REVIEW
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Challenges, innovations, and the role of design-based research in advancing nursing education: a review

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Author contributions
Khin Thandar Aung revised the manuscript, revisited data analysis, interpreted findings as well as approved the final version of the manuscript. Nor'ain Abdul Rashid involved in literature review and advised before finalising the manuscript.

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The authors declare no conflicts of interest.

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Abbreviations
DBR, Design-Based Research; IPE, interprofessional education.

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Abstract
As a response to the complexity of modern health care, nursing education is undergoing significant transformation. This paper aims to explore changing dynamics in nursing education, highlighting trends, challenges, and the potential of Design-Based Research (DBR) as a methodological approach for curricular enhancement. This study employed a qualitative synthesis methodology was utilised, employing a systematic literature analysis of peer-reviewed articles published from 2019 to 2023. Relevant studies were searched in primary databases such as PubMed, Scopus, and Google Scholar, using specific keywords pertaining to nursing education, innovative pedagogical approaches, and DBR. The review revealed significant trends in nursing education including empathy and resilience, cultural competence, technology, interprofessional education, as well as competency-based approaches. Major challenges included teacher shortages, limited clinical placements, technological adaptability, and student mental health issues. DBR became an approach to address these challenges and offers an iterative model for curriculum development and educational innovation. DBR is a systematic and collaborative way to improve nursing education. Despite the barriers to implementation, DBR can lead to a more applicable curriculum based on real-world healthcare needs and create a nimbler educational process to prepare nursing graduates for working in complex healthcare environments.

Keywords: nursing education; innovation; design-based research; interprofessional cooperation; competency-based education

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Background

The healthcare landscape is undergoing unparalleled complexity, necessitating a major reconfiguration of nursing education to equip compassionate, skilled, and versatile practitioners. As healthcare systems advance, nursing education must adapt to meet new problems and incorporate innovative methods that develop critical professional skills.

Modern nursing education is facing a pivotal convergence of revolutionary forces and structural obstacles. Innovative teaching methodologies prioritise the enhancement of holistic competencies beyond conventional clinical expertise, encompassing empathy development, cultural competence, technological integration, and interprofessional cooperation. Considerable challenges, including teacher shortages concurrently impede these trends, restricted clinical training opportunities, and increasing student stress [1, 2].

Nursing education necessitates creative methodological frameworks to adeptly address the intricate dynamics of continually evolving healthcare demands. Design-Based Research (DBR) presents a potential framework, providing a systematic yet flexible process for curriculum improvement and educational innovation. DBR offers a systematic method for the development, implementation, and refinement of educational interventions, potentially addressing the complex difficulties faced by nursing education.

The study aims to identify and critically analyze emerging challenges to nursing education based on modern health care demands. It discusses key challenges to nursing education programs such as faculty shortages, limitations on clinical training, and student welfare. In addition, it discusses whether DBR is effective as a state-of-the-art methodology for addressing pedagogical challenges and enhancing nursing curricula. Through critical analysis of these factors, the study joins the general debate on nursing education reform. Its findings will offer insightful information for educators, policymakers, and researchers interested in embracing innovative pedagogical practices that promote learning and prepare nurses for clinical practice complexities.

Methodology

Study design

A qualitative synthesis approach was adopted to explore current trends, challenges, and innovative solutions within nursing education. To understand the challenges and innovations in nursing education, a qualitative synthesis methodology was employed. This approach is effective for examining complex, multifaceted problems and for tracking changing trends, pedagogical advancements, and structural impediments. A qualitative synthesis combines diverse approaches and perspectives from peer-reviewed literature, theoretical frameworks, and policy analyses, as DBR is an iterative and dynamic research method. This supports a systematic and adaptable exploration of how DBR may assist in identifying learning challenges, creating educational interventions, and evolving nursing competencies. This article provides a theoretically grounded and contextually relevant conceptualisation of the role of DBR in advancing nursing education through a synthesis of existing literature. This review aimed to synthesise results from peer-reviewed publications, reports, and theoretical literature associated with the DBR method.

Data sources

The review employed literature from scholarly sources to guarantee dependability and comprehensiveness. The principal databases employed were PubMed, Scopus, and Google Scholar.

Search strategy. A systematic search strategy employed a combination of appropriate search terms and Boolean operators to enhance the results. The primary search keyword was as follows: “Nursing education”, “Design-Based Research”, “Innovative Teaching Methodologies”, “Trends in Nursing Education 2019–2023”, “Challenges in Nursing Education”, “Educational Innovation in Healthcare”, Boolean operations, including AND, OR, and NOT, were employed to successfully correlate all of information. For instance: “Nursing education AND Design-Based Research”, “Challenges OR barriers in nursing education” “Innovative teaching methodologies NOT traditional methods”.

Inclusion criteria and exclusion criteria

To ensure the relevance and quality of the selected literature, specific inclusion criteria were applied. These included articles published between 2019 and 2023, empirical research, theoretical analyses, and systematic reviews. The focus was on studies examining trends, challenges, and innovative approaches in nursing education, particularly in relation to DBR. Only English-language publications that were fully accessible through institutional or open access sources were considered. Simultaneously, exclusion criteria were established to refine the selection process. Studies unrelated to nursing education or those unable to incorporate DBR were excluded, along with articles published before 2019. Non-peer-reviewed sources, including opinion articles and editorials, were also omitted, as well as non-English publications due to translation constraints. Following article selection, data extraction was conducted systematically, emphasizing current trends and challenges in nursing education, the role of DBR, and the anticipated advantages and challenges of its implementation. The extracted data were then qualitatively synthesized to identify thematic patterns and gaps, providing a structured narrative to inform future research and practice. The details are summarised in Figure 1.

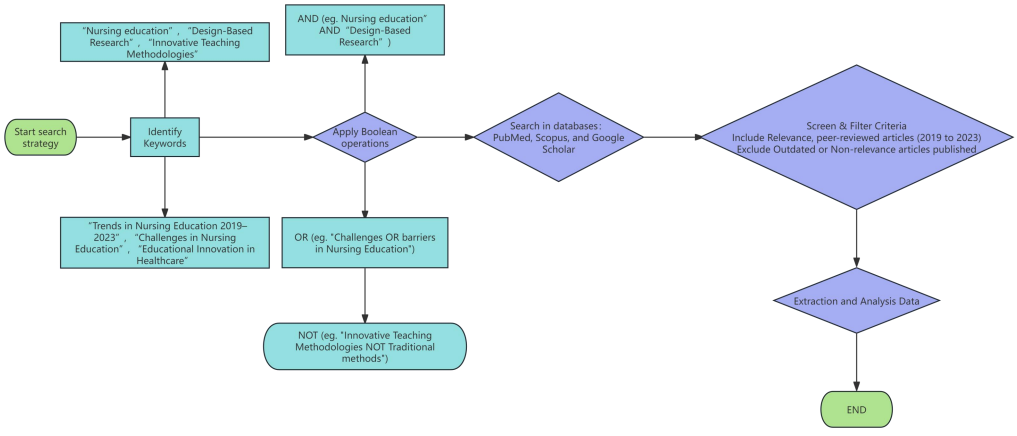

Figure 1 Flow chart of search strategy

Findings and discussion

The review categorises findings into four main themes: Current Trends in Nursing Education, Challenges in Nursing Education, The Role of DBR in Nursing Education, and Advantages and Anticipated Challenges of DBR. By offering an exhaustive analysis of each theme to contextualise the current state of nursing education and the integration of DBR approaches.

The findings highlight a dual narrative: swift advancements in nursing education propelled by innovation, compared with institutional obstacles that impede its full accomplishment. DBR offers a feasible strategy to tackle the issue by advocating for evidence-based, practical solutions. Initiatives to execute DBR must prioritise addressing resistance to change and ensuring equitable access to resources. Moreover, as nursing education increasingly integrates technology and competency-based methodologies, DBR may serve as a framework to evaluate and improve these innovations, ensuring they meet the diverse needs of learners and healthcare systems. By thoroughly addressing these challenges, nursing education can progress towards a more inclusive, effective, and innovative future.

Current trends in nursing education

Nursing education is at a pivotal crossroads due to the swiftly evolving healthcare sector and the diverse requirements of students. Nursing programs are implementing innovative strategies and responding to evolving trends to equip future nurses for the complexities of patient care, hence enhancing student development and proficiency. Current focal points in nursing education encompass the cultivation of empathy and resilience, which assist students in coping with the emotional demands of the job. The growing variety in student populations requires improved cultural competence to cultivate an inclusive and supportive educational environment. Technological advancements, interprofessional education, and competency-based education are reshaping nursing curricula to cultivate proficient, versatile nurses equipped for success in practical environments.

Empathy and resilience in practice. The cultivation of empathy and resilience is increasingly prioritised, acknowledging the emotional difficulties encountered by nurses. Nurses deliver treatment in intensely stressful environments and must reconcile compassion with their own psychological health [2]. Research indicates that elevated stress levels in nursing students can result in burnout, highlighting the necessity for education that fosters emotional resilience in conjunction with clinical competencies [3].

Cultural competence and inclusivity. As student demographics diversify, nursing programs must adjust to address the requirements of learners from many cultural backgrounds [4]. Initiatives that tackle language barriers, honour cultural differences, and foster inclusive settings promote better learning outcomes and prepare future nurses to deliver culturally competent care [5].

Integration of technology. The integration of technology, such as simulation-based learning, online education, and virtual reality, has revolutionised nursing education [6]. Simulation enables students to improve essential skills in secure, regulated environments, and online education offers accessibility to learners in remote or marginalised regions. Integrating technology equips students to manoeuvre through a progressively digital healthcare environment [7, 8].

Interprofessional education (IPE). IPE is becoming significant as healthcare transitions to more collaborative models [9–11]. Nursing students enhance their communication skills and comprehend the functions of other healthcare professionals by collaborating in interdisciplinary teams, which is vital for patient-centered care [12, 13].

Competency-Based education. Transitioning to a competency-based framework in nursing education guarantees that students achieve mastery of critical skills, irrespective of the duration required [14, 15]. This model prioritises outcomes over conventional academic schedules, highlighting the preparedness of nursing graduates for practical application in the field [16, 17].

In essence, several critical trends are presently influencing nursing education. It is essential to underscore the significance of empathy and resilience in students while concurrently addressing the difficulties of stress and burnout. Given the diverse student demographic, it is essential to modify courses to enhance cultural competence and inclusivity. The incorporation of technology, including simulation-based learning and online education, improves skill acquisition and accessibility. IPE promotes collaboration among healthcare professionals, whereas competency-based education emphasises practical skills and competencies, ensuring that students are adequately equipped to fulfil the requirements of nursing practice.

Challenges in nursing education

Nursing education, notwithstanding its progress and favourable tendencies, encounters numerous problems that necessitate care to guarantee the ongoing advancement of the profession.

Shortage of nursing faculty. There is a significant shortage of qualified faculty in nursing programmes, restricting the number of students they can accept. This shortage affects not only the quality of education but also the ability of the health system to supply nurses to meet demand [18–20]. The challenge is particularly pronounced in Bangladesh, India, Indonesia, Nigeria, and Pakistan [21].

Some of the many issues caused by the shortage of nurses include increased errors, higher rates of sickness and death, and nurse burnout due to high patient-to-nurse ratios. Consequently, countries experiencing a shortage of nurses need to grow their nursing programme graduates by an average of 8% annually to meet this global demand. They are also expected to improve their ability to utilise and retain nurses within the healthcare system [21].

In Canada, there are not enough nursing faculty, and this issue is compounded by senior faculty reaching retirement age, poor leadership, and toxic environments [22]. Likewise, the United States is in dire need of diverse nurses. Nursing schools, therefore, need to implement supportive structures for diverse and first-generation college students to succeed and ultimately join the nursing pipeline [23].

Moving forward, a significant issue is the future of nursing education. Previous studies have suggested using DBR to enhance curriculum-related measures and student performance; however, its effectiveness as an approach has yet to be established [24].

A nursing roundtable was held in Western Australia, where several key barriers were identified. These included formal nursing placements being too short, which reduces students' opportunities to interact with patient experiences, inflexible systems for booking placements, and financial and family commitments that inhibit placement opportunities for students. Other issues included the level of on-site supervision and the availability of graduate programmes post-qualification. Innovative teaching approaches, such as longitudinal clinical placements for students, were proposed as a way to relieve academic and clinical staffing pressures, as this would allow students to prepare for work within the sector [25].

Ultimately, the fundamental solution to addressing the nursing shortage lies in reforming education, healthcare delivery, and workforce support structures in a way that re-establishes a framework for the sustainability of the nursing workforce and the quality of patient care delivery.

Limited clinical placements. Clinical experiences are crucial for skill acquisition in healthcare education, yet the limited availability of placements poses significant challenges to the quality and consistency of training programs. Simulation-based education offers a promising solution to this issue by providing alternative clinical experiences that can enhance learning outcomes. SBE allows students to practice and refine their skills in a controlled, risk-free environment, which can lead to improved clinical performance and patient outcomes [26–28]. For instance, simulation-based training in neonatal resuscitation has been shown to improve team performance and technical skills, although its impact on patient outcomes like neonatal mortality remains inconclusive due to a lack of studies in developed countries [26]. Similarly, in nursing education, SBE has been found to enhance

educational outcomes by improving knowledge, skills, and attitudes, although the variability in design elements can influence these outcomes [29].

Technological advancements and curriculum adaptation. Nursing education faces significant challenges in adapting to rapid technological advancements. Integrating electronic health records and digital systems into curricula is crucial for preparing nurses for modern healthcare environments [1]. However, updating programs requires substantial resources and faculty training, which are often limited [30]. To address these challenges, many institutions are incorporating innovative approaches such as virtual reality training, simulation-based learning, and online platforms [1]. Adaptive learning technologies are also being blended into nursing education, with a focus on duration, engagement, and student agency [31]. Despite these efforts, there is a lack of comprehensive pedagogical models for teaching technological literacy in nursing education [32]. Ensuring nurses' technological competence is essential for maintaining quality healthcare services and patient safety, highlighting the need for continued development of nursing curricula to meet evolving technological demands [32].

Mental health and well-being of students. The rigorous demands of nursing education can result in stress, burnout, and mental health challenges among students. Nursing programs must emphasise support mechanisms that assist students in managing stress and preserving well-being, which are crucial for sustained success in the field [19].

Ultimately, nursing education has numerous urgent concerns that must be resolved to maintain the profession's development and quality. A significant problem is the deficiency of qualified faculty, which restricts student admittance and affects the quality of instruction. Furthermore, a deficiency of clinical placements, crucial for practical skill acquisition, creates competition among programs and may compromise the uniformity of training. Modifying curricula to align with technological advancement presents a difficulty, necessitating substantial resources and staff training that are frequently limited. The rigorous requirements of nursing school can result in significant stress and mental health challenges for students, necessitating the implementation of support mechanisms within programs to enhance student well-being and resilience.

The role of DBR in nursing education

DBR is an effective methodology for tackling the obstacles in nursing education. DBR integrates research, design, and practice to provide educational solutions tailored to practical requirements. The iterative nature of DBR facilitates ongoing enhancement of curriculum, instructional strategies, and assessment instruments, rendering it especially beneficial in nursing education, where experiential learning is essential.

Curriculum design. DBR enables nursing educators to create adaptable curriculum that address changing competency requirements [33]. Educators can systematically evaluate and enhance instructional elements to ensure alignment with contemporary healthcare requirements. For example, a DBR approach could facilitate the development of a geriatric care curriculum to address the acknowledged scarcity of nurses proficient in this field, hence meeting a genuine need within the healthcare system.

Instructional strategies. DBR encourages active learning methodologies that involve students and enhance critical thinking skills [34, 35]. Through the evaluation of methodologies such as flipped classrooms, team-based learning, and simulation, DBR assists educators in formulating solutions that improve learning outcomes [36]. One study indicated that a flipped classroom paradigm enhanced student engagement and performance, illustrating the efficacy of active learning when underpinned by DBR principles.

DBR in simulation education focuses on the iterative design and testing of educational interventions to improve learning outcomes. This approach is particularly relevant in the context of SBE, where the design of simulation scenarios and the integration of technology play a critical role in the effectiveness of the training. For example, the impact of design elements on educational outcomes in nursing simulation education highlights the importance of technology, training, and resources in shaping the quality of SBE [29]. DBR can help identify the most effective design elements and strategies for simulation-based training, thereby informing the development of more effective educational programs [27, 29]. Additionally, the integration of emerging technologies such as virtual reality and artificial intelligence into simulation training can further enhance its efficacy and accessibility, offering new opportunities for innovation in medical education [37].

Assessment methods. Authentic assessments, like Objective Structured Clinical Examinations, correspond with the competencies necessary for practical nursing applications [38]. DBR facilitates the creation of evaluation instruments that deliver significant feedback, aiding students in attaining competencies vital for patient care. Nursing programs can enhance the relevance, accuracy, and supportiveness of evaluations by persistently refining assessment procedures using DBR [39, 40].

By adopting DBR, nursing educators may develop new and successful educational experiences that equip students for the complexities of modern healthcare. The implementation of DBR in nursing education can profoundly influence curriculum development, pedagogical approaches, and assessment methods. The iterative and collaborative characteristics of DBR guarantee that educational interventions remain pertinent, successful, and constantly refined through empirical feedback and data. These case studies and references illustrate the beneficial application of DBR in enhancing nursing education, offering a practical framework for educators aiming to innovate and refine their teaching methodologies.

Advantages and anticipated challenges of DBR

Advantages of DBR. DBR has emerged as a novel methodology in nursing education, offering a unique integration of scholarly rigour with practical application. DBR bridges academic research and educational practice by tackling the practical challenges of teaching and learning [41]. The flexible and iterative framework promotes the continuous improvement of curriculum and teaching methods, ensuring their alignment with the ever-evolving requirements of the healthcare sector. Furthermore, DBR's collaborative nature integrates educators, researchers, and learners to develop creative methodologies, making it an indispensable strength for improving nursing education [42].

Anticipated challenges of DBR. Although DBR provides a systematic, practical framework for tackling educational issues, its application in nursing education presents distinct problems, such as resource requirements and the difficulties of reconciling theory with practice.

DBR projects are time-consuming and require financial and human resources [43]. Acquiring these resources is a problem for resource-constrained programs. Solutions that are proposed are to apply for external grants and utilize existing resources such as simulation labs and web platforms that can save costs and make DBR projects viable [44].

The secret to DBR's success is found in blending theoretical and practical know-how in a fruitful way. In order to ensure that educational intervention is responsive to students' and educators' actual needs, cooperation between researchers, practitioners, and students is necessary [44, 45]. Through this mechanism of feedback, theoretically sound and practically viable solutions can be created [42].

Evaluation of the efficacy of DBR interventions is complicated, particularly in dynamic learning situations [42]. Longitudinal studies that follow student performance and retention of competences over time can provide a means to determine the long-term effect of DBR on nursing education results and hence establish efficacy [45].

In summary, the implementation of DBR in nursing education has distinct problems, especially concerning resources, the integration of theory and practice, and the evaluation of impact. DBR projects demand substantial resources, necessitating considerable time, finance, and manpower, posing challenges for budget-constrained

programs. Proposed solutions encompass seeking external subsidies and leveraging existing resources, such simulation laboratories and internet platforms, to minimise expenses. Integrating theory with practical application is crucial for the efficacy of DBR; this requires extensive collaboration among academics, educators, and students to develop solutions that are both pragmatic and conceptually sound. Ultimately, evaluating the impact of DBR is intricate, since the dynamic characteristics of educational settings necessitate longitudinal studies to determine its enduring effects on student performance and skill retention.

Conclusion

In conclusion, nursing education must integrate DBR and other new methodologies to align with improvements in healthcare. DBR empowers nursing programs to tackle both practical and theoretical issues, hence cultivating a learning environment that equips students to answer modern healthcare demands. By connecting curricula with practical requirements and creating assessment techniques that appropriately represent nursing competencies, DBR enhances a holistic educational experience that benefits students, instructors, and the wider healthcare system. The iterative and collaborative nature of DBR is particularly advantageous for nursing education, since it positively influences curriculum development, teaching methodologies, and assessment techniques, hence improving the readiness of nursing graduates for practical difficulties. Despite the resource and implementation issues associated with DBR, its benefits make it an essential instrument for enhancing nursing education, thereby preparing future nurses to deliver compassionate and effective care in a complicated healthcare landscape.

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