What is Your Data Silhouette?

The Wicked Problem of Data Literacy:
A Call for Action

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Explaining the Data Double...

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LILAC: THE INFORMATION LITERACY CONFERENCE

The Wicked Problem of Data Literacy
Presentation Outline

- Research background, questions, sources and methods
- Conceptual and theoretical frameworks
  – Radical Change Theory
  – Theory of Stakeholder Identification and Salience
  – Intellectus Model of Intellectual Capital Capital
  – Wicked Problems
- Emerging findings and conclusions
  – Terms and concepts of the 21st century data society
  – Conceptions and definitions of data literacy
  – Salient stakeholders in the data literacy movement
  – Strategies for resolving the problem and promising practices

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Research Background

- Data now pervades every area of our academic, professional, civic, personal and social lives – it has become the currency and means of exchange in business, government, education, and research

- Calls for action on data literacy have come from all sectors of society – educators, employers, journalists, non-profit organizations, policy makers, scientists, and special interest groups

- No consensus on what it means in practice to be data literate, on how data literacy should be developed, or who should take the lead

  ➤ What does it mean to be data literate in the 21C digital world?

  ➤ Who are the critical stakeholders for advancing data literacy?

  ➤ How should libraries respond to the data literacy challenge?
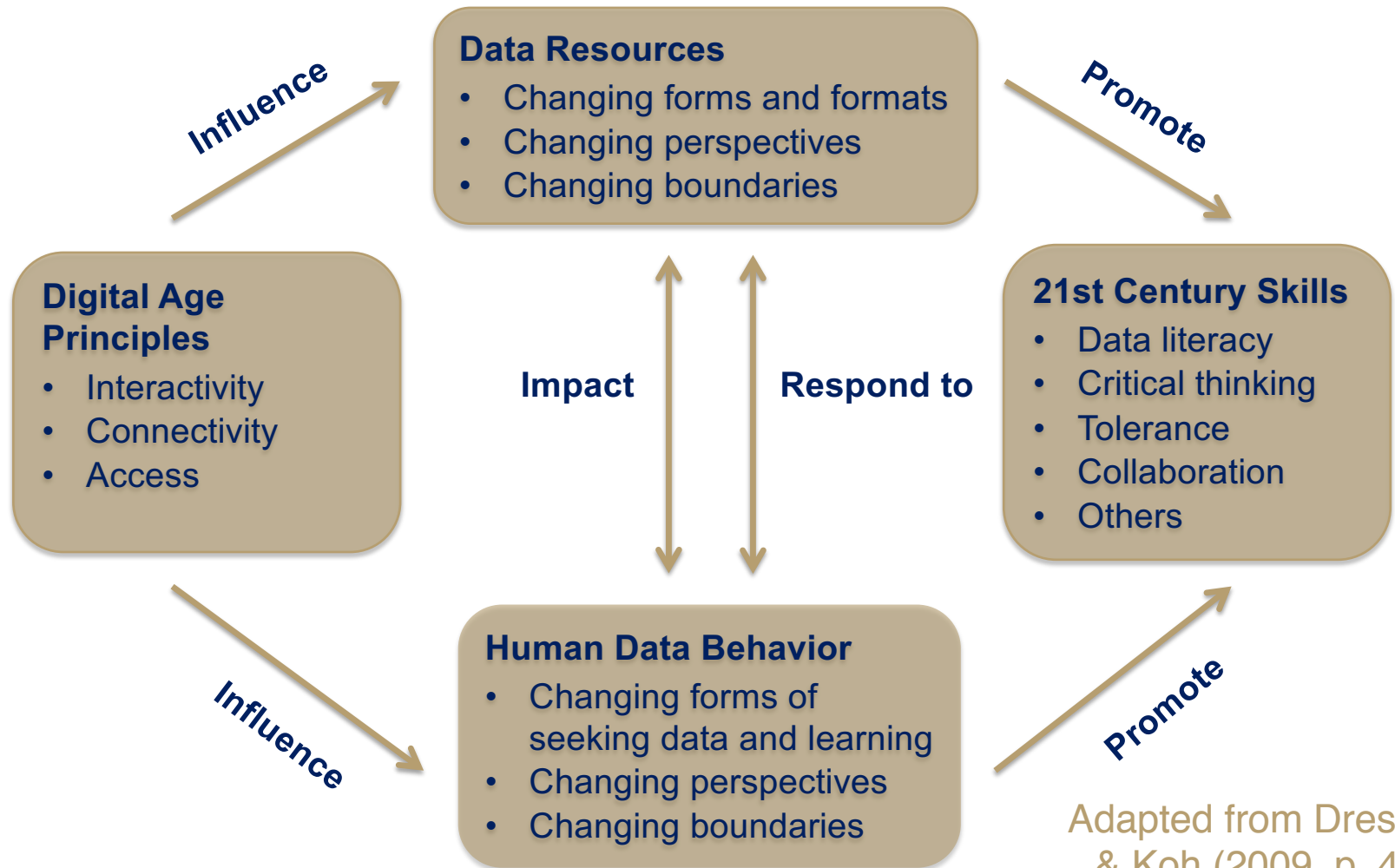
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Data Sources & Methods

- Review and critical appraisal of related literature
  - academic, professional and trade journals and conferences
  - agency/government documents, special reports, white papers, etc.
  - handbooks, textbooks and books for non-specialist/general audiences

- Environmental scan of salient organizations
  - research and development funding bodies/grant agencies (IMLS, NSF)
  - advocacy groups and campaigning organizations, alliances and consortia, education and training organizations, professional associations and membership organizations, research centres and institutes

- Stakeholder analysis of data actors
  - collaborators and partners for data literacy development
  - roles and strengths of information literacy practitioners

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Conceptual & Theoretical Frameworks

- Radical Change Theory (Dresang 1997, 2005, 2006; Dresang & McClelland, 1999; Dresang & Koh 2009) – based on principles of interactivity, connectivity and access, used to frame the complex pluralist environmental context for data literacy development

- Theory of Stakeholder Identification and Saliency (Mitchell, Agle & Wood, 1997) – used to identify groups with interests/involvement in data literacy, and evaluate their potential to influence developments

- Intellectus Model of Intellectual Capital (Bueno, Salmador & Rodriguez, 2004) – used to review and appraise the roles (actual and potential) of libraries in advancing the data literacy movement

- Wicked Problem theory (Rittel & Webber, 1973; Camillus, 2008, 2016: Danken et al., 2016) – used to analyze the problem situation, and identify strategies for resolution
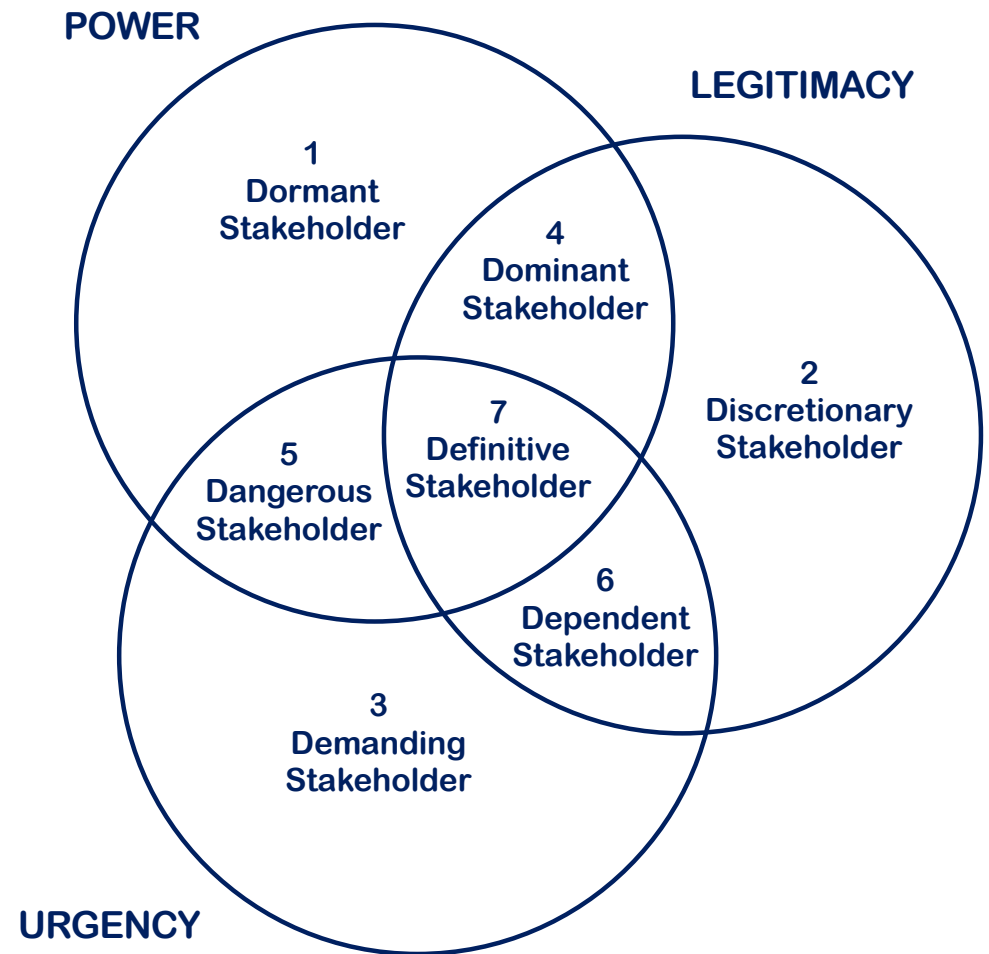
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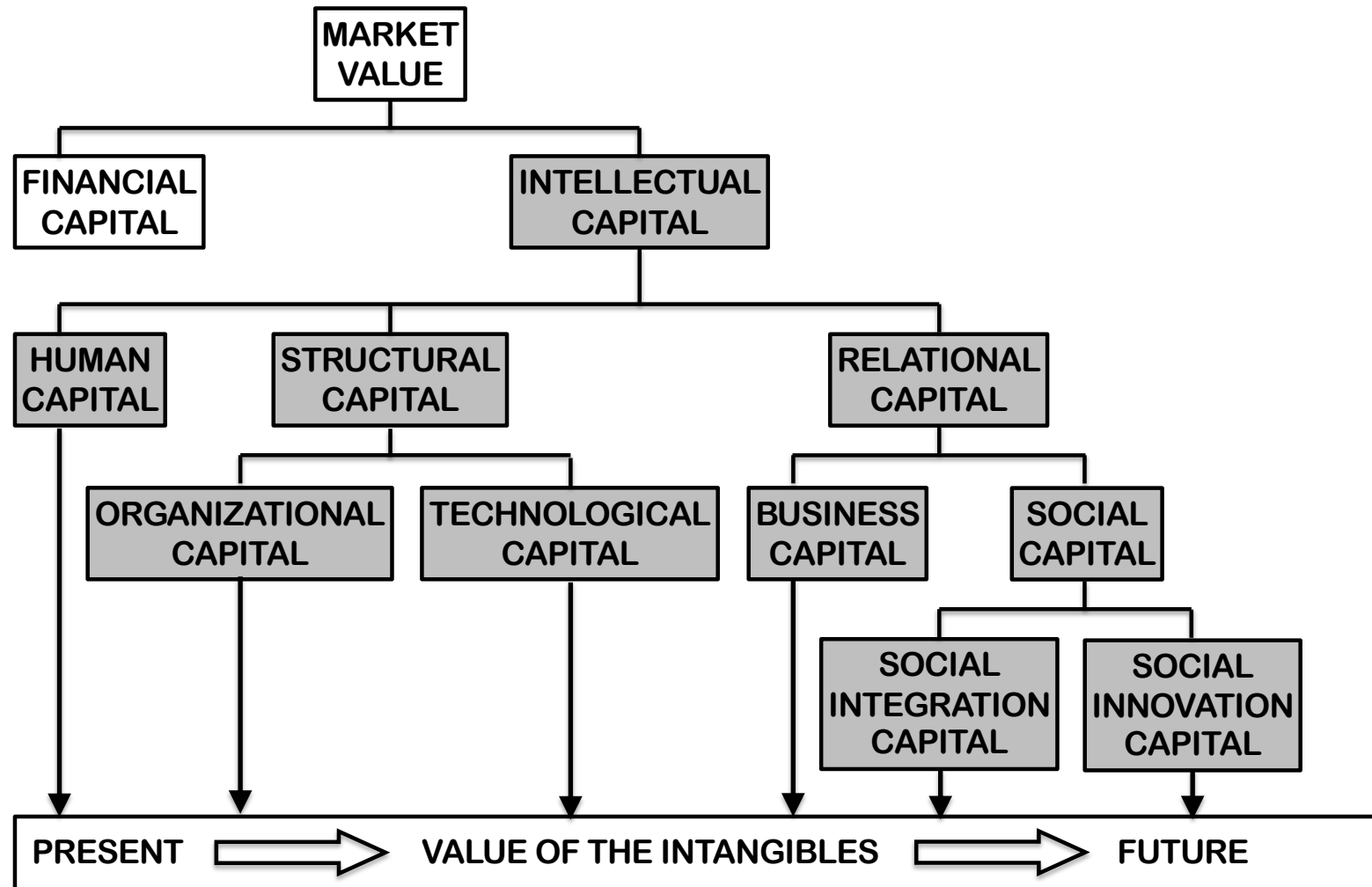# A Radical Change Lens on the Data Literacy Landscape

Data Resources
- Changing forms and formats
- Changing perspectives
- Changing boundaries

Digital Age Principles
- Interactivity
- Connectivity
- Access

21st Century Skills
- Data literacy
- Critical thinking
- Tolerance
- Collaboration
- Others

Human Data Behavior
- Changing forms of seeking data and learning
- Changing perspectives
- Changing boundaries

Influence

Promote

Impact

Respond to

Influence

Promote

Adapted from Dresang & Koh (2009, p. 41)

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Theory of Stakeholder Identification and Saliency

➤ Mitchell, Agle and Wood (1997) classify stakeholders on their possession of three key attributes:
- power to influence an entity
- legitimacy of their involvement
- urgency of their claim

➤ MAW theory provides more nuanced analysis than simpler two-by-two power-interest grid

➤ Enables focus on "who really counts for the firm [or issue]" (Bonnafous-Boucher & Rendtor, 2016, p. 3)

POWER

LEGITIMACY

1
Dormant Stakeholder

4
Dominant Stakeholder

2
Discretionary Stakeholder

5
Dangerous Stakeholder

7
Definitive Stakeholder

6
Dependent Stakeholder

3
Demanding Stakeholder

URGENCY

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Intellectus Model of Intellectual Capital (Bueno et al., 2004)

The Theory of Wicked Problems

➤ Concept defined by policy analysts Rittel and Webber (1973), elaborated and reviewed in policy studies and other disciplines

➤ Prior LIS applications include ERM (McLeod & Childs, 2013), RDM (Cox et al., 2016) and ETD metadata (Long et al., 2017)

> "chronic public policy challenges that are value-laden and contested and defy a full understanding and definition of their nature and implications" (Danken et al., 2016, p. 28)

➤ Danken et al. (2016) reduced the original 10 distinguishing features to three properties only: non-resolvability, multi-actor involvement, and the challenge of problem-definition

➤ They identity two key strategies for resolving wicked problems:
  – cross-boundary collaboration, involving all relevant stakeholders and generating joint action; and public leadership and management, based on collaborative competencies and understanding wickedness

The 21C Data Society

Data Capitalism
Dataclysm
Interactivity
Connectivity
Access
Data Revolution
Data Deluge
Data Exhaust
Data Explosion
Datafication
Data Double
Learning Analytics
Data Fluency
Data Literacy
Data Security
Dataveillance
Data Privacy
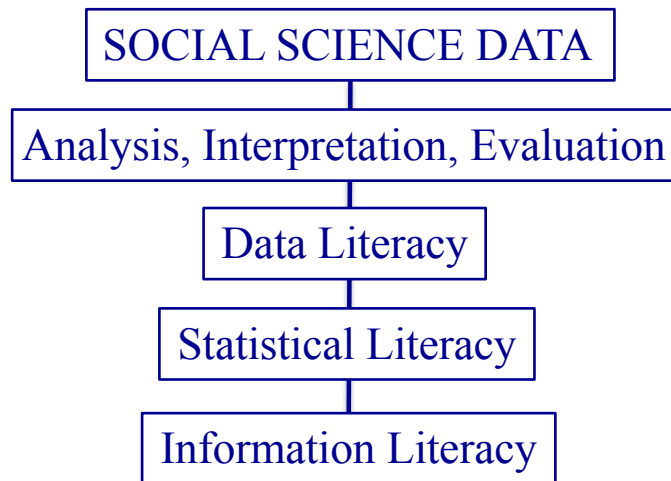Data Protection
The Quantified Self
Produsage
Precision Medicine
Data Warehouses
Data Refineries
Smart Cities
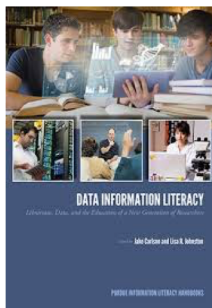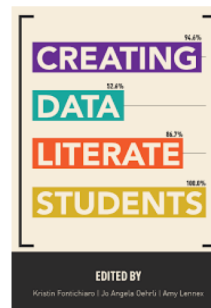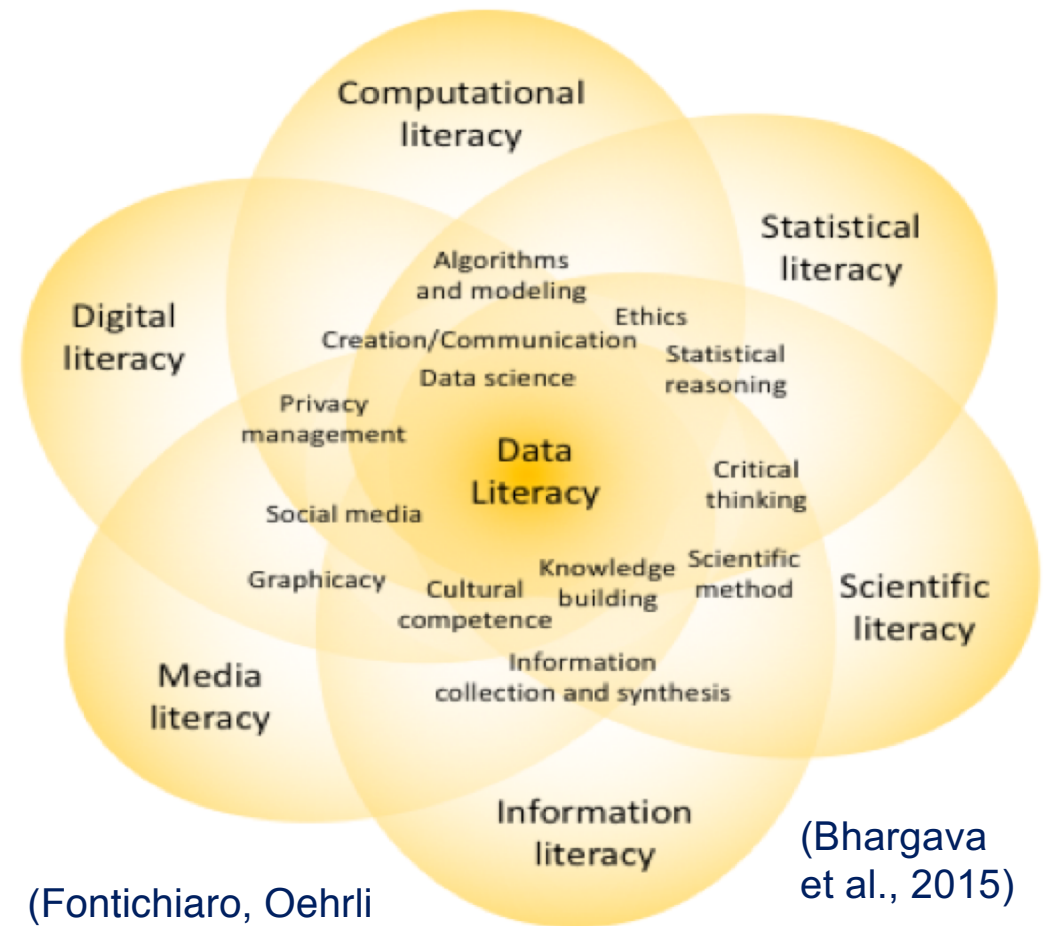
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Conceptions of Data Literacy

SOCIAL SCIENCE DATA

Analysis, Interpretation, Evaluation

Data Literacy

Statistical Literacy

Information Literacy

(Schield, 2004, p. 8)

(Carlson & Johnston, 2015)
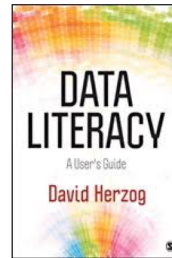
(Fontichiaro, Oehrli & Lennex, 2017)

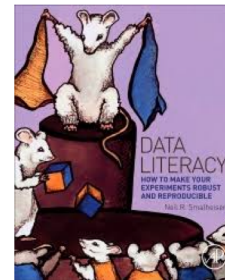(Bhargava et al., 2015)

Alternative Conceptions of Data Literacy

2013
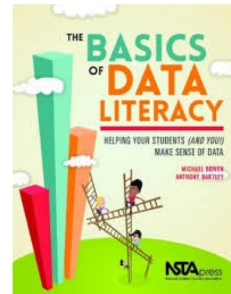
2016
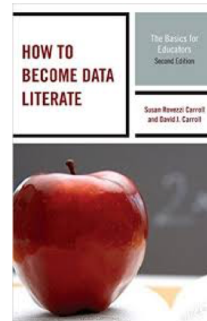
UG Research Skills
(Secondary Data)

PG Research Methods
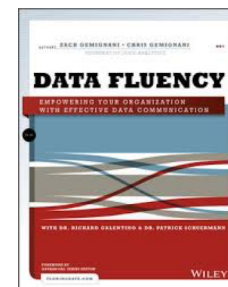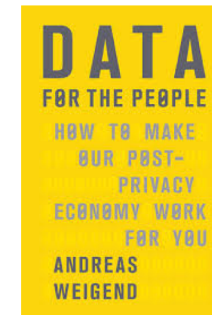(Primary Data)

2017

Statistical Literacy

Data-Based Decision Making
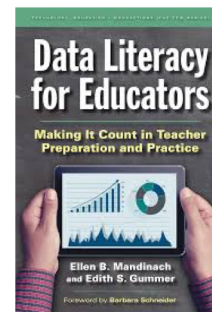
2015

2008

2016

2014

Building a
Data Culture

2017

2015

2016

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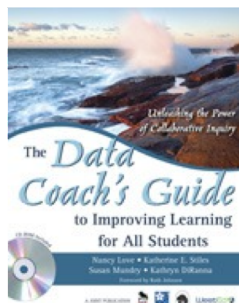
Sample Definitions of Data Literacy

"The desire and ability to engage constructively in society through and with data" (Bhargava et al., 2015) COMMUNITY INFORMATICS

"the ability to read, work with, analyze and argue with data as part of a larger inquiry process" (D'Ignazio & Bhargava, 2016, p. 84)
COMMUNITY INFORMATICS

"The data-literate individual understands, explains, and documents the utility and limitations of data by becoming a critical consumer of data, controlling his/her personal data trail, finding meaning in data, and taking action based on data. The data-literate individual can identify, collect, evaluate, analyze, interpret, present, and protect data." (ODI, 2016, p. 2) CIVIL SOCIETY

"skills like understanding how data refineries work, learning what parameters can and cannot be changed, interpreting errors and understanding uncertainty, and recognizing the possible consequences of sharing our social data" (Weigend, 2017, p.15) CIVIL SOCIETY

Sample Definitions of Data Literacy

"the ability to access, critically assess, interpret, manipulate, manage, summarize, handle, present, and ethically use data" (Okamoto, 2017, p. 120) OPEN GOVERNMENT

"the ability to consume for knowledge, produce coherently and think critically about data. Data literacy includes statistical literacy but also understanding how to work with large data sets, how they were produced, how to connect various data sets and how to interpret them" (Gray, Bounegru & Chambers, 2012, p. 148) JOURNALISM

"the ability of individuals to understand and draw meaning from data …the abilities necessary to thoughtfully consume data " (Gemignani et al., 2014, pp. 23, 196) BUSINESS

"the ability to read, write and communicate data in context, including an understanding of data sources and constructs, analytical methods and techniques applied, and the ability to describe the use case, the application and resulting value" (Gartner, 2018) BUSINESS

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Sample Definitions of Data Literacy

"the ability to examine multiple measures and multiple levels of data, to consider the research, and to draw sound inferences" (Love, 2004, p. 22)
TEACHER EDUCATION

"the ability to frame questions so that the statistics can be manipulated to provide answers; the ability to disaggregate data to address specific rather than global issues; the ability to assess the value *and* implications of reports that are data-based" (Carroll & Carroll, 2015, p. x) TEACHER EDUCATION

"the ability to transform information into actionable instructional knowledge and practices by collecting, analyzing, and interpreting all types of data (assessment, school climate, behavioral, snapshot, longitudinal, moment-to-moment, and so on) to help determine instructional steps. It combines an understanding of data with standards, disciplinary knowledge and practices, curricular knowledge, pedagogical content knowledge, and an understanding of how children learn" (Gummer & Mandinach, 2015, p. 2)
TEACHER EDUCATION

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Sample Definitions of Data Literacy

"understanding what good data and data analysis is so that you can make stronger arguments and better evaluate the arguments of others" (Bowen & Bartley, 2013, p. ix) SCHOOL TEACHING

"the ability to comprehend, evaluate, and synthesize data and numeric information in all of its different forms" (Fontichiaro, Oehrli, & Lennex, 2017, p. 3) SCHOOL TEACHING

"the ability to "read" and "write" effectively with data" (Fontichiaro, Lennex, Hoff, Hovinga, & Oehrli, 2017, p. i) SCHOOL TEACHING

"the ability to ask and answer real-world questions from large and small data sets through an inquiry process, with consideration of ethical use of data. It is based on core practical and creative skills, with the ability to extend knowledge of specialist data handling skills according to goals. These include the abilities to select, clean, analyse, visualise, critique and interpret data, as well as to communicate stories from data and to use data as part of a design process" (Wolff et al., 2016, p. 23) SCHOOL TEACHING

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Related Terms and Concepts

Creative data literacy (D'Ignazio, 2017)

Critical data literacy (Battista & Conte, 2016; Hautea et al., 2017; Pappas et al., 2016; Tygel & Kirsch, 2016)

Data information literacy (Carlson et al., 2011; Carlson & Johnston, 2015; Macy & Coates, 2016; Shorish, 2015)

Data informed learning (Maybee & Zilinski, 2015; Pullman & Zilinski, 2017)

Data visualization literacy (Börner et al., 2016; Börner et al., 2019; Maltese et al., 2015)

Linked open data literacy (Hügi & Schneider, 2014)

Open data literacy (Weber et al., 2017)

Pedagogical data literacy (Mandinach, 2012; Mandinach & Jackson, 2012)

Research data literacy (Schneider, 2013; Vilar & Zabukovec, 2019)

Science/scientific data literacy (Qin & D'Ignazio, 2010, Smalheiser, 2017)

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Representative Themes and Perspectives

Data literacy as a life skill for everyday **problem-solving**

Data literacy as community engagement and citizen **empowerment**

Data literacy as data-based/data-driven **decision making** in schools

Data literacy as education for subjects of business and learning **analytic**s

Data literacy as data-driven **storytelling** in the media and business

Data literacy as a new *lingua franca* or second language for business

Data literacy as a **research skill** for students and professionals

Data literacy as data management and **curation** in research

Data literacy as data protection and **privacy** in personal data management

Data literacy as a building block and critical success factor for rolling out
data science in business, government, and research

Salient Data Literacy Stakeholders

iassist — International Association for Social Science Information Services & Technology — 1974
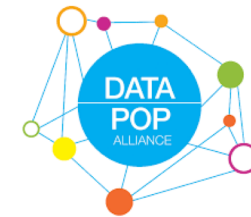
ICSU WORLD DATA SYSTEM — 2008

UK Data Service — 2012

ODI open data institute — 2012

DATA POP ALLIANCE — 2013

NSF — 1950

DQC DATA QUALITY CAMPAIGN — 2005

apdu — ASSOCIATION of PUBLIC DATA USERS — 1975

TeachingWithData.org — Pathway to Quantitative Literacy in the Social Sciences — 2008

RDA RESEARCH DATA ALLIANCE — 2013

D — 2013

INFORMATION LITERACY GROUP

DATA CARPENTRY — BUILDING COMMUNITIES TEACHING UNIVERSAL DATA LITERACY — 2013

IFLA Information Literacy

Open Government Partnership — 2011

SCHOOL OF DATA — 2012

DATAETHICS — 2015

INSTITUTE of Museum and Library SERVICES — 1996

DataKind — 2011

ACRL — Advancing learning Transforming scholarship — Association of College & Research Libraries

Strategies for Resolving the Problem

- Recognize the multifaceted lifewide and lifelong data and information needs of learners, researchers, workers, and citizens

- Build on good practices and initiatives in literacy education, pulling from prior experiences and blending multiple frameworks as needed

- Collaborate and partner across traditional boundaries and silos, involving key stakeholders to pool expertise and catalyze joint action

- Develop a new integrative framework for data literacy, synthesizing and expanding context-specific definitions to promote transferability

- Mobilize intellectual assets of librarians to get things done – professional expertise, organizational structures, technology, networks, business contacts, community relations and social role

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Show Me the Learning:
Navigating Information Literacy through Multiple Life Perspectives

*Alice B. Ruleman, Laura Horne-Popp, and Robert Hallis**

Librarians used scenario-based assignments to help students meet their academic, professional, and personal information needs in a general education course for first and second year undergraduates

Introduction

As the concept of information literacy has expanded, there is growing agreement among librarians and other educators that it is an essential competency in the information age. Despite all their assumed technological expertise, students continue to experience difficulties in locating, critically evaluating, and using accurate information. The General Education Committee at the University of Central Missouri (UCM) recognized this as they began a review of the General Education Program in 2008. Librarians who served on the committee were strong advocates for the inclusion of an information literacy competency. Five years later, the campus implemented a new set of core competencies including *Competency 5: Acquiring and managing information through research and technology*. In fall 2014, five courses were offered to meet the competency, including the James C. Kirkpatrick Library's course, "Truth, Lies and Information Management."

ACRL identified a broad set of skills in their standards and framework, but these principles have generally been interpreted in academia as finding scholarly sources for the ubiquitous research paper. In 2011, a newly created Instructional Design Librarian position at the James C. Kirkpatrick Library (JCKL) provided a new initiative to engage students and faculty in developing information management skills. Working with Freshman Experience, Communication, and English Composition courses, it became clear students needed guidance in finding information for much more than their research papers. Students also dealt with personal and professional as well as academic information needs.[1]

"the foundational goal of information literacy – to foster the ability to handle information intuitively in whatever sphere a student (or a graduate) occupies"
(Badke, 2013)

UNIVERSITY OF
CENTRAL
MISSOURI
1871
LEARNING TO A GREATER DEGREE

Promising Practices

Data information literacy instruction in Business and Public Health: Comparative case studies

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Indiana University-Purdue University Indianapolis, USA

Heather L. Coates
Indiana University-Purdue University Indianapolis, USA

Abstract
Employers need a workforce capable of using data to create actionable information. This requires students to develop data information literacy competencies that enable them to navigate and create meaning in an increasingly complex information world. This article examines why data information literacy should be integrated into program curricula, specifically in the instances of business and public health, and offers strategies for how it can be accomplished. We approach this as a comparative case study within undergraduate business and master of public health programs at Indiana University-Purdue University Indianapolis. These case studies reveal several implications for practice that apply across social and health sciences programs.

Keywords
academic libraries, business, data information literacy, data reuse, information literacy, instruction, public health

Liaison librarians used Calzada Prado and Marzal's (2013) DIL framework to prepare students for workplace data use

IU IUPUI

University Library

The five-module framework:

1. Understanding what data is and how it affects society;
2. Finding and/or obtaining data resources;
3. Reading, interpreting, and evaluating data;
4. Managing data including creation of metadata and collection practices;
5. Using data including data handling, data visualization, and ethical use.

A Multi-Framework Approach to Teaching Data: A Case Study in Modern Languages

Ethan Pullman and Lisa Zilinski, Carnegie Mellon University

Liaison librarian and research data specialist combined the ACRL Framework for IL with Maybee and Zilinski's (2015) principles for Data Informed Learning to teach data

When the ACRL Framework was adopted in 2016, it officially moved teaching information literacy (IL) from applying a prescriptive set of skills or learning outcomes based on standards (ACRL, 2000), to a paradigm built on "interconnected core concepts, with flexible options for implementation" that are demonstrated through knowledge practices and dispositions (ACRL, 2016). And while the Framework presents instruction librarians with pedagogical challenges, its "big picture" philosophy supports experimentation with learning principles from various disciplines and frees librarians to adapt their teaching in ways that the previous prescriptive ACRL Standards did not allow. As a result, even before the Framework was officially adopted, instruction librarians began to discuss its applications. Some voiced concerns over its clarity, practicality, research basis, and ability to reflect the diversity of learners or disciplines (ACRLog, 2015); others began to offer pedagogies for teaching it (e.g., Bravender, McClure, & Schaub, 2015; CARLI, n.d.; CUNY Academic Commons, n.d.; Kuglitsch, 2015). Although many of these pedagogies have typically centered on information literacy as a discipline, as opposed to a network of disciplines, librarians are recognizing the need to revitalize teaching pedagogies by capitalizing on the flexibility of the Framework and employing other contextual and disciplinary models for teaching information literacy. For instance, some point to an example of how decoding and backward design are used to "revise learning outcomes for information literacy" (ACRLog, 2015), while others suggest that constructs such as *transfer* or *CoRe* could be used to contextualize threshold concepts (Kuglitsch, 2015; Shinners-Kennedy & Fincher, 2013).

About the Workshop

Each fall, about a dozen graduates attend a workshop on data literacy and research management, which is a component of a required graduate professional development seminar (82-780) taught in Modern Languages at Carnegie Mellon University. The seminar focuses on second language acquisition and is an opportunity for graduate students to present their projects and receive constructive feedback. Before the workshop was revised in Fall 2015 with a two-framework approach, its lesson plan focused solely on principles drawn from the ACRL Framework, specifically addressing the second frame, Information Creation as a Process, which states that:

Information in any format is produced to convey a message and is shared via a selected delivery method. The iterative processes of researching, creating, revising, and disseminating information vary, and the resulting product reflects these differences (ACRL, 2016).

With this frame in mind, the two learning goals for the lesson stated that attendees will:

- effectively identify, define, and document reproducible data (*knowledge practice*) by understanding "good" data practices and the research data life cycle involved in its creation, dissemination, and reproducibility (*disposition*).

- learn to efficiently use Mendeley as an example of a research management tool (*knowledge practice*) to understand its role in reflecting, or contributing to, scholarly practices in the discipline (*disposition*).

Carnegie Mellon University
Libraries

The three principles:

1. New learning must build on prior knowledge or experience.

2. Learning about data must occur within a disciplinary context.

3. Learning should discover new ways of using data within their discipline

Promising Practices

Promising Practices

Public and academic libraries partnering with regional data centers and other data intermediaries to build data literacy and technical skills

Civic Switchboard
Connecting Libraries and Community Information Networks

Updates

Introducing Civic Switchboard: Connecting Libraries and Community Information Networks

11 Dec 2017

Across the US and around the world, a growing number of public sector and nonprofit organizations have been sharing open data. In sharing data, these organizations hope to increase transparency, enhance governmental efficiency, improve communities, encourage public participation in government, and foster civic innovation and economic development. While there are many success stories around civic open data, there is a growing awareness that the act of publishing open data will not always result in community impact. *Data intermediaries* are often needed to help people extract value from civic open data, and to help data publishers make good decisions about how they publish.
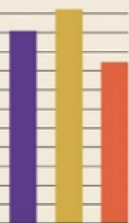
In Pittsburgh, our local civic data ecosystem is unique in that both public and academic librarians are actively involved as data intermediaries, and they work in close collaboration with other civic data publishers and users. Librarians regularly partner with local governments, non-library intermediaries, civic organizations, student organizations, and data users in a variety of ways. They play a number of roles, including helping people discover civic information, building data literacy and technical skills, providing technical assistance in data management and documentation, creating feedback mechanisms to publishers, convening and hosting events, and connecting data users.

Our experience shows that libraries and librarians should be key actors in the continuing development of civic open data portals and act as core data intermediaries; their expertise adds value to a wide range of issues that affect both data publishers and users. Many of our colleagues elsewhere, including librarians and other established civic data intermediaries, have asked us how they can develop similar relationships and roles for librarians in their home communities.

With these requests fresh in our mind, we developed a plan for a guide and toolkit to help libraries carve out roles in their local ecosystems. We are fortunate to have received funding for this work from the **Institute of Museum and Library Services**; with IMLS support we are now starting a two-year project: *Civic Switchboard: Connecting Libraries and Community Information Networks*. The project will develop the guide and toolkit while also directly supporting teams of librarians from around the country to partner with other intermediaries in their local communities.

CREATING DATA LITERATE STUDENTS

AN IMLS-FUNDED PROJECT OF THE UNIVERSITY OF MICHIGAN
SCHOOL OF INFORMATION AND UNIVERSITY LIBRARY

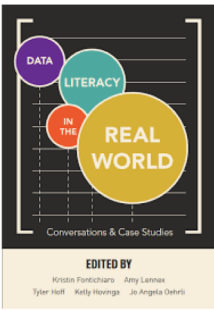About Our Project | Blog | Books | Our Team | Publications and Presentations | Virtual Conference

About Our Project

What are you looking for?

- **View archived sessions from the 4T Virtual Conferences on Data Literacy**
  - 2016 & 2017
  - 2018
- **Learn about our books**
  - *Creating Data Literate Students* – essays about integrating data literacy into high school research projects
  - *Data Literacy in the Real World: Conversations and Case Studies* – discussion guides and activities to accompany the 2016 and 2017 4T Virtual Conference on Data Literacy, plus over 45 case studies around data literacy in the real world
- **Read the blog**

The Supporting Librarians in Adding Data Literacy Skills to Information Literacy Instruction project is a three-year project running from October 2015 through September 2019 to develop data and statistical literacy skills in high school librarians so they can better support critical comprehension skills in their students.

Seven significant themes:
- Statistical literacy
- Data visualization
- Data in argument
- Big data
- Citizen science
- Personal data management
- Ethical data use

iSchool professor and instruction librarian collaborating with data and curriculum experts to support school librarians teaching data literacy in class research projects and real world contexts

Promising Practices

Conclusions and Suggestions for Action

➢ Explore adaptation and/or expansion of existing information literacy models and tools to build shared understanding among key players and facilitate data literacy education, e.g.,

  – threshold concepts, knowledge practices, dispositions (ACRL, 2015/2016)
  – high-level definition, secondary statement, different contexts (CILIP, 2018)

➢ Identify and collate pedagogical practices and learning resources (including OERs and RLOs) with potential for adoption and/or adaptation by data literacy educators

➢ Reach out to potential partners to develop collaborative strategies for data literacy education, with particular reference to facilitating educational, professional, and social transitions

The Wicked Problem of Data Literacy – Key References

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