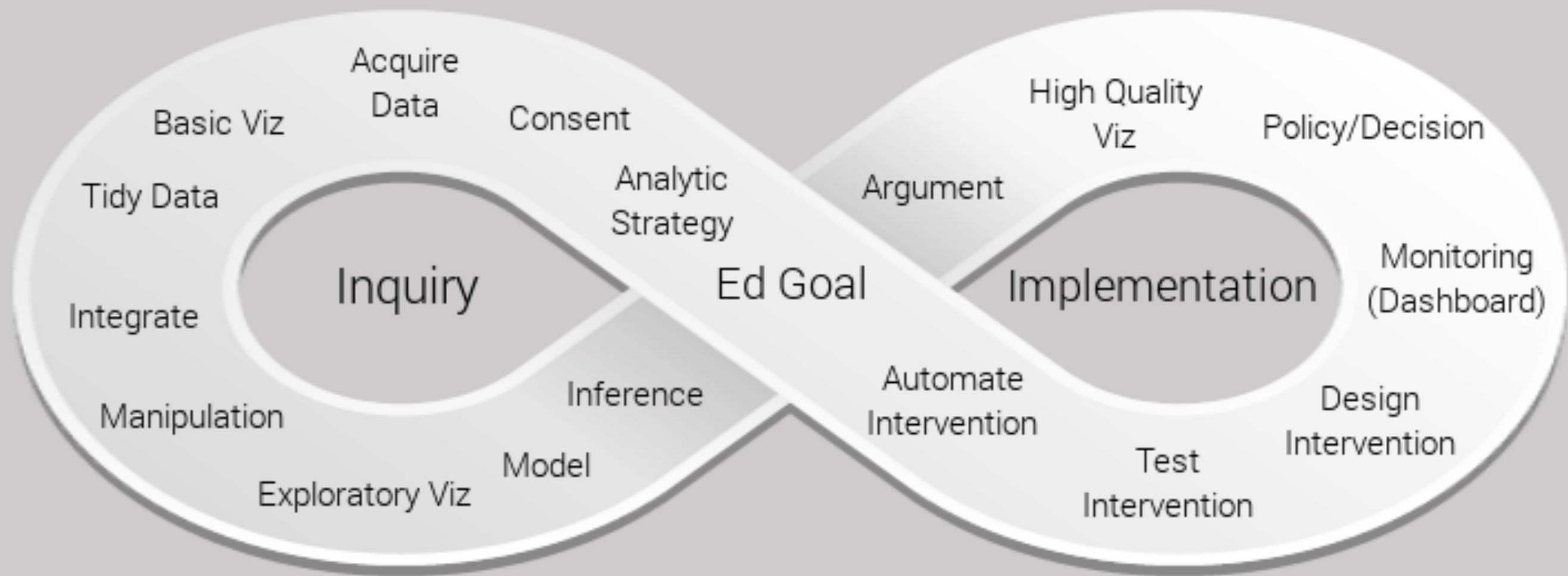


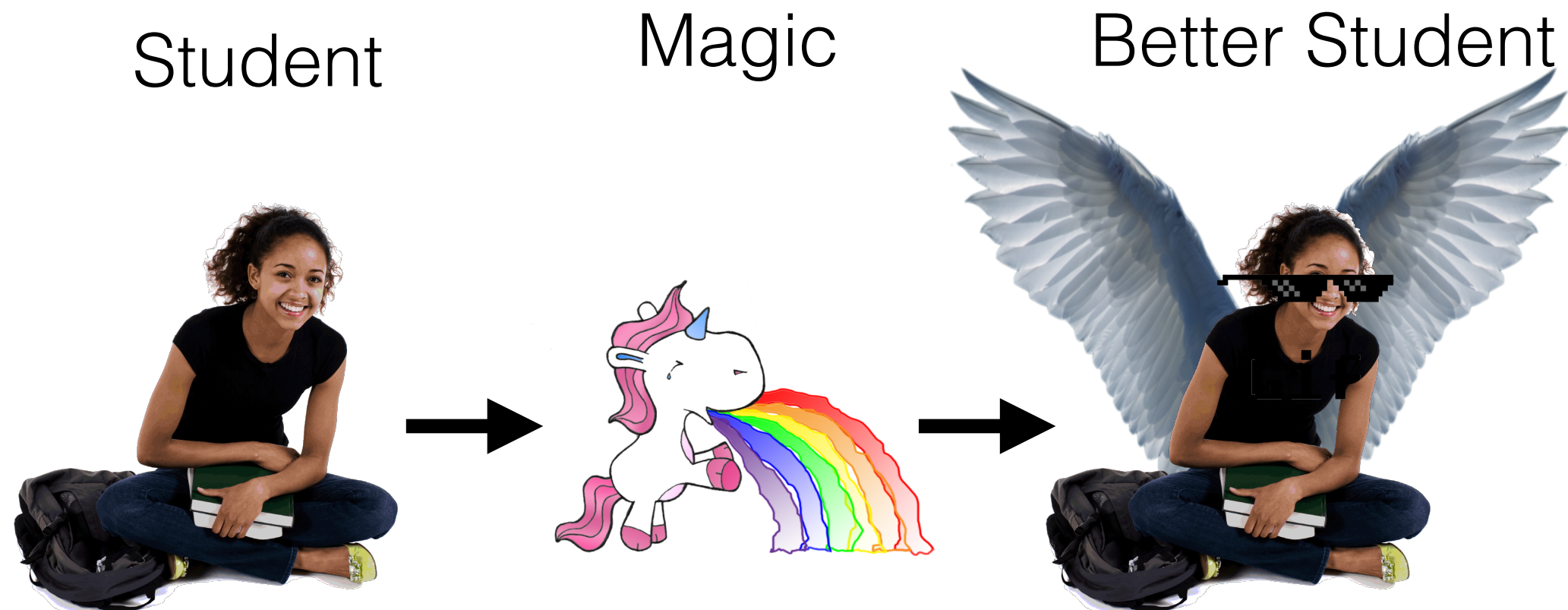
HUDK 4051: LEARNING ANALYTICS PROCESS & THEORY

4/9/19 2:26 PM

Ed Data Science Cycle



Best Definition



If we provide what the student needs, when they need it, they will learn better

Example

1. We see a correlation between LMS logins and grade
2. We record student logins
2. If a student does not login for a week
3. We send them an email
4. We record whether students open the email
5. We look to see if there is a correlation between the email being opened and logins and email and grades

Definitions

- Must involve **time** (or at least two time points)
- Make inferences about **relevant groups** or **individuals**
- Requires a **defined goal/standard**
- Inherently **causal**
- **Automate**

Framework

- **Narrative Model:** Dinner party version of your loop closing model or theory
- **Operational Model:** What you count and how you count it
- **Validation Model:** Convincing yourself there is a connection between your narrative and operational models

Narrative Model

Narrative Model

If we alter the **environment by W**, for **subgroup X**,
then **learner Y** will do **Z**

**If learner X does Y in environment W, they get
result Z (vs. Z')**

Narrative Model

Action

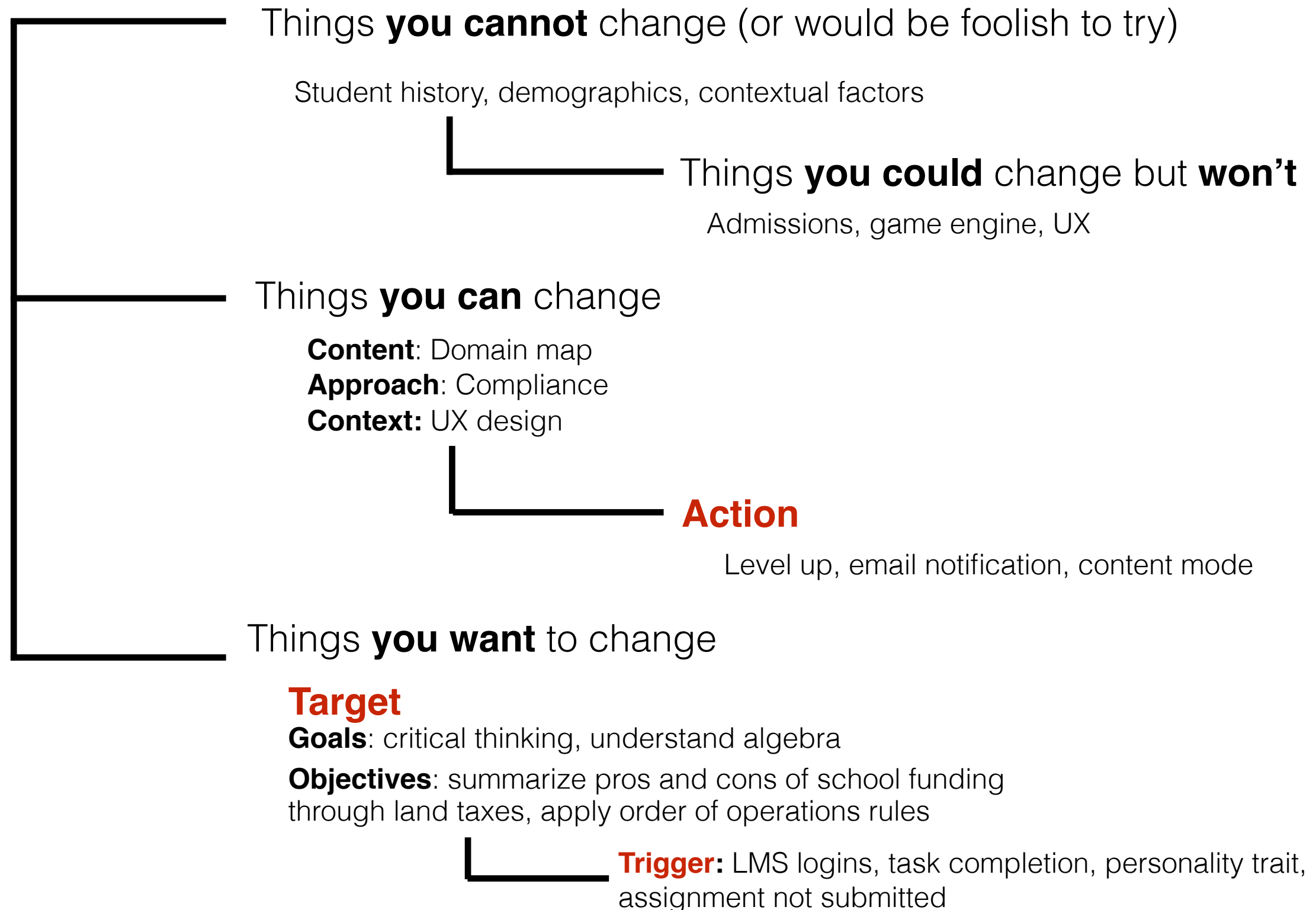
Trigger

If we alter the **environment by W**, for **subgroup X**,
then **student Y** will do **Z**

Target

If we **send email deadline reminders** to **students who do not login** then **those students** will **hand in their assignments on time**

Narrative Model



Exercise 3: Categorize the aspects of your example into:

- Cannot change
- Can change
- Want to change

Narrative Model

Cannot change

Can change

Want to change

Action

Trigger/Target

incoming student
study habits

email deadline
reminders

student logins
meet deadline

incoming student
knowledge

content

understanding
progress

student anxiety

content difficulty

correctness

Exercise 1: Devise an Example

Take five minutes to invent a loop closing example
and write the narrative model

Operational Model

Operational Model

What are you counting?

Cannot change

incoming student
study habits

- student demographics
- previous courses
- previous LMS use

Can change

Action

email deadline
reminders

- send/not send
- time sent

Want to change

Trigger/Target

student logins
meet deadline

- logins
- submissions
- timestamp
- grades
- completion

Exercise 5: Define what you
are counting

Operational Model

What variation are you mining?

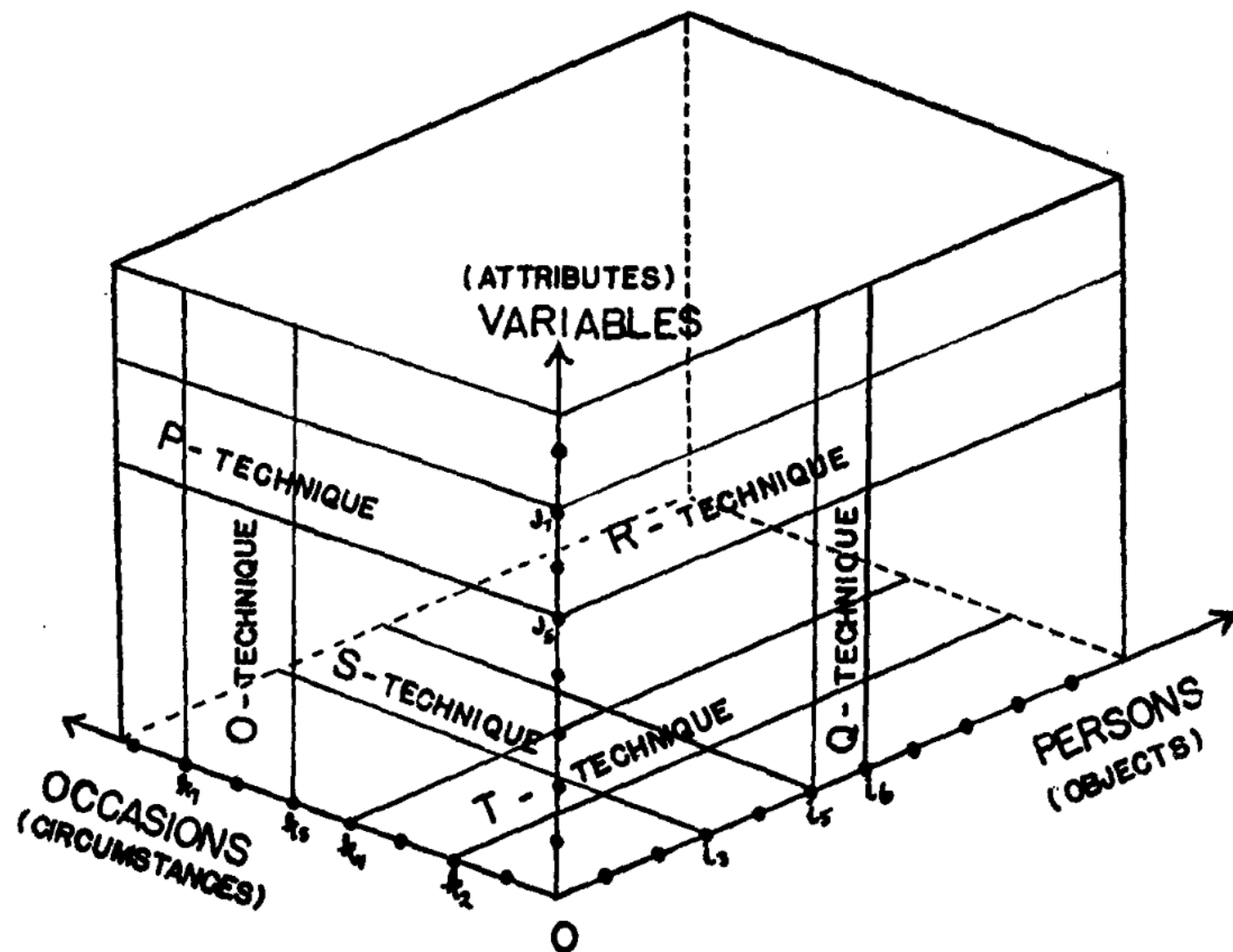


FIG. 1. THE COVARIATION CHART

Cattell, 1952

Exercise 6: Variation

Questions to ask:

- On what planes is the variation?
- What comparisons are available?
- What **relevant information** is available in that variation that we can draw **inferences** about **triggers** from?

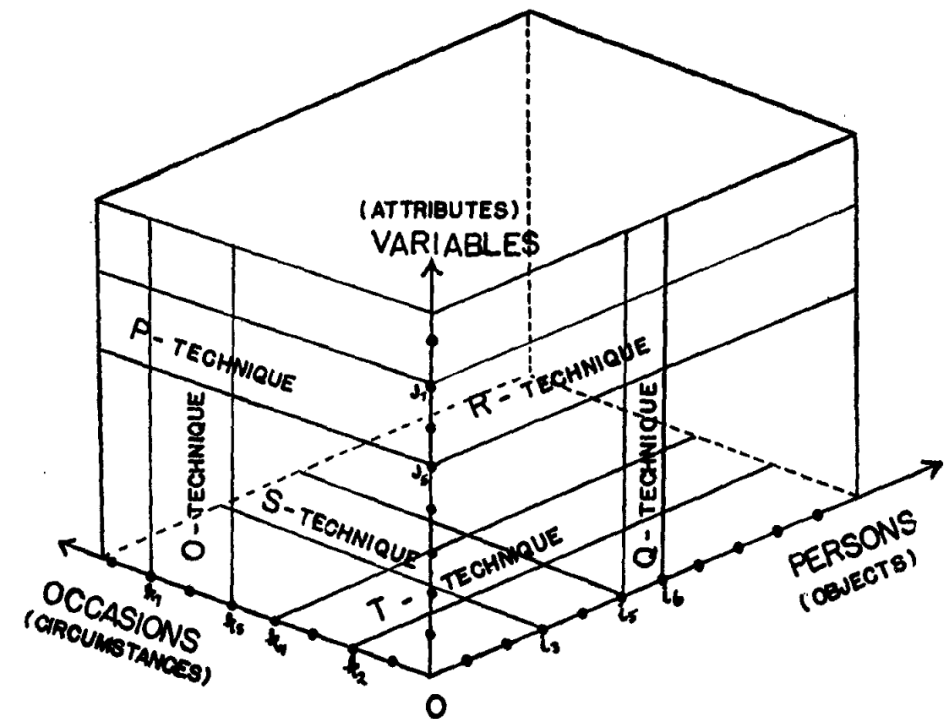


FIG. 1. THE COVARIATION CHART

Operational Model

- How are you making meaning from that variation?
- What is the trigger?
- What is the action?

Exercise 7: Simulate Data

- Using R, simulate and visualize the variables for your example

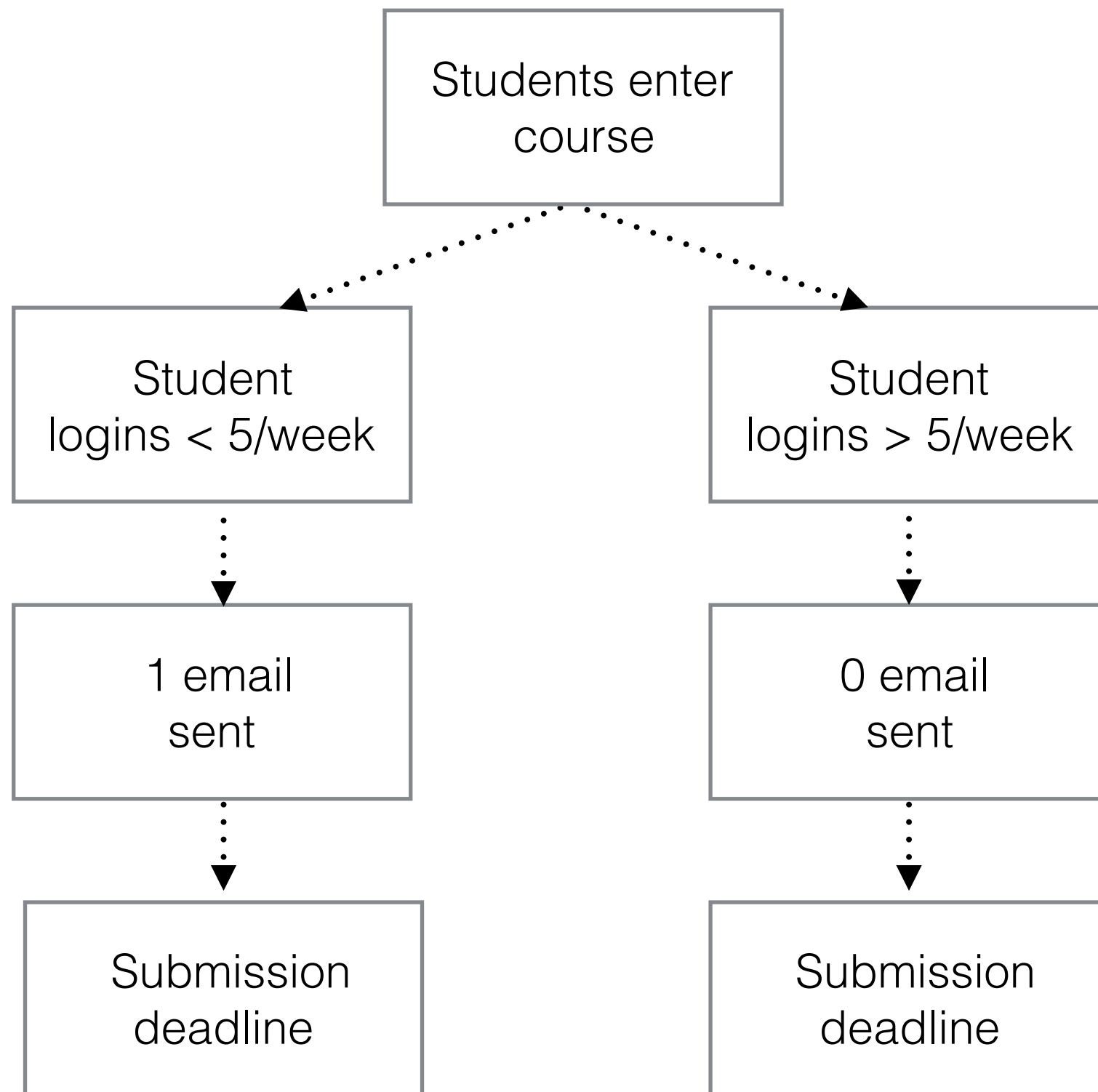
Operational Model

- How does the machine make decisions?

Exercise 3: Categorize the aspects of your example into:

- Cannot change
- Can change
- Want to change

Example 1: Arbitrary Decision

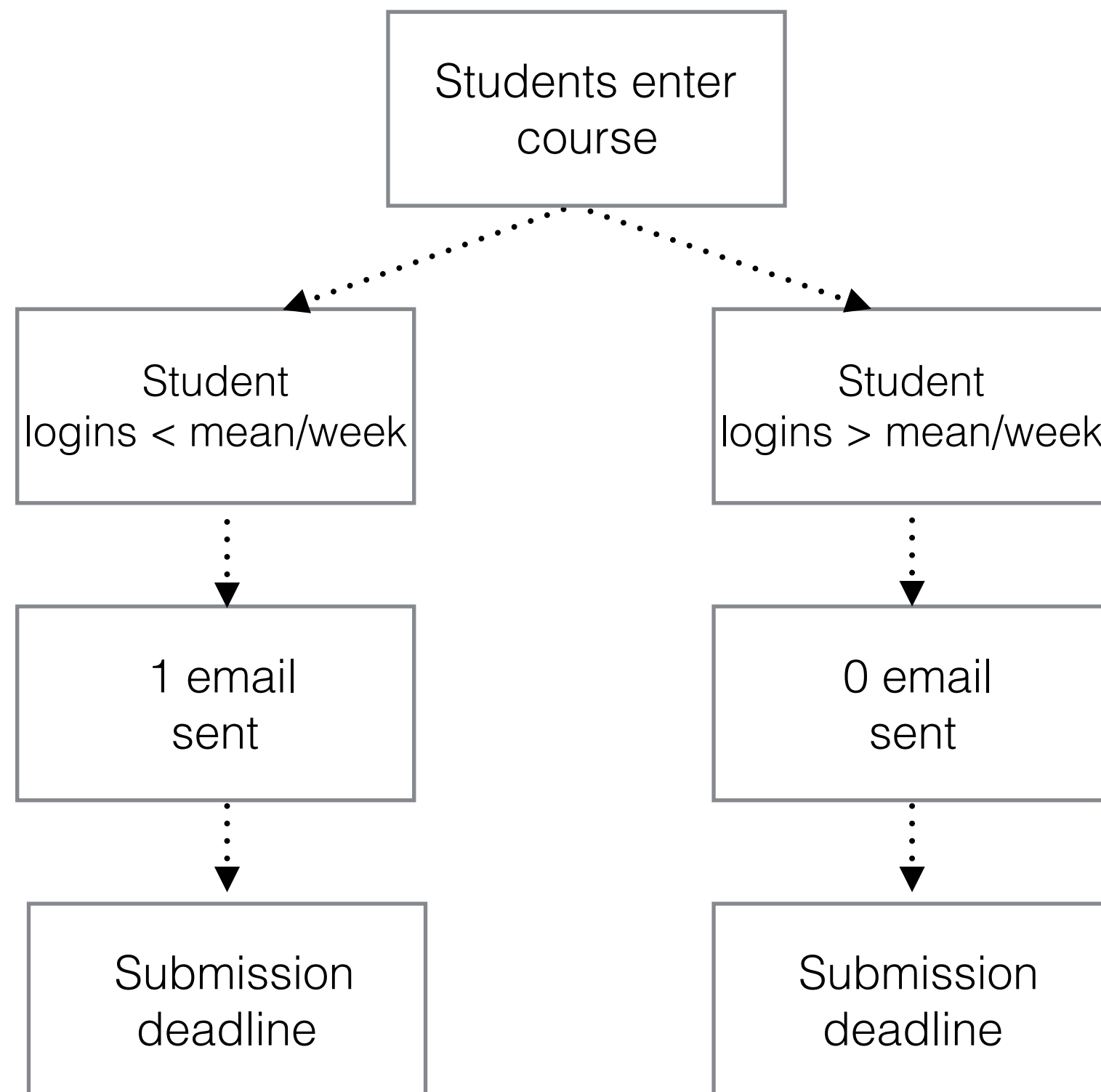


Count: logins

Variation: theoretical/time

Information: priorities

Example 2: Mean Decision



Count: logins

Variation: between-individual

Information: priorities

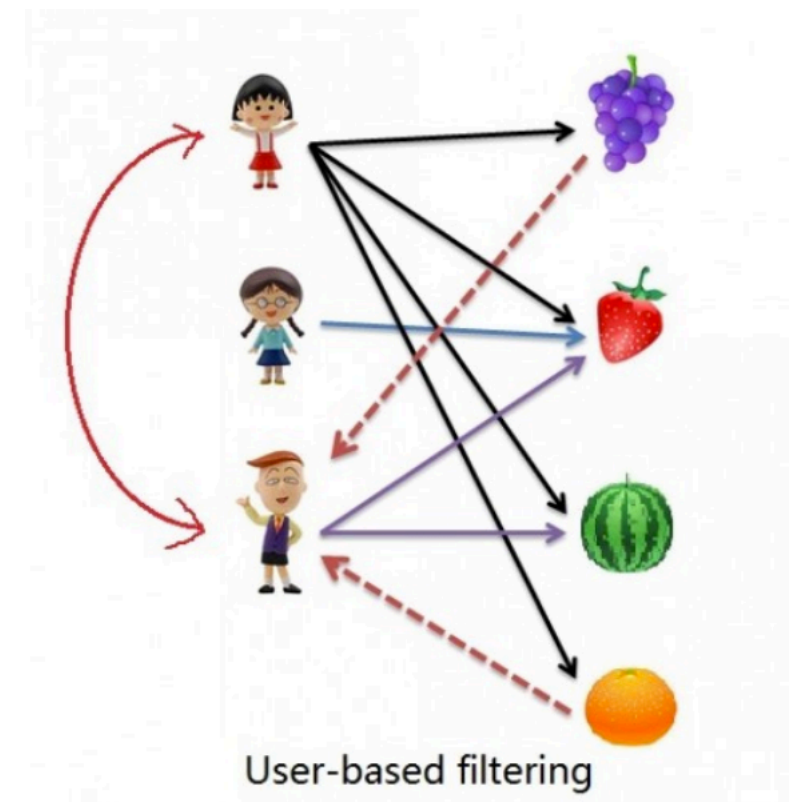
Example 3: User Based Collaborative Filter

	student A	student B	student C
podcast	score improved = yes	yes	no
game	yes	no	no
quiz	yes	yes	no

Count: score change, tasks, students

Variation: between-individual

Information: learning



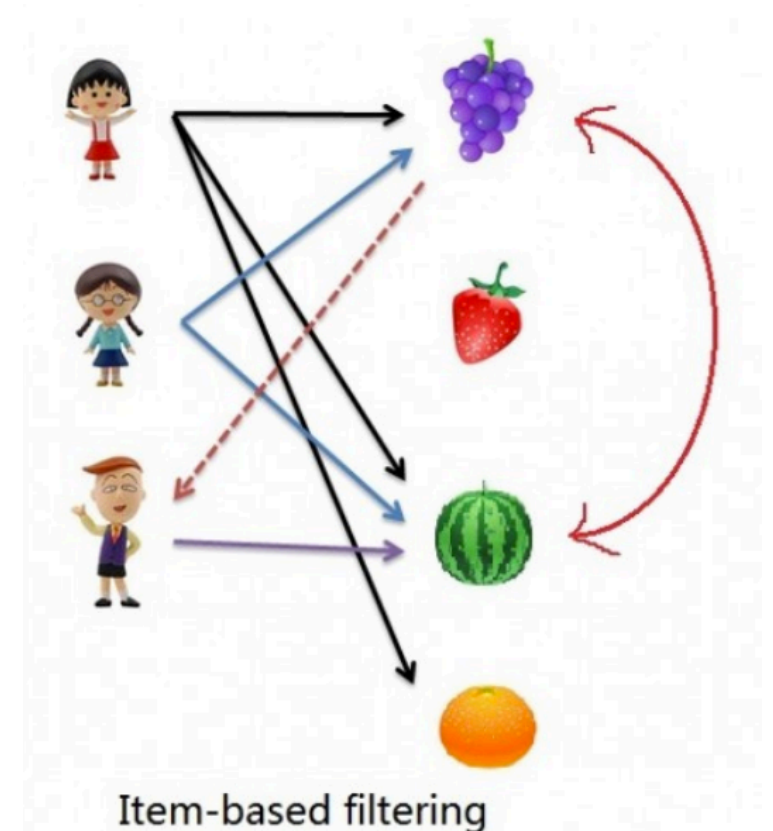
Example 4: Item Based Collaborative Filter

	student A	student B	student C
podcast	score improved = yes	yes	no
game	yes	no	no
quiz	yes	yes	no

Count: score change, tasks, students

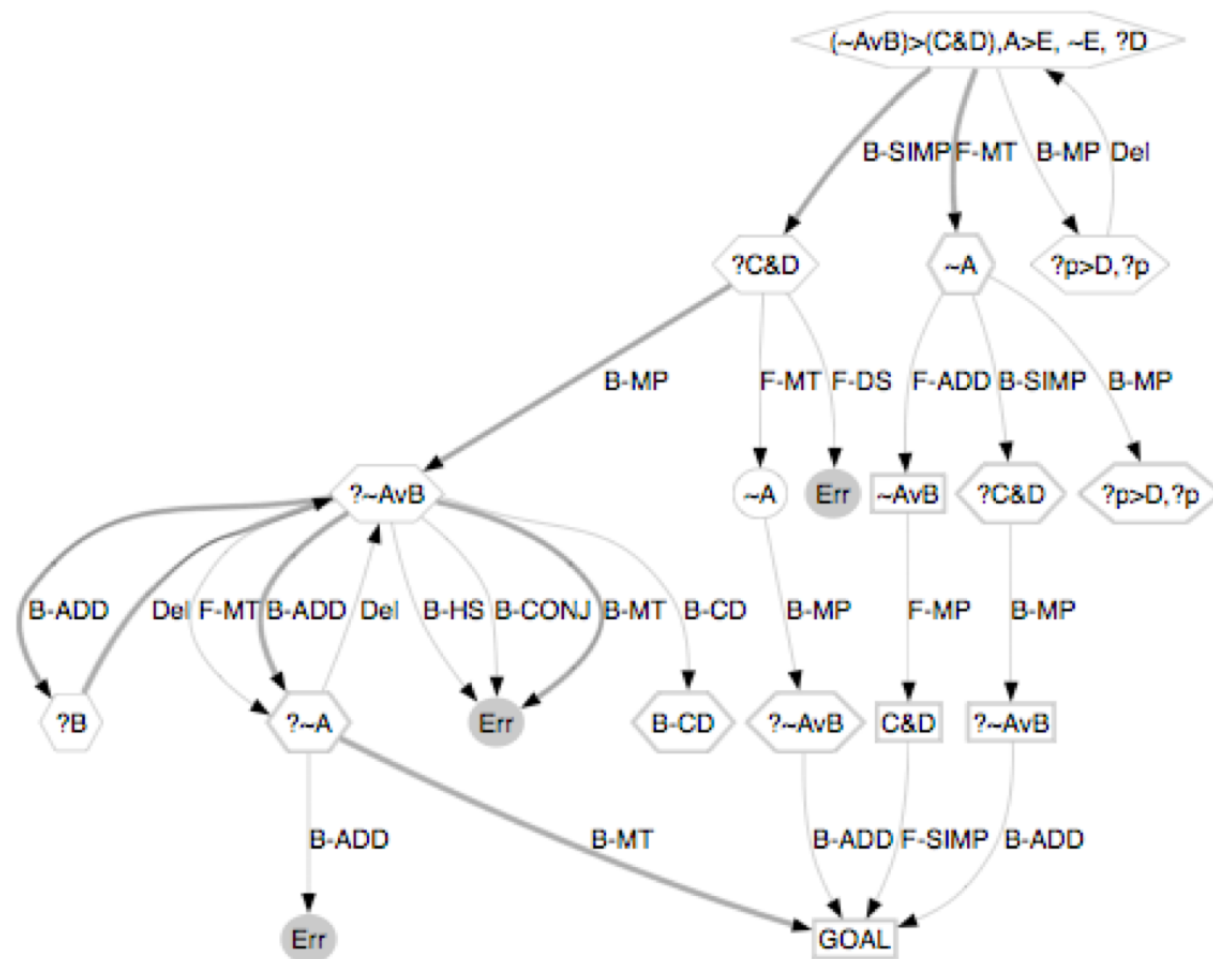
Variation: between-tasks

Information: learning



Example 5: Model Tracer

Compare models of **how** people **know**



Count: decisions,
pathway, success

Variation: between-
students

Information: learning

Validation Model

Reasoning

Statistics

Counterfactual

Predictive

Frequentist

Bayesian

Fiducial

Education

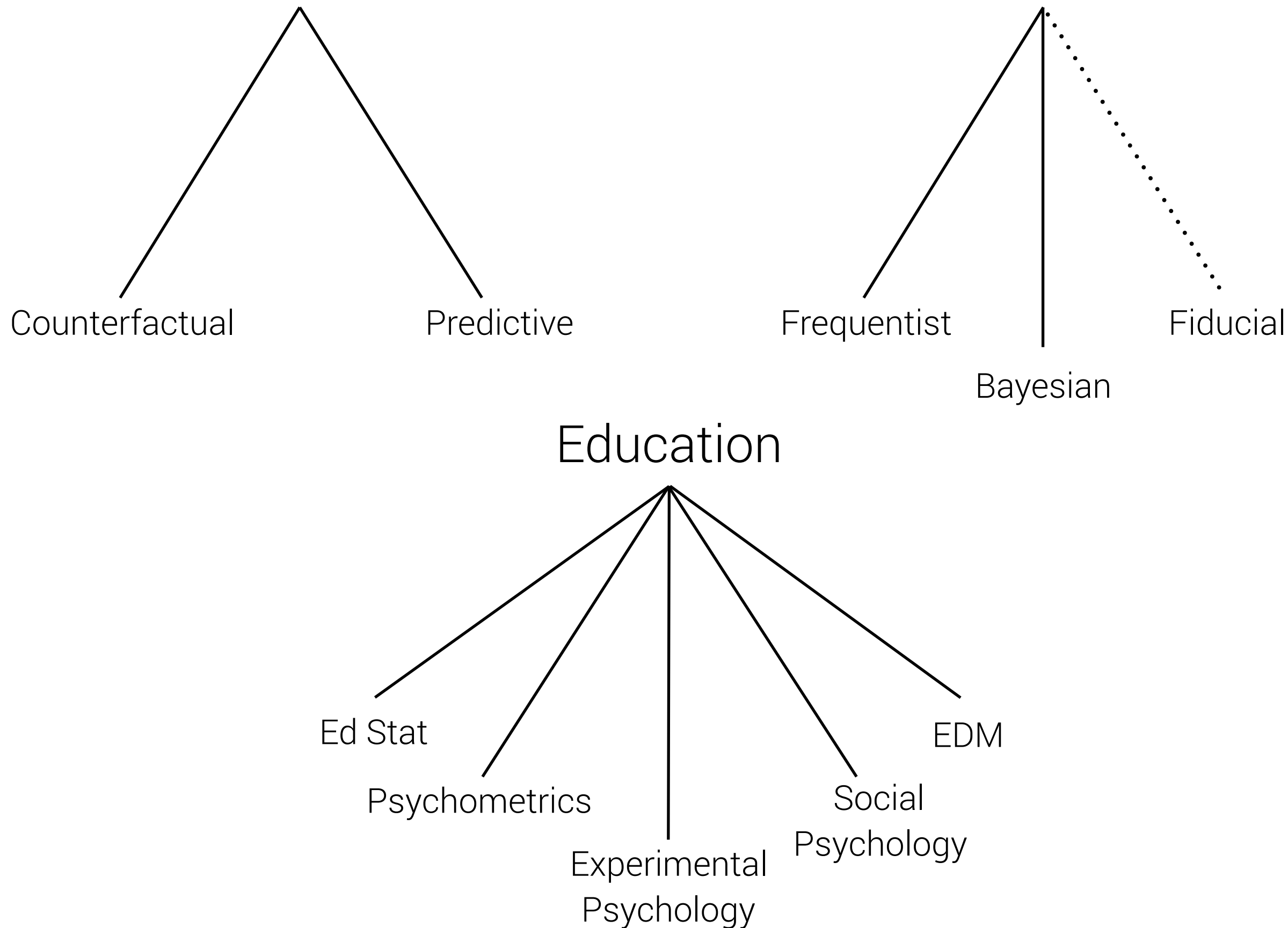
Ed Stat

Psychometrics

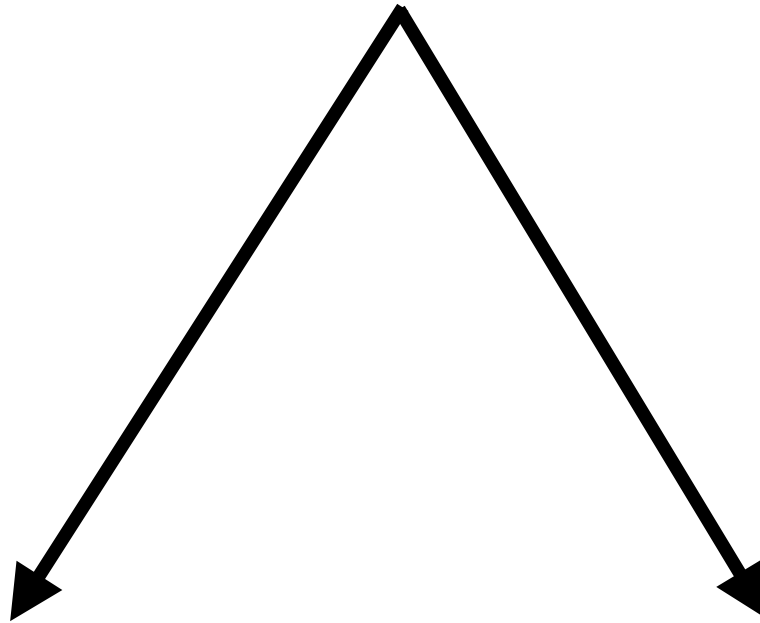
Experimental
Psychology

Social
Psychology

EDM

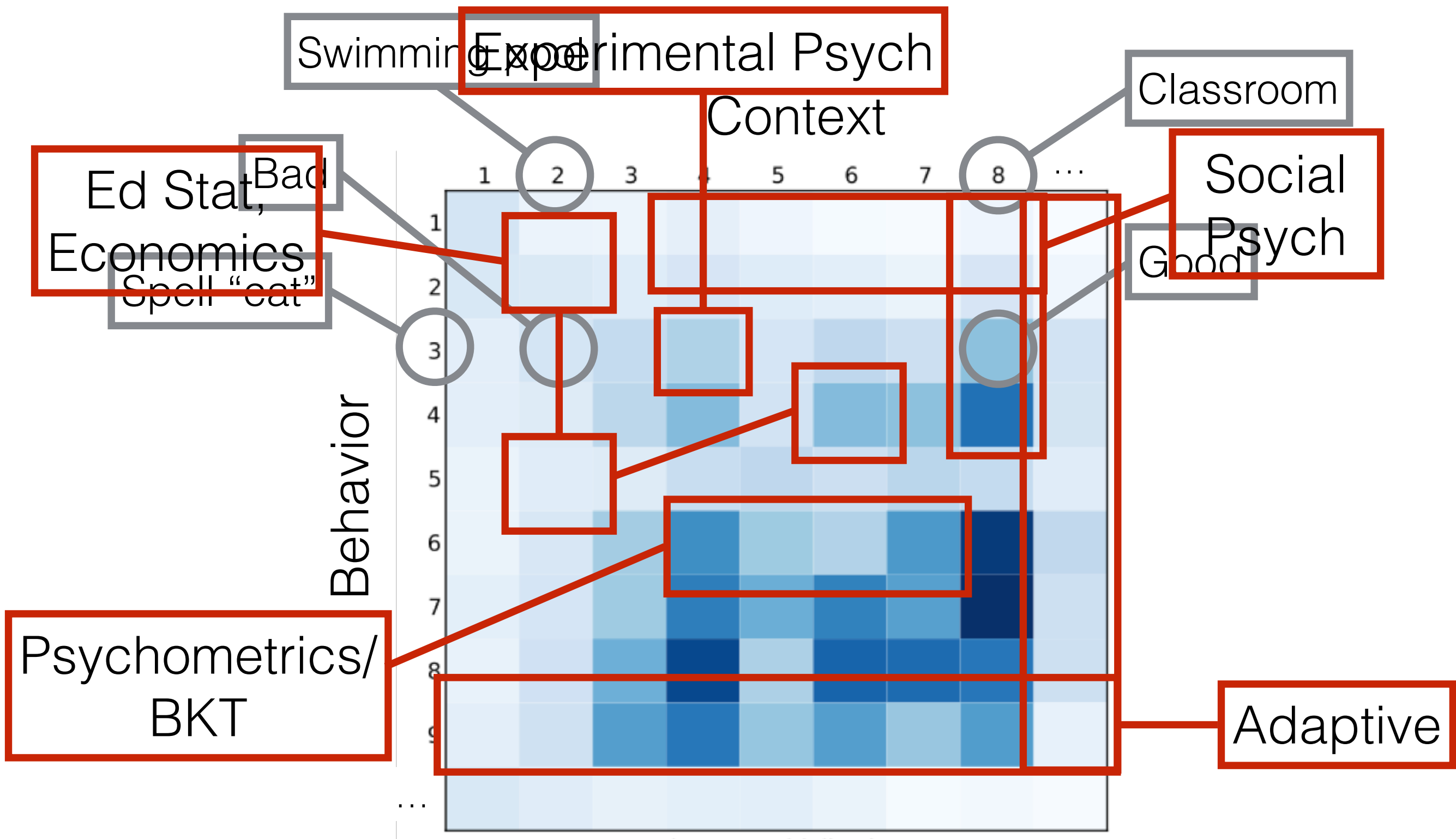


Variation



Patterns

Uncertainty



Narrative Model



Operational Model

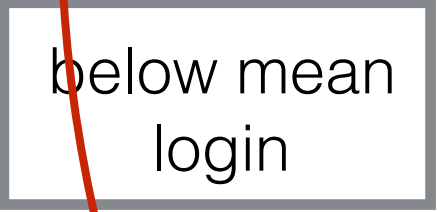
Count



Variation



Machine decision



Logic?
Prediction?
Counterfactual?

Do these reasonably correspond?

Validation Model

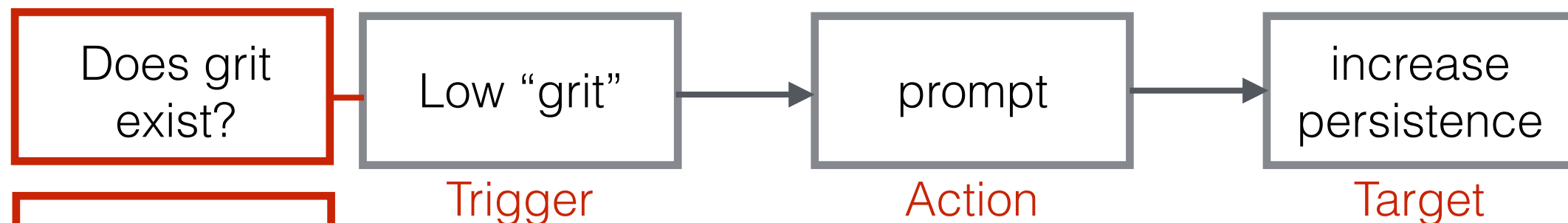
Why trigger?

Did action occur?

Did it work?

Unintended consequences?
Auto-iterate?

Narrative Model



Does logout
= grit?

Operational Model

Count

logout/time

engage with
prompt

Session time

Variation

across/within
students

within
student

across
students

**Machine
decision**

below defined
logout

Do these reasonably
correspond?

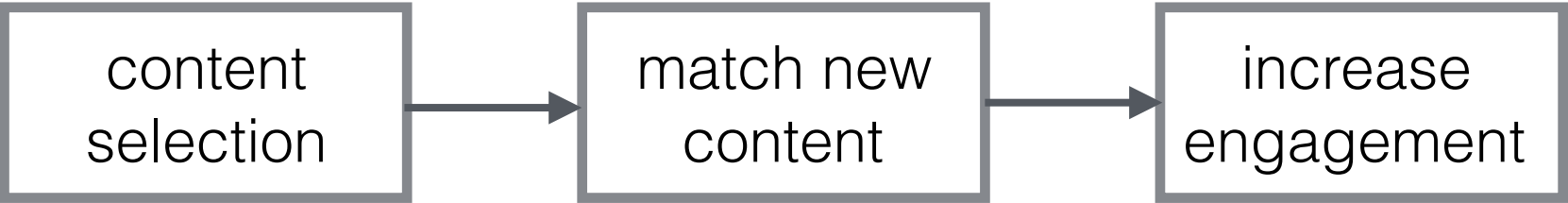
Validation Model

Why
trigger?

Did action
occur?

Did it work?

Narrative Model



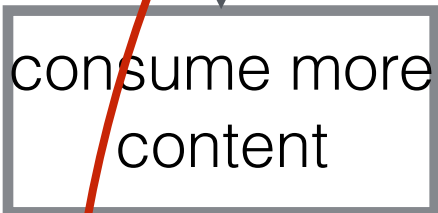
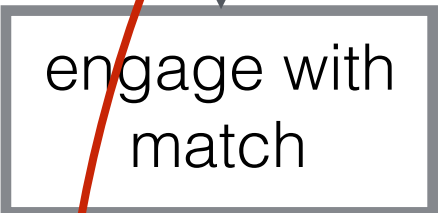
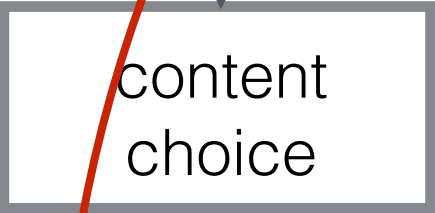
Trigger

Action

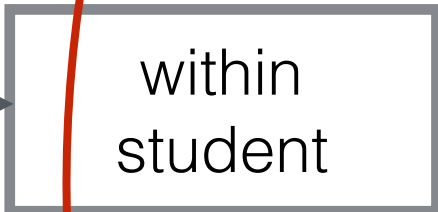
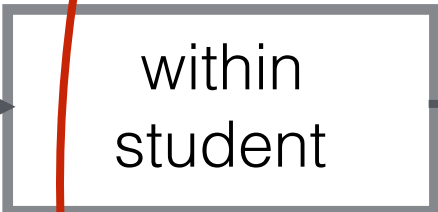
Target

Operational Model

Count



Variation

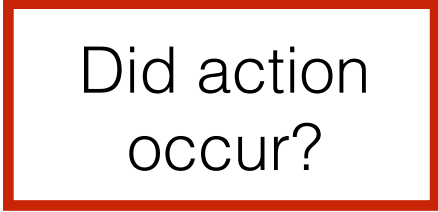
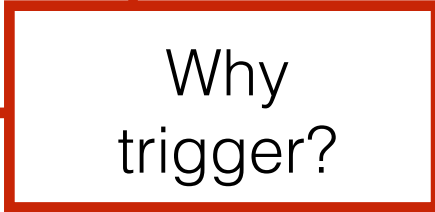


Machine decision



Validation Model

Similarity,
sparsity,
neighborhood



Do these reasonably correspond?