



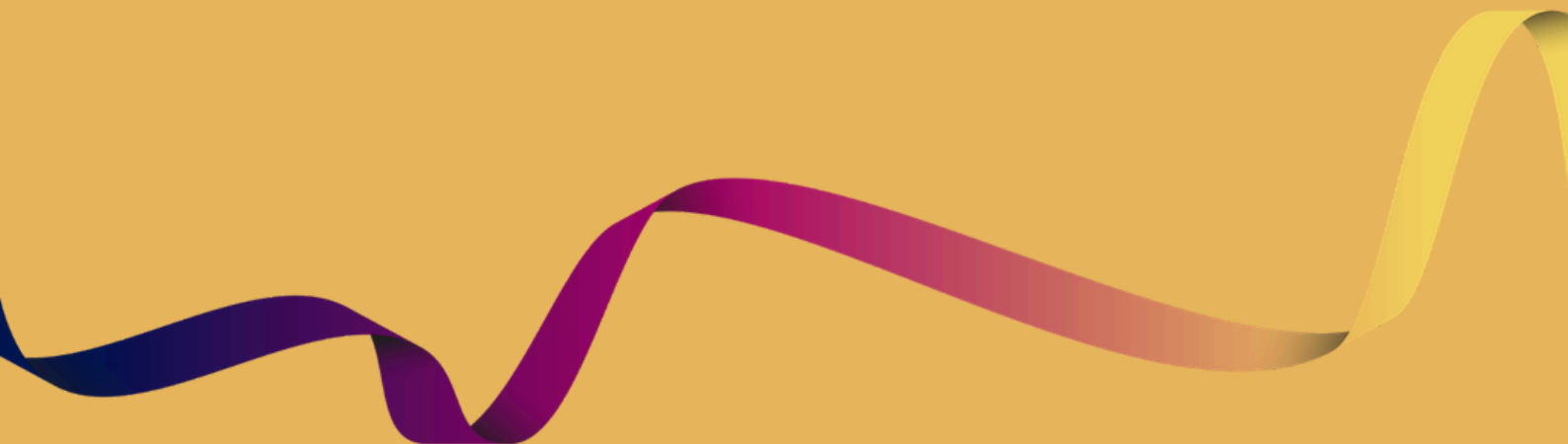
Centre for Teaching Excellence
Ionad Sàr-mhathais ann an Teagasg

Introduction to Data Literacy

Research Brief

Dr Serdar Abaci

Digital Education and Artificial Intelligence (AI)



Introduction to Data Literacy

Introduction

Data plays an increasingly important role in education and everyday life. Teachers and learners encounter data through classroom activities, assessments, digital platforms, media, and online services. Data also underpins many digital and AI-enabled systems that shape how information is presented and how decisions are made. These developments make it essential for learners to understand not only how to work with data, but how to interpret, question, and use it responsibly (Ridsdale et al., 2015).

Data literacy goes beyond technical skills such as reading graphs or calculating averages. It includes understanding where data comes from, recognising its limitations, and considering how it is used to support claims or decisions (Witte et al., 2024). These skills can help learners engage critically with data and data-based claims encountered through social media, digital platforms, news sources, and other everyday contexts. For learners, data literacy is closely linked to critical thinking and informed participation in society. For teachers, related work on “data literacy for teaching” concerns the use of education-related data to inform professional judgement (Schreiter et al., 2024; Mandinach & Gummer, 2016).

This brief focuses on teaching data literacy to learners, drawing on research relevant to primary and secondary education in Scotland.

Definitions

Data literacy refers to the ability to interpret, analyse, and communicate with data (Deahl, 2014; Dunn et al., 2017). It includes identifying patterns, explaining findings, and asking critical questions about how data is collected, represented, and interpreted (Calzada Prado & Marzal, 2013).

For children and young people, data literacy develops progressively. It may begin with collecting and sorting simple data and grow into interpreting more complex datasets, questioning reliability, and considering fairness or bias.

Data literacy for teaching refers to teachers’ capacity to work thoughtfully with education-related data to support teaching and learning (Schreiter et al., 2024). It involves organising and interpreting evidence and using it to inform instructional decisions (Mandinach & Gummer, 2016). While important, this brief concentrates on developing data literacy among learners.

Why is Data Literacy important?

Data now shapes how information is presented and how decisions are justified. Learners encounter data through news, social media, digital platforms, and classroom activities such as scientific investigations, surveys, geographical enquiries, and data-handling tasks in mathematics (Pangrazio & Selwyn, 2019). Supporting learners to engage critically with data is therefore increasingly important.

A small but growing body of empirical classroom-based research suggests that meaningful engagement with data can support learners' reasoning and communication. Studies in primary and secondary classrooms show that when learners interpret data, discuss patterns, and justify claims, they strengthen their ability to evaluate evidence and explain their thinking (Leavy & Hourigan, 2015a; Frischemeier, 2020). These activities can also support higher-order thinking and oracy through discussion, reasoning, and justification (Kim et al., 2026). These studies focus on learning processes rather than large-scale attainment outcomes, but they suggest that structured discussion and reflection are central to effective data learning.

Research on data literacy education remains limited, particularly in terms of longitudinal studies examining outcomes over time. Some classroom-based and design-oriented studies, including those reported in the *Symposium on Integrating AI and Data Science into School Education Across Disciplines*, explore how task design and teacher guidance support learners' interpretation and sense-making (Farrell, 2025; Olari, 2025). These studies analyse learning processes rather than achievement gains, offering insight into how data literacy activities can be designed.

There is also relevant evidence from research on statistical literacy, especially in secondary education. Intervention studies indicate that focused teaching sequences can improve students' understanding of data and statistics and increase confidence in applying these ideas to real-world contexts (Koga, 2024). This is particularly relevant in subjects such as Modern Studies and Geography, where learners regularly work with real-world data and evidence. Reviews further emphasise the importance of helping learners question what data represents, what may be missing, and how conclusions are formed (Gebre, 2022, Lee et al., 2024).

Early experiences also matter. Conceptual work suggests that introducing data-related ideas in primary education can lay foundations for later statistical reasoning (Gould, 2017). Classroom-based studies indicate that working with simple and meaningful data supports children's ability to notice patterns and justify explanations (Leavy & Hourigan, 2015a). Design-based research with younger learners highlights the value of tangible representations, such as physical materials, in supporting engagement and discussion (Bilstrup et al., 2022). However, robust long-term empirical research remains scarce.

In Scotland, the importance of data-related skills is recognised across Curriculum for Excellence, particularly within mathematics, literacy, technologies, and social studies (Robertson et al., 2023a). National skills report also point to increasing demand for data competencies (Scottish Skills Development, 2019). Together, these developments provide a strong rationale for embedding data literacy across subjects.

Overall, although the research base is still developing, existing evidence suggests that teaching data literacy can support learners' reasoning, critical engagement with evidence.

What might Data Literacy look like in classroom practice?

Research consistently shows that data literacy is most effectively developed when it is embedded in everyday classroom practice rather than taught as a separate topic (Gebre, 2022; Ghodoosi et al., 2024). In Scotland, this aligns with Curriculum for Excellence, particularly its focus on breadth, progression, and skills for learning, life, and work. When integrated across subjects, data literacy helps learners make sense of information and reflect on evidence (Robertson et al., 2023a).

Effective classroom practice goes beyond teaching technical skills alone. Research emphasises the importance of supporting learners to collect, interpret, question, and communicate data, as well as to reflect on how data is used in real contexts. Data literacy develops over time, with learners revisiting key ideas and practices at increasing levels of complexity as they progress through stages (Gould, 2017; Wolff et al., 2019).

Importantly, developing data literacy does not rely on advanced technologies or specialist tools. Research indicates that meaningful learning with data is supported through purposeful questioning, discussion, and reflection. Teachers do not need specialist IT skills to support data literacy, and learners can engage with data through a wide range of everyday classroom activities. By embedding data literacy within existing curriculum areas, teachers can help learners build confidence and strengthen their critical thinking skills (Ghodoosi et al., 2024).

Primary School (P1-P7): (Age 5-11)

In primary classrooms, data literacy is often introduced through simple, familiar, and meaningful contexts that connect to children's everyday experiences. Research suggests early data literacy should focus on concrete activities, discussion, and reflection rather than abstract analysis (Leavy & Hourigan, 2015b; Frischmeier, 2020).

Cross-curricular approaches

At primary level, data literacy can be embedded across learning through activities such as:

- collecting class data (for example favourite books, playground use, or travel to school),
- recording observations during topic work (such as weather, plant growth),
- representing information using tallies, charts, pictograms, or simple graphs.

Teachers can also make use of physical or hands-on ways of representing data, such as using blocks, LEGO, beans, or recycled materials to create graphs. These approaches help learners understand data by making it concrete, visible, and easier to discuss.

Such activities support learners to ask questions like “What does this data show?”, “What is the same or different?”, and “What might explain this pattern?”. Studies emphasise the importance of classroom talk at this stage, with learners encouraged to describe what they notice and to justify their ideas using evidence (Leavy & Hourigan, 2015a).

These approaches align closely with Curriculum for Excellence outcomes in numeracy, health and wellbeing, social studies, and sciences, while also supporting literacy through discussion and explanation.

Secondary School (S1-S6): (Age 11-16)

In secondary education, data literacy can be developed through more complex data, deeper inquiry, and critical engagement, building on learners’ earlier experiences. Research and reviews in secondary education argue that learners benefit from opportunities to work with authentic data and to explore how data is used across subject areas and real-world contexts (Gebre, 2022). Alongside this, classroom-based case studies illustrate how integrating data into subject teaching can support learners’ engagement with evidence and reasoning (Bussani & Comici, 2023).

Subject-specific approaches

In the sciences, data literacy is closely linked to investigation and evidence. Learners collect and analyse experimental data, consider reliability, and discuss uncertainty or limitations. Research shows that explicit discussion of how data supports, or does not support, conclusions strengthen learners’ understanding of scientific reasoning (Koga, 2024; Kaur et al., 2025).

In mathematics, learners can work with larger datasets, explore variation, and interpret graphs and tables critically. Data literacy-focused practice encourages learners to explain what results mean and how conclusions might change with different data or assumptions, rather than focusing only on procedures (Koga, 2024).

In social subjects, data literacy supports learners to interpret population data, economic indicators, or survey results, and to evaluate how data is used in policy debates or media reporting. Learners may also develop data literacy by designing and conducting their own surveys,

providing opportunities to consider how data is collected, represented, and interpreted. In literacy and English, learners can analyse how data is used rhetorically in texts such as news articles, reports, and digital media. Research highlights the importance of supporting learners to identify misleading representations, selective use of data, or unsupported claims (Gebre, 2022).

Challenges and considerations

Teachers face practical challenges in developing data literacy. Many teachers have had limited opportunities to explore data literacy during initial teacher education or professional learning, and the area may feel unfamiliar.

Time pressures also matter. Data literacy is more sustainable when embedded within existing lessons and curriculum areas rather than treated as an additional topic or standalone initiative. Starting with small adaptations, such as adding discussion around data interpretation, can be effective.

Access to appropriate data is another consideration. Real-world data can be engaging but complex. Teachers may need support in selecting age-appropriate examples and identifying datasets that are relevant across different curriculum areas.

Ethical issues, including privacy and representation, are also relevant. These can be addressed in age-appropriate ways and help learners understand that data represents people and experiences.

Next steps

Developing data literacy is a gradual process. Practical starting points include:

- Embedding discussion of data interpretation within existing lessons.
- Using familiar contexts and classroom-generated data.
- Sharing ideas and co-planning with colleagues.
- Engaging in enquiry-based professional learning.

When connected to broader aims such as critical thinking, citizenship, digital literacy, and equity, data literacy becomes a natural part of teaching rather than an additional demand.

Reading resources

- **Robertson et al. (2023b) - [Teach Data Literacy: A Guide for Primary Teachers](#)**
A practical and accessible guide offering classroom ideas and prompts for teaching data literacy in primary settings.

- **Yates and Carmi (2022) - [Developing Citizens' Data Literacy: A short guide](#)**
Provides examples and discussion points related to data literacy, ethics, and citizenship.
- **Gebre (2022) – [Conceptions and perspectives of data literacy in secondary education](#)**
A useful starting point for secondary teachers interested in critical and subject-based approaches to data literacy.

Free resources for primary and secondary teachers

The following free, ready-to-use classroom resources from the [Data Education in Schools](#) project may be useful for teachers supporting data literacy in primary and secondary classrooms.

- [Data 101 videos](#): A set of 11 videos to help primary and secondary teachers understand data literacy better.
- [Teaching primary learners data literacy](#): A short research-informed video by K. Farrell and J. Robertson, exploring approaches to data literacy in primary classrooms.
- [Data literacy live lessons](#): Data-related activities presented through live video.
- [Lesson resources](#): Lots of materials to develop learners' data literacy skills. These are mapped to the Scottish primary and secondary curriculum.

Questions for reflection

The questions below are intended to support reflection on current practice and to help identify opportunities to develop data literacy in the classroom.

- Where do learners in my classroom already encounter data?
- How do current activities support interpretation and questioning, not just calculation?
- What opportunities exist to embed data literacy more meaningfully?
- How do I address uncertainty, bias, or fairness when working with data?
- What ethical considerations should be made explicit?

AI use declaration

Consensus and the Web of Science Research Assistant were used to identify relevant studies. ELM (University of Edinburgh AI platform, GPT-4 based) was used during the final editing stage to reduce word count and improve readability.

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