

AI-Enhanced Digital Information Literacy for Inclusive Education: A Conceptual Framework for Learners with Special Educational Needs and Disabilities

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Artificial intelligence (AI) can expand access, personalisation, communication, and participation in inclusive education, yet it can also reproduce barriers when learners lack the digital information literacy (DIL) needed to judge AI outputs, protect privacy, recognise bias, and use assistive or generative tools with agency. This conceptual review reframes AI-enhanced DIL for learners with special educational needs and disabilities (SEND) by integrating research on AI literacy, special-education technology, Universal Design for Learning (UDL), media and information literacy, and human-centred AI. A critical integrative synthesis identified recurring competencies and implementation conditions across foundational and recent literature. The resulting Inclusive AI-Enhanced DIL framework comprises four interdependent pillars: (1) Accessible Technical Fluency, (2) Critical Information Verification, (3) Ethical and Rights-Based AI Use, and (4) Adaptive, Self-Determined Application, with accessibility and learner agency operating across all four. Its distinctive contribution is to conceptualise AI literacy as equitable information participation rather than generic tool proficiency: learners should be able to access AI-mediated information, judge its credibility, protect their rights, adapt support to individual needs, and retain meaningful control over decisions. The framework connects learner competencies with teacher capability, accessible instructional design, institutional governance, and equitable infrastructure, and proposes performance-based assessment through accessible portfolios, verification tasks, supported reflection, and authentic AI-use scenarios. Empirical validation across disability groups, languages, socioeconomic contexts, and levels of digital access is required.

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Introduction

Artificial intelligence (AI), including generative AI, adaptive learning systems, automated feedback, speech technologies, and intelligent assistive tools, is reshaping educational participation. For learners with special educational needs and disabilities (SEND), these technologies may reduce barriers through personalisation, multimodal representation, communication support, and flexible ways of demonstrating learning. At the same time, AI can create new exclusions when systems are inaccessible, training data reproduce ableist or cultural bias, outputs are inaccurate, or students are expected to use digital tools without sufficient information-literacy support (Akgun & Greenhow, 2022; Evmenova et al., 2024; Voultsiou & Moussiades, 2025).

This tension is especially important because special education remains underrepresented in the broader AI-in-education evidence base. Mustafa et al. (2024), in a meta-synthesis of AI-in-education reviews, found that special education received substantially less attention than higher education and general K-12 settings. Technology access is also not equivalent to meaningful participation. Starks and Reich (2023) showed that students in special education can face structural barriers involving device access, digital literacy, teacher preparation, software suitability, and decision-making about technology. Consequently, a learner may be provided with an AI tool yet remain unable to judge its credibility, communicate a need for adaptation, protect personal information, or recognise when automated output should be challenged.

Digital information literacy (DIL) provides a useful foundation for addressing this problem because it concerns how people locate, interpret, evaluate, use, create, and communicate information in digital environments. In AI-mediated environments, however, traditional DIL must be extended. Learners need to understand that AI-generated content is probabilistic rather than inherently authoritative; evaluate provenance and evidence; identify bias and misinformation; make privacy-conscious

choices; and decide when AI should assist rather than replace human judgement (Long & Magerko, 2020; UNESCO, 2024a). These competencies are particularly consequential in inclusive education because students may rely on AI for reading support, language simplification, communication, organisation, or alternative representation of information.

The present paper therefore reframes AI-enhanced DIL specifically for special and inclusive education. It asks: What competencies are required for learners with diverse needs to participate safely, critically, and autonomously in AI-mediated information environments, and what pedagogical and governance conditions are necessary to support those competencies? The paper proposes an Inclusive AI-Enhanced DIL framework that integrates four competency pillars with accessibility and learner agency as cross-cutting principles. Its contribution is conceptual: it connects AI literacy, DIL, UDL, and special-education technology into a framework oriented toward equitable information participation rather than generic AI proficiency.

The framework is not intended as a simple aggregation of existing AI-literacy and accessibility models. Its distinctive contribution lies in linking three levels that are often treated separately: accessible participation in AI-mediated environments, critical and ethical information judgement, and learner control over how AI support is used. Existing AI-literacy frameworks largely specify what learners should understand or be able to do with AI, whereas accessibility frameworks primarily address how environments and resources should accommodate learner diversity. The Inclusive AI-Enhanced DIL framework connects these levels by asking whether learners with SEND can access AI-mediated information, judge its credibility, protect their rights and personal data, adapt support to individual needs, and retain meaningful decision-making. Accessibility therefore functions as an enabling condition, information judgement as a core capability, and

learner agency as the criterion by which inclusive AI use is ultimately evaluated.

2. Methodology

This paper uses a critical integrative conceptual review. The purpose is theory building and framework refinement rather than estimation of intervention effects; accordingly, the review does not claim the exhaustive coverage or reproducibility expected of a registered systematic review. The synthesis began with the literature base of the original DIL-AI manuscript and was purposively expanded with scholarship directly relevant to special education, inclusive education, UDL, accessibility, learner agency, and risks associated with generative AI.

Literature identification was guided by combinations of the concept's artificial intelligence literacy, digital information literacy, special education, inclusive education, disability, Universal Design for Learning, assistive technology, learner agency, generative AI, and AI ethics in education. Sources were prioritised when they (a) defined AI-literacy or DIL competencies; (b) examined AI or digital technology in special or inclusive education; (c) addressed accessibility, UDL, learner agency, or participation; or (d) provided policy or ethical guidance for human-centred AI in education. Particular weight was given to peer-reviewed reviews and empirical studies published from 2022 onward, supplemented by foundational AI-literacy work and UNESCO competency and policy frameworks. Selection was purposive and concept-driven rather than exhaustive; the

objective was conceptual integration, not effect estimation or evidence mapping.

The analysis proceeded through comparative conceptual coding. Constructs across the selected literature were grouped into technical access and understanding, critical evaluation, ethics and rights, adaptive application, accessibility, learner agency, teacher capability, and system-level enabling conditions. Overlapping constructs were then consolidated into four learner-facing pillars. UDL and accessibility were treated as design conditions rather than a separate learner skill, while agency was treated as a cross-cutting outcome because meaningful inclusion requires the learner to retain choice, voice, and decision-making. The resulting framework was examined for conceptual coherence and implications for pedagogy, assessment, teacher education, policy, and future empirical validation. Because the review was integrative, the resulting propositions should be treated as theoretically derived claims requiring empirical testing rather than validated causal relationships.

3. Results: Inclusive AI-Enhanced DIL Framework

The synthesis indicates that AI literacy for inclusive education cannot be reduced to prompt writing or functional tool use. It requires an interaction between information judgement, accessibility, ethical awareness, and context-sensitive application. Four interdependent pillars are proposed, with accessibility and learner agency embedded across each pillar, as explained in Table 1 and illustrated in Figure 1.

Table 1. Inclusive AI-Enhanced Digital Information Literacy Framework

Pillar	Inclusive purpose	Illustrative evidence of competence
Accessible Technical Fluency	Understand basic AI functions and limitations; operate AI and assistive features in accessible formats; select modalities that reduce rather than create barriers.	Can explain what an AI tool can/cannot do; uses speech, text, visual, translation, captioning, or alternative-input options appropriately.
Critical Information Verification	Evaluate accuracy, bias, provenance, evidence, and uncertainty in AI-generated content; distinguish assistance from authority.	Cross-checks an AI answer against credible sources; identifies unsupported claims; explains why an output should or should not be trusted.

Ethical and Rights-Based AI Use	Protect privacy and dignity; understand fairness, consent, intellectual property, data risks, and potential discrimination.	Avoids unnecessary disclosure of disability or personal data; recognises biased or stereotyping outputs; attributes sources and AI assistance appropriately.
Adaptive, Self-Determined Application	Use AI flexibly to support individual goals while retaining human agency, reflection, and choice.	Requests accessible reformulation, plans tasks with AI support, rejects unsuitable recommendations, and articulates when human support is preferable.

3.1 Accessible Technical Fluency

Technical fluency remains necessary, but in inclusive education it must begin with accessibility. Learners need a functional understanding of AI systems and the ability to use features such as text-to-speech, speech-to-text, captioning, translation, image description, alternative input, adjustable complexity, and multimodal output where these support participation. The key criterion is not the number of tools mastered but whether the learner can select and operate technology that reduces barriers. This aligns with UDL's emphasis on multiple means of engagement, representation, and action and expression, while recognising that UDL implementation itself requires deliberate design rather than technology alone (CAST, 2024; Zhang et al., 2024).

3.2 Critical Information Verification

Critical verification is central because generative AI can produce fluent but inaccurate, incomplete, or biased responses. Learners should be taught to pause before accepting an output, identify the claim being made, seek corroborating evidence, inspect source quality where available, compare alternatives, and communicate uncertainty. This is an inclusion issue as well as an information-literacy issue: students who rely on AI for accessible explanations may be disproportionately affected if simplified or reformulated information is wrong. Over-reliance on AI dialogue systems has been associated with risks to critical and analytical reasoning, strengthening the case for explicit verification routines rather than passive acceptance (Zhai et al., 2024).

3.3 Ethical and Rights-Based AI Use

Ethical competence must include privacy, fairness, dignity, attribution, and awareness of algorithmic discrimination. Learners with disabilities may be asked to disclose sensitive information in order to obtain personalised assistance; education should therefore teach data minimisation and informed choice. Students should also be able to recognise stereotyping or deficit-oriented representations and understand that automated recommendations can reflect limitations in data and design. UNESCO's human-centred AI guidance emphasises human agency, non-discrimination, privacy, and meaningful use, principles that are particularly relevant when AI mediates access to learning (Miao & Holmes, 2023; UNESCO, 2024a, 2024b).

3.4 Adaptive, Self-Determined Application

The fourth pillar concerns using AI in ways that are responsive to individual strengths, goals, communication preferences, and support needs. Generative AI can help teachers adapt materials and may support UDL by producing alternative explanations, examples, scaffolds, and formats (Evmenova et al., 2024). Yet adaptation should not become automated dependency. The learner should be able to decide when AI is useful, request modifications, reject an unsuitable response, explain personal preferences, and seek human support when needed. This pillar therefore connects digital competence with self-determination and preserves the learner as an active decision-maker rather than a passive recipient of personalised automation.

4. Discussion

The framework advances AI-enhanced DIL by relocating inclusion from the policy margins to the conceptual centre. In general education, technical, critical, ethical, and adaptive competencies may be treated primarily as future-ready skills. In special and inclusive education, the same competencies also determine whether AI expands or restricts participation. Accessibility without critical literacy can expose learners to misinformation; critical literacy without accessible interfaces can exclude participation; ethical guidance without agency can become paternalistic; and personalisation without learner control can encourage dependency. The framework therefore positions equitable information participation as the outcome of interaction among access, judgement, rights, and agency rather than as a consequence of technology availability alone.

This logic yields four propositions for empirical examination. Proposition 1: accessibility is an antecedent to meaningful AI-enhanced DIL because higher-order verification and ethical judgement depend on usable access to AI-mediated information. Proposition 2: critical information verification conditions the benefits of accessibility, because greater access without evaluative capability may increase exposure to plausible but inaccurate or biased outputs. Proposition 3: rights-based competence constrains potentially harmful personalisation by requiring privacy, dignity, fairness, and informed choice. Proposition 4: learner agency is the principal inclusion-oriented outcome of the framework; successful AI-enhanced DIL should strengthen informed choice and self-determination rather than dependence on automated systems. These propositions convert the framework from a descriptive competency taxonomy into a testable conceptual model.

The framework also has direct pedagogical implications. First, AI-enhanced DIL should be taught through authentic, accessible scenarios rather than abstract definitions. Examples include comparing an AI-generated explanation with a trusted source; asking a chatbot to reformulate content at different reading levels and checking

what meaning was lost; evaluating an AI-generated image for stereotyping; or deciding what personal information is unnecessary to disclose when seeking support. Tasks should permit multiple forms of response and provide scaffolds such as checklists, visual supports, sentence starters, screen-reader-compatible materials, or peer collaboration according to learner need.

Second, assessment should measure judgement and agency rather than tool speed. Accessible portfolios can document how learners formulate questions, verify AI outputs, choose modalities, explain privacy decisions, and reflect on when human assistance was required. Performance tasks can use short AI-generated cases containing errors or bias and ask learners to identify and correct them. Such approaches are more consistent with the multidimensional nature of AI literacy than conventional recall examinations (Long & Magerko, 2020; UNESCO, 2024a). Accommodations should enable access to the construct being assessed without lowering the expectation for critical judgement.

Third, teacher professional development is an enabling condition. Special educators need opportunities to examine AI tools for accessibility, bias, data practices, instructional value, and alignment with individual learner goals. Technology decisions should include special-education expertise rather than being made solely at system level. This responds to evidence that structural conditions, training, and resource decisions strongly influence technology use in special education (Starks & Reich, 2023). Teachers also need sufficient AI literacy to model uncertainty, verification, and ethical decision-making rather than presenting AI as an unquestioned authority.

At policy level, an inclusive AI strategy should require accessibility and privacy review before adoption, procurement criteria that include compatibility with assistive technologies, procedures for reporting inaccessible or harmful outputs, and professional learning for teachers and support staff. Equity should be evaluated as meaningful usability and participation, not only

device distribution. In multilingual and resource-diverse education systems, implementation should also attend to language quality, cultural context, infrastructure disparities, and the availability of accessible digital content. These priorities align with SDG 4 and UNESCO's human-centred approach to AI in education (UNESCO, 2021; Miao & Holmes, 2023).

The framework has limitations. It is conceptual and has not yet been validated across disability groups or educational levels. SEND is heterogeneous, and competencies may manifest differently for learners with sensory, physical, intellectual, neurodevelopmental, communication, or specific learning needs. Competency expectations should therefore be interpreted developmentally and functionally rather than as uniform performance thresholds across disability categories; supported decision-making should not be equated with reduced autonomy. The review was integrative rather than systematic, so it should not be interpreted as an exhaustive evidence map. Rapid changes in AI also mean that technical examples will date more quickly than the underlying principles of accessibility, verification, rights, and agency.

5. Conclusion

AI-enhanced DIL can make a distinctive contribution to special and inclusive education when it is framed as a capability for equitable

information participation. The proposed framework combines Accessible Technical Fluency, Critical Information Verification, Ethical and Rights-Based AI Use, and Adaptive, Self-Determined Application, with accessibility and learner agency operating across all four pillars. Its purpose is not to make learners with SEND more compliant users of AI, but to strengthen their capacity to access, question, adapt, and, when necessary, refuse AI-mediated information and support. By specifying relationships among accessibility, verification, rights, and agency, the framework also offers propositions that can be tested rather than remaining only a descriptive taxonomy.

Future research should empirically test the framework with diverse learners and educators using accessible measures and participatory methods. Priority questions include whether the four-pillar structure is valid across disability groups, how competencies develop over time, which instructional supports improve verification and autonomy, and how AI-enhanced DIL affects participation, self-efficacy, and learning outcomes. Cross-national work is also needed to examine linguistic, cultural, infrastructure, and policy differences. Such evidence can help ensure that the expansion of AI in education advances inclusion through informed human agency rather than creating a new layer of digital disadvantage.

6. References

- Akgun, S., & Greenhow, C. (2022). Artificial intelligence in education: Addressing ethical challenges in K-12 settings. *AI and Ethics*, 2(3), 431–440. <https://doi.org/10.1007/s43681-021-00096-7>
- CAST. (2024). Universal Design for Learning Guidelines version 3.0. <https://udlguidelines.cast.org/>
- Chiu, T. K. F. (2024). The impact of generative AI (GenAI) on practices, policies and research direction in education: A case of ChatGPT and Midjourney. *Interactive Learning Environments*, 32(1), 1–15. <https://doi.org/10.1080/10494820.2023.2253862>
- Cox, A. M. (2021). Exploring the impact of artificial intelligence and robots on higher education through literature-based design fictions. *International Journal of Educational Technology in Higher Education*, 18, 3. <https://doi.org/10.1186/s41239-020-00237-8>
- Evmenova, A. S., Borup, J., & Shin, J. K. (2024). Harnessing the power of generative AI to support ALL learners. *TechTrends*, 68, 820–831. <https://doi.org/10.1007/s11528-024-00966-x>
- Grassini, S. (2023). Shaping the future of learning using the student-centered ecosystem of AI and XR technologies. *Computers*, 12(3), 49. <https://doi.org/10.3390/computers12030049>
- Long, D., & Magerko, B. (2020). What is AI literacy? Competencies and design considerations. *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*, 1–16. <https://doi.org/10.1145/3313831.3376727>
- Miao, F., & Cukurova, M. (2024). AI competency framework for teachers. UNESCO. <https://doi.org/10.54675/ZJTE2084>

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- Miao, F., & Holmes, W. (2023). Guidance for generative AI in education and research. UNESCO.
- Miao, F., Shiohira, K., & Lao, N. (2024). AI competency framework for students. UNESCO.
- Mustafa, M. Y., Tili, A., Lampropoulos, G., Huang, R., Jandrić, P., Zhao, J., Salha, S., Xu, L., Panda, S., Kinshuk, López-Pernas, S., & Saqr, M. (2024). A systematic review of literature reviews on artificial intelligence in education (AIED): A roadmap to a future research agenda. *Smart Learning Environments*, 11, 59. <https://doi.org/10.1186/s40561-024-00350-5>
- Ng, D. T. K., Leung, J. K. L., Su, M. J., Yim, I. H. Y., Qiao, M. S., & Chu, S. K. W. (2023). Teachers' AI digital competencies and twenty-first century skills in the post-pandemic world. *Educational Technology Research and Development*, 71(1), 137–161. <https://doi.org/10.1007/s11423-023-10139-6>
- Starks, A. C., & Reich, S. M. (2023). "What about special ed?": Barriers and enablers for teaching with technology in special education. *Computers & Education*, 193, 104665. <https://doi.org/10.1016/j.compedu.2022.104665>
- UNESCO. (2021). AI and education: Guidance for policymakers. UNESCO Publishing. <https://unesdoc.unesco.org/ark:/48223/pf0000376709>
- Voultsiou, E., & Moussiades, L. (2025). A systematic review of AI, VR, and LLM applications in special education: Opportunities, challenges, and future directions. *Education and Information Technologies*, 30, 19141–19181. <https://doi.org/10.1007/s10639-025-13550-4>
- Zhai, C., Wibowo, S., & Li, L. D. (2024). The effects of over-reliance on AI dialogue systems on students' cognitive abilities: A systematic review. *Smart Learning Environments*, 11, 28. <https://doi.org/10.1186/s40561-024-00316-7>
- Zhang, L., Carter, R. A., Greene, J. A., & Bernacki, M. L. (2024). Unraveling challenges with the implementation of Universal Design for Learning: A systematic literature review. *Educational Psychology Review*, 36, 35. <https://doi.org/10.1007/s10648-024-09860-7>

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8. Author Declaration

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