Experts call for more evidence as medical and teacher education embrace simulation technologies

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Researchers are urging an evidence-based approach to the use of simulations to train medics and teachers, amid signs that technologies

like artificial intelligence (AI) and mixed reality could reshape education in both professions.

In a new special issue of the journal, [Learning and Instruction](link), academics highlight the expanding use of '[simulation](link)-based learning' in both fields. While acknowledging its huge potential, they emphasize that evidence about how best to use new simulation technologies in professional education is still emerging. Without this [evidence base](link), they suggest, rapid adoption could lead to subpar training.

"Simulation-based learning" refers to educational methods that, by emulating real-life situations, offer students a safe environment in which to develop and test their knowledge and skills. Recent advances in AI and mixed reality have dramatically expanded the range of ways it can be integrated into professional education.

One such innovation is "Holoscenarios"; a mixed reality tool co-developed by University of Cambridge researchers, clinicians, and the tech company GigXR, which allows [medical students](link) to train with a realistic holographic patient and was one of Time Magazine's [Best Inventions of 2022](link). Studies in the new special issue refer to other emerging tools, including one in which students interact with a virtual radiologist, and a web-based simulation for dental students learning intricate procedures.

Teacher education is not far behind. In a recent trial in Germany, [AI was used](link) to 'mark' and feedback on the work of trainee teachers who were learning to assess students for potential learning difficulties and was found to improve their diagnostic reasoning.

Virtual classrooms have also been used to help teachers practice how they talk with students and cultivate oracy, which is a focus of the Labor Party's [latest education plans](link).

The special issue, while broadly supportive of these developments, raises the need for a proper understanding of how to use these resources, so that they can be integrated thoughtfully into professional training, rather than according to Facebook's erstwhile mantra, "move fast and break things".

It is one output from a partnership between the University of Cambridge and Ludwig Maximilian University, Munich (LMU). Academics from both institutions edited the special issue, along with colleagues from the Technical University of Munich; and there are contributions from a wide range of experts in simulation-based learning.

Riikka Hofmann, Professor of Learning Sciences at the Faculty of Education, University of Cambridge, said, "Tools like HoloScenarios show how simulation-based learning can positively widen students' access to resources and democratize training; but we need to ensure that new innovations aren't just developed blindly, without a clear sense of what makes them effective. Given the rate of progress in simulation technologies, there is a risk we could end up investing in tools that don't really deliver."

Dr. Nicole Heitzmann, a Research Fellow at LMU, said, "Simulations open up new possibilities in terms of what students can learn and how they can do it. Not every trainee teacher will, for example, meet students with specific learning difficulties during their school placements, and not every trainee medic will meet real patients with rare illnesses. Simulation-based learning addresses those gaps. The challenge is using it wisely."

Several contributions to the special issue suggest that a pressing challenge for developers is how to design simulation-based learning tools that are not only accurate and authentic, but sufficiently versatile to work for students with different levels of experience and learning styles.

Researchers studying the virtual radiologist simulation, for example, found that students with different degrees of prior knowledge responded differently to challenges thrown up by the program, and needed specific information, guidance and navigational aids to surmount them. Similarly, a study of a video-based simulation which trained teachers to assess students' mathematical argumentation skills, found that trainees who already had a reasonable grasp of the training content needed a completely different style of prompting and support compared with those who were less experienced.

Researchers point out that simulation-based learning can adapt to these different learner needs, but that building simulations capable of this rely on having evidence about which approaches are effective, and with whom.

Other studies highlight issues such as the importance of sequencing the use of simulation-based tools appropriately within training environments. For example, trials of a web-based tool for dental students found that it worked best as the first stage in a three-part sequence in which they then role-played the procedure from the simulation, before undertaking a final exercise which tested their understanding.

Professor Tina Seidel, Friedl Schoeller Chair of Educational Psychology at School of Social Sciences and Technology, Technical University of Munich said, "The evidence we have strongly suggests that learners' prior experiences and predispositions as students shape their engagement with simulation-based tools. If we just give new doctors and teachers standardized, one-size-fits-all simulations we will probably find that they underperform. What we need are adaptable simulations, underpinned by an in-depth grasp of learner needs."

Despite the need for caution and care in development, Hofmann believes that thoroughly-tested and effective simulation-based resources, like

HoloScenarios, are likely to feature in medical and teacher education in the years to come.

"Because we don't know enough about how to optimize learning through these tools, the danger, as with any technology, is that we will end up with solutions that are poorly designed and attempt to use tech to compensate for real expertise," she said.

"Fortunately, fields like medical and teacher education still draw heavily on expert, professional advice. They are also fields where the consequences of bad training are so clear and drastic that risks tend to be managed carefully. As long as we continue to value evidence and expert advice, and put simulation-based learning under continual scrutiny, we should be able to harness it in ways that benefit everyone."

More information: Nicole Heitzmann et al, Editorial for the special issue "Advances in simulation-based learning in higher education", *Learning and Instruction* (2023). DOI: 10.1016/j.learninstruc.2023.101774

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