What is Your Data Silhouette?

The Wicked Problem of Data Literacy: A Call for Action

Sheila Corrall
Information Culture & Data Stewardship
University of Pittsburgh
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
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?
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
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
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

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

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

Adapted from Dresang & Koh (2009, p. 41)
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)
Intellectus Model of Intellectual Capital (Bueno et al., 2004)

MARKET VALUE

FINANCIAL CAPITAL

INTELLECTUAL CAPITAL

HUMAN CAPITAL

STRUCTURAL CAPITAL

RELATIONAL CAPITAL

ORGANIZATIONAL CAPITAL

TECHNOLOGICAL CAPITAL

BUSINESS CAPITAL

SOCIAL CAPITAL

SOCIAL INTEGRATION CAPITAL

SOCIAL INNOVATION CAPITAL

PRESENT

VALUE OF THE INTANGIBLES

FUTURE
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).
- 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 identify 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.

"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)
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

Data-Based Decision Making

2016

UG Research Skills (Secondary Data)

2017

PG Research Methods (Primary Data)

2008

Building a Data Culture

2015

Statistical Literacy

2016

PITTSI

2014

UG Research Skills (Secondary Data)

2017

PG Research Methods (Primary Data)

2016

Building a Data Culture
Sample Definitions of Data Literacy

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

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

“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)

“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)
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)
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**
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)

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

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

“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)
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)

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 analytics
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
- ICUS (International Council of Scientific Unions) - 2008
- UK Data Service - 2012
- ODI (Open Data Institute) - 2012
- Data Pop Alliance - 2013
- IFLA (International Federation of Library Associations and Institutions) - 1975
- TeachingWithData.org - 2008
- RDA (Research Data Alliance) - 2013
- Data Carpentry - 2013
- Data Ethics - 2015
- Institute of Museum and Library Services - 1996
- DataKind - 2011
- School of Data - 2012
- ACRL (Association of College & Research Libraries) - 2015
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
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.

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

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.
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.

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

Promising Practices

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.
Promising Practices

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.
Data Literacy: A Call for Action

Launched at LILAC 2018

- High level definition
- Secondary statement
- Roles of info pros
- Five key contexts
  - Everyday life
  - Citizenship
  - Education
  - Workplace
  - Health

Data protection
Open data
Data management
?
?

Towards a Holistic Inclusive Model?
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


Fontichiaro, K., et al. (Eds.), *Data literacy in the real world.* Michigan Publishing.
The Wicked Problem of Data Literacy – Key References

Gartner (2018). *Fostering data literacy and information as a second language* [Special Report]


Oceans of Data Institute (2016). *Building global interest in data literacy* [Workshop Report].


