

Beyond Analytics: Sensemaking with Data

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Educational Data Visualization

Austin, Texas



Research broadly, analytics & visualization specifically, is a structured process of relationship discovery

“connectedness, both between individuals and to environments, opens the opportunity for much richer understanding of individuals and learning.”

DiCerbo & Behrens (2014)

“More is different”

Anderson (1972)

Overload is not new

“Confusing and harmful abundance of books” *Conrad Gesner (1550)*

Blair, Journal of History of Ideas (Jan, 2003)

New methods

Index of indexes

Abstractions

Visualizations

Recently:

Patterning by software

Trails of “the many”

Networks

The problem for which analytics
and visualization are a solution is
abundance

Visualization involves aggregating,
abstracting, and connecting

Analytics & visualization as a tool
to think with – part of the legacy of
narrative and sensemaking

Sensemaking

“Sensemaking is a motivated, continuous effort to understand connections . . . in order to anticipate their trajectories and act effectively”

(Klein *et al.* 2006)

or

“Sensemaking is about labelling and categorizing to stabilize the streaming of experience”

(Weick et al. 2005: 411)

Participatory sensemaking:

“the coordination of intentional activity in interaction, whereby individual sense-making processes are affected and new domains of social sense-making can be generated that were not available to each individual on her own”

De Jaegher and Di Paolo 2007

“the process that takes place when people orient themselves and navigate through space”

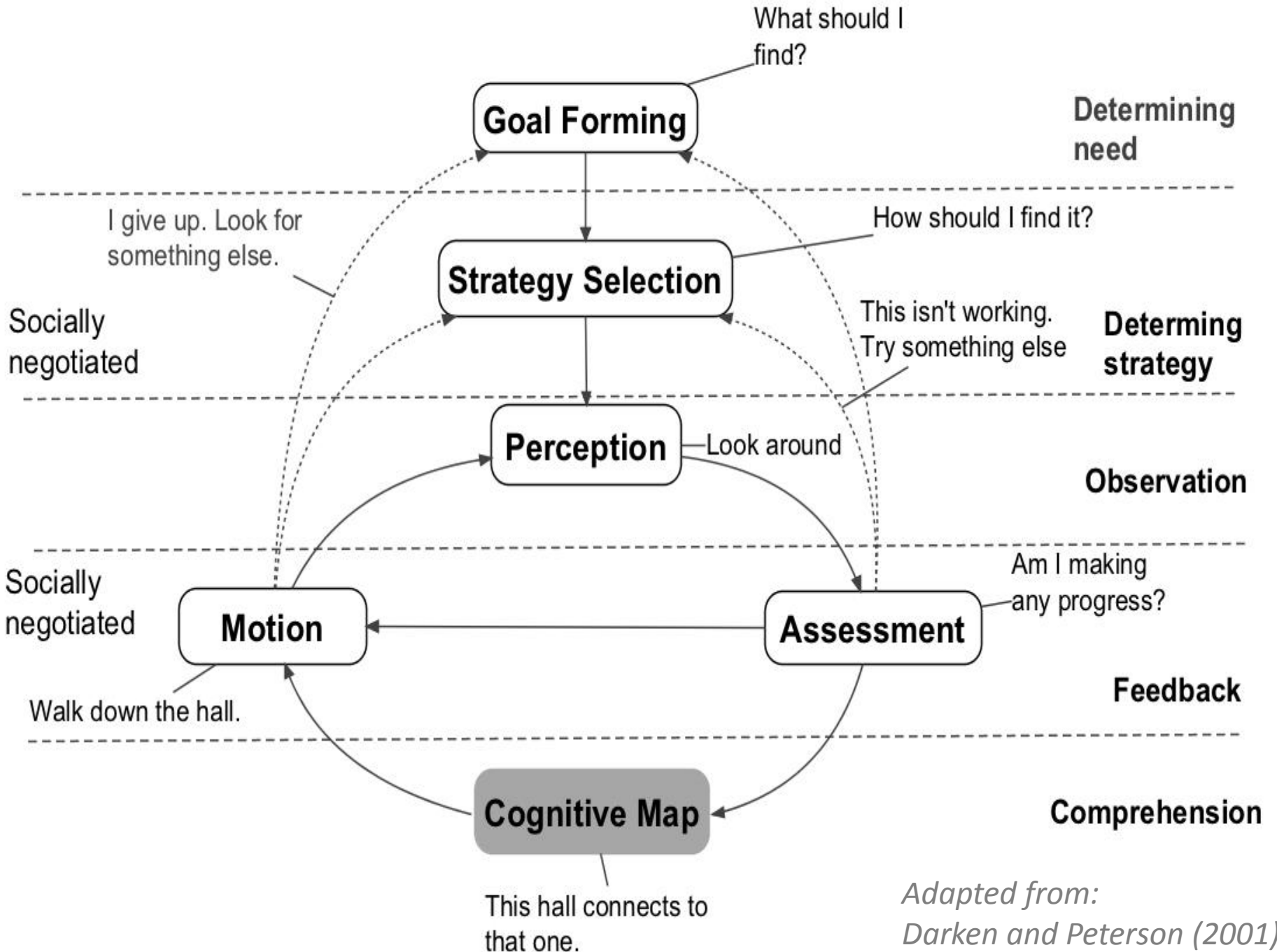
Raubal and Winter 2002

Coherence is an orientation about the meaning and value of information elements based on how they are connected, structured, and related

Antonovsky 1993

“is the cognitive element of navigation ... it does not involve movement of any kind but only the tactical and strategic parts that guide movement.”

Darken and Peterson 2002



*Adapted from:
Darken and Peterson (2001).*

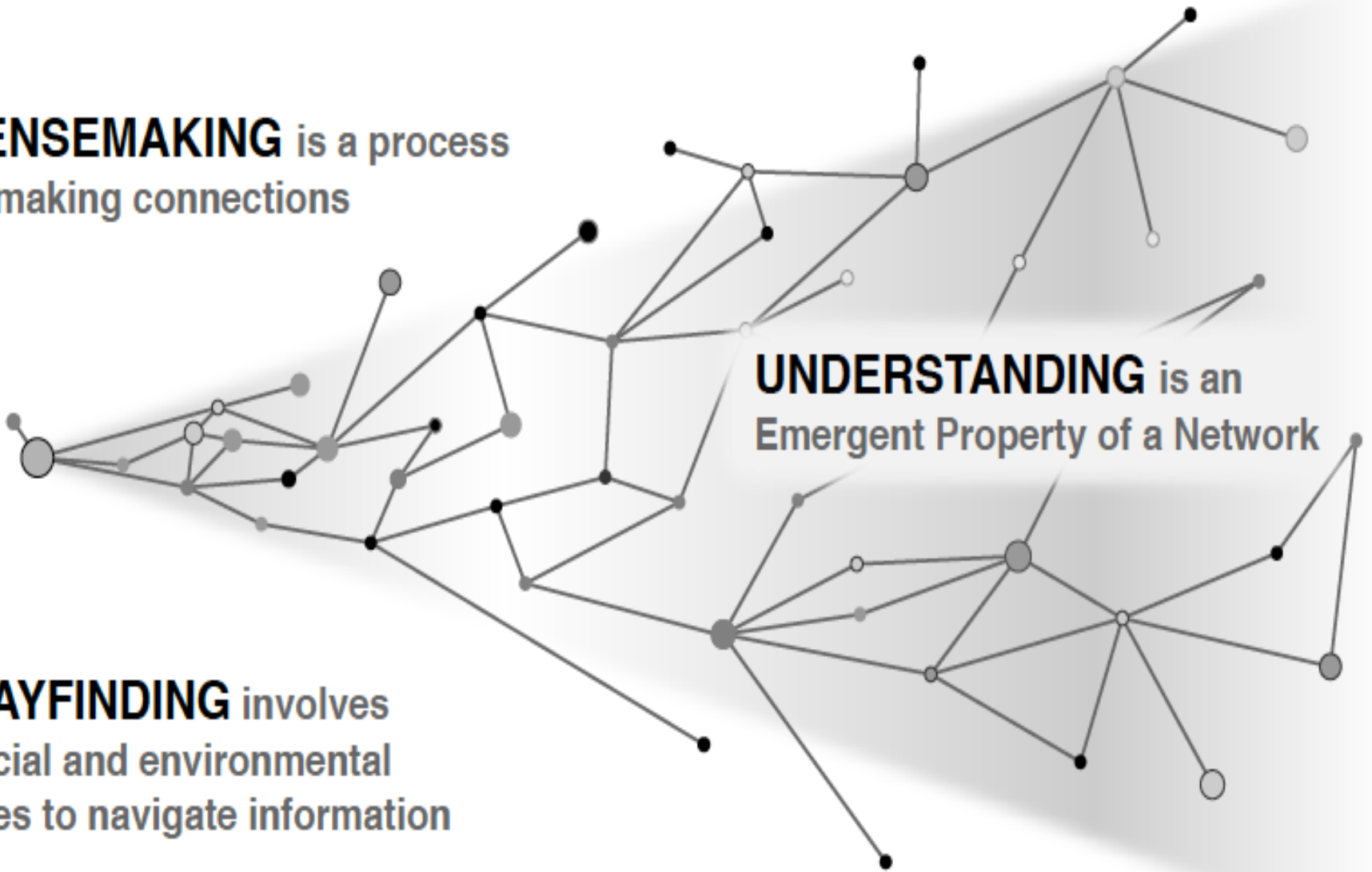
INFORMATION is a node

SENSEMAKING is a process
of making connections

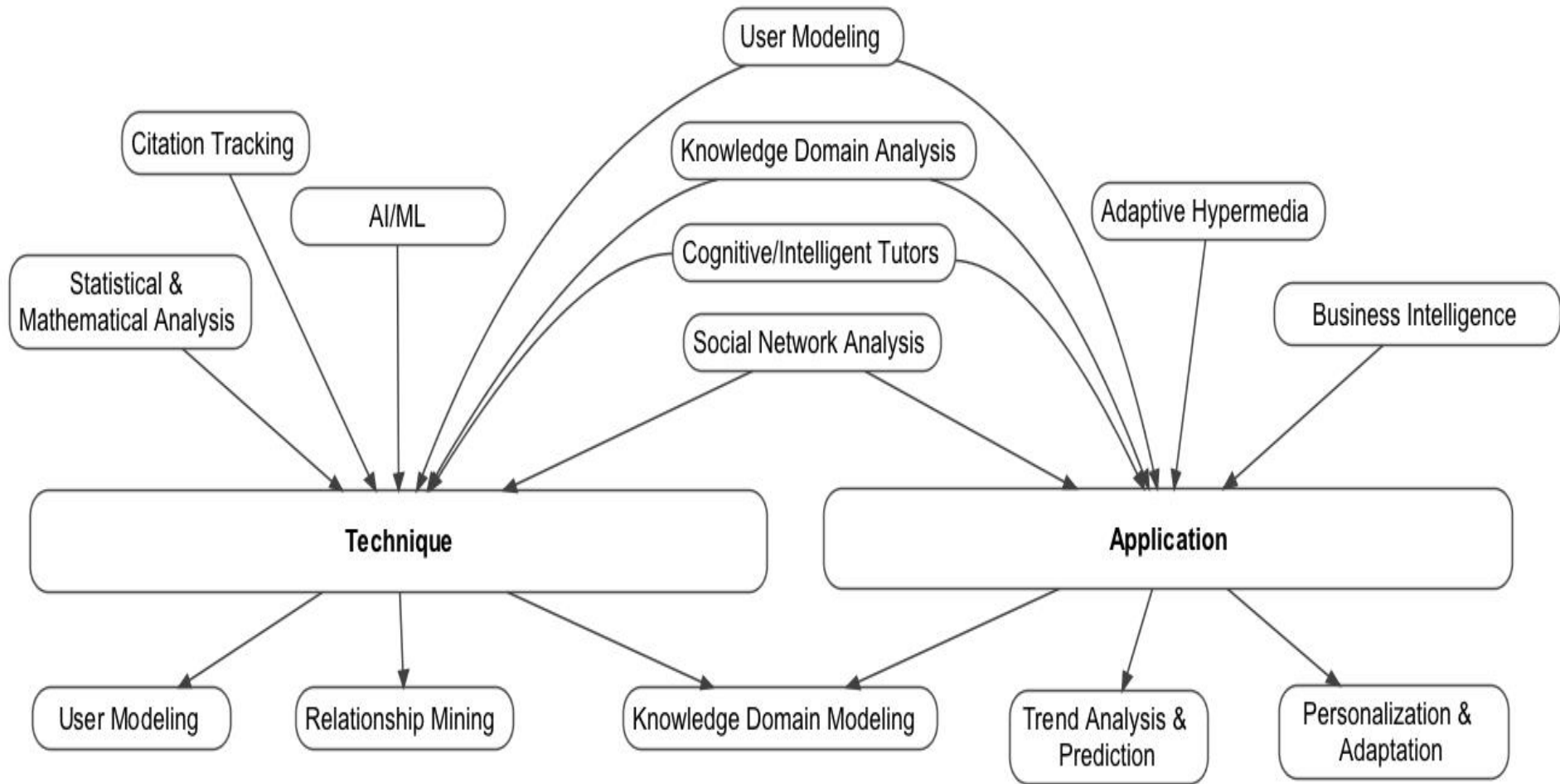
UNDERSTANDING is an
Emergent Property of a Network

WAYFINDING involves
social and environmental
cues to navigate information

KNOWLEDGE is a connection



What visualization and analytics
should do for researchers and
educators:



Siemens, American Behavioral Scientist (2013)

(Baker & Siemens, Cambridge Handbook of Learning Sciences, (2014))

The uncertainty of science

Research as guideposts

Application & Systemic impact

Aggregate

Granular insights

course Signals

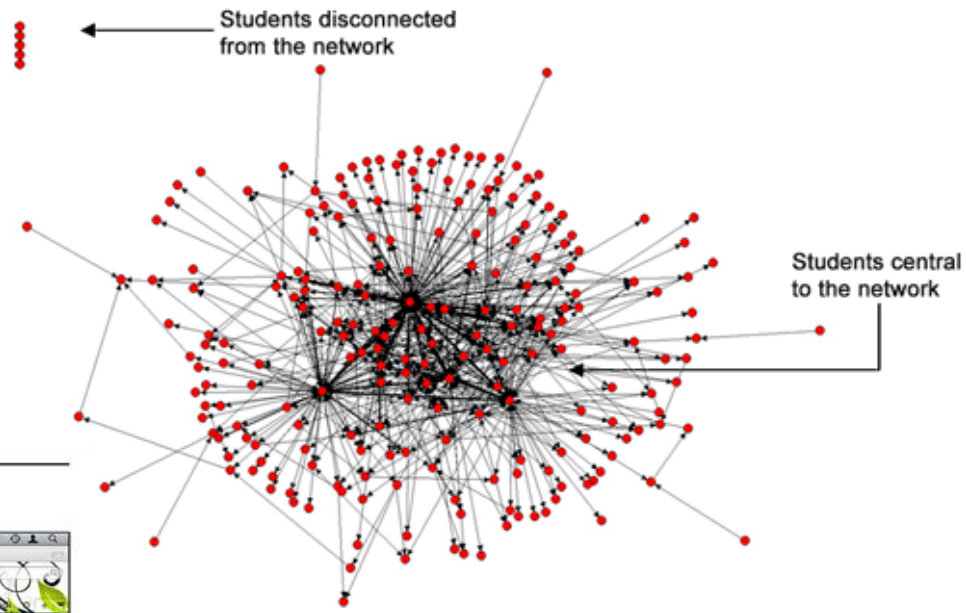


Figure 1. Degree Compass

SNAPP

Firefox File Edit View History Bookmarks Tools Window Help

Collaborative Filtering

BIOL 1010: Principles of Life

Course Description: A course for non-science majors. Topics covered include scientific methodology, the nature of living organisms, cell structure and function, cell chemistry and division, nature of heredity and gene action, the theory of evolution and principles of ecology. BIOL 1010 will not serve as a prerequisite of upper level biology courses.

Note: To add any of the sections below to your class schedule, return to the main OneStop window, click on the "Web Self Service" tab, then "Student", then "Registration", then "Add or Drop Classes". You'll also want to make note of the CIDs for the course you wish to register for as this will make finding the class in the registration system easier.

Spring Semester 2011

Class Section: 01

Class CRN: 1135
 Instructor: Finley, Mack
 Credit Hours: 3
 Time: 08:00 am - 08:35 am
 Days: MWTF
 Campus: Austin Peay SU, Main Campus
 Location: Sundquist Science Complex E106A
 Instructional Method: Conventional Methodology
 Start Dates: 13-JAN-11
 End Date: 06-MAY-11
 Capacity: 99
 Seats Open: 98
 Seats Filled: 1

Learn News Assessment Planner

March 21, 2011

Courses You Should Consider:

BIOL1010 - Principles of Life	★★★★★	View Sections
BIOL1011 - Principles of Life Lab	★★★★★	View Sections
BIOL1010 - Principles of Life	★★★★★	View Sections
GEO1041 - Physical Geology Lab	★★★★★	View Sections
BIOL2011 - Human Anat and Phys Lab	★★★★★	View Sections
GEO1040 - Physical Geology	★★★★★	View Sections

[See more suggestions...](#)

Filter: MATH, ENGL, etc.

These suggestions are courses in which other students similar to you have made successful progress in your program of study. You should always consult your advisor when planning your schedule.

My Courses

Austin Peay Online
 APOnline
 Whenever you go, there we are.

APOnline
 Use this link to access your W1, W2, etc. APOnline course sections.

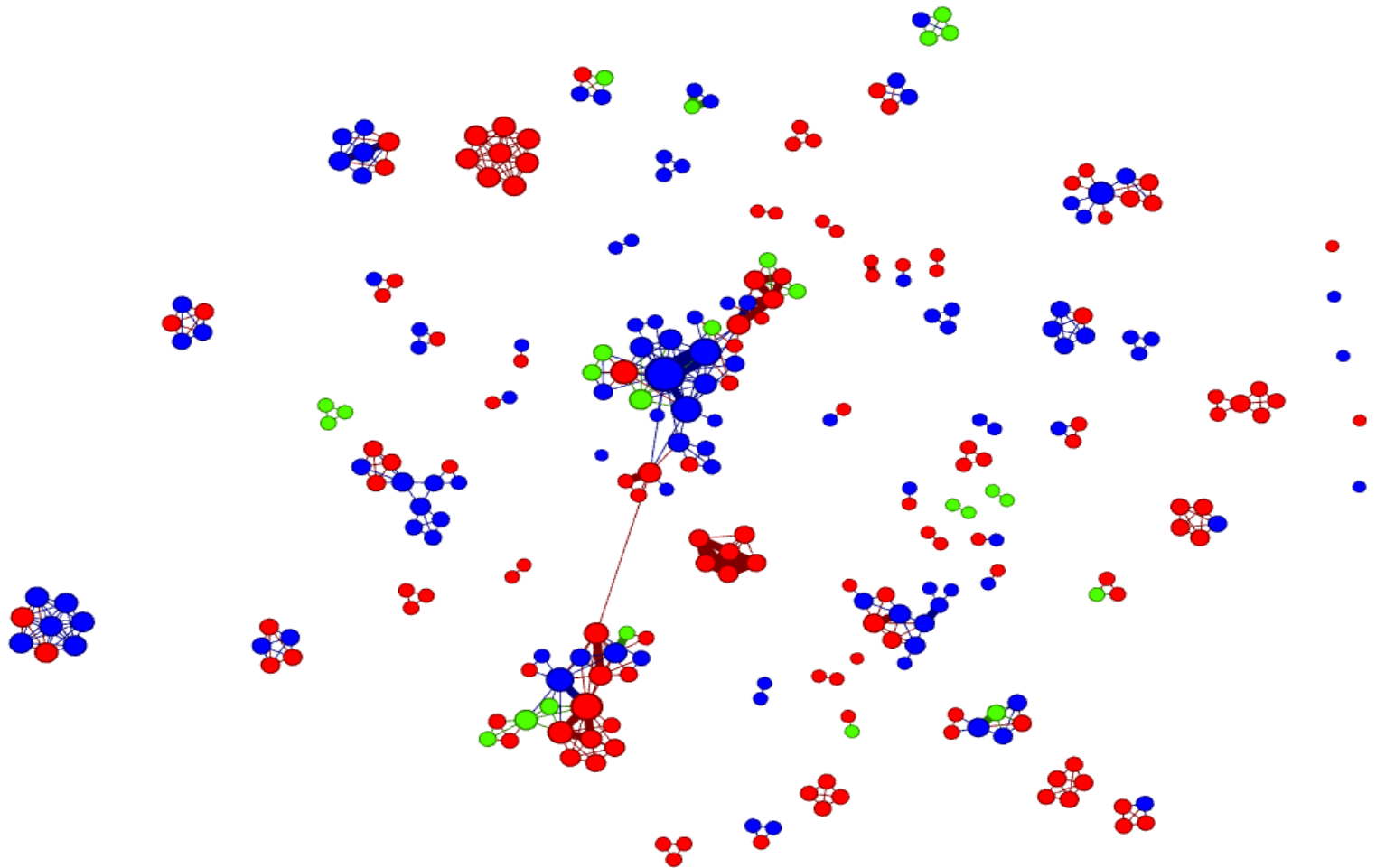
RODP
 Click here to access your R3E, R3L, etc. courses. (Requires log-in)
RODP Login Instructions
 Login instructions are located on the RODP Online login page.

Structured analysis of literature

1. MOOC Research Initiative
2. LA literature and conference proceedings

Unreasonable effectiveness of data

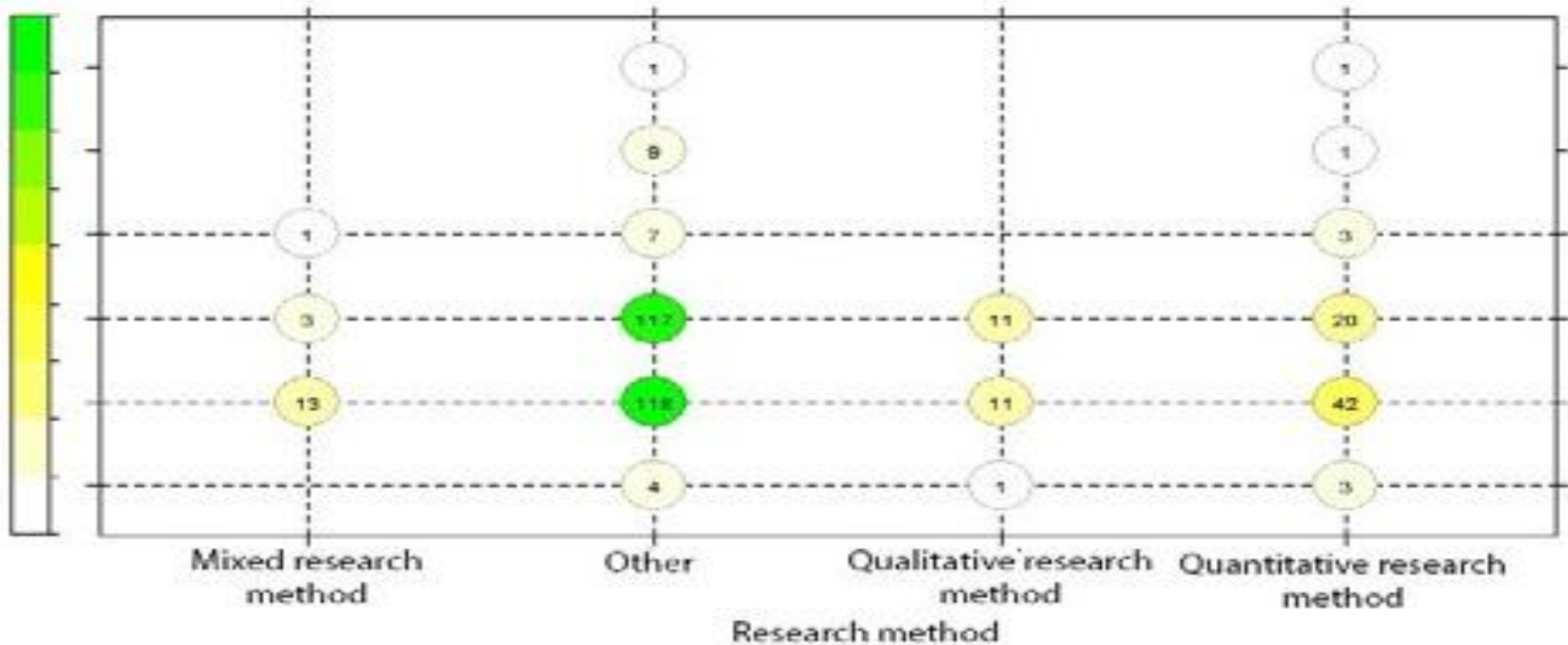
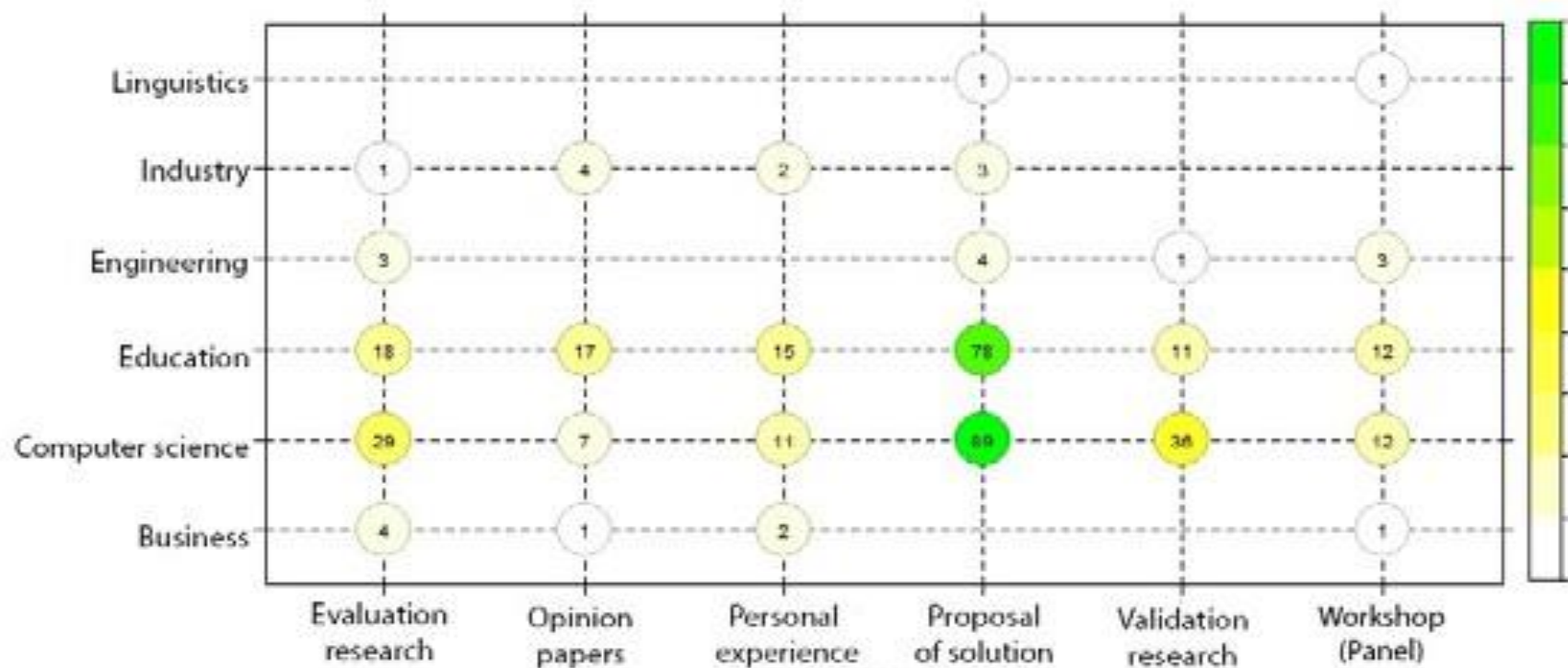
Halevy, Norvig, & Pereira (2009)



Network of all authors in the LAK conferences coded by disciplinary background. Red: Computer Science; Blue: Education; Green: Other (Industry, Engineering; Linguistics; or Business) (nodes sized by degree centrality).

Dawson, Gasevic, Siemens, Joksimovic (2014)

Research field



Dawson,
Gasevic,
Siemens,
Joksimovic
(2014)

Statistics by Country

country	authors
Algeria	1
Australia	19
Bangladesh	2
Belgium	3
Brazil	5
Cameroon	1
Canada	86
China	71
Colombia	4
Denmark	1
Finland	2
France	5
Germany	9
Greece	5
Hong Kong	5
India	6
Indonesia	1
Italy	3
Latvia	3
Malaysia	1
Mexico	7
Nepal	1
Netherlands	9
New Zealand	4
Norway	2
Poland	3
Portugal	1
Russian Federation	14
Rwanda	1
Serbia	-
Slovenia	1
Spain	22
Sweden	1
Switzerland	12
Tunisia	1
United Kingdom	41
United States	212

Phase 1 Stats

266 total submissions
37 countries represented

Top countries:

- USA
- Canada
- China
- UK
- Spain
- Australia

Statistics by Country

country	authors	sl
Australia	9	
Belgium	2	
Brazil	3	
Canada	32	
China	14	
Denmark	1	
Germany	1	
Hong Kong	-	
India	3	
Italy	1	
Netherlands	2	
New Zealand	2	
Serbia	-	
Spain	3	
Switzerland	4	
United Kingdom	26	
United States	104	
unknown	-	

Phase 2 Stats

78 total submissions
15 countries represented

Top Countries:

- USA
- Canada
- UK
- China
- Australia

Final selection

MOOC platforms represented:

- Coursera: 12
- edX: 4
- Multiple: 5
- Non-Major: 6

Countries: 4 (USA, Canada, UK, Australia)

Institutions: ~28

Phase 1 Methodologies and Fields

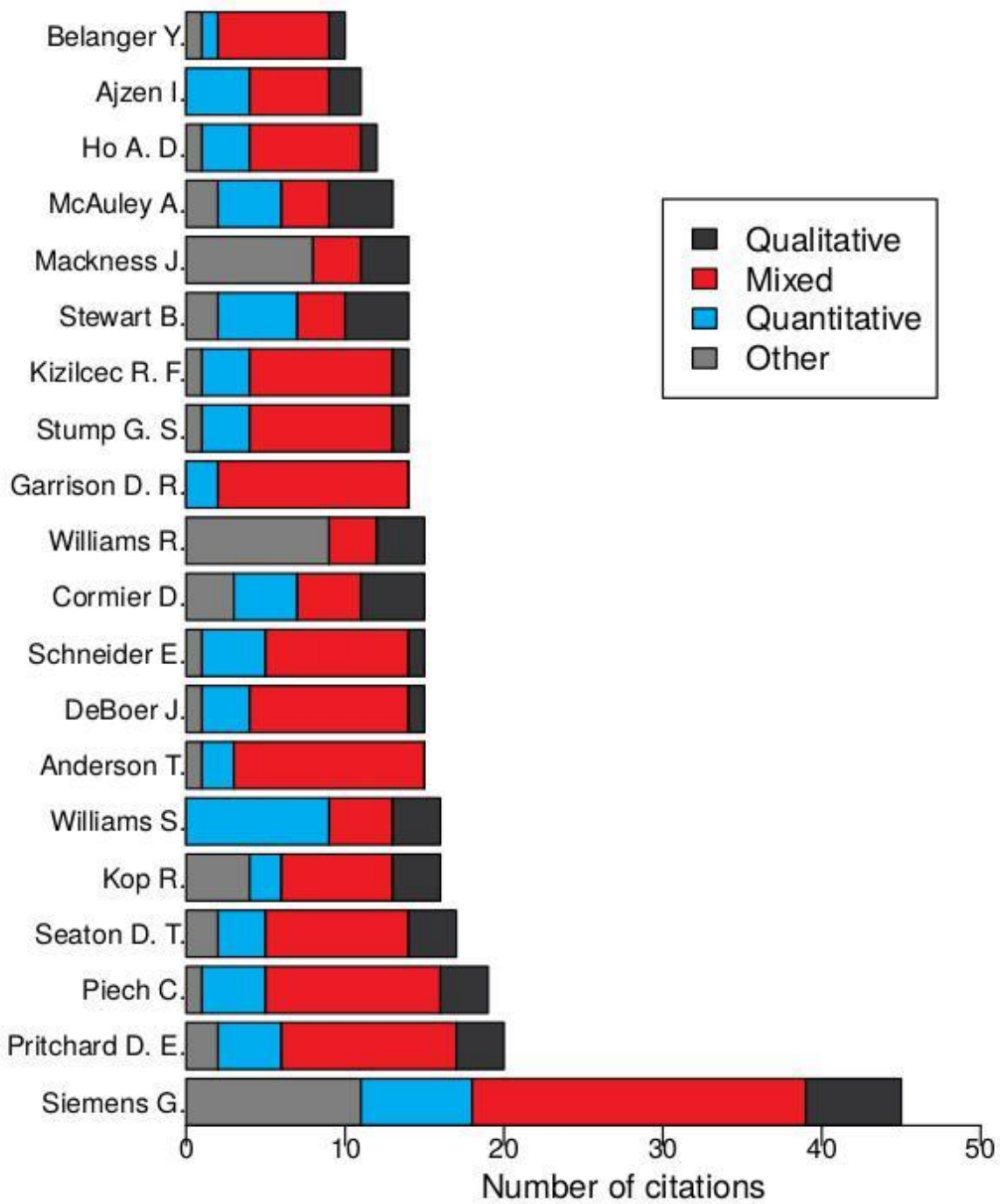
Methodology	Number of Submissions	Percentage of Submissions
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Mixed	93	35.1%
Qualitative	68	25.7%
Quantitative	78	29.4%
Unknown	26	9.8%

Methodology	Average Number of Authors	Average Number of Citations
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Mixed	2.4	8.3
Qualitative	2.4	8.5
Quantitative	2.1	6.7
Unknown	2.0	6.8

Field	Number of Authors	Percentage of Authors
Education	222	42.29%
Industry	55	10.48%
Computer science	52	9.90%
Social Sciences	28	5.33%
Engineering	25	4.76%
Business	24	4.57%
Psychology	24	4.57%
Health Sciences	16	3.05%
Technology	15	2.86%
Environmental Sciences	12	2.29%
Natural Sciences	8	1.52%
Mathematics	8	1.52%
Education	7	1.33%
Industry	6	1.14%
Unknown	23	4.38%
Total	525	100.00%



Phase 2 Most Cited Authors

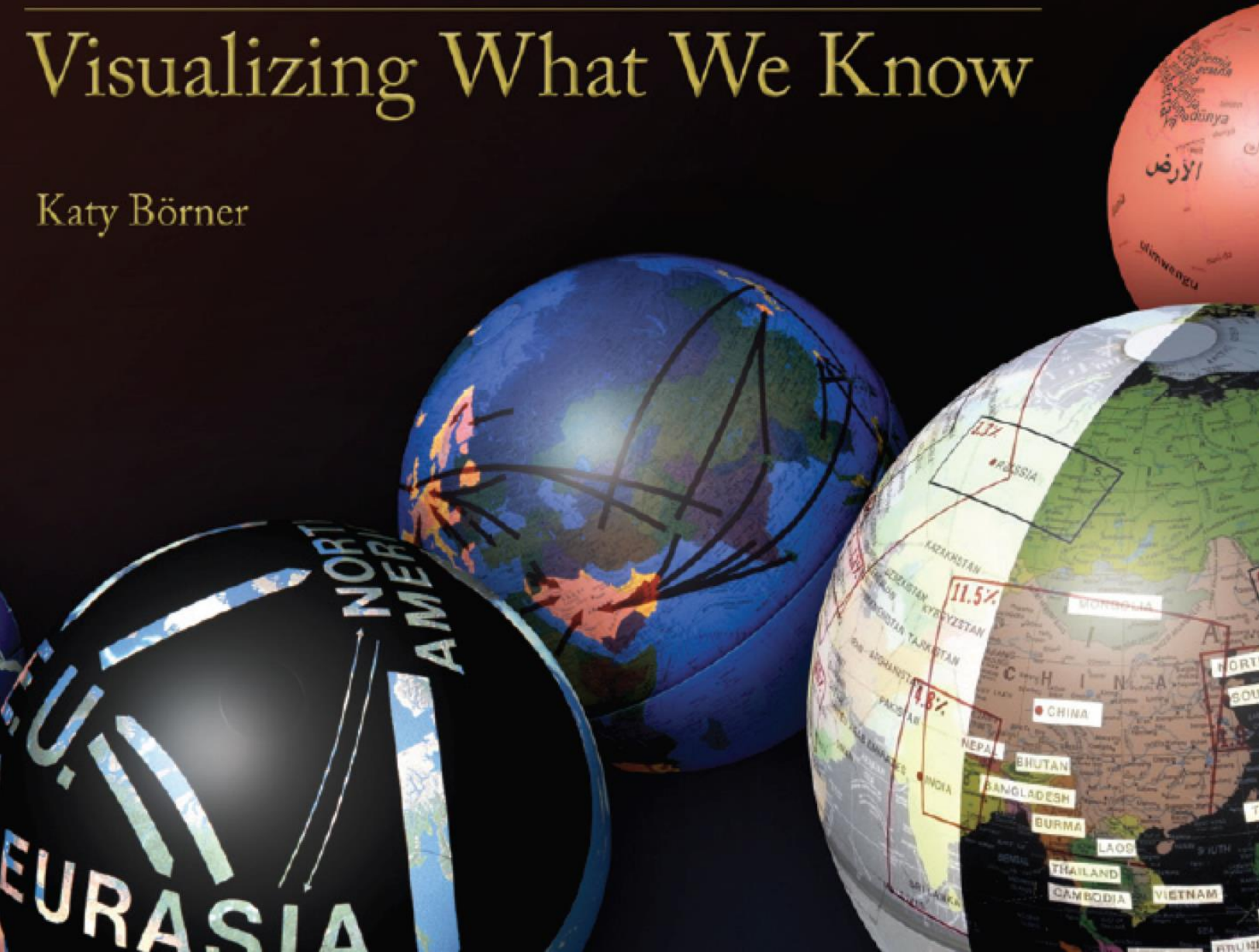
Visualization is a brokering entity
between quantity and cognition

See Word File

Atlas of Science

Visualizing What We Know

Katy Börner



NS



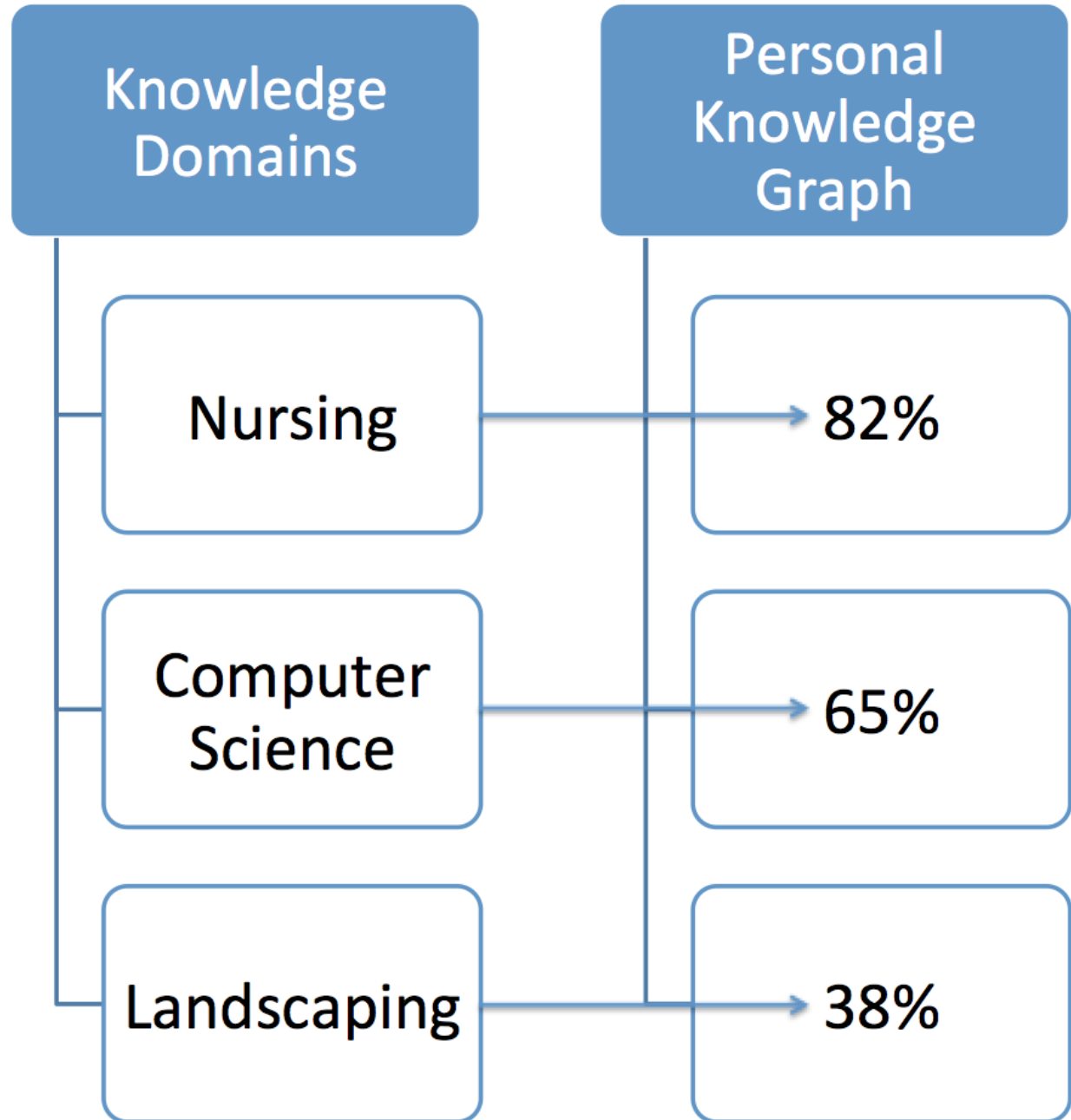
Katy Börner

What does this mean to you?

Play in the spaces and intersections

Learning scientists do not *necessarily* need to become machine learning researchers.
And vice versa.

Personal learner Knowledge Graph



TOP-DOWN

System-wide

“Big data”

Coordinated Team

Enterprise-level tools

Integration of data sources

Automated discovery

Automated Interventions

Size of Data Sets

Social network analysis

Quantified-Self

Server/LMS stats

Language/discourse analysis

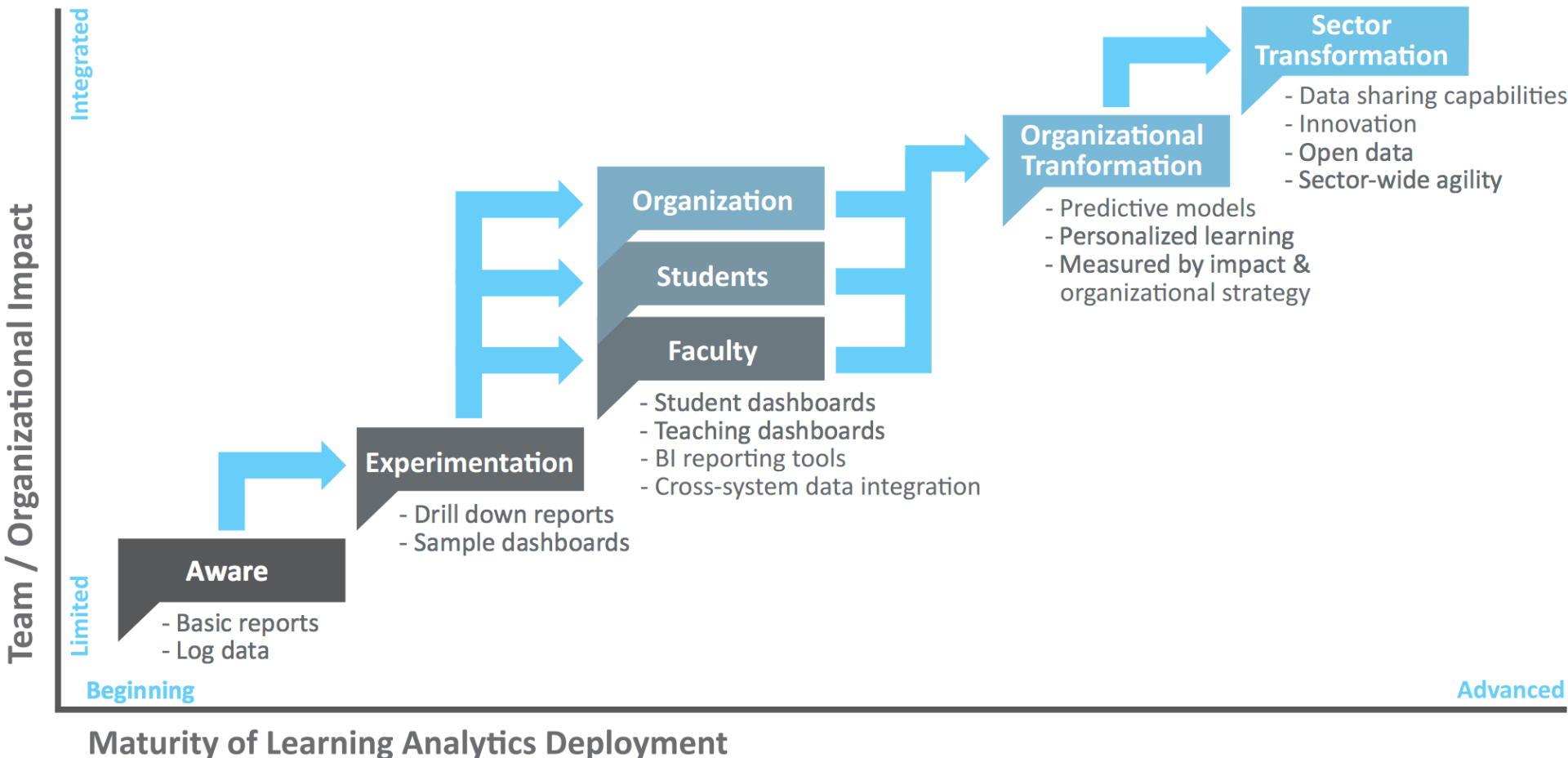
“Small Data”

Individual Faculty Member

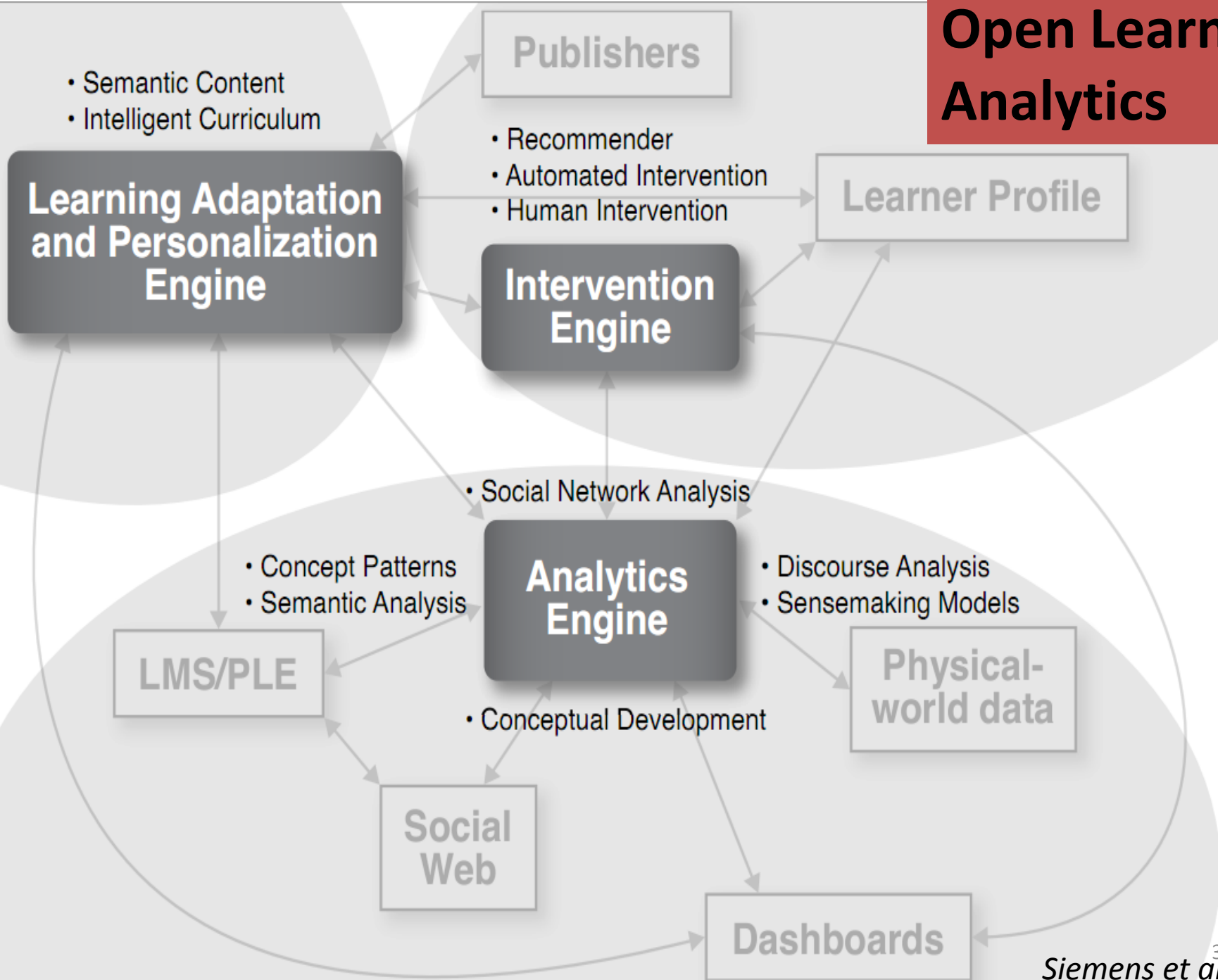
BOTTOM-UP

Classroom-level

Learning Analytics Maturity Model



Open Learning Analytics



LAK15

5th International Learning Analytics and Knowledge Conference

SOLAR
SOCIETY for LEARNING
ANALYTICS RESEARCH
MARIST



Marist College, Poughkeepsie, New York, USA
March 16 - 20, 2015 ● lak15.solaresearch.org

<http://lak15.solaresearch.org/>

Twitter/Gmail/wherever:
gsiemens