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Effectiveness of a Newborn and Umbilical Cord Model to Enhance Practice Skills among Nursing Students

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ABSTRACT

Introduction: The purpose of this is to ensure the safety of those receiving services. Nursing students must practice nursing on mannequins in nursing laboratories until they are proficient, before providing nursing care to patients in hospitals.

Objectives: A quasi-experimental research was aimed at studying the effectiveness of a newborn and umbilical cord model to enhance practice skills among nursing students.

Methods: The research team created the Newborn and umbilical cord model for teaching and learning. The research design One-group pretest-posttest design was used with thirty third-year undergraduate nursing students who were randomly selected through training participation and assigned to one group. Data was collected before and after the intervention using umbilical cord cutting skill assessment and satisfaction questionnaires. Data was analyzed using SPSS 22; Descriptive statistics and paired t-test were used to analyze the data.

Results: Nursing students who had umbilical cord-cutting skills, showed a significant increase in their scores from the pretest to the posttest ($P < 0.05$). The participants also ha the highest level of satisfactory results overall with a mean of 4.52.

Conclusions: The newborn and umbilical cord model can be used improved umbilical cord cutting practice skills and enhance practice skills among nursing students. It is constructed from a hose that is both inexpensive and easy to cut, much like a genuine newborn's umbilical cord. It is also incredibly affordable and efficient; enabling cost reduction when ordering teaching supplies.

Keywords:

Umbilical cord model, Practice skills, Nursing Students, Effectiveness of an *umbilical cord model*

INTRODUCTION

Newborn care represents a critical global health concern, with approximately 2.4 million newborn deaths occurring annually worldwide, 75% of which occur in the first week of life.[1] The World Health Organization emphasizes that proper newborn care, including umbilical cord care, could prevent up to 30% of these deaths.[2] In Thailand's context, the neonatal mortality rate of 5.0 deaths per 1,000 live births in 2021, with infections accounting for 15% of cases, highlights the urgent need for competent newborn care.[3]

The challenge of preparing competent nursing professionals for newborn care has become increasingly evident

in Thailand's healthcare system. The current nursing education system, which produces approximately 12,000 new nurses annually, faces significant challenges in providing adequate clinical exposure to newborn care procedures.[4] Traditional teaching methods have shown limitations, with 68% of Thai nursing students reporting feeling inadequately prepared for newborn care procedures during their first clinical placement.[5] This gap between theoretical knowledge and practical skills has direct implications for patient care quality and safety.

The School of Nursing principals aim to train nurses with expertise in nursing sciences. Nursing graduates need to be able to apply their knowledge and possess positive attitudes regarding leadership, morality, ethics, and the profession. Have the ability to make wise decisions by using sound judgment to analyze problems. The clinical practice is widely acknowledged as the core of nursing education and learning on a global scale. Nursing students can apply theory knowledge into practice through clinical experience. For the nursing student's practicum, specific knowledge about providing care for expectant mothers and newborns is necessary. Nursing students must practice gaining proficiency in the clinic. It is therefore necessary for nursing students to master all nursing skills in the nursing laboratory before starting their clinical practicum. To provide care for nursing mothers and newborns, nursing students participating in the maternal, newborn nursing and midwifery practicum are required to complete clinical practice in the delivery department. Therefore, in order to be competent for the safety of service recipients and to instill confidence in them, nursing students must practice operating in nursing laboratories prior to practicing in the clinic. [6]

Simulation-based education has emerged as a potential solution to address these challenges. This approach is supported by established theoretical frameworks, including Kolb's Experiential Learning Theory[7] and the NLN Jeffries Simulation Theory.[8] Studies in Thai nursing institutions have demonstrated that simulation-based learning can improve students' clinical competence, critical thinking abilities, and self-confidence by up to 45%. [9] The integration of realistic newborn and umbilical cord models offers standardized training experience and objective assessment opportunities.[5] Nursing students utilize mannequins in the nursing lab as a pivotal tool for developing clinical skills through simulation-based learning. Research indicates that these mannequins provide a realistic environment for practicing various procedures, enhancing both technical skills and critical thinking abilities. For instance, Kim et al. highlights that the use of high-fidelity mannequins allows students to engage in complex scenarios that mimic real-life patient interactions, thereby improving their decision-making skills under pressure.[10] Hill et al. further emphasized the importance of debriefing sessions following mannequin-based simulations, which facilitate reflective learning and reinforce the application of theoretical knowledge in practical settings.[11] Additionally, Zhou et al. noted that the integration of technology in mannequins, such as feedback systems, enhances the learning experience by providing immediate performance evaluations. [12] However, Perpiñá-Galvañ et al. cautioned that while mannequins are beneficial, they should complement, not replace, real patient interactions to ensure comprehensive skill development.[13]

To ensure that students acquire knowledge quickly and accurately and that their behavior aligns with the learning objectives, it is essential to set up teaching and learning activities in the laboratory with effective teaching resources. In nursing laboratories, a variety of media, including models, are used to teach and learn health sciences.[14] The models are a common educational tool used in nursing labs that lets students practice a range of skills related to the learning objectives. To guarantee that nursing skills and abilities are developed following academic principles, the instructor closely supervises the students. capable of carrying out accurate

assessments of nursing practice analyses. Along with applying the knowledge gained from the theory section [15] Furthermore, it will help students acquire the necessary skills because nursing students can practice skills from models on a regular basis until they become proficient; this builds confidence and reduces anxiety.[16]
The researcher created a newborn mannequin with an umbilical cord set to lower the expense of imported mannequins. Mobility reduces costs and increases access to educational resources. The newborn and umbilical cord model has operational functions: 1) The arms and legs of the newborn model move with a cry that controls starting and stopping by remote control. 2) Movement and cry patterns have two functions: automatic and manual. 3) Movement speed and cry volume can be adjusted by remote control. It is made from a hose that is inexpensive and simple to cut, it is like a real umbilical cord and is very low-cost and effective. The Nursing students can repeat the practices as needed, and most importantly, it will help them better practice. This will vastly decrease transportation costs and increase its' access.

OBJECTIVES

A quasi-experimental research was aimed at studying the effectiveness of a newborn and umbilical cord model to enhance practice skills among nursing students.

METHODS

Study design and participants

A quasi-experimental study was conducted using an intervention group at the faculty of nursing at Rajamangala University of Technology Thanyaburi Thailand who registered to study mother and child nursing and midwifery practicum during the 2023 academic year. The sample size of the study was 30 subjects randomly selected as undergraduate nursing students in the third year. Selected by simple randomization, using the table of random numbers and sampling frame (list of nursing students in a classroom).

Data collection instruments

The research team created the Newborn and umbilical cord model for teaching and learning and had devices and materials assembled as shown in Figure 1-3

Figure 1 Block diagram of movement controller of newborn model

Operational Function:

1. The arms and legs of the newborn model move with a cry that controls starting and stopping by remote control.
2. Movement and cry patterns have two functions: automatic and manual.
3. Movement speed and cry volume can be adjusted by remote control.

Figure 2 Demonstration of umbilical cord cutting

Figure 3 Demonstration for care umbilical cord

The procedure is as follows:

1. Start and stop the puppet's limb movements as well as the newborn's crying sound by using the remote control.
2. There are automatic and manual forms of crying and movement.
3. It has remote controls that can change the crying volume and movement speed.

The instruments used for data collection using the Umbilical cord cutting skill assessed a total of 12 items and satisfaction questionnaires a total of 11 items. The responses to the questions were rated on 5-point Likert scale (1-5 points) with the following ratings: lowest, low, moderate, high, and highest. The interpretation of the scores was divided into the following five levels of practice skill: lowest (1.00-1.50 points); low (1.51-2.50 points); moderate (2.51-3.50 points); high (3.51-4.50 points) and highest (4.51-5.00 points). The instrument was examined by five qualified experts who tested for validity and item-objective congruence (IOC), which yielded a score of .96 and .92.The reliability of the instrument by finding Cronbach's alpha coefficient (α–coefficient), which equaled .98 and .94

Intervention

This quasi-experimental research used a one-group pretest-posttest design to investigate the effectiveness of a Newborn and umbilical cord model to Enhance Practice skills among Nursing Students. Data was collected before and after intervention using "Umbilical cord cutting skill assessment" and "satisfaction questionnaires". Data was collected between October and December 2023 as follows: 1) The participants were given a two-hour demonstration by the research team of how to cut a newborn's umbilical cord in the nursing laboratory. Then the participants underwent a pretest in which they practiced cutting cords, and they then practiced cutting cords for six hours using a newborn and umbilical cord model. 2) The Newborn and umbilical cord model was used to test each participant's ability to cut their umbilical cord for ten minutes. 3) The participants filled out satisfaction questionnaires after training

Ethical considerations

This research project was considered and certified by the Institutional Review Board on Research Involving Human Subjects, Rajamangala University of Technology Thanyaburi, Project Code: RMUTT_REC No. Exp 72/65 on 17 October 2022.

Data Analysis

Data was analyzed using SPSS 22; Descriptive statistics, Paired t-test were used to analyze the data.

RESULTS

The results of using the Newborn and umbilical cord model for enhancing umbilical cord cutting skills among nursing students, revealed that the participant practice skills had higher mean posttest scores than pretest scores. It proved that there was a statistically significant difference between pre-posttest ($P < 0.05$) Table 1

Table 1 - Comparison of pretest and posttest mean scores for umbilical cord cutting skills

	n	$\bar{x}$	S.D.	t	p
Before Training	30	38.76	3.50	-30.53	.000
After Training	30	57.30	2.16		

The results of the analysis of satisfaction in the newborn and umbilical cord model revealed that the participants had the highest level of satisfaction overall with a mean of 4.52. When individual aspects were considered, satisfaction was also found to be at the highest level with a mean of 4.70. The aspect with the lowest level of satisfaction was "The quality of materials", as shown in Table 2

Table 2 – Nursing students satisfaction on the newborn and umbilical cord model

Assessment issues	$\bar{x}$	S.D.	Level
Design techniques and working systems	4.60	0.49	Highest
Appropriate model	4.53	0.57	Highest
Realism	4.66	0.47	Highest
The quality of materials	4.26	0.58	High
Easy to use	4.70	0.46	Highest
The materials used are appropriate.	4.40	0.81	High
Effective	4.56	0.62	Highest
Efficiency and investment worthiness	4.36	0.85	High
Safety	4.53	0.68	Highest
Able to work on the following objective	4.56	0.62	Highest
Benefit	4.53	0.50	Highest
Overall	4.52	0.60	Highest

DISCUSSION

The aim of this study was to explore the effectiveness of a newborn and umbilical cord model to enhance practice skills among nursing students. The research team created the newborn and umbilical cord model for teaching and learning. The newborn and umbilical cord model can move its limbs as well as the newborn's crying sound by using the remote control. The results of using the newborn and umbilical cord model for enhancing umbilical cord cutting skills among nursing students revealed that the participant practice skills had higher mean posttest scores than pretest scores. We found that the newborn and umbilical cord model is suitable for teaching in maternal, newborn nursing and midwifery subjects. It is beneficial to practice appropriate for practicing umbilical cord cutting skills in order for nursing students to gain valuable experience prior to practicing in the hospital environment for nursing students to prepare before practicing in the hospital.

To acquire practical skills, participants discussed developing competence. They emphasized the necessity of supervision, the significance of organizing learning scenarios, the value of being able to receive skilled training before practice in a clinical setting, and the acquisition of pertinent practical skills in a practical subject. In 2021, Tharinee Nontaput and Pattamamas Chotiban developed the Arm manikin for intravenous venipuncture[17] the results found that manikin training can develop practical skills and increase confidence. And Rattanapenporn S. et.al. found that in comparison to the original mannequins, the developed water-pressure control mannequin had a higher statistically significant average quality score. It is appropriate for use in maternal and newborn nursing and midwifery education. Before practicing in a hospital, nursing students should be ready by practicing their skills for uterine contraction assessment.[18] And nursing students can enhance their practical skills by repeatedly practicing with the developed models.[19,20,21] This is to increase the practical skills and confidence of nursing students before actually working in hospitals. As a result, mannequins are used to support and facilitate nursing students learning. It functions more successfully because of its tangibility. The cost-effectiveness of the created mannequin is therefore a benefit. It has also been demonstrated that the achievement, confidence, and memory retention of nursing students can all be enhanced using models to support practice and demonstration instruction.[16,18,22,23,24]

The importance of cutting the umbilical cord correctly and at the right time ensures the safety of the newborn

and the nursing student who are assisting with the delivery. If nursing students are not proficient in cutting the umbilical cord to aid in delivery, this could cause delays, raise the risk to both the mother and the newborn, and result in umbilical cord infections. Additionally, improper sterile techniques can be a pathway for bacteria that can cause newborn sepsis and death.[25,26,27,28] In addition, delayed cutting of the umbilical cord can result in hypothermia in the newborn. Optimal conditions for cutting the umbilical cord to prevent hypothermia and promote healthy newborn development involve timing, environmental factors, and techniques. Delayed cord clamping (DCC), typically recommended for at least 30-60 seconds post-delivery, allows for improved blood volume transfer to the newborn, which is crucial for thermoregulation and overall health.[29] Additionally, maintaining a warm environment during and after delivery is essential to prevent hypothermia. Research indicates that immediate skin-to-skin contact between the mother and newborn, along with appropriate warming measures, significantly enhances thermal stability.[30] Furthermore, the use of sterile techniques during cord cutting is vital to minimize infection risks, which can indirectly affect the newborn's health.[31] While the benefits of DCC are well-supported, some studies suggest that the specific timing may vary based on individual clinical circumstances, indicating a need for tailored approaches in practice.[32] In summary, a combination of delayed cord clamping, warm environments, and sterile techniques is optimal for promoting healthy newborn development and preventing hypothermia.

Along with the benefits of practicing on mannequins to improve practical skills prior to practicing in a hospital. Nursing students' confidence is also raised by consistent practice until mastery.[33] Research indicates that the use of mannequins in nursing education significantly enhances practice skills and boosts confidence among nursing students. A study by Koukourikos et al. highlights that simulation with mannequins allows students to engage in realistic clinical scenarios, which fosters both technical skills and critical thinking abilities in a controlled environment.[34,35] Hemann et al. further support this by demonstrating that students who practiced on mannequins reported higher confidence levels in their clinical competencies compared to those who did not have such practice opportunities.[35] Additionally, Widiasih et al. found that repeated exposure to mannequin-based simulations leads to improved performance in practical assessments, reinforcing the importance of hands-on experience in nursing education.[36] However, Datak and Sylvia cautioned that while mannequin training is beneficial, it should be complemented with real-life clinical experiences to ensure comprehensive skill development.[37] Overall, mannequin-based practice is a vital component of nursing education that effectively enhances both skills and confidence.

The design and realism of newborn and umbilical cord models significantly influence nursing students' satisfaction and learning outcomes in simulated clinical settings. Research indicates that high-fidelity models, which closely mimic real-life scenarios, enhance students' engagement and confidence in performing clinical skills. For instance, a study found that students reported higher satisfaction levels when using realistic models, as they felt better prepared for actual clinical situations.[38] Additionally, the incorporation of detailed umbilical cord models improved understanding of neonatal care, leading to better learning outcomes.[39] However, some studies suggest that while realism is beneficial, it may also introduce complexity that could overwhelm novice learners, potentially hindering their performance.[40] Therefore, a balance between realism and usability is crucial to maximize educational benefits. Overall, effective model design is essential for fostering a positive learning environment and enhancing the practical skills of nursing students.[41]

Therefore, it can be concluded that the newborn and umbilical cord model produced by the researcher it is a

good teaching tool and can be reused in nursing laboratory. Suitable for use as a teaching media in the study of maternal and newborn nursing and midwifery subject. It is useful in practicing newborn umbilical cord cutting skills for nursing students in preparation for their hospital experience. It also increases the confidence of nursing students.

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