

Editorial. Facets of data literacy: Advancing the field through interdisciplinary lenses

Editoriale. Diversi aspetti dell'alfabetizzazione dei dati: i progressi nel campo osservati attraverso lenti interdisciplinari

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Digital data has consolidated as the fuel of technological development. The commercialisation of Large Language Models and Generative Artificial Intelligence has led to a massive adoption of Artificial Intelligence applications by the general public, bringing data literacy to a prominent position in the public debate. In this data-driven economy and society, academia and industry have to collaborate to meet the needs of a data-literate workforce (León et. al., 2020). Moreover, data literacy is also a powerful enabler of civic engagement, as it empowers individuals and communities to keep governments transparent and accountable, tackle local issues, and navigate their own data ecosystems. In this regard, it is also essential support for the wide exploitation of open data and open government resources. Nonetheless, the data-driven practices have led to critical situations, injustice, and concern in several areas of human activity, from the public to the private sector.

The growing availability of data and the increasing incentives to use it, in fact, have brought about a rising concern known as data literacy. This concern is strongly driven by the fact that many individuals lack the necessary skills to effectively utilise the available data, as well as the necessary competencies to make ethical and responsible use of such data. This special issue contains papers supporting this notion, emphasising that data literacy encompasses not only the ability to work with data but also the ability to understand its use and value within different contexts, including areas like citizen science and digital civic engagement.

While there has been an increase in research on data literacy in recent years, much of the existing research is confined to specific disciplinary areas such as research data, and there is still a relative neglect of the civic and citizen context (Yousef, Walker, & León-Urrutia, 2021). Simultaneously, data

has increasingly become a part of citizens' lives through the presence of algorithms, machine learning, and the potential for artificial intelligence. Hence, this special issue has aimed to gather papers that explore the possibilities of comprehensive multidisciplinary research on the societal implications of data literacy, its significance, and how it can be effectively fostered.

In fact, the concept of data literacy, as the educational activity aimed at developing understanding and skills relating to such dimensions of our societies, spots the contextual and diversified nature of data practices in response to or reaction to metrics, quantification, and algorithms. The research on the topic has highlighted the existence of practices of participation linked to data appropriation to express cultural diversity, civic empowerment, and hence social and economic innovation. Instead, another strand of research is particularly focused on uncovering algorithmic bias, unstructured data usage, and the search for data justice. From these diversified strands of research, there emerges a clear need to embrace interdisciplinary discussion and collaboration in order to explore and expand the concept and practice of data literacy. Specifically, teachers and educators at all levels of the schooling system, including higher education and lifelong learning, are called to transform their practice through the introduction of data literacy as a contextualised and complex perspective on an emerging technological revolution in contemporary society.

To this aim, the focus of this special issue was to gather research that deals with data literacy as an emerging topic, and an area of knowledge and practice that requires reflection, discussion and transformative action. To that end, we highlight the relevance of building understanding on the basis of empirical research as a perspective on a complex and emerging social problem. Specifically, we called for contributions referring to research dealing with conceptual competence frameworks or models, applying constructs, and/or catering to practical cases showing the benefits of different data literacy experiences for different target groups across lifelong learning.

We collected four relevant research articles, which bring to the fore the polysemy embedded in the concept of data literacy, as well as the multiplicity of practices it can generate.

Data literacy is not a crucial competence only in Higher education contexts, it is more and more important to promote the introduction of these competences at an earlier stage. In the paper of Havzi, Tonnini, Mauro and Taibi (2023) the importance of developing data literacy in secondary schools has been investigated through the lens of the experiences acquired in the implementation of the two European funded projects. These projects named Data Literate and Dalfys aimed to provide teachers and students with the appropriate tools to face the challenges in introducing data literacy in secondary schools. The two projects analysed how data literacy is perceived by teachers and students, and the results presented highlight the significant interest toward this topic as well as the need of having specific educational intervention and pedagogical models that include data literacy. In these projects the perception of data literacy from the teacher's perspective was also analysed. The results highlighted the need of developing data literacy competences in educators for preparing them to face the challenges of promoting educational activities related to data driven contexts.

In this perspective, Ranieri, Biagini, Cuomo, and Gabbi (2023) delved into data literacy as educators' relevant competence. Their study explores undergraduate educators' perceptions of effectiveness and relevance for a specific module on data literacy. Nevertheless, they move forward from technical perspectives of data, attempting to cultivate a critical-reflective sensitivity towards data among the educators and explore their understanding of statistics within the educational practice. To achieve these goals, they administered a customised questionnaire to 123 educators who actively participated in the training course. The questionnaire served as a tool to gather their insights and opinions. In actuality,

the study's findings showed that the educators highly valued the intervention in terms of its educational content and thematic relevance. However, there were suggestions for improvement in the dimensions of interdisciplinarity and interactivity, indicating potential areas for future enhancement. Regarding the educators' perceptions of data-based knowledge, particularly statistics, a cautious optimism emerged. The findings revealed that there was an openness towards the potential of quantitative data to contribute to understanding reality. It was also evident that the educators did not idealise statistics as the sole source of knowledge, recognising its limitations and the need for a broader perspective. In conclusion, this research study identifies two relevant findings by highlighting the importance of cultivating critical-reflective sensitivity towards data and acknowledging the potential contribution of statistics in educational contexts. The study also underscores the need for further interdisciplinary approaches and enhanced interactivity in similar training initiatives.

Loría-Solano, Guitert, and Raffaghelli (2023) focused on the role of data literacy in promoting citizens' engagement with open data. The researchers conducted a systematic review of existing literature to gain insights into the importance of data literacy and its relationship with the barriers to using open data. The study identified 66 relevant articles through a comprehensive screening process. The researchers employed a keyword mapping technique to analyse these articles and conducted coding and quantitative analysis to extract meaningful findings. Their objective was twofold: first, to understand the role of data literacy among various barriers to using open data; and second, to explore activities related to open data that facilitate informal learning and the development of critical data literacy. The findings of the study revealed that limited data literacy hampers the effective use of open data. However, the researchers also observed that engaging in activities related to open data presents valuable opportunities for citizens to enhance their technical data literacy. This, in turn, enables them to better comprehend and interact with data-driven decision-making processes. Despite the positive aspects, the study highlighted a gap in the literature concerning critical data literacy as a crucial driver for the strategic and transformative use of open government data. The researchers emphasised the need for greater attention to cultivating critical data literacy skills among citizens, as it plays a vital role in leveraging the full potential of open data. Overall, this research study serves as an important foundation for designing lifelong learning interventions that aim to foster open data literacy among individuals, encouraging their active engagement with open data resources.

Lifelong learning and data literacy in adult education are also central in the paper of Zlatkovski, Temjanovski, and Chabukovski (2023). This paper is a position paper, not based on formal research, that proposes a Data Literacy Framework to support the process of bridging the gender gap in Western Balkans among women entrepreneurs. To succeed in today's data-driven economy, women entrepreneurs need data skills and digital skills to unlock opportunities and grow businesses. The focus of any successful business in modern economies is how to equip women with suitable data and digital literacy so they can pursue careers in the digital economy, to contribute to the digital transformation of the economy and the public sector, especially in the Western Balkans developing countries. The proposed Data Literacy Framework should be used as an instrument to devise public policy measures for providing education and training opportunities, design customised data literacy upskilling for women entrepreneurs, implement career guidance services, promote the role of the women in the digital economy, and provide support for more effective deployment of various concepts of the digital society.

The studies in this issue highlight the relevant role data literacy plays in promoting citizens' and educators' engagement in a data-driven environment. Limited data literacy hampers the effective use of data relating to educational contexts. However, these studies also underline that engaging in formal

or informal activities related to data literacy can enhance basic skills. In Havzi et al., authors explore the challenges for increasing the awareness of teachers and students in secondary schools towards the needs of data literacy competences, according with the vision of a new conceptualization of data literacy integrating conceptions, competencies and contexts through a holistic and context-oriented framing of data literacy for researchers and educators (Gebre, 2022). In Loría-Solano et al., informal engagement with open data supports technical data literacy and improves citizens' understanding and interaction with data-driven decision-making processes. These findings are consistent with existing literature in this topic (Santos-Hermosa, Quarati, Loría-Soriano, & Raffaghelli, 2023). Ranieri et al. show how engaging with statistical data makes the educators feel more optimistic about the role of data in their profession while also being cautious about abuses and misuses of data, confirming the findings of previous studies in related fields (Louie, 2022). Zlatkovski et al., move the focus on gender gap with particular respect to women entrepreneurs for what it concerns data and digital skills in general, and a new competence framework on data literacy is needed to reduce the gap of limited digital literacy that constitutes an obstacle for women entrepreneurs in accessing business development (Oggero, Rossi, & Ughetto, 2020).

All studies, though, concur that critical data literacy is an essential driver for the strategic and transformative use of data in different contexts from secondary school to enterprises. Moreover, these studies highlight the importance of interdisciplinary approaches and enhanced interactivity in training initiatives related to data literacy. There is a need for ongoing improvement to ensure that educational interventions effectively address the needs of educators and citizens. Overall, these findings contribute to an understanding of data literacy's importance, the challenges associated with it, and the potential for cultivating critical data literacy skills among both citizens and educators. The studies provide insights that can inform the design of lifelong learning interventions and training programs aimed at enhancing data literacy and promoting active engagement with data knowledge and resources.

In the contemporary era, an interdisciplinary approach becomes imperative, particularly with the surge of recent advancements in Artificial Intelligence that has directed attention toward novel tools and their integration into daily life. However, the embrace of these technologies remains a topic of controversy across various contexts. On one hand, the use of Artificial Intelligence applications is deemed indispensable for managing complex tasks; conversely, it is perceived as a looming threat to human creativity, giving rise to dystopian scenarios where humanity succumbs to machines. Regarding the cultivation of data literacy competences in lifelong learning settings, leveraging recent artificial intelligence-based tools can prove beneficial for both educators and learners. Nevertheless, it is crucial to heighten awareness regarding the limitations and potential pitfalls associated with these technologies, achieved through the implementation of an interdisciplinary competence framework.

References

- Gebre, E. (2022). Conceptions and perspectives of data literacy in secondary education. *British Journal of Educational Technology*, 53(5), 1080-1095.
- Havzi, S. Tonnini, B., Mauro, A. N., & Taibi, D. (2023). Bringing data literacy competencies in secondary schools. *Italian Journal of Educational Technology*. Accepted Manuscript Online. <https://doi.org/10.17471/2499-4324/1316>
- León-Urrutia, M., Taibi, D., Pospelova, V., Splendore, S., Urbsiene, L., & Marjanovic, U. (2020). Data Literacy: An essential skill for the industry. In *Industrial Innovation in Digital Age* (pp. 326-331). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-030-97947-8_43
- Loría-Solano, E., Guitert Catasús, M., & Raffaghelli, J. E. (2023). (Open) Data literacy: Which relationships with open data adoption? A systematic review of the literature. *Italian Journal of Educational Technology*. Accepted Manuscript Online. <https://doi.org/10.17471/2499-4324/1303>

- Louie, J. (2022). *Critical data literacy: Creating a more just world with data*. Technical Report. National Academies of Sciences, Engineering, and Medicine.
- Oggero, N., Rossi, M. C., & Ughetto, E. (2020). Entrepreneurial spirits in women and men. The role of financial literacy and digital skills. *Small Business Economics*, 55, 313-327. <https://doi.org/10.1007/s11187-019-00299-7>
- Ranieri, M., Biagini, G. Cuomo, S., & Gabbi, E. (2023). 'At the tip of data...': Developing data literacy in educators' professional development. *Italian Journal of Educational Technology*. Accepted Manuscript Online. <https://doi.org/10.17471/2499-4324/1304>
- Santos-Hermosa, G., Quarati, A., Loría-Soriano, E., & Raffaghelli, J. E. (2023). Why does open data get underused? A focus on the role of (open) data literacy. In J. E. Raffaghelli, A. Sangrà, (Eds.), *Data Cultures in Higher Education. Higher Education Dynamics*, 59. Cham, CH: Springer. https://doi.org/10.1007/978-3-031-24193-2_6
- Yousef, A. M. F., Walker, J. C., & León-Urrutia, M. (2021). Defining data literacy communities by their objectives: A text mining analysis. In *Companion Publication of the 13th ACM Web Science Conference 2021 (WebSci '21 Companion)*. Association for Computing Machinery, New York, NY, USA, 26-33. <https://doi.org/10.1145/3462741.3466663>
- Zlatkovski, D., Temjanovski, R., & Chabukovski, V. (2023). Data literacy ecosystem development framework: Approach for bridging the gender gap in the digital economy of the Western Balkan countries. *Italian Journal of Educational Technology*. Accepted Manuscript Online. <https://doi.org/10.17471/2499-4324/1300>