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Review Paper

Redefining Clinical Competency: A Critical Review of Simulation Methodologies in Modern Nursing Education

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ABSTRACT

Simulation-based education has moved from being an optional teaching innovation to an important part of contemporary nursing education. Its value, however, depends less on the sophistication of the simulator than on how the learning experience is designed, facilitated and evaluated. This critical review examines the major simulation methodologies used in nursing education and considers how each contributes to the development of clinical competency. The review draws on established simulation theories and standards together with published systematic reviews, meta-analyses and major evidence from nursing education. The literature consistently indicates that simulation can support knowledge acquisition, psychomotor performance, clinical reasoning, confidence and other affective outcomes. At the same time, the evidence is heterogeneous, and high-fidelity simulation is not automatically superior for every learning objective. Task trainers may be more appropriate for repeated technical practice, standardized patients for communication and assessment, high-fidelity manikins for integrated clinical decision-making, and virtual or extended-reality formats for repeatable cognitive and situational practice. Effective simulation also requires meaningful prebriefing, skilled facilitation and structured debriefing. Important barriers include cost, faculty preparation, infrastructure, curriculum integration and uncertainty about the extent to which simulation can substitute for direct clinical experience. The review argues for a deliberate, multimodal approach in which the technology is selected after the competency has been defined. Simulation should complement, rather than simply displace, authentic patient-care experiences. The future of nursing simulation therefore lies not in using more technology, but in using the right simulation methodology for the right learning purpose.

INTRODUCTION

Clinical competency in nursing is broader than the ability to perform a procedure correctly. A

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competent nurse must be able to recognize changes in a patient's condition, interpret information, prioritize care, communicate with patients and colleagues, perform technical skills safely, and respond appropriately when a situation changes. These capabilities develop through repeated exposure to clinical situations, guided practice, feedback and reflection. Yet opportunities for students to encounter the full range of clinical experiences are not always predictable. Differences in patient volume, case mix, length of stay, institutional policies, faculty availability and patient-safety considerations can limit what a student is able to see or perform during a clinical placement.

Simulation-based education (SBE) offers a way to create selected clinical experiences in a controlled learning environment. It allows learners to practise assessment, decision-making, communication and technical skills without making an actual patient carry the burden of the learner's first attempt. Evidence from systematic reviews and meta-analyses has generally shown favourable effects of simulation on knowledge, skills, confidence and other learning outcomes, although the size of the effect varies between studies and outcomes.[1,2]

Over time, the term simulation has come to include a wide range of approaches. A student practising intravenous insertion on a task trainer, interviewing a standardized patient, managing a deteriorating manikin, or entering a virtual emergency department is participating in simulation, but these experiences are not educationally interchangeable. The central question for nurse educators is therefore not simply whether simulation should be used, but what kind of simulation is appropriate for a particular competency and how that experience should be integrated into the curriculum.

This distinction is important because technology can easily become the most visible part of a simulation programme. A sophisticated manikin may attract attention, but a poorly constructed scenario can still produce a weak learning experience. Conversely, a relatively simple simulation can be highly effective when its objectives are clear, the level of realism is appropriate, learners are adequately prepared, and the debriefing helps them make sense of what happened. Contemporary simulation standards consequently emphasize measurable objectives, deliberate design, appropriate facilitation and meaningful evaluation rather than technology alone.[3–6]

The present review examines simulation methodologies from this broader perspective. It considers the pedagogical foundations of simulation, the major modalities used in nursing education, their application across clinical areas, the role of prebriefing and debriefing, the evidence for learner outcomes, implementation challenges, and the emerging role of virtual and immersive technologies. Particular attention is given to a question that is often overlooked: whether greater fidelity necessarily produces better learning. The review argues that clinical competency is best supported by a multimodal strategy in which simulation is selected according to the competency being developed and used alongside authentic clinical experience.

MATERIALS AND METHODS

This article was developed as a critical narrative review rather than as a de novo systematic review or meta-analysis. The purpose was to interpret the existing evidence on simulation methodologies in nursing education and to connect findings from major reviews with established educational frameworks and simulation standards.

The literature considered for this review included systematic reviews and meta-analyses examining simulation-based learning, high-fidelity simulation and virtual reality in nursing education; foundational publications describing simulation

theory and experiential learning; and major professional guidance on simulation design, facilitation, evaluation and the use of simulation in prelicensure nursing programmes. The core evidence base included publications available through 2024, with emphasis on sources directly addressing undergraduate and prelicensure nursing education. The review did not attempt to calculate a new pooled effect size or to reproduce the methodology of the individual systematic reviews.

Evidence was organized thematically around five questions: (1) what educational purposes can simulation serve; (2) which simulation modalities are best suited to different competencies; (3) what outcomes are supported by the current evidence; (4) what factors determine whether a simulation experience is educationally effective; and (5) what limitations and implementation challenges should be considered before expanding simulation within a nursing curriculum. Particular weight was given to findings that were repeated across systematic reviews and to areas in which the literature remained inconsistent.

Pedagogical Foundations of Simulation-Based Education

Simulation as a learning strategy, not simply a technology

One of the most useful ways to understand simulation is to see it as a teaching strategy rather than as a piece of equipment. A manikin, virtual environment or actor is only the medium. Learning occurs through the interaction between the learner, the scenario, the facilitator, the objectives and the reflection that follows the experience. This distinction is reflected in contemporary simulation guidance, which places design, facilitation, prebriefing and evaluation at the centre of the simulation process.[3–6]

The NLN Jeffries simulation framework

The NLN Jeffries Simulation Theory provides a practical conceptual foundation for understanding how simulation components interact. It considers the learner, teacher, educational practices, simulation design characteristics and outcomes as connected elements rather than isolated parts of an activity. [3]

For nursing educators, the value of the framework is its reminder that a simulation scenario does not work in isolation. The same scenario can produce different learning experiences depending on the learner's level, the facilitator's approach, the clarity of the objectives, the realism of the environment and the way the debriefing is conducted. This is particularly relevant when institutions compare simulation centres based mainly on the equipment available. Educational quality should be judged by what learners are able to do and understand after the experience, not by the number of technological features in the laboratory.

Experiential learning and reflection

Simulation also fits naturally within experiential learning. Kolb described learning as a cycle involving concrete experience, reflective observation, abstract conceptualization and active experimentation. [7]

In simulation, the clinical event provides the experience; debriefing creates the opportunity to examine what happened; discussion connects the experience with clinical principles; and a subsequent scenario or clinical encounter allows the learner to try a different approach. This cycle helps explain why simply watching a demonstration is not equivalent to participating in a well-designed simulation. The learner must have an opportunity to act, think about the action and use the resulting insight.

Standards and deliberate design

Contemporary simulation standards reinforce this educational logic. Simulation-based experiences should begin with measurable objectives and should be designed around the behaviours or outcomes expected from the learner.[3,5] A scenario should therefore answer a simple question before equipment is selected: what should the learner be able to demonstrate by the end of the experience? This approach also helps educators decide how much fidelity is actually required. If the objective is sterile wound dressing, a task trainer may provide all the necessary realism. If the objective is recognizing a deteriorating patient and coordinating a team response, a more integrated environment may be useful. The level of fidelity should follow the educational purpose rather than the other way around.

Simulation Modalities in Nursing Education

Simulation exists on a continuum rather than as a single method. Physical realism, psychological realism and environmental realism can be increased or reduced independently. The most appropriate modality is therefore determined by the competency, learner level, available resources and desired outcome.

TRAINING CLASS	CORE ATTRIBUTES	EDUCATIONAL FOCUS
Partial-task trainers	Simple anatomical models, task trainers or procedural pads.	Repeated practice of focused psychomotor skills such as injections, catheterization, wound care or venipuncture.
Standardized patient actors	Trained people who portray patients or family members consistently according to a scenario.	History taking, assessment, therapeutic communication, health education, difficult conversations and interpersonal skills.
High-fidelity simulators	Computerized manikins capable of producing changing physiological responses and clinical cues.	Integrated assessment, clinical reasoning, prioritization, emergency response, teamwork and crisis management.
Virtual / immersive formats	Computer-based, virtual-reality, augmented-reality or other digital environments.	Repeatable clinical reasoning, situational awareness, remote-care scenarios, visualization and practice where physical access is limited.

Task trainers are particularly useful when the educator wants students to repeat a procedure until the sequence becomes familiar. Their relative simplicity can be an advantage: learners can focus on hand position, sequencing, aseptic technique or equipment handling without being distracted by a complex scenario.

Standardized patients add a different form of realism. They allow students to practise the human side of nursing, including open-ended questioning, empathy, education and responses to anxiety or frustration. These skills are difficult to reproduce with a manikin alone.

High-fidelity manikins are valuable when several competencies must come together. A learner may need to notice a change in vital signs, assess the patient, interpret findings, call for assistance, communicate with the team and reassess the response. Such integrated experiences can make clinical reasoning visible and discussable during debriefing.

Virtual and immersive simulation can offer repeated access to clinical situations that may be difficult to reproduce physically. It may be especially useful for cognitive rehearsal, orientation, triage and scenarios requiring a large or changing environment. However, virtual

learning cannot reproduce every sensory and interpersonal feature of bedside care, so its strongest role is usually complementary.

RESULTS

Overall evidence for simulation-based learning

Across the literature, simulation generally produces positive educational outcomes. Mishra and colleagues reported beneficial effects across cognitive, affective and psychomotor domains, including knowledge, self-confidence, satisfaction and skill-related outcomes, although heterogeneity was substantial. [1]

An earlier meta-analysis by Shin et al. similarly found a medium-to-large overall effect of patient simulation, while noting that outcomes differed according to the learner group, evaluation method, clinical subject and fidelity level. [2]

These findings are encouraging, but they should not be interpreted as evidence that every simulation intervention will be equally effective. Simulation studies differ in duration, modality, scenario complexity, learner experience, assessment tools and comparator teaching methods. This variation makes broad statements such as 'high-fidelity simulation is better' less useful than asking which modality works best for which outcome.

Clinical reasoning and decision-making

Clinical reasoning is one of the more important outcomes in modern nursing education because competent practice requires learners to interpret changing information rather than simply recall facts. A systematic review by Alshehri et al. found evidence supporting high-fidelity simulation for clinical reasoning-related outcomes, while also noting variation in the available studies. [8]

Simulation has a particular advantage here because it can make the patient's condition evolve. A learner may begin with a stable patient and then have to respond to new information, reassess priorities and justify decisions. The educator can then explore not only what the learner did, but why the learner chose that action. This makes clinical reasoning observable in a way that is difficult to achieve through written examinations alone.

Knowledge and psychomotor performance

High-fidelity simulation has also demonstrated positive effects on knowledge and skills performance. Tonapa et al. reported significant pooled effects for knowledge acquisition, self-confidence and skills performance in their systematic review and meta-analysis. [9]

More recently, Vangone et al. synthesized evidence from six systematic reviews comprising 133 primary studies and found significant pooled effects of high-fidelity simulation on knowledge and performance. Importantly, the authors also reported substantial heterogeneity, indicating that the effects varied across contexts and study characteristics. [10]

The practical implication is that repetition and feedback may matter as much as fidelity. A student who performs a procedure several times, receives specific feedback and corrects technique may gain more from a simple task trainer than from a highly complex scenario in which the procedure is performed only once.

Confidence, satisfaction and affective outcomes

Students commonly value simulation because it gives them an opportunity to practise before facing a real patient. The ability to make mistakes, receive feedback and repeat the activity can support confidence and reduce uncertainty. However, confidence should not be treated as a substitute for competence. A learner may feel comfortable with a procedure without being able to perform it correctly, and therefore confidence

should ideally be assessed alongside objective performance.

The broader literature supports positive effects on self-confidence and satisfaction, but these outcomes are influenced by the quality of the learning environment and the way learners experience the simulation. [1,2]

Virtual reality and immersive learning

Virtual reality has become increasingly prominent in nursing education. Huai et al. found that VR-based education improved knowledge, skill performance, learning satisfaction and self-efficacy in nursing students. However, significant differences were not consistently observed for clinical reasoning and communication when VR was compared with other educational approaches. [11]

This finding is important because it challenges the idea that immersion automatically produces deeper learning. Virtual environments can provide repetition, visualization and access, but clinical reasoning and communication may require additional guided discussion, interpersonal interaction and integration with other forms of teaching. VR is therefore best viewed as another tool in the educator's repertoire rather than as a universal replacement for simulation or clinical placement.

Application of Simulation across Nursing Specialties

Medical-surgical nursing

Medical-surgical nursing provides many opportunities for simulation because patients often present with several interacting problems. Scenarios can be designed around deterioration, medication safety, postoperative complications, fluid and electrolyte imbalance, respiratory compromise or sepsis recognition. The educational value is not simply in recognizing the diagnosis; students must decide what information matters most, what should happen first, whom to inform and how to reassess the patient.

Simulation can also be used to introduce prioritization. A student may receive several simultaneous demands, such as a new admission, a change in vital signs and a request from another patient. The scenario can then be debriefed around prioritization principles, delegation, communication and time management.

Maternity and obstetric nursing

Obstetric emergencies are often suitable for simulation because they may be infrequent but require coordinated action when they occur. Postpartum haemorrhage, hypertensive emergencies, shoulder dystocia and neonatal resuscitation can be rehearsed without requiring students to wait for a rare event during clinical placement.

The value of these scenarios lies in the opportunity to practise early recognition, escalation, teamwork and role clarity. Simulation also allows educators to repeat the same emergency with increasing complexity, helping learners move from following a checklist toward understanding the sequence and rationale of care.

Pediatric and critical care nursing

Pediatric care requires careful assessment, age-appropriate communication and attention to weight-based medication calculations. Simulation can bring these elements together while allowing students to practise communicating with parents or caregivers. In critical care, scenarios can focus on trends in vital signs, oxygenation, perfusion, medication administration, emergency response and interdisciplinary communication.

An important advantage of simulation in these areas is the ability to expose learners to uncommon

but consequential situations. The educator can pause, repeat or modify a scenario, which is rarely possible during a live clinical emergency.

Community and primary health care

Simulation should not be limited to acute hospital care. Community nursing scenarios can include home visits, health education, chronic disease follow-up, communication with families, infection prevention and assessment of environmental or social factors affecting health. Virtual simulation may be particularly useful when educators want to represent a variety of home or community settings without physically moving learners between locations.

Design and Implementation of an Effective Simulation Session

Prebriefing: preparing learners to learn

Prebriefing is more than explaining where the equipment is located. It establishes the expectations for the activity, introduces the environment, clarifies roles and helps create psychological safety. Current simulation standards emphasize the importance of structured preparation before the active scenario. [4,5]

A useful prebriefing should also make the learner's task clear. Students should know what is expected of them, what resources are available and how the experience will be assessed. When learners are uncertain about the rules of the simulation, they may spend valuable cognitive effort trying to understand the environment rather than focusing on patient care.

Enactment: giving learners space to think and act

During the active phase, learners should have enough autonomy to make decisions. The facilitator's role is not to rescue students at the first sign of difficulty. At the same time, the educator must balance learner autonomy with patient-safety boundaries appropriate to the simulation. Cues can be introduced when they are part of the planned design, but excessive prompting can turn a clinical reasoning exercise into a guided checklist.

Debriefing: where experience becomes learning

Debriefing is a central component of simulation because it gives learners an opportunity to examine their actions, reasoning and emotions. Standards for facilitation emphasize purposeful guidance, psychological safety and methods that help learners connect the experience with the objectives. [5]

A good debriefing is not simply a list of errors. The facilitator should invite learners to explain what they noticed, what they were thinking, what influenced their decisions and what they would do differently next time. This approach keeps the conversation focused on learning rather than blame. It also recognizes that an incorrect action may have been based on a reasonable interpretation of the information available at the time.

Evaluation and feedback

Evaluation should be aligned with the objectives and may address knowledge, skills, attitudes, behaviours or combinations of these domains. [6]

For high-stakes assessment, educators should use clearly defined criteria and appropriate validity evidence rather than relying solely on general impressions. Formative simulation can be more flexible, allowing feedback and repeated attempts. The distinction between learning through simulation and assessing competence through simulation should be explicit.

DISCUSSION

High fidelity is not synonymous with high educational value

One of the clearest themes across the evidence is that fidelity should be purposeful. High-fidelity simulation can create a rich environment for integrated clinical decision-making, but it is resource-intensive and may introduce unnecessary complexity when the objective is narrow. The older meta-analytic evidence already suggested that simulation effects are not explained simply by fidelity level, and more recent reviews continue to show variation between studies.[2],[10]

A useful principle for educators is therefore: define the competency first, then select the modality. If the competency is psychomotor precision, repeated task practice may be sufficient. If the competency is communication, a standardized patient may be more educationally authentic. If the competency is recognizing deterioration while coordinating a team, high-fidelity simulation may offer advantages. If the competency involves remote triage or repeated situational exposure, virtual simulation may be appropriate.

Simulation should complement, not automatically replace, clinical experience

The NCSBN National Simulation Study provided important evidence that substantial amounts of simulation could be incorporated into prelicensure nursing education without compromising graduate outcomes under the conditions studied. [12]

That finding should be interpreted carefully. The study was conducted within a structured programme in which participating schools had established clinical education infrastructure and substantial clinical experience. It does not mean that simulation can reproduce every aspect of patient care. Clinical placements expose students to the unpredictability of real people, real families, real teams, real environments and real consequences. Simulation can prepare learners for these experiences, provide additional practice and address gaps in exposure, but it should not be treated as a simple technological substitute for the clinical world.

Faculty expertise may matter as much as equipment

Simulation requires a different teaching skill set from conventional classroom instruction. Faculty must be able to write scenarios, anticipate learner actions, facilitate safely, recognize when to intervene and conduct reflective debriefing. The educator also needs to understand the technology well enough that equipment problems do not become the focus of the session.

National guidance and simulation standards emphasize the need for trained personnel, appropriate infrastructure and programme-level support. [4,5,12]

Institutions sometimes invest heavily in equipment before establishing faculty development and curriculum integration. This can create a laboratory that is technically impressive but underused. A more sustainable approach is to build faculty capability alongside infrastructure and to start with achievable simulation activities before expanding complexity.

Cost and accessibility

High-fidelity laboratories require initial investment as well as continuing expenditure for consumables, software, maintenance, technical support and faculty time. These costs can be challenging for institutions with limited resources. The answer is not necessarily to abandon simulation. A carefully planned programme can combine low-cost task trainers, peer role-play,

standardized patients, low- and medium-fidelity manikins and selected high-fidelity sessions.

This multimodal approach can also be pedagogically stronger. Students may first learn a procedure using a task trainer, then apply it within a clinical scenario, and finally demonstrate communication and decision-making with a standardized patient. The progression allows each modality to do what it does best.

Psychological safety and learner experience

Simulation is most useful when students feel able to participate, make reasonable mistakes and discuss their thinking without humiliation. Psychological safety does not mean removing accountability. Rather, it creates an environment in which learners can be challenged while still being treated with respect. The distinction is particularly important in debriefing, where an overly judgmental tone can cause students to defend themselves rather than examine their reasoning.

What the evidence still does not answer well

Despite a growing evidence base, several questions remain unsettled. Studies use different simulation durations, outcome measures and definitions of fidelity. Many focus on immediate learning outcomes rather than transfer to clinical practice. Some studies measure confidence or satisfaction, which are valuable but not equivalent to competence. Recent umbrella and meta-analytic work also demonstrates considerable heterogeneity, suggesting that context and implementation matter.

Future studies would benefit from clearer descriptions of scenarios, facilitator preparation, learner characteristics, dosage of simulation, comparator conditions and longer-term outcomes. Research should also examine cost-effectiveness and whether learning is retained after students return to clinical practice. For nursing education, the most meaningful endpoint is not simply whether students enjoyed a simulation or performed well immediately afterward, but whether the experience contributes to safer, more thoughtful practice.

Emerging Trends and Future Directions

Virtual, augmented and mixed reality

Immersive technologies are likely to become more accessible and more closely integrated with nursing curricula. Their greatest potential may lie in providing repeatable experiences, visualizing complex environments and supporting learning outside scheduled laboratory sessions. The current evidence supports benefits for several outcomes, but also shows that VR does not consistently outperform other methods for clinical reasoning or communication.[11]

Artificial intelligence and adaptive simulation

Artificial intelligence may eventually make simulated patients and virtual scenarios more responsive to learner decisions. In principle, an adaptive scenario could alter the patient's responses according to the learner's actions and generate individualized practice. Such systems could also support feedback and help faculty identify patterns in learner performance.

However, the introduction of AI should not be treated as an educational goal in itself. Any adaptive system still requires sound learning objectives, appropriate clinical content, transparent evaluation and faculty oversight. Technology that generates plausible responses is not necessarily technology that teaches well.

Remote and community-based simulation

The growth of telehealth and distributed care creates opportunities to use simulation beyond the traditional skills laboratory. Students can practise

remote assessment, telephone triage, health education and communication across distance. Simulation can also be used to prepare learners for community settings in which clinical decisions are influenced by family circumstances, access to services and social context.

Toward multimodal curricula

The most realistic future is unlikely to be a curriculum dominated by one technology. Instead, nursing programmes can use a sequence of modalities: demonstration and task practice for foundational skills, standardized patients for communication, high-fidelity simulation for integrated decision-making, virtual simulation for repetition and access, and clinical placement for authentic patient care. This approach treats simulation as part of a learning pathway rather than as a separate event.

Critical Synthesis

The literature supports simulation as a valuable component of nursing education, but the evidence is stronger for some claims than for others. The most consistent support is for improvements in knowledge and practical performance. Evidence for confidence and satisfaction is also generally favourable. Clinical reasoning appears promising, particularly with well-designed high-fidelity scenarios, but the evidence is more variable. Virtual reality shows useful effects for knowledge, skills and self-efficacy, while its superiority for communication and clinical reasoning is less established.[1,8–11]

Several conclusions follow from this pattern. First, simulation works best when it is deliberately matched to an educational objective. Second, debriefing and facilitation are not optional additions; they are part of the intervention. Third, higher fidelity should not be confused with higher quality. Fourth, simulation cannot reproduce every feature of authentic clinical practice and should therefore be integrated with real patient experiences. Finally, implementation capacity—including trained faculty, infrastructure, time and curriculum alignment—is likely to determine whether the theoretical benefits of simulation are realized in practice.

For nurse educators, this leads to a practical shift in emphasis. The question should move from 'Which simulator should we buy?' to 'Which competency are we trying to develop, what experience will help students develop it, and how will we know they have learned it?' This change in perspective keeps educational purpose ahead of technology and makes simulation more defensible, sustainable and meaningful.

CONCLUSION

Simulation has become an important part of modern nursing education because it creates structured opportunities for learners to practise clinical skills, decision-making, communication and teamwork. The evidence reviewed in this article indicates that simulation can improve several educational outcomes, but its effectiveness depends on how the experience is designed and implemented.

No single simulation modality is best for every competency. Task trainers, standardized patients, high-fidelity manikins and virtual technologies each have distinct strengths. The most effective nursing curricula are therefore likely to use them in combination, with the choice guided by learning objectives rather than by the sophistication of available technology.

Simulation should also remain connected to authentic clinical practice. Its greatest contribution may be to prepare learners for real patient care, provide opportunities that clinical placements cannot reliably offer, and create a safe setting in which learners can practise, receive feedback and try again. When supported by sound educational

theory, clear objectives, skilled faculty and structured debriefing, simulation can help redefine clinical competency as more than task performance—as the ability to think, communicate, adapt and provide safe nursing care in changing clinical situations.

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Declaration of Use of Artificial Intelligence

During manuscript preparation, generative artificial intelligence tools, including Google Gemini, Copy.ai and ChatGPT, were used to assist with language clarity, grammar and readability. The author reviewed and takes responsibility for the final content, interpretation of the literature and accuracy of the submitted manuscript.

Conflicts of Interest

None.

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