HUDK 4050:CORE METHODS IN EDM

11/1/16 8:17 AM

In the news

How One University Used Big Data To Boost Graduation Rates

npr

The Promise and Peril of Predictive Analytics in Higher Education

NEW AMERICA

Extracting Data from the Web Part 1

Date: November 9th
Time: 11:00 AM EDT

RStudio

A Devil's Dictionary of Educational Technology

Posted on September 22, 2016

http://bit.ly/2emtEwI

http://bit.ly/2ecDAtF

U.S. Ed Department Launches Free Online Tool to Rapidly Evaluate Ed Tech Products

ED TECH RCE COACH *beta*

Next Glass

Incomplete or inaccurate state data muddies charter school debate

MASS LIVE

IBM launches Watson application developer certification

ZDNet

Impact and Nonimpact of Online Competition

INSIDE HIGHER ED

WiML Women in Machine Learning

http://wimlworkshop.org

LibX

http://library.columbia.edu/technology/tools/libx_tool.html

Examples of A4?

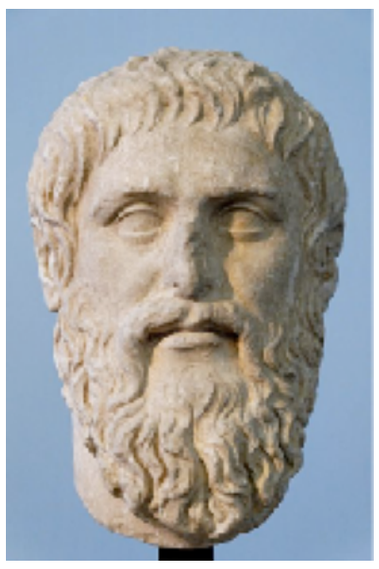
No assignment this week

Domain Structure Discovery

- Identifying the structure of knowledge in a(n) (educational) domain
- We've been at this a while
- Quantified epistemology

Samkhya, Yoga

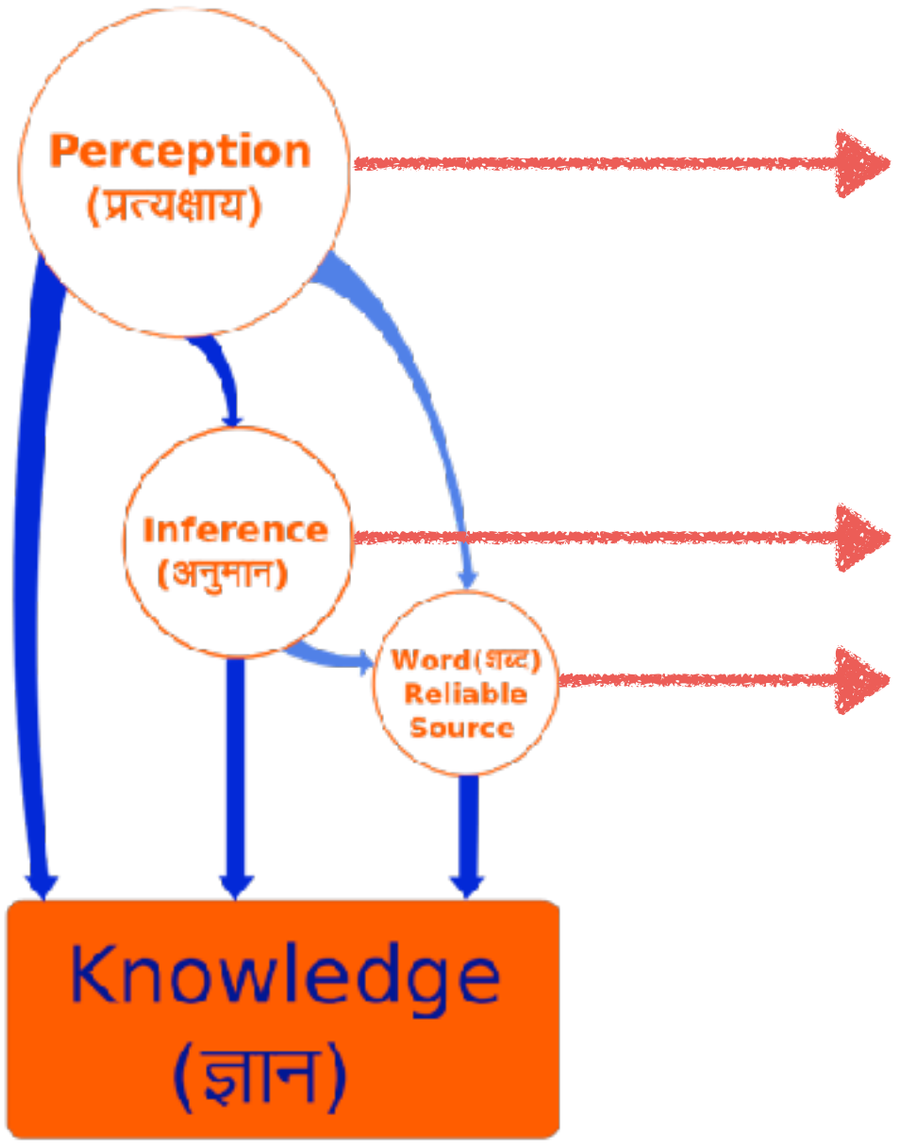
सांख्य
~500BCE



Plato ~300BCE

孟轲 ~ 200BCE

Domain Structure Discovery



Certain indivisible content

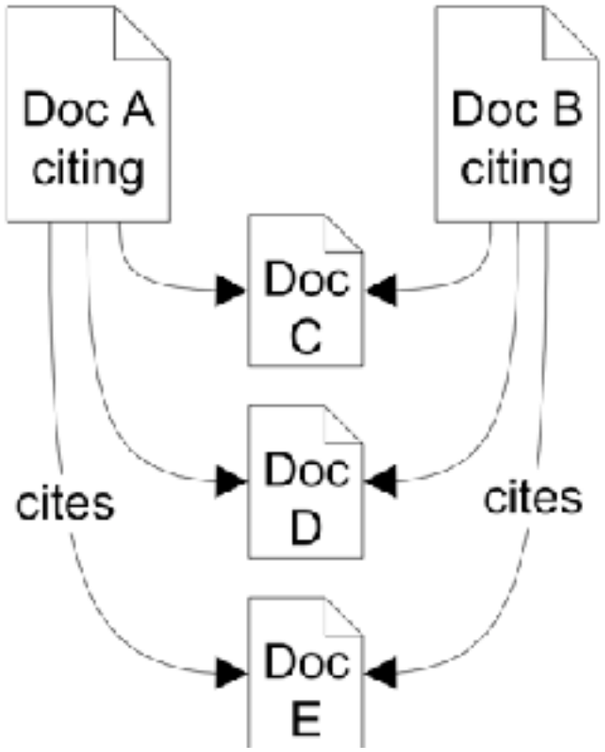
Infer from perception

Expert opinion

Bibliometrics

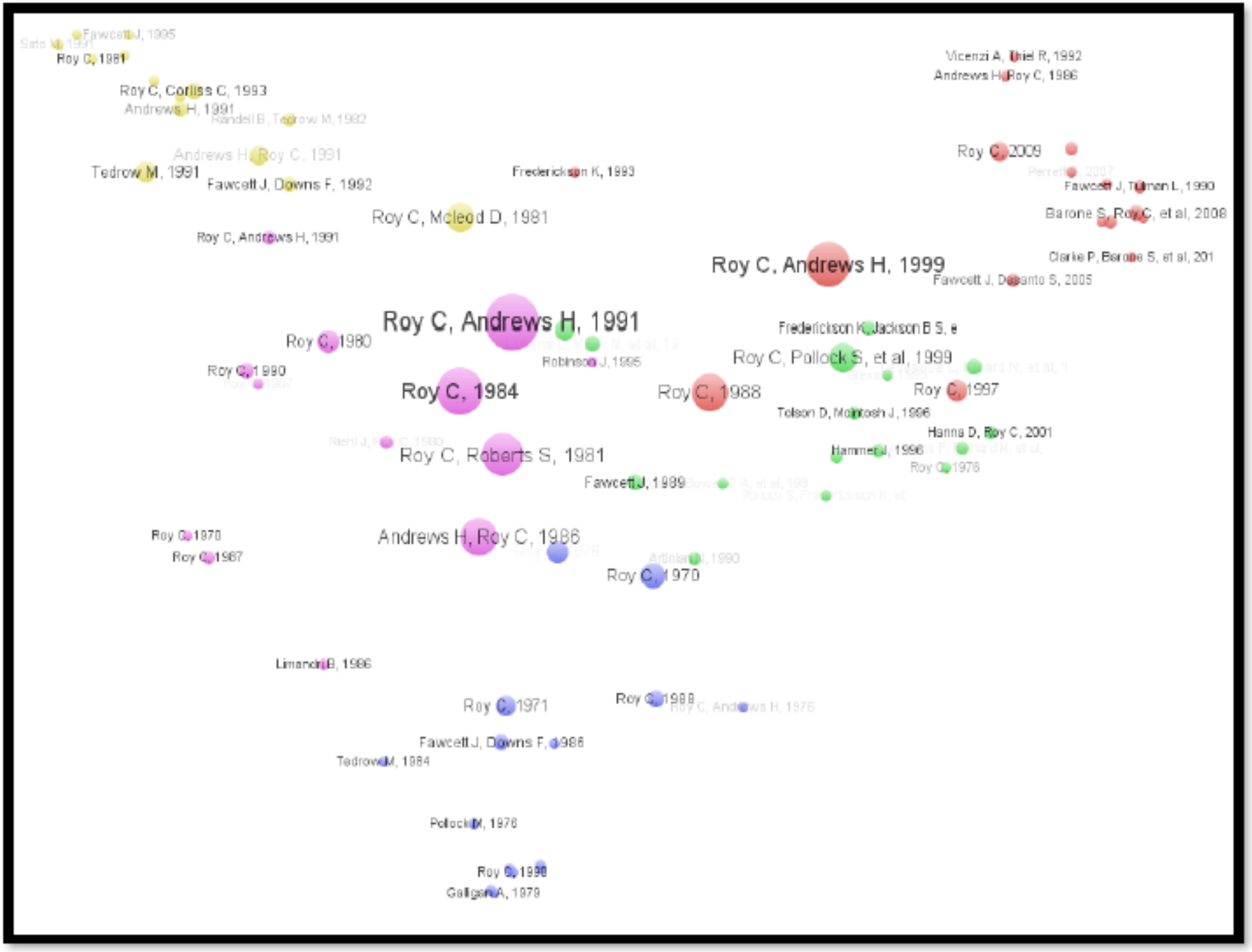
(scientometrics, librametry, statistical bibliography)

- Citation patterns
- Raw number (impact score), Erdős Number
- Co-word analysis
- Network representation

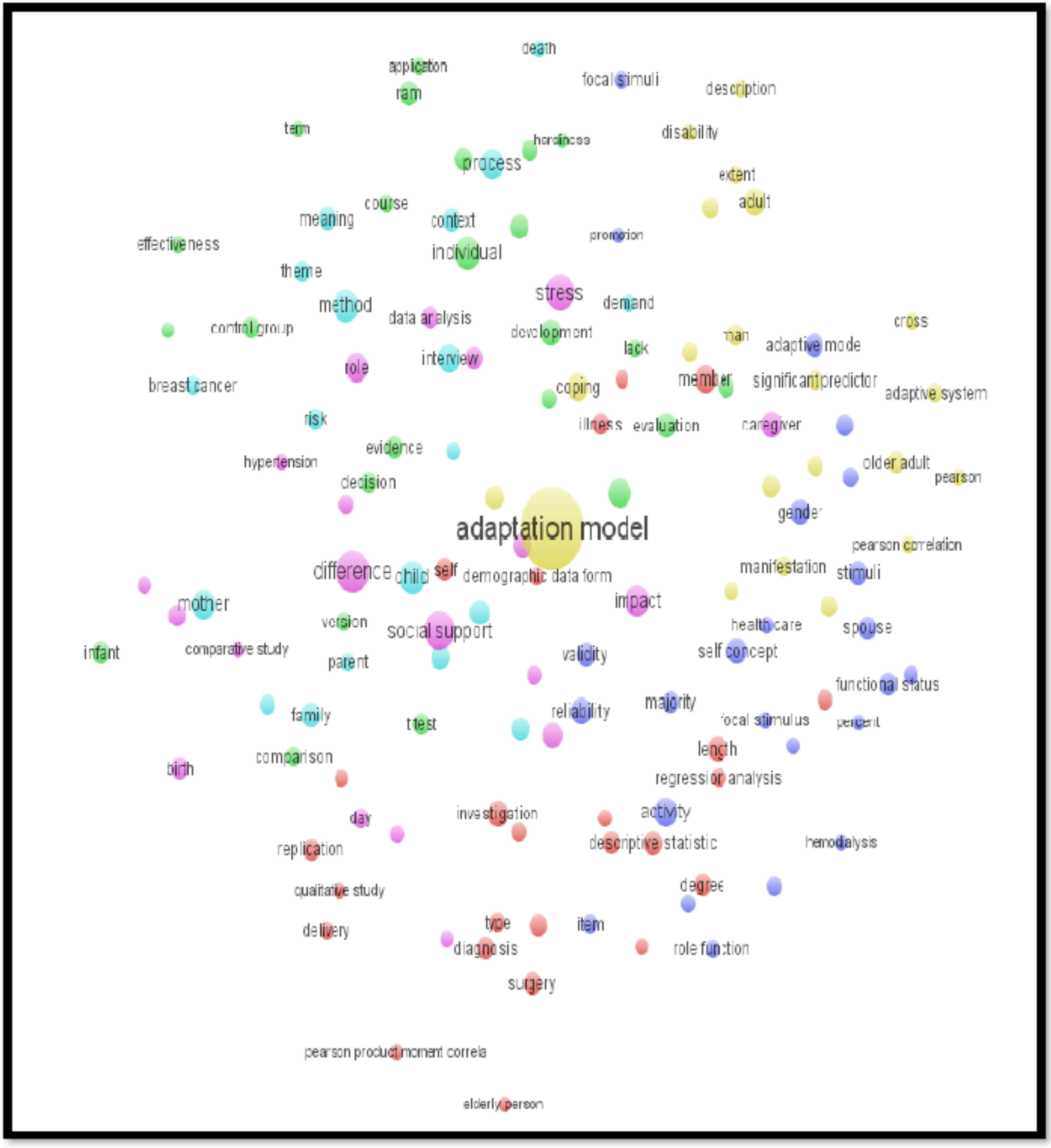


Bibliographic Coupling

(Eigenvectors again!)

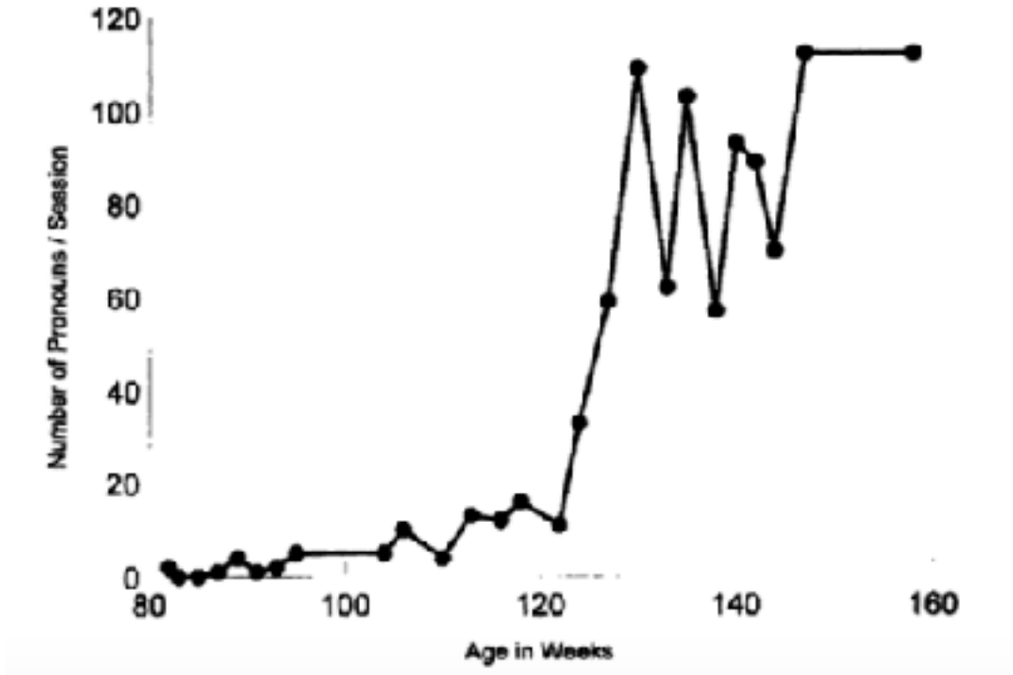


Alfonzo, Sakraida, Hastings-Tolsma (2014)



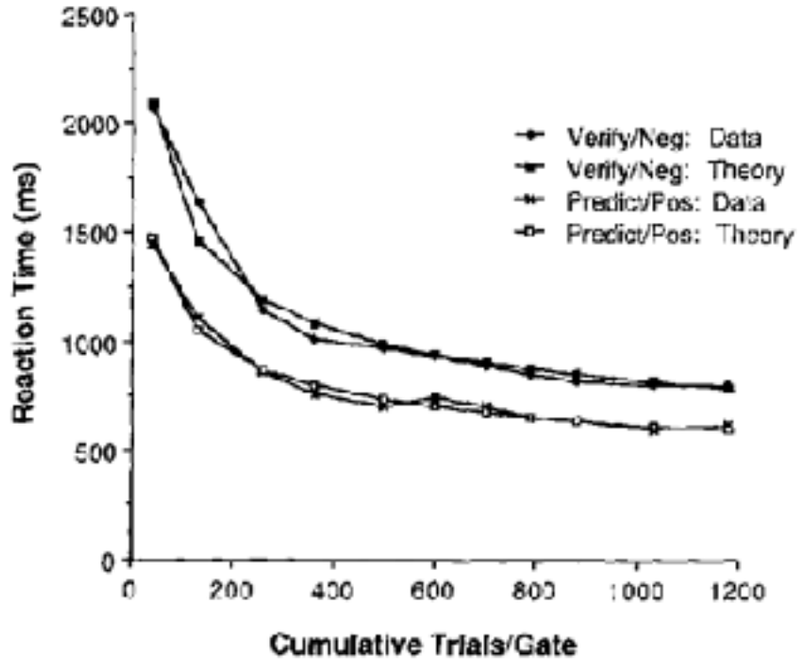
Alfonzo, Sakraida, Hastings-Tolsma (2014)

Skills



Fischer & Yan, 1980

(There is also the whole world of construct validity)



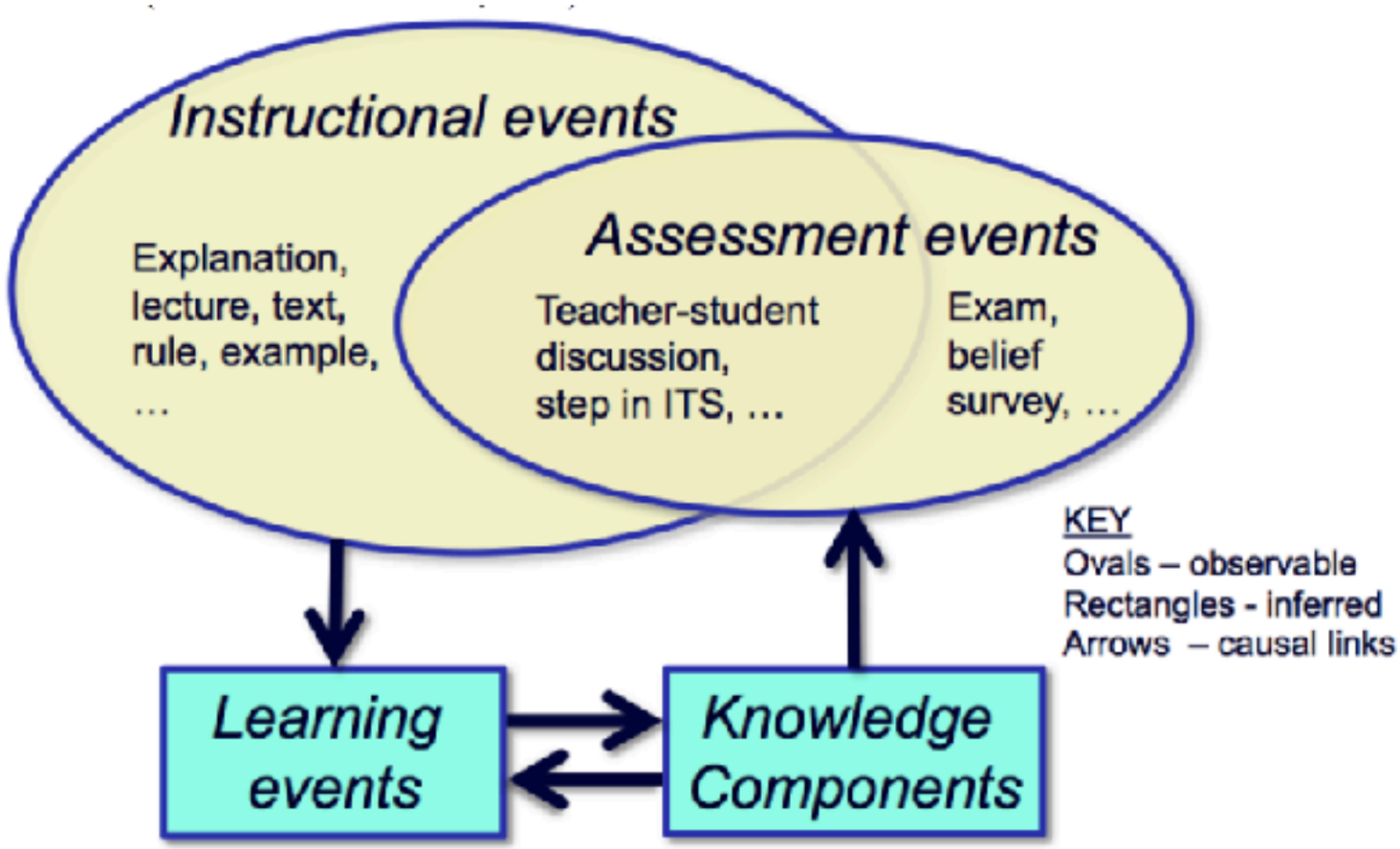
Anderson, 1982

Prolonged learning (memory) about a family of events

Mostly defined by experts/definitionally true

Knowledge Components

A description of a mental structure or process that a learner uses, alone or in combination with other knowledge components, to accomplish steps in a task or a problem (Koedinger & Nathan, 2004)



Q-Matrices

History

- Interested in student misconceptions

- Devised the “Rule Space Method”

- RSM converts item response patterns into probabilities of mastering particular “skills” or concepts

Kikumi Tatsuoka

Concepts are defined by experts. Very time consuming & domain specific

Q-Matrix

	q1	q2	q3	q4	q5	q6
con1	1	0	0	0	0	1
con2	1	1	0	1	0	0
con3	1	1	1	0	0	0

(Tatsuoka, 1983;1996)

Latent Variable

Latent variables are variables that are not directly observed but are rather inferred from other variables that are observed and directly measured.

(What isn’t latent variable?)

Probability a student is correct given mastery of a given concept

Q-Matrix

	q1	q2	q3	q4	q5	q6
con1	1	0.01	0.6	0	0.7	1
con2	0.8	0.7	0.8	0.76	0.5	0.42
con3	0.5	0.6	1	0.55	0.5	0.67

(Brewer , 1996)

Problem

Correspondence between expert-derived Q-matrices and student responses is not 100%

(Hubal, 1992)

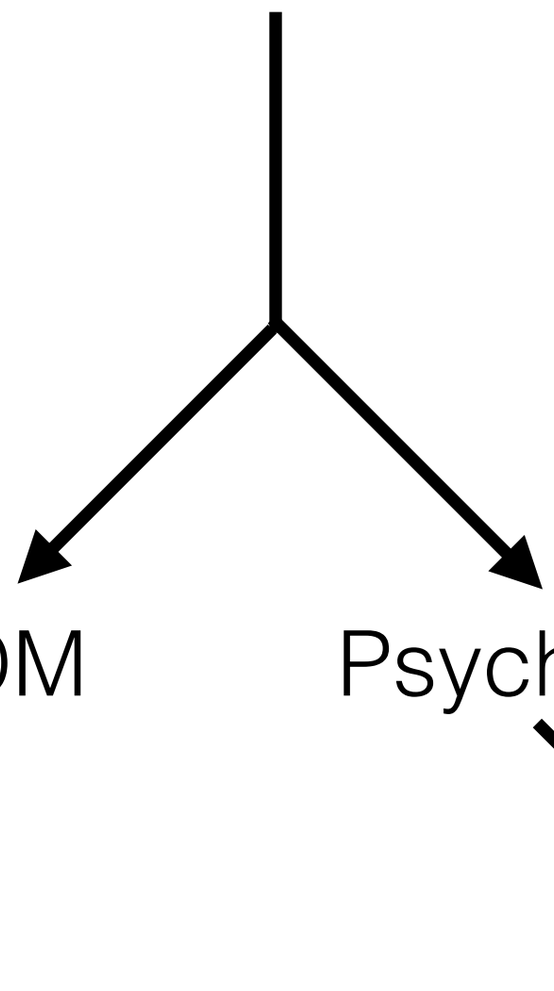
Question: Can we use the Q-matrix method to derive valid “student metal states” (constructs? knowledge states? skill definitions?)

No

Can this problem be solved?

Yes

Divergence by Domain



Tutoring Systems
Automation
Identifying KS

Large scale assessments
Identifying cognitive states
for use by instructors

Activity: Build Q-M

- Get into groups
- Agree on a topic
- Agree on concepts within that topic
- Devise some questions that relate to the concepts
- Map the concepts to those questions
- Email your answer to me

One Solution

- Create idealized patterns
- Compare the observed pattern to the idealized
- Use difference between them as an indicator of “model fit”

Idealized Pattern

	q1	q2	q3	q4	q5	q6
c1	1	0	0	0	0	1
c2	1	1	0	1	0	0
c3	1	1	1	0	0	0

$$L_1 = \quad d(p, IDR) = \sum_q |p(q) - IDR(q)|$$

$$L_1 = \ 1$$

Student Answer: 101110

Concept State	Ideal Response Vector
000	000010
001	001010
010	000110
011	011110
100	000011
101	001110
110	000111
111	111111

Hill Climbing Algorithm