

Artificial Intelligence-Based Assessment and Intervention for Specific Learning Disabilities: A Systematic Review

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1. Round 1

1.1. Reviewer 1

Reviewer:

In the Introduction, the paragraph beginning “The conceptualization of specific learning disabilities has expanded considerably in recent years” is theoretically relevant, but it combines cognitive, neurobiological, genetic, rhythm-perception, and working-memory factors without clearly explaining how these mechanisms justify the use of artificial intelligence. The authors should strengthen the logical transition by explicitly stating that the multidimensional and heterogeneous nature of specific learning disabilities creates a methodological need for computational models capable of integrating multimodal data. This would improve the conceptual bridge between learning-disability theory and AI-based assessment.

In the paragraph discussing dyslexia, the manuscript states that “dyslexia has received the greatest research attention.” This is an important observation, but the authors should more clearly explain why dyslexia dominates the AI literature. Possible reasons include the availability of standardized reading measures, measurable linguistic features, digital reading tasks, eye-tracking data, spelling-error patterns, and larger public datasets. Without this explanation, the paragraph reads as descriptive rather than analytical. The authors should also indicate whether this imbalance creates a risk that conclusions about AI for “specific learning disabilities” are overly influenced by dyslexia-focused studies.

In the Introduction paragraph on dyscalculia and dysgraphia, the manuscript appropriately notes that these domains are less represented. However, the authors should develop this point more critically by explaining the methodological reasons for underrepresentation. For example, dyscalculia may be difficult to model because mathematical performance involves number sense, symbolic processing, working memory, visuospatial reasoning, curriculum exposure, and language demands, while dysgraphia involves motor, visual-spatial, orthographic, and linguistic components. Clarifying these complexities would make the discussion of AI-based dyscalculia and dysgraphia more scientifically precise.

In the Data Collection Tools section, the search syntax is described with keywords, but the authors should include at least one complete database-specific search string, either in the manuscript or as supplementary material. The paragraph beginning “The search strategy combined terms related to artificial intelligence with terms related to specific learning disabilities” is useful, but systematic-review standards require enough detail for replication. The authors should also specify whether truncation, MeSH terms, subject headings, title/abstract restrictions, and language filters were used.

In the Data Collection Tools section, the authors state that “The reference lists of eligible articles were also reviewed manually.” This is appropriate, but the manuscript should clarify whether forward citation searching, gray literature searching, preprint screening, or manual searching of key journals was performed. Because several references in the manuscript appear to include preprints or non-final publication formats, the authors should explain how preprints were handled and whether they were appraised differently from peer-reviewed journal articles.

Authors revised and uploaded the document.

1.2. Reviewer 2

Reviewer:

In the paragraph stating that “AI-based systems can process large datasets, identify complex nonlinear patterns, classify learners according to risk or diagnostic profiles, integrate heterogeneous sources of data, and provide automated or semi-automated feedback,” the authors should also acknowledge the risks of overfitting, dataset bias, and weak external validation. The current sentence presents AI primarily as an opportunity, but the Introduction would be more balanced if it immediately recognized that algorithmic accuracy within a development dataset does not necessarily imply diagnostic validity in real educational or clinical contexts.

In the Introduction, the paragraph on AI-based intervention includes mobile applications, serious games, exergames, adaptive learning platforms, and intelligent tutoring systems. This is comprehensive, but the authors should differentiate more clearly between “AI-based” tools and general digital or technology-assisted tools. Some mobile applications or games may be interactive without using machine learning, adaptive algorithms, learner modeling, or automated decision-making. The review should explicitly state what qualified a tool as AI-based; otherwise, the conceptual boundary of the systematic review remains too broad.

In the final paragraph of the Introduction, the sentence “a systematic synthesis is needed to clarify what is currently known” is well placed, but the research gap should be made sharper. The authors should specify that existing reviews tend to focus separately on dyslexia detection, dysgraphia diagnosis, dyscalculia screening, neurodevelopmental disorders, or AI-based interventions, whereas the present article attempts to integrate both assessment and intervention across specific learning disabilities. This distinction would make the novelty and contribution of the review more convincing.

In the Methods section, the paragraph “This study was conducted as a systematic review of empirical research on the application of artificial intelligence-based assessment and intervention approaches for specific learning disabilities” should be revised to include the precise review question. A systematic review requires a clearly formulated question, ideally structured around population, concept/intervention, comparator where applicable, outcomes, and study design. The authors should add a sentence specifying whether the review asked: “What AI-based methods have been used for assessment and intervention in specific learning disabilities, and what outcomes have been reported?” This would improve methodological transparency.

In the Methods section, the sentence “The review was designed and reported in accordance with the principles of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses framework” should be strengthened. The authors should state whether the PRISMA 2020 checklist was followed, whether a PRISMA flow diagram was prepared, and whether the review protocol was registered in PROSPERO, OSF, or another registry. If no protocol was registered, this should be transparently acknowledged as a limitation rather than omitted.

In the Study Design and Sample paragraph, the manuscript reports that “The initial database search identified 1,286 records” and that “Finally, 42 studies met all inclusion criteria.” This screening flow is clear, but the authors should provide a more detailed explanation of the exclusion reasons at the full-text stage. The current list of reasons is broad. For a systematic review, readers need to know how many articles were excluded for each reason, such as no AI component, wrong population, review article, insufficient outcome data, conference abstract, or non-specific academic difficulty. This revision would substantially improve reproducibility.

In the Methods section, the eligibility criteria require further precision. The manuscript states that studies were included if they “used a clearly identifiable AI-based method,” but this phrase is too general. The authors should define which methods were accepted as AI, such as machine learning, deep learning, expert systems, natural language processing, computer vision, adaptive algorithms, intelligent tutoring systems, and learning analytics. They should also clarify whether traditional statistical prediction models, rule-based decision trees, or general educational software were included or excluded. This clarification is essential for the internal validity of the review.

Authors revised and uploaded the document.

2. Revised

Editor’s decision after revisions: Accepted.

Editor in Chief’s decision: Accepted.