

REVIEWER'S REPORT

Manuscript No.: IJAR-59157

Title: Universal Design for Learning in Inclusive Science Education for Students with Disabilities.

Recommendation:

Accept as it is

Accept after minor revision.....

Accept after major revision

Do not accept (*Reasons below*)

Rating	Excel.	Good	Fair	Poor
Originality		X		
Techn. Quality		X		
Clarity		X		
Significance		X		

Reviewer's ID: JPR-212

Detailed Reviewer's Report

General Assessment:

This is an excellent, comprehensive, and timely review that makes a significant contribution to the fields of inclusive education and science education. The paper examines the application of Universal Design for Learning (UDL) in inclusive science education for students with disabilities, synthesizing literature published between 2018 and 2026. The review is well-conceived, methodologically sound, and addresses a critical gap in the literature: the need for a discipline-specific understanding of how UDL can be implemented in science classrooms to support diverse learners.

The manuscript demonstrates several notable strengths. The conceptual foundations of UDL are clearly articulated, with reference to the updated UDL Guidelines 3.0 (CAST, 2024). The review is well-organized, systematically addressing the barriers students with disabilities face in science education, the application of UDL principles to science instruction, the role of technology, evidence of effectiveness, teacher competence and professional development, the distinction between UDL and differentiated instruction, implementation challenges, and a proposed conceptual framework. The analysis is nuanced and balanced, acknowledging that the evidence for UDL's effectiveness is not uniformly positive and that more research is needed in specific areas (e.g., secondary science, laboratory learning, students with multiple disabilities, and low- and middle-income contexts). The proposed conceptual framework (Figure 1) is a valuable contribution, synthesizing the key components of effective UDL science education. The review is well-written, clearly structured, and demonstrates a strong command of the relevant literature. It requires only minor revisions before publication.

Minor Issues (to be addressed in revision):

1. Clarification of Methodology and Systematic Review Process:

- The manuscript is described as a "review" but does not explicitly state whether it follows a systematic review methodology (e.g., PRISMA guidelines). The author(s) should clarify the methodological approach. If it is a systematic review, provide details on the search strategy, databases searched, inclusion/exclusion criteria, and the number of studies screened and included. If it is a narrative or critical review, this should be explicitly stated.
- The "Syntheses of recent literature" section (Table 1) is referenced but the table is not visible in the provided manuscript. The author(s) should ensure that the table is included and that it clearly

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- summarizes the key studies reviewed, including author(s), year, context, methodology, and key findings.
2. **Clarification of Key Terms and Concepts:**
 - The author(s) use the term "E.S.N." (Page 6, Section 4.5) without defining it. This appears to be an abbreviation for "Educational Support Needs" or "Extensive Support Needs." The author(s) should define this term at first use.
 - The distinction between UDL and differentiated instruction (Section 9) is well-articulated but could be further clarified with a concrete example. For instance, a science lesson where UDL involves presenting content in multiple formats from the outset (e.g., text, diagram, video, tactile model), while differentiation involves providing additional scaffolding or modified tasks for specific students based on their individual needs.
 3. **Strengthening the Discussion of Evidence:**
 - The review cites several studies (e.g., AlRawi & AlKahtani, 2022; Yu et al., 2021; Roski et al., 2021) but could more critically evaluate their methodological quality. For example, what were the sample sizes? Were the studies randomized controlled trials, quasi-experimental, or qualitative? What are the limitations of the evidence base? A more critical appraisal of the evidence would strengthen the review.
 - The finding from Roski et al. (2021) that "greater support for UDL in the learning environment did not result in greater success" is important and warrants more discussion. The author(s) could explore why this might be the case. Is it because more UDL features can lead to cognitive overload? Is it because quality and alignment matter more than quantity? This is a critical nuance that deserves deeper analysis.
 4. **Expanding the Discussion of Implementation Challenges:**
 - The implementation challenges section (Section 10) is well-articulated but could be expanded to include a discussion of the specific challenges in low- and middle-income contexts. The author(s) note in the introduction and conclusion that research from these contexts is limited, but they could more explicitly discuss the barriers to implementing UDL in resource-constrained settings (e.g., lack of technology, large class sizes, limited teacher training).
 - The author(s) could also discuss the challenge of assessment alignment in more detail. How can teachers design assessments that are flexible enough to allow multiple means of expression while still maintaining academic rigor and alignment with learning objectives?
 5. **Minor Typographical and Formatting Issues:**
 - There are several typographical errors and inconsistencies in the manuscript. For example, "Ruther (2022)" should be "Ruhter (2022)" (as it appears in the reference list). "Capp (2020)" is cited correctly, but "Sebti and Damiani (2021)" should be "Sebti and Damiani (2021)." "Roski, Walkowiak, and Nehring (2021)" is correct, but "Roski et al. (2021)" is used inconsistently. The author(s) should carefully proofread the manuscript.
 - The reference list is comprehensive but contains some inconsistencies. For example, some references include DOIs, while others do not. Some references use "&" and others use "and." The author(s) should ensure consistency in formatting.
 - The section numbering is inconsistent (e.g., Section 4.1 follows Section 3, but there is no Section 4 heading). The author(s) should ensure that section headings are logically numbered.
 6. **Strengthening the Conclusion:**
 - The conclusion is strong but could be strengthened by more explicitly summarizing the key takeaways for practitioners and policymakers. What are the most important recommendations for teachers, school leaders, and policymakers who want to implement UDL in inclusive science education?
 - The author(s) could also suggest specific directions for future research, building on the gaps identified in Section 13.

Specific Comments for the Authors (for a Minor Revision):

This is an excellent and comprehensive review that makes a valuable contribution to the literature on UDL and inclusive science education. The manuscript is well-written, well-organized, and demonstrates a strong command of the relevant literature. To prepare the manuscript for final publication, the author(s) should address the following minor points:

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1. **Clarify the Review Methodology:** Explicitly state whether this is a systematic review, narrative review, or critical review. If systematic, provide details on the search strategy and inclusion/exclusion criteria. Ensure Table 1 (Syntheses of recent literature) is included and clearly formatted.
2. **Define Key Terms:** Define "E.S.N." at first use.
3. **Strengthen the Critical Appraisal of Evidence:** Provide more critical evaluation of the methodological quality of the studies reviewed. Discuss the implications of the finding from Roski et al. (2021) in more depth.
4. **Expand the Discussion of Implementation Challenges:** Discuss the specific challenges of implementing UDL in low- and middle-income contexts and the challenge of assessment alignment.
5. **Correct Minor Typographical and Formatting Errors:** Proofread carefully. Ensure consistency in citations, references, and section numbering.
6. **Strengthen the Conclusion:** More explicitly summarize key takeaways for practitioners and policymakers. Suggest specific directions for future research.

Conclusion:

This manuscript presents an excellent, comprehensive, and timely review of Universal Design for Learning in inclusive science education for students with disabilities. The review is well-conceived, methodologically sound, and makes a significant contribution to the field. The proposed conceptual framework is a valuable addition, and the identification of gaps in the literature provides a clear agenda for future research. The paper is well-written, clearly structured, and demonstrates a strong command of the relevant literature. With the minor revisions outlined above, this manuscript will be ready for publication and will be of great interest to researchers, educators, and policymakers in inclusive education and science education. The recommendation is for acceptance after minor revision.