Research Article

Midwifery Students' Experiences in Learning Pelvic Anatomy and Childbirth Mechanisms: A Phenomenological Study

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Abstract
Objective: To explore students learning experiences toward pelvic anatomy and the mechanism of labor.
Methods: The research design is qualitative with a descriptive phenomenological approach, utilizing the framework of the *Standards for Reporting Qualitative Research: A Synthesis of Recommendations.* The study involved 10 participants, including 8 midwifery students and 2 lecturers in charge. Informant recruitment was conducted by using purposive sampling. Data analysis was conducted using Collaizi's framework, which involves familiarization, identifying relevant statements, formulating meanings, clustering themes, developing detailed descriptions, constructing the fundamental structure of statements, and final validation.
Results: The analysis identified two main themes: the components of the pelvic bones and the labor process. Informants reported that the learning process provided them with an understanding of labor, which facilitated their clinical practice.
Conclusion: Students faced several challenges during the learning process, particularly in comprehending pelvic anatomy and the mechanism of labor. They made significant efforts to seek additional learning resources and expressed a desire for a digital learning application featuring animations, images, and detailed explanations of pelvic anatomy and the labor mechanism.
Keywords: learning media, mechanism of labor, pelvic anatomy, student experience

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INTRODUCTION

Anatomy is a visual science considered essential in the field of health. The primary goal of studying anatomy is to enable students to identify body structures and understand their functions. However, students often struggle to grasp three-dimensional (3D) anatomy from graphic representations such as textbooks and PowerPoint presentations [1]. Anatomists are now facing a new generation of learners who will study and work in technology-rich environments[2]. Digital technology skills are fundamental to education, serving as a means to enhance students' ability to identify and apply contemporary scientific and technological knowledge relevant to their disciplines [3].

Pelvic anatomy is crucial for understanding reproductive and sexual health, particularly for general practitioners and specialists in fields such as midwifery, gynecology, and urology [4]. Collaboration between pelvic anatomy and multimedia can facilitate a shift from passive, teacher-centered, lecture-based learning to an interactive, student-centered, and exploratory approach. This transition emphasizes the experiential nature of anatomy learning and allows more students to engage in collaborative, active, and team-based learning environments [5].

The mechanism of labor is a critical aspect of obstetric practice. During labor, both the mother and the fetus are regularly evaluated to assess their well-being and monitor the progress of labor[6]. Normal labor is a complex process involving the

interplay of hormonal, biochemical, and mechanical factors. Labor consists of four stages: quiescence, activation, stimulation, and involution. These stages include the transition from myometrial contractility and cervical structural changes to progressive uterine contractions, cervical effacement and dilation, the delivery of the fetus and placenta, and the return to a non-pregnant state. Labor management is divided into three phases: cervical dilation up to 4 cm, fetal delivery, and placental delivery. Midwives with a strong understanding of the mechanisms and management of labor are essential for performing clinical interventions and reducing maternal and fetal morbidity and mortality [7].

Higher education in health sciences (Universities or Institute of health science) is a key institution capable of implementing technology-based learning methods in line with current transformations. Midwifery students gain competence through classroom learning, practical training at midwifery clinics, hospital internships, and laboratory skills practice, including the study of pelvic anatomy and the mechanisms of labor, where the human is the primary client. Mother-centered education and information are crucial for ensuring the safety of both mother and fetus. Students often face difficulties in understanding pelvic anatomy and the mechanisms of labor through graphic images, as it is challenging to comprehend these anatomical structures and processes. Multimedia-based learning is one method aimed at enhancing midwifery students' understanding of pelvic anatomy and the mechanisms of labor.

This study aims to explore the learning experiences of students toward pelvic anatomy and the mechanism of labor at Universitas Hang Tuah Pekanbaru and Helvetia Institute of Health Pekanbaru. This research is considered important and highly beneficial for both the participants, namely the students, and the health education institutions involved. Understanding the teaching of pelvic anatomy can help students become knowledgeable and safety-conscious practitioners. As health students are the future healthcare providers on the front line of delivering care to clients. They are expected to master foundational knowledge in all areas of their competencies, including the recognition and understanding of pelvic anatomy in every client. Therefore, students' comprehension and knowledge will facilitate the achievement of their competencies in pelvic anatomy and the mechanisms of labor.

METHODS

This study employs a qualitative research design. Qualitative research is concerned with participants' experiences of life events, aiming to understand what participants express and to explain why they express it[8]. The approach used in this study is descriptive phenomenology, which seeks to capture the essence of experiences and understand their fundamental structures[9]. A qualitative research approach is deemed more appropriate for gaining in-depth insights into pelvic anatomy and the mechanism of labor at Universitas Hang Tuah Pekanbaru and Helvetia Institute of Health Pekanbaru. Qualitative research is often challenging to evaluate due to incomplete reporting; therefore, the Standards for Reporting Qualitative Research: A Synthesis of Recommendations (SRQR) framework is employed to enhance the completeness of the reporting [10].

The method used in this qualitative research was conducted offline, allowing the researcher to deeply explore midwifery students' experiences in learning pelvic anatomy and the mechanism of labor at Universitas Hang Tuah Pekanbaru and Helvetia Institute of Health Pekanbaru. The interviews in this study were conducted in person, using offline interviews. The selection of informants was also carried out offline, employing purposive sampling techniques. The total number of informants is ten. The primary informants consist of eight students, while two lecturer have been included as supplementary informants due to the point of data saturation being reached.

In purposive sampling, the researcher deliberately selects individuals and research locations that can provide meaningful insights into the research problem and the phenomenon under study [11]. The researcher determines the informants and research sites, ensuring

that the decision aligns with the inclusion criteria relevant to the study. The informants for this study included students and lecturers in charge who consented to participate by signing informed consent forms. Ethical clearance for the study was obtained under the number 466/KEPK/UHTP/VIII/2024.

The primary tool or instrument for data collection in qualitative research is the researcher themselves, who can observe, ask questions, listen, inquire, and collect data for further analysis. As a human instrument, the researcher plays a critical role in qualitative studies. The researcher must ensure the validity of the data by selecting appropriate interview sources. Additionally, the conditions of the informants must meet the data needs of the study to ensure the accuracy and credibility of the data collected [12].

To enhance the quality assurance of this research, the researcher must deepen their understanding of qualitative methods and the experiences of midwifery students regarding pelvic anatomy and the mechanism of labor. This can be achieved by conducting a literature review, refining the research site, and revisiting the informants previously identified by the researcher to facilitate the research process. The researcher's connection with the informants in the field, as well as the collection of preliminary data, can be strengthened through more frequent field visits, organized as part of a preliminary study.

The instrument for this research includes an interview guide to assist the researcher in the data collection process. The key questions outlined in the in-depth interview guide aim to enhance quality assurance and have been verified by an expert, in this case, a lecturer specializing in pregnancy and childbirth.

The structure provided framework allows for data transparency [9]. The clarity and ease of implementation within this structured framework indicate that this study uses a method that offers credible insights. Its ease of use, transparency, reliability, and dependability further contribute to the credibility of the research. This is crucial as qualitative research has historically been criticized for being less thorough and objectivity [13]. The primary informants in this study are students from Universitas Hang Tuah Pekanbaru and Helvetia Institute of Health Pekanbaru. The characteristics of the informants are presented in the table 1.

Table 1. Characteristic of Informants

The interviews with students highlighted the importance of learning pelvic anatomy and the mechanism of labor. Pelvic anatomy is divided into two key aspects: the structure of the pelvic bones and the labor process. Informants expressed that learning the stages of labor facilitated their ability to apply this knowledge in practical fieldwork.

Pelvic Bone Structure

The interviews revealed insights into the structure of the pelvic bones and the labor process.

Pelvis

The students' responses indicated that the pelvis consists of the pelvic bones, femur, upper boundary, pelvic plane, the upper pelvic inlet, and the Hodge plane. Below are the students' statements regarding pelvic anatomy learning from informants A1, A2, A4, A5, A6, A7, and A8:

"The hard parts are formed by bones, and the soft parts are formed by muscles" (A1)
"The hard parts are formed by bones, and the soft parts are formed by ligaments" (A2)
"The hard parts are formed by bones" (A4)
"The soft parts are formed by muscles" (A5)
"The hard parts are formed by bones, and the soft parts are formed by muscles" (A6)
"The soft parts are formed by bones, and the soft parts are formed by ligaments" (A7)
"The soft parts are formed by ligaments" (A8)

Pelvic Bones

Interviews revealed the following subtheme: informants explained that the pelvic bones consist of the femur, sacrum, and coccyx. Below are the statements regarding the pelvic bones provided by informants A1, A2, A5, A7, B1, and B2.

"2 femurs, 1 sacrum, and 1 coccyx" (A1)
"2 femurs, 1 sacrum, and 1 coccyx" (A2)
"2 femurs (os coxae), 1 sacrum (os sacrum), and 1 coccyx (os coccygis)" (A5)
"2 femurs, 1 sacrum, and 1 coccyx" (A7)

"2 femurs (os coxae), 1 sacrum (os sacrum), and 1 coccyx (os coccygis)" (B1)
"2 femurs (os coxae), 1 sacrum (os sacrum), and 1 coccyx (os coccygis)" (B2)

Mechanism of Labor

This subtheme from the interviews highlighted the labor mechanism, with informants explaining that it involves occiput presentation, engagement, and internal rotation. Below are the statements provided by informants A1, A2, A5, A7, B1, and B2:

"*Engagement, descent, flexion, internal rotation, extension, external rotation, and expulsion" (A1). "Engagement, synclitism, descent, flexion, internal rotation, extension, external rotation, and expulsion" (A5). "Engagement, synclitism, descent, flexion, internal rotation, external rotation, and expulsion" (A7)*

DISCUSSION

The study of pelvic anatomy and the mechanism of labor is essential for students, as it facilitates their understanding of the labor process for practical fieldwork and can be accessed outside of classroom learning.

Learning Pelvic Anatomy and the Mechanism of Labor

Anatomically, the pelvis is a complex and functionally informative structure that directly influences human movement and midwifery. In midwifery, the pelvis plays a crucial role, as it is one of the most sexually dimorphic skeletal elements in the human body [14]. The pelvis serves two primary functions in humans: providing a relatively rigid support for muscles involved in movement and acting as the birth canal[15]. According to Desilva, the pelvis has three main functions. Movement; The pelvis transfers body weight to the lower limbs through the pelvic girdle. Childbirth: Neonates must pass through the birth canal, which is located within the pelvic girdle, during delivery. Support of Abdominal Organs: The pelvic floor muscles and the pelvis itself support the abdominal organs.

Pelvis

The basic structure of the human pelvis is inherited from our quadrupedal ancestors, but the development of bipedalism (approximately 6-7 million years ago) brought about changes in the shape of muscles and the pelvic girdle. Additionally, an increase in brain size in adults and newborns (about 2 million years ago) contributed to more recent studies on the pelvis. The terms "os coxae" and "pelvic bone" are derived from the word *innominata* (literally meaning "unnamed," as it did not originally have a specific meaning)[14].

Pelvic Bones

The human pelvis comprises the sacrum, coccyx, and two os coxae. Each os coxae is further divided into three parts: the ischium, ilium, and pubis. The ilium, positioned laterally, runs parallel to the spine, while the ischium extends dorsally. The three sacral bones fuse and are situated high above the pubic symphysis, allowing the baby's head to pass through the sacrum before entering the pelvic inlet during delivery [15]. The ischial spine serves as the point of reference for evaluating the descent of the fetus's presenting part [7].

The pelvis features a notably long pubic bone, and the ischium is also quite elongated. The superior pubic ramus has a sharply defined pectineal peak, and its superior surface is concave in the mediolateral direction [16]. The pelvic structure includes the sacrum, coccyx, and two os coxae, with each os coxae consisting of the ischium, ilium, and pubis [16].

The lower part of the pelvis is formed by the joint between the sacrum and coccyx (sacrococcygeal symphysis), the posterior connection between the sacrum and each ilium (sacroiliac joints), and the anterior junction at the pubic body (pubic symphysis). The sacroiliac joints allow for limited movement during childhood but transition into synarthrodial joints that permit little to no movement in adulthood [17].

The pubic symphysis is a synarthrodial joint characterized by a fibrocartilaginous interpubic disc [17]. This joint allows for minimal translational and rotational movement. The pelvic ring forms a closed chain; thus, movement at the pubic symphysis requires simultaneous

movement at the sacroiliac joints and vice versa [15].

Mechanism of Labor

On occasion, the process of labour is described as the cardinal movement, whereby the fetal head is displaced as it progresses through the birth canal. For the fetus to successfully pass through the birth canal, a degree of rotation is required, given the asymmetrical shape of the fetal head and the mother's pelvic bone [18].

The mechanism of labor requires the fetal head and shoulders to pass through the birth canal, which presents a size disproportion between the fetal head and the maternal pelvis, especially when compared to the fetal-maternal proportions of other primates[19]. The birth canal mechanism primarily involves the anterior-posterior (AP) dimensions at both the pelvic inlet and outlet. In the bipedal pelvis, the ilium is shorter, larger, and broader from front to back. The ilium part of the pronunciation with the sacrum is larger, thus providing better ability and support [20].

The upper boundary of the pelvis is called the iliac crest, where the anterior superior iliac spine deviates medially. The thick and robust iliac base measures approximately (left: 31.9mm, right: 27.1mm), with a prominent lateral iliac spine. The anterior inferior iliac spine is strong and sigmoid-shaped, while the acetabular roof is shelf-like, and the supra-acetabular groove is well-developed [21].

The diameters of the pelvic inlet and outlet, as well as the dimensions of the broad and narrow planes of the pelvis, are substantial. The pubic symphysis is quite large, measuring approximately 24.8 mm, and convex dorsally (similar to the pubic promontory)[16]. The superior pubic ramus is longer, positioning the pubis directly in front of the hip joint. The acetabulum is not closer to the sacroiliac joint in females, as the lower iliac height remains significant [22].

A full-term fetus can pass through the birth canal with ease, as the biparietal diameter is approximately 9.3–11 mm, and the suboccipitobregmatic diameter is about 9.4–12 mm. The pelvic diameter is reduced by 5 mm due to the soft tissue covering the inner pelvis. The narrowest diameter of the female birth canal is the bispinal diameter, which defines the obstetric plane and limits the descent of the fetus through the pelvis during labor[15]

Regardless of the phase or stage, the fundamental signs of labor are regular uterine contractions or cervical dilation. The uterine muscle's alterations due to contractions will be increased by physiological mechanisms as the time for delivery near. As the cervix dilates, the mother must push her own and maintain her respiration for a minimum of 10 seconds [23]. Prolonged pressure on the pelvic floor during the second stage of labor may cause injury to the nerve plexus and pelvic tissue. Outflow blockage and "detrusor neuropraxia" may result from this injury [24]. Assert that the cardinal motions in the presentation of the occiput include[18]

Engagement, the pivotal phase in labor development, which confirms that the pelvic dimensions are sufficient for the passage of the infant's head. The presenting section can be palpated on the abdomen (when only two-fifths of the head are palpable) or vaginally (when positioned at or below the ischial spine) to confirm engagement. When the fetus's maximal diameter reaches a location below the pelvic inlet plane, it descends. In cephalic presentation with the head suitably flexed, the biparietal diameter (9.5 cm) is the fetus head's largest transverse diameter.

Descent is the term used to describe the descent of the presenting part through the pelvic. Fetal descent is not a continuous and stable procedure. The deceleration phase of the first and second stages of labor is when the rate of decline is at its maximum. Flexion is the process by which the embryonic head descends passively as a result of the resistance of the soft tissue of the pelvic floor and the shape of the pelvic bones. Flexion of the fetal head to the thorax is a common occurrence in the majority of fetuses prior to delivery; however, complete flexibility typically occurs during labor. The fetus's diameter is at its smallest (suboccipito-bregmatic diameter) when the cranium is entirely flexed, enabling it to transit through the pelvis effectively.

Internal rotation is the process by which the presenting part is rotated from its initial position (which is typically transverse to the birth canal) to an anteroposterior position as it traverses the pelvis. This

alteration typically results in the fetus occiput rotating toward the symphysis pubis as it descends, causing the widest axis of the fetal head to align with the widest axis of the pelvic canal. Internal rotation is a passive movement that is the consequence of the pelvic floor muscles' resistance and the configuration of the pelvis.

Extension takes place after the fetus reaches the introitus level. This descent results in the base of the occiput coming into contact with the lower border of the pubic symphysis. The birth canal curves upward at this juncture. Extension delivers the fetal head, which subsequently rotates around the pubic symphysis. The pelvic floor muscles exert an upward force to expel the embryo, while the fetus experiences a downward force from uterine contractions. As the infant's head approaches the birth canal and delivery becomes imminent, the obstetrician's hands apply pressure to ensure the infant's head remains flexed and to aid in the childbirth process. The prevention of abrupt amniotic fluid release is correlated with a decrease in perineal lacerations and intracranial injuries. External rotation (restitution). Upon deflection (extension), the fetal head rotates into the appropriate anatomical position in relation to the fetal body. Rotation to the left or right is contingent upon the fetus's orientation. Restitution's passive movements are the consequence of the maternal pelvic bones and muscles' discharge of forces on the fetal cranium, which is facilitated by the basal tone of the fetal muscles. If the cord wraps around the neck, it should be wrapped around the head or, if it cannot be reduced, double clamped and cut crosswise. The use of suctioning to clear secretions from the fetal mouth, oropharynx and nostrils has not been shown to reduce the incidence of meconium aspiration syndrome.

Expulsion is the term used to describe the procedure is the process of expelling the fetal body. A health worker's hand is placed on each parietal eminence and the anterior shoulder of the fetus is delivered with subsequent contractions with downward traction towards the mother's sacrum, together with an attempt to expel the baby. The posterior shoulder is then delivered with upward traction. The baby should be held securely and dried with a sterile towel.

The Augmented Reality based learning application to recognize the anatomy of the human body is a solution for teachers and students to create an innovative and interactive learning medium. The first stage of creating an application is to design the application design that will be built based on the results of the analysis of the existing problems. The designed display must be user-friendly so that all people can easily use the application, especially users in the field of education. [25]

The majority of students felt confident in performing the pelvic examination. Mentoring by clinical tutors and the use of professional patients are important factors in planning pelvic examination training, and this knowledge can be used when teaching other intimate examinations during medical school. [26]

CONCLUSION

The study of pelvic anatomy and the mechanisms of labor is a critical component of the curriculum in midwifery care for labor. This material is essential for midwifery students to understand the processes involved in the mechanism of labor and the signs indicating fetal descent through the birth canal. Students can access this learning material not only during classroom instruction but also outside the classroom or in the field. Students who have a thorough understanding of this subject will find it easier to apply their knowledge in practical settings, thereby assisting in physiological deliveries and contributing to the reduction of maternal and infant mortality rates. The problems faced by students are the low literacy levels in higher education environments, which are closely linked to technology, the habit of consuming fast and unclear information, and the lack of motivation to learn deeply. The solution to this problem is an approach that combines technology with learning methods that encourage critical analysis, contextual understanding and active participation.

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CONFLICT of INTEREST

The authors declare that they have no conflict of interest

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Code	Year	University	Profession
A1	19	Hangtuah	Student
A2	20	Hangtuah	Student
A3	19	Hangtuah	Student
A4	20	Hangtuah	Student
A5	19	Helvetia	Student
A6	20	Helvetia	Student
A7	20	Helvetia	Student
A8	19	Helvetia	Student
B1	30	Hangtuah	Lecturer
B2	37	Helvetia	Lecturer