Journal of Medical Education Development
e-ISSN: 2980-7670
https://edujournal.zums.ac.ir

Volume 19, Issue 2
April 2026
Pages: 131-132

Letter to Editor

Precision realism in intelligent simulation: addressing the algorithmic validation gap in medical sciences education

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Article info

Article history:
Received 8 Jan. 2026
Revised 15 Jan. 2026
Accepted 22 Feb. 2026
Published 1 Apr. 2026

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How to cite this article:
Toofaninejad E, Shapoori S, Nobakht M. Precision realism in intelligent simulation: addressing the algorithmic validation gap in medical sciences education. *J Med Educ Dev*. 2026; 19(2): 131-132.http://dx.doi.org/10.66224/edcj.19.2.131

Recent literature on medical education has highlighted the significant and evolving impact of Artificial Intelligence (AI) on clinical learning environments. However, a pedagogical gap has emerged in the transition from static simulation to 'intelligent systems', largely due to the absence of sound pedagogical principles in the development of generative AI and Virtual Reality (VR)-based platforms. While these tools offer meaningful opportunities for personalized clinical training, the field is increasingly moving toward 'open-loop', continuously evolving content that lacks the expert verification and stability characteristic of traditional approaches. As large language models become more widely integrated into medical training infrastructure, a rigorous analysis of the 'Validation Paradox' is needed. This paradox concerns the fundamental difficulty of maintaining clinical realism and instructional integrity when scenario content is autonomously generated by algorithms using real-time data. Empirical evidence suggests that while generative AI increases learner engagement, it also carries a significant risk of 'pedagogical hallucinations', whereby AI-generated content prioritizes narrative coherence over adherence to evidence-based clinical protocols [1, 2]. In the absence of established verification procedures, this dynamic personalization of clinical scenarios may contribute to the development of flawed cognitive reasoning patterns in long-term patient care decision-making [3]. To manage these risks and maintain educational quality, the following strategic measures should be carried out:

1. **Development of clinical guardrails:** Algorithmic control layers should be created to align AI output with current, gold-standard clinical guidelines in real time, before learners are exposed to the generated content [4].
2. **Recalibration of assessment methods:** New assessment frameworks should be created to evaluate student competency without requiring identical learning experiences; for example, by using varied clinical scenarios that produce equivalent educational outcomes [5].
3. **Algorithmic transparency and grounding:** Researchers must clearly define the operational constraints of their methods and provide the grounding datasets needed to assess reproducibility and educational safety [6]. Accreditation bodies should govern AI-generated content in medical education through the formal adoption of 'Competency-Based Validation of AI-Generated Content' procedures. Moving from a static accreditation system to a Dynamic Accreditation Model would help ensure that advanced simulation technologies remain grounded in rigorous standards

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[DOI: 10.66224/edcj.19.2.131]

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of scientific validity and professional competency for as long as they are in use.

Ethical considerations
Not applicable.

Artificial intelligence utilization for article writing
The authors declare that the Gemini 1.5 Flash model was used solely to improve linguistic structure and ensure an academic tone. All scientific content and final responsibility for the manuscript rest entirely with the authors.

Conflict of interest
The authors declare that they have no competing interests.

Funding
This research received no external funding.

Author contributions
All three authors contributed to the conception and design of this letter. SS and MN prepared the initial draft of the manuscript, while ET critically reviewed the content and made the necessary revisions. All authors read and approved the final manuscript and accepted responsibility for all aspects of the work.

Acknowledgments
Not applicable.

Data availability
Not applicable.

References
1. Cook DA, Hatala R, Brydges R, Zendejas B, Szostek JH, Wang AT, et al. Technology-enhanced simulation for health professions education: a systematic review and meta-analysis. *JAMA.* 2011;306(9):978–88. https://doi.org/10.1001/jama.2011.1234
2. Masters K. Artificial intelligence in medical education. *Med Teach.* 2019;41(9):976–80. https://doi.org/10.1080/0142159X.2019.1595557
3. Thirunavukarasu AJ, Ting DSJ, Elangovan K, Gutierrez L, Ting TF, Ting DSW. Large language models in medicine. *Nat Med.* 2023;29(8):1930-1940. https://doi.org/10.1038/s41591-023-02448-8
4. Wartman SA, Combs CD. Medical education must move from the information age to the age of artificial intelligence. *Acad Med.* 2018;93(8):1107–9. https://doi.org/10.1097/ACM.0000000000002044
5. Liaw SY, Wong LF, Chan SW, Ho JTY, Mordiffi SZ, Ang SBL, et al. Designing and evaluating an interactive multimedia web-based simulation for developing nurses' competencies in acute nursing care: a randomized controlled trial. *J Med Internet Res.* 2015;17(1):e5. https://doi.org/10.2196/jmir.3853
6. Shorey S, Ang E, Yap J, Ng ED, Lau ST, Chui CK. A virtual counseling application using artificial intelligence for communication skills training in nursing education: development study. *J Med Internet Res.* 2019;21(10):e14658. https://doi.org/10.2196/14658

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[DOI: 10.66224/edcj.19.2.131]