PROGRESSION Project Handbook

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FICHA TÉCNICA

TITLE

PROGRESSION - deeP undeRstanding Of positioninG foR midwivES (in obstetrics) uSing mOderN technologies AR/VR

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1. Background

Midwifery education across Europe shows considerable variation in structure, content and practical training methods (1). In some countries, midwifery is a postgraduate specialisation, while in others it has only recently become an academic degree (2). These differences result in heterogeneous skill levels and diverse approaches to teaching and simulation practices. In addition, the teaching of positioning manoeuvres - manual techniques performed by midwives on pregnant women to counteract birth complications (e.g., shoulder dystocia) - has not been given sufficient emphasis in most curricula. Current training methods mainly focus on the correct execution of manoeuvres, but they often fail to address the underlying invisible anatomical changes and biomechanical effects that occur during these movements.

This was exactly the starting point for this project. The conception originated from an exchange between experts in the fields of midwifery and medical simulation. Currently, traditional teaching tools, such as theoretical courses and practicing on low-tech manikins or fellow midwifery students, cannot make invisible anatomical structures - such as the pelvis and foetus - visible. However, with these techniques, it is not possible to simulate position manoeuvres as realistic as intended for. As a result, students frequently struggle to understand how movements affect internal structures. This gap must be addressed as a matter of urgency. Recent advances in immersive technologies such as **Virtual Reality (VR)** and **Augmented Reality (AR)** offer new opportunities to visualise and interact with these invisible elements in a safe, repeatable and cost-efficient way (3). Evidence from medical and technical education shows that VR and AR can improve learners' comprehension, motor memory, spatial understanding, and confidence by enabling interactive, multi-sensory, and repetitive training without patient involvement (3).

2. Project Aims

The **PROGRESSION** project (deeP undeRstanding Of positioninG foR midwivES using mOderN technologies VR/AR) responds to these challenges. It builds on an international consortium of experts in midwifery education, simulation science, computer science, and social science from three different countries (Germany, Portugal, and the Czech Republic) and five institutions (Ludwig-Maximilians-Universität München, Escola Superior de Enfermagem da Universidade do Porto, Katholische Stiftungshochschule München, Masaryk University, and Faculdade de Medicina da Universidade do Porto). This project is co-funded by the European Union. By integrating interdisciplinary expertise and cross-national perspectives, the project aims to harmonise the teaching of positioning manoeuvres and promote shared standards of midwifery education across Europe. Beyond developing a course, PROGRESSION seeks to strengthen international cooperation, foster innovation in healthcare education, and ultimately contribute to improved patient safety during childbirth.

The main objective of the PROGRESSION project is to design, implement, and evaluate an **innovative**, **technology-enhanced learning concept** for midwifery students focusing on positioning manoeuvres before and during birth. The course combines **virtual and augmented reality simulations** to visualise invisible anatomical structures and support students in developing both cognitive understanding and motor skills.

Specifically, the project aims to:

1. **Enhance learning and understanding**: Enable midwifery students to gain a deep comprehension of the ana-

tomy and mechanics involved in positioning manoeuvres by visualising internal structures and their responses to movement.

2. **Integrate advanced simulation technologies:** Develop a two-stage learning approach that combines VR-based comprehension training and AR-based hands-on practice with manikins to bridge theoretical and practical learning.

3. **Develop a reproducible teaching framework:** Produce an evidence-based and user-friendly course concept, including didactic materials, evaluation tools, and a technical guide to facilitate adoption in other institutions.

4. **Promote international harmonisation and collaboration:** Strengthen cooperation between European higher education institutions and foster standardisation and quality assurance in midwifery training.

5. **Contribute to patient safety and healthcare quality:** Improve the competence, confidence, and situational awareness of future midwives, leading to better outcomes for mothers and newborns.

By the end of the project, the full set of materials - including the VR/AR application, as well as this **open-access handbook inkl. evaluation guidelines** - will be made freely available online. This will ensure that universities, simulation centers, and healthcare educators across Europe can easily reproduce and adapt the PROGRESSION learning concept within their own curricula, promoting sustainable innovation and equity in medical education. This handbook can be used as a guide for how the content can be properly integrated into the curriculum (chapter 3) and how to use the course as intended (chapter 4). It also explains the use of the developed application in more detail and counteracts possible technical hurdles to implementation (chapter 5). Finally, it also helps to show how the results can be used and evaluated after successful integration into the curriculum, thus making the impact of the project as sustainable as possible (chapter 6). As a quick guide, it also includes a short Q&A section addressing potential issues and unresolved questions (chapter 7).

3. Rational for the use of VR/AR in midwifery education

Integrating VR and AR into midwifery education requires a pedagogical framework grounded in experiential, constructivist, and simulation-based learning principles. These technologies should be embedded within curricula, not as isolated tools, but as structured learning experiences that complement theoretical, clinical, and reflective components of midwifery training.

New teaching-learning strategies are essential to keep curricula relevant, prepare students and professionals for contemporary challenges, and encourage critical thinking. With rapid technological advancements, VR and AR have emerged as transformative tools in education. These immersive technologies offer novel ways to engage students, enhance spatial understanding and promote experiential learning.

Immersive VR learning environments in midwifery education have been associated with improved learner's confidence, engagement and perceived preparedness. Studies focusing specifically on midwifery students report high levels of satisfaction and self-confidence following VR-based learning experiences, even when objective knowledge gains are modest or variable. These findings suggest that immersive simulation contributes not only to cognitive outcomes but also to affective and motivational dimensions of learning, which are particularly relevant in preparing students for emotionally and clinically demanding situations such as childbirth and obstetric emergencies.

The integration of VR and AR into midwifery curricula offers innovative means of teaching maternal positioning and its physiological impact on foetal descent during labour, by enabling students to visualise how different maternal positions influence foetal alignment, rotation, and engagement within the pelvis, thereby reinforcing clinical decision-making and biomechanical understanding through immersive, scenario-based simulations embedded within midwifery curricula (4,5,6). VR appears particularly beneficial for domains that require spatial understanding and three-dimension

conceptualisation. For example, immersive VR applications in midwifery anatomy education have shown improvements in both immediate and retained knowledge, especially in relation to complex anatomical structures. Such applications bridge theory-practice gaps and support kinaesthetic and spatial learning, especially when aligned with competency-based frameworks and simulation pedagogy (6,7). A pedagogical approach grounded in experiential and constructivist learning theories supports the integration of VR and AR into midwifery education, as these immersive tools enable active, situated, and reflective learning experiences that enhance clinical reasoning, psychomotor competence, and empathetic understanding of childbirth dynamics (8,9).

4. PROGRESSION learning concept

4.1 General design of the learning concept

Course Overview

The Extended Reality (XR)-based training programme is designed to enhance the theoretical knowledge and practical competencies of midwifery students through a technology-supported learning approach. The overall course comprises 16 learning hours and integrates self-directed online learning with XR–based simulation. The pedagogical framework follows principles of adult learning, constructivist learning theory, and experiential learning, aiming to foster deep understanding, clinical reasoning, and professional decision-making in obstetric care.

The course is divided into sequential learning phases that progressively build foundational knowledge and apply it in immersive, practice-oriented scenarios. The first part is dedicated to a self-directed learning unit, which prepares students for the subsequent XR-based training by establishing essential theoretical foundations (Table 1).

Table 1 - Learning Concept

Learning concept	Didactic Approach	Aims	What the student does
1. Self-Directed Learning Unit	Asynchronous self-learning module	- Repeat the understanding of female pelvic anatomy relevant to childbirth. - Understand the physiological process of labour and birth, including its stages and key biomechanical principles. - Analyse and compare maternal positioning theories and their implications for labour progression and maternal-foetal outcomes.	The learning materials are provided in the form of PowerPoint presentations, videos, and curated literature links. Each chapter concludes with a quiz that must be successfully completed to unlock the subsequent chapter.

2. VR-Based Conceptual Training	Technical Introduction and Skill Familiarization	- Understand the components of the virtual reality system, their functions, and the safety guidelines for use. - Learn to use virtual reality equipment correctly in a simulated context, including navigation, interaction and visualisation tools. - Distinguish between technical issues and clinical-anatomical content, adjusting your use of the system as necessary to optimise performance. - Ensure the safe and effective use of the equipment by identifying any errors or limitations in its operation. - Adapt strategies for using the system to improve efficiency and reduce cognitive load during learning.	- Familiarises with the virtual reality equipment and safety guidelines - Navigates the virtual environment in a guided manner - Explores interaction mechanisms (selection, manipulation, and control) - Uses the available visualisation tools - Engages in guided practice to develop technical autonomy - Consolidates basic system operation skills
	Scenario-Based Learning Design	-- To analyse changes in pelvic dimensions, foetal alignment, and maternal-foetal spatial relationships in different labour scenarios. - Apply biomechanical principles to select and adjust appropriate maternal positions in a simulated setting. - To assess the appropriateness of the positions adopted by the mother, justifying the decision based on the observed effects on labour dynamics.	- Reviews patient information and analyses the clinical scenario - Observes the initial position of the labouring woman and the foetus within the pelvis - Selects the most appropriate maternal position for the given situation - Actively modifies maternal posture (e.g., pelvic tilt, leg positioning, trunk orientation) - Observes and interprets the immediate effects of positional changes within the virtual environment

3. AR-Based Practical Application Training	Experiential AR-based learning for practical and interpersonal skills	- Translate virtual anatomical and biomechanical models into real-world practice. - Provide accurate verbal guidance for maternal positioning based on clinical objectives. - Visually verify and adjust positioning measures using AR overlays	- Interacts with a peer in a simulated setting, assuming a clinical practice scenario - Provides verbal instructions for maternal positioning Adjusts positioning based on defined clinical objectives - Uses AR visualisation to validate and correct interventions - Integrates communication, observation, and hands-on action in real time - Identifies and corrects errors based on immediate visual feedback.

Self-Directed Learning Unit (Part 1)

The initial learning phase is implemented as an asynchronous self-learning module delivered via any system of choice. This unit enables students to acquire core theoretical knowledge at their own pace and serves as a prerequisite for participation in the XR application later. The donated material is in the form of PowerPoint-Presentations, videos, and literature links. Every chapter ends with a quiz that needs to be solved, to unlock the next chapter

VR-Based Conceptual Training (Part 2)

The second phase of the course consists of a VR-–based conceptual training unit, which builds directly upon the theoretical foundations established during the self-directed learning phase. This unit is designed to deepen students' spatial understanding and biomechanical reasoning related to maternal positioning and pelvic dynamics during childbirth. The application is available online in the app store and can be downloaded for free. VR glasses are required for its implementation.

Didactic Approaches and Learning Activities

Technical Introduction and Skill Familiarisation

Before engaging with the VR learning scenarios, students participate in a structured technical onboarding session. This session is designed to ensure the safe, effective, and autonomous use of virtual reality equipment. The session covers the key operational aspects of the system, such as navigating the virtual environment, interacting with it, and using visualisation tools. Students are guided through hands-on practice activities to help them develop the confidence and technical proficiency needed to handle the equipment. By developing these technical skills in advance, the training reduces the cognitive load associated with operating the system. This enables learners to focus their full attention on the intended clinical and anatomical learning objectives during subsequent VR-based activities.

Scenario-Based Learning Design

The VR module comprises multiple scenarios, each representing different labour situations and maternal positions. Within these scenarios, students can read a patient's information, see the starting position of the labouring woman and the foetus in the pelvis. Afterwards, they are asked to decide what is the best position for the current case. Then they need to actively modify maternal posture, such as pelvic tilt, leg positioning, or trunk orientation, and immediately observe the resulting changes in:

Pelvic inlet and outlet dimensions

Alignment of the foetal head within the pelvic planes

Spatial relationships between bony structures and the foetus

The immersive nature of VR enables students to move beyond static representations and engage in experiential, exploratory learning, fostering conceptual understanding that is difficult to achieve through traditional two-dimensional teaching methods (Fig. 1).

Figure 1 - VR-based training

AR-Based Practical Application Training (Part 3)

The third phase of the course focuses on augmented reality (AR)–supported skills transfer, enabling students to apply previously acquired theoretical and conceptual knowledge in a practical, interpersonal learning setting. The application and scenarios used are the same as in the VR-phase described above. VR/AR glasses are required for its implementation.

Didactic Approaches and Learning Activities

Experiential AR-based learning for practical and interpersonal skills

In this phase, the digital anatomical model used in the VR training is projected via an AR application onto a fellow stu-

dent, who assumes the role of a laboring woman. The AR system overlays a visual of the pelvis and foetus onto the real body (Fig 2).

Students practice verbal instruction for correct positioning (e.g., pelvic rotation, exact positioning of the legs, or weight distribution), while simultaneously visually validating the accuracy of their guidance through the AR visualisation. This multimodal approach combines verbal communication, visual feedback, and kinaesthetic experience, closely reflecting real clinical interactions.

The AR-based training serves as a critical bridge between simulation and clinical practice. It supports the development of communication skills, professional confidence, and embodied understanding of maternal positioning. By allowing immediate visual feedback, the AR application enhances error recognition and corrective learning in a safe, peer-based environment.

Figure 2 - AR-based training

Together, the VR and AR components form a coherent learning progression that aligns cognitive, spatial, and practical competencies. The VR training emphasises conceptual understanding and experimentation, while the AR application facilitates practical implementation and interpersonal skill development. This integrated XR learning design supports sustainable knowledge transfer and prepares midwifery students for evidence-based, woman-centered clinical practice.

4.2 What midwifery content can be taught with this application

The application is specifically tailored to midwifery education and focuses on clinically relevant positioning manoeuvres before and during birth.

The content is structured around realistic clinical scenarios that reflect common challenges in intrapartum care, like:

- Anatomic understanding
- Clinical reasoning
- Stepwise education
- Reflection and discussion

Educators can choose which scenarios to include in teaching and integrate the application into their training at any time. To make the content more accurate, new cases can be designed or existing ones modified - depending on the context, country-specific requirements, etc.

5. Technical use of VR/AR and the PROGRESSION application

5.1 General concept

The PROGRESSION application is designed for use with the Meta Quest VR device. The application is installed directly on the Meta Quest device. Institutions should ensure that the correct and most recent app version is used to guarantee compatibility and access to all features. Regular updates may be provided to improve functionality, fix bugs, or add new scenarios. Updates should be installed prior to teaching sessions. Detailed instructions on how to update the software can be found below.

The settings “room-scale / stationary mode” and “controllers / hands” are part of the Meta Quest system settings and are not controlled directly within the application.

Please note that specific details may change because of updates released by Meta.

Room scale/stationary mode

The application supports both room-scale and stationary modes. Room-scale tracking is recommended for immersive VR learning, while stationary mode may be preferable in smaller spaces or during guided instruction.

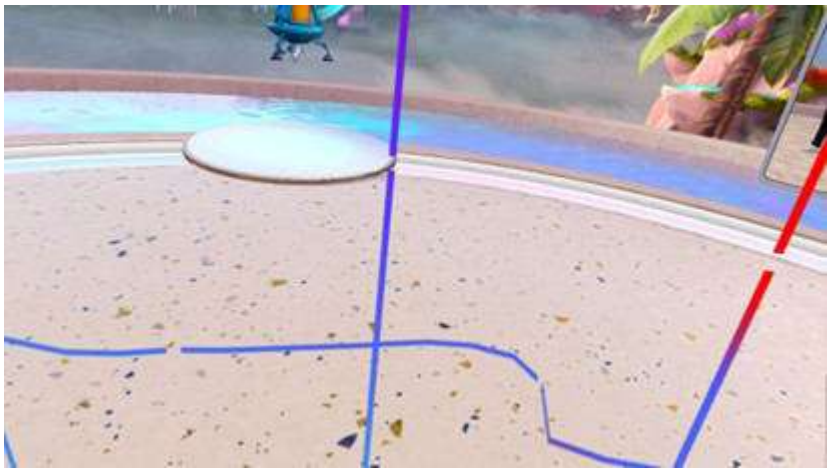

Figure 3 - Boundary system

When using room-scale mode, a boundary system is active (See Fig.3). If the user moves too close to the defined boundary, a visual warning is displayed.

To change between room-scale and stationary mode, follow the instructions provided by Meta:

1. Start the application (see Fig.4)
2. Return to the Meta Quest home screen by pressing the Meta button once on the right controller or using the corresponding hand gesture
3. Open settings
4. Navigate to the boundary or room setup options (Fig.5)
5. Change the boundary mode as required and follow the on-screen instructions

Further details can be found in the official Meta Quest support documentation.

Figure 4 - Start application

Figure 5 Navigate to the boundary or room setup options

Controllers/Hands

The application can be used with either hand tracking or controllers (Fig. 6). For general information on how to use the Meta Quest, please refer to the official Quest User Guide, which can also be found in the “Help and Tips” App.

Figure 6 - Controllers

When using controllers, interactions such as grabbing or poking objects are performed with the controller buttons. Visual feedback is provided by a white sphere indicating the interaction point. When using hand tracking, objects can be grabbed or poked directly with the hands.

Users can switch between controllers and hand tracking at any time. To do so, simply put down the controllers and look at your hands to activate hand tracking, or pick up the controllers and press any button to switch back.

Additional settings for hand tracking and controllers can be adjusted in the Meta Quest system settings → Movement tracking (Fig.7).

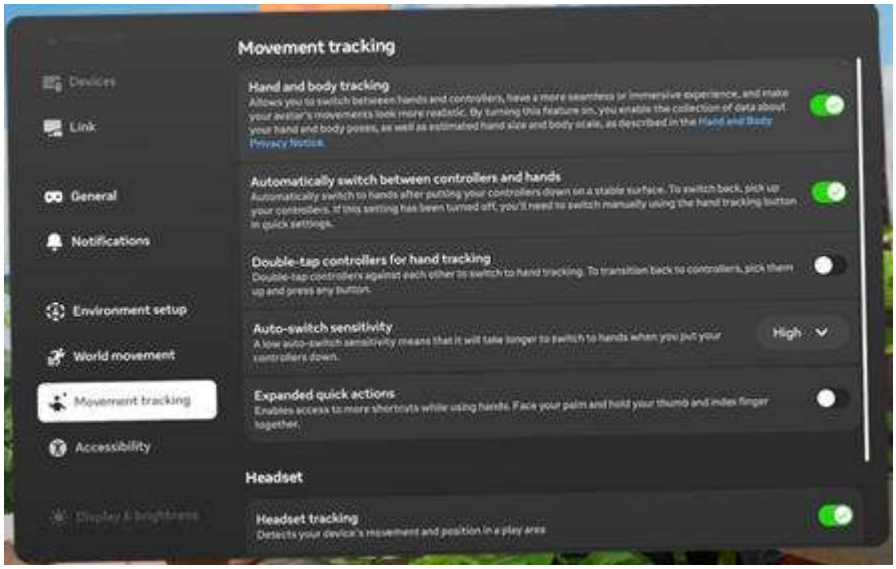

Figure 7 - Movement tracking

Check App Version

Start the app and look at the "Patient information" (Fig. 8). Before you select a case, it will display the app version.

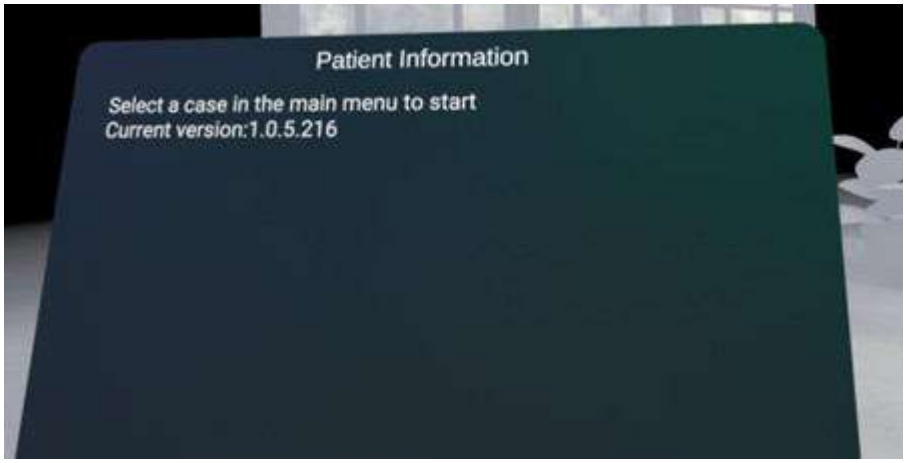

Figure 8 - "Patient information"

Update App

Go to all apps on the bottom right and then click on the three dots for more options you see when hovering over the app logo (Fig. 9).

Figure 9 - Update App

Click on “See details” (Fig. 10).

Figure 10 - “See details”

If an update is available you should see an “Update” button (Fig. 11).

Figure 11 - “Update”

After you click on “Update” it should proceed (Fig. 12).

Figure 12 - “Instaling”

5.2 Operating the software

TThe following section explains the basic points for understanding the operating method and the correct operation of te software.

Main Menu

The main menu can be freely positioned and resized within the virtual environment (Fig. 13).

Users can navigate through menu pages using buttons on the bottom or swipe gestures.

All interactive elements provide visual and audio feedback, such as a change in color, to indicate selection or interaction.

On the first page, users can select different scenarios, as well as choose between Tutorial mode and AR mode. By poking the lower buttons or swiping, the case menu, settings and the change ring color menu can be reached.

Figure 13 - Main menu

Case Menu

The case menu provides access to all functions related to the currently selected case (Fig. 14). Users can select different positions using the position selection feature. Below, there are buttons available to interact with the current case and control its progression. The fast-forward function moves the foetus forward to the next position. The play again function moves the foetus back to the starting position and restarts the animation. The reset woman function returns the limbs to the starting position of the current phase, similar to the effect of the position selection button. The reset case function restarts the case from the beginning. The force complete function completes the current step automatically, for example, by selecting the required position or moving the limbs.

Figure 14 - Case menu

Settings

The settings menu allows users to customise the application environment and functionality (Fig. 15). Users can choose the virtual room in which they want to be located when using VR mode. There are 2 different rooms available, as well as the option “No Room”. It is possible to switch between VR mode (video-based) and AR mode (see-through). Switching to AR-mode will reset any selected room to “No Room”, a room can be selected again. The Pin Popup option keeps pop-up windows fixed in their current position. The Scenario Editor allows users to create custom scenarios, as described in the section below. Debug spheres can be activated if required for troubleshooting purposes. It is not recommended to activate the debug spheres during training because it could distract the students. The Delete Custom option restores the application to its default settings. Custom colour settings, custom scenarios, etc. will be deleted. To do that, both buttons must be pressed at the same time.

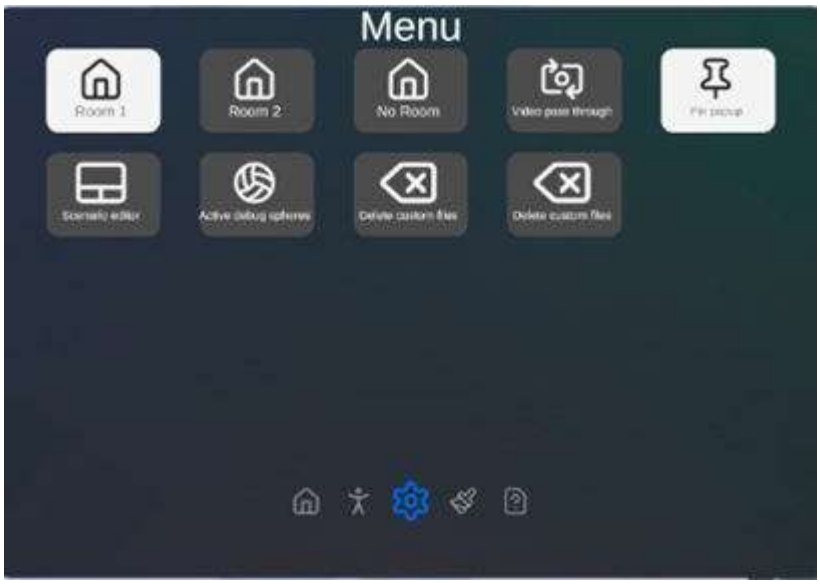

Figure 15 - Settings menu

Change ring colors menu

The Change ring colours menu allows users to customise the colours of the visual indicators according to their needs and preferences (Fig. 16). The colours for the inlet and outlet can be adjusted individually. The colour reset option restores all indicator colours to their default settings. Between the different pelvis states, the indicator colour is linearly interpolated. The profile settings file can be copied to other devices in order to apply the same settings for room selection, video see-through mode, pop-up behaviour, and colour configuration. Further details on handling these files can be found in section 5.3.2.

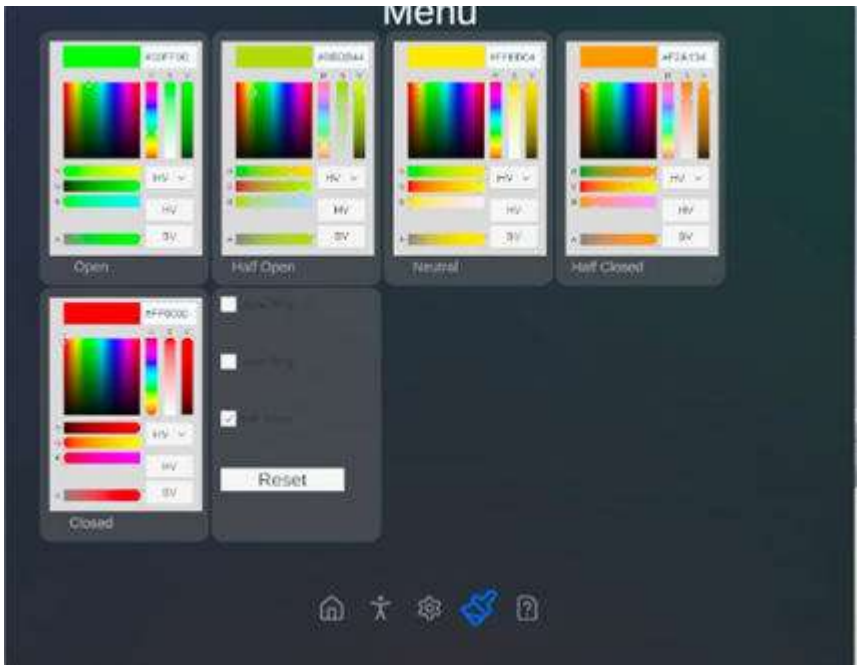

Figure 16 - Ring colors menu

Scenario editor

The Scenario editor can be accessed via the dedicated button. When activated, a new window opens displaying the scenario editor interface. Further details can be found in Section 5.3.2.

5.3 General concept of scenarios

5.3.1 Applicable scenarios

All scenarios contained in the PROGRESSION app are outlined below. They are also provided in more detail in the appendix in the form of a table for each scenario to ensure better and smoother implementation.

Self-training 1: Nutation

Learning Objective

Students will learn to recognise and manage a case of arrest of labour by utilising maternal positions that promote nutation, increasing the pelvic outlet diameter to facilitate foetal descent.

Case briefing (given to student at the beginning of the scenario)

I - Identification:

You have been handed over the care of Jesica Peterson, a 30-year-old patient at 40 weeks of gestation in labour.

S - Situation:

Jesica is a G2P0, fully dilated, and in the passive second stage of labour. She has been in labour for 11 hours, but progress has stagnated for the past hour despite regular contractions. The foetal position is occiput anterior at station +1. **The patient does not want to be in bed anymore and would like some upright position.**

B - Background:

She had a spontaneous rupture of membranes 6 hours ago with clear amniotic fluid. There are no complications in her medical or obstetric history. She has been progressing well until now, but has not yet started pushing.

A - Assessment:

Contractions remain regular every 2-3 minutes, lasting 60 seconds. Foetal heart rate is reassuring at 140 bpm baseline with normal variability and no decelerations. Despite full cervical dilation and a favourable foetal position, there is no further descent of the foetal head.

R - Request:

We need to facilitate foetal descent by employing maternal positioning techniques. Please take a look at this patient and consider maternal positioning techniques that respect her wishes.

Correct solution

Taking into account her wishes, the only correct solution is squatting.

Self training 2: Counternutation

Learning Objective

Students will learn to recognise and manage a case of arrest of labour by utilising maternal positions that promote counternutation, increasing the pelvic inlet diameter to facilitate foetal descent.

Case briefing (given to student at the beginning of the scenario)

I - Identification:

You have been handed over the care of Sarah Johnson, a 28-year-old patient at 39 weeks of gestation in active labour.

S - Situation:

Sarah is a G2P1, fully dilated, and has been in labour for 10 hours. However, labour has stagnated for the past hour despite regular contractions. Her foetal position is occiput transverse at station -2. **She does not want to be in bed, but standing is also not comfortable for her. She cannot extend her left leg due to a recent injury.**

B - Background:

She had a spontaneous rupture of membranes 4 hours ago with clear amniotic fluid. There are no complications in her medical or obstetric history. She had been progressing well until this point.

A - Assessment:

Contractions remain regular every 2-3 minutes, lasting 60 seconds. Foetal heart rate is reassuring at 140 bpm baseline with normal variability and no decelerations. Despite full cervical dilation, there is no further descent of the foetal head.

R - Request:

We need to facilitate foetal descent and rotation by employing maternal positioning techniques. Please take a look at this patient and consider maternal positioning techniques that respect her wishes.

Correct solution

Taking into account her wishes and limitations with the left leg, the only correct solution is Asymmetrical kneeling with the right kneeling leg extended at the hip.

Scenario 1: Lack of engagement

Learning Objective

Students will learn to recognise and manage a case of lack of foetal engagement in early labour by using maternal positioning strategies that optimise pelvic inlet diameters and promote foetal descent.

Case briefing (given to student at the beginning of the scenario)

I - Identification:

You have been handed over the care of Anna, a primiparous woman at 39 weeks and 5 days of gestation, admitted in spontaneous labour.

S - Situation:

Anna demonstrates effective coping with contractions and, according to her birth plan, wishes to have a normal vaginal birth. She reports lower back pressure and expresses a desire to move to relieve discomfort.

B - Background:

This is her second pregnancy, with one previous spontaneous vaginal birth. There are no reported obstetric complications. Labour has progressed spontaneously to this point.

A - Assessment:

Maternal vital signs are stable. Fundal height measures 33 cm. Uterine contractions are regular, with an intensity of 25-40 mmHg, lasting 40-50 seconds, and occurring every 8 minutes. Vaginal examination reveals 3 cm cervical dilatation with intact membranes. The foetal heart rate ranges between 130 and 140 bpm, auscultated on the left flank, with normal variability and no decelerations.

R - Request:

Please assess Sara's current clinical status and consider appropriate maternal positioning strategies that may promote comfort, facilitate foetal engagement, and support labour progression while respecting her wish to remain active.

Correct position

Taking into account Anna's clinical presentation, the correct management involves selecting one of the three appropriate maternal positioning strategies aimed at increasing the pelvic inlet diameter and promoting foetal flexion and rotation:

- **Abdominal Lift and Tuck** (performed for 10 consecutive contractions).
- **Sitting on a firm birth ball** with hip circles or figure-of-eight movements.
- **All-fours position** with external rotation of the toes.

Scenario 2: Arrested labour

Learning Objective

Students will learn to recognise and manage a case of arrested labour by using maternal positioning strategies that optimise pelvic inlet diameters and promote foetal rotation and descent.

Case Briefing (given to student at the beginning of the scenario)

I - Identification:

You have been handed over the care of a primiparous woman, Claudia, at 40 weeks and 2 days of gestation, admitted in spontaneous labour.

S - Situation:

The woman demonstrates effective coping with contractions and, according to her birth plan, wishes to have a normal vaginal birth. She reports lower back pain and expresses a desire to move to relieve discomfort.

B - Background:

This is her first pregnancy, with one previous spontaneous vaginal birth. There are no reported obstetric complications. Labour has progressed spontaneously to this point.

A - Assessment:

Maternal vital signs are stable. Fundal height measures 33 cm. Uterine contractions occur regularly every 3 minutes. Vaginal examination reveals 8 cm cervical dilatation with intact membranes. The foetal heart rate ranges between 130 and 140 bpm, auscultated on the right flank, with normal variability and no decelerations.

R - Request:

Please assess the woman's current clinical status and consider appropriate maternal positioning strategies that may promote comfort, facilitate foetal rotation and descent, and support labour progression while respecting her wish to remain active.

Correct position

Taking into account the woman's clinical presentation, the correct management involves selecting one of the three appropriate maternal positioning strategies aimed at increasing the pelvic inlet diameter and promoting foetal rotation and descent:

- **lying on the right side - on all 4s**
- **SIMS-Position on the right side - left side - on all 4s**
- **left side - SIMS-position on the left side – on all 4s**
- **SIMS-position on the right side – left side – SIMS-position on the left – on all 4s**

Scenario 3: Fetal Malposition

Learning Objective

Students will learn to recognise and manage a case of arrest of labour due to asynclitism by utilising maternal positions. Positing will correct the malposition of the foetal head in the uterus relative to the birth canal.

Case Briefing (given to student at the beginning of the scenario)

I - Identification:

You have been handed over the care of Diana Soul, a 25-year-old patient at 41 weeks of gestation in active labour.

S - Situation:

Diana is a G2P1 who is 9 cm dilated and has been in active labour for 8 hours. However, her labour has stagnated for the past 2 hours. The foetal head is demonstrating asynclitism, with the occiput positioned toward number 8 and the sagittal suture closer to the sacrum. **She has received an epidural and prefers to stay in bed, as she does not feel comfortable standing. She also finds the current position on all fours unstable.**

B - Background:

Her membranes ruptured spontaneously 4 hours ago with clear fluid. There are no notable complications in her medical or obstetric history, and her labour was progressing normally until the recent stagnation.

A - Assessment:

Contractions are regular, occurring every 3 minutes and lasting 60 seconds. The foetal heart rate is at a baseline of 120 bpm with normal variability and no decelerations. The current asynclitic position is contributing to protracted labour.

R - Request:

We need to facilitate foetal descent and rotation while keeping the patient comfortable in bed. Please take a look at this patient and consider alternative maternal positioning techniques that accommodate her limitations.

Correct position

Taking into account her limitations, the only correct solution is the semiprone lunge.

Scenario 4: Nutation

Learning Objective

Students will learn to recognise and manage a case of arrest of labour by utilising maternal positions that promote nutation, increasing the pelvic outlet diameter to facilitate foetal descent.

Case Briefing (given to student at the beginning of the scenario)

I - Identification:

You have been handed over the care of Jesica Peterson, a 30-year-old patient at 40 weeks of gestation in labour.

S - Situation:

Jesica is a G2P0, fully dilated, and in the passive second stage of labour. She has been in labour for 11 hours, but progress has stagnated for the past hour despite regular contractions. The foetal position is occiput anterior at station +1. **The patient does not want to stay lying down anymore but also does not feel like standing and would like to try some positions on the bed.**

B - Background:

She had a spontaneous rupture of membranes 6 hours ago with clear amniotic fluid. There are no complications in her medical or obstetric history. She has been progressing well until now but has not yet started pushing.

A - Assessment:

Contractions remain regular every 2-3 minutes, lasting 60 seconds. Foetal heart rate is reassuring at 140 bpm baseline with normal variability and no decelerations. Despite full cervical dilation and a favourable foetal position, there is no further descent of the foetal head.

R - Request:

We need to facilitate foetal descent by employing maternal positioning techniques. Please take a look at this patient and consider maternal positioning techniques that respect her wishes.

Correct solution

Taking into account her wishes, the only correct solution is asymmetrical kneeling with legs adducted.

5.3.2 Scenario editor

The Scenario editor is used to create, modify, and manage custom cases. This section describes the editor workflow and all available options.

Starting the Scenario editor

The Scenario editor is started from the Settings page of the main menu (Fig. 13).

- Click on the **Scenario editor** button.
- The editor window opens on the **left side** of the user's view.
- The editor consists of multiple pages, which can be switched by **swiping** or by using the **navigation buttons at the bottom** of the editor.

The **Save** button is always available. Pressing it stores the current state of the case to a file on the device.

Editor – Page 2: Edit case

On the first page, the active case is selected, or a new case is created (Fig. 17).

- A case can be selected using the **main menu case selection**.
- Alternatively, click **Add new case** to create a new, empty case.
- Only **user-created cases** can be fully deleted.
- If a **customized default case** is deleted, it is reverted to its original default version.
- Default cases can be edited. Once edited, they appear in the main menu with "**(Custom)**" appended to the case name.
- All changes are stored using the **Save** button.
- Use swipe gestures or the bottom buttons to move to the next editor page.

Figure 17 - Editor: Page 1: Select case

Editor – Page 2: Edit case

A case is defined as a sequence of phases. Each case consists of at least the following steps:

Case start → Select position → Adjust limbs → Fetus move → End

On the **left side** of the editor page:

- **Prev Phase / Next Phase** buttons are used to switch between phases.
- If multiple alternatives exist for the next phase, **a combo box below the phase buttons** is used to select the active alternative.
- A **label next to the "Prev Phase" button** shows the type of the currently edited phase.

Phase-specific editors

Case start editor

The Case start phase defines the initial state of the scenario (Fig. 18).

- Define the start conditions:
  - Select the **start position of the woman** from the standard menu.

- Adjust **limbs** as required.
- Adjust the **pelvis** if needed.

- Bring the foetus into the initial position. Limb adjustments of the foetus are possible.
- Enter patient-related text in the **Patient Information** panel.

It is recommended to prepare patient information texts externally. When the case is saved, a folder for the case is created on the device. Patient information files follow this naming convention:

case.{PhaseName}.{PageNumber}.{DataType}

- {PhaseName}: e.g. Case start, Select position 1, Adjust limbs 2, Fetus move 1; Current phase name is displayed on the top left of the editor window
- {PageNumber}: 0, 1, or 2 (first to third page of patient information)
- {DataType}:
  - .txt for text
  - .png for images
  - .mp4 for videos

Rich text formatting is supported in text files. Supported syntax includes bold, italic, and colour tags.

Unity UI rich text

Additional controls:

- **Add alternative / Remove alternative**

By default, a case contains one linear sequence. Adding an alternative inserts an additional Select position and Adjust limbs phase that shares the same final Foetus move.

- **Foetus Joint**

Activates a tool for adjusting foetal limbs. Select **none** after finishing adjustments.

Figure 18 - Case start editor

Select position editor

This phase defines the start of the case (Fig. 19).

- Select the start position of the woman from the standard menu.
- Adjust limbs and pelvis as required. Deviations from the default position are allowed.
- A pillow can be placed to support the position. Its placement is saved and restored when the position is selected during the case.
- Reset Tools moves the pillow back to its initial position.
- Reset IK woman resets all limb adjustments.

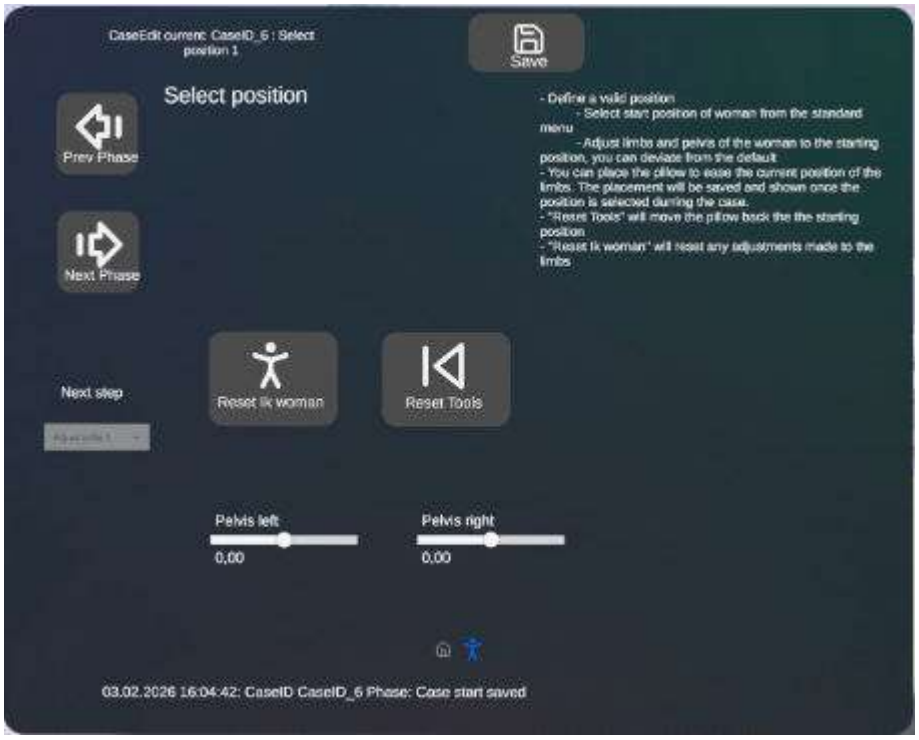

Figure 19 - Select position editor

Adjust limbs editor

This phase defines the target pelvis configuration (Fig. 20).

- Adjust the **limbs of the woman** to the final intended position.
- Adjust the **pelvis model** using the sliders to achieve the desired effect.
- Only **pelvis movements** are used to evaluate whether a student successfully adjusted the limbs.
- **Test pelvis** allows temporary testing by moving the limbs to observe the effect.

While a specific maternal position has no alternative pelvis configurations, multiple paths can share the same foetus movement:

- By default, all alternatives use the same foetus movement.
- To define a different foetus movement, use:
  - The **Foetus phase** dropdown list
  - The **Add alternative / Remove alternative** buttons

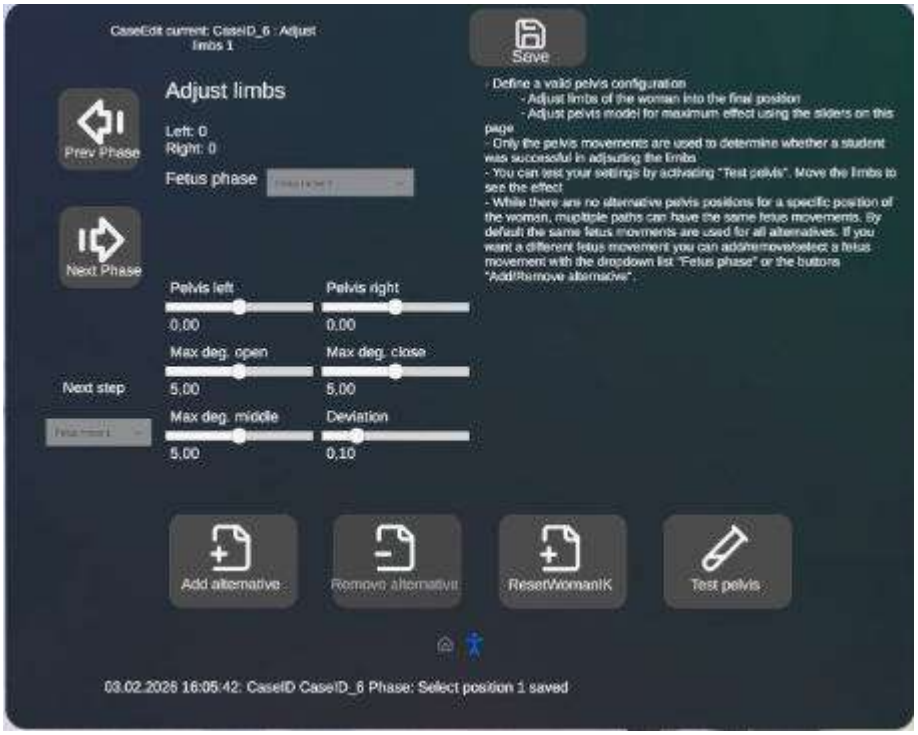

Figure 20 - Adjust limbs editor

Foetus move editor

This phase defines the movement and final position of the foetus.

- Adjust **foetal limbs and body** to the final successful position.
- Set the **Fast Forward duration** (in seconds). The foetus moves from its initial to its final position within this time.
- **Play** previews the movement.
- **Add / Remove** inserts or deletes movement steps.
- **Prev / Next** switches between movement steps.

Phase linking and control:

- The **combo box** allows selecting a Select position phase that follows this foetus movement, enabling multiple manoeuvres in sequence.
- **Reset IK Foetus** resets foetal limbs to their default configuration.

- **Reset Foetus** resets the foetus to the position defined at the start of this phase.
- **Is end** indicates whether this phase concludes the case.
- **Add / Remove phase** adds or removes a complete new sequence of Select position → Adjust limbs → Foetus move as the next step.

The Scenario editor provides full manual control over scenario structure, branching, and data content. All changes persist only after saving and are stored locally on the device.

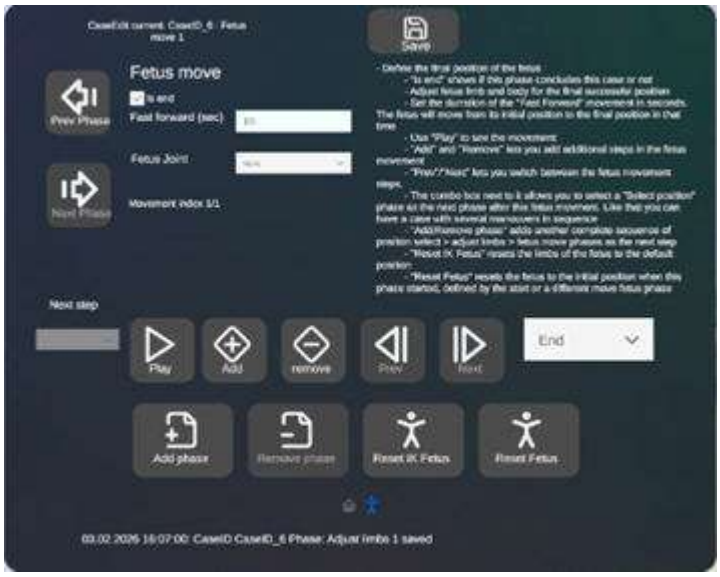

Figure 21 - Fetus move editor

5.3.3 Custom case and other files

If you have a modified case, then it will appear with the word "(CUSTOM)" in the name (Fig. 22).

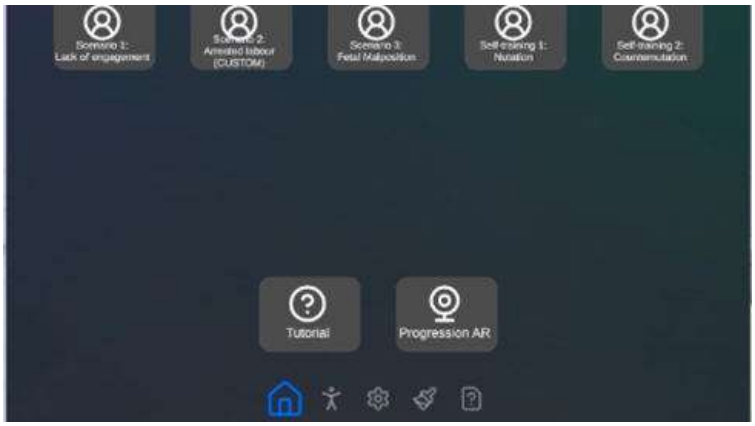

Figure 22 - Custom case

To access the files and remove/copy/add custom cases, you have to attach the Quest with a USB cable to a pc/laptop (Fig. 23). Then, in the Quest, go to messages and select the "USB Detected" message to allow file transfer with the PC.

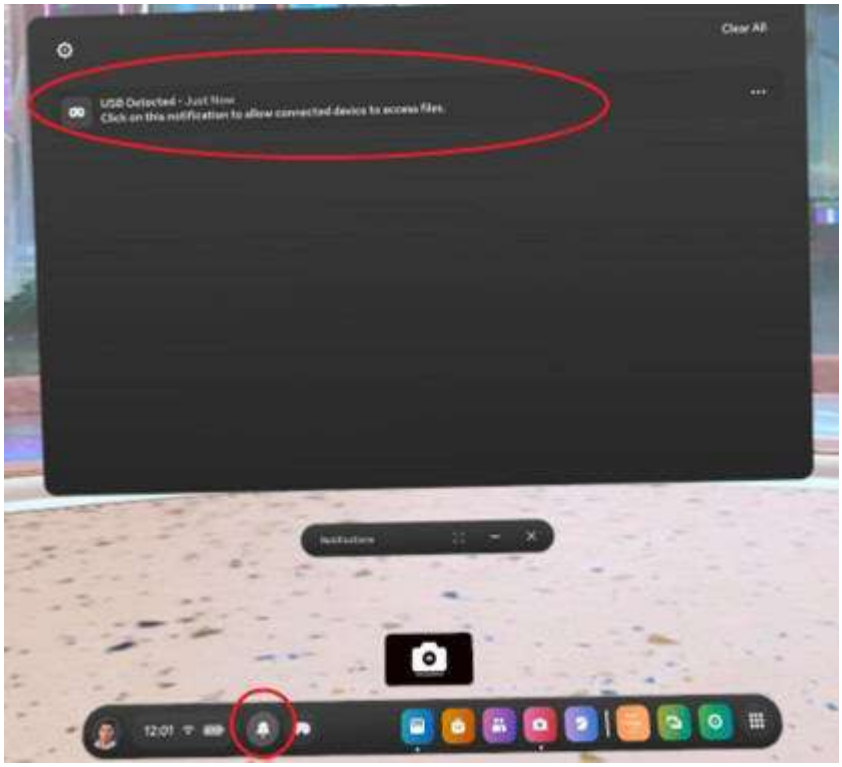

Figure 23 - Attach the Quest with an usb cable

Open a file explorer window and go to this: PC\Quest 3\Internal shared storage\Android\data\com.inm.progession.quest\files (Fig. 24). One folder is one case. If you modify any case, it will be stored there. Copy the folder to other devices to add the case. Or you can copy the config.json file to other devices to apply the same settings to those devices, e.g. colour.

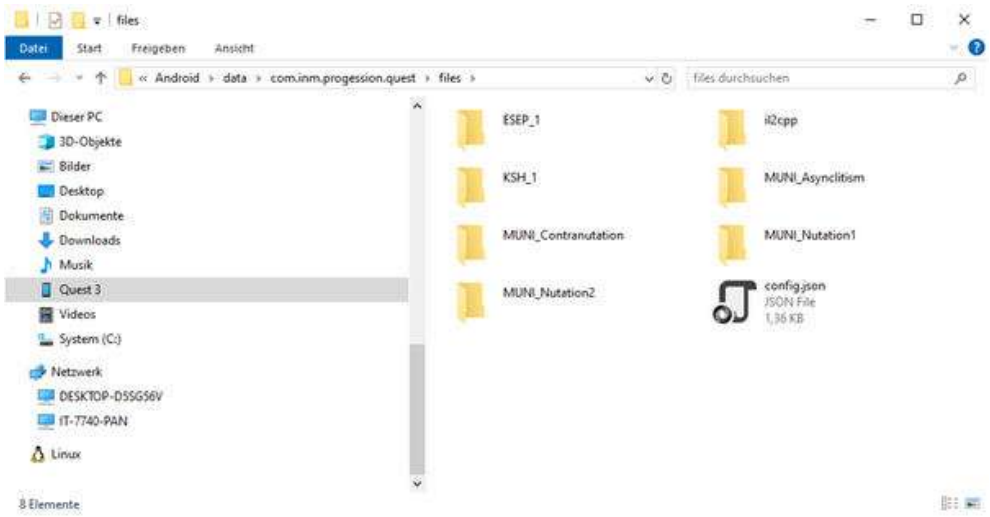

Figure 24 - PROGRESSION quest file

6. Evaluating the Application and Learning Experience

This chapter outlines the evaluation strategy adopted within the PROGRESSION project to assess the functionality, usability, and educational impact of the VR and AR learning tools. It provides an overview of the testing protocol applied during implementation, introduces general evaluation methods suitable for readers wishing to conduct their own impact studies, and summarises key findings and recommendations.

6.1 Evaluation During Testing

To ensure that the PROGRESSION learning tools met both technical and pedagogical requirements, a structured three--phase evaluation protocol was implemented. This approach enabled systematic validation of the technology while capturing user experience and learning progress throughout the pilot courses.

Phase 1 – Functionality and Performance Testing

The first phase focused on validating the technical integrity and overall performance of the VR and AR prototypes. This included:

- **Technical and clinical review** to confirm alignment with relevant standards and intended educational use.
- **Iterative refinement**, supported by continuous exchanges between developers and evaluators, to address technical issues, improve design elements, and optimise system stability.
- **Validation of the prototype**, marking readiness for user testing in educational settings.

Phases 2 and 3 – Usability, Quality, and Educational Impact Assessment

Phases 2 and 3 were conducted concurrently during the delivery of the PROGRESSION courses (Fig. 25). These phases examined two complementary aspects:

1. **User experience**, including usability, perceived quality, and overall satisfaction.
2. **Knowledge acquisition**, evaluated through structured pre- and post-assessments.

Standardised evaluation instruments were used after each VR or AR session, including System Usability Scale (SUS) (10), Virtual Reality System Usability Questionnaire (VRSUQ) (11), supplemented by expert-developed questionnaires tailored to the learning context. Knowledge tests were administered before the course and immediately after each immersive session to measure educational impact. Full versions of all survey instruments are included in the appendices.

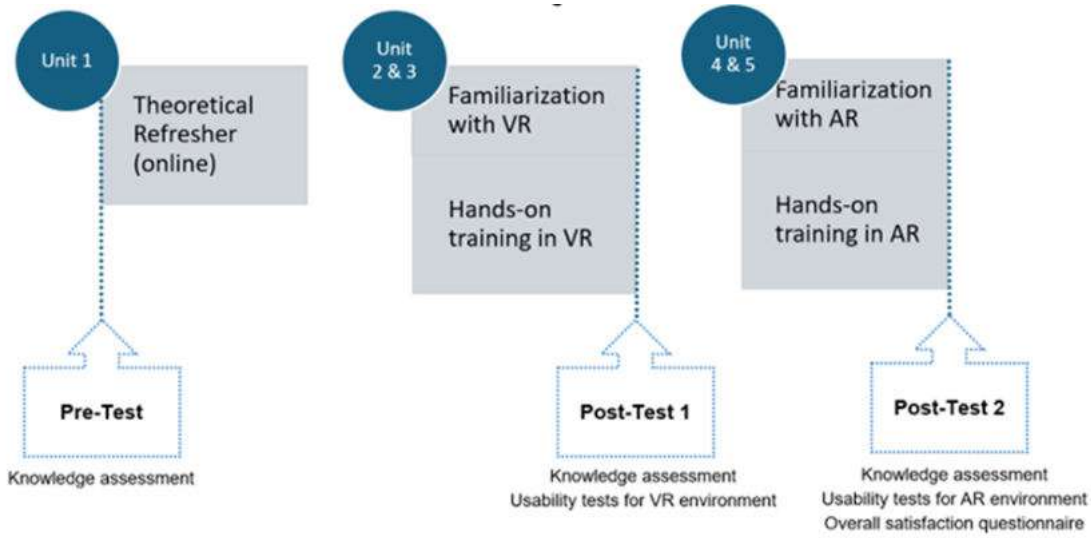

Figure 25 - Study Design

6.2 Key Results

Results from the PROGRESSION evaluation demonstrate a **positive cumulative learning effect**. The findings indicate that the PROGRESSION learning tool exerted a positive educational impact. Although knowledge gains between the Pre--Test and Post-test 1 (following the VR intervention) did not reach statistical significance, a significant improvement was observed between the Pre-Test and Post-test 2 (after completion of the full learning experience), increasing from 69±12 to 75±11 points. This pattern suggests a cumulative learning effect, whereby the staged integration of VR and AR **may enhance the reinforcement of complex physiological concepts.**

With respect to usability, the VR component achieved a mean SUS score of 68, which corresponds to the lower threshold of the widely accepted benchmark for average usability, alongside a moderate VRSUQ score of 56. By contrast, the AR component yielded lower usability ratings, with SUS and VRSUQ scores of 55 and 54, respectively. These results underscore the need for further technological refinement, particularly in relation to AR functionality and interface design, to improve user experience and ensure alignment with educational objectives.

Detailed information on the results is available at the open-access publication (12) (https://doi.org/10.3389/fmed.2026.1771624).

6.3 Evaluation Methods: A Practical Overview

Designing an evaluation study for educational technologies can be challenging. The following table (Table 2) presents simplified guidance, reflecting practices used in PROGRESSION that can support similar future implementations.

Table 2 -Practical Steps for Designing an Evaluation Study

Define Clear Objectives	Identify what you want to measure: • Technical performance • Usability and user satisfaction • Knowledge gain or skill acquisition • Comparative effectiveness (e.g., against traditional teaching)
Plan the Study Design	A basic design suitable for most educational evaluations includes: • A baseline assessment (pre-test) • Exposure to the intervention (VR/AR session) • A post-test after each learning module • A final cumulative assessment at the end of the course
Choose Appropriate Instruments	Use a combination of: • Standardized tools (e.g., SUS, VRSUQ) for comparability • Custom questionnaires for context-specific insights • Pre/post knowledge tests to quantify learning outcomes

Ensure Data Quality	Implement: • Clear guidance for participants • Standardized procedures for instructors • Automated or semi-automated data management tools to minimize errors

6.4 Recommendations for Future Implementations

The PROGRESSION project encountered several practical challenges during data collection and coordination across sites. Based on these experiences, the following considerations are recommended for teams planning to evaluate technology--enhanced learning tools, especially within multicentric settings. Additional guidance on multicentric implementations is available in Sa-Couto, et al. (2025) (13).

- **Strengthen data management:** Introduce system-generated participant IDs and built-in validation checks to reduce manual errors and ensure accurate pairing of responses.
- **Improve participant onboarding:** Provide clear, consistent guidance on study procedures, test timing and ID creation to avoid inconsistencies across sites.
- **Expand evaluation approaches:** Incorporate objective performance metrics and consider including a comparison group using traditional teaching methods to better assess the effectiveness of VR/AR tools in learning outcomes.

7. Frequently asked questions

1. *Does the PROGRESSION app require prior familiarity with VR or AR technologies?*

The PROGRESSION app is designed to be intuitive and user-friendly, requiring no prior experience with VR or AR technologies. The interface and this handbook (chapter 5) include clear guidance and step-by-step instructions that enable users to navigate and engage with the immersive content easily, regardless of their technological background.

2. *What should be done if the "Patient information" panel becomes excessively large during the course of the scenario?*

If the "Patient information" panel becomes excessively large during the scenario, it can be manually resized or adjusted using the hand controls by dragging the panel edges or corners from both sides to modify its size.

3. *Does the exclusive use of hand tracking interfere with the physical presence of the controllers near the user?*

Yes. Only one input method can be used at a time. If hand tracking is active, the controllers must not be used simultaneously.

4. *Is it possible to adjust the boundaries of the physical space (limits) during the course of the scenario?*

Yes. It is possible to adjust the boundaries of the physical space during the course of the scenario by accessing settings (also see chapter 5.1).

5. *Is the equipment compatible with users who wear glasses?*

Yes. The equipment is compatible with users who wear glasses. Most headsets are designed to accommodate standard-sized eyeglass frames. Users should ensure that their glasses fit comfortably inside the headset and adjust the straps properly to maintain both comfort and optimal visual clarity.

6. *Does the resolution of the scenarios include all clinically possible options for maternal positioning?*

No. The scenarios are designed to represent the most common and educationally relevant positions, focusing on key learning objectives rather than covering the full range of clinical variations.

7. *What should I do if I feel sick or dizzy while using VR glasses?*

This condition is called cybersickness and is caused by a mismatch between the movement your eyes see and the stillness your body perceives. It happens very rarely, but if it does occur, you should respond appropriately. At the first sign of nausea, take off the glasses. Find a stable place to sit, drink clean water, and focus on a fixed point in real space. Cybersickness can be overcome by gradually increasing the duration of your VR glasses use with static applications.

8. *What should you do if your VR headset is blurry?*

Find the sweet spot: Loosen all straps and place the headset against your face. Slowly move the headset up, down, and sideways until you see the image in the center as sharp as possible. Only then tighten the top and then the side straps.

9. *What to do if the battery in the headset does not last the entire course?*

In practice, during testing, we found it useful to use an external battery (power bank) placed in a carry-on bag.

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9. Appendices

Scenario 1 - Lack of Engagement

1. SCENARIO OVERVIEW
Scenario Name
Lack of Engagement

2. CURRICULUM INTEGRATION	
Participants profile	
Nursing-Midwifery students	
Learning Objectives	
Clinical/Technical Skills	**Non-Technical Skills (NTS)**
Clinical/Technical Skills 1. Identify the "problem" situation - lack of engagement of the foetus, using the following data: patient information, foetal position, Hodge's plane, and relating the woman's current position to the pelvic diameters. 2. Identify the maternal position that facilitates foetal engagement. 3. Position the woman in one of three possible approaches: • Path 1: Abdominal Lift and Tuck (for 10 contractions). • Path 2: Sit on a firm birthing ball and perform rapid hip circles or figure-of-eight movements, particularly in the absence of contractions. • Path 3: All-fours position, with external rotation of the toes. 4. Integrate clinical decision-making and critical thinking during scenario management, considering the woman's preferences.	1. Effective communication • Clear, structured, and appropriate communication with the woman/couple regarding the clinical situation, objectives of the intervention, and procedures to be performed. 2. Clinical decision-making • Integrated analysis of available information (maternal data, foetal position, Hodge's plane). • Selection of the most appropriate postural strategy based on clinical assessment. 3. Critical thinking and clinical reasoning • Identification of the problem (unengaged foetus) using multiple data sources. • Ability to relate maternal positions to pelvic diameters and the mechanism of labour. • Clinical justification of the selected interventions.

3. PREPARATION		
Simulation Modality		
☐ Full-body simulators AR	☒ Standardized Patient (AR)	☒ VR

Characterization/specific features (moulage/clothing/positioning) and Instructions (verbal cues)

VR	AR
Virtual Patient (Anna) Pregnant woman avatar in labour. The scenario takes place in a virtual room equipped with a bed. Foetal position and pelvic anatomy are visualised digitally. Cues represent Anna's wishes or sensations related with the positioning.	**Standardized Patient** A student portraying a pregnant woman in labour. Neutral clothing suitable for movement (e.g. comfortable). Verbal cues are delivered strictly according to the script and represent subjective experience (e.g. back pressure, desire to move). The standardized patient does not provide clinical guidance.

4. BRIEFING OF THE SIMULATION ENVIRONMENT	
Environment Briefing	
Equipment/Material location and functions Expect vs reality Basic simulation rules	• Meta Quest 3 with the Progression app installed (2 or 3 per room, fully charged). • Controllers/commands. • Screen and computer. • Stopwatch. • Pelvis model. • Private, spacious room free of obstacles, allowing the simultaneous movement of two students during the use of virtual reality technology (minimum of 6 m^2 – 3 × 3 m). • Avoid excessive furniture or sharp corners. • Stable internet connection.

Simulator/SP Briefing	
Can do	• Wear the VR/AR glasses during the simulation once correctly fitted and calibrated. • Use the glasses to visualise foetal position, pelvic anatomy, and scenario progression. • Move the head freely to explore the virtual/augmented content. • Follow on-screen prompts and system messages related to scenario progression. • Pause or remove the glasses if instructed by the facilitator for safety reasons. • Move freely within the predefined safe area of the room.
Cannot do	• Adjust system settings, recalibrate boundaries, or manipulate the software. • Run, jump, or perform abrupt movements that compromise safety. • Obstruct another participant's movement within the space.
Cues from outside	• If you hear my voice, it is intended to guide your clinical decision-making within the scenario. • These cues represent facilitation prompts and do not replace your own assessment or reasoning. • External cues are provided only when necessary to support scenario flow and learning objectives.

5. CASE BRIEFING
Disclosure *If faculty/confederates have specific roles in the scenario*

PREPARATION

1. Ensure that the headset is switched on and that the physical boundaries are correctly defined.

2. Mirror the image on the screen, confirming that the application is functioning properly.

INTRODUCTION

3. Inform the student that she is in a safe learning environment:

I would like to remind you that this simulation takes place in a safe learning environment. This means that you are in a space where you can explore, question, experiment, and even make mistakes, without fear of judgement. The aim is precisely to support learning, and for this it is essential that everyone feels comfortable and respected. I count on your collaborative spirit to maintain an atmosphere of mutual respect, in which each of you can develop your competencies with confidence and consistency.

4. Inform the student that, at the end, she will be invited to complete an evaluation questionnaire.

5. Explain that the complete process (familiarisation, simulation, feedback, and questionnaire) will have an approximate duration of 30 minutes per student.

EQUIPMENT DEMONSTRATION

6. Present the Meta Quest 3 headset and demonstrate how to adjust it, with the assistance of a student/lecturer.

7. Using a student or a lecturer, demonstrate the navigation controls, with the remaining students following the demonstration on the screen and collectively reading the Tutorial screens.

Participants and Roles	Briefing
The student is a nurse-midwife	You are caring for Anna during labour. You may read the case information in the Patient Information section. The objective is that, based on the information provided and considering the current position of the woman and the foetus, you assist Anna in adopting a position that may facilitate the progression of labour. If you hear my voice, it will represent what Anna wishes and/or feels. The scenario ends with the message: “Success - Foetus turned into final position. Press ‘Reset’ to start from the beginning again.”

6. SCENARIO PROGRESSION

	CLINICAL INFORMATION	EXPECTED ACTIONS	TRIGGER TO CHANGE STATE
Stage I	Gestational age: 39 weeks and 5 days. **Admitted in labour**. Evidence of ability to cope with labour contractions. According to her birth plan, she wishes to have a normal vaginal birth. Blood pressure: 110/70 mmHg. Maternal heart rate: 80 bpm **Obstetric examination** Fundal height: 33 cm Regular uterine contractions: intensity between 25–40 mmHg, duration 40–50 seconds, interval 8 minutes. Vaginal examination: 3 cm cervical dilatation and intact membranes. Foetal heart rate: 130–140 bpm, auscultated on the left flank, with good variability and no decelerations. Sara wishes to move and relieve pressure in her lower back. • **Initial maternal position** Left lateral decubitus, with a pillow between the legs in a position that influences the pelvic inlet diameter. • **Initial foetal position** Deflexed foetal head, above the 1st Hodge's plane, in left occiput posterior position.	Analyse clinical data. Identify lack of foetal engagement. Relate maternal position to pelvic diameters. Recognise need for positional intervention.	

Stage II	The student should decide on one of three positions to promote foetal engagement (flexion and rotation to transverse): **PATH 1:** **Abdominal Lift and Tuck** (lifting the abdomen during contractions, for 10 consecutive contractions). 1. Choose the standing position. 2. Adjust the lower limbs: separate the heels, place the toes slightly turned outwards, and simultaneously elevate the legs so that the knees are slightly flexed. 3. At the blue spheres, slightly lower the pelvis while keeping the knees flexed; the purpose is to increase the pelvic inlet diameter (sacral counternutation and iliac abduction). 4. Observe the change in the colours of the rings to understand the change that is occurring. 5. When the desired position (flexion and rotation to transverse) is achieved, a message appears. **PATH 2:** **Sitting on a firm birth** ball and performing rapid hip circles or figure-of-eight ("8") movements (particularly useful in the absence of contractions). 1. Choose the seated position on the birth ball, to respect the movements, the pelvis should not be moved. 2. Adjust the lower limbs: elevate the knees and feet (without moving the pelvis), with the legs slightly apart and the feet slightly turned outwards. 3. Observe the change in the colours of the rings; the purpose is to increase the pelvic inlet diameter (sacral counternutation and iliac abduction). 4. When the desired position (flexion and rotation to transverse) is achieved, a message appears. **PATH 3:** **All-fours position**, with external rotation of the toes. 1. Choose the all-fours position. 2. Adjust the lower limbs: slightly separate the legs, aiming to maintain a right angle between the pelvis and the knees, with the feet slightly turned outwards. 3. Observe the change in the colours of the rings; the purpose is to increase the pelvic inlet diameter (sacral counternutation and iliac abduction). 4. When the desired position (flexion and rotation to transverse) is achieved, a message appears.	**If incorrect:** the foetus remains in the baseline state. **LIFE SAVERS:** 1. If, after 3 minutes, none of the possible positions is selected, reinforce Anna's intention expressed in the Patient Information: "I really want to get out of bed to relieve the pressure in my back." 2. If, after a further 5 minutes, the position of the legs, feet, and pelvis is not identified: "Has my baby found the way out?" 3. If, after a further 5 minutes, the student is unable to adjust the position of the lower limbs, suggest "Force complete".	

Final Stage	Final foetal position: Flexed foetal head, between the 1st and 2nd Hodge's planes, rotating to transverse, with the back to the left (LOT).	Select FAST FORWARD and observe the foetal movement: the head flexes and rotates to the transverse position (LOT).	Scenario ends – Final position achieved.

7. FEEDBACK/Debriefing TOPICS

The Anna clinical scenario was designed to support reflection on midwifery intrapartum care, with a focus on maternal positioning, pelvic biomechanics, and labour progression (foetal rotation and descent). This feedback moment aims to review the clinical decisions and actions taken, highlighting strengths and identifying opportunities for improvement in a safe and constructive learning environment.

Performance observation parameters:

Domain	Criterion	Observable indicators	Performance	Life savers used
1. Clinical reasoning	Identifies the fetal presentation	Analyses foetal position, Hodge's plane, and the relationship with pelvic diameters	☐ Yes ☐ No	
	Relates the woman's current position to labour progression	Justifies the choice of intervention based on pelvic biomechanics	☐ Yes ☐ No	
2. Knowledge	Selects the appropriate maternal position to facilitate engagement	Chooses between *Abdominal Lift and Tuck*, sitting on the birth ball, or the all-fours position based on the observed situation	☐ Yes ☐ No	
3. Performance	Implements/Adjust the selected positioning	Positions the woman and describes the pelvic diameters intended to be achieved	☐ Yes ☐ No	
4. Evaluation of progression and critical reflection	Observes and describes maternal and foetal responses after the intervention	Analyses the effects of positioning on labour progression (foetal descent and pelvic diameters)	☐ Yes ☐ No	
	Reflects on the effectiveness of the intervention applied	Identifies areas for improvement in the learning process, when appropriate	☐ Yes ☐ No	

1. Reaction phase – Experience and perception

- How did you feel during the scenario?
- What aspects of the scenario did you find most challenging?

2. Clinical reasoning and decision-making

- What cues led you to identify the foetal position and level in relation to Hodge's planes?
- How did the woman's position influence your clinical reasoning regarding promotion of labour progression?

- What guided your decision of maternal position?

3. Knowledge application and biomechanics

- How did pelvic biomechanics influence your decision to select this position?
- Which pelvic diameters were you aiming to modify or optimise?
- How did the chosen position support foetal flexion and rotation?

4. Use of cues and "life savers"

- Did you recognise and respond to the cues provided during the scenario?
- How did these cues influence your actions or decision-making?
- In a real clinical context, what equivalent cues might you expect from the woman or the clinical environment?

5. Reflection and learning transfer

- What went well in your performance during this scenario?
- What would you do differently if you encountered a similar situation in clinical practice?
- How can this learning be transferred to real intrapartum care?
- What key learning point will you take forward from this scenario?

Scenario 2 - Arrested labour

1. SCENARIO OVERVIEW
Scenario Name
Arrested labour

2. CURRICULUM INTEGRATION	
Participants profile	
Nursing-Midwifery students	
Learning Objectives	
Clinical/Technical Skills	**Non-Technical Skills (NTS)**
1. Identify the "problem" situation – posterior position, using the following data: patient information, foetal position, Hodge's plane, and relating the woman's current position to the pelvic diameters. 2. Identify the maternal position that facilitates foetal engagement. 3. Position the woman in one of three possible approaches: • **Path 1:** Left side – on all 4s • **Path 2:** SIMS-position on the right side – left side - on all 4s • **Path 3:** left side - SIMS-position on the left side – on all4s • **Path 4:** SIMS-position on the right side – left side – SIMS-position on the left – on all 4s 4. Integrate clinical decision-making and critical thinking during scenario management, considering the woman's preferences.	1. Effective communication • Clear, structured, and appropriate communication with the woman/couple regarding the clinical situation, objectives of the intervention, and procedures to be performed. 2. Clinical decision-making • Integrated analysis of available information (maternal data, foetal position, Hodge's plane). • Selection of the most appropriate postural strategy based on clinical assessment. 3. Critical thinking and clinical reasoning • Identification of the problem (unengaged foetus) using multiple data sources. • Ability to relate maternal positions to pelvic diameters and the mechanism of labour. • Clinical justification of the selected interventions.

3. PREPARATION		
Simulation Modality		
☐ Full-body simulators AR	☒ Standardized Patient (AR)	☒ VR

Characterization/specific features (moulage/clothing/positioning) and Instructions (verbal cues)

VR	AR
Virtual Patient (Anna) Pregnant woman avatar in labour. The scenario takes place in a virtual room equipped with a bed. Foetal position and pelvic anatomy are visualised digitally. Cues represent the womans wishes or sensations related with the positioning.	**Standardized Patient** A student portraying a pregnant woman in labour. Neutral clothing suitable for movement and an empathy belly. Verbal cues are delivered strictly according to the script and represent subjective experience (e.g. back pressure, desire to move). The standardized patient does not provide clinical guidance.

4. BRIEFING OF THE SIMULATION ENVIRONMENT	
Environment Briefing	
Equipment/Material location and functions Expect vs reality Basic simulation rules	• Meta Quest 3 with the Progression app installed (2 or 3 per room, fully charged). • Controllers/commands. • Screen and computer. • Stopwatch. • Pelvis model and fetus model • Private, spacious room free of obstacles, allowing the simultaneous movement of two students during the use of virtual reality technology (minimum of 6 m^2 – 3 × 3 m). • Avoid excessive furniture or sharp corners. • Stable internet connection.

Simulator/SP Briefing	
Can do	• Wear the VR/AR glasses during the simulation once correctly fitted and calibrated. • Use the glasses to visualise foetal position, pelvic anatomy, and scenario progression. • Move the head freely to explore the virtual/augmented content. • Follow on-screen prompts and system messages related to scenario progression. • Pause or remove the glasses if instructed by the facilitator for safety reasons. • Move freely within the predefined safe area of the room.
Cannot do	• Adjust system settings, recalibrate boundaries, or manipulate the software. • Run, jump, or perform abrupt movements that compromise safety. • Obstruct another participant's movement within the space.
Cues from outside	• If you hear my voice, it is intended to guide your clinical decision-making within the scenario. • These cues represent facilitation prompts and do not replace your own assessment or reasoning. • External cues are provided only when necessary to support scenario flow and learning objectives.

5. CASE BRIEFING	
Disclosure	
PREPARATION 1. Ensure that the headset is switched on and that the physical boundaries are correctly defined. 2. Mirror the image on the screen, confirming that the application is functioning properly. **INTRODUCTION** 3. Inform the student that she is in a safe learning environment: I would like to remind you that this simulation takes place in a safe learning environment. This means that you are in a space where you can explore, question, experiment, and even make mistakes, without fear of judgement. The aim is precisely to support learning, and for this it is essential that everyone feels comfortable and respected. I count on your collaborative spirit to maintain an atmosphere of mutual respect, in which each of you can develop your competencies with confidence and consistency. 4. Inform the student that, at the end, she will be invited to complete an evaluation questionnaire. 5. Explain that the complete process (familiarisation, simulation, feedback, and questionnaire) will have an approximate duration of 30 minutes per student. **EQUIPMENT DEMONSTRATION** 6. Present the Meta Quest 3 headset and demonstrate how to adjust it, with the assistance of a student/lecturer. 7. Using a student or a lecturer, demonstrate the navigation controls, with the remaining students following the demonstration on the screen and collectively reading the Tutorial screens.	
Participants and Roles	**Briefing**
The student is a midwife	You are caring for the woman during labour. You may read the case information in the Patient Information section. The objective is that, based on the information provided and considering the current position of the woman and the foetus, you assist the woman in adopting a position that may facilitate the progression of labour. If you hear my voice, it will represent what the woman wishes and/or feels. The scenario ends with the message: “Success - Foetus turned into final position. Press ‘Reset’ to start from the beginning again.”

6. SCENARIO PROGRESSION

	CLINICAL INFORMATION	EXPECTED ACTIONS	TRIGGER TO CHANGE STATE
Stage I	Location: Birth center/Maternity Physical conditions: • Phase of labour: active phase • Dilatation: 8-10 cm • Initial positioning: standing • Contractions: effective, every 3 min • Membranes: intact (no rupture) • Pain: located on back • No medication started • No I.V. line • Monitor: Intermittent auscultation • Partogram filled up to the initial point of the simulation Pregnant woman characteristics: • Readiness (collaborative) • In control of her emotions and pain • Hospital gown Fetal position/conditions: • Fetal descend: +1 or +2 (Hodge plane - 1st) • Fetal Heart Rate (FHR): 130 bpm, with good variability, no decelerations	Analyse clinical data. Identify posterior position Relate maternal position to pelvic diameters. Recognise need for positional intervention.	

Stage II	The student should decide on one of three positions to promote foetal engagement (rotation of the fetus):
	• Path 1: Left side – on all 4s
	  ○ To support the rotation of the fetal back from the back to the front, position the woman on the left side
	  ○ Adjust the legs, that the pelvis is a neutral position
	  ○ You receive the message: Limbs adjusted correctly press fast forward to observe fetal movement
	  ○ Position the woman on all 4s to support the further rotation of the fetus
	  ○ Adjust the limbs to open the pelvic outlet and support the decense of the fetus
	  ○ Observe fetal movement
	• Path 2: SIMS-position on the right side – left side - on all 4s
	  ○ Position the woman on the right side
	  ○ Adjust the limbs to get to a SIMS position to support the rotation of the fetus using gravity
	  ○ Observe the fetal movement
	  ○ Position the woman on the left side
	  ○ Adjust the limbs by opening the legs and bending them, to open the pelvic inlet and supporting the rotation of the fetus through gravity
	  ○ Observe fetal movement
	  ○ Position the woman on all 4s to support the further rotation of the fetus
	  ○ Adjust the limbs to open the pelvic outlet and support the decense of the fetus
	  ○ Observe fetal movement
	• Path 3: left side - SIMS-position on the left side – on all4s
	  ○ To support the rotation of the fetal back from the back to the front, position the woman on the left side
	  ○ Adjust the legs, that the pelvis is a neutral position
	  ○ You receive the message: Limbs adjusted correctly press fast forward to observe fetal movement
	  ○ Position the woman on the left side
	  ○ Adjust the limbs to reach a SIMS position to support the rotation of the fetus stepwise
	  ○ Observe fetal movement
	  ○ Position the woman on all 4s to support the further rotation of the fetus
		Incorrect actions:
		1. Doing nothing.
		2. Placing/keeping the woman in a lying position.
		
		If the action is correct: the scenario transitions to the final state.
		If incorrect: the foetus remains in the baseline state.	

Stage II	○ Adjust the limbs to open the pelvic outlet and support the decense of the fetus ○ Observe fetal movement • Path 4: SIMS-position on the right side – left side – SIMS-position on the left – on all 4s ○ Position the woman on the right side ○ Adjust the limbs to get to a SIMS position to support the rotation of the fetus using gravity ○ Observe the fetal movement ○ Position the woman on the left side ○ Adjust the limbs by opening the legs and bending them, to open the pelvic inlet and supporting the rotation of the fetus through gravity ○ Observe fetal movement ○ Position the woman on the left side ○ Adjust the limbs to reach a SIMS position to support the rotation of the fetus stepwise ○ Observe fetal movement ○ Position the woman on all 4s to support the further rotation of the fetus ○ Adjust the limbs to open the pelvic outlet and support the decense of the fetus ○ Observe fetal movement	**If incorrect:** the foetus remains in the baseline state. **Incorrect actions:** 1. Doing nothing. 2. Placing/keeping the woman in a lying position. **If the action is correct:** the scenario transitions to the final state. **If incorrect:** the foetus remains in the baseline state.	
Final Stage	Final foetal position: Rotation of the fetal back to the frond deepening of the head into the middle of the pelvis +0	Select FAST FORWARD and observe the foetal movement: the fetus rotates to the front and gets deeper into the pelvis.	Scenario ends – Final position achieved.

7. FEEDBACK/Debriefing TOPICS

The clinical scenario was designed to support reflection on midwifery intrapartum care, with a focus on maternal positioning, pelvic biomechanics, and labour progression (foetal rotation and descent). This feedback moment aims to review the clinical decisions and actions taken, highlighting strengths and identifying opportunities for improvement in a safe and constructive learning environment.

Performance observation parameters:

Domain	Criterion	Observable indicators	Performance	Life savers used
1. Clinical reasoning	Identifies the fetal presentation	Analyses foetal position, Hodge's plane, and the relationship with pelvic diameters	☐ Yes ☐ No	
	Relates the woman's current position to labour progression	Justifies the choice of intervention based on pelvic biomechanics	☐ Yes ☐ No	
2. Knowledge	Selects the appropriate maternal position to facilitate engagement	Chooses between *Abdominal Lift and Tuck*, sitting on the birth ball, or the all-fours position based on the observed situation	☐ Yes ☐ No	
3. Performance	Implements/Adjust the selected positioning	Positions the woman and describes the pelvic diameters intended to be achieved	☐ Yes ☐ No	
4. Evaluation of progression and critical reflection	Observes and describes maternal and foetal responses after the intervention	Analyses the effects of positioning on labour progression (foetal descent and pelvic diameters)	☐ Yes ☐ No	
	Reflects on the effectiveness of the intervention applied	Identifies areas for improvement in the learning process, when appropriate	☐ Yes ☐ No	

1. Reaction phase – Experience and perception

- How did you feel during the scenario?
- What aspects of the scenario did you find most challenging?

2. Clinical reasoning and decision-making

- What cues led you to identify the foetal position and level in relation to Hodge's planes?
- How did the woman's position influence your clinical reasoning regarding promotion of labour progression?

- What guided your decision of maternal position?

3. Knowledge application and biomechanics

- How did pelvic biomechanics influence your decision to select this position?
- Which pelvic diameters were you aiming to modify or optimise?
- How did the chosen position support foetal flexion and rotation?

4. Use of cues and "life savers"

- Did you recognise and respond to the cues provided during the scenario?
- How did these cues influence your actions or decision-making?
- In a real clinical context, what equivalent cues might you expect from the woman or the clinical environment?

5. Reflection and learning transfer

- What went well in your performance during this scenario?
- What would you do differently if you encountered a similar situation in clinical practice?
- How can this learning be transferred to real intrapartum care?
- What key learning point will you take forward from this scenario?

Scenario 3 - Fetal Malposition

1. SCENARIO OVERVIEW
Scenario Name
Fetal Malposition

2. CURRICULUM INTEGRATION	
Participants profile	
Nursing-Midwifery students	
Learning Objectives	
Clinical/Technical Skills	**Non-Technical Skills (NTS)**
1. Identify the "problem" situation - lack of engagement of the foetus, using the following data: patient information, foetal position, Hodge's plane, and relating the woman's current position to the pelvic diameters. 2. Identify the maternal position that facilitates foetal engagement. 3. Position the woman in possible approach: taking into account her limitations the only correct solution is the semiprone lunge. 4. Integrate clinical decision-making and critical thinking during scenario management, considering the woman's preferences.	1. Effective communication • Clear, structured, and appropriate communication with the woman/couple regarding the clinical situation, objectives of the intervention, and procedures to be performed. 2. Clinical decision-making • Integrated analysis of available information (maternal data, foetal position, Hodge's plane). • Selection of the most appropriate postural strategy based on clinical assessment. 3. Critical thinking and clinical reasoning • Identification of the problem (unengaged foetus) using multiple data sources. • Ability to relate maternal positions to pelvic diameters and the mechanism of labour. • Clinical justification of the selected interventions.

3. PREPARATION		
Simulation Modality		
☐ Full-body simulators AR	☒ Standardized Patient (AR)	☒ VR

Characterization/specific features (moulage/clothing/positioning) and Instructions (verbal cues)

VR	AR
Virtual Patient (Diana) Pregnant woman avatar in labour. The scenario takes place in a virtual room equipped with a bed. Foetal position and pelvic anatomy are visualised digitally. Cues represent Diana's wishes or sensations related with the positioning.	**Standardized Patient** A student portraying a pregnant woman in labour. Neutral clothing suitable for movement (e.g. comfortable). Verbal cues are delivered strictly according to the script and represent subjective experience (e.g. back pressure, desire to move). The standardized patient does not provide clinical guidance.

4. BRIEFING OF THE SIMULATION ENVIRONMENT	
Environment Briefing	
Equipment/Material location and functions Expect vs reality Basic simulation rules	• Meta Quest 3 with the Progression app installed (2 or 3 per room, fully charged). • Controllers/commands. • Screen and computer. • Stopwatch. • Pelvis model and fetus model • Private, spacious room free of obstacles, allowing the simultaneous movement of two students during the use of virtual reality technology (minimum of 6 m^2 – 3 × 3 m). • Avoid excessive furniture or sharp corners. • Stable internet connection.

Simulator/SP Briefing	
Can do	• Wear the VR/AR glasses during the simulation once correctly fitted and calibrated. • Use the glasses to visualise foetal position, pelvic anatomy, and scenario progression. • Move the head freely to explore the virtual/augmented content. • Follow on-screen prompts and system messages related to scenario progression. • Pause or remove the glasses if instructed by the facilitator for safety reasons. • Move freely within the predefined safe area of the room.
Cannot do	• Adjust system settings, recalibrate boundaries, or manipulate the software. • Run, jump, or perform abrupt movements that compromise safety. • Obstruct another participant's movement within the space.
Cues from outside	• If you hear my voice, it is intended to guide your clinical decision-making within the scenario. • These cues represent facilitation prompts and do not replace your own assessment or reasoning. • External cues are provided only when necessary to support scenario flow and learning objectives.

5. CASE BRIEFING	
Disclosure	
PREPARATION 1. Ensure that the headset is switched on and that the physical boundaries are correctly defined. 2. Mirror the image on the screen, confirming that the application is functioning properly. **INTRODUCTION** 3. Inform the student that she is in a safe learning environment: *I would like to remind you that this simulation takes place in a safe learning environment. This means that you are in a space where you can explore, question, experiment, and even make mistakes, without fear of judgement. The aim is precisely to support learning, and for this it is essential that everyone feels comfortable and respected. I count on your collaborative spirit to maintain an atmosphere of mutual respect, in which each of you can develop your competencies with confidence and consistency.* 4. Inform the student that, at the end, she will be invited to complete an evaluation questionnaire. 5. Explain that the complete process (familiarisation, simulation, feedback, and questionnaire) will have an approximate duration of 30 minutes per student. **EQUIPMENT DEMONSTRATION** 6. Present the Meta Quest 3 headset and demonstrate how to adjust it, with the assistance of a student/lecturer. 7. Using a student or a lecturer, demonstrate the navigation controls, with the remaining students following the demonstration on the screen and collectively reading the Tutorial screens.	
Participants and Roles	**Briefing**
The student is a midwife	You are caring for the woman during labour. You may read the case information in the Patient Information section. The objective is that, based on the information provided and considering the current position of the woman and the foetus, you assist the woman in adopting a position that may facilitate the progression of labour. If you hear my voice, it will represent what the woman wishes and/or feels. The scenario ends with the message: “Success - Foetus turned into final position. Press ‘Reset’ to start from the beginning again.”

6. SCENARIO PROGRESSION

	CLINICAL INFORMATION	EXPECTED ACTIONS	TRIGGER TO CHANGE STATE
Stage I	Gestational age: 41 weeks. **Admitted in labour** There are no notable complications in her medical or obstetric history, and her labour was progressing normally until stagnation in the last 2 hours. Blood pressure: 125/82 mmHg. Maternal heart rate: 85 bpm. **Obstetric examination** Fundal height: 33 cm Regular uterine contractions: duration 60 seconds, interval 3 minutes. Vaginal examination: 9 cm cervical dilatation and membranes ruptured spontaneously 4 hours ago with clear fluid. Foetal heart rate: baseline of 120 bpm, with good variability and no decelerations. Diana has received an epidural and prefers to stay in bed, as she does not feel comfortable standing. She also finds the current position on all fours unstable. • Initial maternal position All-fours position with external rotation of the toes. • Initial foetal position The fetal head is demonstrating asynclitism, with the occiput positioned toward number 8 and the sagittal suture closer to the sacrum.	Analyse clinical data. Identify asynclitism. Relate maternal position to pelvic diameters. Recognise need for positional intervention.	

Stage II	The student should decide on one of the offered positions to promote foetal engagement (return the sagittal suture to middle): **Semiprone lunge** Choose the right lateral position. 1. Adjust the lower limbs: The left leg is bent at the knee and the knee is pulled as close to the abdomen as possible. The left knee is loosely lying on the bed. 2. Observe the change in the colours of the rings to understand the change that is occurring. 3. When the desired position (return the sagittal suture to middle) is achieved, a message appears.	**Incorrect actions:** 1. Doing nothing. 2. Placing/keeping the woman in a supine position. **If the action is correct:** the scenario transitions to the final state. **If incorrect:** the foetus remains in the baseline state. **LIFE SAVERS:** 1. If, after 3 minutes, none of the possible positions is selected, reinforce Diana's intention expressed in the Patient Information: "I prefer to stay in bed, as I do not feel comfortable standing." 2. If, after a further 5 minutes, the position of the legs, feet, and pelvis is not identified: "Has my baby found the way out?" 3. If, after a further 5 minutes, the student is unable to adjust the position of the lower limbs, suggest "Force complete".	
Final Stage	Final foetal position: Comparison fetal head, where the sagittal suture is in the middle (LOT).	Select FAST FORWARD and observe the foetal movement: the head is flexed, but in extension of the spine so that the sagittal suture is in the middle (LOT).	Scenario ends – Final position achieved.

7. FEEDBACK/Debriefing TOPICS				
The clinical scenario was designed to support reflection on midwifery intrapartum care, with a focus on maternal positioning, pelvic biomechanics, and labour progression (foetal rotation and descent). This feedback moment aims to review the clinical decisions and actions taken, highlighting strengths and identifying opportunities for improvement in a safe and constructive learning environment. **Performance observation parameters:**				
Domain	**Criterion**	**Observable indicators**	**Performance**	**Life savers used**
1. Clinical reasoning	Identifies the fetal presentation	Analyses foetal position, Hodge's plane, and the relationship with pelvic diameters	☐ Yes ☐ No	
	Relates the woman's current position to labour progression	Justifies the choice of intervention based on pelvic biomechanics	☐ Yes ☐ No	
2. Knowledge	Selects the appropriate maternal position to facilitate engagement	Chooses between *Abdominal Lift and Tuck*, sitting on the birth ball, or the all-fours position based on the observed situation	☐ Yes ☐ No	
3. Performance	Implements/Adjust the selected positioning	Positions the woman and describes the pelvic diameters intended to be achieved	☐ Yes ☐ No	
4. Evaluation of progression and critical reflection	Observes and describes maternal and foetal responses after the intervention	Analyses the effects of positioning on labour progression (foetal descent and pelvic diameters)	☐ Yes ☐ No	
	Reflects on the effectiveness of the intervention applied	Identifies areas for improvement in the learning process, when appropriate	☐ Yes ☐ No	

1. Reaction phase – Experience and perception

- How did you feel during the scenario?
- What aspects of the scenario did you find most challenging?

2. Clinical reasoning and decision-making

- What cues led you to identify the foetal position and level in relation to Hodge's planes?
- How did the woman's position influence your clinical reasoning regarding promotion of labour progression?

- What guided your decision of maternal position?

3. Knowledge application and biomechanics

- How did pelvic biomechanics influence your decision to select this position?
- Which pelvic diameters were you aiming to modify or optimise?
- How did the chosen position support foetal flexion and rotation?

4. Use of cues and "life savers"

- Did you recognise and respond to the cues provided during the scenario?
- How did these cues influence your actions or decision-making?
- In a real clinical context, what equivalent cues might you expect from the woman or the clinical environment?

5. Reflection and learning transfer

- What went well in your performance during this scenario?
- What would you do differently if you encountered a similar situation in clinical practice?
- How can this learning be transferred to real intrapartum care?
- What key learning point will you take forward from this scenario?