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Effectiveness of a Modified Phantom-based Mannequin in Improving Vaginal Toucher Examination Skills of Midwifery Students

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ABSTRACT

Introduction: The goal of clinical practice is to provide students with practical training experience and the ability to work as a team.

Objective: This study aims to analyze the effectiveness of a phantom-based mannequin in improving midwifery students' performance in vaginal toucher (VT) examinations

Materials and Methods: This is a quasi-experimental study with a pre-test/post-test design. Participants were 70 final-year midwifery students in two groups of factory mannequin (n=35) and modified mannequin (n=35). The instrument used for assessing performance was a validated 10-item scale. Data analysis was done using paired t-test, Kolmogorov-Smirnov test, and ANCOVA.

Results: Participants had a mean age of 21.6±2.2 years in the modified mannequin group and 21.3±2.4 years in the factory mannequin group. There was no significant improvement in students' performance after using the factory mannequin, but the modified mannequin improved their skills, since there was a significant difference in VT examination performance before and after using the modified mannequin (mean difference=3.97, P=0.001). The ANCOVA results showed a significant difference in the mean post-test scores between the factory and modified mannequin groups (mean difference=1.59,η^2=0.299, P<0.05).

Conclusion: The modified mannequin is more effective than the common factory mannequins in improving the VT examination performance of midwifery students. For this reason, these devices are highly recommended for practical learning of VT examinations.

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Highlights

- Midwifery students have difficulties learning vaginal toucher examinations.
- Simple factory mannequin is used for practical learning of childbirth care.
- The modified phantom-based mannequin is more effective than the common factory mannequins in improving the ability for vaginal toucher examination.

Plain Language Summary

It is essential to improve the ability of midwifery students in carrying out vaginal examinations, as a part of the delivery care. In teaching clinical practices, midwifery students often complain about their lack of understanding of the details of the method; hence, it is necessary to have a simulation device that can provide conditions similar to the actual conditions during childbirth. This study compares the effectiveness of common manufactured mannequins with a modified technology-based mannequin. Modified mannequins showed more effectiveness and could increase the students' ability to carry out vaginal examinations.

Introduction

Learning midwifery practice is very important for nursing students to provide professional services. One of the targets for achieving competence in midwifery practice is the ability to provide standard delivery services [1, 2]. The ability in this field can increase competence in standard delivery care [3]. It has a causal relationship with the criteria for carrying out tasks based on a midwife's practice, attitudes, and knowledge of safe and standard delivery care [4]. In this regard, the students in midwifery should be competent by learning with different methods, including social media [5]. Midwifery students still have limitations in learning delivery care in laboratory settings. They often complain that they are referred to theoretical aspects more than direct clinical practice during the lecture [6]. As a result, they still have difficulty handling delivery care and have become incompetent in delivery care [7].

In midwifery practice, simple mannequins are used for teaching how to deliver a baby. This method may lead to the lack of understanding in students [8–10]. Practical learning should give students a learning experience in terms of applying theory and preparation for applying clinical practice [11, 12]. Midwifery graduates may have a lack of competency in normal childbirth care and carrying out internal examinations vaginal toucher examination [7, 13]. A study by Hilinti et al. showed that in several health institutions in Makassar, the childbirth care skills of students were at a low level (only 36.6%) and suggested that an effort is needed to improve student learning outcomes [14]. Mardiyana et al. [15] reported that many midwifery students are not competent in performing internal examinations during the first stage of labor. Hence, students cannot fully perform or master the skills of cervical examination during the first stage of labor. Kodiyah et al. [16] stated that many midwifery students still do not pass the childbirth course; only 23% could pass. The competencies can significantly influence the quality of midwifery services.

One of the efforts is to choose a practical learning method using simulation tools such as mannequins. The tool currently used in learning childbirth by mannequins is mostly a rigid mannequin which does not automatically describe the steps of childbirth. Therefore, it is necessary to create a labor mannequin that can provide a more transparent and precise delivery method, especially for cervical examination [7]. Learning childbirth using a modified technology-based mannequin is the best solution for learning more details so that midwifery students become more interested in learning standard childbirth care in the laboratory [15, 17]. The design of a modified mannequin for practical learning can provide a direct understanding of carrying out vaginal toucher (VT) examinations. In addition, using standard mannequins makes it impossible to see changes in the skin's structure during delivery. Therefore, this study aimed to design and determine the effectiveness of manufactured and modified mannequins for VT examination.

Materials and Methods

This quasi-experimental study with a pre-test/post-test design was conducted in January 2023. Participants were 70 midwifery students from the Health Polytechnic of the Ministry of Health, Jambi, Indonesia, divided into factory mannequin (n=35) and modified mannequin (n=35) groups. The inclusion criteria were the study in the fifth semester and willingness to participate in the study. Figure 1 shows the flowchart of the sampling process.

We measured the students' VT examination skills the day before the study using a validated 10-item scale. Each correct answer had 1 point, while incorrect answers had zero points. The scale was valid and reliable. It had a Cronbach's α of 0.845. On the first day, the modified mannequin group was given a detailed explanation of its use, followed by a practical demonstration of the VT examination for 60 minutes. This modified mannequin was designed using which is inputted with a program that has been conceptualized in advance according to the theory of labor opening so that the mannequin can be thinned and widened and become flexible and in such a way that be thin and flexible. The process was controlled with programmed input. The designed mannequin could open automatically, while standard mannequins are not digital and works semi-manually. Afterward, the participants were allowed to use the mannequin under the supervision of researchers and continue the same activities for the second and third days. The intervention group was divided into subgroups of 5. In the factory mannequin group, the manufactured products owned by the Health Polytechnic of Jambi were used after approval by the head of the study program under supervision of a laboratory assistant. The used factory mannequin was a standard tool used for vaginal examination in the Health Polytechnic of Jambi. The factory mannequin group was also divided into subgroups of 5 for time efficiency. The number of assessed skills was a basis for forming subgroups in two groups.

The participants were tested individually for three consecutive days in obstetric laboratory rooms I and II with the same room settings in front of researchers, laboratory assistants, and lecturers who were using a checklist. Each group was tested in different rooms; the modified mannequin group was in room I and the control group were in room II. The test included the examination of the vulva-vagina and perineal areas, vulva hygiene, examining the amniotic fluid, determining the direction of the fetal head, and examination of the condition of the pelvis. After the completion of the test, the experts were asked to rate their performance using a Likert scale as "very good," "good," "moderate," and "poor".

Kolmogorov-Smirnov test showed the normality of data distribution in both groups. Moreover, a homogeneity test was carried out to ensure that the data between the two groups were homogeneous. Since the data were homogeneous, a t-test was used to see the effectiveness of the manufactured and modified mannequins. For assessing the difference between the mean pre-test and post-test scores in the two groups, a paired t-test was used. ANCOVA was used to determine the difference in the mean post-test score between the factory and modified mannequin groups. $P<0.05$ was considered statistically significant.

Results

Participants were 70 students with a mean age of 21.6±2.2 years in the modified mannequin group and 21.3±2.4 years in the factory mannequin group. Most participants were living in dormitories (Table 1). Most students were studying in midwifery and had the support from their parents. The results of the VT examination skill assessment test before using the factory mannequin (pre-test) showed that 26 students (74.3%) had no skills, while 9 students (25.7%) were skilled. In the modified mannequin group, it was found that 30 students were unskilled (85.7%). After using the factory mannequin, the number of unskilled students decreased to 11(31.4%) and the number of skilled students increased to 24(68.6%). In the modified mannequins group, it was found that the number of unskilled students decreased to 6(17.1%), and the number of skilled students increased to 29(82.9%).

The resluts of Table 2 show no significant difference between the pre-test and post-test scores in the factory mannequin (mean difference=1.74); hence, it can be said that factory mannequin had no effect on students' VT examination skills. The difference was significant in the modified mannequins (mean difference=3.97, $P<0.05$), indicating the effect of using modified mannequin on students' skills. ANCOVA results showed (Table 3) a significant difference in the mean post-test scores between the factory and modified mannequin groups ($\eta^2=0.299$, $P<0.05$).

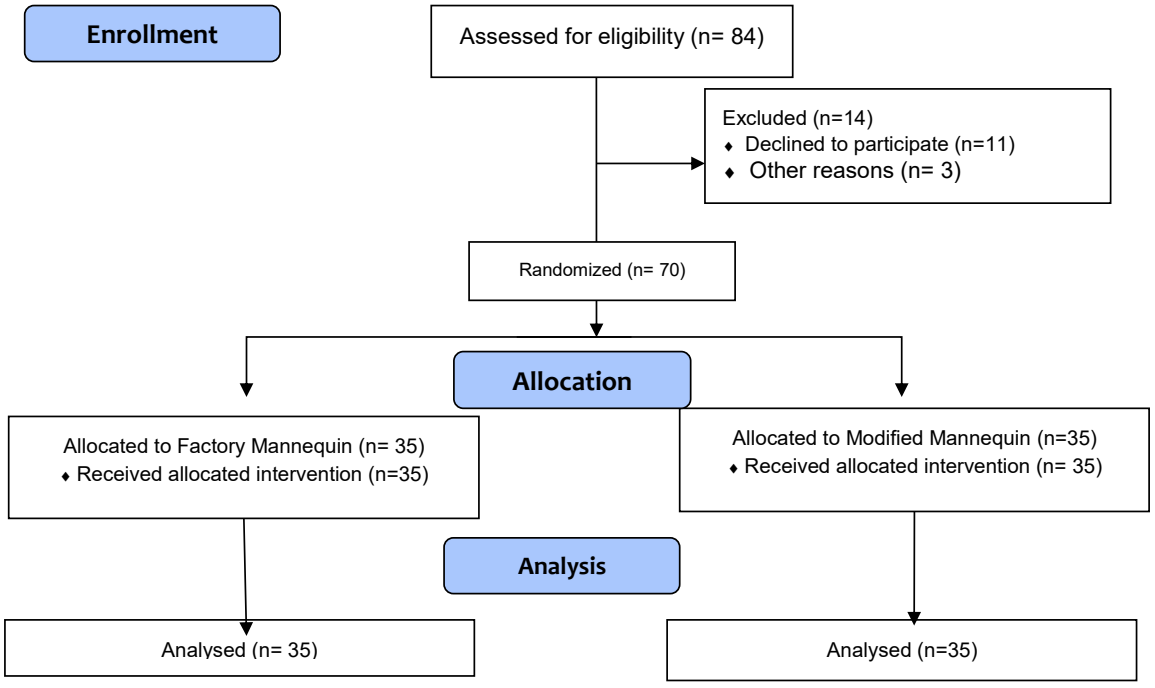

Figure 1. CONSORT flow diagram of the sampling and allocation process

Table 1. Demographic characteristics of the students

Variables		Mean±SD/No. (%)	
		Modified Mannequin	Factory Mannequin
Age (y)		21.6±2.2	21.3±2.4
Stayed in dormitory	Yes	25(71.4)	21(60)
	No	10(28.6)	14(40)
Department	Midwifery	28(80)	28(80)
	Nursing	7(20)	7(20)

Table 2. The difference between pre-test and post-test scores of vaginal examination skills in two groups

Group	Time	Mean±SD	Median (Q1-Q3)	Mean Difference	P*
Factory mannequin group (n=35)	Pre-test Post-test	74.57±0.814 76.31±0.631	74 (74-75) 76 (76-77)	1.74	0.068
Modified mannequin group (n=35)	Pre-test Post-test	74.14±0.943 78.11±1.875	74 (74-74.5) 77 (76-80)	3.97	0.0001

*Paired t-test

Table 3. The difference in the post-test scores of VT examination skills between the study groups

Group	Df	Mean±SD	Mean Difference	P*	η^2
Factory mannequin Modified mannequin	1	77.29±1.611 78.88±1.811	1.59	0.001	0.299

*ANCOVA

Discussion

The current study found that the students had no VT examination skills before using a factory mannequin because they could not measure the cervical opening. Based on the results of the post-test phase, there was an increase in the students' skills. This indicates that factory mannequins are quite effective in practical learning. This result is consistent with the results of Coates et al. [18], who showed that the midwives had increased skills, knowledge, and self-confidence in carrying out standard delivery practices. A study states that with self-confidence, students' ability to carry out actions becomes better in a good laboratory setting and with the availability of sufficient mannequins [19]. A VT examination should be systematically carried out to determine the opening of the cervix in labor [7]. Akram et al. [20] stated that the presence of a learning model could solve the midwives' difficulties in studying cervical dilation changes. In the current study, the students had been used to mannequins and were confident in using them; they have been using them for a long time as a routine practical activity in the Health Polytechnic of Jambi.

The students in our study were not able to assess the decline in the fetal head position in pregnant women. Achieving a VT examination skill is essential to monitor the progress of the labor. Therefore, an effort is needed by the students to repeat the procedure in the laboratory using mannequins. Training in clinical settings or direct training in the field may help students achieve the competencies expected. In this process, the lecturer is fully responsible for facilitating student interaction in their learning environment and creating an educational environment that allows students to acquire skills and competencies [21]. At baseline, students were unskilled in performing VT examinations due to a lack of understanding of the internal investigations and determining cervical opening. Differences in VT examination results are caused by varying finger sizes, in addition to lack of ability in measuring the size of the cervical opening based on centimeters [22].

The current study showed the improvement in VT examination skills after using a modified mannequin. The modified mannequin makes it easier for students to conduct a VT examination and measure the size of the cervical opening based on the centimeter. Utami et al. [23] measured the skills of students in the installation of a phantom-based IUD and showed this method could improve students' skills in performing cervical examinations. In addition, students can also visualize the results of the cervical investigation following the examination results. Measuring cervical dilation based on centimeters is one crucial aspect of VT examination during labor [24]. Learning by using modified mannequins can cause students to become more interested in learning the practice of regular childbirth care in the clinical setting [25–27]. Based on the results, the modified mannequin was more effective than the factory mannequin. Modified mannequins can provide precise inspection results set in the mannequin. They have technological advantages that can be controlled through smartphones to regulate cervical dilation.

The modified mannequin is easy to use and safe because it is made of programs that have been previously validated, making it an appropriate learning device. Similarly, research conducted by Sari et al. [28] measured the effect of courageous learning on the clinical practice ability of midwifery students during the Covid-19 pandemic and designed a learning device using colored rings to assess cervical dilatation and identify slow labor progress. This tool is an appropriate technology that is easy to understand and use. Modified mannequin may solve various problems for students in studying the changes in cervical dilation. It combines a cervical phantom with an electronic circuit useful for moving the actuator as a cervical controller. Students can study cervical dilation from 1 to 10 cm using this mannequin. Setting the cervical opening by this modified mannequin can be done wirelessly by Bluetooth enabled using an application installed on an Android smartphone. This modified phantom-based device provides many advantages, such as being simple, durable, economical, and practical [29].

The strength of this study is the design of a modified mannequin for childbirth simulation for the first time. The limitation of this study was the lack of consideration of the students' previous scores given by earlier supervisors as their inclusion criteria. Therefore, future studies can correct the criteria for students by considering several variables that may interfere with the research results. The designed modified mannequin use is highly recommended for learning childbirth care among midwifery students.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Health Research Ethics Committee of the Health Polytechnic of Jambi (Code: LB.02.06/2/251/2021).

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Authors' contributions

Planing and carrying out the simulations: Fitriani Fitriani and Lia Artika Sari; Sampling: Rosmaria and Neti Herawati; Data interpretation: Rosmaria and Fitriani Fitriani; Initial draft preparation: Rosmaria Rosmaria; Study design and final approval: All authors.

Conflict of interest

The authors declared no conflict of interest.

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