International Research Journal of Human Resource and Social Sciences
ISSN(O): (2349-4085) ISSN(P): (2394-4218)
Impact Factor 7.924 Volume 12, Issue 07, July 2025
Website- www.aarf.asia, **Email** : editoraarf@gmail.com

Game-Based Learning for Breastfeeding Education: A Pilot Study on Attitude Outcomes and Usability Among Nursing Students

1. Li-Lan Chuang, Ph.D.
Associate Professor, Department of Nursing, Chang Gung University of Science and Technology, Taoyuan; and Department of Nursing, Chang Gung Memorial Hospital, TuCheng, New Taipei City, Taiwan.
**Correspondence:*
Li-Lan Chuang
Address: No.261, Wenhua 1st Rd., Guishan Dist., Taoyuan City 33303, Taiwan (R.O.C.)
Email address: llchuang@mail.cgust.edu.tw
Fax number: 886-3-2118866
Phone number: 886-3-2118999 ext 3329

Abstract

Background: Breastfeeding promotes the physical and mental well-being of both mothers and infants. However, mothers may encounter numerous challenges that lead to early cessation of breastfeeding. Nurses play a key role in supporting and assisting mothers to achieve successful breastfeeding. As part of maternity nursing education, breastfeeding content is included in the undergraduate nursing curriculum.

Objective: This study aimed to evaluate the learning effectiveness of using an online educational game platform on breastfeeding, developed by a Department of State Health Services, as a supplemental learning tool.

Methods: A quasi-experimental, two-group pretest-posttest design was adopted. Participants were third-year nursing students enrolled in a maternity nursing course at a university of science and technology in northern Taiwan. The intervention group used the online English-language game platform with Chinese translation support. Instruments included a demographic questionnaire, Iowa Infant Feeding Attitude Scale in Chinese and the System Usability Scale (SUS). A total of 156 students were recruited: 102 in the intervention group and 54 in the control group. The mean age was 21.53 (±0.78) years, and most participants were female (85.5%).

Results: The mean SUS score in the intervention group was 59.41 (±14.47) out of 100. The posttest breastfeeding attitude scores were 53.83 (±6.73) in the intervention group and 54.31 (±4.33) in the control group, showing no significant difference between the two groups.

Conclusion: Despite providing translated interface support, the intervention did not yield statistically significant improvements in breastfeeding attitudes, suggesting that linguistic adaptation alone may be insufficient without deeper cultural contextualization. Future research may consider developing localized, game-based online learning tools tailored to the needs of nursing students.

Keywords: game-based learning, breastfeeding, attitude, nursing, maternity

Introduction

Breastfeeding provides well-documented benefits for both infants and mothers, including enhanced immunity, reduced risks of infections, and improved maternal-infant bonding (Victora et al., 2016; World Health Organization [WHO], 2023). Nurses play a critical role in breastfeeding education and support, and therefore, developing breastfeeding competence among nursing students is a key educational objective.

Despite its importance, traditional lecture-based instruction may not sufficiently engage learners or facilitate knowledge retention. In recent years, gamification, the use of game elements in non-game contexts, has emerged as an innovative teaching strategy in health education. Compared to conventional persuasive technologies or health games, gamification offers unique motivational mechanisms that may enhance behavioral change, learning engagement, and attitude shifts (Johnson et al., 2016). Although empirical evidence supports the potential of gamification in health promotion, current research indicates that its effects can vary depending on the targeted outcome, with more consistent benefits observed in behavioral domains than in cognitive or attitudinal measures (Johnson et al., 2016).

Game-based learning (GBL) has gained growing attention as an effective instructional strategy to cultivate students' engagement and critical skills necessary for the 21st century. According to a systematic review by Qian and Clark (2016), GBL not only enhances students' motivation but also promotes essential competencies such as problem-solving, collaboration, and creative thinking. These outcomes are particularly valuable in health education, where students are expected to apply theoretical knowledge to real-world patient care. By providing immediate feedback, scenario-based tasks, and opportunities for trial and error, GBL creates a safe and stimulating learning environment that can improve both knowledge acquisition and learner confidence. The authors further note that well-designed educational games aligned with curricular goals tend to produce more consistent and positive learning outcomes. In nursing education, especially in sensitive topics such as breastfeeding support, these features of GBL may help students develop not only factual knowledge but also professional judgment and empathetic communication (Qian & Clark, 2016). Effective breastfeeding support by nursing professionals hinges not only on foundational knowledge but critically on targeted education and hands-on training. Register et al. (2000) examined the knowledge and attitudes of pediatric office nurses, finding that while most had a strong understanding of breastfeeding benefits, less than half felt confident managing common breastfeeding issues, such as concerns over infant weight gain or maternal milk supply. Importantly, the authors reported that 85% of nurses cited on-the-job training as their primary source of breastfeeding education, highlighting a marked inconsistency in formalized training.

In Taiwan, despite the inclusion of breastfeeding education in core curricula, limited traditional pedagogies may hinder students' readiness to provide effective support. Given this, embedding comprehensive breastfeeding training modules, such as translated interactive games, into nursing education could more effectively prepare students to deliver evidence-based, empathetic support to breastfeeding mothers.

Given the increasing emphasis on active learning strategies in nursing education, GBL offers a novel approach to enhance student engagement and motivation in complex clinical topics such as breastfeeding support. While traditional lecture-based instruction may fall short in fostering practical competencies and critical thinking, GBL presents a learner-centered alternative that encourages participation and knowledge application. To explore its application in nursing education, this study adopted an online gamified breastfeeding education platform and translated it into Traditional Chinese for use with Taiwanese nursing students. This study aims to evaluate the effectiveness of a translated, web-based educational breastfeeding game in improving undergraduate nursing students' attitudes toward breastfeeding.

Literature review

Demirci et al. (2022) conducted a randomized controlled pilot trial to evaluate the feasibility, acceptability, and preliminary outcomes of a mobile web-based breastfeeding educational intervention designed for both postpartum mothers and clinicians. The intervention, named "MILK," aimed to improve breastfeeding self-efficacy and support through accessible, evidence-based digital content. The study included both maternal participants and clinicians and demonstrated high acceptability and usability across both groups. Mothers reported that the intervention helped them better understand breastfeeding challenges and solutions, while clinicians noted improved patient engagement and satisfaction. Importantly, the study found a trend toward increased breastfeeding self-efficacy and longer breastfeeding duration among mothers who used the intervention, though the sample size limited statistical power. This study supports the growing body of literature indicating that digitally delivered breastfeeding education—when designed to be interactive, convenient, and user-centered—can positively impact both maternal knowledge and breastfeeding outcomes. It also underscores the importance of including both healthcare providers and patients in intervention design to ensure consistency of information and support.

Tavares et al. (2022) conducted a systematic review examining the use and impact of GBL in nursing education, particularly in simulation training and debriefing, and found that most included studies reported positive student experiences and increased engagement, especially when educational games such as quizzes, escape rooms, or digital simulations were integrated into clinical scenarios. However, some students experienced anxiety when games involved strict time constraints. While short-term knowledge gains were consistently observed, evidence for long-term retention was mixed, with some studies reporting performance plateaus over time. The review also emphasized the importance of structured debriefing following gameplay, which students viewed as essential for consolidating knowledge, reflecting on decision-making, and deriving meaningful learning from game experiences.

Gallegos et al. (2017) explored the educational impact of using the 3D Gamelab© platform in undergraduate nursing education and found that participants perceived increased engagement and immersive learning during simulation-based activities, though some noted challenges with navigating the technology (Gallegos et al., 2017).

Vázquez-Calatayud et al. (2024) explored the integration of real-world learning and GBL, specifically combining case-based learning with an escape-room format, in a sample of 66

postgraduate nursing students and found that participants achieved high academic scores, demonstrated effective decision-making skills, and expressed enthusiasm and perceived enhancement of their clinical competence through an engaging, gamified training approach.

Zehler and Musallam (2021) conducted a pilot study to explore the impact of a postpartum hemorrhage (PPH)–focused GBL activity, modeled after the "Minute to Win It" game show, on nursing students' clinical judgment. Seven PPH stations were designed within an undergraduate nursing course, where teams of students engaged in timed challenges corresponding to components of the Clinical Judgment Model (recognition, analysis, action, evaluation). The results showed significant improvements from pre- to posttest in each element of clinical judgment, with students also reporting enhanced engagement and knowledge retention. The authors concluded that GBL is an effective strategy to integrate clinical reasoning frameworks into classroom instruction, particularly for complex topics such as PPH, and that students associate GBL with stronger engagement and practical learning.

Qian and Clark (2016) conducted a systematic review of empirical studies on GBL and found that GBL can significantly enhance students' motivation, engagement, and development of higher-order thinking skills. The authors highlight that these outcomes are largely attributed to the interactive, student-centered nature of GBL, which promotes autonomy, competence, and active learning—core principles aligned with motivational learning theories.

Grassley et al. (2017) piloted "Healthy Moms," a web-based antenatal breastfeeding education intervention which included 12 interactive game-like modules and found it to be feasible and acceptable for delivering prenatal breastfeeding self-efficacy and intention content online, although no statistically significant changes were observed in maternal self-efficacy or intention post-intervention, suggesting that while online GBL is practical, further research is needed to evaluate its true impact on outcomes(Grassley et al., 2017).

Moraes and Ferraz (2021) developed and validated a serious educational game titled *Expressing Milk Game*, aimed at enhancing occupational nurses' knowledge of human milk expression, which includes four stages: preparation, expression techniques, storage, and usage. The game achieved a high content validity index (CVI = 86.7%) and was rated as having excellent usability (mean SUS score = 83.9). Moreover, learning effectiveness, assessed via the EGameFlow scale, yielded a high average score (6.52 out of 7), indicating the game's strong educational impact, usability, and engagement.

Collectively, the literature highlights the pedagogical value of GBL across various domains of nursing education. From clinical decision-making simulations to breastfeeding instruction, GBL has consistently demonstrated its ability to improve student motivation, support knowledge retention, and enhance learning experiences. Although limitations such as technological constraints and mixed results in long-term outcomes have been noted, the evidence suggests that GBL represents a feasible and effective educational strategy, particularly for topics that require applied skills and student engagement. These findings support the integration of game-based tools into nursing curricula, especially in areas like breastfeeding education where interactive, scenario-based learning can enhance understanding and clinical preparedness.

Methods

Participants

The participants in this study were third-year undergraduate students enrolled in a four-year Bachelor of Science in Nursing (BSN) program at a university of technology in northern Taiwan. These students had completed several professional nursing courses and clinical practicum prior to the study. Inclusion criteria were as follows: (1) enrollment in the "Maternity Nursing and Laboratory" course, (2) ability to read and comprehend Chinese, and (3) willingness to participate in the study. A class-based sampling strategy was employed, with two classes (n = 102) assigned to the experimental group and one class (n = 54) assigned to the control group, resulting in a total of 156 participants.

Instruments

1. Demographic Information Sheet

A self-administered demographic questionnaire was used to collect background information on each participant. The items included age, gender, and level of interest in nursing.

2. Breastfeeding Attitude Scale

To assess students' attitudes toward breastfeeding, this study employed the Chinese version of Iowa Infant Feeding Attitude Scale (IIFAS), originally developed by Mora et al. (1999). The IIFAS is a 17-item instrument designed to measure cognitive beliefs and attitudes toward infant feeding, particularly breastfeeding versus formula feeding. Each item is rated on a 5-point Likert scale, with higher scores indicating a more positive attitude toward breastfeeding. The original scale demonstrated good internal consistency, with a Cronbach's alpha of 0.86. The Chinese version of the IIFAS, as validated by Ho and McGrath (2011), has been shown to retain acceptable reliability (Cronbach's alpha = 0.74) and has been widely used in studies examining the relationship between feeding attitudes and breastfeeding duration.

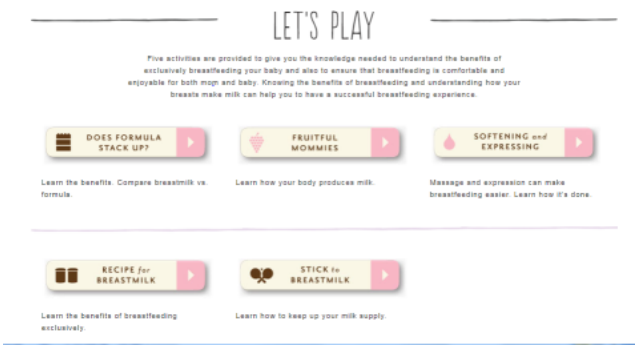
3. System Usability Scale (SUS)

SUS was used to evaluate participants' perceived usability of the GBL system. Originally developed by John Brooke, the SUS is a widely recognized standardized questionnaire used to assess the usability of digital products, user interfaces, and software systems. It consists of 10 items rated on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree), alternating between positively and negatively worded statements. Items 1, 3, 5, 7, and 9 are positively worded, while items 2, 4, 6, 8, and 10 are negatively worded to minimize response bias and assess attentiveness. Participants were instructed to provide their immediate impressions after using the system, with a score of 3 indicating a neutral response if the item was unclear. The scoring procedure involved subtracting 1 from the raw score for each odd-numbered (positive) item and subtracting the raw score from 5 for each even-numbered (negative) item. The total score was then multiplied by 2.5 to yield a final usability score ranging from 0 to 100, with higher scores indicating better perceived usability. The SUS is considered a highly reliable and efficient tool for assessing user-system interaction quality in a variety of contexts, including web-based learning environments.

Intervention: Game-Based Learning Implementation

The game-based educational material used in this study was adapted from an online platform originally designed for public health promotion. This interactive resource, composed of several simple mini-games, aimed to increase awareness and improve attitudes toward breastfeeding among the general population. Although it was not specifically developed for professional or academic training, it was selected for this study due to its accessible format and introductory content, which was considered appropriate for nursing students who were first-time learners in the subject. The original platform has since been removed from public access.

To support local implementation, the original English content was translated into Traditional Chinese and uploaded onto the university's online learning platform as a self-directed learning module. A user guide was also provided to help students navigate the platform and engage with the game content. Students in the experimental group were instructed to access and complete the interactive learning activities during their own time after class, without any in-class guidance. This approach aimed to simulate autonomous learning and evaluate the real-world usability and effectiveness of the digital educational game in a nursing education context.



Data Collection Procedures

This study was conducted as part of the "Maternity Nursing and Laboratory" course, a three-credit core professional nursing subject required for third-year students in a four-year Bachelor of Science in Nursing (BSN) program at a university of technology. The course is typically offered during either the first or second semester of the third academic year; in this study, it was implemented during the second semester. Given the inclusion of practical clinical skill training, the course comprises four hours of instruction per week over an 18-week semester, totaling 72 instructional hours. The course is grounded in the philosophy of family-centered care and covers the continuum of care for families during pregnancy, childbirth, and the postpartum period. In addition to classroom-based instruction on theoretical knowledge, students receive hands-on training in key maternity nursing skills, such as Leopold's maneuvers (four-step abdominal palpation), immediate newborn care, and newborn bathing procedures.

The breastfeeding unit, which covered topics such as the physiology of lactation, benefits of breastfeeding, breastfeeding techniques, and common challenges with corresponding interventions, was implemented around Week 11 or 12 of the 18-week semester. The classroom instruction for this unit lasted approximately three hours, followed by one hour of self-directed learning arranged by the students themselves. The game-based learning material was embedded in the postpartum breastfeeding module of the course and was only accessible to the

experimental group during the study period. In contrast, students in the control group engaged in routine self-study using the assigned textbook and lecture slides provided by the instructor.

Participants were recruited using class-based sampling and assigned to either the experimental group or the control group based on their existing class enrollment. At the beginning of the study, both groups completed a pretest that included two instruments: a demographic information sheet and the IIFAS.

Following the classroom lecture, the experimental group received access to the translated game-based guide on breastfeeding, which was hosted on the university's online teaching platform. These students accessed the materials using personal or school-provided computers with wireless internet connectivity, typically in locations such as the library or student dormitories. Each student logged in using their individual university account. These students were asked to engage in the game content through self-directed learning during their own time. After completing the intervention, they also filled out the System Usability Scale (SUS) to evaluate their user experience with the game.

Both the experimental and control groups subsequently completed a posttest of IIFAS. The data collection process was conducted over a period aligned with the breastfeeding unit of the maternity nursing course. To ensure ethical equity, the control group was granted access to the GBL materials after completion of the study intervention phase.

Ethical Considerations

This study was approved by the Institutional Review Board (IRB) of Chang Gung Memorial Hospital, Taiwan (NO. 201801253B0). All procedures were conducted in accordance with the ethical standards outlined in the Declaration of Helsinki. Prior to participation, all students were informed about the study's purpose, procedures, confidentiality measures, and their right to withdraw at any time without penalty. Written informed consent was obtained from all participants. To protect student privacy, all data were anonymized and used solely for research purposes.

Data Analysis

All data were analyzed using IBM SPSS Statistics version 22. Descriptive statistics, including means, standard deviations, frequencies, and percentages, were used to summarize participants' demographic characteristics and baseline measurements. The *t*-tests and chi-square tests were conducted to examine differences between the experimental and control groups in terms of demographic variables and baseline scores. The System Usability Scale (SUS) scores in the experimental group were analyzed using descriptive statistics to evaluate the perceived usability of the game-based learning platform. A p-value of less than 0.05 was considered statistically significant.

Results

Participant Characteristics

A total of 156 nursing students participated in the study. The average age of participants was 21.53 years (SD = 0.78). The majority of students were female (85.5%) and reported having an interest in nursing (52.5%).

Breastfeeding Attitude Outcomes

The mean breastfeeding attitude score in the experimental group decreased slightly from 54.44 (pretest) to 53.91 (posttest), while the control group showed a slight increase from 53.17 to 54.31. However, neither group demonstrated statistically significant changes in attitude scores. The within-group comparison revealed no significant difference in the experimental group ($p = 0.094$) or the control group ($p = 0.118$). These findings indicate that the intervention had no statistically significant effect on students' attitudes toward breastfeeding.

System Usability Results

The average System Usability Scale (SUS) score reported by students in the experimental group was 59.41 (SD = 14.47) out of a maximum score of 100. According to standard SUS interpretation guidelines, a score below 68 is generally considered below average usability. This result suggests that students perceived the game-based learning platform as moderately usable, but with notable limitations. Improvements to the system's interface design, language accessibility, or navigation structure may be necessary to enhance its overall usability and learning effectiveness.

Discussion

The findings of this study highlight the potential and limitations of integrating GBL into breastfeeding education for undergraduate nursing students. Although the use of an interactive digital game as a supplementary learning tool offered a novel and engaging approach, the intervention did not result in statistically significant changes in students' breastfeeding attitudes. One possible explanation is that the original content was developed in English and may not have been fully aligned with the linguistic and cultural context of Taiwanese nursing students, despite the provision of translated materials.

The relatively low usability score reported by the experimental group further underscores the need for culturally and linguistically localized educational game development. A score of 59.41 on the SUS scale suggests that students encountered usability barriers that may have interfered with their learning engagement or comprehension. Language challenges, unfamiliar gameplay mechanics, and interface design that did not reflect local learning preferences may have contributed to these difficulties.

Localization is essential for maximizing the effectiveness of digital learning tools, particularly in professional education such as nursing. Locally developed or culturally adapted serious games can address the specific needs, values, and clinical practices relevant to Taiwanese learners. Moreover, localized games can incorporate regionally appropriate case scenarios, professional language, and educational standards, which are more likely to resonate with students and promote deeper learning outcomes.

Therefore, future research and development should focus on the co-design of breastfeeding education games with local educators, students, and subject matter experts. This collaborative

approach may help ensure that both the educational content and technological design are contextually meaningful, culturally sensitive, and pedagogically effective.

Limitations and Future Research

This study has several limitations that should be considered when interpreting the findings. First, the game-based learning material used in the intervention was originally developed in English and only partially translated into Chinese. Despite the translation, the interface and game flow remained in the original language format, which may have hindered full comprehension and engagement for some students. This linguistic barrier could have reduced the intervention's potential effect on learning outcomes.

Second, the study was conducted in a single institution with a convenience sample of third-year nursing students, which may limit the generalizability of the results to other academic settings or student populations. Additionally, the quasi-experimental design did not include random assignment, which may introduce selection bias and confounding variables.

Third, students were asked to complete the game-based learning activity independently during their personal time, and individual engagement levels or time spent on the activity were not controlled or monitored. This variability in exposure could have affected the consistency of the intervention.

For future research, we recommend the development of fully localized game-based learning materials that incorporate culturally relevant content and user-centered design tailored for nursing students in Taiwan. Randomized controlled trials with larger and more diverse samples should be conducted to further evaluate the effectiveness of such interventions. Additionally, incorporating system logs or learning analytics to monitor usage patterns may help assess learner engagement and its relationship with educational outcomes.

Conclusion

This study explored the effectiveness of an English-based game-based learning intervention on breastfeeding education among undergraduate nursing students in Taiwan. While the integration of an educational game offered an innovative supplement to traditional instruction, the intervention did not significantly improve students' breastfeeding attitudes. Additionally, the perceived usability of the game platform was below average, highlighting challenges related to language and contextual mismatch.

These findings underscore the importance of developing localized, culturally relevant digital learning tools in nursing education. To maximize the benefits of GBL, future efforts should prioritize the co-creation of educational games that reflect the linguistic needs, clinical environment, and learning preferences of local student populations. With proper adaptation and user-centered design, game-based learning has the potential to become a valuable strategy for enhancing knowledge, engagement, and competency in maternal and child health education. With culturally tailored game-based tools, nursing educators can enhance student engagement and foster readiness for clinical breastfeeding support.

References

Demirci, J. R., Kotzias, V., & Bogen, D. L. (2022). Evaluating the feasibility and acceptability of a mobile web-based breastfeeding educational intervention for mothers and clinicians: A randomized controlled pilot trial. *Primary Health Care Research & Development, 23*, e49. https://doi.org/10.1017/S1463423622000493

Gallegos, C., Tesar, A. J., Connor, K., & Martz, K. (2017). The use of a game-based learning platform to engage nursing students: A descriptive, qualitative study. *Nurse Education in Practice*, *27*, 101-106. https://doi.org/https://doi.org/10.1016/j.nepr.2017.08.019

Grassley, J. S., Connor, K. C., & Bond, L. (2017). Game-based online antenatal breastfeeding education: A pilot. *Applied Nursing Research*, *33*, 93-95. https://doi.org/https://doi.org/10.1016/j.apnr.2016.10.011

Ho, Y. J., & McGrath, J. M. (2011). A Chinese version of Iowa Infant Feeding Attitude Scale: reliability and validity assessment. *International journal of nursing studies*, *48*(4), 475–478. https://doi.org/10.1016/j.ijnurstu.2010.09.001

Johnson, D., Deterding, S., Kuhn, K. A., Staneva, A., Stoyanov, S., & Hides, L. (2016). Gamification for health and well-being: A systematic review of the literature. *Internet Interventions, 6*, 89–106. https://doi.org/10.1016/j.invent.2016.10.002

Moraes, M. H. F. D., & Ferraz, C. M. (2021). Development and validation of an educational serious game about human milk expression. *Revista Brasileira de Saúde Materno Infantil, 21*(3), 811–819. https://doi.org/10.1590/1806-93042021000300007

Qian, M., & Clark, K. R. (2016). Game-based learning and 21st century skills: A review of recent research. *Computers in Human Behavior, 63*, 50–58. https://doi.org/10.1016/j.chb.2016.05.023

Register N, Eren M, Lowdermilk D, Hammond R, Tully MR. Knowledge and Attitudes of Pediatric Office Nursing Staff About Breastfeeding. *Journal of Human Lactation*. 2000;16(3):210-215. doi:10.1177/089033440001600305

Tavares, N. (2022). The use and impact of game-based learning on the learning experience and knowledge retention of nursing undergraduate students: A systematic literature review. *Nurse Education Today*, *117*, 105484. https://doi.org/https://doi.org/10.1016/j.nedt.2022.105484

Vázquez-Calatayud, M., García-García, R., Regaira-Martínez, E., & Gómez-Urquiza, J. L. (2024). Real-world and game-based learning to enhance decision-making. *Nurse Education Today, 140*, 106276. https://doi.org/10.1016/j.nedt.2024.106276

Victora, C. G., Bahl, R., Barros, A. J. D., França, G. V. A., Horton, S., Krasevec, J., Murch, S., Sankar, M. J., Walker, N., & Rollins, N. C. (2016). Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect. *The Lancet*, *387*(10017), 475-490. https://doi.org/10.1016/S0140-6736(15)01024-7

World Health Organization. (2023). *Infant and young child feeding*. https://www.who.int/news-

room/fact-sheets/detail/infant-and-young-child-feeding

Zehler, A., & Musallam, E. (2021). Game-Based Learning and Nursing Students' Clinical Judgment in Postpartum Hemorrhage: A Pilot Study. *Journal of Nursing Education*, *60*(3), 159–164. https://doi.org/10.3928/01484834-20210222-07 (Original work published March 1, 2021)