

Empowering Compulsory Education Through Data Literacy with the DATA-READY Project

Apostolos Kostas¹, Vasilios Paraschou¹, Stavros Pitsikalis², George Kritikos²,
Filippos Tzortzoglou¹, Ilona-Eleftryja Lasica², Nefeli Dimopoulou³
apkostas@aegean.gr, bparaschou@aegean.gr, spitsikalis@aegean.gr, gkritikos@aegean.gr,
filippostz@aegean.gr, e_ilona@aegean.gr, nefeli@idec.gr

¹Department of Primary Education, University of the Aegean

²Department of Preschool Education Sciences and Educational Design, University of the Aegean

³IDEC Training Center

Abstract

The DATA-READY project focuses on integrating Data Literacy (DL) into compulsory education across Europe. Recognising DL as a vital 21st-century skill, closely linked to digital, scientific, and AI literacies, the project addresses the current gap in curricula. It proposes a comprehensive European Data Literacy Framework (DLF) to guide teaching and assessment, support teacher training, and promote interdisciplinary learning. Spanning from 2025 to 2028, project activities involve mapping existing practices, piloting with students, and formulating policy recommendations in partner countries (Greece, Cyprus, Germany, Portugal, Poland). By equipping educators and students with critical data skills, DATA-READY aims to foster informed, ethical, and data-literate citizens.

Keywords: competence framework, data-driven education, data literacy, data methods in education

Introduction

In a world where data influences nearly every aspect of daily life, the ability to understand, analyse, and effectively use data has become an essential skill. Data Literacy (DL) is now regarded as a vital component of overall literacy, representing a new dynamic scientific field closely linked to advances in ICT, Computational Thinking, and STEAME, and is recognised as a fundamental part of other technology-related literacies.

Recent studies and educational frameworks, including DigComp 2.2, highlight the need for comprehensive digital competencies, including DL, to prepare students for the challenges of the 21st century. However, despite its importance, DL is not yet systematically integrated into the curricula of compulsory education across many European countries. Traditional curricula often focus on basic literacy and numeracy, leaving a significant gap in teaching data-related skills.

Recognising the importance of DL, several international organisations and educational bodies have underlined the need to embed DL into curricula and teacher training programmes. Nonetheless, the implementation of DL education remains inconsistent and patchy across different countries and educational systems. The project DATA-READY (Empowering Education through Data Literacy Integration in Compulsory Education) aims to bridge this gap by developing a comprehensive framework for data literacy in compulsory education (primary and lower secondary) and strengthening teachers' ability to foster these skills in their students. By focusing on the foundational years of education, the project aims to equip future generations with the essential competencies needed to navigate the data-rich world they will face, aligning with the priorities outlined in the Digital Education Action Plan 2021-2027.

Data literacy

According to Wolff et al. (2016), DL is a core skill for navigating the modern information landscape, where data-driven decision-making is increasingly common. DL includes understanding how data is collected, processed, and analysed, as well as being able to evaluate its credibility and relevance (D'Ignazio & Bhargava, 2016). The importance of DL extends beyond technical fields, as it is a fundamental competency for informed decision-making in everyday life, from interpreting news articles to managing finances. Moreover, DL is framed as a cross-disciplinary competency, integrating subjects like mathematics, computer science, and social sciences. The key components of DL include understanding the sources of data and methods of collection (*Data Collection*), applying statistical and analytical techniques (*Data Analysis*), drawing meaningful conclusions from the data (*Data Interpretation*), and presenting data in an understandable and actionable manner (*Data Communication*).

DL, scientific literacy, digital literacy, learning analytics, data science, and citizen science are interconnected concepts, each playing a vital role in the modern digital environment, with DL being the fundamental skill to work with data at a basic level.

- **AI Literacy:** UNESCO highlights DL as a fundamental skill for understanding and engaging with AI technologies. By teaching DL, educators can empower students to critically evaluate AI systems, identify biases, and responsibly manage data in an increasingly AI-driven world (UNESCO, 2022).
- **Scientific Literacy:** DL enhances scientific literacy by enabling individuals to critically interpret scientific data, assess research findings, and draw evidence-based conclusions (Qiao et al., 2024).
- **Digital Literacy:** While digital literacy emphasises the ability to utilise digital technologies effectively, DL is a more specialised skill set, as it complements digital literacy by enabling individuals to navigate and critically evaluate digital data. DL is regarded as a crucial component of digital literacy (Hallam et al., 2018).
- **Learning Analytics:** DL acts as the initial step towards mastering learning analytics, ensuring that individuals can interpret data, draw meaningful conclusions, identify trends, and make informed decisions (Mandinach & Abrams, 2022).
- **Data Science:** Executive scientists, with the help of advanced DL techniques, combine principles and practices from the fields of mathematics, statistics, programming, AI, and computer engineering to analyse large datasets (Pedersen & Caviglia, 2019).
- **Citizen Science:** Citizen science projects depend on volunteers (non-expert individuals) being able to handle data accurately and responsibly (Bonney et al., 2014) and provide meaningful insights into scientific studies.

Moreover, despite its importance, DL is not consistently included in school curricula worldwide, as it requires a comprehensive approach that addresses the interdisciplinary nature of the field, ethical considerations, and assessment challenges. Various challenges exist in integrating DL into compulsory education (Donate-Beby et al., 2025; Nwagwu, 2025), such as lack of specialised TPD programmes, systemic integration of DL into the curricula, promotion of interdisciplinary collaboration, support for open access and collaboration initiatives, improved technological infrastructure, and reliable research and evidence. Several strategies can be employed to integrate DL into educational curricula effectively, such as:

- Dedicated courses on DL can provide students with a comprehensive understanding of DL skills on topics such as data collection, analysis, visualisation, and ethics.
- Incorporation of DL into mathematics, science, and social studies.

- Encouraging students to engage in projects that require data collection and analysis, involving real-world scenarios, surveys, etc.
- Providing teachers with training and resources on DL. Workshops, online courses, and professional learning communities can help teachers in teaching DL concepts.
- Utilising technology (spreadsheets, data visualisation tools, coding platforms, etc.) can make DL more accessible to students.
- Open data initiatives can provide students with real-world datasets.
- Promoting data ethics, where students discuss issues related to privacy, bias, misinformation, and ethical dilemmas in using data.

The DATA-READY project

DATA-READY is based on the belief that fostering DL from an early age promotes critical thinking, problem-solving, and informed decision-making, empowers students in both personal and professional contexts, enables them to prepare better to engage in democratic processes, understand complex issues, and support evidence-based policymaking. The project aims to create a comprehensive, structured framework for DL education, by *defining key domains, learning outcomes, and skill progressions* to help teachers effectively integrate DL into their classrooms. Recognising the pivotal role of educators, the project will also *enhance teacher training and professional development* to build their capacity in delivering DL instruction. Using a collaborative, transnational approach, DATA-READY will *promote knowledge exchange, best practices, and support for evidence-based educational policies*. It will *develop, test, and implement a new policy model* to strengthen DL skills in primary and early secondary education. By equipping educators with effective tools and clear guidance, DATA-READY will support the integration of DL into curricula, advancing digital skills and contributing to a robust digital education ecosystem in partner countries (Greece, Cyprus, Germany, Portugal, Poland) and, ultimately, across Europe.

Key activities include:

- Mapping current DL strategies and practices: during the project, partners will conduct a comprehensive mapping of existing DL strategies, policies, and practices in national curricula across partner countries.
- Designing a European DL Framework (DLF): based on this analysis, the project will develop the European-wide framework defining domains, learning outcomes, and progressions for DL skills in compulsory education. The framework will provide a comprehensive, structured approach to developing core DL competencies among primary and secondary school students. It will outline essential skills, proficiency levels, performance indicators, and implementation guidelines for utilising DL into curricula. DLF will also include supporting resources for educator training, evaluation methods, and governance structures to ensure its relevance and sustainability.
- Building teacher capacity and pilot: next step will be the capacity building of teachers and the experimentation phase with students in schools.
- Formulating evidence-based policy recommendations: based on the experimentation results, the project will propose evidence-based policy recommendations for transferability and sustainability of data literacy education strategies. The planned research, analysis, and experimentation phases will generate evidence-based insights and recommendations to inform policy making on data literacy education at national and European levels

Conclusion

DL is an essential competence for the 21st century, intersecting with scientific and digital literacies. Although not yet included in curricula, by embedding DL across subjects, utilizing project-based learning, and training educators, educational institutions can prepare students to navigate the data-driven landscape. In this context, the DATA-READY project, based on evidence-based research, will propose educational policies that will prioritize the integration of DL in compulsory education.

Contributors (Project partners)

Bastian, J., Batsi, Z., Bidarra, G., Biniari, L., Fernandes, J., Frangou, S., Höfer, M., Kazantzidou, N., Krein, U., Makrides, G., Makrides, L., Margariti, E., Matilde, C., Michael, M., Mouzakis, C., Owczarz, M., Papageorgiou, E., Paparistodemou, E., Papke, L., Silva, J., Solarz, P., Spyrou, S., Szemberg, T., Szpond, J., Vaz-Rebelo, P., Wójcik, D., Xronopoulou, K., Ziontaki, Z.

Acknowledgement

This work was funded by the European Commission, under project DATA-READY (Empowering Education through Data Literacy Integration in Compulsory Education), ERASMUS-EDU-2024-POL-EXP-DIGITAL, No. 101195801.

References

- Bonney, R., Shirk, J. L., Phillips, T. B., Wiggins, A., Ballard, H. L., Miller-Rushing, A. J., & Parrish, J. K. (2014). Next steps for citizen science. *Science*, 343(6178), 1436-1437. <https://doi.org/10.1126/science.1251554>
- D'Ignazio, C., & Bhargava, R. (2016). DataBasic: Design principles, tools and activities for data literacy learners. *Journal of Community Informatics*, 12(3), 83-107. <https://doi.org/10.15353/joci.v12i3.3280>
- Donate-Bebby, B., García-Penalvo, F. J., Amo-Filva, D., & Aguayo-Mauri, S. (2025). Filling the gap in K-12 data literacy competence assessment: Design and initial validation of a questionnaire. *Computers in Human Behavior Reports*, 17, 100583. <https://doi.org/10.1016/j.chbr.2024.100583>
- Hallam, G., Thomas, A., & Beach, B. (2018). Creating a connected future through information and digital literacy: strategic directions at the University of Queensland Library. *Journal of the Australian Library and Information Association*, 67(1), 42-54. <https://doi.org/10.1080/24750158.2018.1426365>
- Mandinach, E. B., & Abrams, L. M. (2022). Data literacy and learning analytics. In C. Lang, G. Siemens, A. Friend Wise, D. Gašević, & A. Merceron (Eds.), *Handbook of learning analytics* (pp. 196-204). SoLAR. <https://doi.org/10.18608/hla22>
- Nwagwu, W. E. (2025). Citation analysis of global research on data literacy. *Education and Information Technologies*, 1-29. <https://doi.org/10.1007/s10639-025-13397-9>
- Pedersen, A. Y., & Caviglia, F. (2019). Data Literacy as a Compound Competence. In T. Antipova, & A. Rocha (Eds.), *Digital Science* (vol. 850, pp. 166-173). Springer. https://doi.org/10.1007/978-3-030-02351-5_21
- Qiao, C., Chen, Y., Guo, Q., & Yu, Y. (2024). Understanding science data literacy: a conceptual framework and assessment tool for college students majoring in STEM. *International Journal of STEM Education*, 11(25), 1-21. <https://doi.org/10.1186/s40594-024-00484-5>
- UNESCO (2022). K-12 AI curricula-A mapping of government-endorsed AI curricula. UNESCO Education Sector. <https://doi.org/10.54675/ELYF6010>
- Wolff, A., Gooch, D., Montaner, J. J. C., Rashid, U., & Kortuem, G. (2016). Creating an understanding of data literacy for a data-driven society. *The Journal of Community Informatics*, 12(3), 9-26. <https://doi.org/10.15353/joci.v12i3.3275>