Beyond Analytics: Sensemaking with Data

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Educational Data Visualization

Austin, Texas

SOLAR
SOCIETY for LEARNING ANALYTICS RESEARCH

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”

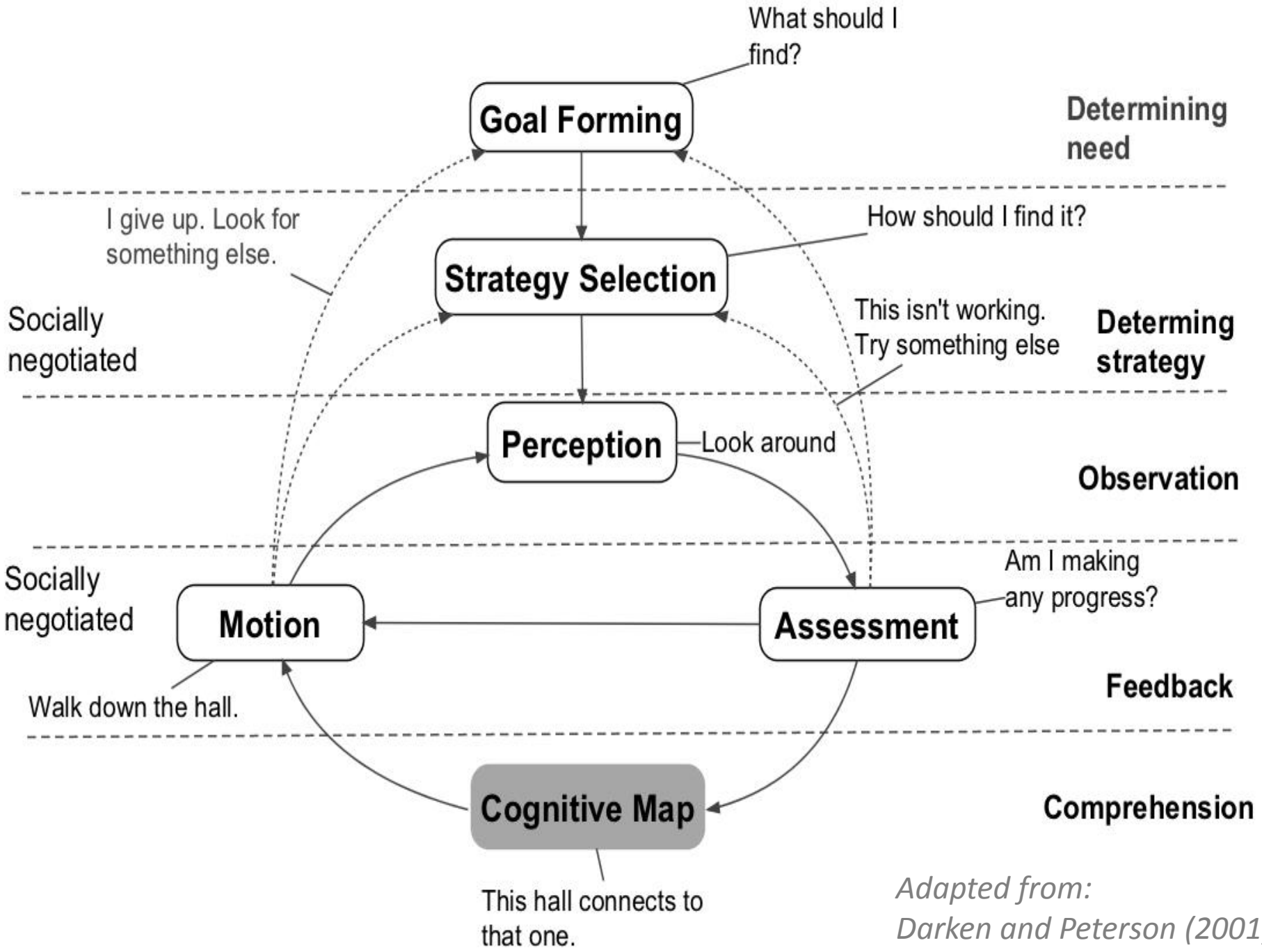
Raubal and Winter 2002

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.”

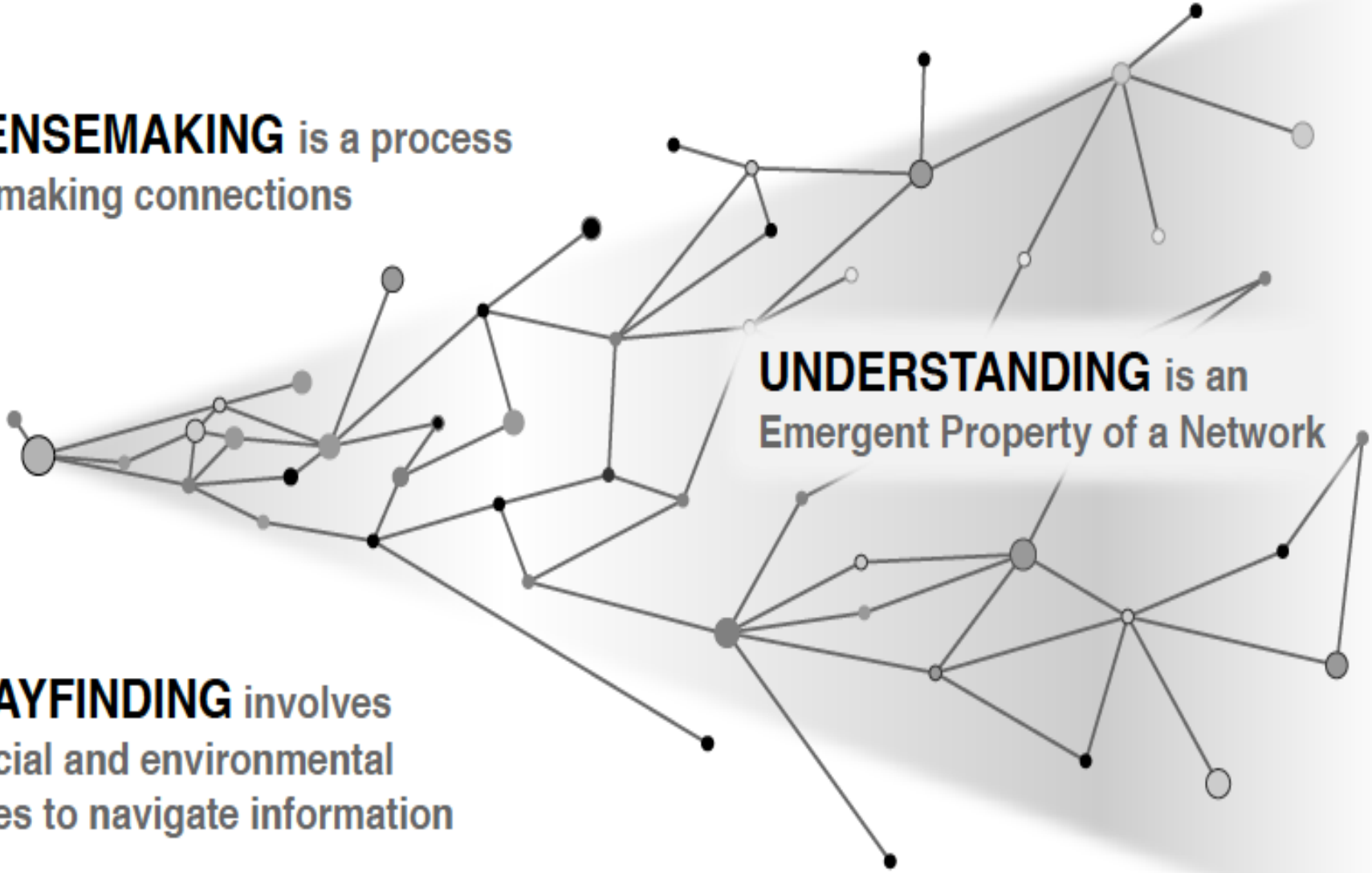
Darken and Peterson 2002



Adapted from:
Darken and Peterson (2001).

INFORMATION is a node

SENSEMAKING is a process of making connections

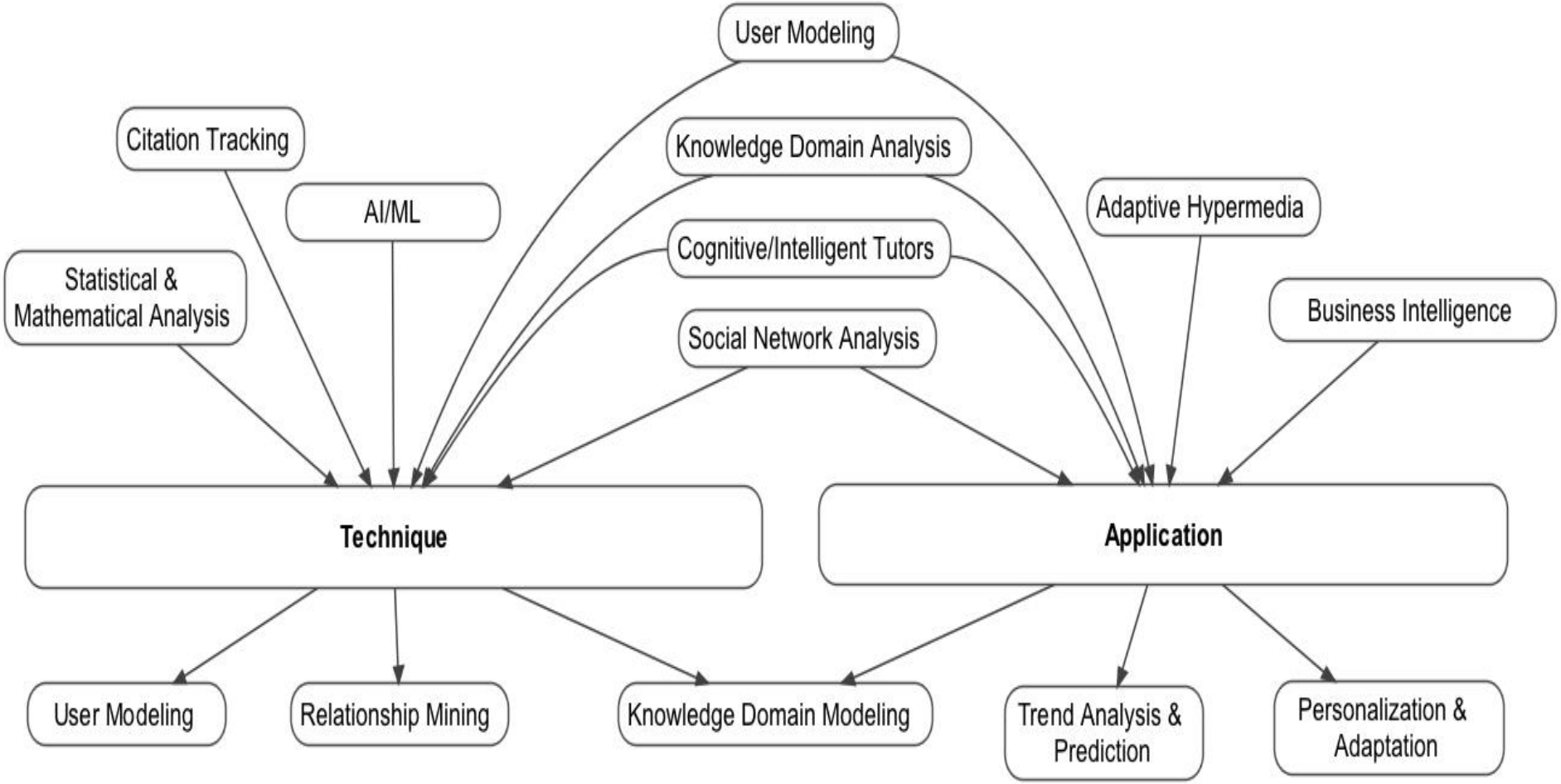


UNDERSTANDING is an Emergent Property of a Network

WAYFINDING involves social and environmental cues to navigate information

KNOWLEDGE is a connection

What visualization and analytics should do for researchers and educators:

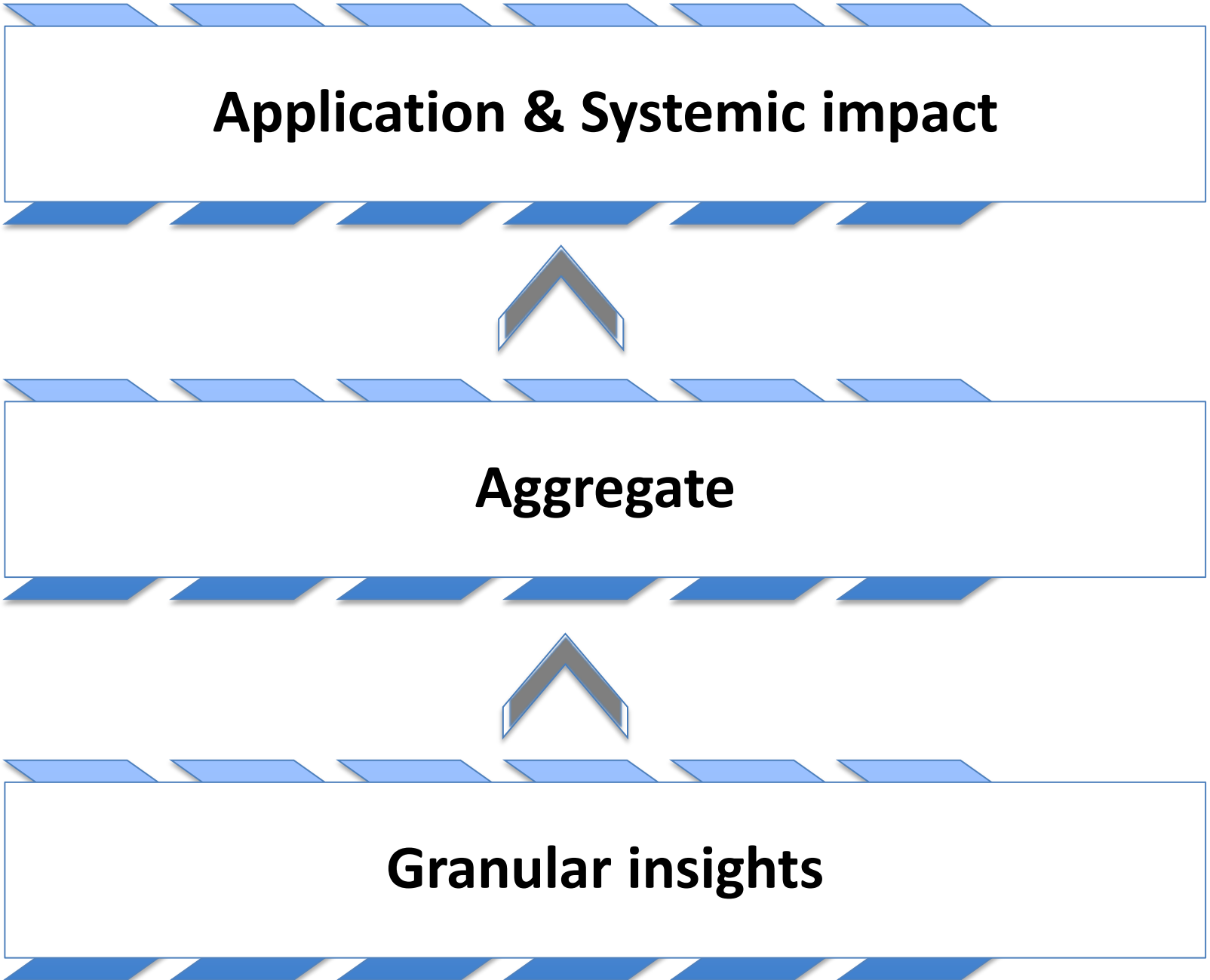


Siemens, American Behavioral Scientist (2013)

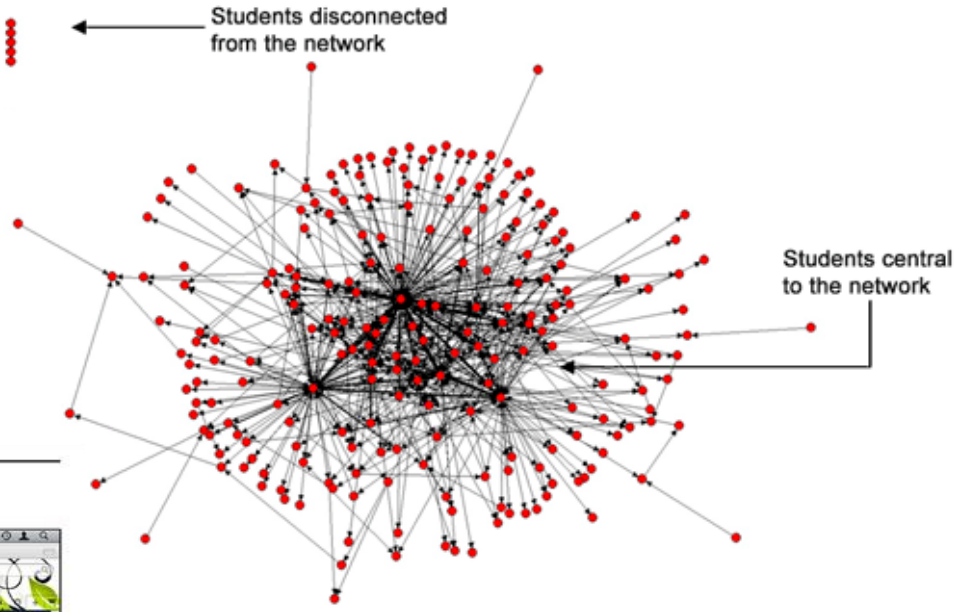
(Baker & Siemens, Cambridge Handbook of Learning Sciences, (2014)

The uncertainty of science

Research as guideposts

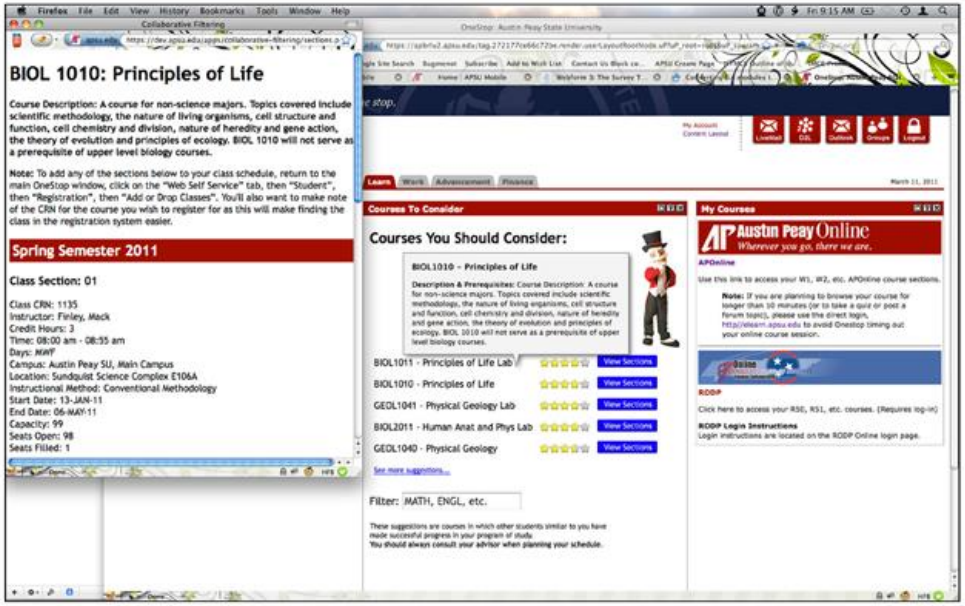

Application & Systemic impact
Aggregate
Granular insights

course Signals



SNAPP

Figure 1. **Degree Compass**



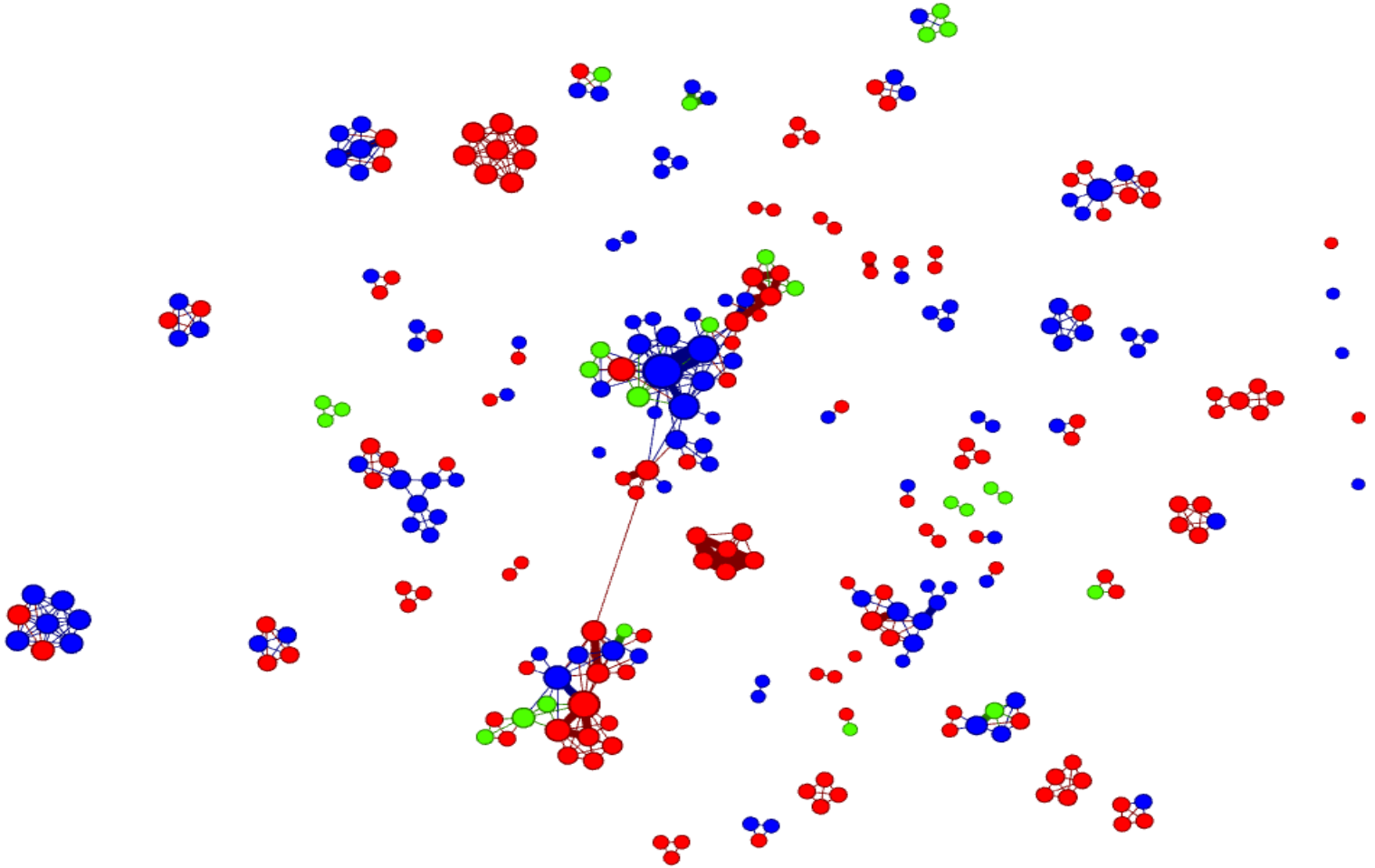
Structured analysis of literature

1. MOOC Research Initiative

2. LA literature and conference proceedings

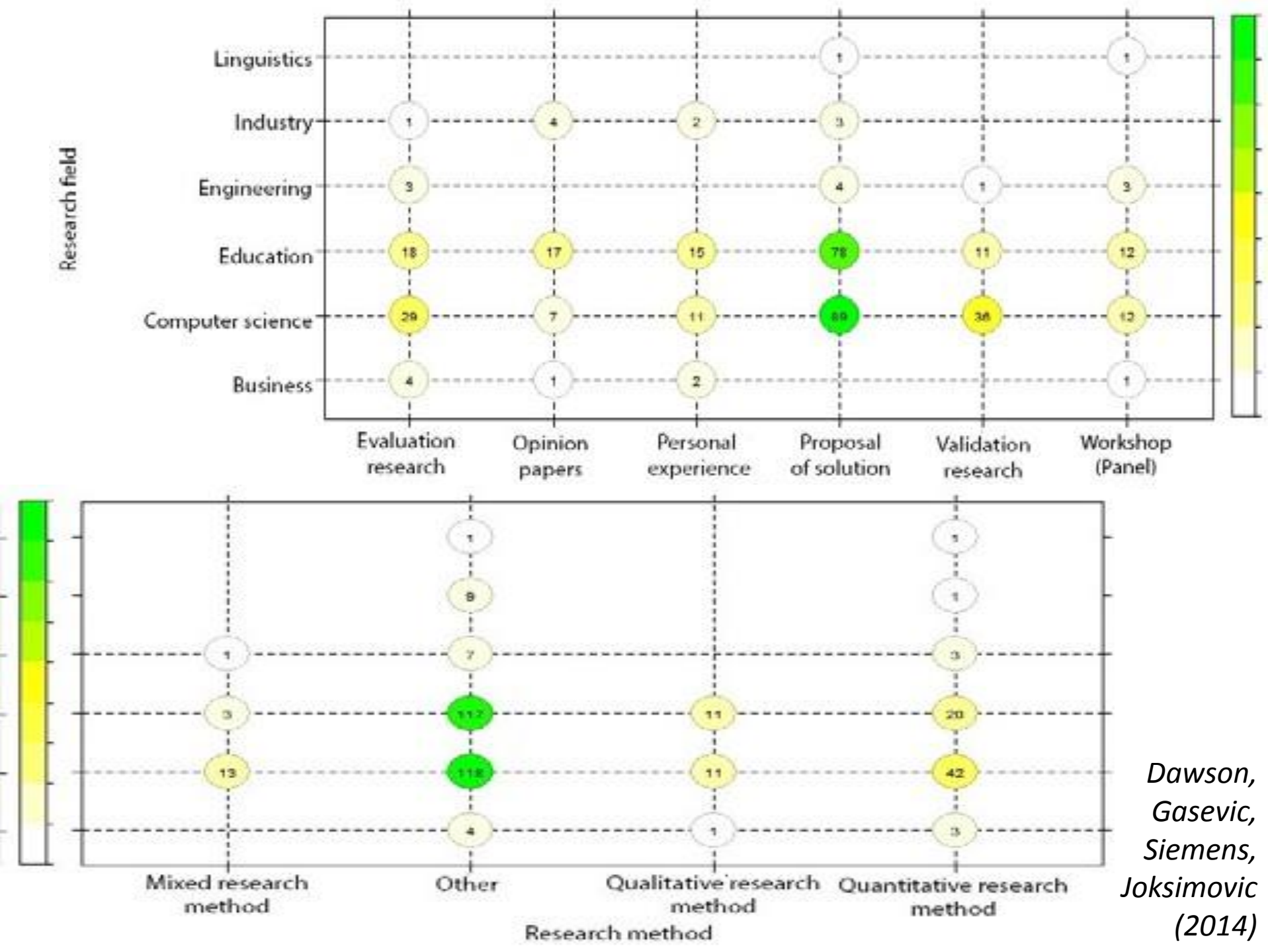
Unreasonable effectiveness of data

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)



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	su
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)

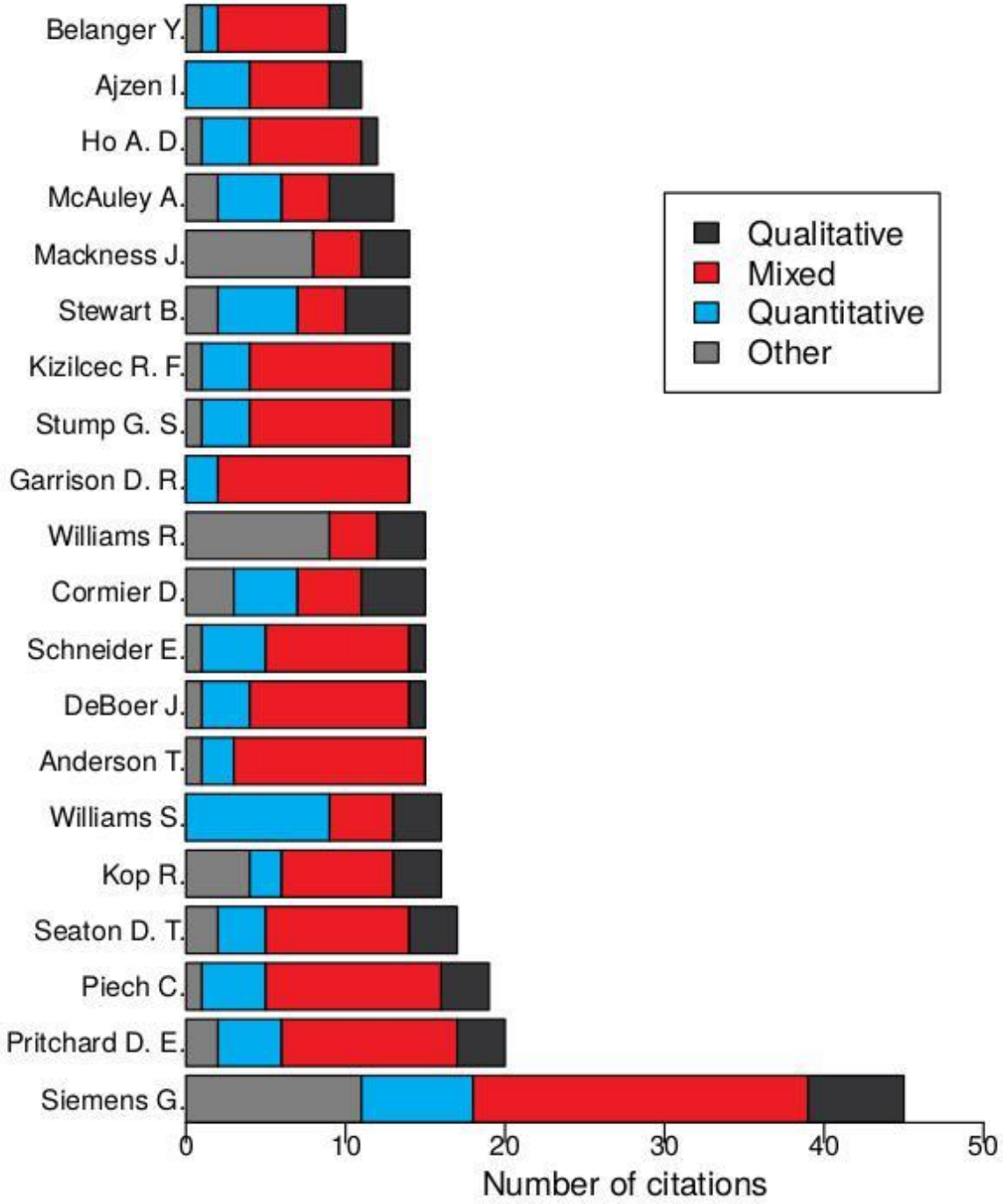
Institutions: ~28

Phase 1 Methodologies and Fields

Methodology	Number of Submissions	Percentage of Submissions
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
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

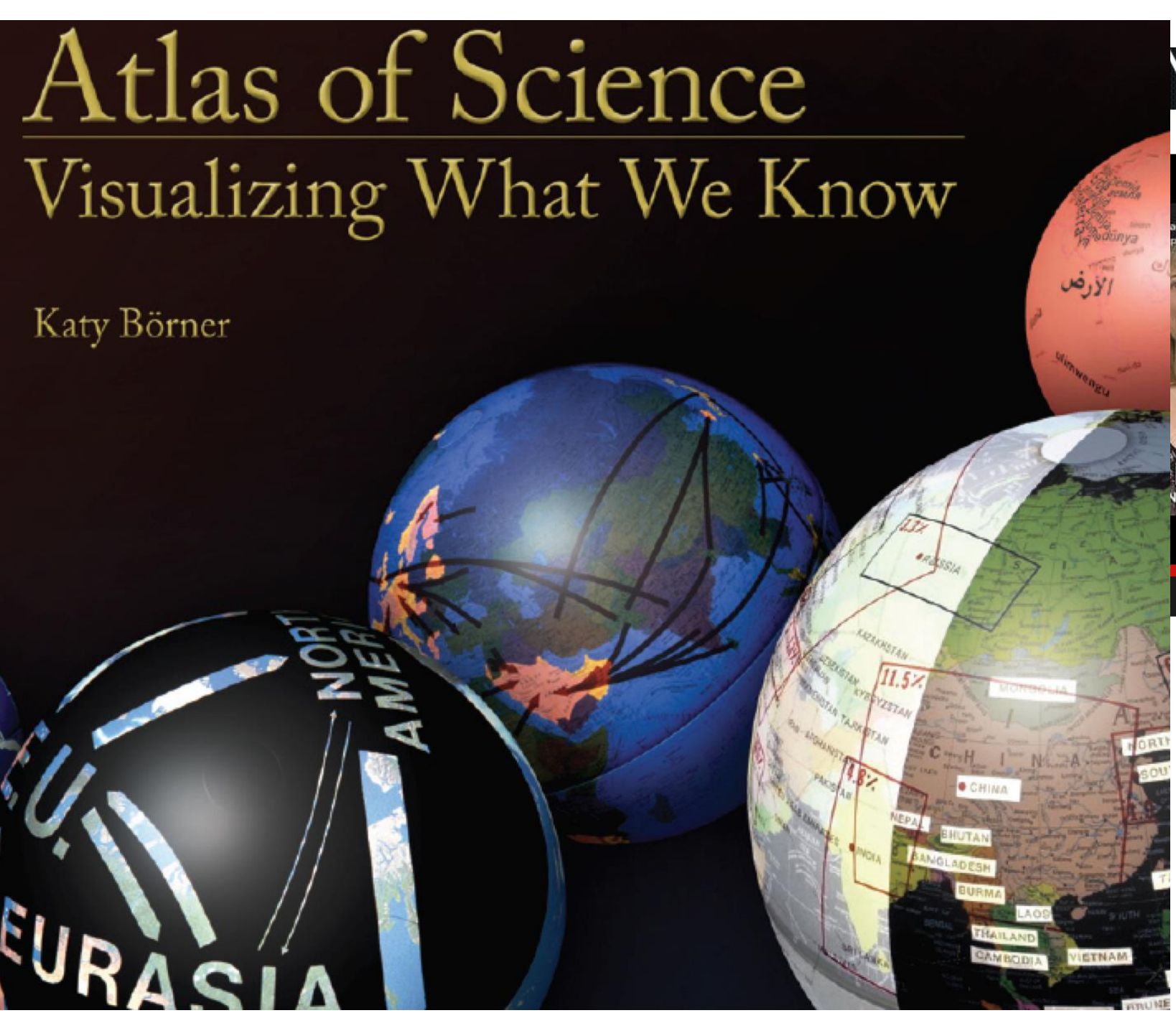
Visualization is a brokering entity between quantity and cognition

See Word File

Atlas of Science

Visualizing What We Know

Katy Börner



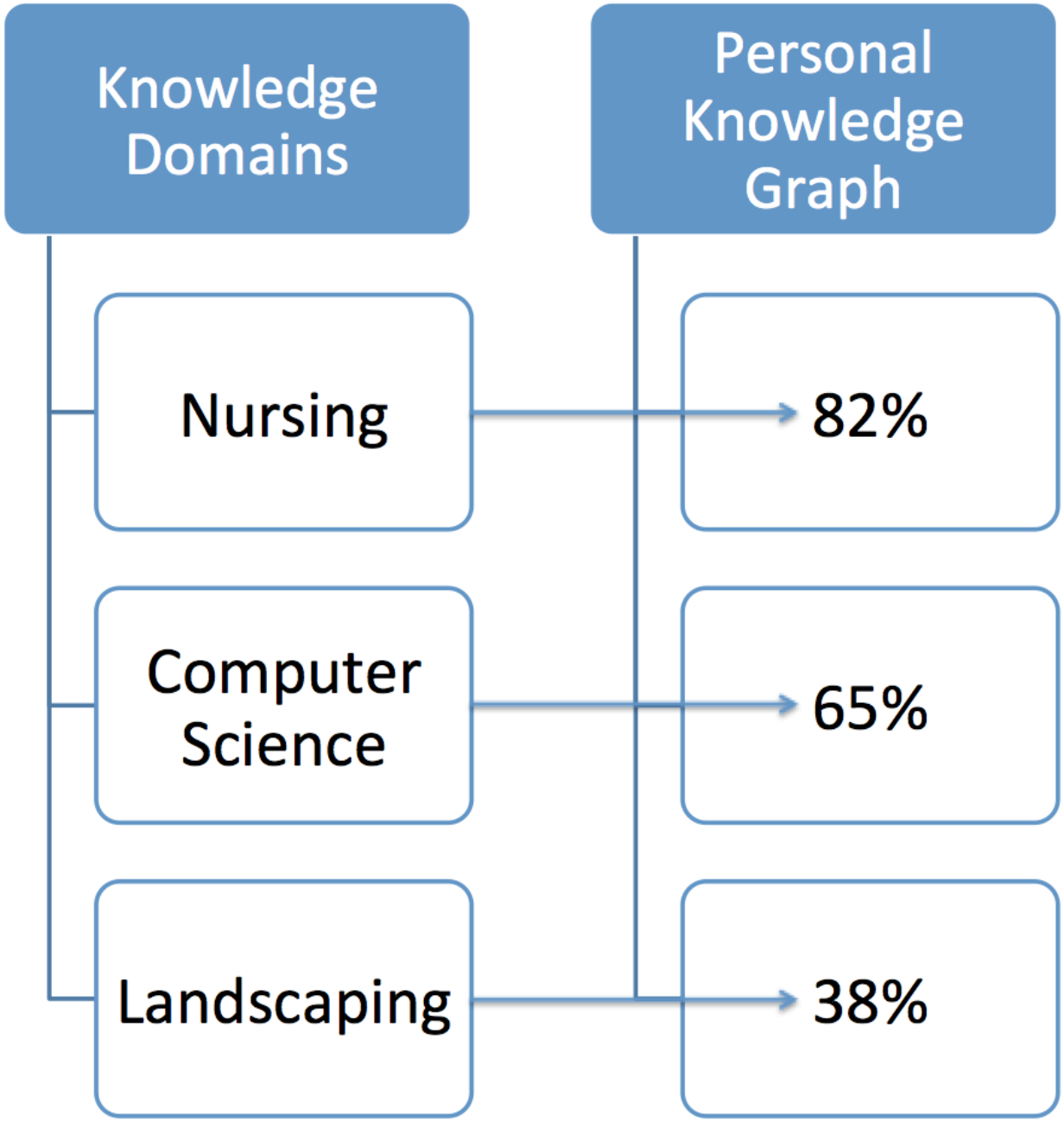
Katy Börner

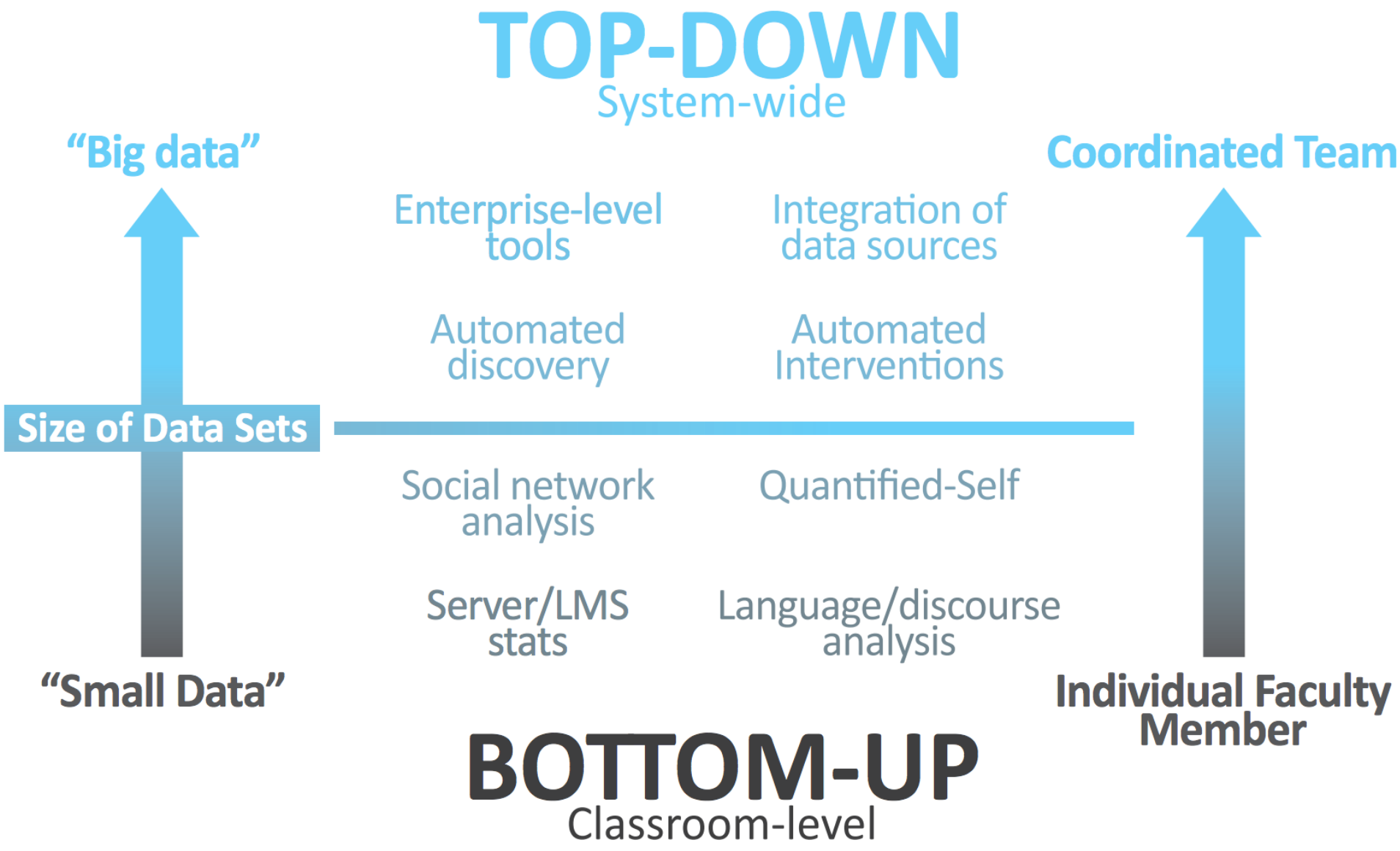
What does this mean to you?

Play in the spaces and intersections

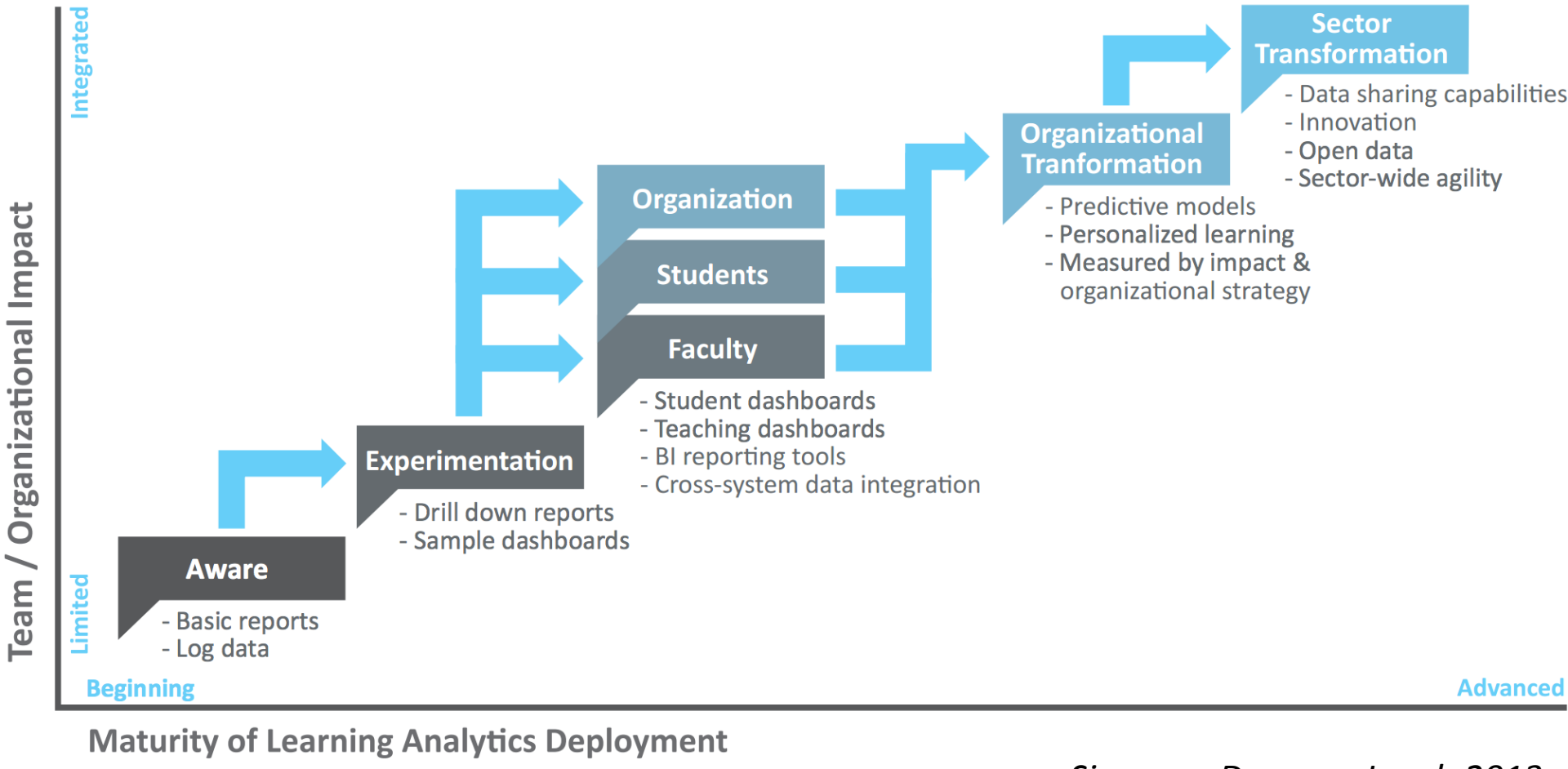
Learning scientists do not *necessarily* need to become machine learning researchers. And vice versa.

Personal learner Knowledge Graph



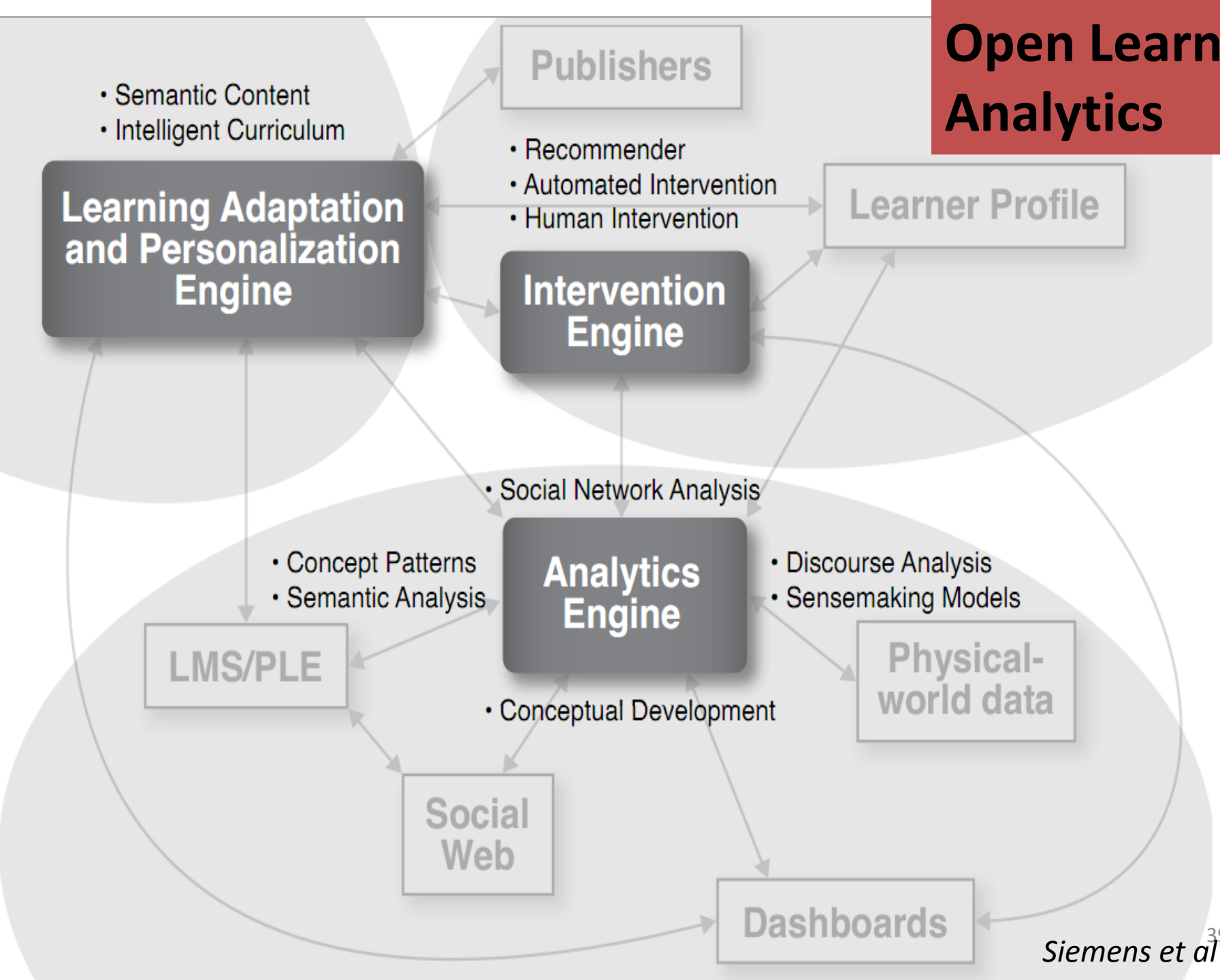

TOP-DOWN
System-wide
"Big data"
Coordinated Team
Enterprise-level tools
Integration of data sources
Automated discovery
Automated Interventions
Size of Data Sets
Social network analysis
Quantified-Self
Server/LMS stats
Language/discourse analysis
"Small Data"
Individual Faculty Member
BOTTOM-UP
Classroom-level

Learning Analytics Maturity Model

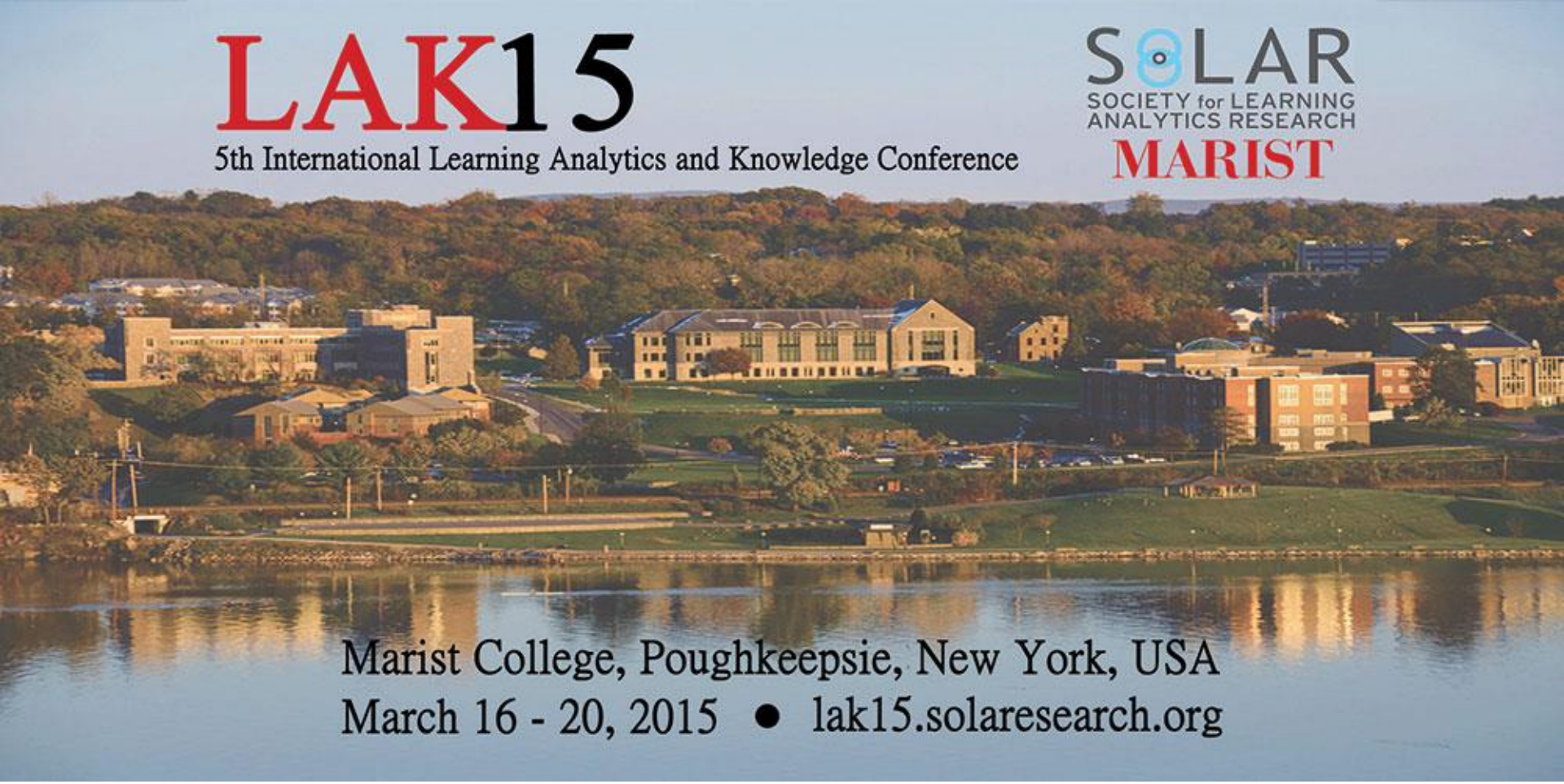


Siemens, Dawson, Lynch 2013

Open Learning Analytics



Siemens et al (2011)



http://lak15.solaresearch.org/

Twitter/Gmail/wherever:
gsiemens