Exploring the Evolving Landscape of Simulation-Based Education in Nursing Undergraduate Curricula 2018-2023: A Bibliometric Investigation

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This study conducts a bibliometric analysis of 2,724 highly cited articles on simulation-based nursing education published between 2018 and 2023. The study evaluates the simulation-based nursing education research landscape using the Web of Science database and specialized bibliometric analysis. Various visualization techniques were applied to construct co-citation networks and conceptual maps, revealing an interdisciplinary landscape that includes higher education, virtual reality, and medical education as pivotal themes. These interconnected domains underscore their importance in crafting effective educational interventions. The study stresses the value of comprehending the evolving bibliometric trends for enriching nursing education and healthcare practice. The insights generated from this analysis are significant for academia and the healthcare sector, offering a structured understanding of the developments and emerging research avenues within simulation-based nursing education.

Introduction

The landscape of clinical nursing practice has significantly transformed over the past decade. The emphasis on incorporating clinical simulation education into nursing curricula has been prominent, given its potential to emulate real-world scenarios (Wang et al., 2022). Simulation-based teaching methods are pivotal, allowing nursing students to hone vital clinical skills in controlled environments (Cant & Cooper, 2009). The COVID-19 pandemic has further underscored the importance of this shift as clinical practice opportunities dwindled (Smith et al., 2018).

Our bibliometric analysis scrutinizes 2,724 peer-reviewed papers from January 2018 to September 2023, sourced from the Web of Science (WoS). We centered our eligibility criteria on articles written in English within Education and Educational Research, focusing on document types like Articles and Review Articles. The review elucidates evolving trends in simulation-based nursing education, highlighting the trajectory from traditional curriculum approaches to embracing advanced technologies (Blandford, 2023) like Virtual Reality (VR) and Augmented Reality (AR).

Evolving Trends in Simulation-Based Nursing Education

Historically, the impetus behind simulation-based nursing education was integrating scientific methods into nursing curricula (Reese et al., 2011). By 2020, research expanded to encompass emerging technologies like VR and AR, the evaluation of learning outcomes, and strategies for emotional and stress management (Chen et al., 2019; Gudadappanavar et al., 2021). The pandemic propelled research toward alternative clinical experiences through simulation education (Cobbett & Snelgrove-Clarke, 2016).

Game-Based Learning and Technological Advancements

Game-Based Learning (GBL) has gained traction as an innovative pedagogical technique, captivating students with game-centric elements (Pellas et al., 2019). Within nursing education, GBL enhances learning outcomes by fostering problem-solving, collaboration, and critical-thinking skills (Wan et al., 2021). The evolution of VR and AR technologies further refines GBL, furnishing immersive experiences instrumental for clinical skill acquisition (Fealy et al., 2019).

Challenges and Gaps in Research and Practice

Despite these advancements, hindrances still need to be addressed. The pandemic unveiled the constraints of conventional clinical education, heightening the significance of simulation-based methods (Smith et al., 2018). Integrating VR and AR technologies is imperative to mitigate these challenges. The retention of psychomotor skills, crucial for clinical efficacy, is a paramount concern addressed by consistent simulation-based learning. A chasm persists between research insights and educational implementation. Bridging this gap requires a cohesive effort from educators, researchers, and clinical professionals (Smith et al., 2018; Um, 2023).

Bibliometrics Utility in Research

Bibliometrics offers researchers a quantitative perspective to discern thematic trends in academic research (Callon et al., 1983). Combined with Social Network Analysis, these methods generate visual representations of academic citation networks.

In nursing simulation education, bibliometrics provides a unique view of evolved knowledge structures. This study employs co-word analysis to define these structures, identifying research voids. Bibliometrics remains an invaluable tool in academic research, providing a view of the publication landscape and illuminating the path forward for fields like nursing simulation education.

Methodology

Database Selection and Tools Utilized

Based on the range of bibliometric analysis tools offered, we decided to establish our research on the Web of Science (WoS) database. We specifically focused on WoS because of its features like co-citation, co-authorship, and keyword co-occurrence, which played a crucial role in our article selection process (Falagas et al., 2008). It is worth noting WoS stood out due to its academic coverage, setting it apart from databases like PubMed, which mainly focus on life sciences and biomedicine.

Search Strategy

To improve the accuracy of our search, we utilized the "Web of Science Subject Categories and Keywords," a controlled vocabulary used in WoS. Like PubMed MeSH terms, these vocabularies enhance the precision of categorization and article indexing. This approach greatly enhances the effectiveness of our search by ensuring an exploration of key research themes. We designed our strategy based on a customized WoS query string which included terms in the field like "simulation," "virtual reality," and "nursing education." To broaden the scope of our search, we also incorporated variations and synonyms of these terms, ensuring a thorough investigation (Moher et al., 2009).

Temporal and Inclusion/Exclusion Criteria

Our research focused on articles published from January 1, 2018, to September 5, 2023. The results were further narrowed down by well-defined inclusion and exclusion criteria based on document type, language, and research area. The inclusion criteria comprised articles, review articles, and early access papers primarily in English and focused on education and educational research. Exclusion criteria were implemented to avoid irrelevant fields like chemistry, psychology, and computer science.

Data Analysis Framework

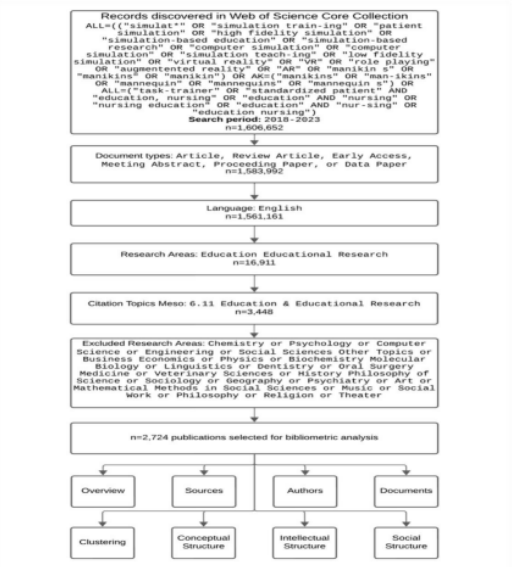
We utilized the PRISMA framework (see Figure 1) to synthesize our information. Our method organized data by publication date, co-citation, keywords, and themes, ensuring a comprehensive dataset for bibliometric analysis (Moher et al., 2009).

Using the built-in functionality of the WoS database to filter our dataset based on our inclusion and exclusion criteria, we fine-tuned our research dataset to focus on our research objective: *How have the research themes in simulation education specific to nursing education in undergraduate nursing programs evolved over time?*

Our approach was dedicated to accuracy and thoroughness. The WoS database played a role in our work, providing various academic resources and analytical tools. With a search strategy, strict selection criteria, and a clear plan for handling data, we were well-positioned to uncover detailed insights into the development of educational technology and the growing field of simulation science.

Figure 1

Prisma Table

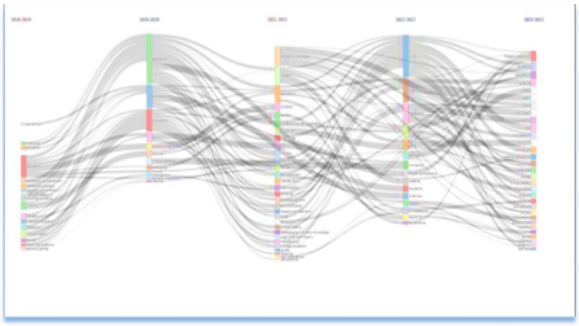


Results and Analysis

Our bibliometric approach used the online tool Biblioshiny (Aria & Cuccurullo, 2017). This method emphasizes the frequency of concurrent keyword appearances within the academic dataset, suggesting thematic or topical coherence in the subject matter (Van Eck & Waltman, 2010).

Figure 2

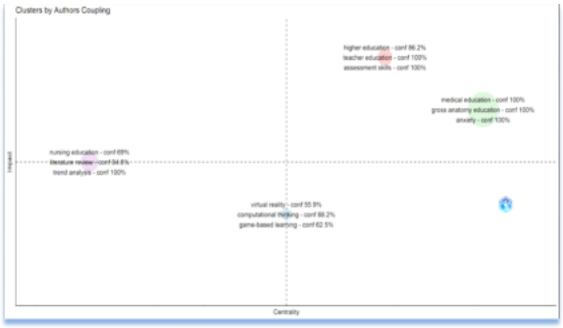
Network Analysis



The network analysis (see Figure 2) visually demonstrates these inter-relationships. Keywords served as nodes and their co-occurrence frequencies were represented as edges, giving insight into prevalent themes, critical areas, and potential research gaps (Pons & Latapy, 2005).

Figure 3

Co-Occurrence Matrix



Similarly, the co-occurrence matrix (see Figure 3) quantifies how often keyword pairs appear together within a specific collection of academic documents, with frequency encoded in each matrix cell (Huang et al., 2009).

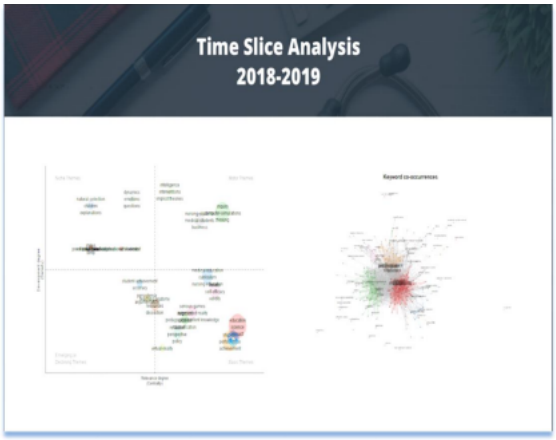
Notably, the diagonal elements of the matrix frequently indicate the total number of occurrences for each keyword across the dataset. This kind of matrix serves a dual purpose: it acts as both the foundational data layer for constructing a network graph and a basis for any ensuing statistical analyses that may be conducted (van Eck & Waltman, 2010).

This matrix laid the foundation for constructing the network graph and subsequent statistical analyses (Van Eck & Waltman, 2010).

Discussion

Figure 4

Time Slice Analysis: 2018—2019



Keyword analysis showed a shift from VR integration in 2018-2019 to wider educational strategies and foundational research by 2019 (see Figure 4).

Figure 5

Time Slice Analysis 2020

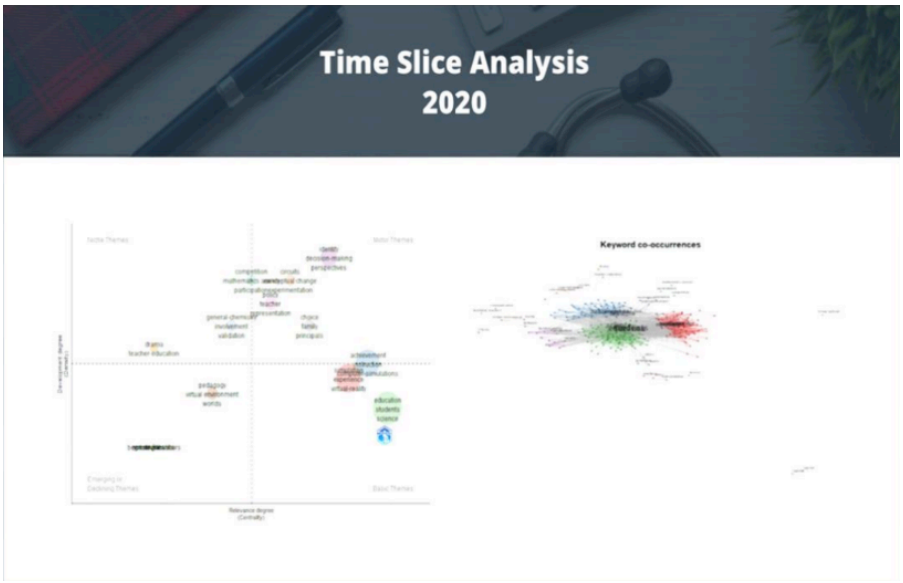
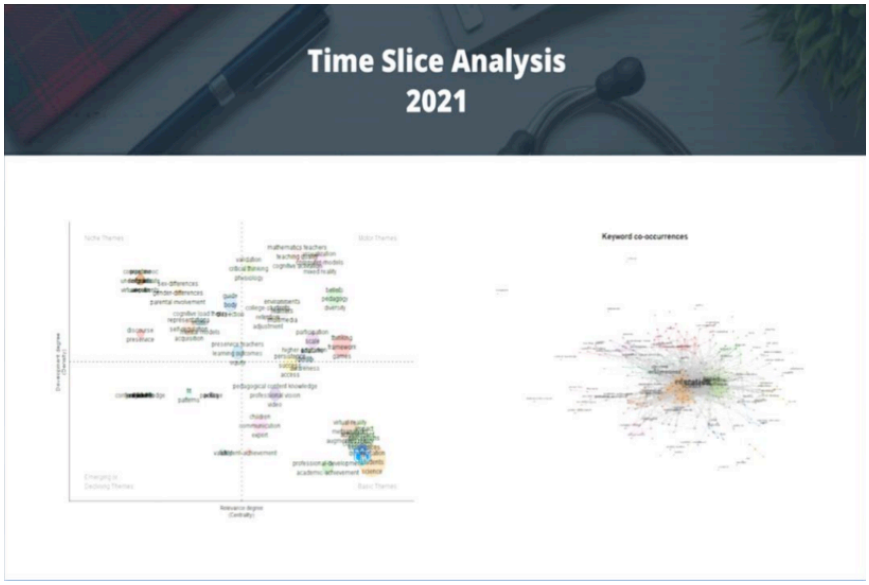


Figure 6

Time Slice Analysis 2021



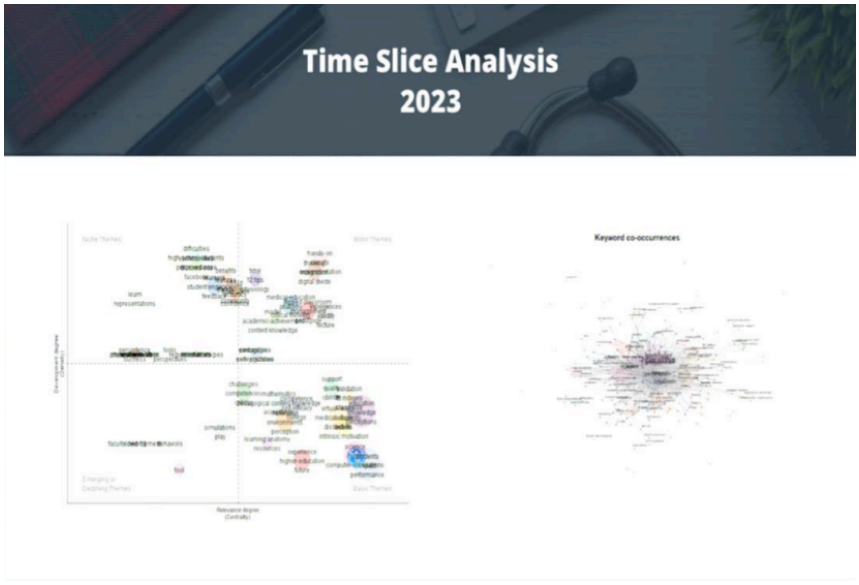
During 2020-2021 (see Figures 5 & 6), the literature emphasized performance metrics, interconnectedness, and knowledge tracing. There was a straightforward merging of science with educational technology in the context of simulation research.

Figure 7

Time Slice Analysis 2022

Figure 8

Time Slice Analysis 2023



During 2022—2023 (see Figures 7 & 8), trends in nursing education underscore the rising prominence of VR and AR (Heesung et al., 2017), game-based learning, and simulations, particularly during the pandemic when traditional instructional methods faced limitations.

Conclusion

Our analysis reveals that simulation-based nursing education is an expanding field, bridging higher education, virtual reality, and medical education. The COVID-19 pandemic highlighted the constraints of traditional clinical education, necessitating the adoption of VR and AR technologies to maintain critical psychomotor skills. While these technologies offer enhanced learning through consistent exposure, they also present challenges including cognitive overload, and potential neurological and behavioral issues, indicating a need for further investigation. This study provides a vital framework for educators, researchers, and practitioners, highlighting the dynamic nature of nursing education and the need for adaptive educational strategies. Future research should focus on the pedagogical effects of these technologies to improve the quality and efficacy of nursing education.

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