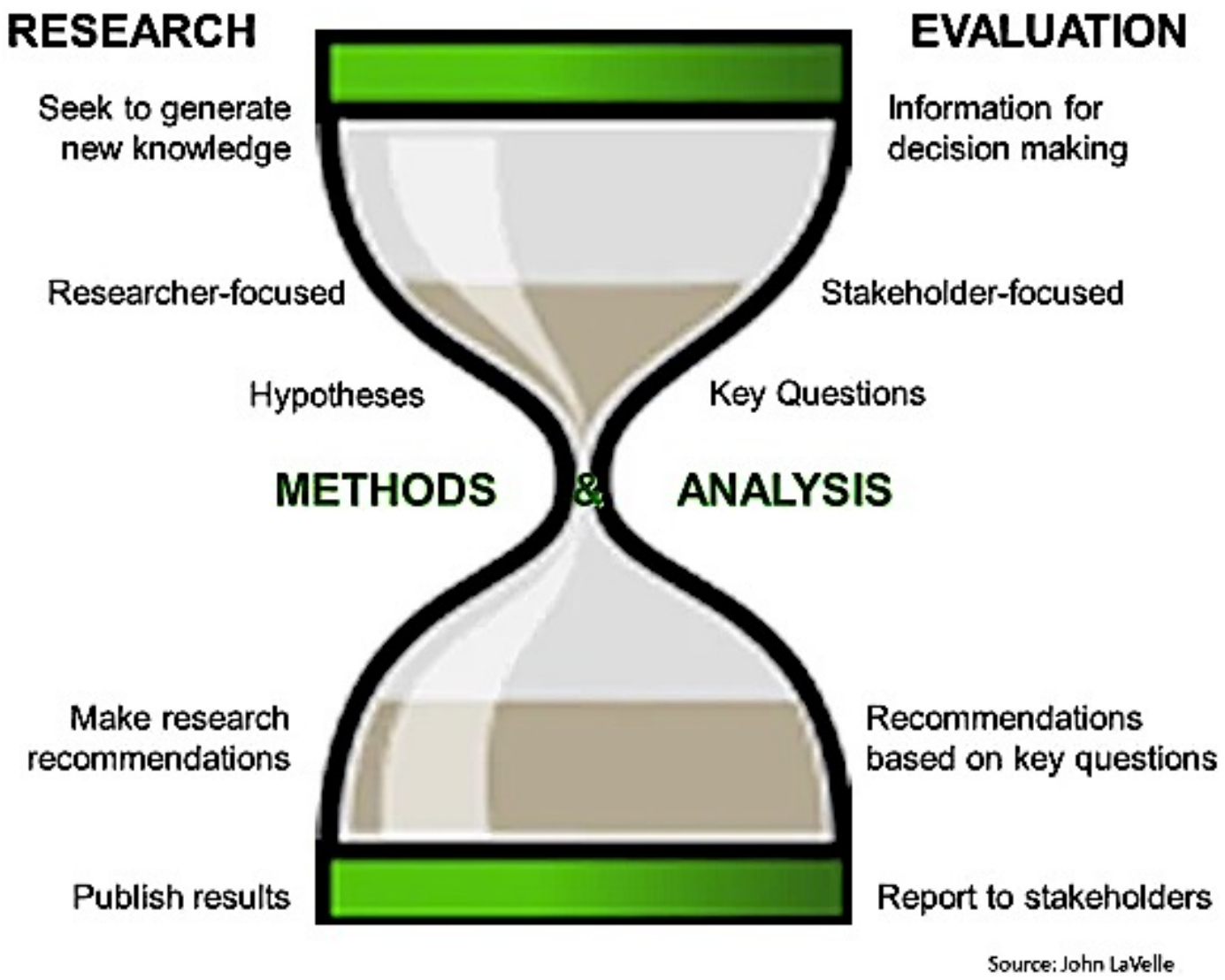


This **evaluation** is really going to help our program become more effective.

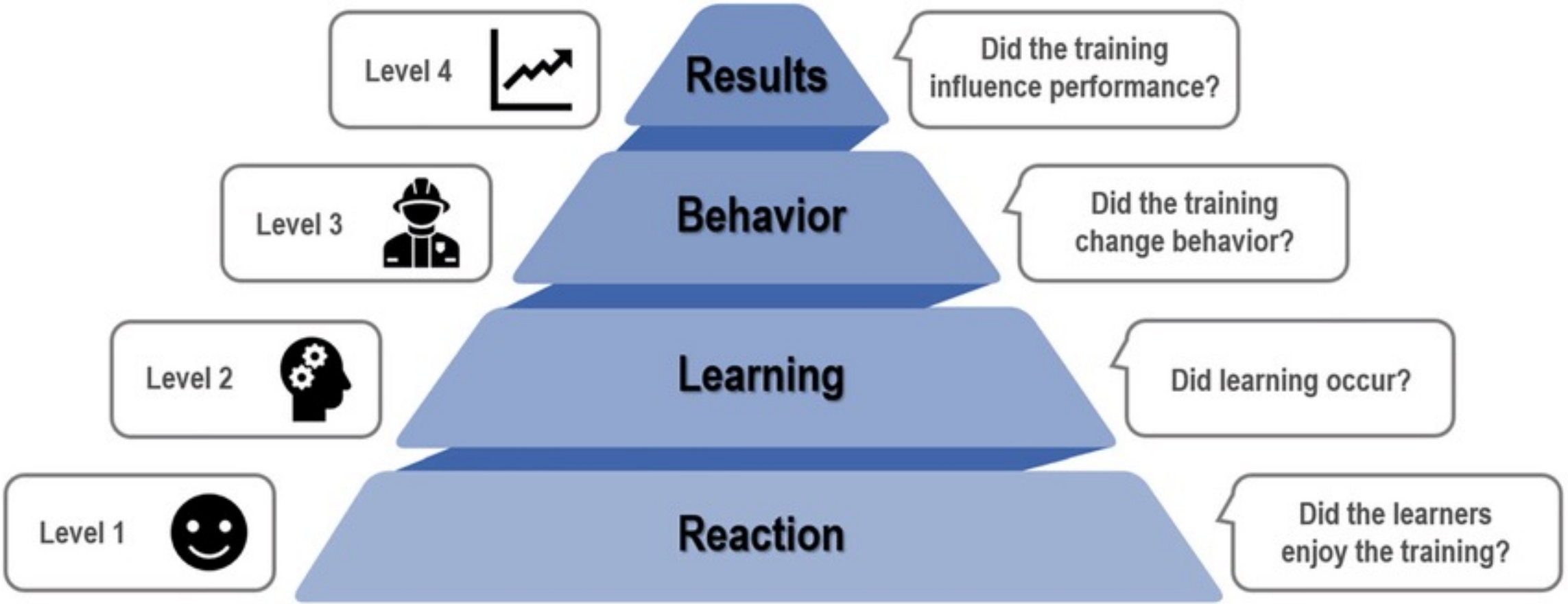
"Research seeks to prove, evaluation seeks to improve.

-Michael Quinn Patton

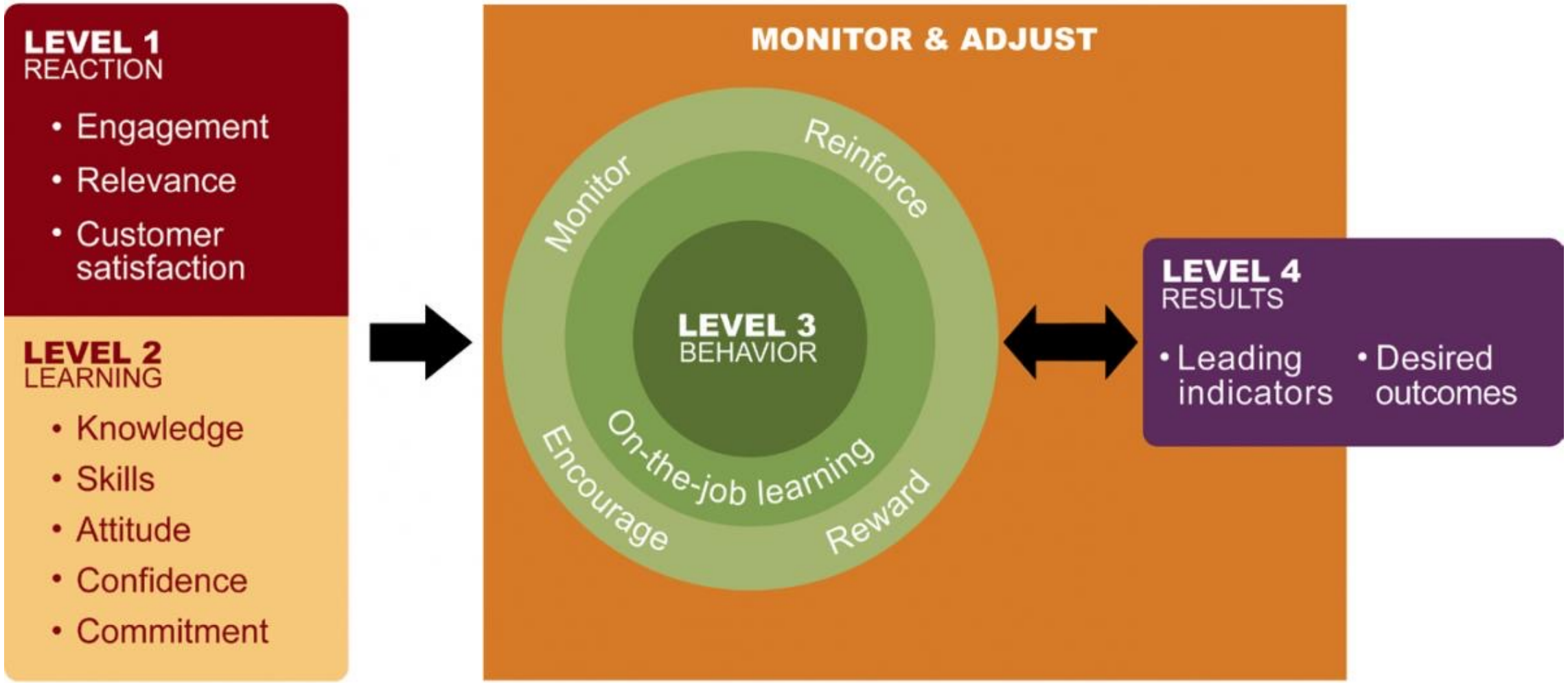
Research vs Evaluation



Kirkpatrick Evaluation Model



New World Kirkpatrick Model



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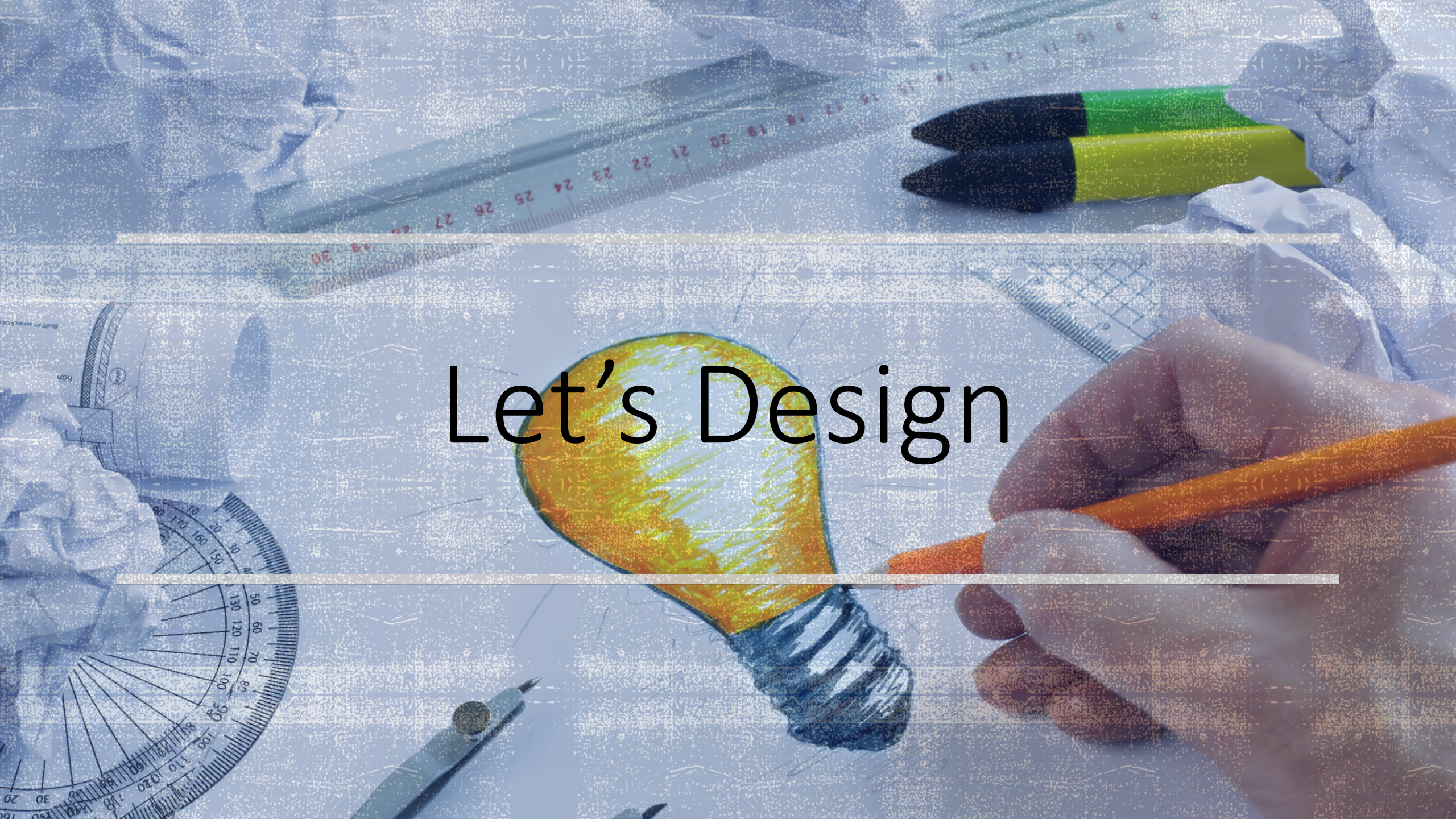

Let’s Design

Resident Duty Hour Model & Patient Safety

Postpositivist

"Does it work??

- Multicenter, RCT
  - Max 24-hr vs. Max 16-hr
  - N=100 programs/ group
- Outcome measurements at 12 mo
  - Serious medical errors
- Reject Null hypothesis ($p<0.05$)
- Implement the approach (?)

Pragmatist

How can we make it work better?

Resident Duty Hour Model & Patient Safety

Pragmatist

How can we make it work better?

- Design Research-Mixed Methods
- Iterative design of a duty-hour model, implemented in authentic practices
- Monthly evaluations
  - Residents/Faculty/other providers/stakeholders (viewpoints)
  - Serious medical errors (Trends)
  - Resident well-being
  - System and organizational culture
- Rapid revisions of the model to make it work best for the program

Analysis/
Exploration

Design/
Construction

Evaluation/
Reflection

Understand the Problem

Prototype Solutions

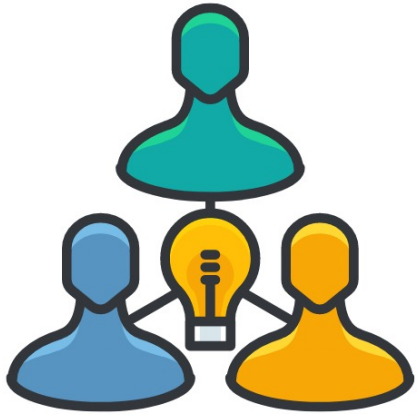
Evaluate the Results

Analysis/ Exploration

- Multimodal approach to gain understanding of the problem and context with stakeholders
- Scanning existing knowledge, programs and resources

Design/ Construction

- Theory-informed design of possible solutions to the problem
- Craft and modify prototypes iteratively



Evaluation/ Reflection

- Comprehensive and pragmatic evaluation of the product and design principles
- Reflection on theory used to guide the design

Many problems in medical education are complex and cannot be solved completely (wicked problems).

Educational Design Research is a socially responsible, solution-oriented and pragmatic approach to addressing complex problems in a real-world setting.

In EDR, evaluation seeks to improve the “solution” and enhance theoretical understanding.

Session Evaluation

Additional Reading Materials