SOME ISSUES OF DATA LITERACY AND AI LITERACY IN THE LIBRARY

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Purpose: The paper explores the nature of data literacy and its relationship to artificial intelligence literacy, also referred to as AI literacy.
Methodology: A scoping review was conducted to identify publications on data literacy and AI literacy.
Results: The literature shows that data literacy is related to several other literacies, and that AI literacy is also rooted in data literacy. Both are important, are receiving increasing attention, and are linked to other literacies.
Conclusions: It is important to explore the characteristics of data literacy and AI literacy and to examine the relationship between them, taking into account known approaches such as information literacy and digital literacy.

Keywords: data literacy, artificial intelligence literacy, AI literacy, scoping reviews

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INTRODUCTION

A search was conducted using a large and diverse pool of papers from a variety of sources. Based on this, we discuss the characteristics of two main areas, research data and citizenship, as both have commonalities and different approaches.

Data literacy remains a key concept in today's data-driven era. However, this concept needs to be further refined through effective data management, which requires a collaborative effort across different sectors, including academic, public, school and special libraries.

Let us add that the new *DigComp 2.2 Citizenship Digital Literacy Framework*, although approaching data literacy in a different way, shows similarities with data literacy, among others by covering the storage, management and organization of digital data. It also addresses the issues of information and data management (Vuorikari, Kluzer and Punie 2022).

DATA LITERACY FOR RESEARCH

There are relatively early, well-established approaches to defining data literacy. For example, Calzada Prado and Marzal (2013) highlight that it enables the access, interpretation, evaluation, management, and ethical use of data. At its most basic level, data literacy is about the tactics and procedures for finding, processing, organizing, sorting and summarizing datasets throughout the data lifecycle (D'Ignazio and Bhargava 2016). We can also add that it is *„a specific skill set and knowledge base that enables individuals to transform data into information and actionable knowledge"* (Koltay 2017, p. 10).

In fact, none of them can be considered exclusive, as there are different definitions that lead to different ways of solving the problem (Fotopoulou 2021). It also reflects different domains embodied in different approaches. Data literacy involves the following skills:

- planning, based on lifecycle models,
- discovery and acquisition,
- description and metadata,
- copyright and licensing,
- sharing data,
- visualization,
- publishing,
- curation and preservation (Carlson and Stowell Bracke 2015).

One of the most comprehensive definitions of data literacy elaborated by Ridsdale and her colleagues (2015) identify foundational processes. Ones of them are listed below:

- basic data analysis,
- data organization,
- assessing and ensuring the quality of data sources,
- handling and manipulating data,
- understanding and interpreting data,
- making data-driven decisions,
- presenting data orally and through data visualization,
- providing data citations,
- facilitating data sharing.

DATA LITERACY FOR CITIZENS

Data literacy can combine approaches from different fields and aims to understand and examine how knowledge is produced and enacted. However, in contrast to supporting research exclusively, we should focus not only on the skills to use data, accepting that there is an urgent need to develop awareness, understanding and skills that enable critical reflection in order to serve a wide range of citizens (Kitchin and Lauriault 2014).

This move is due to the changing environment, which requires critical approaches, especially in regard to big data, and going beyond relying merely on skills, but should paying attention to data security (Sander 2020). Given that many of today's digital technologies are based on collecting, processing and analyzing data, we need to recognize the downsides of allowing easy and uncontrolled access to varied datasets of varying provenance and quality (Kitchin 2021). All this also means that data is a life skill, so data literacy must be accessible to all citizens by providing tools that enable successful and sustainable action based on evidence (Schüller 2022).

A MODEL OF DATA LITERACY ACTIVITIES

Matthews (2016) depicts data literacy processes and competencies, interpreted as a generalized capability of community informatics that relies on most data literacy processes. In the model below, competencies,

related to consumption of data are shown in red, creation is in purple, while common competencies are shown in green and ethical considerations in yellow (Fig. 1).

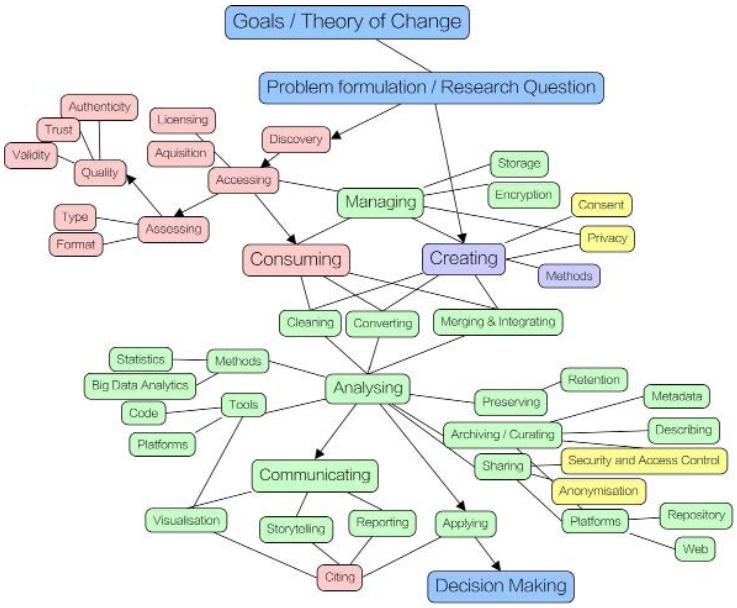

Fig. 1 Generalized conceptual model of data literacy activities (Matthews 2016)

A further development of data literacy led to the concept of data infrastructure literacy, conceived by Gray, Gerlitz and Bounegru (2018) and aiming at creating *„a space for collective inquiry, experimentation, imagination and intervention around data"* (p. 1). It also includes *„how data infrastructures can be challenged, contested, redesigned and repurposed to align with interests and publics other than those originally intended"* (p. 1).

There is also a socio-technical conceptualization of data literacy, as it is also linked to citizens' data practices, highlighting the agentic, contextual, critical and social aspects of data skills and competences. We need to understand that civil society organizations also need data advocacy, using multiple data-related skills, coupled with a critical awareness of the power of data (Fotopoulou 2021).

The European *Erasmus+* project, called *DALI Data Literacy Framework* (2020), aims to empower adults for responsible citizenship and civic engagement in a post-digital world. The figure below shows the competences that should characterize a data literate citizen (Fig. 2).

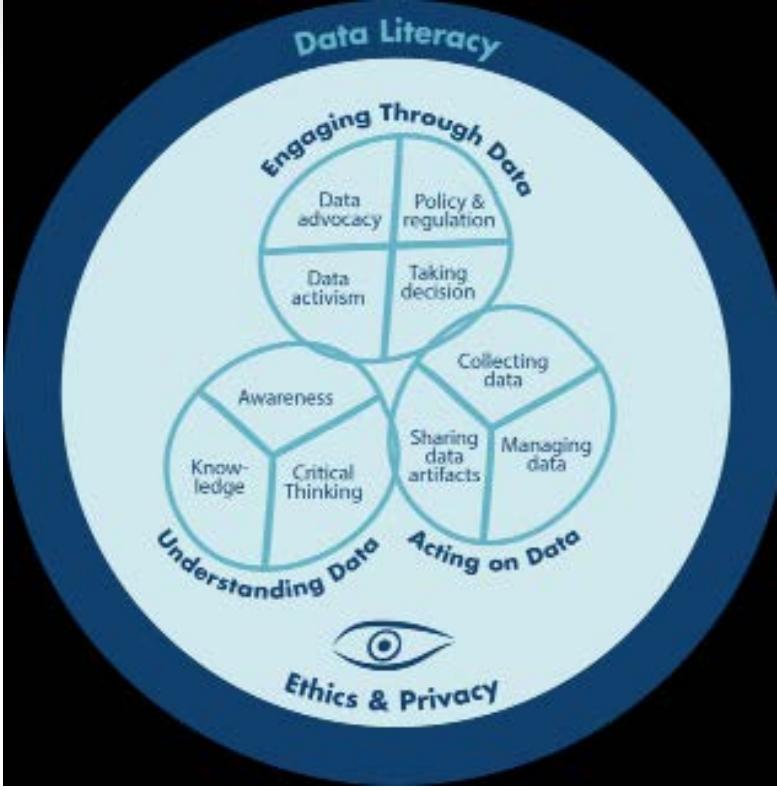

Fig. 2 DALI Data Literacy Framework (DALI Data Literacy Framework 2020)

AI LITERACY

AI literacy paves the way for an understanding that makes AI tangible and enables people to critically understand, evaluate and use AI systems to participate safely and effectively in an increasingly digital world (Cox 2018). This concept provides foundational knowledge and analytical evaluation of AI by acknowledging not only its representations, strengths and weaknesses, but also intelligence, decision making and the human role in AI. It also emphasizes that there are skills and competencies for non-experts (Laupichler, Aster, Schirch a Raupach 2022). They add that, similar to data literacy, AI literacy focuses less on the data itself and more on the use of technologies and how to use them. In this environment, we need to adhere to all the core professional values and ethical principles relevant to working with data. This means that we should emphasize equal access to information, avoidance of bias and misinformation, protection of confidentiality, and support for intellectual property rights, so the relevant guiding principles are also highly relevant to data stewardship (Cox 2024).

According to Hervieux and Wheatley (2024), being AI literate is a conscious decision to participate in a discourse that promotes learning about AI by using technology to better understand its presence in everyday life. Obviously, this does not work without

critiquing the biases that can be present in artificial intelligence and algorithms, so becoming AI literate means staying involved in the conversation by engaging with the relevant literature, discussion groups, or any other material that helps to keep informed on the topic. This is made possible by understanding the basic principles of AI, becoming familiar with the basic differences between types of AI, and experimenting with them. It also requires reviewing the results of AI, assessing its impact and engaging in the related discourse.

Hibbert, Altman, Shippen and Wright (2024) propose four frameworks for AI literacy, including understanding, using and applying, analyzing, evaluating and creating. We can also draw on six key constructs of AI literacy, namely identifying, knowing and understanding data, using and applying, evaluating, creating and navigating ethically (Almatrafi, Johri and Lee 2024).

EXAMPLES OF THE USE OF DATA LITERACY AND AI LITERACY IN THE LIBRARY

Public libraries, in particular, readily recognize the need to provide data literacy and thereby foster innovation and creativity (Nwagwu 2024). Obviously, academic and other libraries are also making efforts to fulfill this mission.

Data literacy continues to be a growth opportunity for the engagement of librarians through its impact on teaching and learning in higher education. For instance, a number of higher education institutions in the United States are working with teachers to provide training for their students. The key outcomes have been:

- enabling a campus-specific data literacy framework to be developed and integrated into the curriculum,
- creating a toolkit for faculty, including a video overview of data literacy, a campus data literacy framework, and sample activities that can be adapted depending on the general education curriculum (Burress, Mann and Neville 2020).

Librarians at the Ringwood Public Library in New Jersey used a solar eclipse for programming, focused on data literacy and scientific inquiry. Over the course of about eight weeks, educational activities taught participants about eclipses, how to make observations, and how to collect and analyze data. They also provided opportunities to practice data literacy skills for data visualization and to interpret graphical data (Caldwell 2025).

AI is based on the ability of a system to interpret external data correctly, to learn from that data, and to use that learning to achieve specific goals and tasks through flexible adaptation (JISC 2022). This needs to be understood by librarians who recognize that data-driven decision making is here to stay. However, it needs to be supported by librarians who recognize that while data-driven decision making requires a general focus on the use and management of data, it also requires learning how to incorporate, interpret and reflect on data-driven decisions (Massis 2016).

The shift from data literacy to artificial intelligence is likely to have a significant impact not only on data-related developments. Data literacy enables library users and librarians to critically evaluate data literacy and AI technologies, and to communicate and collaborate effectively with AI.

They also state that AI literacy is a set of skills that enable people to evaluate, communicate and collaborate effectively with AI technologies. It answers the following questions:

- How can we identify AI?
- What can it do, and what is its ability to distinguish between right and wrong?
- How can we imagine future applications that reflect the evolving nature of AI?
- How does AI work and what models represent its nature?
- How should AI be used, with an emphasis on ethical considerations?
- How do people perceive AI? (Long and Magerko 2020).

Although it may be difficult to identify the role of librarians in contemporary research teams, there is hope for collaboration between them (Borrego, Ardanuy and Urbano 2018). We must also recognize that this is true for the presence of new practices in libraries that may require innovative thinking and new forms of collaboration, including data librarianship (Koltay 2019).

The impact of AI on the activities of academic libraries is highly complex. It has many connotations, in some cases fuelled by science fiction and other

popular media. In reality, it can be understood as an evolving idea rather than a single technology. The potential impact of AI remains controversial and it is difficult to predict what might be possible in terms of anticipating the impact on particular areas of work (Cox 2023).

Data literacy has proven to be an integral continuation of various literacies. On the other hand, AI literacy is constantly developing. The interest in AI has its roots in the theory and intensive activity around big data. At the moment, full-fledged AI is expensive and, more importantly, we still need to improve it, including making the systems and their design more transparent (Cox, Pinfield and Rutter 2019).

AI literacy can be defined as a set of competencies that enable us to take advantage of the opportunities that AI offers. However, it also requires a critical attitude (Long and Magerko 2020). This latter point reminds us that libraries and librarians have a potential role to play in supporting the use of AI because their skills and values are relevant, because their work is extremely valuable, because both ownership and quality of data are increasingly important, including through the implementation of principles for the ethical use of collections. It is clear that their skills need to be adapted to meet the needs of AI literacy. This requires translating our well-established information skills into the context of data management, as they remain invaluable in areas related to searching for data, understanding and respecting copyright, promoting data sharing, and standards-based description of data (Cox 2024).

ETHICAL ISSUES

Whether we are looking at data literacy or AI literacy, we should deal with varied ethical issues. We must be attentive to ethical questions, tied to the discussion of various topics such as privacy, perpetuation of bias and social impact.

Caring for this in many is often the responsibility of libraries and librarians. They should be increasingly involved in educating users to understand that the ubiquity and opacity of algorithms is *„a wicked problem for information professionals who aim to promote equitable access, informed citizenship and the preservation of public memory"* (Lloyd 2019, p. 1480).

Besides, deploying AI systems may go beyond knowledge and skills and raises questions about ethical implications, such as the issue of algorithms, described by many as black boxes because their operation is not transparent in many ways. Because of this, it is difficult to use them to analyze phenomena, and drawing the boundaries of their decision-making mechanisms is a challenging task (Lloyd 2017). We can therefore agree with Thomas, Nafus and Sherman's argument (2018, p. 1) that algorithms are powerful *„because we invest in them the power to do things. With that promise, they can turn the ordinary, such as snapshots along a robot vacuum cleaner's route, into something much more, such as a clean home"*.

Citizens' worldviews are constantly being shaped by the consumption of vast amounts of data that shape our views and influence our decisions. Therefore, we need to educate people to read, understand and analyze data (Raffaghelli and Stewart 2020).

CONCLUSION

When discussing the characteristics of the two main areas, i. e. data literacy for research and its "twin brother" that is data literacy for citizens revolve around the understanding and appreciation of diverse knowledge. The third member of this family is AI literacy, which promises to open the door to the application of artificial intelligence. All of these efforts must include a basic understanding of the appropriate learning processes and skills, drawing on technologies, skills and competences, coupled with the knowledge and understanding, evaluation and critical appraisal of ideas involved. All in all, the continuum of these literacies promises intriguing developments in the data-driven world and – last but not least – libraries.

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