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CONTEMPORARY APPROACHES TO PAEDIATRIC EDUCATION: A SCOPING REVIEW OF TEACHING MODALITIES

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Abstract

Introduction:

Paediatric clinical education faces challenges due to limited placements and evolving healthcare needs. Innovative educational strategies are essential to ensure students are adequately prepared for paediatric practice.

Methods:

A scoping review was conducted following JBI methodology and the PRISMA-ScR checklist. A comprehensive search of OVID Medline, and CINAHL databases identified 128 eligible studies published between 2013 and 2024. Studies were categorised into simulation-based education, online modalities, and alternative teaching methods, and synthesised for educational impact in tertiary health curriculums.

Results:

High-fidelity simulation (HFS) emerged as the most frequently studied intervention and was commonly associated with improved learner confidence, communication, and short-term clinical decision-making outcomes. Low-fidelity simulation (LFS) supported foundational skill development but lacked realism. Several studies reported comparable cognitive learning outcomes between online modalities and traditional educational approaches. Emerging approaches such as interprofessional education, community-based learning, and nuanced technologies showed potential but require further validation. Most included studies originated from the United States and focused on undergraduate nursing education, which may limit generalisability across healthcare disciplines and international contexts.

Discussion/Conclusion:

Simulation-based learning appears to provide a valuable supplementary strategy to the delivery of paediatric education, though cost and scalability remain concerns. A scaffolded, integrated curriculum that combines simulation, digital platforms, and alternative approaches are shown to enhance student readiness for paediatric practice. Further longitudinal research is needed to assess clinical and patient outcomes.

I INTRODUCTION

The education of future healthcare professionals is continually evolving to meet the growing complexity of clinical practice in paediatric healthcare (McCall et al., 2009). In this challenging space health professionals must navigate the unique developmental, emotional, and physiological needs of each child and their support networks. Despite its importance, paediatric education is often underrepresented and inconsistently integrated within university health programs leading to gaps in student knowledge, preparedness and confidence when caring for children in a clinical setting (Peasey et al., 2024).

Traditional models of clinical education face growing challenges including limited placement availability, rising costs, additional resourcing requirements, and increasing competition for paediatric clinical hours (Betz, 2021). These pressures are felt across the spectrum of health professional training, including medicine, nursing, paramedicine, and allied health disciplines, all of which require structured paediatric clinical exposure as part of accreditation and competency standards set by governing bodies (Australian Health Practitioner Regulation Agency [AHPRA], 2023).

Paediatric clinical education is typically delivered as a combination of classroom-based teaching, simulation activities, and supervised clinical placement experiences embedded within undergraduate and postgraduate health professional programs. In medicine, nursing, paramedicine, and allied health curricula, paediatric content is commonly integrated into broader clinical subjects or specialty rotations rather than delivered as a standalone discipline-specific course. As a result, student exposure to paediatric patients and clinical scenarios can vary

considerably depending on institutional structure, placement availability, and local workforce capacity.

Paediatric clinical education typically refers to training that addresses the medical care of infants, children, and adolescents up to 18 years of age, encompassing both acute and primary healthcare settings (Royal College of Paediatrics and Child [RCPCH], 2020). Traditionally, paediatric health education has predominantly emphasized theoretical knowledge tailored to specific subgroups, often neglecting the consideration of how such interventions might be effectively adapted or transferred to diverse populations (Cambon et al, 2012). In response to these constraints, educational institutions are increasingly exploring innovative, evidence-based teaching strategies to ensure students still meet required paediatric competencies. These challenges are being approached by adapting interventions such as simulation.

Simulation is a broad term used to describe the use of simulated environments, tools and scenarios to represent clinical scenarios in order to foster safe learning for clinical, procedural, decision making and problem-solving skills (Saleem & Khan, 2023). Simulation tries to fill the hole between theory and 'real life' practice. Broadly speaking simulation can be broken into a number of different categories such as high-fidelity simulation (HFS), low fidelity simulation (LFS), online simulations and virtual simulations through problem-based learning (Ratish, 2025). HFS involves the use of advanced, computer-controlled manikins capable of mimicking humans and their normal physiological responses (e.g., spontaneous breathing, heart sounds, pupil reactions, or seizures). Additionally, HFS uses interactive scenarios in replicated clinical environments to simulate real world situations (Massoth et al., 2019). LFS uses simpler models and anatomical devices designed to practice specific technical skills. For example, this may include practicing intravenous cannulation, urinary catheter insertion, or airway management.

Existing literature demonstrates substantial variability in how paediatric education is incorporated across health disciplines, including differences in placement duration, simulation use, curriculum scaffolding, and required clinical exposure hours (Bowling et al., 2018; Peasey et al., 2024). While individual studies have evaluated specific educational interventions, there remains limited synthesis of how these approaches are collectively being used to address contemporary challenges in paediatric clinical education (Kim et al., 2023).

This scoping review aims to explore and synthesise current literature on innovative educational interventions used to deliver paediatric content in tertiary health programs. It investigates how these approaches are being implemented, their outcomes, barriers, and their potential role in future curriculum design. By mapping current literature and identifying gaps, this review contributes to the ongoing development of effective, achievable, and engaging paediatric education across health disciplines.

II METHODOLOGY

A Research Approach

A scoping review approach was chosen to explore this new and emerging complex topic of paediatric health care education. It is a broad topic that is not well defined and this approach aims to map the range of evidence available and identify the gaps in research. This is done in order to summarise the extent of research on the topic and inform future research direction (JBI, 2024).

This research was conducted in accordance with the JBI methodology for scoping review. The review title was not pre-registered before the scoping review commenced (JBI, 2024). The research was reported in alignment with the PRISMA ScR checklist (Pollock et al., 2023).

B Research Paradigm

This scoping review was conducted on the basis of theoretical and educational framework surrounding the constructivist learning theory. The constructivist learning theory emphasises that students need to build their knowledge through experiences and pragmatic learning (McLeod,

2025). This framework will aid in exploring how paediatric content can be introduced in a way that is practical and aligns with constructivist principals through experiential learning and active engagement.

C Search Strategy

Preliminary searches of online databases OVID Medline and CINAHL were performed to enable familiarisation with keywords and to aid in the development of the final search strategy. Initial searches focused on paramedicine literature to align with the project's discipline-specific context. However, due to limited volume and to ensure breadth and relevance, the search and therefore project context was purposefully expanded to include allied health professions. This multidisciplinary lens reflects the shared educational needs across healthcare learners and improves the applicability of findings without introducing bias (Patel et al., 2025).

The search strategy was formulated using a modified Population-Concept-Context (PCC) framework to explore how paediatric content is integrated into health professions education. The Population included medical and health professionals such as doctors, nurses, paramedics, and allied health practitioners (P1) at the university-level or undergraduate education (P2). The Concept was divided into two components: (C1) the use of innovative, active, or non-traditional educational strategies (e.g., simulation, flipped classrooms, interprofessional education), and (C2) the delivery or integration of paediatric-specific content within health curricula. The Context focused on paediatrics or child health as the clinical or curricular focus. A full list of search terms is provided in Table 1.

Within this review, 'delivery' referred to the educational modality or teaching method used to facilitate paediatric learning (e.g., simulation, online learning, case-based teaching), while 'integration' referred to how paediatric content was embedded or scaffolded within broader health professional curricula.

The databases that were included in the literature search were OVID Medline and CINAHL. These databases were used as they are specific to biomedical health care which would identify all the relevant literature to assist in answering my research question (Methley et al., 2014). The parameters of the initial search include humans, English language and publication year of 2013-2023. This limitation of 10 years was placed to ensure up to date innovative practice were captured. The final search was conducted on the 20th of September 2023.

Table 1

Search Strategy

Population 1	Population 2	Concept 1	Concept 2	Context
Medical professionals	Undergrad*	Problem-Based Learning	P*ediatric Curriculum Integration	Pediat*
Doctors	University	Simulation	P*ediatric Teaching Strategies	Child*
Paramedics	Uni*	Online Modules	P*ediatric Content Delivery	Baby
Ambulance	Student	Interprofessional Education	Child Health Curriculum	Infant
Nursing	Freshman	Active Learning	P*ediatric Education Enhancement	Newborn
Allied Health		Flipped Classroom	Educat*	Babies
EMS		Team-Based Learning	Medical Education	

		Innovat*	Curriculum	
		Strateg*		

Note: Terms within each column were combined with the OR Boolean operator with AND used to combine the columns.

Grey literature sources were explored during preliminary searching to identify potentially relevant reports, institutional publications, and professional guidance documents. However, no grey literature sources met the final inclusion criteria for this review, which focused on peer-reviewed literature to ensure methodological consistency and quality appraisal across included studies.

D Screening Process

All identified citations for each database were collated and uploaded into Covidence online software and duplicates were removed (Covidence systematic review software, 2023). The abstract of these citations was screened by two independent reviewers for assessment against the inclusion and exclusion criteria, which are listed below (Table 2).

Table 2:

Eligibility criteria

Inclusion: • Peer reviewed. • Human study. • The study must directly address paediatric education. • Studies must be health specific. • Studies must have been published within the last 10 years (published after 2012). • Studies may include qualitative, quantitative, reviews, meta-analyses, and case studies. • Studies must be published in English.	Exclusion: • Studies focussing solely on animal models or veterinary medicine. • Non-English literature. • Studies of conference abstracts, editorials, and opinion pieces. • Studies published more than 10 years ago (published before 2013).
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Potentially relevant sources were retrieved in full and their citations imported into Covidence. Through consultation among the research team, it was decided that the exclusion criteria needed to be increased to restrict the number of irrelevant articles being selected. The exclusion criteria for full text screening that was added included:

- *Articles including maternity care, neonatal care and infants up to 4 days old.*
- *Other systematic reviews, scoping reviews and meta-analysis.*

E Quality Assessment

A quality assessment was completed for each study included in the scoping review. It is important to ensure contextual understanding, credibility of the articles used to identify gaps and inform recommendations, as well as ensuring transparency to the audience. Although not mandatory for scoping reviews, quality appraisal was undertaken to provide contextual interpretation of evidence strength across the included literature.

The QUADS tool (Quality Assessment with Diverse Studies) was used for the quality assessment of each article (Harrison et al., 2021). This tool was selected for its comprehensive criteria, which facilitate the identification of bias across a range of study designs, an essential

feature given the diversity and scale of this scoping review. This tool also provides a standardised assessment of each article and allows comparison.

F Data Extraction

Data was extracted into a table to provide an organised summary of the information from each of the included studies, making it easier to compare findings. The table also provides a standardised extraction process ensuring consistency, clarity and transparency across the outcomes and key findings. The variables in the table were decided based on the guidance from the JBI evidence synthesis by Pollock et al. (2023) and consisted of the article's author(s), year of publication, country of origin, aims/purpose, population size, the methodology used, outcomes and key findings. A modification was added to include which health profession were targeted in each study. This table was later separated by taking the outcomes and key findings with the grouping of interventions used to create a separate table. This allows for ease of access and viewing can be found in the supplementary materials.

G Data Synthesis

Consistent with the exploratory remit of scoping reviews and the methodological diversity of the included studies, the synthesis was primarily descriptive and narrative. First, a descriptive mapping exercise was conducted: each study's population, intervention type, and outcomes were reported in a characteristics table, and a simple frequency count quantified how often each intervention category (e.g. simulation, online teaching, in classroom tutorial) appeared. Next, studies by these interventions were grouped categories to enable structured comparison and to summarise shared features and findings within each group. A thematic synthesis was conducted by looking at each category's strengths and limitations with a focus on clinical practice. The studies were grouped by their modality to ensure we compare studies with similar methods. By combining straightforward quantitative counts with a thematic reading of the data, this unified narrative synthesis both highlights key patterns and explores their meaning, without resorting to a full formal content-analysis protocol, which would have been impractical given the breadth and scoping nature of this review (Arksey & O'Malley., 2002).

H Use of Artificial Intelligence

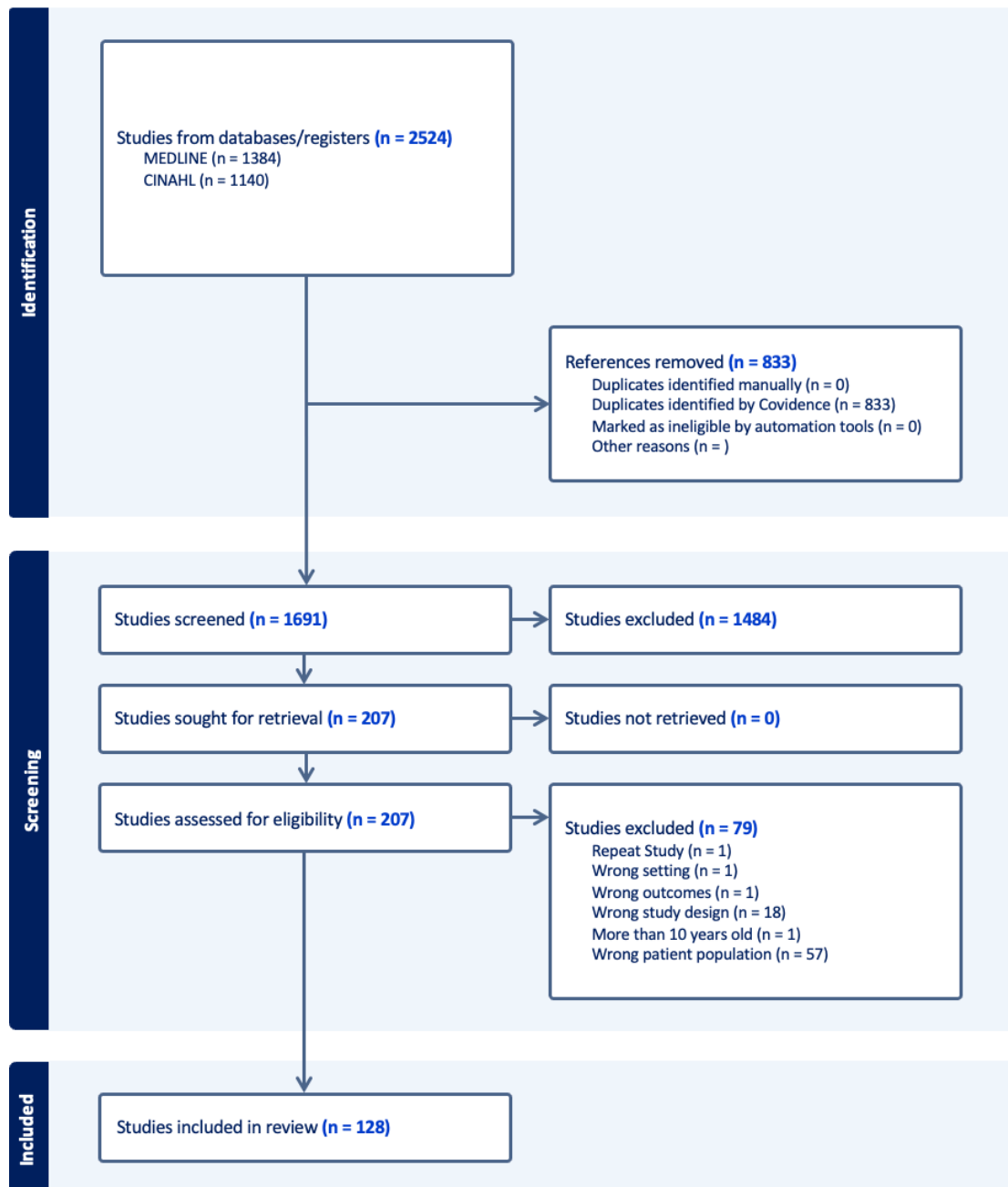
Generative artificial intelligence (AI) was used as an adjunct to the literature review process to assist with identifying potentially relevant sources and collating information extracted from the included literature. All sources, extracted information, study classifications, and interpretations were independently reviewed and verified by the authors. AI was not used to determine study eligibility, assess study quality, interpret findings, or generate the conclusions of this review.

III RESULTS

The initial PRISMA search yielded a total of 2524 references, with the final yield being a total of 128 studies to be included in the scoping review. Common reasons for the studies to be excluded were wrong population groups and wrong study design. No further studies were identified through grey literature searching. This is summarised in Figure 1. The median quality analysis score was 65.3% with studies performing well when having theoretical underpinning to the research. A well-justified research methodology, clearly defined target population, appropriate data collection and analysis techniques all significantly contributed to achieving a high-quality analysis score. There are several factors that contributed to studies performing poorly in the quality analysis and these include poor justification of research methodology, unclear or inappropriate target population, weak data analysis without explanation and justification. The complete quality analysis is provided within *Supplementary Material Table 1*.

Figure 1:

PRISMA Search Outcomes



A Narrative Synthesis

1 Descriptive Mapping

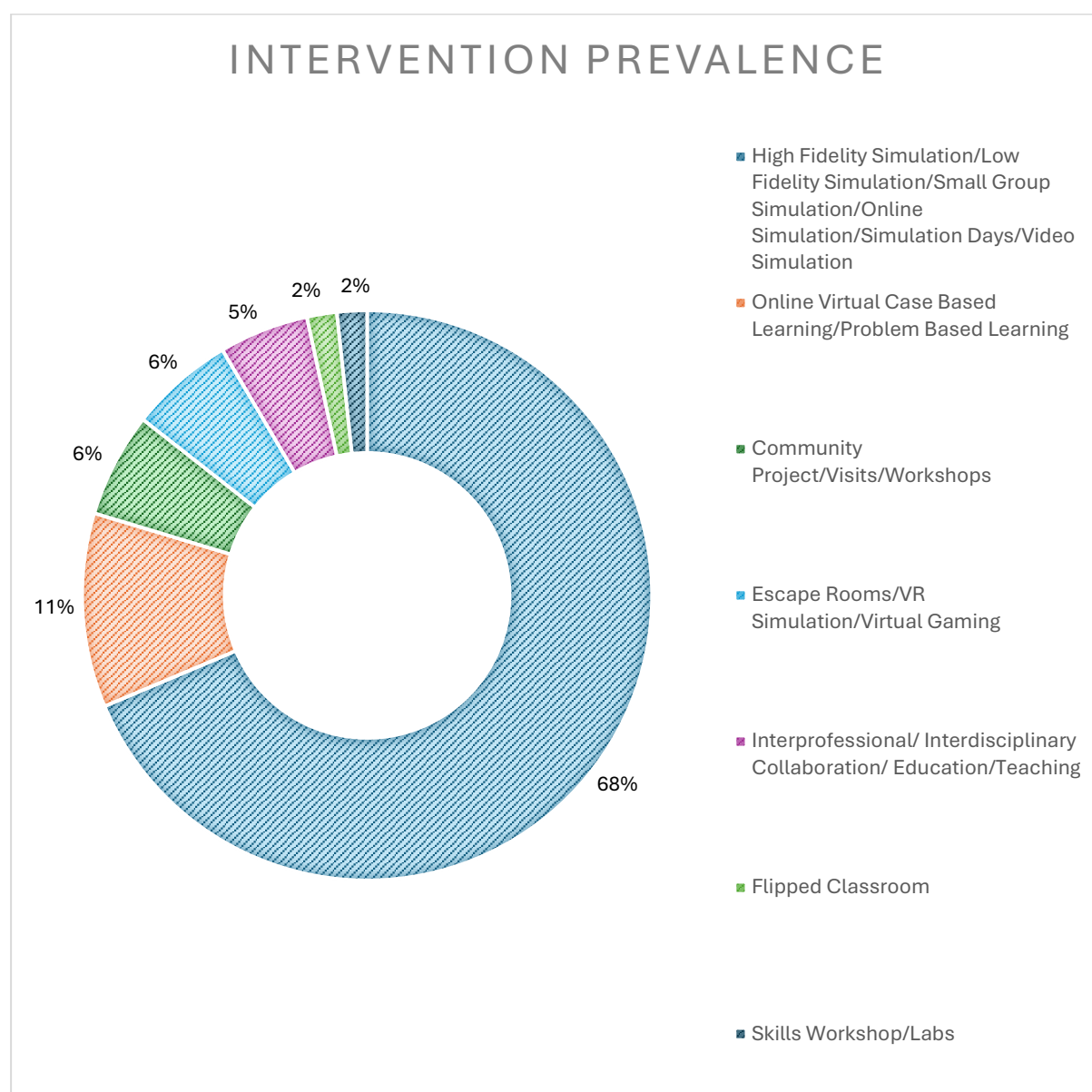
Of the 128 included studies, approximately 90 originated from the United States of America and conducted during the period of the COVID-19 pandemic from 2019–2021. A majority of the studies (90%) were targeted towards nursing students with a mixed methods approach using qualitative and quantitative data. The use of simulation across varied mediums proved to be the most used intervention of the studies and has provided the most relevant data. A detailed breakdown of the characteristics and article quality analysis of the included studies can be seen in *Supplementary Material Table 1*.

2 Frequency Analysis

The interventions included high fidelity simulation, low fidelity simulation, small group simulation, online simulation, simulation days, video simulation, online virtual case-based learning, problem-based learning, interprofessional teaching, escape rooms, virtual reality simulation, virtual gaming, community engagement, skills workshops/labs and flipped classrooms. The studies have been grouped in accordance with their interventions in *Supplementary Material Table 2* to allow for categorised presentation and synthesis. As seen in Figure 2, simulation-based modalities were the most commonly identified intervention category, represented in 88 of the 128 included studies (68%). Online virtual and case-based learning approaches were identified in approximately 14 studies (11%), while community-based learning and immersive technologies such as escape rooms and virtual reality were less frequently represented.

Figure 2:

Intervention Prevalence



B Thematic Synthesis

1 High Fidelity Simulation

Across multiple studies, HFS was the most frequently evaluated modality and was commonly associated with positive learner perceptions and short-term educational outcomes. A synthesis of findings reveals three key themes within this intervention: supplement traditional clinical experiences, implementation factors affecting outcomes, and resource considerations.

Multiple studies documented HFS's effectiveness as a **substitute for traditional clinical experiences**. Curl et al. (2016) reported that replacing up to 50% of traditional clinical placement hours with high-fidelity simulation produced comparable educational outcomes in selected paediatric nursing competencies when structured debriefing was incorporated. While this

suggests simulation may partially supplement clinical exposure, the evidence does not support complete replacement of authentic paediatric clinical experience. Darcy-Mahoney et al. (2013) reported achievement of paediatric learning objectives exceeding 80% in simulation scenarios, further supporting HFS as an alternative to traditional clinical education.

Implementation factors emerged as critical determinants of HFS effectiveness. Structured debriefing was consistently identified as essential across studies, with both Darcy-Mahoney et al. (2013) and Curl et al. (2016) emphasizing its role in solidifying learning outcomes. The format and timing of debriefing sessions varied across studies, but all successful implementations included this component.

Resource constraints were identified as a consistent limitation across the literature. Unlike lower-fidelity approaches, HFS implementation requires substantial financial investment and technical infrastructure. Darcy-Mahoney et al. (2013) specifically highlighted limited availability of high-fidelity simulators as a significant barrier, a finding echoed in subsequent studies.

Analysis revealed notable gaps in the HFS literature. Few studies addressed the differential impact of HFS across various learner levels or specialties within paediatric education. Additionally, while studies consistently reported positive short-term outcomes, longitudinal impacts on clinical practice were rarely examined.

Collectively, the literature suggests that high-fidelity simulation may be most valuable for exposing learners to infrequent, high-acuity paediatric presentations in a psychologically safe environment. The strongest evidence relates to improvements in learner confidence, communication, and short-term clinical decision-making. However, current evidence remains limited regarding long-term competency transfer, patient outcomes, and whether simulation can adequately replicate the interpersonal and contextual complexity of authentic paediatric clinical environments.

2 Low-Fidelity Simulation

Low-Fidelity Simulation (LFS) has been consistently recognised in the literature as a valuable educational tool, particularly in the context of paediatric clinical training. The following themes emerged from the analysis of current studies; skill development and procedural understanding, cost effectiveness and accessibility, realism and clinical complexity.

LFS is widely reported to support **skill development which includes understanding of procedural flow**, basic decision-making, and technical skills. Its design encourages repetitive practice and fosters learner autonomy in a safe environment. Hill et al. (2023) demonstrated how LFS helped students simulate the journey of a surgical patient, enhancing their understanding of clinical processes and improving their ability to navigate patient care pathways.

One of the most frequently cited advantages of LFS is its **cost-effectiveness**. Compared to high-fidelity simulation, LFS is more affordable and easier to implement, making it especially beneficial for institutions with limited resources. This increased accessibility allows a broader range of students to engage with simulation-based learning.

Despite its benefits, a common criticism of LFS is its **lack of realism**. Studies such as Lo and Yang (2022) found that students often became overly focused on technical tasks, with reduced emphasis on clinical reasoning, emotional communication, and patient empathy. The simplified nature of LFS scenarios was perceived to limit engagement with the patient interaction aspects of patient care.

Gaps exist in the LFS literature with few studies looking at the integration of LFS with other educational approaches. Integrating LFS with virtual simulations, augmented reality, or high-fidelity components could bridge the gap between basic procedural competence and higher-order clinical reasoning and empathy development.

An additional layer of insight surrounding simulation, comes from a curriculum review by Bowling et al. (2018), which exposes inconsistencies in clinical hour requirements across nursing

education programs in the United States. The review found no clear evidence linking the number of practiced clinical hours to paediatric competency, nor support for fully replacing clinical time with simulation. However, expert opinion from the Society of Paediatric Nursing suggested that a minimum of 61–80 hours may be required to ensure competency, highlighting a tension between empirical data and professional consensus (Bowling et al., 2018). This finding is underpinned by the need for further research into evidence-based guidelines for balancing clinical placements with alternative learning modalities.

The reviewed literature indicates that low-fidelity simulation provides an accessible and cost-effective approach for developing foundational paediatric procedural skills and reinforcing clinical workflows. Its affordability and ease of implementation may make it particularly useful for institutions with limited simulation infrastructure. However, the simplified nature of these modalities may reduce opportunities for learners to engage in higher-order clinical reasoning, emotional communication, and complex interpersonal interactions. Current evidence therefore suggests that low-fidelity simulation may be most effective when integrated within broader scaffolded educational models that combine procedural practice with opportunities for reflective and immersive learning.

3 *Virtual Simulation, Video & Case Based Learning*

This analysis explores the emerging role of virtual simulations, video-based learning, and online case-based education within health and medical training. Drawing from several studies, three primary themes emerged: enhanced accessibility, cognitive skill development and limitations in experiential and tactile learning.

Virtual and case-based simulations were consistently reported as effective learning tools that contribute to knowledge retention, procedural understanding, and clinical reasoning in a risk-free environment. With **enhanced accessibility**, these modalities allow students to practise independently, reinforce theoretical learning, and engage with complex scenarios at their own pace.

Diaz et al. (2021) conducted a comparative study of high-fidelity simulation (HFS) and virtual simulations, finding no statistically significant difference in knowledge outcomes ($p = .319$) or clinical pass/fail rates. These findings suggest that virtual learning platforms can offer equivalent educational value to traditional, in-person high-fidelity experiences, particularly in **cognitive skill development**. Similarly, Cantey et al. (2021) reported that 95% of students found online case-based learning to be highly engaging, citing student survey feedback that emphasised self-paced learning, critical thinking, and problem-solving as key benefits. These findings align with constructivist and adult learning theories, which support active learner engagement through contextualised learning experiences.

Despite the cognitive benefits, a notable limitation identified in the literature is the lack of experiential and tactile learning inherent in virtual simulations. The inability to physically interact with patients or practice hands-on procedures was recognised as a persistent challenge. This concern is echoed in broader pedagogical discussions, as clinical education relies heavily on kinaesthetic and affective domains of learning. However, Lagunas et al. (2021) provide reassuring findings, suggesting that virtual clinical simulations, when well-designed, do not negatively impact paediatric knowledge acquisition or core clinical skill development. This indicates a growing acceptance of blended learning models, where digital tools serve as supplements, rather than replacements, to traditional methods.

Virtual simulation, video-based education, and online case-based learning appear to provide flexible and scalable opportunities for paediatric education, particularly in supporting knowledge acquisition, clinical reasoning, and self-directed learning. These approaches may be especially valuable when access to paediatric placements or simulation laboratories is restricted. Nevertheless, the literature consistently highlights limitations in experiential learning, psychomotor skill development, and interpersonal communication. While virtual modalities demonstrated comparable cognitive outcomes in several studies, current evidence supports their

role primarily as supplementary tools within blended educational frameworks rather than stand-alone replacements for hands-on paediatric clinical experience.

4 *Alternative approaches*

A range of innovative educational strategies are emerging in health education, particularly in paediatrics. Four key themes were identified when synthesising these alternative approaches: experiential community learning, gamification and immersive technology, collaborative interprofessional learning, and flipped classroom engagement. These are further explained below:

Experiential community learning is learning through everyday activities and was explored through community projects, visits, and workshops, providing rich opportunities to build both clinical and interpersonal skills. In Woodley et al. (2023), the Paediatric Play Project enabled nursing students to design therapeutic play activities, enhancing understanding of paediatric development through hands-on engagement. This approach promoted the nursing students to apply developmental theory they have learnt in real-world contexts.

Escape rooms and virtual reality (VR) are increasingly explored due to their alignment with Gen Z learner preferences and represent **gamification and immersive technologies**. Wintheiser & Becknell (2023) demonstrated that a paediatric escape room simulation effectively familiarised students with specialty environments, while Wu et al. (2022) found significantly higher post-test scores ($t = 5.05$, $p < .001$) among students exposed to a VR seizure scenario, when completing a knowledge check quiz. Though outcomes are promising, further research is needed to assess long-term retention and clinical transfer.

Collaborative interprofessional education allowed students to work along other health professionals on a common paediatric based health problem. This approach was found to foster teamwork, leadership, and communication skills. Bally et al. (2022) reported improved confidence in paediatric patient care discussions through collaborative case-based learning. Nicholl et al. (2016) emphasised that effective program design must account for the dynamics and value of interpersonal interaction.

The **flipped classroom model** encourages active learning by shifting content delivery outside the classroom allowing more time in classroom to solidify teaching through practical based problems and skills. Sezer & Esenay (2022) found no significant differences in academic outcomes compared to traditional methods, yet students perceived the flipped model as more engaging and helpful, highlighting its role in promoting learner autonomy and interactive discussion, potentially leading to better paediatric focussed health care.

Emerging educational approaches, including interprofessional learning, gamification, virtual reality, flipped classrooms, and community engagement activities, reflect a growing shift toward learner-centred and collaborative paediatric education models. These modalities may enhance learner engagement, empathy, teamwork, and adaptability, all of which are important competencies in paediatric healthcare practice. However, much of the existing evidence remains exploratory, small-scale, and focused on learner satisfaction or short-term perceptions rather than objective clinical outcomes. Further rigorous evaluation is required to determine the sustainability, transferability, and long-term educational impact of these innovative approaches across diverse healthcare disciplines and training contexts.

IV DISCUSSION

This review mapped a diverse and rapidly evolving field of educational strategies aimed at preparing students for paediatric clinical practice. As healthcare education continues to face pressures from workforce demands, clinical placement shortages, and changing learner needs, the findings of this review feel particularly timely. Four overarching discussion points stood out: the central role of simulation-based learning, the rise of online modalities, the importance of how interventions are implemented, and the emergence of innovative approaches. Together, these

findings offer important insight, not just into what's currently being done, but where educators need to go next.

A Simulation as the Predominant Modality in Contemporary Paediatric Education Research

Simulation, particularly high-fidelity simulation (HFS), emerged as the most frequently used educational tool. Its ability to safely replicate complex clinical situations, particularly in paediatrics, makes it a valuable supplemental strategy when access to placements is limited or inconsistent. In some cases, HFS was shown to be associated with comparable short-term educational outcomes, especially when paired with structured debriefing (Curl et al., 2016; Darcy-Mahoney et al., 2013).

At the same time, cost and infrastructure barriers remain a significant limitation. Not every institution can afford a high-tech simulation suite, and this raises real concerns about educational equity, particularly for rural programs or under-resourced universities. Low-fidelity simulation (LFS) offers a more affordable, scalable alternative that still supports procedural skill development, though often at the expense of realism and clinical reasoning (Massoth et al., 2019).

Simulation is not just a “nice-to-have” anymore, it is a core tool for clinical preparation. Investment in simulation should be matched with thoughtful integration into health education curriculums, alongside policies that support its broader accessibility and sustainable use (Carey & Rossler, 2023). The takeaway here is not that one modality is superior, but that educators need to build flexible, blended models of simulation that suit the needs and capacities of individual programs.

B Digital and Virtual Learning: An Established Component of Modern Education

The shift towards digital and virtual learning is one of the most noticeable developments in the last decade of healthcare education. Online case-based learning, virtual simulations, and video-based tools were widely used across the reviewed studies and often rated highly by learners. The flexibility they offer, learning anytime, anywhere, at one's own pace is incredibly valuable, allowing for a greater work, university and life balance (Cantey et al., 2021).

What's more, studies like Diaz et al. (2021) suggest that when it comes to knowledge outcomes, virtual platforms can rival traditional in-person experiences by allowing better learning environments from a cognitive neuroscience perspective.

Educators also need to be cautious and careful in how this is approached. These tools consistently fell short in areas requiring hands-on practice or interpersonal nuance, things like physical examination, emotional intelligence, and responding to subtle clinical cues (McGee et al., 2024; O'Doherty et al., 2018). The future of healthcare education will likely involve hybrid models, where digital learning is used to front-load knowledge and clinical reasoning, while in-person time is protected for skills development, feedback, and professional identity formation. The convenience of tech should not come at the cost of what makes clinical learning meaningful: human connection, practice, and reflection.

C Effective Teaching Requires More Than Content: The Importance of Clear Aims, Reflection, and Debriefing

One of the clearest patterns across the review was that educational quality wasn't defined by modality alone. Instead, it depended heavily on the quality of how it was implemented. Studies that performed best had a clear theoretical basis, well-defined learning objectives, targeted learner groups, and most importantly, structured debriefing and time for reflection. These features were often more predictive of success than whether the intervention was high-tech or traditional (Darcy-Mahoney et al., 2013; Carey & Rossler, 2023).

In a time when educational innovation is moving rapidly, it may be easy to get caught up in chasing the newest tool or latest educational trend. However, without thoughtful design and delivery, even the most advanced simulation or virtual reality won't lead to better outcomes. Educators need support and training to build high-quality, evidence-based learning experiences, not just access to the latest technology. Not every educator feels confident running simulation scenarios or facilitating effective debriefs (Kumar et al., 2025). Embedding these capabilities into teaching programs and clinical educator training will be key to making simulation and digital education sustainable in the long run.

D *Emerging Approaches Hold Promise for the Future of Paediatric Education*

Gamified learning, interprofessional case discussions, flipped classrooms, and community-based experiences are gaining traction, and for good reason. These approaches are often better aligned with how today's students learn, interactive, collaborative, and self-directed. While they were less commonly evaluated in the literature, they show real promise, especially for developing the "soft skills" that are essential in paediatric health care: empathy, teamwork, adaptability (Wintheiser & Becknell, 2023; Bally et al., 2022; Woodley et al., 2023).

The challenge is that many of these studies were small scale, under theorised, or lacked long-term follow-up. Educators can't assume that engagement alone translates into clinical competence (Berro et al., 2023). But these approaches should not be dismissed as "too experimental" to be taken seriously. They very well may represent the next step in health education, and as educators, there is a responsibility to rigorously evaluate them, not just whether they're enjoyable, but whether they truly prepare students for safe, patient-centred paediatric care.

E *Future Directions*

This review makes one thing clear; there is no one-size-fits-all solution. Different contexts, learners, and outcomes call for different approaches. Interventional tools like simulation, virtual reality, and escape rooms have been integrated into university curricula for decades, often without an evidence-based framework (Estalella et al., 2023). As research on their effectiveness grows, the need for structured implementation has become clear. A recent study by Peasey et al. (2024) mapped paediatric content in Australian paramedic programs and introduced scaffolding as a curriculum design that supports progression from basic to complex concepts. Integrating paediatrics early and revisiting it with increasing complexity helps students apply foundational knowledge in clinical setting. However, many programs still teach core sciences in isolation, creating a disconnect between theory and practice. A scaffold, integration approach can bridge this gap by aligning learning with clinical application. For example, students might begin with online modules, then engage in case-based discussions, followed by progressively complex simulations, from virtual, to low-fidelity to high-fidelity scenarios.

Future research should focus on evaluating the effectiveness of scaffolded, integrated paediatric education models that incorporate interventional tools such as high-fidelity simulation (HFS), low-fidelity simulation (LFS) and online learning. A multicentre, prospective randomised controlled trial comparing these modalities, both individually and in progressive combination, would provide robust evidence on their relative impact on clinical competency, knowledge retention, and learner confidence. Longitudinal follow-up of student cohorts is essential to assess the durability of learning and real-world clinical performance over time. Given the significant resource implications of HFS, cost-effectiveness modelling should be included, particularly in low-resource settings, to guide sustainable curriculum design and equitable implementation (Estalella et al., 2023).

F Limitations

While this scoping review provides valuable insights, limitations must be acknowledged. The absence of prior registration may have impacted transparency and reproducibility. This review was not registered as at the time of commencement; registration of scoping reviews was not considered the gold standard. The search strategy, limited to three databases, English-language publications, and studies from 2013 onward, may have restricted generalisability, although these criteria ensured relevance and accessibility. Given the broad scope of the topic and the high volume of literature, a comprehensive analysis was not feasible; instead, this review aimed to be descriptive due to the limited concrete evidence available. Additionally, grey literature, including unpublished studies, conference proceedings, and reports was not explored, meaning some relevant findings may have been missed.

A large proportion of included studies originated from the United States and were predominantly focused on undergraduate nursing education. This geographic and disciplinary concentration may limit the transferability of findings to other healthcare systems, professional groups, and educational contexts. Differences in curriculum structure, placement models, funding, and workforce requirements across countries may influence both the implementation and effectiveness of paediatric educational interventions. Future research should therefore prioritise broader international and multidisciplinary representation, particularly in regions where paediatric workforce shortages and clinical placement limitations differ substantially from North American settings.

V CONCLUSION

This scoping review highlights the diverse educational strategies used in paediatric health education, including simulation-based learning, online modalities, and alternative teaching methods. While high-fidelity and low-fidelity simulations enhance clinical preparedness, cost and resource constraints remain challenges. Online approaches offer flexibility and comparable outcomes, though concerns about hands-on experience persist. Emerging methods like interprofessional collaboration and flipped classrooms show promise but require further research. A scaffolded curriculum integrating these strategies may optimise learning. Despite limitations in study heterogeneity and scope, future research should explore long-term impacts of interventional education modalities on clinical competency and patient care. By continuing to explore innovative approaches, medical education can better prepare future healthcare professionals for the complexities of paediatric care.

Supplementary Material 1

Characteristics and Synthesized Outcomes of Included Studies

Author, Year	Country	Profession	Educational Modality	Study Design	Synthesised Educational Outcome
Akselbo et al., 2018	Norway	Nursing Students	Simulation	Qualitative content analysis	Enhanced understanding of paediatric care through experiential simulation
Aldridge, 2019	USA	Nursing Students	Simulation	Mixed Methods Approach - Quantitative and Qualitative	Improved chronic disease management learning through home-based simulation
Allert & Mallory, 2020	USA	Nursing Students	Simulation	Quantitative & Qualitative	Improved learner confidence
Arslan et al., 2018	Turkey	Nursing Students	Simulation	Quasi-experimental Study	Enhanced self-efficacy
Atkins et al., 2022	USA	Nursing Students	Educational Innovation	Descriptive, Qualitative Design	Enhanced learner engagement
Austin et al., 2013	USA	Nursing Students	Educational Innovation	Qualitative content analysis	Enhanced understanding of family experiences following childhood injury
Ayed et al., 2022	USA	Nursing Students	Educational Innovation	Quasi-experimental Study	Improved paediatric clinical judgement through high-fidelity simulation
Ayed et al., 2021	Palestine	Nursing Students	Simulation	Pretest-post-test design, Quasi-experiment	Enhanced empathy and self-awareness in paediatric nursing care
Bally et al., 2022	Canada	Nursing Students	Interprofessional Education	Quantitative Data	Strengthened interprofessional teamwork and collaborative practice
Barnum & Mutascio, 2023	USA	Nursing Students	Educational Innovation	Clinical Experience (In Hospital) - Evaluation Survey	Strengthened workforce readiness for paediatric nursing practice
Bowling, 2015	USA	Nursing Students	Skills Laboratory	Quasi-experimental Study	Improved medication administration and patient safety skills
Bowling et al., 2018	USA	Nursing Students	Educational Innovation	Curriculum Review	Highlighted variability in paediatric curriculum structure and clinical exposure
Bowling & Eismann, 2017	USA	Nursing Students	Educational Innovation	Qualitative content analysis & Student Surveys	Improved knowledge acquisition
Budd et al., 2017	Australia	Nursing Students	Educational Innovation	Mixed Methods Approach - Quantitative and Qualitative	Improved preparedness for working with children and families
Cantey et al., 2021	USA	Nursing Students	Virtual Simulation	Cross sectional Approach - Student Survey	Increased engagement and collaborative learning in virtual environments
Carey et al., 2018	UK	Nursing Students	Educational Innovation	Qualitative ethnographic study	Enhanced peer-supported clinical learning and engagement

Cieslowski et al., 2023	USA	Nursing Students	Simulation	Mixed Methods Quasi Experimental	Supported clinical preparedness through virtual reality simulation
Clarke & Lippe., 2022	USA	Nursing Students	Educational Innovation	Quasi-experimental Study	Improved communication skills
Clark et al., 2018	UK	Nursing Students	Educational Innovation	Mixed Methods Approach - Quantitative and Qualitative	Improved understanding of child development and team-based learning
Clephane et al., 2023	USA	Nursing Students	Simulation	Quasi-experimental Study	Improved confidence managing paediatric clinical scenarios
Cleveland et al., 2015	USA	Nursing Students	Educational Innovation	Satisfaction Survey	Supported clinical reasoning development
Clifton & Roberts, 2016	USA	Nursing, Medical, Physician assistant, Mental Health Nursing Students	Educational Innovation	Interprofessional Clinical Experience	Enhanced interdisciplinary collaboration and leadership skills
Cole & Foito, 2019	USA	Nursing Students	Educational Innovation	Quasi-experimental Study	Improved preparedness for paediatric end-of-life care
Colwell, 2016	UK	Nursing Students	Simulation	Quantitative Data - Satisfaction Survey	Improved learner confidence
Cook & Camp-Spivey, 2022	USA	Nursing Students	Skills Laboratory	Quantitative Data - Satisfaction Survey	Improved confidence performing paediatric assessment skills
Curl et al., 2016	USA	Nursing Students	High-Fidelity Simulation	Quasi-experimental Study	Demonstrated comparable learning outcomes to traditional clinical placement
D'Alonzo et al., 2020	USA	Nursing Students	Educational Innovation	Designing a creative, interactive educational session	Enhanced community engagement and adolescent health promotion skills
Mahoney et al., 2013	UK	Nursing Students	High-Fidelity Simulation	Qualitative & Quantitative	Improved preparedness for acute paediatric care situations
da Silva & Kamada, 2022	Brazil	Nursing Students	Virtual Simulation	Qualitative Study	Enhanced learner engagement through tele-simulation
Davis et al., 2020	USA	Nursing Students	High-Fidelity Simulation	Quantitative Data	Supported experiential paediatric learning
Dexter, 2016	UK	Nursing Students	Educational Innovation	Qualitative Study	Strengthened reflective practice and professional development
Diaz-Agea et al., 2022	UK	Nursing Students	Educational Innovation	Qualitative Study	Improved understanding of autism care and family communication challenges
Diaz et al., 2021	USA	Nursing Students	Virtual Simulation	Quasi-experimental Study	Maintained learning outcomes during virtual clinical replacement
Dubovi, 2018	Israel	Nursing Students	Virtual Simulation	Quantitative Data	Supported clinical reasoning development

Eade & Winter, 2017	UK	Nursing Students	Educational Innovation	Mixed Methods Approach - Quantitative and Qualitative	Enhanced student engagement with paediatric clinical learning
Edwards et al., 2021	UK	Nursing Students	Educational Innovation	Anecdotal Feedback	Improved communication skills
Erdogan & Turan, 2023	Turkey	Nursing Students	Gamified/Immersive Learning	Quasi-experimental Study	Increased learner motivation through game-based education
Farinati Nadler et al., 2022	Brazil	Nursing Students	High-Fidelity Simulation	Quasi-experimental Study	Supported experiential paediatric learning
Felton et al., 2013	UK	Nursing Students	Educational Innovation	Qualitative Study	Improved understanding of interprofessional paediatric care
Ferguson, 2013	USA	Nursing & Speech Pathology Students	Simulation	Quasi-experimental Study	Supported clinical reasoning development
Fielding et al., 2022	USA	Nursing Students	Simulation	Qualitative Study	Supported experiential paediatric learning
Fogg et al., 2020	USA	Nursing Students	Virtual Simulation	Mixed Methods Approach - Quantitative and Qualitative	Supported clinical reasoning development
Friedrich et al., 2021	USA	Nursing & Medical Students	Interprofessional Education	Mixed Methods Approach - Quantitative and Qualitative	Improved understanding of interprofessional roles and responsibilities
Gamble, 2017	Australia	Nursing Students	Simulation	Mixed Methods Approach - Quantitative and Qualitative	Improved confidence applying paediatric knowledge in practice
George et al., 2016	USA	Nursing Students	Educational Innovation	None	Improved knowledge integration through concept mapping
Gibson-Young et al., 2023	USA	Nursing Students	Educational Innovation	Mixed Methods Approach - Quantitative and Qualitative	Reduced anxiety and improved preparedness before paediatric placement
Golinveaux et al., 2013	USA	Nursing Students	Educational Innovation	Quantitative Data - Survey	Improved learner confidence
Gotwals & Scholtz, 2016	USA	Nursing Students	Educational Innovation	None	Enhanced engagement with paediatric learning activities
Hill et al., 2023	UK	Nursing Students	High-Fidelity Simulation	Mixed Methods Approach - Quantitative and Qualitative	Improved understanding of clinical workflows and patient deterioration
Hutson & Zeno, 2021	USA	Nursing Students	Skills Laboratory	Mixed Methods Approach - Quantitative and Qualitative	Increased confidence managing paediatric mental health presentations
Kahraman et al., 2019	USA	Nursing Students	Simulation	Quasi-experimental Study	Improved knowledge acquisition
Kang et al., 2015	UK	Nursing Students	Educational Innovation	Quantitative Data Analysis	Increased confidence delivering paediatric care

Kasen & Abuhammad, 2022	Jordan	Nursing Students	Simulation	Quantitative Data Analysis	Improved knowledge acquisition
Khanbodaghi et al., 2019	USA	Nursing Students	Educational Innovation	Quantitative Data	Improved learner confidence
Kim et al., 2014	UK	Nursing Students	Simulation	Mixed Methods Approach - Quantitative and Qualitative	Improved management of paediatric fever assessment and treatment
King et al., 2022	USA	Nursing Students	Online Learning	Quantitative Data Analysis	Supported transition from academic learning to clinical practice
Kirkpatrick et al., 2018	USA	Nursing Students	Simulation	Quasi-experimental Study	Enhanced leadership and team communication skills
Kubin et al., 2022	USA	Nursing Students	Educational Innovation	None	Advanced clinical reasoning through virtual patient encounters
Lagunas et al., 2021	USA	Nursing Students	Virtual Simulation	Quasi-experimental Study	Maintained paediatric knowledge acquisition during virtual placement substitution
Lee et al., 2022	USA	Nursing Students	Educational Innovation	Qualitative & Quantitative	Promoted learner engagement through neuroscience-informed education
Lee et al., 2023	USA	Nursing Students	Educational Innovation	Mixed Methods Approach - Quantitative and Qualitative	Improved peer collaboration through mobile learning technology
Lee-Jayaram et al., 2020	USA	Paramedic Students	Educational Innovation	Not Stated	Improved preparedness for paediatric paramedic practice
Lee et al., 2017	Australia	Nursing Students	Simulation	Quasi-experimental Study	Increased confidence applying paediatric nursing skills
Lee & Lee, 2022	UK	Nursing Students	Simulation	Quasi-experimental Study	Increased confidence identifying and responding to child abuse
Lui et al., 2020	Taiwan	Nursing Students	Online Learning	Quantitative Data	Improved paediatric pain management knowledge
Lo & Yang, 2022	Taiwan	Nursing Students	Simulation	Mixed Methods Approach - Quantitative and Qualitative	Improved knowledge acquisition
Lubbers & Rossman, 2023	USA	Nursing Students	Simulation	Quasi-experimental Study	Increased confidence caring for paediatric patients
Lubbers & Rossman, 2016	USA	Nursing Students	Simulation	Quasi-experimental Study	Increased confidence delivering community-based paediatric care
Luctkar-Flude et al., 2013	USA	Nursing & Medical Students	Interprofessional Education	Mixed Methods Approach - Quantitative and Qualitative	Improved interprofessional teamwork during paediatric emergencies
Maguire, 2023	UK	Nursing Students	Educational Innovation	Not Stated	Increased understanding of parental perspectives in neonatal care

Makowski et al., 2022	USA	Nursing Students	Educational Innovation	Not Stated	Expanded opportunities for virtual paediatric clinical learning
May & Cole, 2014	USA	Nursing Students	Educational Innovation	Qualitative Study	Enhanced understanding of paediatric family-centred care
McDermott, et al., 2022	USA	Nursing Students	Simulation	Mixed Methods Approach - Quantitative and Qualitative	Improved preparedness for paediatric clinical placement
Mcdonnald, 2016	USA	Nursing Students	Skills Laboratory	Mixed Methods Approach - Quantitative and Qualitative	Improved teamwork during simulated paediatric care
Mendoza-Maldonado & Barria-Pailaquilen, 2018	Chile	Nursing Students	Skills Laboratory	Qualitative Study	Improved paediatric procedural skills while reducing learner anxiety
Merritt, 2020	USA	Nursing Students	Virtual Simulation	Mixed Methods Approach - Quantitative and Qualitative	Improved diagnostic accuracy and clinical competence
Molloy et al., 2016	USA	Nursing Students	Educational Innovation	Quantitative Data	Introduced telehealth competencies through simulation
Montgomery et al., 2015	USA	Nursing Students	Educational Innovation	Mixed Methods Approach - Quantitative and Qualitative	Improved leadership, teamwork and clinical judgement
MontiFonseca et al., 2016	Portugal	Nursing Students	Simulation	Quasi-experimental Study	Improved performance in paediatric clinical scenarios
Moss, 2023	USA	Nursing Students	Simulation	Mixed Methods Approach - Quantitative and Qualitative	Increased confidence managing paediatric deterioration
Mudd & Silbert-Flagg, 2016	USA	Nursing Students	Educational Innovation	Mixed Methods Approach - Quantitative and Qualitative	Increased engagement through active learning approaches
Neilson & Reeves, 2019	UK	Nursing Students	Community-Based Learning	Qualitative & Quantitative	Enhanced communication with children and families
Nicholl et al., 2016	Ireland	Nursing, Social Workers, Physiotherapist Students	Interprofessional Education	Qualitative & Quantitative	Improved interprofessional collaboration and communication
Oh et al., 219	Korea	Nursing Students	Skills Laboratory	Not Stated	Improved therapeutic communication skills
Opton et al., 2014	USA	Nursing Students	High-Fidelity Simulation	Qualitative Study	Improved confidence and preparedness for paediatric emergencies
Ozkara et al., 2023	USA	Nursing Students	Simulation	Descriptive, Qualitative Design	Enhanced preparedness for paediatric clinical practice
Palomino et al., 2021	Australia	Nursing Students	Simulation	Quasi-experimental Study	Improved knowledge acquisition

Pan et al., 2020	China	Medical Students	Educational Innovation	Quasi-experimental Study	Improved academic performance and clinical problem-solving
Parker et al., 2015	USA	Nursing Students	Simulation	Quasi-experimental Study	Increased confidence managing paediatric clinical situations
Paully-O'Neill & Prion, 2013	USA	Nursing Students	Educational Innovation	Quasi-experimental Study	Increased confidence in paediatric assessment and decision-making
Petty et al., 2020	UK	Nursing Students	Educational Innovation	Mixed Methods Approach - Quantitative and Qualitative	Enhanced empathy through parent-centred digital storytelling
Price et al., 2013	UK	Nursing Students	Educational Innovation	Qualitative Study	Improved understanding of paediatric palliative and hospice care
Price et al., 2014	UK & USA	Nursing & Midwifery Students	Educational Innovation	Mixed Methods Approach - Quantitative and Qualitative	Enhanced international and interprofessional learning perspectives
Ramachandra et al., 2020	India	Medical Students	Educational Innovation	Article	Highlighted simulation as a strategy to supplement paediatric exposure
Reid-Searl et al., 2021	Australia	Nursing Students	Educational Innovation	Mixed Methods Approach - Quantitative and Qualitative	Increased confidence in paediatric clinical communication
Reid-Searl et al., 2016	Australia	Nursing Students	Educational Innovation	Qualitative Study	Improved engagement through procedural puppet simulation
Riley et al., 2022	USA	Nursing Students	Educational Innovation	Mixed Methods Approach - Quantitative and Qualitative	Improved communication support using visual cue strategies
Salari et al., 2018	Iran	Medical Students	Skills Laboratory	Quasi-experimental Study	Improved procedural competence in paediatric skills
Sanders et al., 2020	USA	Nursing Students	Educational Innovation	Mixed Methods Approach - Quantitative and Qualitative	Increased clinical readiness and critical thinking
Schick Makaroff et al., 2013	Canada	Nursing Students	Educational Innovation	Not Stated	Enhanced experiential learning during paediatric camp placement
Sezer & Esenay, 2022	Turkey	Nursing Students	Flipped Classroom	Quasi-experimental Study	Increased learner engagement through flipped classroom delivery
Shaw et al., 2018	USA	Nursing Students	Simulation	Quasi-experimental Study	Improved management of paediatric clinical deterioration
Shin & Kim 2014	South Korea	Nursing Students	Simulation	Quasi-experimental Study	Improved paediatric assessment and intervention skills
Shorey et al., 2023	Singapore	Nursing Students	Virtual Simulation	Quasi-experimental Study	Improved communication skills

Small et al., 2018	Canada	Nursing Students	High-Fidelity Simulation	Phenomenological method	Enhanced understanding of paediatric patient experiences
Son & Yim, 2022	South Korea	Nursing Students	Simulation	Quasi-experimental Study	Increased confidence and clinical competence
Stout-Aguilar et al., 2018	USA	Nursing, Medical, Pharmacy & Public Health	Simulation	Quasi-experimental Study	Improved interprofessional response to paediatric emergencies
Sun-Yi & Tun-Hee, 2023	South Korea	Nursing Students	Online Learning	Quasi-experimental Study	Improved motivation, self-efficacy and self-directed learning
Taha et al., 2021	USA	Nursing Students	Simulation	Quasi-experimental Study	Improved paediatric resuscitation knowledge and performance
Teall et al., 2023	USA	Nursing Students	Educational Innovation	Quasi-experimental Study	Enhanced understanding of paediatric care experiences
Teles et al., 2020	Brazil	Nursing Students	Simulation	Qualitative Study	Supported experiential paediatric learning
Valler-Jones, 2014	UK	Nursing Students	Simulation	Mixed Methods Approach - Quantitative and Qualitative	Improved preparedness for paediatric nursing practice
Vance et al., 2018	UK	Medical Students & Nursing Students	Online Learning	Mixed Methods Approach - Quantitative and Qualitative	Enhanced self-efficacy
Verkuyl et al., 2016	Canada	Nursing Students	Virtual Simulation	Mixed Methods Approach - Quantitative and Qualitative	Improved clinical reasoning through virtual simulation
Verkuyl et al., 2017	Canada	Nursing Students	Virtual Simulation	Mixed Methods Approach - Quantitative and Qualitative	Enhanced self-efficacy
Wada et al., 2023	Hawaii	Nursing & Social Work Students	Simulation	Mixed Methods Approach - Quantitative and Qualitative	Strengthened interprofessional understanding in paediatric care
Waldron et al., 2016	USA	Nursing Students	Educational Innovation	Qualitative Study	Enhanced professional development through clinical case presentations
Walsh et al., 2021	USA	Nursing Students	Educational Innovation	Mixed Methods Approach - Quantitative and Qualitative	Expanded paediatric learning opportunities through virtual clinical simulation
Weston et al., 2021	USA	Nursing Students	Simulation	Quasi-experimental Study	Improved critical thinking and transition of knowledge to practice
Weston et al., 2021	USA	Nursing Students	Educational Innovation	Qualitative Study	Improved critical thinking and transition of knowledge to practice
Weston & Zauche, 2021	USA	Nursing Students	Virtual Simulation	Quasi-experimental Study	Improved clinical reasoning through virtual paediatric simulation

White & Champion, 2021	USA	Nursing Students	Virtual Simulation	Quantitative Data Analysis	Maintained clinical learning during virtual simulation placement
Wintheiser & Becknell, 2023	USA	Nursing Students	Gamified/Immersive Learning	Qualitative Study	Improved communication and engagement through escape room learning
Woodley et al., 2023	USA	Nursing Students	Educational Innovation	Mixed Methods Approach - Quantitative and Qualitative	Enhanced application of child growth and development principles
Wu et al., 2022	Taiwan	Nursing Students	Gamified/Immersive Learning	Quasi-experimental Study	Improved paediatric knowledge through immersive virtual reality learning
Wyllie & Batley, 2018	UK	Nursing Students	Simulation	Qualitative Study	Enhanced understanding of paediatric nursing concepts
Yang & Oh, 2023	South Korea	Nursing Students	Online Learning	Quasi-experimental Study	Supported paediatric learning outcomes
Zimmermann & Alfes, 2019	USA	Nursing Students	Educational Innovation	Mixed Methods Approach - Quantitative and Qualitative	Improved self-directed learning and online engagement.

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