



Construction of Culture Sensitive Obstetrics and Gynecology Nursing Teaching Model Based on Humanoid Robots

Pengying Yue, Kailing Wang, Huimin Li, Wenyao Yan, Jimei Li

Xi'an Innovation College of Yan'an University, Xi'an 710100, Shaanxi, China

Abstract: Objective: To develop a humanoid robot-based teaching model for culturally sensitive obstetric and gynecological nursing, thereby providing a theoretical framework for innovating nursing education methodologies. Methods: A systematic search and thematic synthesis of literature published between January 2015 and May 2025 was conducted across major databases, including PubMed, Web of Science, CINAHL, CNKI, Wanfang, and VIP. Results: Leveraging their capabilities for multilingual interaction, emotion recognition, and behavioral simulation, humanoid robots can create highly simulated cross-cultural nursing scenarios. This study integrated Leininger's Culture Care Theory and constructivist learning theory to construct a three-dimensional integrated teaching model encompassing "Culture-Technology-Pedagogy." This model includes a spiral curriculum design, a human-robot collaborative teaching mechanism, and specific technological implementation pathways. It demonstrates potential for effectively enhancing nursing students' cultural awareness, cross-cultural communication skills, and empathy. However, its application faces challenges such as high technical costs, ethical risks, and the standardization of cultural scripts. Conclusion: The humanoid robot-based teaching model for culturally sensitive obstetric and gynecological nursing shows significant application potential. Future efforts should focus on strengthening interdisciplinary collaboration, optimizing algorithm design, and conducting empirical research to promote its deeper integration into nursing education.

Keywords: Humanoid Robot; Cultural Sensitivity; Obstetric and Gynecological Nursing; Nursing Education; Teaching Model

1. Introduction

The increasing global mobility of populations presents healthcare systems with growing challenges in providing care for pregnant and postpartum women from diverse cultural backgrounds [1]. Cultural beliefs and social norms significantly shape women's decisions regarding reproductive health, childbirth, and postnatal care [2]. According to the World Health Organization (WHO), a lack of cultural sensitivity among healthcare providers can lead to communication barriers, erosion of trust, and health disparities [3]. Thus, developing cultural competence has become a central objective in nursing education worldwide.

Traditional obstetric and gynecological nursing education relies heavily on case studies and role-playing. While useful for knowledge acquisition, these methods are limited in simulating realistic, dynamic cross-cultural clinical encounters, often due to low fidelity, inadequate feedback, and inconsistent learner engagement. Recent advances in artificial intelligence have enabled the use of humanoid robots—characterized by anthropomorphic design, natural language interaction, and emotional feedback—as innovative tools in medical simulation training [4]. Within culturally sensitive contexts such as obstetric care, these robots can create safe, repeatable training environments where learners can practice cross-cultural communication without judgment or risk.

Although robotic technology has been studied in areas such as geriatric and psychiatric nursing, its application in culturally sensitive obstetric nursing education remains underexplored. Existing research tends to focus on technical features or isolated cultural knowledge, lacking an integrated pedagogical framework. This review therefore aims to examine the current role of humanoid robots in culturally sensitive obstetric nursing education and to propose a teaching model that incorporates cultural theory, instructional design, and intelligent technology, thereby offering a theoretical and practical foundation for educational innovation.

2. Theoretical Basis and Practical Needs for Culturally Sensitive Teaching

2.1 The Practical Impact of Cultural Factors on Obstetric and Gynecological Nursing

Obstetric and gynecological nursing, encompassing highly personal domains like childbirth and reproduction, is deeply influenced by cultural values and social practices. Pregnant and postpartum women from different cultural backgrounds exhibit significant variations in health beliefs, pain expression, and perceptions of the body. For instance, the "doing the

month" (confinement) tradition in East Asian cultures emphasizes postpartum avoidance of wind and rest, which may conflict with modern medical advice. Influenced by religious and modesty norms, women in Middle Eastern cultures often prefer same-sex healthcare providers. In some parts of Africa, reliance on traditional birth attendants and herbal remedies remains widespread [5]. If these cultural differences are not adequately respected and addressed, they can directly impact the effectiveness of nursing interventions and even lead to patient-provider conflicts [6]. The systematic differences in obstetric care preferences across cultural groups (Table 1) necessitate that nursing education moves beyond mere knowledge transmission to cultivate students' core competency in responding to cultural diversity.

Table 1. Comparison of Obstetric Care Preferences Across Cultural Contexts

Cultural Context	Attitude Towards Childbirth	Pain Expression	Postpartum Practices	View on Breastfeeding
East Asian Cultures	Natural process, emphasizes endurance	Restrained, low-key expression	Values "doing the month," avoids wind/cold	Widely endorsed, longer duration
Western Cultures	Medicalized management, active intervention	Direct expression, seeks relief	Emphasizes early ambulation and recovery	Generally accepted, shorter duration
Middle Eastern Cultures	Significant religious meaning, values privacy	Potentially expressive	Specific taboos and protective rituals	Commonly practiced, influenced by modesty
African Cultures	Blends traditional beliefs and rituals	Diverse expressions	May incorporate herbs and traditional therapies	Highly encouraged, longer duration

2.2 Theoretical Evolution of Culturally Sensitive Teaching

The theoretical foundation for culturally sensitive teaching has evolved significantly, progressing from cultural knowledge to cultural safety. The transcultural nursing model proposed by Papadopoulos et al. [7] outlines a four-stage developmental framework: cultural awareness, cultural knowledge, cultural sensitivity, and cultural competence. This model emphasizes the need for nurses to identify potential cultural biases through continuous self-reflection and develop adaptive care strategies.

Building upon this, the concept of cultural safety has further deepened the connotation of cultural sensitivity. It demands that nursing education move beyond superficial recognition of cultural differences to address power imbalances and institutional discrimination within healthcare relationships. This concept carries crucial implications for instructional design: cultural education should not stop at knowledge transmission but must foster students' critical thinking and sense of social justice, ensuring their care does not compromise patient dignity due to cultural factors.

3. Educational Applicability and Application Pathways of Humanoid Robots

3.1 Technical Characteristics and Pedagogical Advantages

Humanoid robots, as intelligent systems with humanoid form and multimodal interaction capabilities, utilize core technologies including natural language processing, affective computing, precise motion control, and programmability [8]. Compared to standardized patients, humanoid robots demonstrate unique advantages in obstetric nursing education: they can be precisely programmed to exhibit language features and non-verbal taboos specific to cultural contexts, ensuring consistency in cultural representation; they provide standardized, repeatable teaching scenarios, eliminating assessment bias introduced by human factors; and they create a psychologically safe practice environment, allowing learners to repeatedly practice communication on sensitive topics without the fear of judgment.

3.2 Pathways for Realizing Teaching Functions

Humanoid robots can fulfill multidimensional functions in culturally sensitive obstetric nursing training (Table 2), providing technical support for the construction of the teaching model.

Table 2. Functional Applications of Humanoid Robots in Obstetric Nursing Training

Function Type	Technical Features	Teaching Application	Value for Cultural Sensitivity
Physiological Simulation	Simulating childbirth, vital sign changes	Delivery techniques, emergency management	Understanding cultural variations in perceiving physiological processes
Emotional Expression	Facial expression generation, vocal tone modulation	Empathy training, emotional comfort	Recognizing culturally specific patterns of emotional expression
Culture-Specific Behaviors	Multilingual switching, cultural gesture programming	Cross-cultural communication, taboo avoidance	Cultivating cultural knowledge and respect
Feedback & Assessment	Data recording, behavior analysis	Skill evaluation, personalized feedback	Providing objective metrics for cultural sensitivity performance

4. Model Construction and Implementation Pathways

This study proposes a three-dimensional "Culture–Technology–Pedagogy" integration model grounded in Leininger's Transcultural Nursing Theory and Constructivist Learning Theory. The framework establishes four core design principles: (1) Cultural Authenticity—scenarios must be co-developed by cultural and clinical experts to ensure accurate representation while avoiding stereotyping. (2) Technological Appropriateness—robot functionality must align with pedagogical objectives rather than drive instructional design; (3) Reflection-Orientation—structured reflection activities enable critical examination of cultural assumptions and internalization of awareness; and (4) Ethical Safety—clear boundaries for robot use and data handling must safeguard the learning environment [9].

A spiral curriculum structures the learning progression through four integrated modules: Cultural Cognition establishes theoretical foundations; Cultural Context applies knowledge to specific population needs; Robot Simulation enables immersive practice with culturally-programmed avatars; and Reflection & Integration consolidates learning through guided debriefing [10]. This scaffolded approach systematically develops cultural sensitivity competencies from awareness to application.

The human-robot collaborative model strategically divides educational roles: instructors provide pedagogical direction and facilitate reflection, while robots simulate culturally-specific patient interactions, deliver real-time prompts, and document learner performance [11]. This synergy creates a closed-loop learning cycle where theoretical knowledge is applied in simulated scenarios and refined through structured reflection. For instance, when a robot enacts a Muslim patient declining male care due to modesty norms, the instructor guides students through both clinical and ethical dimensions of the situation [12].

Technological implementation requires an interdisciplinary team and integrated systems: multimodal sensors capture behavioral cues, natural language processing enables multilingual interaction, affective computing simulates emotional responses, and a cultural behavior database ensures script authenticity [13]. This infrastructure supports dynamic, context-aware interactions essential for developing nuanced cultural competencies.

5. Challenges and Future Directions

Implementation faces four significant barriers: limited robot capability in replicating subtle cultural and emotional nuances reduces training fidelity; potential reinforcement of stereotypes through inadequate scripting; insufficient faculty training creating technology-pedagogy gaps; and prohibitive costs restricting institutional adoption.

Future development should prioritize: AI-enhanced adaptability using large language models to generate dynamic, responsive scenarios; hybrid reality integration to create richer simulated environments; systematic development of localized cultural databases; and incorporation of intelligent education into national nursing standards to support scalable implementation [14].

6. Conclusion

The humanoid robot-based teaching model demonstrates significant potential through its systematic integration of cultural theory, pedagogical design, and intelligent technology. Subsequent work should validate effectiveness through multi-center trials and establish standardized assessment protocols to support broader adoption in nursing education.

Acknowledgments

This paper was supported by Xi'an Innovation College of Yan'an University "Humanoid Robot+Course" Teaching Reform Research Special Project (Project Number: 2025YKG04).

References

- [1] International Organization for Migration. World Migration Report 2022. Geneva: IOM; 2022.
- [2] Betrán AP, Ye J, Moller AB, et al. Trends and projections of caesarean section rates: global and regional estimates[J]. *BMJ Global Health*, 2021, 6(6): e005671.
- [3] World Health Organization. WHO recommendations on maternal and newborn care for a positive postnatal experience[R]. Geneva: WHO, 2022.
- [4] Belpaeme T, Kennedy J, Ramachandran A, et al. Social robots for education: A review[J]. *Science Robotics*, 2018, 3(21): eaat5954.
- [5] Maimbolwa MC, Sikazwe N, Yamba B, et al. Cultural practices and beliefs during pregnancy, childbirth, and postpar-

- tum among women in Zambia: A systematic review[J]. *Journal of Transcultural Nursing*, 2021, 32(4): 398-409.
- [6] Iheduru-Anderson K, Valderama-Wallace C, Bigger S E, et al. A critical discourse analysis of AACN's Tool Kit of Resources for cultural competent education for baccalaureate nurses[J]. *Global Qualitative Nursing Research*, 2023, 10: 23333936231214420.
- [7] Papadopoulos I. The Papadopoulos, Tilki and Taylor model of developing cultural competence[J]. *Transcultural health and social care: Development of culturally competent practitioners*, 2006: 7-24.
- [8] Tao Yong, Wan Jiahao, Wang Tianmiao, etc Building a new paradigm of embodied intelligence: a review of the current status and development trends of humanoid robot technology [J]. *Journal of Mechanical Engineering*, 2025, 61 (15): 121-147.
- [9] Sharkey A, Sharkey N. We need a conversation about ethics in social robotics[J]. *AI & Society*, 2021, 36(3): 839-851.
- [10] Osmancevic S, Steiner L M, Großschädl F, et al. The effectiveness of cultural competence interventions in nursing: A systematic review and meta-analysis[J]. *International Journal of Nursing Studies*, 2025: 105079.
- [11] Weerarathna I N, Raymond D, Luharia A. Human-robot collaboration for healthcare: a narrative review[J]. *Cureus*, 2023, 15(11).
- [12] Alomair N, Alageel S, Davies N, et al. Factors influencing sexual and reproductive health of Muslim women: a systematic review[J]. *Reproductive health*, 2020, 17(1): 33.
- [13] Rodriguez-Guerra D, Sorrosal G, Cabanes I, et al. Human-robot interaction review: Challenges and solutions for modern industrial environments[J]. *Ieee Access*, 2021, 9: 108557-108578.
- [14] Luo P, Chen L, Liu Y, et al. Forecast of the number of nursing beds per 1000 older people from 2023 to 2025: Empirical quantitative research[J]. *Nursing Open*, 2024, 11(4): e2159.