

Data-informed professional learning

Impact on pupils	Impact on teachers	Strength of evidence
Promising	Promising	Weak

What is it?

In this strand, data-informed professional learning refers to how professional learning is structured to support disciplined engagement with evidence to improve decision-making. It focuses on how teachers and teacher educators use information to understand the needs of individuals, schools, and trusts, and how professional learning helps teachers adopt a more inquiry-oriented approach to their own practice and development. The emphasis is on strengthening professional judgement through structured, shared engagement with evidence.

It is not about training colleagues to operate spreadsheets or management systems. Instead, it treats data use as an inquiry process within professional learning, not as a technical task.

Across the research, this typically involves:

- Beginning with a shared problem or question, rather than starting with whatever data happens to be available.
- Drawing on multiple sources of data, such as assessment information, observation insights, participation patterns in professional learning, or digital traces where relevant.
- Interpreting data through professional judgement, including recognising limits and contextual influences.
- Testing and reviewing decisions over time through structured inquiry cycles.

Because this strand focuses on professional learning design, data-informed PL is usually organised as a collective activity. It often takes place through data teams, collaborative inquiry groups, or structured facilitation that helps colleagues interpret evidence together and act on it over time.

Key findings

Impact on teachers

Across the research, professional learning framed as data-informed professional learning is associated with improvements in teachers' knowledge, skills, and confidence in using evidence to inform instructional decisions. Gains appear strongest where learning is structured and clearly connected to how teachers plan, adapt, and review their teaching.

- Data literacy education shows a strong positive association with teachers' knowledge and skills for using evidence, supporting more systematic instructional judgement rather than reliance on intuition alone.
- Training in data literacy is linked to improvements in knowledge, skills, and self-efficacy, particularly when teachers are given structured opportunities to apply and practise decision processes rather than only receive information. Effects are most visible immediately after training and closely aligned to what was taught.
- Professional development focused on regular, curriculum-aligned information and structured decision routines is associated with moderate gains in teachers' knowledge, confidence, and reported instructional practice, although many studies are conducted in researcher-supported settings.
- Where analytics or structured reflection tools are used to prompt teachers to review and adjust their teaching, reported improvements in self-efficacy and teaching practice are more evident.
- Maintaining ongoing professional development support appears linked to stronger evidence-related skills and more sustained instructional routines than one-off training alone.

A recurring pattern is that collaboration and structured reflection appear to strengthen these outcomes. Active formats that allow teachers to interpret evidence together and test new approaches are often associated with stronger effects than individual or transmissive models.

Evidence for sustained changes in everyday teaching remains weaker than evidence for knowledge and confidence gains. Behavioural outcomes are often inferred rather than independently observed over time.

The research suggests that data-informed professional learning can strengthen teachers' capability and confidence to make instructional decisions. The extent to which these gains embed consistently into long-term teaching practice remains less certain.

Impact on pupils

Evidence for pupil impact is more limited than evidence for teacher outcomes.

- One meta-analysis reports a small but statistically significant positive effect on pupil achievement following structured data-focused professional learning.
- Sustained support that helps teachers adapt instruction using data is also associated with positive academic outcomes, particularly for pupils with identified learning difficulties.

These effects are typically modest and often observed in research-supported contexts rather than routine school settings.

Across most of the wider literature, pupil impact is inferred rather than directly measured. Reviews tend to describe plausible pathways, where improvements in teacher knowledge, confidence, and decision-making may contribute to improved pupil outcomes over time.

The pupil evidence appears promising in specific contexts but remains limited and uneven at system level.

How effective is the approach?

The research presents a consistent but uneven picture. Data-informed PL is most securely evidenced at the level of short-term teacher outcomes, particularly knowledge and confidence. Effects are reported across multiple reviews and include meta-analytic studies, which strengthens reliability at this level.

Confidence decreases when moving beyond capability to sustained professional behaviour. Many studies rely on short-term or training-aligned measures, and follow-up data are limited. As a result, the durability of inquiry routines in everyday school conditions remains less certain.

Evidence for pupil outcomes is comparatively thinner and more context dependent. Where positive associations are reported, they are often modest or observed under research-supported conditions.

Across the strand, effectiveness appears more dependable when evidence use is framed as a structured decision process, supported over time, rather than as technical data handling in isolation. However, there is no single model that emerges as definitively superior. Variation in design, context, and measurement quality continues to shape reported effects.

The approach appears credible as a means of strengthening teachers' inquiry capability. Its impact on sustained behaviour and pupil outcomes remains promising but less secure.

How to implement it well

Stronger implementation appears to depend less on selecting particular datasets or tools, and more on how leaders design and protect the conditions for data-informed PL. Across the research, teacher engagement is stronger where inquiry is framed as a shared, improvement-focused process, rather than a technical routine or accountability mechanism.

A second recurring message is the importance of making the reasoning process explicit. Professional learning appears more meaningful when teachers can see how a question leads to the use of evidence, how that evidence informs professional judgement, and how decisions are reviewed over time, rather than being left to infer these connections.

Finally, several reviews highlight the role of facilitation. Inquiry appears more sustainable where leaders create structured opportunities for collaborative interpretation and adjust support as teachers' confidence develops, rather than relying on one-off inputs.

Behaviours

- **Frame inquiry as collective improvement:** position data-informed PL as developmental and shared, not as surveillance or compliance.
- **Make professional reasoning visible:** model how problems are clarified, how data is weighed, what judgements are made, and how actions are revisited.
- **Design for collaborative sensemaking:** structure dialogue where teachers test interpretations, surface uncertainty, and build shared understanding.
- **Co-define what counts as useful data:** involve teachers in clarifying purposes, agreeing criteria for action, and setting boundaries around interpretation.

Contextual factors

The research suggests that data-informed PL is more likely to take root where it is supported by coherent organisational conditions. Uptake appears shaped less by individual enthusiasm and more by how leadership messaging, infrastructure, and professional norms align around improvement rather than compliance. These influences sit largely at school, trust, and system level.

Key contextual factors include:

- **Leadership narratives about evidence:** How data use is positioned, as professional learning or as accountability, appears to shape trust, openness, and willingness to engage.
- **Conditions for collective learning:** Protected time, shared goals, and aligned expectations across roles appear to support deeper engagement, especially where inquiry is collaborative rather than individual.
- **Access to usable information and systems:** Many studies assume stable data systems and digital platforms. Where infrastructure is fragmented or unreliable, inquiry can feel burdensome rather than enabling.
- **Professional trust and culture:** Previous experiences of evidence being used for judgement may influence whether teachers experience inquiry as developmental or as surveillance.
- **Wider policy pressures:** Accountability frameworks and reform agendas can shape motivation and feasibility, sometimes supporting focus, and sometimes narrowing it.

The evidence indicates that inquiry does not operate in isolation. Its contribution depends on leadership signals, organisational readiness, and system conditions that influence how teachers interpret both the purpose and the risks of engaging with evidence.

Structured but flexible

In data-informed PL, shared frameworks appear to provide coherence, while adaptation allows learning to respond to local priorities and teachers' starting points. At the same time, the research shows that when approached in this way, professional learning can be treated as iterative rather than linear.

Key features of this structured but flexible approach include:

- **Shared inquiry frameworks, adaptable pathways:** Stable cycles or decision models offer common language, while allowing participants to revisit stages rather than follow a fixed sequence.
- **Consistent processes, local interpretation:** Repeatable routines for examining data are often paired with collaborative sensemaking, where conclusions are negotiated rather than prescribed.
- **Sequenced development over time:** Designs tend to move from building understanding towards applying professional judgement, while remaining responsive to variation in confidence and role.

- **Reflection as a core feature:** Structured opportunities to review decisions and revisit assumptions are built into the learning process, supporting adaptation rather than one-off completion.
- **Common reference points, flexible delivery:** Alignment with recognised frameworks provides shared direction, while formats and examples are adjusted to fit local context.

The evidence suggests that inquiry-based professional learning benefits from enough structure to sustain shared understanding, alongside sufficient flexibility to preserve professional judgement and contextual relevance.

Barriers to effective implementation

Barriers to data-informed PL tend to sit less in teacher motivation and more in professional learning design, organisational signals, and the credibility of the wider evidence environment. Five categories recur across studies.

- **Too little time to build practical skill:** Brief or one-off professional learning often helps teachers understand the idea of data-informed PL but does not give them enough practice to use it confidently in real situations. Without ongoing support, early gains in understanding may not translate into consistent changes in day-to-day professional routines.
- **Weak connection between interpretation and decision-making:** Several reviews note that learning can emphasise analysing information while leaving the decision process implicit. Teachers may leave more confident in reading data, but less prepared to translate insight from the inquiry into planned action and review.
- **Uneven capability and confidence:** Variation in baseline knowledge can constrain participation and transfer. Where digital or analytic tools are involved, the challenge often lies in critically interpreting outputs rather than simply accessing them.
- **Trust and legitimacy concerns:** When inquiry is framed as surveillance or compliance, engagement and honest dialogue appear more fragile. Approaches that are perceived as “about teachers” rather than shaped with them may weaken professional ownership.
- **System and ethical constraints:** Many studies assume usable infrastructure and clear governance. Where systems are fragmented, inaccessible, or poorly understood, routines are difficult to sustain. In AI and analytics contexts, ethical knowledge gaps, including concerns about privacy and cyber security among trainee teachers, are identified as a distinct risk.

These barriers help explain why the evidence is stronger for short-term gains in knowledge and confidence than for durable changes in professional behaviour at scale.

Other considerations

Across the evidence, professional learning that includes structured opportunities for shared interpretation is often associated with stronger outcomes, particularly in relation to teachers’ confidence and sense-making. However, the research rarely specifies why these formats are more

influential, or under what precise conditions they outperform alternatives. Structured peer engagement appears promising, but not sufficient in itself.

- **Evidence is largely short term:** Most studies measure outcomes close to the professional learning episode, using tools aligned to the training. There is limited evidence about sustained enactment or wider organisational change.
- **Teacher involvement shapes legitimacy:** Approaches where teachers help interpret evidence or shape inquiry processes are more often described as meaningful than approaches where evidence is analysed “about” them.
- **Confidence mediates use:** Self-efficacy appears to influence whether teachers move from understanding evidence to acting on it. Knowledge alone does not reliably translate into changed professional judgement.
- **Professional capital can be made visible:** Some research explores how participation data and network analysis can be used to understand patterns of collaboration, trust, and engagement within professional learning communities, offering insight into the health of professional capital. This remains exploratory and depends on careful interpretation.

Summary

This strand frames data-informed PL as a feature of professional learning design rather than a technical skill or classroom method. Across the reviewed papers, the focus is on how teachers learn to interpret data, exercise professional judgement, and engage collectively in structured inquiry over time.

The strongest and most consistent evidence relates to teacher outcomes. Professional learning in this area is associated with improvements in teachers’ knowledge, skills, and confidence, particularly where inquiry is sustained, collaborative, and clearly linked to decision-making. Evidence for longer-term changes in professional behaviour, system impact, or pupil outcomes is weaker and more context-dependent.

Across studies, inquiry appears most credible when it supports professional judgement rather than replaces it. Where reasoning is made visible and improvement-focused norms are protected, engagement appears stronger. Where it is framed as compliance or technical monitoring, effects are more fragile.

The research base remains uneven. Many studies rely on short-term measures, limited reporting of design features, and contexts that may not transfer straightforwardly to everyday school settings. Overall, the picture is coherent but tentative: data-informed PL can strengthen teacher capability but claims about durability and downstream impact should be treated with caution.

When citing this strand, please use the following reference:

National Institute of Teaching (2026). NIoT Evidence Toolkit: Professional learning to inform teachers’ use of data strand

References

	Review	Years of research	Focus	# studies	Countries	Impact on pupils	Impact on teachers	Reporting quality
1	Ansyari et al. (2022) A systematic review and meta-analysis of data use professional development interventions. <i>Journal of Professional Capital and Community</i> , 7(3), 256–289.	2009-2019	CPD only	27	Netherlands, New Zealand, Sweden & USA	Positive	Positive	Medium
2	De la Hoz-Ruiz et al. (2024) Learning analytics for enhanced professional capital development: A systematic review. <i>Frontiers In Psychology</i> , 15.	2011-2021	CPD only	77	China, Netherlands, Spain, UK, USA	Not reported	Positive	High
3	Doğan (2022) A Meta-Analysis Study on Data Literacy Education For School Administrators and Teachers.	2006-2021	CPD only	8	Netherlands, USA	Not reported	Positive	Medium
4	Fildermann et al. (2022) Data Literacy Training for K–12 Teachers: A Meta-Analysis of the Effects on Teacher Outcomes. <i>Remedial and Special Education</i> , 47(5), 328–343	1975-2019	ITE & CPD	33	USA	Not reported	Positive	Excellent
5	Gabbi et al. (2023) About or with Teachers? A Systematic Review of Learning Analytics Interventions to Support Teacher Professional Development. <i>Qwerty - Open and</i>	2011-2021	CPD only	31	Australia, Belgium, China, Estonia, Germany, Italy, Netherlands, Rwanda, Singapore, Spain, Sweden, UK, USA	Not reported	Positive	Medium

	<i>Interdisciplinary Journal of Technology, Culture and Education.</i>							
6	Gesel et al. (2011) A Meta-Analysis of the Impact of Professional Development on Teachers' Knowledge, Skill, and Self-Efficacy in Data-Based Decision-Making. <i>Journal of Learning Disabilities, 54</i> (4), 269–283.	1984-2020	ITE & CPD	28	USA	Not reported	Positive	High
7	Salas-Pilco et al. (2022) Artificial Intelligence and Learning Analytics in Teacher Education: A Systematic Review. <i>Education Sciences, 12</i> (8), 569.	2017-2021	ITE & CPD	13	Canada China Estonia Germany India Indonesia Japan Malaysia Morocco Portugal Rwanda South Korea Spain Taiwan Türkiye USA	Positive	Mixed	Medium
8	Sandoval-Ríos et al. (2025) Role of data literacy training for decision-making in teaching practice: A systematic review. <i>Frontiers in Education, 10</i> , 1485821.	2014-2023	ITE & CPD	16	Germany, Netherlands, USA	Not reported	Mixed	High
9	Schreiter et al. (2024) Teaching for statistical and data literacy in K-12 STEM education: A systematic review on teacher variables, teacher education, and impacts on classroom practice. <i>ZDM – Mathematics</i>	2009-2021	Both ITE & CPD STEM Education	42	Australia Canada China Colombia Cyprus Ireland Israel Malaysia New Zealand Philippines Portugal South Africa South Korea	Not reported	Positive	Medium

	<i>Education</i> , 56(1), 31–45.				Spain Türkiye Uganda USA			
10	Shanahan et al. (2025) Ongoing Teacher Support for Data-Based Individualization: A Meta-Analysis and Synthesis. <i>Journal of Learning Disabilities</i> , 58(1), 3–18.	1977-2022	CPD only	26	Not reported	Mixed	Mixed	Excellent

Review citations

Ansyari, M. F., Groot, W., & De Witte, K. (2022). A systematic review and meta-analysis of data use professional development interventions. *Journal of Professional Capital and Community*, 7(3), 256–289. <https://doi.org/10.1108/JPC-09-2021-0055>

de la Hoz-Ruiz, J., Khalil, M., Segovia, J. D., & Liu, Q. (2024). Learning analytics for enhanced professional capital development: A systematic review. *Frontiers In Psychology*, 15. <https://doi.org/10.3389/fpsyg.2024.1302658>

Doğan, E. (2023). A Meta-Analysis Study on Data Literacy Education For School Administrators and Teachers. *Kuramsal Eğitim Bilim*, 16(1), 199–217. <https://doi.org/10.30831/akueg.1134207>

Filderman, M. J., Toste, J. R., Didion, L., & Peng, P. (2022). Data Literacy Training for K–12 Teachers: A Meta-Analysis of the Effects on Teacher Outcomes. *Remedial and Special Education*, 43(5), 328–343. <https://doi.org/10.1177/07419325211054208>

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Salas-Pilco, S., Xiao, K., & Hu, X. (2022). Artificial Intelligence and Learning Analytics in Teacher Education: A Systematic Review. *Education Sciences*, 12(8), 569. <https://doi.org/10.3390/educsci12080569>

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Schreiter, S., Friedrich, A., Fuhr, H., Malone, S., Brünken, R., Kuhn, J., & Vogel, M. (2024). Teaching for statistical and data literacy in K-12 STEM education: A systematic review on teacher variables, teacher

education, and impacts on classroom practice. *ZDM – Mathematics Education*, 56(1), 31–45.

<https://doi.org/10.1007/s11858-023-01531-1>

Shanahan, E., Choi, S., An, J., Casey-Wilke, B., Birinci, S., Roberts, C., & Reno, E. (2025). Ongoing Teacher Support for Data-Based Individualization: A Meta-Analysis and Synthesis. *Journal of Learning Disabilities*, 58(1), 3–18. <https://doi.org/10.1177/00222194241271335>