Master's thesis

NTNU
Norwegian University of Science and Technology
Faculty of Architecture and Design
Department of Design

Greger Gahre

Role of Design to Reduce Cognitive Load on Training for Maternity Care in Tanzania

Master's thesis in Industrial Design
Supervisor: Dr. Ashis Jalote Parmar
Co-supervisor: Yuanzhen Cai
January 2024

NTNU
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Laerdal
helping save lives

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NTNU
Fakultet for arkitektur og design
Institutt for design

Master Thesis for student Greger Tronstad Gahre

Title: Role of Design to Reduce Cognitive Load on Training in Maternity Care in Tanzania
Title in Norwegian: Design sin rolle for å redusere kognitiv load under opptrening i svangerskapsomsorgen i Tanzania

Introduction and project background:

Every year, there are around 3 million perinatal deaths and approximately 295,000 maternal deaths that occur globally. Among these numbers of perinatal deaths, 98% of cases happen in low-resource countries. The main causes behind these imbalanced numbers are inadequate skills of healthcare workers, long and demanding shifts, shortage of staff, and challenging working environments. To reduce these high numbers, it is important to utilize new training tools that can help distribute knowledge across geographical boundaries, to improve the quality of care in low-resource areas. However, every time overworked healthcare workers are introduced to a new training tool, it is another thing to focus on, thereby adding an extra burden on top of everything else. This project is a part of Laerdal Global Health (LGH). LGH is a non-profit sister company of Laerdal Medical. Their primary focus is to save the lives of mothers and newborns in low-resource areas. Their products and solutions are designed to meet the needs of maternal healthcare workers in developing countries.

Thesis content:

This thesis will focus on four design cases taken from the current product portfolio of Laerdal Global Health's existing training tools. The tools are NeoNatalie Live, NeoBeat, LIFT, and MamaBirthie. They are being used in low-resource countries, with the common goal of enhancing healthcare workers' knowledge and skills around maternity care. This project will address how these tools currently work, their advantages and pain points, and then explore how design can be employed to reduce the cognitive load on healthcare workers during their training. Design methodology will be used to gain a more comprehensive understanding of their daily routines and how training can occur in the most effective manner, ensuring that the added work does not surpass the learning outcome.

Research Question:

To investigate how experience design can be used when designing training tools for maternal healthcare workers in low-resource countries to reduce their cognitive load and make the users understand the value of utilizing it.

Expected methodology and key stages:

- Secondary Research - A literature review of relevant theory
- Primary Research - Interviews, focus group, observations

- Ideation and prototyping of training tools for maternity care in low-resource settings, based on LGH's four existing tools, through design methodology
- Test with end users (maternal healthcare workers in Tanzania)

Oppgaven utføres etter «Retningslinjer for masteroppgaver i Industriell design».

Supervisor: Ashis Jalote Parmar

Co-supervisor: Yuanzhen Cai (Company collaboration: Laerdal Medical)

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~~NTNU~~, Trondheim, (dato)

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Preface

This thesis is written at the Institute of Design at Norwegian University of Science and Technology (NTNU) in collaboration with Laerdal Global Health. The thesis has been an independent and explorative part of Laerdal's ongoing projects. The aim is trying to reduce the cognitive load on training for maternal healthcare workers in Tanzania.

Abstract

This thesis explores service design and cognitive load in the context of continuous training for maternal healthcare workers in Tanzania. In 2019, 98% of maternal deaths happened in low-and middle-income countries. The main causes of these imbalanced numbers are inadequate skills and a shortage of healthcare workers. To reduce these high numbers it is helpful to distribute knowledge and implement new training products. However, introducing new training products to already overworked healthcare workers will place an extra burden on them. Even though we find it user-friendly, the overall implementation might be too complex and take too much time. When our brain gets overloaded, it is harder to remember and learn new information.

In this thesis, service design has been used to get a comprehensive picture of healthcare workers' experience with training. The aim is how to improve the training without increasing the cognitive load too much. Analyzing four training products within Laerdal Global Health's existing portfolio, served as a foundation for identifying the areas that urgently required improvement. The primary studies were conducted both remotely and on-site in Tanzania, using methods like contextual inquiries, focus groups, and co-design. Organizing and preparing scenario training were identified as the primary issues related to training.

This thesis results in a new user driven training system for maternal health care workers. It aims at streamlining scenario-training based on existing services offered by Laerdal. Building a new solution on familiar services ensures smoother implementation, while distributing roles and responsibilities reduces task complexity. This approach will help to implement a new service without excessively burdening the cognitive load of the healthcare workers. Collaborative design has been used to ensure a user-centric design process and make the final solutions based on ideas coming from the healthcare workers.

This thesis contributes to Laerdal Global Health by providing a system that makes it easier for healthcare workers to use their training products. Overall, this thesis supports the use of service design as a valuable approach when working with healthcare workers in Tanzania.

Sammendrag

Denne oppgaven utforsker service design og kognitiv load i konteksten av etterutdanning av fødselshjelpere i Tanzania. I 2019 skjedde 98% av maternelle dødsfall i lav- og middelinntekt land.Hovedårsaken til denne skjeve fordelingen er mangelen på helsepersonell og lavt kunnskapsnivå hos fødselshjelperne. For å redusere disse høye tallene er det nyttig å spre kunnskap og implementere nye treningsprodukter. På den andre siden vil det å introdusere nye treningsprodukter til allerede overarbeidede fødselshjelpere, bli en ekstra byrde for dem. Selv om vi synes produktene er brukervennlige, kan den generelle implementeringen fort bli for kompleks og tidkrevende. Når det blir for mye ny informasjon, er det vanskeligere å huske ting og få med seg ny lærdom.

I denne oppgaven har service design blitt brukt for å få et overordnet bilde av treningserfaringen til helsepersonell. Målet er hvordan treningen kan forbedres uten å øke kognitiv load for mye. For identifisering av områder det haster å forbedre, ble fire allerede eksisterende treningsprodukter i Laerdal Global Health portfolio analysert. Primære studier ble utført både fra Norge og on-site i Tanzania ved å bruke metoder som contextual inquiry, fokusgrupper og co-design. Organisering og forberedelse til scenario trening ble identifisert som de primære problemene relatert til opptreningen.

Denne oppgaven skildrer et nytt brukerdrevet treningsystem for fødselshjelpere. Målet er å lage et mer effektivt scenario treningsopplegg basert på allerede eksisterende hjelpemidler som finnes hos Laerdal. Det å lage nye løsninger på allerede kjente metoder samtidig som man fordeler roller og ansvar, reduserer kompleksiteten. Denne fremgangsmåten vil gjøre det lettere å implementere et nytt konsept uten å øke helsearbeiderens kognitive load for mye. Co-design har blitt brukt for å sikre en brukervennlig designprosess og at den endelige løsningen stammer fra helsearbeideren.

Oppgaven bidrar til Laerdal Global Health ved å tilføre et system som gjør det enklere for fødselshjelperne å bruke treningsproduktene deres. Først og fremst støtter oppgaven bruk av service design som en verdifull tilnærming til bruk ved samarbeid med helsearbeidere i Tanzania.

1. Introduction

1. Introduction

Maternal and perinatal deaths are significant problems in Low- and Middle-Income Countries (LMIC). In 2019, 2.4 million neonatal deaths were reported globally. This amounts to 6700 neonatal deaths per day. In the same period, the number of maternal deaths reached 300,000. Approximately 98% of these deaths occurred in LMIC, 50% of them in Sub-Saharan Africa. The high incidence is mainly caused by inadequate skills and a shortage of healthcare workers, challenging working environments, and demanding shifts. WHO emphasizes the significance of having trained healthcare workers present at every birth. In reality, only 51% of women in low-resource countries receive skilled care during birth [22].

The Sustainable Development Goals (SDGs) are agreed upon by the United Nations. SDG 2.3 aims to reduce perinatal deaths and deaths of children under the age of 5 years [6]. Tanzania reported a neonatal mortality rate (NMR) of 25 per 1,000 live births in 2016 [35]. Although this is a major reduction from the NMR in 1990 which was 40 per 1,000 live births, there is still a challenge to meet the SDG 3.2 of 12 neonatal deaths per 1,000 live births [7]. This means Tanzania must reduce neonatal mortality by more than 50% before 2030. The maternal mortality rate (MMR) in Tanzania was in 2016 556 deaths per 100,000 live births. This also far exceeds the SDG target of 70 deaths per 100,000 births. The majority of these fatal numbers are associated with challenges regarding care during birth [39].

To reach the Sustainable Development Goal, there are different training programs aiming to improve the skills of healthcare workers in Tanzania. Helping Babies Breath, a program by the American Academy of Pediatrics (AAP) and Laerdal Global Health (LGH), had a remarkable reduction of 47% in newborn mortality from 2010 to 2011 [26]. However, these skills decreased after some months. Further reporting claims that only a one-day training did not result in acquired skills to improve clinical practices. It reported the importance and the value of using a low-dose high-frequency model instead [19].

Tanzania is a developing country, categorized as a low-and middle-income country. The Tanzanian maternal healthcare workers already face exhausting and extended shifts due to a shortage of staff. This results in healthcare workers often having to work in areas they are not originally trained for. Many healthcare workers, even if they aren't formally trained as midwives, are expected to do tasks that usually require midwifery skills. Because of this, continuous education becomes even more crucial, and it is vital to introduce new tools and methods for improving clinical abilities. However, due to already overworked healthcare workers, every new thing added to their working day will become an extra burden to become familiar with. This is increasing their cognitive load even more.

There is limited previous research on the use of service design to reduce cognitive load for healthcare workers in Low- and Middle-Income Countries. There are scarce resources on a more holistic and human-centered approach to get an overview of the whole user journey between healthcare workers and continuing onsite training.

This thesis explores how service design can be used to understand the current flow between healthcare workers and training tools. It seeks to comprehensively look at how the products are being introduced to them,

how, when, and where they are being used, in addition to seeing what happens after the products have been utilized. The primary aim is to understand the needs and possibilities to enhance their skills, avoiding overwhelming tasks and lightening their cognitive workload. In order to achieve this, the study conducts an analysis of four products offered by Laerdal Global Health today to examine the current journey flow of continuous training for maternal healthcare workers in Tanzania.

By applying service design, this project will address challenges in maternal healthcare workers' daily routines and their previous experience with continuing training, aiming to enhance the training process.

1.1 Research Questions

RQ1:
To investigate how experience design can be used when designing training tools for maternal healthcare workers in low-resource countries to reduce their cognitive load and make the users understand the value of utilizing it.

RQ2:
Secondly, I want to explore the value of co-design when designing for foreign and low-resource countries.

Furthermore, this project aims to contribute to how designers, through applying service design and co-design, can create enduring solutions that deliver valuable impact for end users in foreign, low-resource countries.

1.2 Key Terms

PERINATAL HEALTH

Refers to the health of babies from 22 weeks of pregnancy until seven days after birth.

MATERNAL HEALTH

Refers to the health of mothers during pregnancy and before, during, and after birth.

NEONATAL

Refers to newborn babies, and the neonatal period is the first four weeks of a baby's life.

POST PARTUM

It means "after birth" and refers to the initial 24 hours after birth.

POSTPARTUM HEMORRHAGE (PPH)

PPH is severe bleeding of the mother after giving birth. It is one of the leading causes of maternal deaths in developing countries.

STILLBIRTH

The death of a baby after 28 weeks of pregnancy, but before or during birth.

Figure 1: Showing the materinty ward at Igoma Health Center in Mwanza, Tanzaia

Figure 2: Healthcare workers at Igoma Health Center conducting a scenario training with MamaNatalie

2. Background

2. Background

2.1 Laerdal Global Health

Laerdal Global Health (LGH) is a non-profit sister company of the Norwegian company Laerdal Medical. They specialize in developing medical training products and services. LGH specifically focuses on providing innovative and cost-effective health solutions to improve maternal and newborn health in developing countries. They develop products and programs designed to train healthcare workers, support safe childbirth, and enhance the quality of care in order to reduce maternal and newborn mortality.

Time and money are limited resources, especially in low-resource settings. This makes the importance of achieving more with little even more crucial. Therefore, LGH strongly believes in the importance of focusing on low-dose high-frequency (LDHF) when it comes to developing training tools for healthcare workers in developing countries. Research says that the skills of healthcare workers often decrease after four to six months after the training [18]. LDHF refers to short, targeted sessions over time through structured sessions onsite at the workplace. Training in short and frequent doses is not only effective for skill-building but also provides ongoing improvements and helps maintain competence over time.

As part of the LGH's goal to reduce maternal and neonatal mortality, they build their products and services around both scenario training sessions in groups, as well as individual skill-based training.

2.2 Scenario Training

Scenario training is a form of training designed to demonstrate real-life scenarios. They are organized in groups, where the focus is communication, collaboration, decision-making, and clinical improvements around specific topics. It is designed to provide the participants with a practical way of improving their skills and is valuable in a way that it allows the participants to gain experience without real-life consequences. Scenario training is often organized by a facilitator who will start the training by going through a brief and give an introduction to the scenario and topic, assign roles, and go through the equipment needed for the training. Participants are assigned different roles such as midwife, nurse, doctor, or mother, each with distinct tasks throughout the session. During the training, the facilitator should have an overview and control of what is happening and give the participants feedback whenever the simulator is not capable of giving objective feedback. The scenario training will end with a debrief, where the facilitator will go through his/her observations and the group will reflect together on the training outcome.

2.3 Skill-Based Training

In scenario training, the focus is more on demonstrating a real-life scenario where multiple tasks need to be solved simultaneously, just as they occur under actual conditions. Skill-based training, on the other hand, places greater emphasis on specific abilities or competence in individuals. It involves practical and hands-on exercises. For example, practice to do ventilation. Skill-based training programs are designed to enhance a person's skills in performing a particular job or task. The goal of skill-based training is to become competent enough

in various tasks that, in a stressful real-life scenario, one can execute these tasks comfortably and efficiently, minimizing the need for extra effort. This allows the focus to be on the overall situation, rather than getting too focused on individual, small tasks.

2.4 Healthcare System In Tanzania

Tanzania faces many health-related challenges. The Tanzanian healthcare system is divided into three levels: National, Regional, and District. Where each district is again divided into divisions, wards, villages, and streets. Tanzania is a country limited by its resources and it has one of the lowest rates of access to healthcare workers in the world. The majority of the healthcare facilities are public and are run by the government [24]. Due to the scarce amount of human resources and money in the country, and the government being the main source of funding in the healthcare system, the different facilities have issues when it comes to affording expensive training products and equipment. Consequently, due to Tanzania's neonatal and maternal mortality rates exceeding the Sustainable Development Goal targets, Tanzanian healthcare facilities meet the criteria for Laerdal Global Health's not-for-profit pricing [12].

2.5 Midwives In Tanzania

In a typical workday for midwives in Tanzania, they are occupied with tasks like assisting with deliveries, newborn assessments, documentation, cleaning, comforting mothers and babies, and providing health education to other colleagues. There is a lack of midwives in Tanzania [35]. Hence, they are being overworked in demanding environments with extremely long working hours. This results in other healthcare workers often having to step in wherever is needed. Consequently, nurses or other healthcare workers are expected to work as a midwife during birth and do tasks that exceed their knowledge [9]. In addition, there is no specific midwife education in Tanzania [kilde om tanzania moidwoves]. It is just a part of the nursing program. This results in under-qualified midwives, which makes the importance of onsite, continuing education even higher.

2.6 Training Today

Continuing training sessions are usually based on either skill-based individual training or group-based scenario training. The equipment for skill-based training is usually stationed in a specific place, and the healthcare workers can go whenever they have time. Scenario training, on the other hand, needs more organizing and setup. It also needs one facilitator who is responsible for the training session. By being responsible for the training, they have to schedule and organize it, lead the scenario, find the right equipment and simulators, and find a vacant room. These facilitators are healthcare workers themselves and are often engaged and motivated towards training and sharing their knowledge. The training system is based on a system consisting of champions, facilitators, and participants. Where the overall goal is that Laerdal can be responsible for teaching the champions who will further teach the facilitators, who will again teach the participants.

2.7 Champions - Facilitators - Participants

To streamline the implementation process regarding training sessions, it starts with champions, who are healthcare workers. Each champion is given a group of 10 hospitals. They make sure the training happens and identify facilitators within each hospital. They teach the facilitators how to conduct scenario training, use the tools, and maintain ongoing communication to improve their skills as facilitators.

Facilitators are healthcare workers, often charismatic or pedagogical, who are usually engaged in training and have an eagerness to teach other colleagues their skills and share their experiences. They have been trained by champions, and with guidance from the champions, the facilitator plans, invites participants, schedules training, and then conducts the training.

The facilitator's role involves finding participants and enrolling them in training sessions. Participants are regular healthcare workers.

Healthcare worker
Role: Healthcare worker
Tasks: Being a nurse or midwife

Facilitator
Role: Healthcare worker
Tasks: Conducting scenario training + being a nurse or midwife

Champion
Role: Healthcare worker
Tasks: Implementation of training tools and make sure scenario trainings are happening + being a nurse or midwife

2.8 Project and Scope

This project is looking at the training of midwives in Tanzania from a system design perspective. It dives into how four of Laerdal Global Health's current tools operate, their advantages and challenges, and explores how design can be employed to reduce the cognitive burden on healthcare workers during their training. The project doesn't solely focus on the training products themselves but mostly on the entire training process. From introducing midwives to the tools, to their usage and post-training procedures. The aim is to comprehensively understand a midwife's daily routine, identify training-related challenges, and understand cultural variations. While training products may have excellent quality, their value diminishes if they are underutilized or not comprehended.

The ultimate aim is to make continuous training easier to conduct, reducing unnecessary distractions that hinder the training process, and thereby enhancing the skills of the healthcare workers.

2.9 Four Products

The four products I have chosen to use as my outset for this project are NeoBeat, MamaNatalie, NeoNatalie Live, and LIFT. I decided these products to have a variety and a broader approach to how training works in Tanzania today. To look at differences and similarities between maternity and neonatal care training products, compare a clinical product to training products, and look at how healthcare workers utilize and conduct scenario group training compared to individual skill-based training. I decided to look at four different products to get a more comprehensive and holistic picture of healthcare workers' experience and relationship with training products. I focused on understanding rather than limiting myself to one type of training when approaching the topic.

2.9.1 Neonatalie Live

NeoNatalie Live, shown in figure 3, is a smart manikin of a newborn. It responds realistically to ventilation and the heart rate of a newborn, as well as crying to signal a successful resuscitation. It is possible to connect the smart manikin to a digital device, which makes it possible to receive objective feedback after the training session. This makes it possible for the healthcare workers to debrief after the training, and understand what they did right and wrong to improve their ventilation skills. It can also be used together with NeoBeat. NeoNatalie Live allows both individual skill-based training as well as team scenario training. In both cases, it focuses on a low-dose high-frequency approach.

Type: Group scenario training and individual skill-based training

Tool: Digital and physical

Figure 3: Visualizing the utilization of NeoNatalie Live [10]

2.9.2 MamaNatalie

MamaNatalie, shown in figure 4, is a birthing simulator that makes it possible to train on everything from normal to more complex birthing scenarios. It is being used for group training, where communication between the healthcare workers, but also between the healthcare workers and the mother, is an important aspect of it. The mother, who is also the facilitator/operator of the training, has to strap the simulator onto herself. Throughout the training, she will manually control the features of the simulator and give feedback to the other participants.

Type: Group scenario training

Tool: Physical

Figure 4: Visualizing the utilization of MamaNatalie [10]

2.9.3 NeoBeat

NeoBeat is a reusable heart-rate meter to presents an accurate and rapid display of the heart rate of a newborn. This can be seen in figure 5. It provides an objective heart rate and is quicker and more accurate than other methods like stethoscopes. Displaying the objective heart rate for the entire team makes it possible for the whole team to clearly see the newborns' heart rate constantly while performing their tasks.

It is mainly for clinical use. However, it can be used together with NeoNatalie Live for training.

Type: Clinical use and training together with NeoNatalie Live

Tool: Physical and digital

Figure 5: Showing NeoBeat on a newborn's torso [8]

2.9.4 LIFT

The LIFT project, visualized in figure 6, is a hybrid training service that combines a digital tool with physical scenario training around maternal and neonatal care. The idea with the digital component is to collect data during training sessions to address challenging areas and track training progress. Avoiding the cumbersome process of taking notes by hand filling in forms and sending the data somewhere after the training.

Type: Group scenario training

Tool: Digital and physical

Figure 6: Illustrates a scenario training using LIFT [10]

3. Literature Review

3. Literature Review

In the early stages of this project, I conducted a literature study to gain a deeper understanding of the field I am diving into. The literature study is based on articles collected from databases such as PubMed and Google Scholar. To find relevant articles search words such as: “cognitive load”, “maternal healthcare”, “maternal healthcare training Tanzania”, “mHealth”, “cross-cultural design”, “digital literacy developing countries”, “ICT4D” and “health design developing countries” were used.

The following section will go through the theory which has worked as a foundation for the design solution I propose in this project.

3.1 Cognitive Load

Cognitive Load is one of many ways of understanding how people learn. It is a theory in psychology, that explores how the human brain works when it comes to memorizing and how the number of tasks we are dealing with influences our ability to process information. Based upon the work of Baddeley and Hitch, Cognitive Load Theory divides the brain’s memory system into two parts: working memory and long-term memory [40].

Working memory is dealing with all the new information we meet. However, it is not very good at holding on to information for a very long time. The information has to be sent to long-term memory where it is stored for later use [41]. Working memory has limited capacity, and according to psychologist George Miller, it is not able to keep more than five to nine elements simultaneously. Newer research has shown variations of these numbers, but the overall consensus is that the working memory is limited [41]. Long-term memory, on the other side, has unlimited capacity and works as a storage where information can be retrieved when needed [14].

There are three main categories of Cognitive Load.

The first one is intrinsic load, which represents the inherent complexity and difficulty of a task, regardless of how it is presented. It is determined by the number of novel elements and the level of interactivity of each element. An example here is learning how to solve complex mathematical equations. The learner has to understand the relationships between the variables, all the mathematical principles, and different techniques to solve them. All of these steps result in a high intrinsic load.

The second one is extraneous load, which involves the irrelevant distractions of a task when it is being presented. The higher the intrinsic load of a task, the lower the extraneous load should ideally be. An example of extraneous load can be a poorly designed textbook with messy layouts and unnecessarily complicated vocabulary. This makes the mental effort of learning the material harder due to the messy presentation and difficult words, and not the content itself.

The last category is germane load. The goal here is to activate the learner to promote learning. To integrate new and novel information with already existing knowledge. For the learner to understand how to use this new information in problem-solving. To somehow connect the working memory with the long-term memory. One way to think of it is that it is the part of your brain going “Oh, I get it! That’s like…” and then linking the new information to some past knowledge. If we overload the brain, we leave no room for these connections to happen, and the new information will not be remembered [4].

The optimal learning scenario will adjust the intrinsic load to the user's skill level, minimize extraneous load, and activate germane load [28].

3.2 Life Of Midwives

Role Of Midwives:

The primary responsibility of midwives is to have holistic care of childbearing women and newborns. To provide necessary support and care during pregnancy, labor, and the postpartum period. They have a crucial role in reaching Sustainable Development Goal 3 which aims for, among other things, improving maternal healthcare. By preventing early detection of any complications during pregnancy, as well as trying to provide emergency care during birth [16]. World Health Organization (WHO) claims that the majority of maternal deaths could be prevented if there were an adequate number of qualified midwives. Sri Lanka, Malaysia, and Thailand have managed to reduce maternal mortality by more than 50% by investing in midwifery training and universal access to maternal healthcare [31].

Role Of Midwives In Tanzania:

To better understand the role of midwives in Tanzania, let's start by looking at the education system. To become a midwife in Tanzania, they can choose from two educational pathways. They can either enroll in a two-year program to earn a certificate in nursing and midwifery or opt for a three-year course leading to a diploma in nursing and midwifery. Currently, there are no studies that only focus on midwifery education; therefore, midwifery education is integrated into the broader nursing curriculum. Students study midwifery alongside various other nursing disciplines. However, the Tanzanian government has granted approval for an advanced diploma in midwifery, a three-year course available to graduates of the diploma program. This is not implemented yet [27].

Due to a shortage of staff and tight schedules, healthcare workers often find themselves filling in wherever is needed [13]. Consequently, healthcare workers often have to take on the role of a midwife and are required to carry out procedures that surpass their expertise. This underscores the significance of onsite and continuous training even more [27].

Previous studies indicate that the midwives in Tanzania need improved education to enhance their skills to be able to deliver effective and quality maternal care. The suboptimal care is also a result of scarce resources available in the hospitals, inadequate government expenditure, and understaffed wards [16].

Midwives in Tanzania most often work in public, government hospitals [16].The percentage of the Tanzanian government's total expenditure that is going to healthcare is significantly lower than other higher-income countries. This results in a limited number of staff due to the low funding for employing a more suitable number of healthcare workers [16]. Besides the high number of underqualified midwives, the doctor-patient ratio is considerably lower than what WHO recommends [13]. In Tanzania, there is one nurse for every 10,000 people and one doctor for every 25,000 people [13], which falls significantly short of the WHO's recommendation of having 23 doctors or nurses for every 10,000 people [13].

In hospitals facing understaffing, another significant challenge arises regarding the

duration of healthcare workers' training [23]. Healthcare workers often struggle to fully focus on training when they are needed elsewhere in the hospital. In addition, scheduling a group training of healthcare workers working on the same shift at the same ward can be difficult. Nevertheless, existing research suggests the potential establishment of a culture promoting low-dose, high-frequency training in hospitals characterized by low midwife-to-patient ratios and hectic schedules [23]. However, further research is needed to determine the optimal frequency and duration for this type of training [23]. This is crucial for enhancing the efficiency and cost-effectiveness of an onsite, frequent training program in resource-scarce settings [23].

3.3 mHealth and Digital Literacy

The World Health Organization's (WHO) Global Observatory for eHealth provides the following definition for mHealth:

"medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants, and other wireless devices " [32].

This definition is quite wide. However, throughout this project, mHealth will refer to digital tools designed to enhance maternal healthcare workers' education in Tanzania.

The prevalence of personal mobile phones is increasing in Low-and Middle-Income Countries, which results in greater experience related to technological devices. However, the level of digital literacy is still low [17]. The increased usage of mobile phones is paving the way for mHealth to be used for the training of maternal healthcare workers. Given the global disparities in perinatal and maternal deaths, mHealth is breaking down geographical barriers by being able to spread crucial information between countries and enhancing the education of maternal healthcare workers worldwide, thereby enhancing their skills. In addition to being very flexible, allowing training to occur at the convenience of the learners and at their own pace [29].

Digital literacy refers to one's competence in utilizing digital tools and technologies [3]. Low- and Middle-Income Countries tend to have a higher number of individuals with limited digital literacy compared to High-Income Countries (HICs). Yet, the effectiveness of mHealth is mostly studied in higher-income countries [39]. People with low digital literacy are often more skeptical of technology and not that confident using it [25]. Literature talks about the many benefits of digitalizing learning tools in maternal health, but scarcely mention the actual user experience. If mHealth tools should work properly in Low- and Middle-Income Countries, it is important to focus on trust, expectations, and confidence between the users and the technological tool while designing it. The product can be as good as it gets and work perfectly, but if the user is not convinced of the usefulness and value it brings, it won't be used.

3.4 Design In a Cross-Cultural Context

Culture is a complex phenomenon, and tells us, among other things, how social groups work and behave.

Designing in a foreign and different culture requires a comprehensive understanding of the new culture. It is not vital to just translate a service that works in one culture to the

language of the new culture. What proves effective in one culture might not necessarily yield the same results in another. It is necessary for the designer to be conscious of cultural differences, like language, communication, norms, values, habits, behaviors, and taboos. To avoid drawing conclusions based on the designer's own culture and to base the work on biases and prejudice.

Annemiek van Boeijen's book (2020) about culture-sensitive design talks about two approaches to gaining a comprehensive understanding of culture and the importance of looking at the new culture from different perspectives. Cultural understanding can happen through both an emic and etic lens, where it is optimal to take advantage of both lenses. An emic approach is about analyzing a culture within the society itself, while an etic approach focuses on examining a culture from an external point of view. To design a feasible and sustainable product or service in a different culture, it is essential with a humble approach to show the culture that you want to learn from and understand them. Not the other way around [15].

3.5 Health Design In The World Of Midwives

Service design has proven to be successful in developing healthcare solutions and services worldwide [33]. However, there is limited literature on the use of service design in maternal healthcare in developing countries. Given the limited experience with service design in maternity care, it is crucial to ensure clear communication at each step of the process and involve stakeholders in decision-making [33].

A study conducted in Nigeria and Uganda offers a framework for enhancing maternity care in low- and middle-income countries. It emphasizes the importance of gathering insights from all relevant stakeholders and underscores the use of visual communication tools when adopting a co-design approach. Involving various stakeholders throughout the process is imperative. Establishing a narrative to guide stakeholders through co-design sessions emerged as a key takeaway. This narrative facilitated discussions on sensitive topics by creating a non-confrontational environment without the feeling of being judged or challenged. Building trust relies on a mutual understanding of challenges, context, service flows, and an empathetic approach from the designer [33].

Toyama (2011) discusses the challenge companies face in balancing profitability with the act of doing something good. He suggests the main solution lies in engaging and trusting the people that are being designed for, rather than merely selling products to them. This approach fosters inclusion and trust, ensuring active participation instead of just being recipients of help [2].

Additionally, maintaining contact with stakeholders who have participated in the process is crucial to help them recognize the value of their contributions, ensuring that their voices are heard and taken seriously. This fosters ongoing relationships between stakeholders and the designer, promoting continuity [33].

However, it's essential to acknowledge a limitation: staff turnover, driven by shortages and busy schedules, may make it challenging to gather the same healthcare workers for consistent participation. This could potentially reduce their sense of ownership of the solution over time [33].

3.6 Summary Of Findings

Cognitive load theory helps us understand how people learn new things. It explains how challenges and distractions can make learning harder, and talks about how we turn new knowledge into our long-term memory. When our brain gets overloaded, it is harder to remember new information. Therefore, training in overwhelming environments may not be very effective.

Studies have shown that training midwives in developing countries can significantly reduce maternal deaths. To enhance the education of midwives in these areas, mHealth is becoming a more popular tool for sharing knowledge and information across geographical barriers. However, the implementation of using mHealth is not well-documented yet. Especially in low-resource settings. Hospitals in these settings often suffer from a shortage of staff and busy schedules. This makes it hard to conduct training sessions.

Most of the research around mHealth is done in higher-income countries. This means there is a scarce amount of literature on the actual user experience between mHealth and healthcare workers in developing countries. Studies have emphasized the significance of using a human-centered service design approach to involve healthcare workers in the design process for creating viable and sustainable training services.

4. Methodology

4. Methodology

When designing for maternal healthcare workers in a foreign culture like Tanzania, it is important to tailor a unique design methodology to fully understand their issues and challenges. In addition to being flexible for changes that might arise throughout the process. The design process should take the cultural differences into consideration, together with understanding the healthcare workers' needs while accounting for existing contextual and physical limitations. Hence, design solutions need to be holistic. When it comes to designing for developing countries, it is important to emphasize the balance between value and implementation.

To avoid biases being made from the other side of the world, and to ensure human needs are being met throughout the design process, service design and human-centered design have been the main drivers for design methodology in this project. These methods are supported by a set of tools, such as journey maps and co-design sessions, to develop viable solutions.

4.1 Role Of The Designer

My main goal in this project is to design something where the end users can see the value. I aim to implement a solution driven by their insights and needs, rather than on my distant design biases. Even though I am geographically far from my end users, I want to include them as much as possible throughout this project. Building trust between us is crucial. Collaborating closely allows us to develop something together. It is important that they feel ownership of the solutions. Otherwise, its practical use could be limited. I do not intend to develop an idea in Norway and tell them this will solve their challenges. Rather, following Toyama's approach, I aim to iterate together, fostering their engagement and enabling them to adapt the solution to their everyday lives and cultural context. As a designer, I take on two different roles: the first involves actively engaging healthcare workers in the process, creating an environment where they feel comfortable with contributing ideas and collaborating on the development. The second role focuses on creating outcomes and make effective solutions.

4.2 Service Design

Service design is a combination of a toolbox, a process, a mindset, and a cross-disciplinary language. The goal is to get a holistic approach focusing on enhancing services, both from the users' and the stakeholders' points of view. Addressing both conscious and unconscious needs. As a mindset, service design relies on testing and observations to draw conclusions, always putting the user first. This mindset drives the process, where the goal is to improve and develop innovative solutions through iterative cycles. Working in iterative cycles of repetition and exploration plays a central role in service design. It involves consistently testing and engaging with the service's users to understand whether something works or not. The first thing many people think of when they hear about service design is a set of tools, visualized with tons of sticky notes hanging on a wall. However, these tools will not be as valuable without the right mindset. Tools used properly can help visualize the process and create a common understanding and a common language. Using tools to connect people from different silos, to make them understand each other and communicate well, is an important role

of service design. Visualization can be used to make cross-disciplinary people work together, without having to understand too much of each other's world. Always keeping the end user focused, but looking at the challenges from different perspectives [37]. In this project, service design turns human-centered design from theory to action within the proper scope.

4.3 Human-Centered Design

Human Human-centred design (HCD) is a problem-solving approach that emphasizes the need to understand the needs, behaviors, and preferences of the end-users and take contextual surroundings into consideration. To consider both explicit and implicit needs. It is a methodology driven by working with the end user in all the different steps of the process. Involve the end user during the initial research phase and throughout the entire development process. By always testing and talking with the end users, the designer has a higher chance of working on the right problem and designing viable solutions [37].

When designing in a different culture, it is crucial to approach the end users as they are the experts, and you are here to learn. Different stakeholders and experts often know a lot, but no one knows the challenges the maternal healthcare workers meet better than themselves. It is also important to include all the affected users and consider the complex system. It forces us as designers to look at the challenges from different perspectives and re-examine existing assumptions [36]. Another important aspect of HCD is to make solutions that can be tested in the real world with proper end users. Solutions that are beyond low-fidelity prototypes, involve the healthcare workers more on realistic problems to make them feel more ownership of the solution.

A lot of literature and theory exists on the many benefits of mHealth. However, there is scarce data on how end users use the tools. This makes the use of HCD in this project important. A typical working day for maternal healthcare workers in Tanzania consists of many challenges, and there are many hectic pain points to consider. HCD empowers solutions based on demand-pull rather than technology-push [34]. Making the users identify the challenge, rather than technology providers, will result in implementing the most essential products [34].

4.4 Ethnographic

Ethnographic is a qualitative research method, used to get a more comprehensive understanding of a foreign culture and its social norms. One of the main advantages of utilizing ethnography as a research approach is to get direct access to culture. By being immersed in a new social group, you will be able to get a more authentic and real picture of how the culture works, interact with people, and observe dynamics that are hard to understand only by asking or reading about the culture. It is also quite an open method. So instead of aiming for a specific finding, the goal of ethnographics is to better understand the culture itself allowing you to explore in a more general way [5].

This is why this method is being used for this project. With a goal of looking at the challenges with fresh eyes and getting most of my insight from midwives in Tanzania instead of only experts abroad. To try to understand their culture, everyday life, and challenges before starting to develop a solution that I think might work.

4.5 Contextual Inquiry

Contextual inquiry is a design research method, that focuses on gathering insight from the users' natural context. It involves users being observed while they are doing their normal tasks, simultaneously as they talk about what they are doing and why they are doing it [36,20]. One of the main differences between contextual inquiry and other research methods is that the user should take a more proactive role in guiding the session [38].

Designing in a culture I am totally unfamiliar with, opens up a lot of aspects to focus on. Something that sounds like an issue for me, is not a problem at all for the maternal healthcare workers. In addition, they are very busy during the working day, which makes it harder for them to have time for long in-depth interviews. Observing and talking to them while they are doing their tasks is both efficient and focuses more on them teaching me instead of the feeling of being challenged in an interview. To build trust between me as a designer and them. Contextual inquiry is also a good way of gathering the important details about their tasks and challenges throughout the day. Participants being interviewed in a different environment are more often prone to bias than being observed in their natural context. This makes contextual inquiry an important method to gather valuable insight into [1].

4.6 Collaborative Design

Collaborative design will be termed as co-design throughout this project. Co-designing is all about designing with, and not for, the end users. Co-design is about involving all relevant stakeholders in the design process to make an active collaboration between designers and users. This involvement can be done in every step of the design process, with a common goal of learning together, knowledge exchange, and developing together.

This aspect is important in this project, where I am designing for a culture different from my own. It's crucial to communicate my role as a designer, emphasizing my desire to learn from their culture and collaboratively apply their insights to develop sustainable solutions [37].

In this project, co-design will be used both digital and physical together with midwives in Tanzania. The digital co-design session will be conducted before my field trip, to learn directly from them and prepare myself for the field trip. The physical session will be onsite at a hospital with midwives. The goal here will be to create some quick and feasible concepts together.

4.7 User Journeys

Journey Maps is a design tool to visualize the experience of a user over time. Due to being a human-centered tool, journey maps do not only focus on the steps where the user is interacting with the specific product or company, but they look at all the important steps of an experience. It is quite a flexible tool, which can be used to understand existing solutions, find gaps in the experience, and envision future services. The journey maps can be in different scales. Hence, there are often being used more than one to visualize different aspects of the experience [37].

User journey maps have been a great tool to use throughout this project. Both for me as a designer to get a holistic view of maternal

healthcare workers' relation with continuing training, as well as visualizing their journey and my findings in co-design sessions when language barriers are being an issue.

4.8 Workflow Integration Matrix

The Workflow Integration Matrix (WIM) serves as a valuable framework in complex environments, enhancing the comprehension of workflow dynamics and the interaction between users and technology. Designers utilize it to create human-centered workflow systems tailored for clinicians, grounded in theories of human behavior. This tool aids designers in analyzing data, to better understand the different steps of a process and the connection of various tasks and challenges.

In the context of this project, WIM was used to analyze the data collected during a digital co-design session with Tanzanian midwives. The framework required adjustments to align with this project's goals, providing a structured way of organizing data within different stages of training: pre-training, during training, and post-training [21].

4.9 Double Diamond

Double Diamond is a design method and has been used as a foundation of this project, leading me through a creative process consisting of divergent and convergent stages. The first phase defines the right problem, while the subsequent phase focuses on developing the right solution. In addition to guiding me through the project, it has been used to highlight when and where different tools have been used [11].

5. Primary Study

5. Primary Study

Theory talks about the importance of including the end users in the whole process when designing for a foreign culture. This is why it was important for me to not know exactly what the outcome would be like and why my aims were open for so long. I wanted the end users to navigate me and show me their challenges and most urgent needs before developing solutions for them. However, the end users are far away, so the communication is limited. Therefore, I have used experts in the field as much as possible to prepare myself to whenever I talk to the end users.

To improve maternal training for healthcare workers in Tanzania, the training products must be effective and practical. However, even the best products lose their value if they are unused. This led me to look at training more comprehensively–how, when, and by whom these tools are used, how they are introduced, what happens after the training, and what obstacles hinder more training. I aimed to simplify the training process, reducing unnecessary complexities that could add to their cognitive load and discourage training. To understand the culture deeply and design accordingly and effectively, I went on a field trip to Tanzania and visited hospitals.

My approach follows a customized version of the Double Diamond method, visualized in figure 7, encompassing 3.5 stages. These stages involve both diverging and converging steps, and each phase includes specific studies that I will further elaborate on in this section.

5.1 Ethics

Throughout my primary studies, I have followed Laerdal's guidelines regarding the privacy of the data collected from healthcare workers. I got permission from Laerdal to talk to the end users I have talked to. During my field trip, the consent form was delivered to the regional manager, who distributed it to the hospitals we visited. We agreed that the data we collected would be anonymized and unable to trace back to the end users. No personal data would be collected.

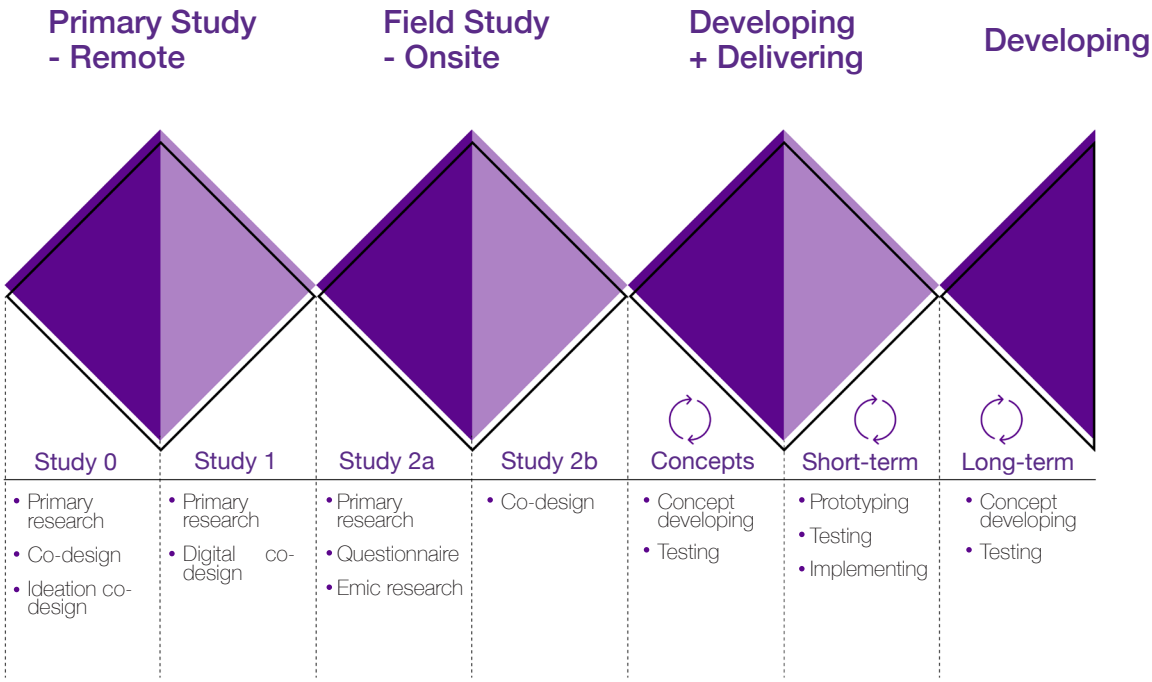


Figure 7: A customized version of Double Diamond, highlighting the different stages of my process and where different methods have been used.

5.2 Study 0: Pre-Study

In preparation for this project, a pre-study was done in the course Design 9 to comprehensively understand the topic, context, and ongoing work Laerdal Global Health is doing. Figure 8 shows where in the process Study 0 took place.

USERS	METHOD	NUMBER OF USERS
Experts from Laerdal Global Health	Semi structured interviews	12
Maternity Foundation	Competetive analysis	1
Designers from Laerdal Global Health	Co-design session	3
Designers from Laerdal Global Health + doctor students	Ideation co-design session	3
Experts from Laerdal Global Health	Heuristic Evaluation	6

Table 1: Methods used in my pre-study and participants

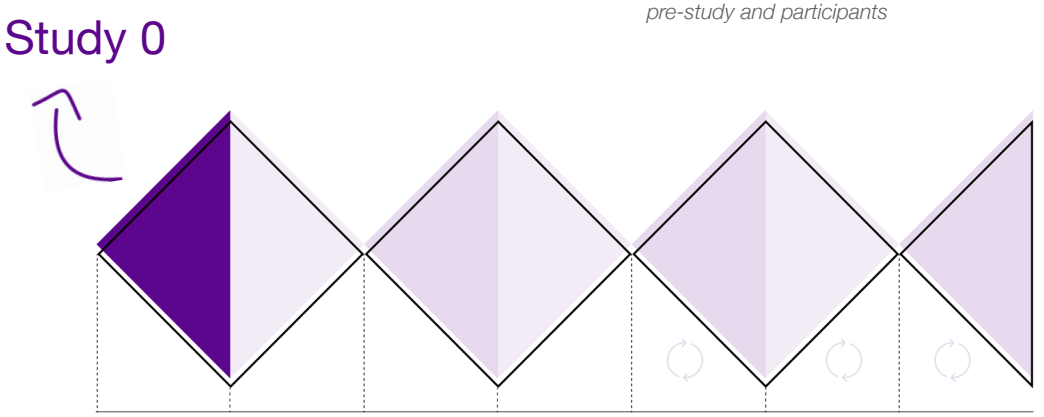


Figure 8: Illustrates where the pre-study was in the process

5.2.1 Background information:

Scenario training is a group training to demonstrate real-life scenarios. For each scenario training, there is a facilitator who conducts the training, distributes roles, and is responsible for going through the correct scenario. In addition, collect data for Laerdal to know how the tools are being used in order to improve them. Documenting is a cumbersome process after the training is over and is more of a burden for the healthcare workers. I aimed to dig deeper into the possibilities around gathering data during the training instead of having to do it afterward.

Aims:

1. Investigate how to support facilitators in gathering data easily during scenario training so it enhances the training instead of just being an extra burden.
2. Investigate how to design something digital for a group with low digital literacy so the benefits of a digital tool surpass the extra challenges it brings adapting to it.

5.2.2 Method:

- Mixed methods were used.
- A combination of literature study, semi-structured interviews, digital co-design session with experts, and ideation co-design sessions with experts.

5.2.3 Literature Study:

A literature study was conducted in the initial phase of the study to get a broader understanding of cultural differences, digital learning equipment in developing countries, training of maternal healthcare workers, and socio-economic conditions. In addition to getting a broader understanding of cultural differences. Followed by looking at prior research conducted by Laerdal Global Health.

5.2.4 Interviews:

The interviews were semi-structured and conducted with both locals and experts. The initial interviews enhanced my comprehension of the culture and the everyday life of healthcare workers in Tanzania. In addition to a better understanding of how continuing education works today, both in Norway and Tanzania.

5.2.5 Co-design Session with Experts:

I conducted a co-design session with three senior designers from Laerdal Global Health to better understand a facilitator's needs during scenario training. We were trying to understand what type of data is needed and to examine why the facilitator should collect data from their perspective. To make the facilitator see the value in the data being gathered.

5.2.6 Ideation Co-design Session With Experts:

The ideation sessions were conducted to generate concepts based on previous insights. Two ideation sessions were conducted, one with two senior designers from Laerdal Global Health and one with two Norwegian doctor students. Preferably, I wanted to engage end users in a co-creative ideation session, yet due to limited connections with healthcare workers in Tanzania, I collaborated with experts instead.

5.2.7 Outcome:

I developed a digital concept, focusing on how to streamline the facilitator's tasks and how to design something digital for someone with low digital literacy. The goal of the service was to help the facilitator gather data throughout the training, to avoid a cumbersome process afterwards. In addition to enhancing the overall quality of the training. A video of how the service works is included in Appendix 1.

5.2.8 Key Takeaways:

Furthermore, the research identified six key challenges around the training of maternal healthcare workers in Tanzania:

1. Work environment

Healthcare workers in Tanzania work in demanding work environments. There is often a lack of essential equipment, resources, and learning materials. Coupled with unreliable electricity and internet, these difficulties create challenges for effective healthcare and continuous training.

2. Tight Schedules

The lack of staff is a huge problem. There are many patients and wards to look after, resulting in extremely long shifts with a lot to do.

3. Motivation

Conducting training sessions poses challenges when it comes to motivation and resource constraints. The motivation to initiate is decreasing due to the shortage of staff and busy schedules, making it difficult to allocate time for training and to take responsibility for conducting a training session.

4. Cognitive Load of Healthcare Workers

The healthcare workers are already overworked. This means that every additional element is perceived as something negative.

5. Low digital literacy

The level of digital literacy is considerably lower in Tanzania than in higher-income countries. This leads to lower confidence in using digital tools, and writing sentences digitally rather than taking physical notes is often more time-consuming. Their understanding of digital systems is also a challenge. Due to the strong hierarchies in the hospitals, they are often afraid of where the data is going and who will read it. If they are being too honest about their shortcomings in a training system, they are afraid they will get fired.

6. Documentation

Documentation of training is another huge challenge. Right now, it is a cumbersome process involving taking notes by hand during the training and filling these into an Excel sheet, which has to be filled in somewhere else to be analyzed. It takes time, and they do not always see the value in doing it, which results in low documentation numbers.

Continuous work:

These main findings and the insight gathered from this pre-study were the starting point of this project. Working with training products and services for healthcare workers in developing countries is entirely different from working with more digital, western solutions. After this study, it was easier to scope down my aims for this project. I ended up focusing my continuous work on the cognitive load during training, aiming to simplify the process for healthcare workers.

> *"They are overworked, so any additional element introduced to their daily work life is perceived as negative.*
> *- UX Design Manager, LGH*

5.3 Study 1: User Study

From my initial study, I understood the busyness of the user group, so any time I spend with them must be carefully planned, and the foundation must be thorough. To better understand previous work, the existing knowledge, and the available information at Laerdal, I interviewed experts specializing in design and implementation within Tanzanian healthcare. While the pre-study provided broader insights, Study 1 aims to intricately explore healthcare workers' working day and their interactions with training products, and identify areas where my contribution could be most impactful. I used these findings to map the current flow of the four chosen Laerdal training products. These maps helped me prepare to engage with healthcare workers. Consequently, I organized a digital co-design session with midwives in Tanzania. Figure 9 shows where in the process Study 1 took place.

USERS	METHOD	NUMBER OF USERS
Experts from companies working with midwives in developing countries	Semi structured interviews	9
Midwives in Tanzania	Digital co-design session	3

Table 2: Methods used in Study 1 and participants

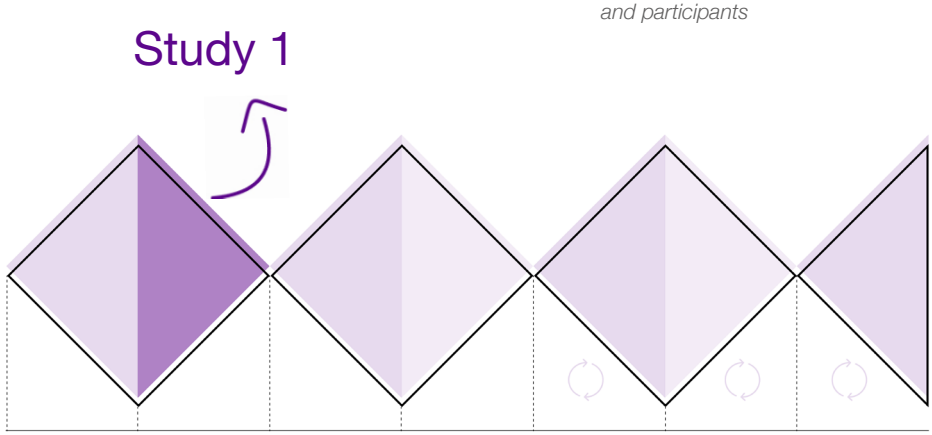


Figure 9: Illustrates where Study 1 was in the process

5.3.1 Expert Interviews

Nine experts were interviewed, all with experience in healthcare, design, or healthcare product development in Tanzania. The conducted interviews were semi-structured. The experts from Laerdal whom I interviewed primarily aimed to make me understand how healthcare workers utilize the four products (MamaNatalie, NeoNatalie Live, NeoBeat, and LIFT). Key takeaways from these interviews are summarized below. Section 5.3.2 will provide more detailed information on the challenges and knowledge gaps of the four products.

Aim:

I aim to better understand how these training products are used, how healthcare workers are being introduced to them, where they have succeeded, and where they face the most significant challenges. Additionally, I seek a deeper understanding of the culture and how to design for it.

Summary:

These findings highlight the complexities around continuing training of healthcare workers in Tanzania, especially scenario training. They emphasize the importance of considering cultural nuances, technological feasibility, and user-friendly approaches.

Key takeaways:

1. Individual skill-based training:

- The healthcare workers are pretty good at learning skills and techniques.
- The challenging part is to transform these learned skills into real-life scenarios.
- Individual skill-based training like NeoNatalie Live is used more than scenario training in groups. NeoNatalie Live can just lay on a table, and healthcare workers can go and practice alone whenever they have time. They are not dependent on others to have some spare time to join.

2. Group scenario training:

- Group training requires more organizing to happen.
- Due to difficulties with organizing, it is challenging to maintain a low-dose, high-frequency culture around the training.
- Organizing, scheduling, and inviting participants are challenging, and there is a lack of knowledge on how this works in practice.
- It is important to focus on communication and decision-making throughout the training.
- A good amount of participants are 5-8 in each training session. If there are more, it is harder to maintain the active participation of all the participants.
- The importance of training together to share knowledge and discuss.

- The importance of documentation after the training. Scenario training expects a lot, both from the participants and the facilitator. How they communicate with each other and how the facilitator is carrying out the training is essential to help enhance the session.
- It is challenging to document key takeaways.
- Facilitators do not have any pedagogical tools, so it is crucial that they are being trained well.

3. Training in general:

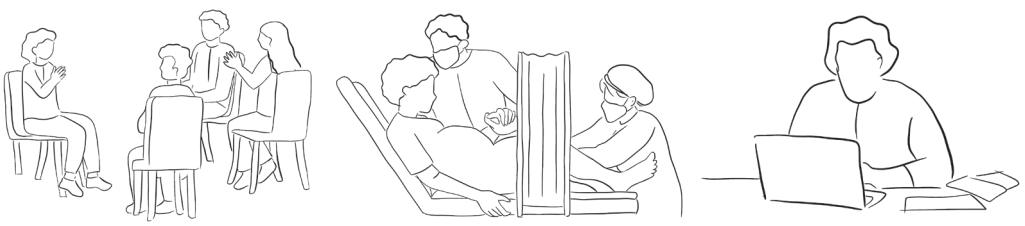
- Less group training is carried out than individual training
- The greater amount of technology that is being implemented, the vulnerability of the solution increases.
- It is challenging to implement digital tools due to unstable internet and unreliable access to electricity and services.
- Midwives prefer services that can be used even though the internet is gone.
- How much change can be implemented in a ward, and how often, without increasing their cognitive load too much? The problem is not necessary the solutions, sometimes it is just too much going on and too many devices and products to use, that it all ends up being overwhelming for the healthcare workers.
- Sometimes, there is a shame and blame culture at the hospitals. Meaning they might lose their job if they are doing something wrong.
- Therefore, understanding the culture is an important aspect of making them feel psychological security when using training products.
- Lack of documentation. There are no electronic documentation systems existing. Everything is manual and cumbersome.
- Most of the staff has their own smartphone.
- If the healthcare workers need help understanding what to do regarding training, they usually ask each other for help.
- It is difficult if the tools do not have any objective feedback. To obtain a valuable training session you need more skilled personnel.

5.3.2 User Journey Map

Simultaneously with the interviews, I created a user journey map for each product. These four products were used to better understand how individual and scenario training works. I was additionally exploring differences and similarities with a clinical tool, NeoBeat. Mapping the flow of the four products helped me approach the topic more precisely and more tangible. The maps I made are less detailed than the user journey maps usually are. That is because, at this stage of the process, it was more important to understand the overall flow of how training products are used from a healthcare worker's perspective rather than going into too much detail on each step. I divided the training process into three parts: Pre-training, During training, and Post-training. The following section will go through each of the four products, identifying pain points across their training process. The entire user journeys are included in Appendix 2.

Aim:

The goal of the user journeys was to use them as a guide for further research. The user journeys were developed alongside the interviews, allowing me and the interviewees to visualize the training journeys, identify shortcomings, and pinpoint pain points. This helped me identify gaps in my knowledge, Laerdal's expertise, and areas where I needed further exploration on how the training process works.



Pre-training

MamaNatalie

- Invitation and organization of the training.
- Choosing which scenario and who is responsible for choosing?
- Understand how the training product works.
- Where do they find information to learn it?
- Prepare the product.
- Fill the MamaNatalie with fake blood.
- Prepare for the case, both the facilitator and the participants.
- Motivation to train.

NeoNatalie Live Individual Training

- Motivation to train.
- Know how to use the product.
- Make sure it works well.

Neonatalie Live Scenario Training

- Invitation and organization of the training.
- Motivation to train.
- Self-preparation, both the facilitator and the participant.
- Understand how the product works.

LIFT

- Invitation and organization of the training.
- Self-preparation, both facilitator and participants.
- Understand how the product works.
- Motivation to train.

NeoBeat

- Understand how the product works
- They do not see the value in using it
- Who is responsible for the installation?
- Understand the charging system.
- Everyone is utilizing it different.
- Charge it
- Know where to find it

Pain point

During Training

MamaNatalie
- Understanding roles.
- Understanding equipment and products.
- Understand case.
- Something urgent is happening, so they have to leave what they are doing.

NeoNatalie Live Individual Training
- Understand the feedback.
- Something urgent is happening, so they have to leave what they are doing.

NeoNatalie Live Scenario Training
- Understand your task and your role.
- Understand the feedback.
- Something urgent is happening, so they have to leave what they are doing.
- Valuable debrief.

LIFT
- Understanding roles.
- Understanding equipment and products.
- Understand case.
- Something urgent is happening, so they have to leave what they are doing.

NeoBeat
- Understand when to use it.
- What to do if the user does not understand the feedback.

Pain point

After Trainng

MamaNatalie

- They have to clean the blood tank and the equipment after the training. Will this make them less motivated to use it, due to the extra work after the training? Is it too cumbersome to set up and clean, and who is responsible?
- How to remember new learnings.
- Clean and disassembly and reassembly .

NeoNatalie Live Individual Training

- A graph at the end showing the ventilation summary can be hard to read for some.
- Something urgent is happening, so they have to leave what they are doing.
- Remember key takeaways.

NeoNatalie Live Scenario Training

- A graph at the end showing the ventilation summary can be hard to read for some.
- Something urgent is happening, so they have to leave what they are doing.
- Remember key takeaways.

LIFT

- Carry out a valuable debrief.
- Remember key takeaways and reflections from the training session.
- Something urgent is happening, so they have to leave what they are doing.
- Overview of previous trainings and their respective key takeaways.

NeoBeat

- Put it back in the charger.
- Clean and disinfect.
- Who is responsible for putting it back where it belongs and to clean it properly?

Pain point

Summary:

The user journey maps helped to pinpoint where the biggest challenges are. Scenario training is a challenging part. It seems like the preparation part is both unknown how it is executed in practice and tricky to solve. Getting everything organized and scheduled is a huge challenge. As well as how the healthcare workers prepare themselves for the training, to become more confident on the scenario and the products. Additionally, how to motivate them to conduct training to maintain a low-dose high-frequency culture. Together with the preparation part, the post-training part is also a huge challenge.

5.3.3 Digital Co-Design Session With End Users

Trondheim, Norway +
Dar Es Salaam, Tanzania

4

Planning:

A digital co-design session with end users was done after completing semi-structured interviews and mapping the four products. Up to this point, the focus has been on gaining a deeper understanding of the current context, how the training process works, knowledge gaps, and the challenges Laerdal faces.

The intention was to maintain a broad scope before the co-design session with the midwives, avoiding personal or Laerdal biases. The goal was to comprehend the local midwives' needs, challenges, and difficulties. Scheduling the digital co-design session early in the semester was intentional. It prepared me for the trip to Tanzania and helped me shape my ongoing thoughts and ideas through direct insights from the midwives. The co-design session aimed to gain firsthand insights from the midwives and understand their daily work routine, their interaction with Laerdal products, and their prior experiences with training.

Understanding their busy schedules, the intention was to ensure efficient and valuable use of their time. The curiosity centered on their willingness to share thoughts and understand their tasks, especially considering the language differences. Visual aids were used to enhance the communication throughout the session.

Being aware of the strong hierarchy in Tanzania and its hospitals, there was a question about how willing the participants would be to openly discuss Laerdal's products, given three representatives were from Laerdal. It was expected that they might hesitate to mention anything negative about the products, fearing it could have a negative impact on them and the collaboration between the hospital and Laerdal in the future. Therefore, creating a comfortable atmosphere was crucial. The focus was on emphasizing a learning-centered approach to show them our willingness to learn from their experiences and listen to their insight without posing any challenge.

To be able to talk and work with midwives before my field trip, it had to be through a digital session. I got help arranging the session from an employee from Laerdal stationed in Tanzania. He helped me to gather midwives and helped me with some language problems during the session. They were all together physically in a room at a hospital in Dar-Es-Salaam, as shown in figure 10, while a colleague from Laerdal and I joined digitally. The presentation is included in Appendix 3.

Aims:

- Explore their experiences using Laerdal products and understand when and where they are using them, the difficulties in utilizing them, and the challenges in comprehending their functionality.
- Investigate cultural disparities, the daily routines of maternal healthcare workers, challenges they face daily, and areas of inefficiency.

Digital Co-Design Session:

Task 1:

In group discussions, productivity might decrease, and not all voices are heard equally. To counteract this, the midwives started to work alone and then discussed in groups. The first task was to better understand a typical day at work for the midwives. The midwives started by writing on post-its, answering these four questions: things they like to do in a day, tasks they often have to do during the working day, challenges they meet in a day, and their experience with medical training and how they prefer to train on new things. Then we went through their answers in plenary while I was filling out the Miro board. They inspired each other to add new ideas and thoughts throughout the talk.

Key takeaways Task 1:

Things they like to do during their working day:

1. Talk to pregnant women
2. Collaborate with colleagues and work in teams
3. Teach other staff new things
4. Follow up babies and mothers
5. Learn new things to enhance their skills

Tasks they often have to do:

1. Collect data and document
2. Make sure mothers and babies are okay
3. Clean ward
4. Writing reports
5. New born assessments
6. Deliver babies

Challenges they meet in a day:

1. Shortage of staff
2. Lack of equipment
3. Long working hours
4. Lack of time for learning, teaching and sharing knowledge
5. Shortage of teaching materials
6. Timetable of scheduling trainings is not working very well
7. Workload

Their experience with medical training:

1. Training new stuff is more commitment and more tiring
2. More training needs more equipment
3. Prefer scenario trainigs over individual trainings
4. Training is often more theoretical, due to lack of equipment
5. Invitations: They share upcoming training sessions in WhatsApp groups, and they use a timetable to schedule, but it is not working that well
6. They miss some type of an overview on what you have trained on and future trainings
7. They are eager to learn new things

Task 2:

The next task was a bridge between the first part of the session and the second part. It was aimed towards training. They were shown a lot of Laerdal training tools and then asked if they had seen any of them before or if they had used any of these products before.

Key takeaways Task 2:

Some of them had used some of the Laerdal products, but they did not feel too comfortable with any of them.

Figure 10: Photo from the digital co-design session showing the midwives sitting together in a room in Tanzania, with a colleauge from Laerdal and I joining on the screen

Task 3:

The third task focused on group training. They were split into two groups with two participants each. Then, I showed them a timeline of group training, divided into before training, during training, and after training. They discussed their experiences around group training, how the group training usually works, what works well, and what is challenging. Initially, the question was open-ended, but later, I introduced specific questions on the Miro board to guide their ideas without steering them in any direction. They were highly engaged, sharing valuable insights. Although we couldn't cover individual training due to time constraints, the main focus was on understanding group training.

Key takeaways Task 3:

Challenges before training:

1. Finding time to train, due to high workload
2. Get the right number of participants
3. When they are going to select participants to join a training they either allow anyone who is free and available, or select those with weaknesses in this specific topic.
4. Self preparation: the facilitator will go through needed information during the training, but it is nice to know the topic beforehand.
5. Rooms might not be available for training
6. Not getting information on time
7. Facilitators are not comfortable on how to use the products and simulators
8. No one is telling you how to use products and when to learn how to use it
9. Availability of tools- Sometimes the tools are not where they are supposed to.
10. Equipment not working. Healthcare workers do not know how to fix them or to proper maintain them.

Challenges during training:

1. Someone has to leave during the training
2. Improvising, due to lack of teaching materials
3. Lack of experience and confidence

Challenges after training:

1. Knowing if they are really practicing after the scenario training to maintain their new learnings
2. Do not have clear rules of who is responsible for the equipment and products after the training
3. Documentation is a burden

Analyzing the data:

To analyze the findings from the digital co-design session, the Workflow Integration Matrix (WIM) was used to better understand the workflow of how training happens today, to better understand the different steps, and to get a comprehensive understanding of different connections and challenges. The WIM is included in Appendix 5, and the main findings from the digital co-design session is included in Appendix 4.

5.3.4 Key Takeaways from Study 1

The following findings highlight key takeaways and the most important observations and insights collected in Study 1

1. The shortage of staff is a major problem when it comes to organizing and conducting scenario trainings.
2. The healthcare workers are passionate about what they do and eager to teach others.
3. Scheduling scenario training is an issue, and they do not have a real system that works today.
4. Most healthcare workers prefer scenario training over individual skill-based training and see the value of training together as a team.
5. The healthcare workers miss an overview of previous and upcoming training sessions.
6. They often lack confidence in using the training products due to lack of knowledge, and staff rotation leads to no one in the ward knowing it either.
7. Due to a lack of knowledge on properly using the products, they are often not used correctly nor treated correctly. This leads to inadequate maintenance of the products, and they often end up not working quite fast.

5.4 Study 2: Field Study in Tanznaia

From the end of October, I spent two weeks in Tanzania, visiting a neonatology conference, two different hospitals and conducted a co-design session with midwives to gather insight. I was traveling with locals from Laerdal all the time. They showed me everything I needed, helped me with language barriers and communication with midwives, and helped me access hospitals. The trip was really valuable for me to better understand the culture, context, how things work, and get the chance to talk to midwives onsite in their natural environments. I went to Tanzania with four main aims based on my prior research.

Aims:

- Explore how a product is received, used, and stored at the hospitals.
- Investigate how group training sessions are planned.
- Understand healthcare workers experience with new products and how they learn to use them.
- Investigate how they keep track of training and skills.

The aims deliberately remained quite open. Before I visitied Tanzania, I did not want to commit to a specific idea until I could gain a deeper understanding of the culture. While I attempted to narrow my aims, I wanted the idea to stem from the midwives. To develop something that directly addresses their needs. Figure 11 shows where in the process Study 2 took place.

USERS	METHOD	NUMBER OF USERS
Midwives from different African countries	Semi structured interviews	6
Midwives, nurses, doctors from different African countries	Questionnaire	12
Midwives and healthcare workers at a hospital in Mwanza	Observing scenario training	6
Midwives and healthcare workers at two hospitals in Mwanza	Observing skill-based individual training	3
Midwives and healthcare workers at two hospitals in Mwanza	Semi structured interviews	4
Midwives, doctors and healthcare workers at two hospitals in Mwanza	Focus group	14

Table 3: Methods used in the first part of my field study (2a) and participants

USERS	METHOD	NUMBER OF USERS
Midwives from Tanzania	Co-design session onsite	4

Table 4: Methods used in the second part of my field study (2b) and participants

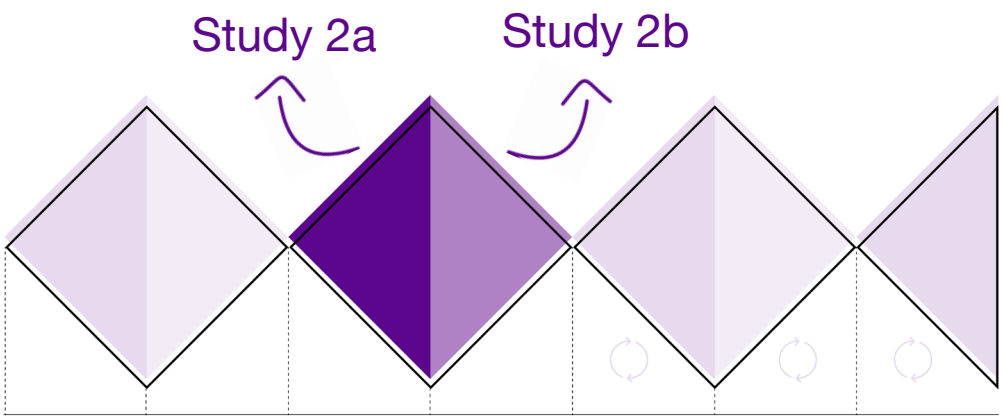


Figure 11: Illustrates where Study 2a and 2b were in the process


pepsi

5.4.1 Conference

Tiny Feet, Big Steps - Conference, Arusha, Tanzania

12

"Tiny Feet, Big Steps - Advancing Care of Critically Ill and Premature Babies in Africa" is an annual neonatology conference in Arusha, Tanzania. Doctors, nurses, and midwives from 15 different African countries were gathered to share knowledge, experience, and skills to help babies survive in low-resource settings in Africa. I attended the conference for two days. Together with two colleagues from Laerdal Global Health, we stood at a booth talking to midwives and nurses and showing Laerdal's products around maternity and neonatal care, see figure 12.

In addition to talking to nurses and midwives, I conducted a questionnaire, shown in figure 13. This allowed me to gather input from those who could not talk while we were standing at the booth. Despite the limited number of questionnaire respondent (n=12), there are some limitations to note. Nevertheless, the data gathered with the questionnaire and the interviews confirmed previous research findings.

Aims:

Investigate the experiences of nurses and midwives from various African countries regarding maternal and neonatal training products. .

Key takeaways:

1. Importance and difficulties around maintenance

2. They need to be more experienced with training products. They often train with real-life patients

3. Reparation of tools is complex and a challenge

4. The staff frequently rotates, so there is often a lack of healthcare workers who are familiar with the proper usage of these training products.

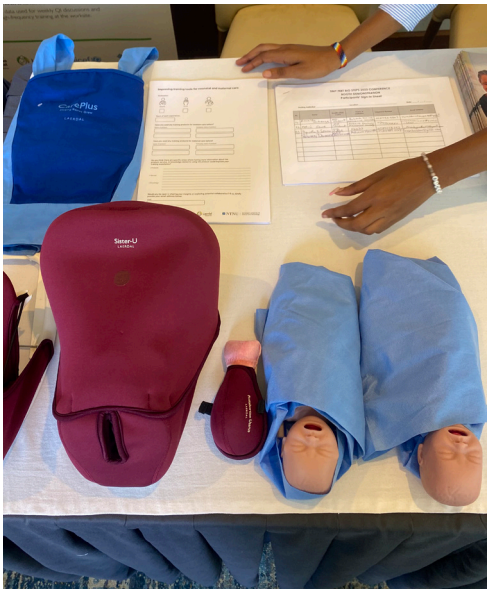


Figure 12: Photo of my questionnaire laying on the table together with the other Laerdal products on the booth

Improving training tools for neonatal and maternal care

Profession:

Midwife ☐ Nurse ☐ Doctor ☐

Years of work experience:

☐

Have you used any training products for newborn care before?

Name of product | Company name of product

☐ ☐

☐ ☐

Have you used any training products for maternal care before?

Name of product | Company name of product

☐ ☐

☐ ☐

Do you think there are specific areas where having more information about the product, service, or knowledge related to using the product could improve your training experience?

- Products _____
- Service _____
- Knowledge _____

Would you be open to sharing your insights or exploring potential collaboration? If so, kindly provide your email address below:

Email

☐

Greger Gahre, Norway
Master Student, Industrial Design, NTNU
greger.gahre@laerdal.com

Laerdal helping save lives

NTNU | Norwegian University of Science and Technology

Figure 13: The questionnaire I conducted on the conference

5.4.2 Observations and Interviews at Igoma and Sengerama Hospital

I visited two hospitals in the Mwanza region of Tanzania, Igoma Health Center, figure 14, and Sengerama District Hospital, figure 15. The hospitals were quite different. Igoma was much smaller than Sengerama. Hence, the structure, training routines, and organization worked differently.

Therefore, I wanted to visit more than one hospital. To see where they are similar and where there are changes. To develop something that can work in more than one hospital. During my stay at the hospitals, I was lucky to be able to talk to midwives, nurses, and doctors in their natural environment, observe both group scenario training and individual skill-based training, conduct a focus group, and conduct a co-design session.

Figure 14: Igoma Health Center in Mwanza, Tanzania

Figure 15: Sengerama District Hospital in Mwanza, Tanzania

Interviews And Observations With Midwives

Igoma Hospital and Sengerama Hospital, Mwanza Tanzania

4

In both hospitals, some midwives showed me around the labor ward while I was interviewing them, shown in figure 19. It was important to make it feel more like a conversation than an interview, to make them talk more honestly. It also helped talking in their environment, to make the atmosphere more natural and easier to ask things that suddenly appeared and would have been missed in an interview somewhere else. The training products were located at a training station, see figure 16.

Aim:

Explore where the training is happening, both scenario and skill-based training, how the labor ward is organized and structured, and understand more of the healthcare workers' daily routines.

> *We usually only conduct 1 or 2 scenario trainings a month*
> *- Midwife, Tanzania*

Key takeaways:

1. Designated areas for training, but within the labor ward
2. Limited space
3. Group scenario trainings are happening in one of the beds dedicated for patients, so if it is a full ward, scenario training is not happening.
4. NeoBeat is hanging on the wall, both on the training station were the training tools are located and with a patient bed.
5. NeoNatalie Live is on the training station and the iPad is locked.
6. The notebook for documentation is on the training station
7. Easier to complete individual skill based training
8. They know how to use the tablet and connect it with the NeoNatalie Live.
9. However, in the beginning it is difficult to use before someone explains how to use it.
10. MamaNatalie is locked inside of a room.
11. Few staff on each shift.
12. Both hospitals have data discussion meetings once a week.
13. The electricity often goes off. This is done by the government. They have some radiators, but not enough for the whole hospital. This results in dark rooms and hallways, and some equipment are not possible to use.
14. They usually conduct 1 or 2 scenario training each month.

Figure 16: Photo of a training station at Igoma Health Center in Mwanza, Tanzania

Observation Of Scenario Training

Igoma Hospital and Sengerama Hospital, Mwanza Tanzania

6

I was lucky to observe a group scenario training at Igoma Health Center, shown in figure 17. I observed a training with MamaNatalie. I was supposed to observe one at Sengerama Hospital as well. However, patients occupied all the beds, so no beds were vacant for training. Only some hospitals in the area receive these training products. The locals know about this, resulting in even more people coming to give birth at the hospitals with these products. This results in even more busy labor wards, which makes it even more difficult to conduct scenario training. The scenario training at Igoma Health Center was successful. However, the session was pre-planned due to our visit, which affected the genuine nature of the approach. Even though the training was successful, no documentation took place.

Aim:

Explore and observe how a group scenario really is being conducted.

Key takeaways:

Igoma Hospital

1. The facilitator has a personal notebook during the training
2. However, the facilitator is not taking notes
3. Scenario training went really well
4. Good debrief
5. No documenting
6. Organization was not real, because they were demonstrating for us, and therefore more people at work
7. The champion was leading the scenario training and worked as a facilitator

Sengerama Hospital

8. All beds were occupied, so they were not able to conduct a training. No rooms available

Figure 17: Photo of healthcare workers at Igoma Health Center conducting a scenario training with MamaNatalie

Observation Of Skill-Based Individual Training

Igoma Hospital and Sengerama Hospital, Mwanza Tanzania

3

I observed individual skill-based training conducted with NeoNatalie Live in both hospitals. Figure 18 is showing the training at Igoma Hospital. Observing the training on the spot, enabled me to ask questions throughout the training, allowing for insights that might not arise during a regular interview. Again, the training is pre-planned, so it is difficult to understand the actual initiative to carry out a training session. However, it gave me a hunch that they understood how it works and saw the value in using the products.

Aim:

Explore and observe how an individual skill-based training is being conducted.

Key takeaways

1. They know how to use the tablet
2. They know how to connect the doll with the tablet
3. They understand the feedback from the tablet
4. They completed a good training

Figure 18: Photo of a healthcare worker at Igoma Health Center conducting an individual skill-based training with NeoNatalie Live

Interview With The Person Ordering The Training Products

Igoma Hospital and Sengerama Hospital, Mwanza Tanzania

2

I interviewed the person accountable for receiving training products in both hospitals.

In this part, I included details about the Moyo, despite it not being among my initial four products. Moyo is a clinical tool to measure fetal heart rate. Highlighting information related to Moyo was essential as it was one of the most frequently used products. This provided valuable insight into the product's maintenance.

Aim:

Explore what happens with the products when they are being received at the hospital, who is responsible for them, and how they are distributed to the wards.

Key takeaways

1. When new products are being received they are being opened and stored in the meeting room, and then distributed to the different wards where they are needed.
2. If the products are not working, they are being sent to the regional manager which will send them forward to Haydom (a big hospital in the northern part of Tanzania)
3. It takes usually at least one week to get new products
4. Biggest issue with NeoBeat is if it stays for a long time without charger
5. Maintenance with Moyo is the biggest maintenance problem. They do not know what to do with them, and end up destroying them

Figure 19: Photo from when I conducted interviews with healthcare workers at Igoma Health Center in Mwanza, Tanzania

Focus Group

Igoma Hospital and Sengerama Hospital, Mwanza Tanzania

14

A labor ward is a busy place where the staff is often caught up with something or has to run due to urgent tasks. This made the midwives I talked to rotate, and new staff joined the conversation. Therefore, it is difficult to have an exact number of healthcare workers in each session. However, I estimate around 8 in Igoma and 6 in Sengerama—a combination of nurses, midwives, champions, and doctors, see figure 20. I conducted the focus groups with my colleague from Laerdal, who knows Swahili. This made the participants being able to speak either in English or Swahili, whatever they were most comfortable with. This made the atmosphere more comfortable for everyone.

Aim:

Investigate the diverse training experiences of healthcare workers to better understand the areas of improvement.

Figure 20: Photo from the focus group

Key takeaways

1. There are few nurses and midwives, but a lot of wards
2. The training can happen in the overlapp between shifts
3. Everyone is together on Thursdays to discuss data, so they usually do trainings at that time because there is a lot of staff at work
4. They do not conduct scenario training because they often expect a champion to conduct it, but the champion is not always there.
5. Most of them are confident enough to conduct scenario trainings themselves
6. Initiativ to schedule and actually conduct a scenario training is the hardest part
7. Not all the training products are stored in the wards, but locked in somewhere else.
8. They wants someone to fix the products when they are not working anymore, instead of having to send them back and wait until they receive new ones
9. Checklist during scenario training works good
10. Someone sends a message in the labour group on WhatsApp whenever they want to conduct a scenario training. Based on intrinsic motivation, and no external factors to motivate training.
11. Participants respond on WhatsApp if they want to come
12. A reminder is being sent out in the same group when the time is getting close for the training.

13. The roles are being distributed in the beginning of the training session.
14. Rotation of staff is a problem regarding the number of people who know how to use the different products.
15. Miss some overview of the previous and upcoming training sessions

> *We usually expect the champion to conduct the training, but when they're not around, no one takes responsibility.*
> *- Midwife, Tanzania*

Continuous work:

The primary challenge lies in scenario training. The communication between healthcare workers in a scenario training session is extremely important. Individual skill-based training works better than scenario training. This leads to a continued focus on scenario training in my work. As well as the importance of proper training on how to use the different products to prevent their misuse.

Key takeaways from the Hospital Visits:

1. Maintenance of training products is a challenge.
2. Organizing scenario training is difficult due to a lack of self-initiative and staff.
3. Incorrect usage of training products due to inadequate learning
4. Products, tools, and equipment were not available to use.
5. Documentation is a cumbersome process, and they do not see the value in spending extra time doing it.

5.4.3 Co-Design Session With End Users

Igoma Hospital, Mwanza Tanzania

4

Planning:

I conducted a co-design session with midwives from Igoma and Sengerama Hospital at the end of my stay, see figure 21. To conduct it, I got help from a local colleague from Laerdal. He knows Swahili, which resulted in most of the co-design session being in Swahili. This made the barrier for the midwives to talk and address issues smaller, making them talk more naturally about their experiences and thoughts. In addition to making them feel more comfortable in the setting. Even though I do not know Swahili, my colleague translated everything to me in real time, and we discussed the findings afterward. However, some things get lost in translation, but I believe it has more impact and value to focus on the comfortableness of the midwives to get the most valuable information, rather than requiring them to speak in english.

Aim:

Collaboratively develop some concepts together with the midwives to further design and develop.

Co-design session:

Before the session, we categorized the five primary findings from my previous research - Maintenance, Organizing scenario training, Correct usage of products, Unavailability of products, and Documentation - into two overarching themes: scenario training and maintenance. At the beginning of the session, all participants anonymously voted on the most challenging topic, and scenario training emerged as the biggest challenge with all the votes. Consequently, the entire co-design session centered around scenario training.

We organized the midwives into groups, ensuring each sat with a midwife from a different hospital. From this point, they went back and forth between individual thinking, group discussion, and presenting concepts and ideas to the other group.

Key takeaways from Co-design Session with end users:

The co-design session resulted in a concept focusing on scenario training and increasing self-initiative to schedule and organize a scenario training. I will go further into detail on the concept in section 6.5.

> *Try to have training at least once a week. It would be easy to find many staff this way and remind one another. We cannot achieve this if we say we do it daily.*
> *- Midwife, Tanzania*

Figure 21: Photo from the co-design session

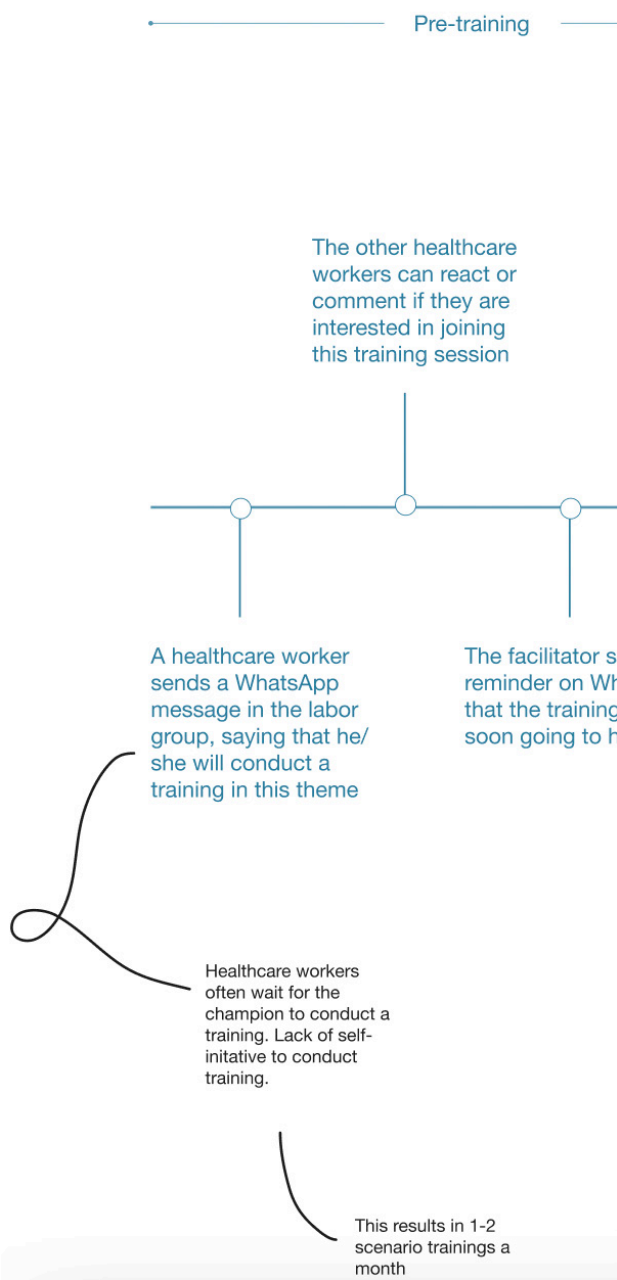
5.5 FINAL ANALYSIS OF KEY TAKEAWAYS OF ALL THE PRIMARY STUDIES

At the end of my primary studies, I was clustering my findings, and they are included in Appendix 6. I looked at how the hospitals, maintenance, and scenario training work today and prioritized these findings. After analyzing these findings, I came up with these four key takeaways that my solution will build upon:

1. The challenge of organizing and scheduling scenario training
2. The low confidence in using the products
3. The limited maintenance of products due to improper use
4. The cumbersome process of documentation

How training works today:

By talking to and observing healthcare workers I got a better understanding on how scenario training works. Figure 22 shows the overall flow of how a scenario training works today. One of the main issues is the lack of self-initiative to conduct a training.



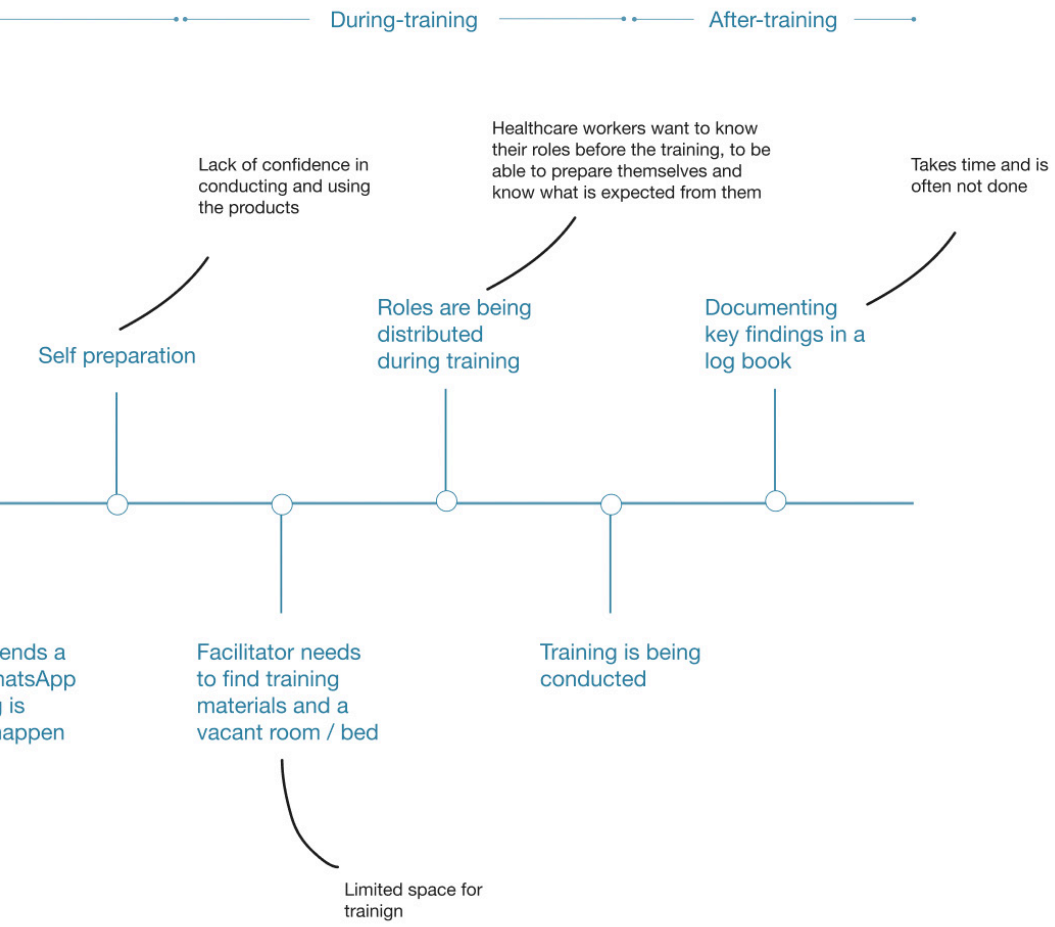


Figure 22: Illustrates how scenario training works today

6. Design and Concept

6. Design and Concept

6.1 Different Core-Stakeholders

Healthcare worker

- Enjoy talking to patients and other colleagues.
- Often work long working days.
- Busy days at work.
- Eager to learn.
- Often unfamiliar with using training tools.
- Love their job.

Facilitator

- Facilitator is a healthcare worker.
- Trained by champion.
- Often pedagocial.
- Eager to teach, but think it is difficult when they are so busy.
- Engaged in training.
- Love their job.

Champions

- Champion is a healthcare worker.
- Responsible for more than one hospital.
- Eager to teach.
- Pedagocial.
- Love their job.

6.2 Final Problems Identified

I spent a lot of time researching to understand the culture, the available resources, and the midwives' challenges and needs. My aim is to develop a solution without increasing their cognitive load even more. The most important aspect of all training is to help the midwives to enhance their skills to decrease maternal and neonatal mortality. This is the part I want to improve as a designer. I want to design a solution that decreases the irrelevant distractions around scheduling scenario training and to make organizing easier. I made two solutions, one short-term and one long-term. The short-term solution is focusing primarily on the "pre-training" phase, see figure 23, addressing three out of the four key takeaways from the previous studies:

1. The challenge of organizing and scheduling scenario training
2. The low confidence in using the products
3. The limited maintenance of products due to improper use

Then, for the long-term solution, the focus is also on documentation, see figure 23, and addresses all four key takeaways from the previous studies:

1. The challenge of organizing and scheduling scenario training
2. The low confidence in using the products
3. The limited maintenance of products due to improper use
4. The cumbersome process of documentation

It is essential to have documentation to see how the tools work and get more data to work with. However, the prime goal is to help the healthcare workers conduct training.

The value of designing one short-term solution and one long-term solution

To develop a solution that would be realistic and feasible to implement, I prioritized the different key takeaways. To make the training happen is the most important goal. To solve all four key takeaways in one solution would be too complex today; therefore, I developed two concepts. One short-term, ready for implementation, and one long-term, which is more of a concept Laerdal could work further on. The short-term solution is a physical, non-digital solution, taking advantage of solutions that already exist today. This means it can be implemented and tested in real life quicker to make progress faster. On the other side, Laerdal is working towards a more digital direction. Therefore, it is also valuable for them to see a digital, long-term solution.

6.3 Aim Of The Final Design Solutions

The short-term solution concentrates on streamlining preparation and pre-training phases to simplify the organization and scheduling of scenario training. Meanwhile, the long-term solution encompasses all stages, including during and after training. See figure 23. On the next page I will go through the main aims of each solution. In section 6.4 I will talk about the theory the two solutions are based on, and then explain the overall concepts in 6.5, and more detailed in part 7.

Aims for short-term solution:

- Improve product maintenance by learning how to use them properly
- Enhance confidence in using the products among healthcare workers
- Develop an efficient system for organizing and scheduling scenario training
- Distribute roles to increase responsibility for conducting training
- Design something that can be implemented quickly
- Avoid too much digitalization
- Incorporate existing successful concepts into the new solution
- Collaborate with midwives to co-design a solution, to make them feel ownership of the solution
- Design a solution that is not too rigid because all the hospitals work differently.

Aims for long-term solution:

- Improve product maintenance by learning how to use them properly
- Enhance confidence in using the products among healthcare workers
- Develop an efficient system for organizing and scheduling scenario training
- Distribute roles to increase responsibility for conducting training
- To further develop their already existing digital solution
- Add the idea from the short-term solution into a digital solution to make it even more streamlined
- Gather data during the training session and make it easier to document
- Continue the work I did with Design 9

Focus areas

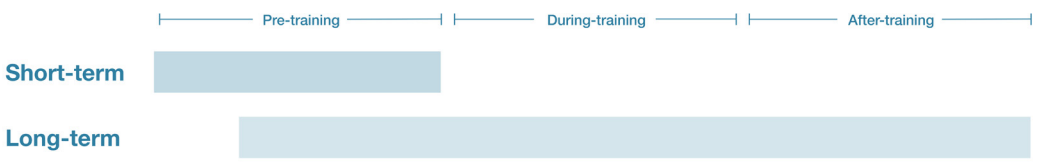


Figure 23: Illustrates the focus areas of the two different solutions

6.4 Cognitive Load Theory

I have used principles from cognitive load theory to enhance healthcare workers' training experience to make it easier to conduct scenario training. These are the choices I have based my further work on to reduce their cognitive load.

6.4.1 Short-term solution:

Decrease intrinsic load

- Distribute responsibility to break tasks into smaller, manageable parts.
- Utilize familiar tools to reduce the difficulty of tasks.
- Make components less interdependent.
- Use various touchpoints to help remember, but without interconnection.

Decrease extraneous load

- Simplify and minimize distractions
- Highlight the most essential information

Activate germane load

- To help healthcare workers remember and utilize the new information about this system, the focus is on preventing cognitive overload by reducing intrinsic load and minimizing extraneous load.

6.4.2 Long-term solution:

Decrease extraneous load

- They have the flexibility to organize, prepare, and schedule training sessions according to their convenience. This enables them to do it in locations other than the maternity ward, the usual spot for training products and iPads. By doing so, they can minimize distractions from their surroundings, such as urgent tasks that require their attention.

Decrease intrinsic load

- Distribute responsibility to break tasks into smaller, manageable parts.
- The intrinsic load is excessively high when introducing a completely new digital system. Although they have their own phones and know how to use them, implementing a new application will currently negatively influence their cognitive load due to its complexity and their limited digital literacy.

6.5 Design Concepts

6.5.1 Design Concept 1: Short-term Solution

As a result of the co-design session with midwives in Tanzania, we developed a concept on increasing self-initiative to conduct more frequent scenario training. The goal of the session was to come up with an idea to improve scheduling scenario training and for them to mention how they would like to implement it.

Concept from co-design:

Name:
Organization of staff at labor ward for scenario training

Description:
Have a training overview to promote conducting scenario training at least once a week. It would be easy to find many staff this way and remind one another. We cannot achieve this if we say we do it every day.

Aims:

- We should have a timetable for the trainings.
- We will distribute roles before training. This will allow healthcare workers to prepare for the roles before the training.
- Distributing responsibilities will increase the self-initiative to conduct scenario training.

Implementation:

- We should encourage one another to continue to do the training frequently.
- We should have a timetable with responsibilities somewhere visible in the ward.
- We should have someone responsible for the training. The nurse in-charge of the labor ward would be ideal because he/she is always around and can help make the timetable and distribute roles. The champion should work with the nurse in-charge to make the timetable.

Who is the nurse in-charge?

Nurse in-charge is a healthcare worker who has gained a promotion done by the government in Tanzania. This promotion gives them more responsibility for the ward, and they have an overview of what is going on.

6.5.2 Design Concept 2: Long-term Solution

The digital, long-term solution uses Design Concept 1 as a foundation and is an iteration of my project from my pre-study.

During the course Design 9, in my pre-study, I was working with the product LIFT and I focused on the “during training” phase. I aimed to create a digital solution integrated with their existing solution, emphasizing data gathering throughout the training. The goal was to enhance the training process while collecting data, instead of making the data gathering an extra element. However, after testing the solution with a local colleague from Tanzania, and based on the insight and knowledge I got during my field trip, I realized that my solution would not work for maternal healthcare workers in Tanzania. Even though I tried to make a solution for users with low digital literacy, it ended up being too reliant on digital elements.

For this project, I am looking at the entire training process– pre-training, during training, and post-training. I have extracted elements from my project in my pre-study and tried to integrate them into my new solution. The long-term solution aims to use the ideas from my short-term solution, emphasizing organization and preparation for scenario training, into a digital framework. Additionally it will focus on documentation of the training effects.

This solution is a long-term solution and is therefore more of a concept than a final solution. It is a digital service, making it easier to schedule and organize training and reach out to the participants. In addition, it helps the facilitator to document digitally throughout the training. Because this is a digital solution, it is not ready for implementation. The midwives have their own phones and services they use quite well today, so the potential exists.

The main difference between this solution and the previous one from my pre-study is the amount of level of intrinsic load.

7. Iterative Design and Development of Solution

7. Development of Solution

Section 7.1 will first discuss the different iterations of Concept 1 and then present the outcome of the short-term solution. Following this, section 7.2 will elaborate on the development and ideas behind the long-term solution.

7.1 Design Concept 1: Short-Term Solution

7.1.1 Iteration 1:

I started to visualize four concepts based on the idea behind the concept from the co-design session, described in 6.5.1. The full concepts are included in Appendix 7.

Today they put training-related posters on the walls in different places in the ward, and there is no pre-planned scenario training. Whenever someone wants to conduct a training, they send a message on WhatsApp to the labor group, and ask people to join in, further explained i figure 22. Because of the workload, it is often difficult to gather a group. It is challenging to find motivation for conducting training when it is not put in a better system. I base this concept on small changes of these already existing solutions.

I made an overview to put on the wall in the ward to distribute responsibility for the training among the nurses in-charge. They then distribute roles to their colleagues through the already existing WhatsApp message. Taking advantage of existing systems that already work, will decrease the difficulty of implementation. The concepts are divided into two parts: one overview for the wall (1.1) and one PDF for distributing and explaining roles (1.2). I will explain the common idea behind the two parts, and then show their different visualizations, see figure 24,25,26,27 and 28.

1.1 - Part 1: The Overview:

The idea is to have a large, printed poster visible in the ward. The champion can distribute responsibility to the nurse in-charge to facilitate training for a specific week. The nurse in charge can write the type of scenario and title. After the training, the nurse in-charge or the champion can put a mark on the poster that the training is conducted.

Key takeaways this idea will aim to improve:

- Develop an efficient system for organizing and scheduling scenario training
- Distribute roles to increase responsibility for conducting training
- Design something that can be implemented quickly
- Avoid too much digitalization
- Design a solution that is not too rigid because all the hospitals work differently.

Aims:

It is easier to facilitate and conduct scenario training when the responsibility is distributed, and everyone knows that "midwife 1" is responsible this week. By checking off when the training is conducted, everyone can see that it is done regularly. The aim is to increase the motivation by making them see that they are reaching a common goal of increasing their skills. It also works as an overview to see previous and upcoming training sessions.

Different visualizations on the overview (1.1):

Figure 24: Visualization of Overview 1 from iteration 1

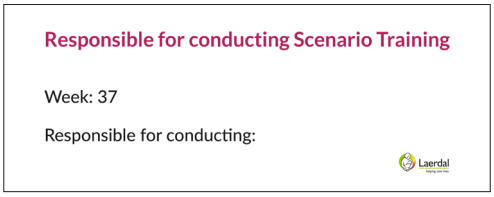


Figure 25: Visualization of Overview 2 from iteration 1

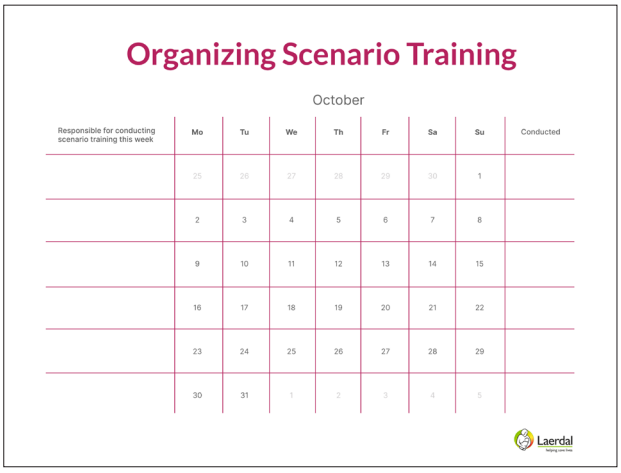


Figure 26: Visualization of Overview 3 from iteration 1

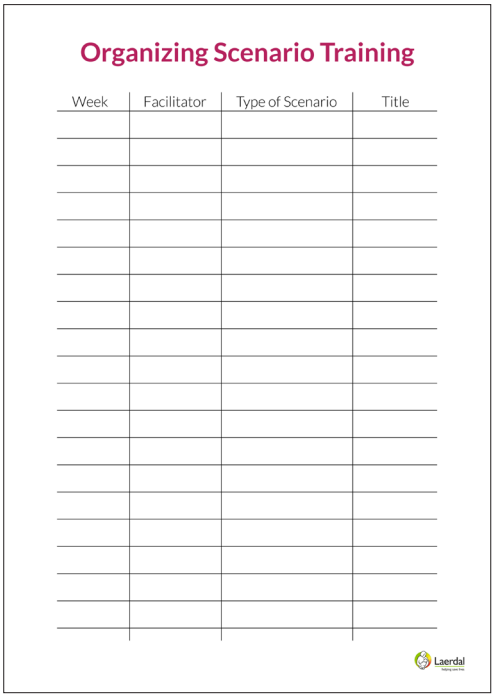


Figure 27: Visualization of Overview 4 from iteration 1

1.2 - Part 2: The PDF:

This part of the solution will take advantage of the WhatsApp message the facilitator sends to the labor group whenever training occurs, see figure 22 on page 76. Together with this message, the facilitator can distribute roles and add a PDF to the message. The PDF is a description of the scheduled training, a tutorial on how to use the product, and a description of the different roles. The PDF is shown in figure 28. In this way, the participants can prepare themselves for the training whenever it suits them and on their own phones. There will exist one PDF for each training, and it will already be made. This means the nurse in-charge is not responsible for making it, just distributing it to the other participants.

Key Takeaways this idea will aim to improve:

- Improve product maintenance by learning how to use the products properly.
- Enhance confidence in using the products among healthcare workers.
- Distribute roles to increase responsibility for conducting training.
- Design something that can be implemented quickly.
- Avoid too much digitalization.
- Incorporate existing successful concepts into the new solution.
- Design a solution that is not too rigid because all the hospitals work differently.

Aims:

The confidence among the participants will increase, so more people can conduct and facilitate training in the future. Knowing how to use a product properly will decrease misusage, which will be positive for maintenance, and the products will last longer. It is easier for the champion and nurse in-charge to distribute roles and responsibilities when the other participants can be trained through the PDF instead of only being trained by the champion.

Scenario Training Preparation

Theme: PPH

Scenario Overview

Maya Angelou, G3 P2 L2 (Gravida 3, para 2, living children 2), who has attended 3 antenatal visits at your facility, arrived with 40 weeks pregnancy (full term) full dilatation and is delivering now.
You have the required logistics to conduct a normal delivery and manage any common complications for the mother and baby postpartum.
You have already identified a helper, prepared the labour room, washed your hands, and checked your equipment.
The baby is born, the amniotic fluid is clear. You have to manage the mother hereon.

Roles

Mother

Tasks

- How to operate MamaNatalie
  - Wear on the body
  - Hold onto the placenta and don't release it after the AMTSL is performed
  - Wait for the facilitator's cue before you release the placenta
- When there is much activity happening around you for removal of placenta- you become anxious and start asking questions frequently.

Midiwfe

Tasks

- Individual tasks for this role

Nurse

Tasks

- Individual tasks for this role

Doctor

Tasks

- Individual tasks for this role

Mother-in-law

Tasks

- Individual tasks for this role

During the training you will use MamaNatalie

MamaNatalie is ideal for training for active management of the third stage of labor, and prevention and management of postpartum hemorrhage. It can realistically bleed up to one liter of blood.
Click here to learn how to use it

Laerdal
helping save lives

Figure 28: Visualization of the PDF idea (1.2). It includes a scenario overview, roles and their respective tasks, and tutorial on how to use the product.

Concept Testing With Experts:

To prevent conceptual errors and flaws, I conducted a heuristic evaluation with experts from Laerdal Global Health before testing it with healthcare workers. This approach allowed me to gather valuable feedback from experts, enhancing the testing with healthcare workers later in the process.

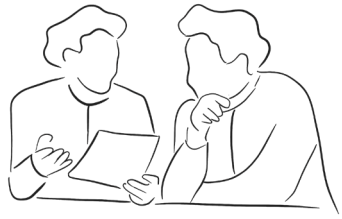


Figure 29: Visualization of Overview 1 from iteration 1

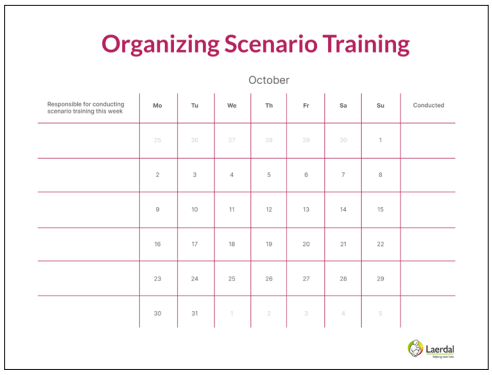


Figure 30: Visualization of Overview 3 from iteration 1

Figure 31: Visualization of the PDF solution from iteration 1

Key findings from the heuristic evaluation:

Overall, the feedback was positive. However, there was a particular need for improvement in the reminder part of the solution.

Reminders:
Facilitators might overlook scheduled activities without notifications due to their hectic schedules.

Flexibility:
Queries about modifying the content on the posters, including changing facilitators or scenario types, and whether such alterations are feasible in the physical version.

Long-Term Scheduling:
Organizing schedules for an entire quarter would benefit preparation. However, this approach requires consistent reminders to be effective.

Simplicity:
The process should be straightforward and not overburden the champions or those in charge.

Google Calendar:
Implement a Google Calendar with detailed information for scheduling recurring events. This would allow individuals to integrate this calendar into their own and receive timely reminders.

Google Docs:
Consider using Google Docs for templates instead of physical copies.

PDF, see figure 31:
The PDF is not ideal for reading on a mobile screen, due to its horizontally long rows and text.

Feedback Overview 1, see figure 29:

- They do not use the word Theme for trainings, but “Title” and “Type”.
- Will the poster be ignored?
- Make the interested column bigger
- Who is responsible for checking off documenting?
- The overview is nice; it will be interesting to see if they fill out the “interested” and “conducted” columns.
- There is not enough focus on who is responsible for each training.

Feedback Overview 3, see figure 30:

- Will the poster be ignored?
- Who is responsible for checking off documenting?
- The calendar stands out for its visualization

7.1.2 Iteration 2:

Based on the feedback from the heuristic evaluation, I iterated further on the concepts. I chose to continue with Overview 1 & 3 see figure 29 and 30.

Changes from iteration 1:

Google Calendar:
Using Google Calendar as an extra toucpoints. The healthcare workers already have their own phones and use Google Calendar today, this can be a valuable touchpoint and work as an extra reminder.

Reminders:
They already use posters, which are easy to overlook. Therefore, by including Google Calendar, I am adding an extra touchpoint. In this way, the nurses in-charge will be reminded through their calendars on their phones and the poster on the wall.

Flexibility:
Modifying the content on the physical posters is difficult. However, by including Google Calendar, the nurse in-charge can invite the participants through a Google Calendar Event and write the essential information here. This information is easier to modify, and the participants will get the updated information on their personal calendars.

Long-term scheduling:
By having a flip-over calendar consisting of all the months in a year, the champions and the nurse in-charge do not need to print out a new one every month. Just flip over to the new month. In this way, all the training history is gathered in one place. It is easy to go back and forth between the months, to plan future training, and to see previous training.

Simplicity:
By delivering the calendar in a physical format, instead of handing over a Google Docs template, the healthcare workers have to do less. A multi-page calendar offers easy writing, regardless of the surface it's hung on. The calendar lasts one year, making it easier for Laerdal to know and follow up with new products/calendars.

PDF, see figure 33:
The layout on the PDF is changed to narrower columns instead of textboxes as wide as the paper. In this way, healthcare workers can zoom in on their mobile phones and read the text without scrolling horizontally back and forth.

Overview 1, see figure 32:
On the table, the theme column is changed to two different ones based on healthcare workers' wording regarding training today. Instead of writing "theme", I have changed it to "Title" and "Type of Scenario."

The two first columns are highlighted, to put more focus on the most important information.

Overview 3, see figure 34:
To increase the focus on who is responsible each week, the calendar highlights the section by adding a background color.

You scan a poster by looking at the top and then read from left to right. Therefor, the most important information is highlighted on the top left side.

To emphasize the need to check off the calendar after the training to show that the training is conducted, I incorporated circles to serve as indicators for this action.

It is more visual, to make it stand out on the wall and easier to see.

Visual representation of changes from iteration 1:

Figure 32: Visualization of Overview 1 from iteration 2

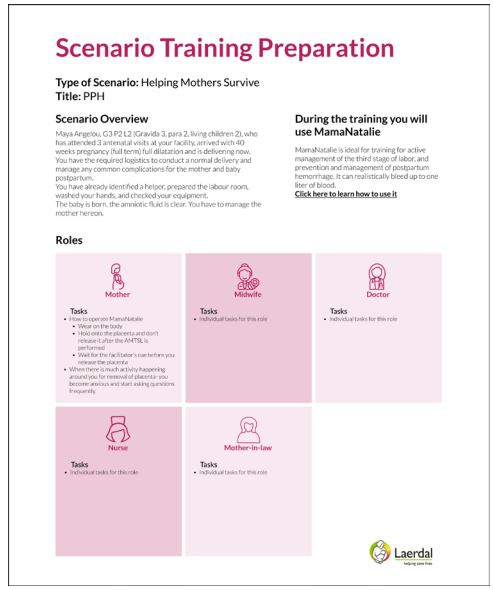


Figure 33: Visualization of the PDF solution from iteration 2

Figure 34: Visualization of Overview 3 from iteration 2

7.1.3 Iteration 3:

Based on the results from iteration 2, I made three concepts, two with the calendar (overview 3) and one with the table (overview 1). All of them with the PDF idea.

I got help translating these concepts into Swahili and shared them with the midwives from the two hospitals I visited during my field trip to Tanzania. This allowed them to witness their ideas and thoughts being transformed into design solutions. I will go through the overall ideas of the concepts, followed by the feedback from the midwives. Full overview of the concepts are included in Appendix 8.

Figure 35: Visualization of Overview 3 from iteration 3

Figure 36: Visualization of Overview 1 from iteration 3

Concept 1:

Features of the Concept:

Physical Calendar (figure 35), PDF (figure 33), WhatsApp, Google Calendar

Description:

1. Champion and Nurse in-charge put up the calendar on the wall in the ward.
2. Champion sends out recurring event of training sessions on Google Calendar to nurses in-charge.
3. Champion fills out the calendar on the wall with names and responsibilities.
4. Nurse in-charge sends a WhatsApp message with roles, type of training, time and PDF to the labor group.
5. Nurse in-charge and the participants are getting prepared for the training session.
6. Nurse in-charge is being reminded by Google Calendar that he/she is responsible for a training this week
7. Nurse in-charge sends out a reminder on WhatsApp to the participants.
8. The training is being conducted
9. Champion/nurse in-charge is checking off the calendar that the training is conducted.

Concept 2:

Features of the Concept:
Physical Table (figure 36), PDF (figure 33), WhatsApp, Google Calendar

Description:

1. Champion and Nurse in-charge put up the table on the wall in the ward.
2. Champion sends out recurring event of training sessions on Google Calendar to nurses in-charge, and says who is responsible for each training.
3. Champion fills out the names of the responsible nurses in charge along with the corresponding week numbers on the table on the wall.
4. Nurse in-charge is filling out “Type of scenario” and “Title”.
5. Participants can write their name on the “Interested” column on the table.
6. Nurse in-charge invites participants to join the scenario training via Google Calendar.
7. Nurse in-charge and the participants are getting prepared for the training session.
8. Nurse in-charge and the participants are being reminded by Google Calendar that the training is this week.
9. The training is being conducted
10. Champion/nurse in-charge is checking off the table that the training is conducted.

Concept 3:

Features of the Concept:
Physical Calendar (figure 35), PDF (figure 33), WhatsApp.

Description:

1. Champion and Nurse in-charge put up the calendar on the wall in the ward.
2. Champion is sending a WhatsApp message to the group with nurses in-charge with an overview of who is responsible for conducting trainings in the following weeks this designated month.
3. Nurse in-charge know he/she is responsible for a training this week, and is being reminded by the physical calendar.
4. When the time is getting closer for the training to happen, nurse in-charge sends a WhatsApp message with roles, type of training, time and provide this PDF to the labor group.
5. Nurse in-charge and the participants are getting prepared for the training session.
6. Nurse in-charge sends out a reminder on WhatsApp to the participants.
7. The training is being conducted
8. Champion/nurse in-charge is checking off the calendar that the training is conducted.

Key findings from testing with midwives in Tanzania:

We sent the three concepts to the midwives together with a survey to collect feedback. We asked about their thoughts regarding whether the concepts would enhance the effectiveness and frequency of scenario training, how easy it would be to implement it, and how practical they think it is to maintain the concept over time. We got feedback from 10 midwives from Igoma and Sengerama Hospitals. The overall feedback was positive, and they liked to see their ideas being developed into solutions. I will go through some main findings from the feedback below.

Calendar:
The calendar will remind you, and every time you look at it, you will know there is something you need to do.

Reminding each other even if someone has forgotten to do something.

Everyone will be oriented on what's happening using the calendar.

We know how to use calendars, so we are ready for this solution.

Preparation for training:
Even juniors will be capable of practicing.

It will empower everyone, including juniors, on how to handle the mother and the baby before and soon after delivery.

Improvements:
Weekly reports should be available if someone doesn't complete their tasks.

We need to supervise the process.

Implementation:
It's easy to implement whenever service providers have the opportunity.

It helps in contrast to now, where organizing scenarios relies solely on a champion, and without them, nothing will happen.

We've been trying to make it possible for a long time with very little success. By establishing this practice, it will become more frequent.

Ease of concept adaptation in daily use.

If it's well received, I'm sure it will be used for a long time because it will be clear and provide time for preparation for those involved.

Distributing roles and responsibility:
When someone forgets, it will be easy to remind each other through the calendar.

Each nurse will be responsible for different tasks, and it's clear.

> *A person can be reminded even if they have forgotten.*

> *I have liked it and I hope it starts soon.*

> *It will be easy to start using it.*

> *We'll strive to improve because the tools are friendly to us.*

> *More practice leads to more competence.*

> *We know how to use calendars, so we are ready for this solution.*

7.1.4 Final Solution Of Concept 1:

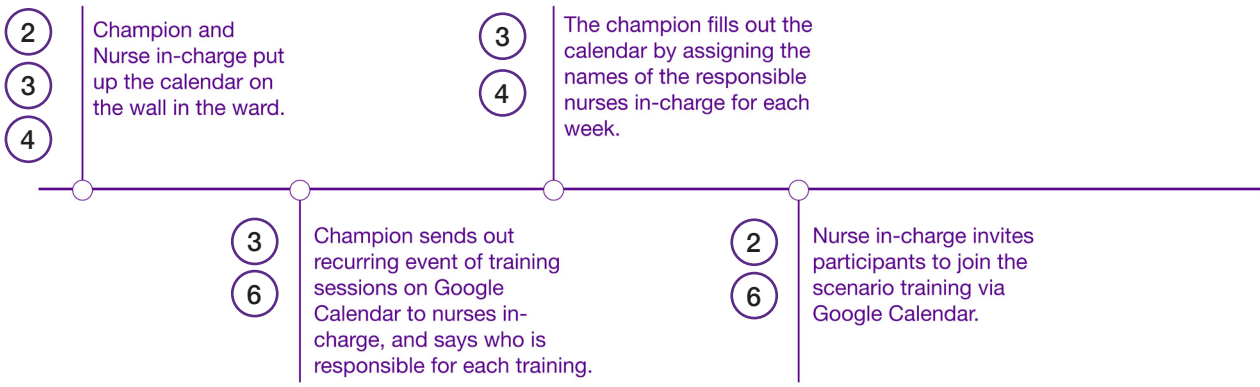
The midwives leaned towards Concept 2, yet they appreciated the layout of the overview in a calendar format. Consequently, I combined Concept 2 with the calendar layout instead of the table overview. The solution is ready to be implemented, and the plan is that Laerdal will try to implement the solution in one of the hospitals in the beginning of 2024, to test it in real life. The flow of the solution is illustrated in figure 37.

Description:

Laerdal Global Health will be responsible for making the calendars and the PDF for the different scenario trainings. By having a flip-over calendar consisting of all the months in a year, the champions and the nurse in-charge do not need to print out a new one every month. In this way, all the training history is gathered in one place. It is easy to go back and forth between the months, to plan future training, and to see previous training. A multi-page calendar offers easy writing, regardless of the surface it's hung on. The calendar lasts one year, making it easier for Laerdal to know and follow up with new calendars. A more detailed stakeholder journey map is included in Appendix 9.

The physical calendar will be on a wall in a visible place in the ward. It will display each nurse in-charge's assigned training weeks and indicate their responsibility for conducting a scenario training a given week. The champion can send Google Calendar reminders to the nurses in-charge, who can further invite the chosen participants. In this way, the training can be added to their personal calendars, serving as an extra touchpoints as a reminder to make the training happen. Google Calendar is something they are familiar with today. Additionally, the nurse in-charge sends WhatsApp messages to the labor group, assigning roles and sharing a comprehensive PDF with case details, product tutorials, and task descriptions. The PDF makes it possible for the participants and the facilitator to prepare themselves for the training. As the midwives said in the feedback, even juniors will be able to conduct trainings in this way. Below, there is a visual timeline illustrating the solution, its various steps, and the features utilized.

Timeline of the solution:



Participants

1

Nurse in-charge

2

Champion

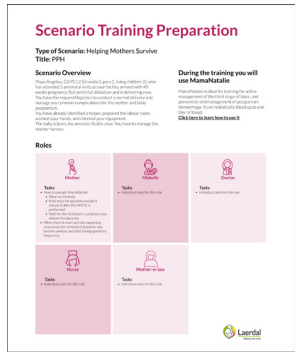
3

Google Calendar

6

Calendar Overview

4



PDF

5

2
5

Nurse in-charge sends out a WhatsApp message to the labor group, distributing roles and adds the PDF.

1
2
6

Nurse in-charge and the participants are being reminded by Google Calendar that the training is this week.

2
3

Champion/nurse in-charge is checking off the circle that the training is conducted.

1
2
5

Nurse in-charge and the participants are getting prepared for the training session.

1
2

The training is being conducted

Figure 37: Illustrating the different steps of the solution and where the different features are supposed to be used

7.2 Design Concept 2: Long-Term Solution

Design Concept 1, the short-term solution, was tested with end-users and experts, whereas Design Concept 2 was solely tested with experts. This long-term concept aims to offer valuable digital features for Laerdal's future development. Given that healthcare workers have limited time and busy schedules, I believe the concept is not ready nor suited to be tested with midwives. The solution is far from ready to be implemented. Currently, the healthcare system faces challenges with internet reliability, electricity access, and low digital literacy. Consequently, implementing a new digital system will result in an excessively high cognitive load. Testing at this stage might cause confusion among healthcare workers, preventing them from seeing iterations and results. However, it uses the ideas from Concept 1: short-term solution, which was developed based on ideas from the midwives.

Key findings from heuristic evaluation of Iteration 1:

- They liked the idea of organizing and planning scenario training on their personal phones, as well as to make it possible to prepare for training wherever and whenever.
- They were positive to the feature of adding participants to the training, as well as making it possible to set up a training at home or while they have time at work. Instead of being reliant on the tablet in the ward, where they usually are interrupted by urgent tasks they have to help with.
- Like the idea that the participants get a notification to be reminded for the training
- Internet is an issue.

7.2.1 Iteration 1: The Overall Idea

Today, Laerdal's digital solution only focuses on the training itself. I wanted to incorporate scheduling and preparation into this digital system to enable facilitators to organize and schedule training on their own phones and then invite participants whenever they have time. In addition to helping them prepare for the training.

I started by testing the overall idea, showed in figure 38, with experts and explained the ideas of the new features.

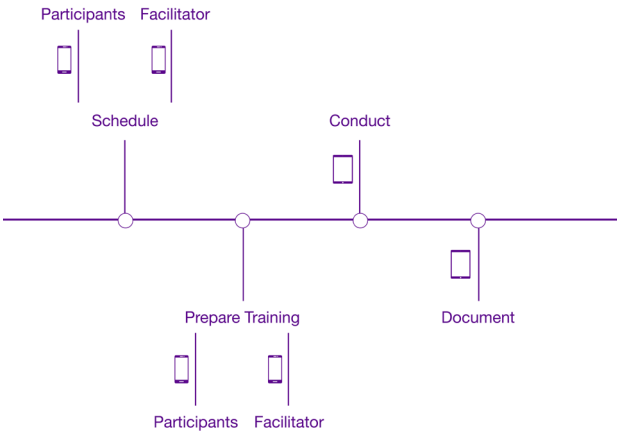


Figure 38: Illustrates the first flow of the long-term solution, and it shows where phones and tablets are going to be used

7.2.2 Iteration 2: A More Detailed Journey

I was still working on the logic behind the digital system, and I was trying to make the journey more detailed, as shown in figure 39 below. I tested this flow again with experts from Laerdal.

Key findings from the heuristic evaluation of Step 2:

- Focus on communication during the training, try to avoid too many digital distractions.
- How are they going to select team and distribute roles?
- Documenting after the training is still an issue.
- Is there going to be a different flow for participants and facilitators?
- Make it possible to say you are interested in an upcomming training session.

7.2.3 Iteration 3: Prototyping

Based on the feedback on the idea and the flow of the digital service, I made an information architecture diagram, which is included in Appendix 10, so it would be easier to visualize the flow and the different screens needed. Then I started to make a prototype to visualize the concept.

The aim with this prototype is to show how I, with a fresh pair of eyes, would solve this digital system now, my design decisions, and provide ideas to Laerdal based on the project's insights.

Figure 39: Illustrates the main flow of the long-term solution, telling what each step will include

7.2.4 Final Solution Of Concept 2:

The design was iteratively tested during the concept development, focusing on healthcare workers with low digital literacy. It aims for visual simplicity, easy comprehension, featuring large buttons, and offering limited options for ease of use.

In the following pages, I will go through the different stages of the solution, see figure 40, talk about the aims of each step, highlight the key takeaways they aim to enhance, and share some of my design decisions.

The solution consists of three main parts:

1. Scheduling Training
2. Preparing for training, both for the facilitator and the participants
3. Conducting and documenting the training

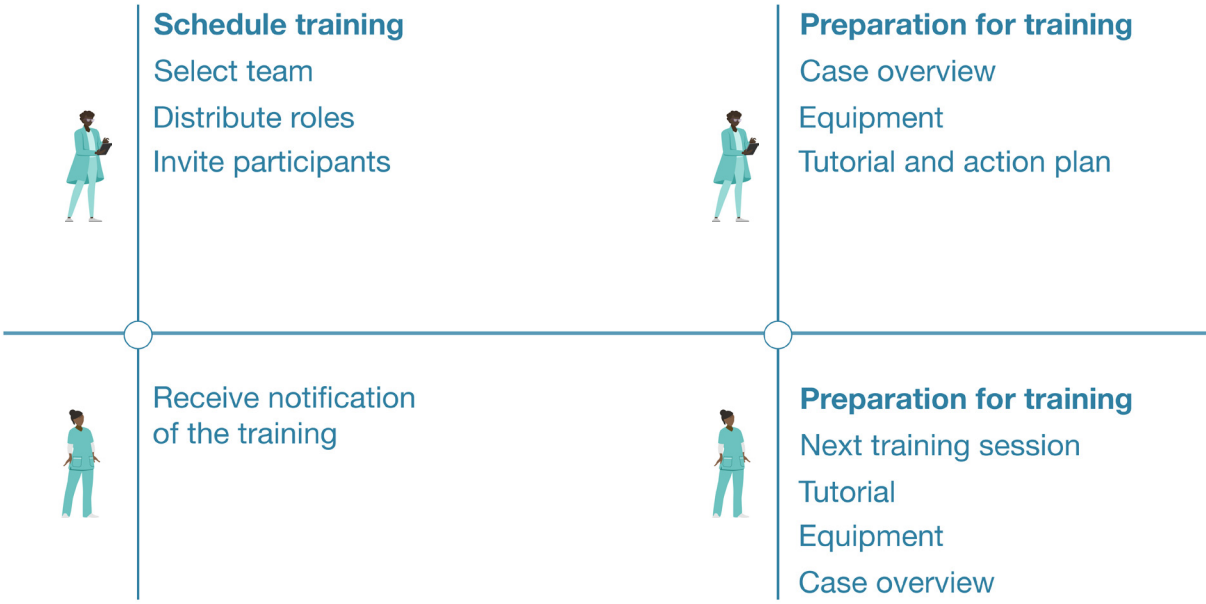


Figure 40: Illustrates the main flow of the long-term solution, showing what each step will include and shows which tasks are for the facilitator and which ones are for the particiapnts

Link to the application showing how the service can help to prepare and schedule scenario training:

Figma Link

Link to the application showing how the service can help to conduct and document scenario training:

Figma Link

Participants

Facilitator

Conduct training

Facilitator introduce the case and equipment

Facilitator observe and take digital notes

Debrief

Reminder notification of the training

Documentation

Document challenging and succeeded topics

Document key takeaways from the training session

1. SCHEDULE TRAINING

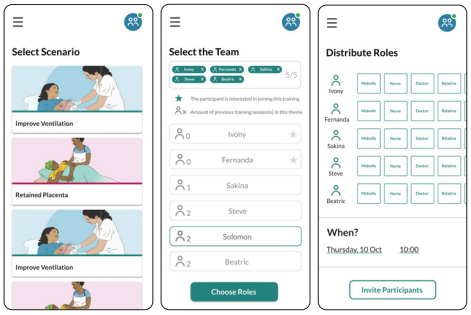


Figure 41: Shows some of the screens belonging to the “scheduling part” of the long-term solution

2a. PREPARATION FOR TRAINING - PARTICIPANTS

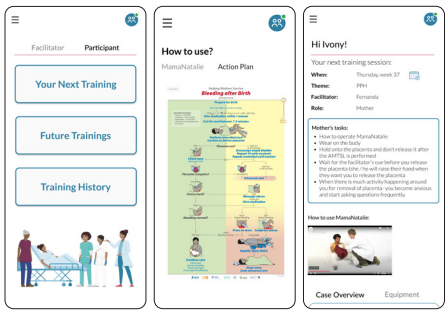


Figure 42: Shows some of the screens belonging to the “preparation part for the participants” of the long-term solution

2b. PREPARATION FOR TRAINING - FACILITATOR

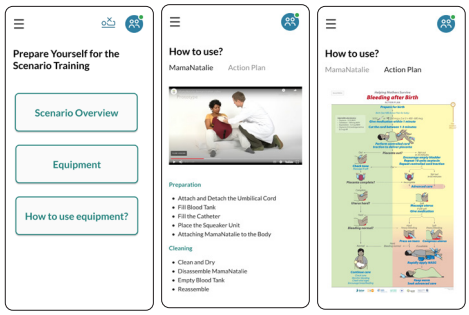


Figure 43: Shows some of the screens belonging to the "preparation part for the facilitator" of the long-term solution

3. CONDUCT AND DOCUMENT TRAINING

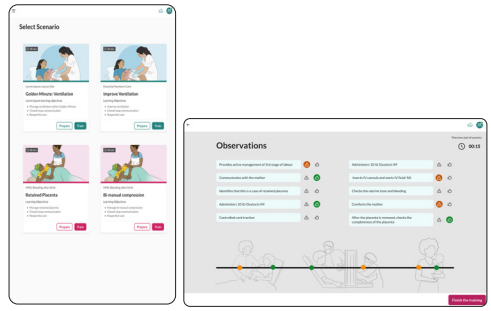


Figure 44: Shows some of the screens belonging to the "conducting and documenting part" of the long-term solution

1. Schedule Training:

Description of this part:

In this part, the facilitator can schedule a training session by selecting a scenario, selecting the team, distributing roles, setting a time, and inviting the chosen participants. It is lower barrier to use their own phones, instead of a common tablet locked in at the ward.

I will go through my design decisions for some of the screens in the following part.

Key Takeaways This Part Will Aim to Improve:

- Develop an efficient system for organizing and scheduling scenario training
- Distribute roles to increase responsibility for conducting training
- Further develop their already existing digital solution
- Add the idea from the short-term solution into a digital solution to make it even more streamlined

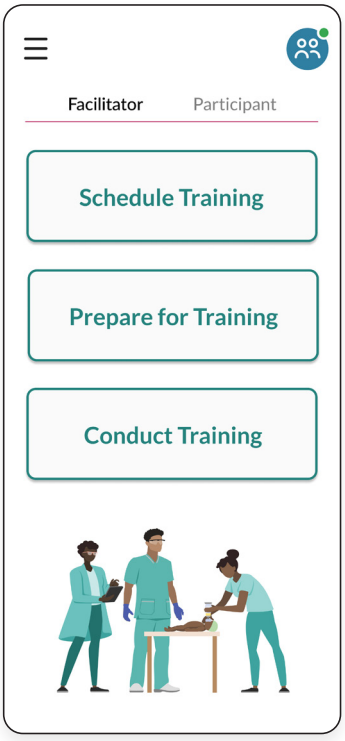


Figure 45: The facilitator's menu

- The facilitator will use the service to schedule, prepare, and conduct the training.The participants will mainly use it to prepare themselves. The main goal is to decrease the burden of organizing the scenario training. That is why the facilitator's menu is the default when someone is logging in, as shown in figure 45.
- By scheduling the training on their phones, they can do it wherever and whenever they have time. They do not depend on some common equipment or a specific time during busy days.
- Big buttons to enhance the user-friendliness.

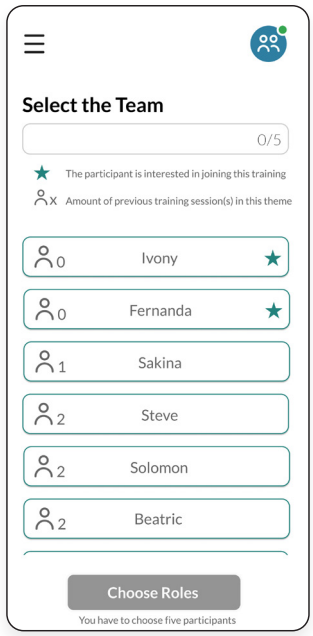


Figure 46: The facilitator can select participants to join a scenario training

- The facilitator can see which participants are interested in this specific scenario training, visualized in figure 46.
- Symbols are explained with text to remove confusion.
- The participants' names are accompanied by the number of past training sessions related to this theme. The list is organized so that the highest numbers are on the bottom and the lowest on the top. To ensure the staff is getting equal training to enhance the total of skills at the maternity ward.
- By showing who is interested and having their names in ascending order regarding their previous training session will make it easier for the facilitator to choose the participants for this training. In addition, make sure everyone is being trained.

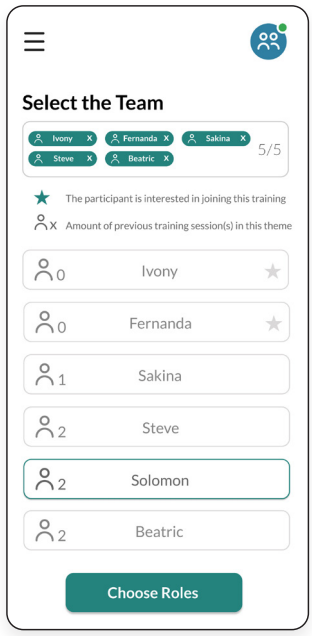


Figure 47: The chosen participants are moved to the top and marked in green

- The chosen participants are turning light grey to distinguish between the chosen ones and the others.
- The facilitator receives feedback on the number of participants needed for this scenario training.
- Whenever the correct amount is chosen, the button on the bottom turns green, see figure 47.

Figure 48: The facilitator can distribute roles to the chosen participants

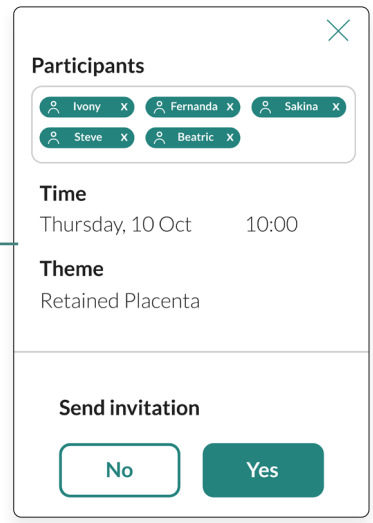


Figure 49: Pop-up screen appearing before the facilitator invites the participants for a scenario training

- By distributing roles to the different participants, they can prepare themselves for the training and know what is expected from them.
- Distributing roles fosters readiness and accountability among participants. See figure 48.
- When the facilitator presses the button to invite the participants, a pop-up screen will appear to make sure he/she understands that the invitation will be sent, see figure 49. The pop-up screen will contain a summary of the prepared training session.

2a. Preparation For The Participants:

Description of this part:

Whenever the facilitator invites the participants, they get a notification on their phones. The participants can enter the service to read more about their next training. They can see their role, read about their tasks during the scenario training, learn how to use the training products, get an overview of the case, and go through the equipment needed for the training. In the menu bar, they also get the chance to see future training sessions and their training history.

I will go through design decisions for each screen in the following section.

Key Takeaways This Part Will Aim To Improve:

- Enhance confidence in using the products among healthcare workers
- Improve product maintenance by learning how to use them properly
- Overview of previous and upcoming training sessions
- Reach out to the participants
- Enhance the flexibility regarding when to get prepared

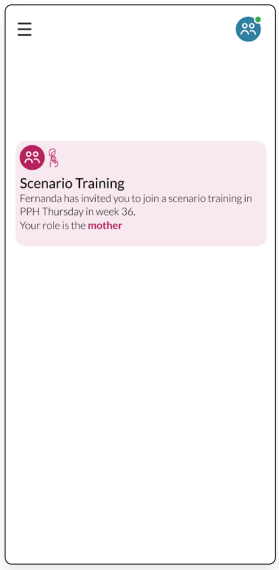


Figure 50: Whenever a participant is being invited to a scenario training, he/she will receive a notification on their phone

- Whenever the facilitator sends out the training invitations, each participant will receive a notification on their phones of the training they are invited to, as shown in figure 50. The notification tells the participant when the training is, who the facilitator is, the title of the training, and the participant's role.
- In this way, it is easier to reach out to the participants for the facilitator.
- The notification works as an extra touch-point and works as a reminder for the training.

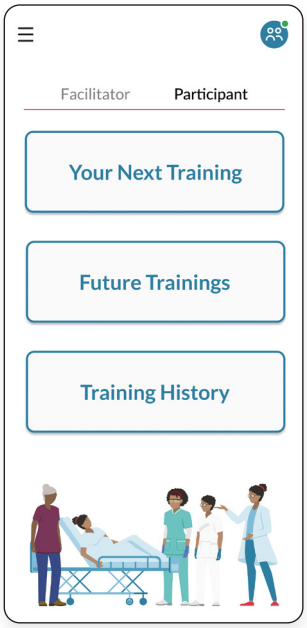


Figure 51: The participant's menu

- The participants can check the training on their phones. They can do it wherever and whenever they have time. They do not depend on some common equipment or a specific time during busy days.
- They are more flexible when they can use their own phones.
- Big buttons to enhance the user-friendliness, shown in fiugre 51.
- When participants select 'Future Trainings' they will access an overview of upcoming training sessions. Additionally, they can view a list of various scenarios and choose those that interest them, indicating their desire to attend a training on a specific topic.

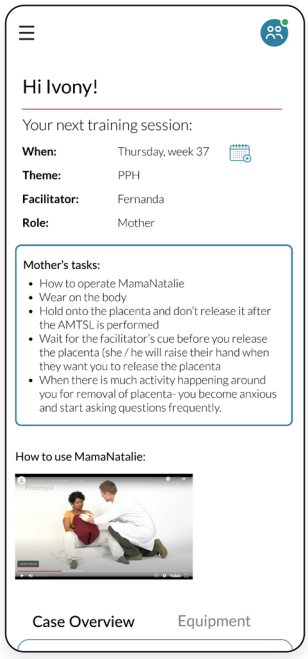


Figure 52: Training overview of the participant's next training

- The participants can read about their next training session and add it to their personal calendar by pressing the calendar symbol, see figure 52. This will make it easier for them to remember.
- The participants' tasks are highlighted and written with bullet points, so it is easy to read all of them and get a quick feeling of what is expected from them.
- It is also possible to watch a video on how to use the training product, read about the case, or check the needed equipment.
- All of this preparation is to make the participants more prepared for the training, so whenever all the healthcare workers meet, they can use their time to focus on the training and not spend a lot of time briefing the whole group.
- The potential damages might decrease once the participants know how to use the products properly, resulting in better maintenance.

2b. PREPARATION FOR THE FACILITATOR:

Description of this part:

Whenever the facilitator has scheduled a training, he/she can prepare for it. They can get an overview of the scenario, go through the needed equipment, and learn how to use the training product.

I will go through design decisions for each screen in the following section.

Key Takeaways This Part Will Aim To Improve:

- Improve product maintenance by learning how to use them properly
- Enhance confidence in using the products among healthcare workers
- Increase confidence when conducting training
- Enhance the flexibility regarding when to get prepared

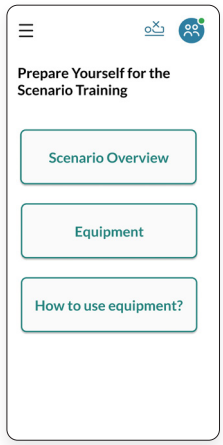


Figure 53: Menu for preparing the facilitator for the upcoming scenario training

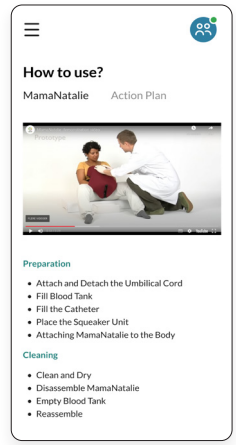


Figure 54: Tutorial on how to use the training product needed for the scenario training

The facilitator can check and prepare for the training on their phones, see figure 53. They can do it wherever and whenever they have time. They do not depend on some common equipment or a specific time during busy days.

They are more flexible when they can use their own phones.

The preparation is to make the facilitator more prepared for the training, so whenever all the healthcare workers meet, they can use their time to focus on the training and the facilitator is confident enough to conduct the training.

Opens up for facilitators with not a lot of experience in conducting training because they are getting this learning material, as shown in figure 54, to prepare themselves to increase their confidence.

Whenever the facilitator know how to use the products properly, the potential damages might decrease, resulting in better maintenance.

3. Condict The Training As a Facilitator

Description of this part:

This part is for the facilitator to use during the training session. The facilitator will brief the participants about the scenario and ensure they understand their roles, tasks, and the scenario. Whenever the training starts, the facilitator can use the tablet to address and document things that are going well and things that could be improved regarding the action plan. Ultimately, the facilitator can document key takeaways from the training session.

Key Takeaways This Part Will Aim To Improve:

- Make it easier to document during the training instead of just after.
- Prioritizing data, avoiding writing long sentences
- Visualize the data to make it easier to connect it with the training and make the healthcare workers see the value.
- Take advantage of principles that work today to make the adoption easier.

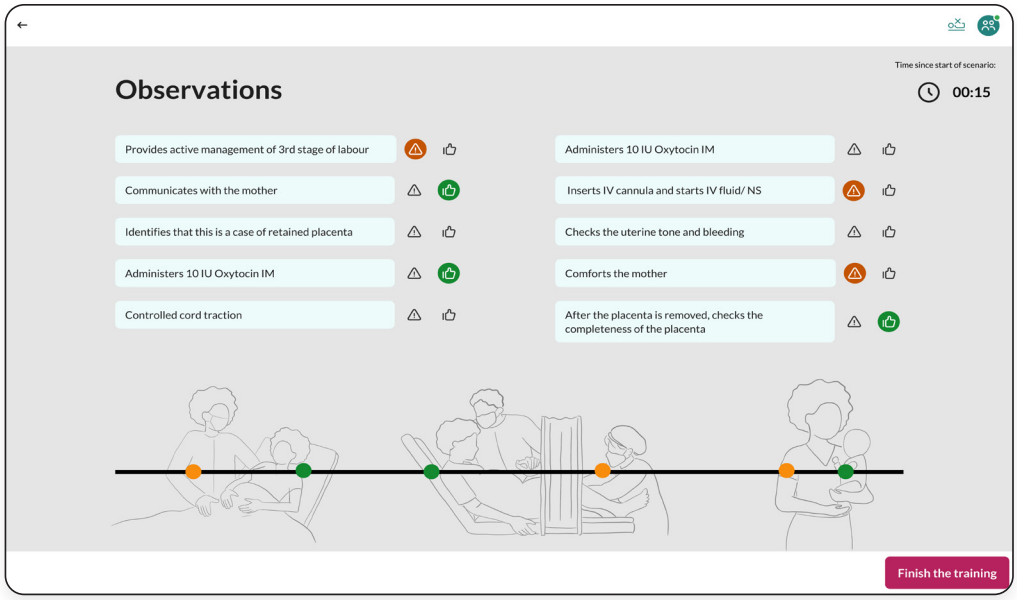


Figure 55: The facilitator's screen during a training session

- This part, shown in figure 55, is a new iteration of my delivery in my pre-study.
- Unlike the initial part of the concept, this part is designed to suit a tablet screen. The scheduling part of scenario training in this digital service offers flexibility, allowing healthcare workers to manage it at their convenience using their personal phones rather than relying on a shared tablet within the ward. However, utilizing the tablet becomes more advantageous during training sessions held in the same location as the tablet. Its larger screen facilitates easier use as a tool, enabling a better focus on the scenario training and the communication between the participants.
- This part is flipped horizontally due to the timeline it contains.
- This part is for the facilitator to note observations throughout the training session. Whenever the facilitator observes one of the steps from the action plan, he/she can either press the warning triangle or the thumb up. If the action was done in a good manner, it deserves a thumbs up, but if there is potential to do it better, the facilitator can press the warning triangle.
- The observations are just in a checklist format based on the action plan to mitigate time-consuming tasks like writing during the training. Based on the observation and interviews onsite with the midwives, the midwives mentioned that checklists work.
- The timeline with the illustrations is made to visually link the observations and the data gathered with the training scenario. Whenever the facilitator presses on an observation, it appears on the timeline in its designated color (corresponding to either a thumbs-up or a warning triangle) and is positioned according to its timestamp.
- In designing for maternity care, utilizing illustrations is important for effective visual communication, particularly for healthcare workers with limited digital literacy. These illustrations are designed with simplicity in mind, ensuring minimal data is needed to load the page.

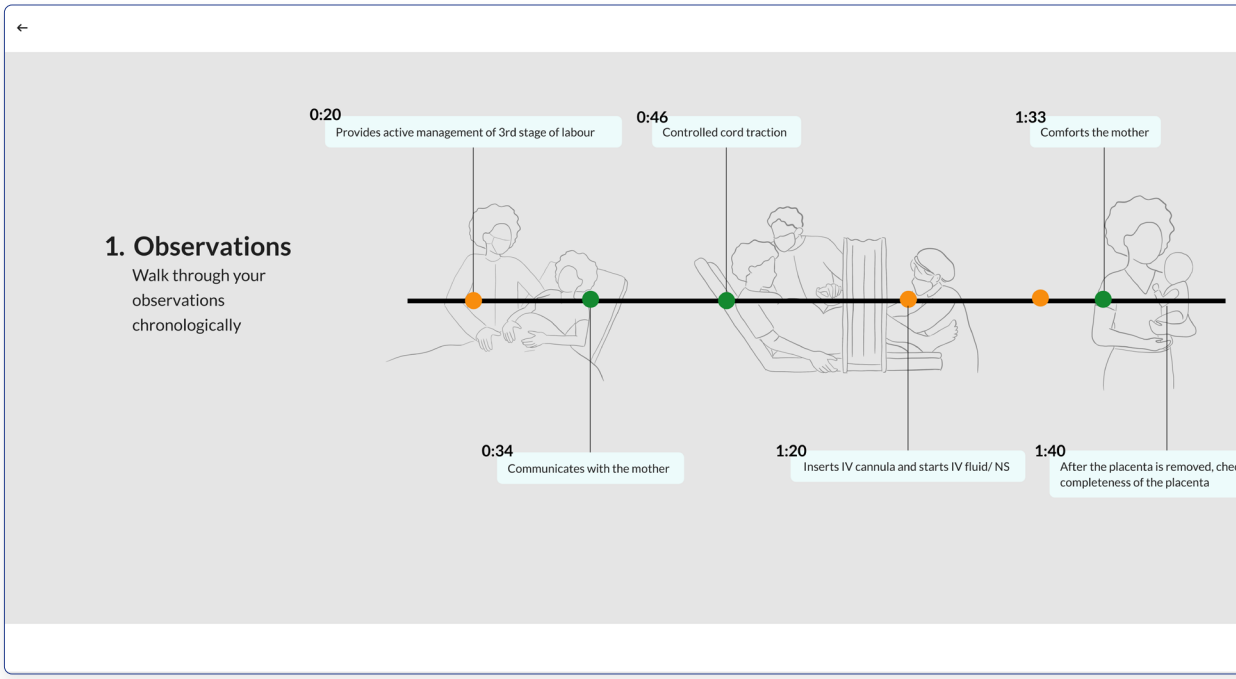
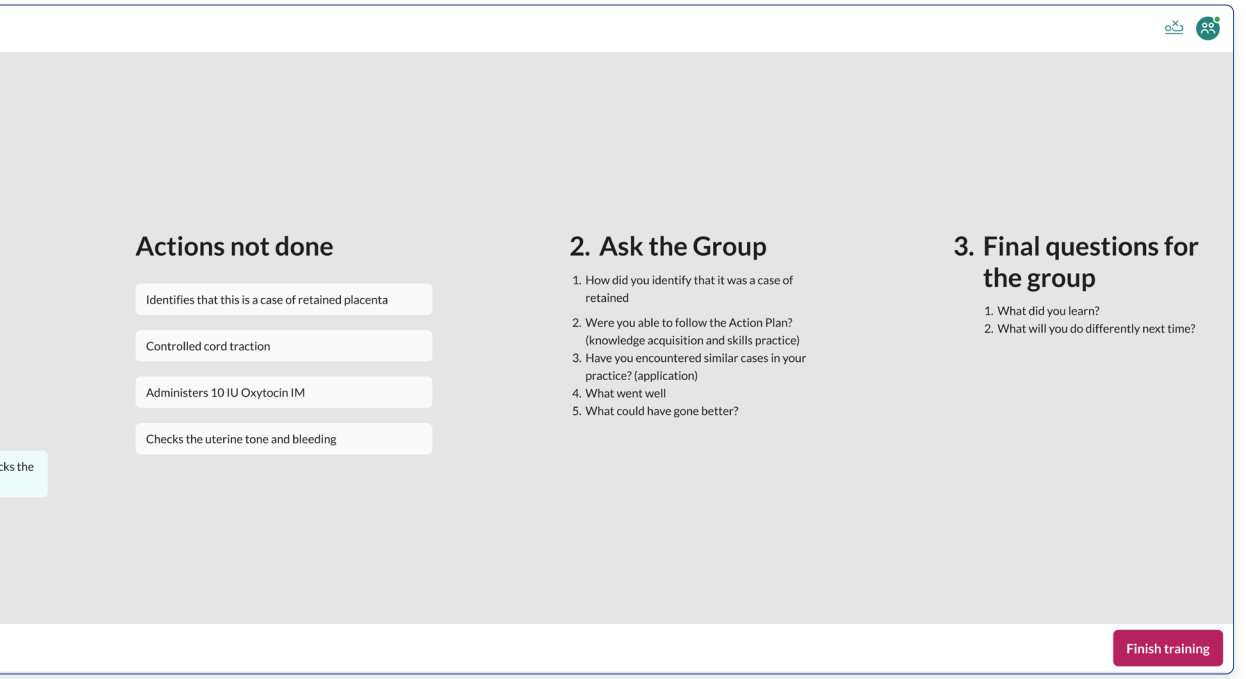


Figure 56: The facilitator's screen during debrief

- The screen from figure 56 is for the debrief of the training session. To use the data and observations gathered during the training as a tool for the debrief, the facilitator can scroll horizontally through the training session and talk about what worked well and where there is potential for improvement. The illustrations help the facilitator to better remember the observations and connect them to the actual timeline of the training.
- Observations not clicked on by the facilitator will appear at the end of the timeline to help the facilitator ask the participants why this was not done.


Actions not done
Identifies that this is a case of retained placenta
Controlled cord traction
Administers 10 IU Oxytocin IM
Checks the uterine tone and bleeding
cks the
2. Ask the Group
1. How did you identify that it was a case of retained
2. Were you able to follow the Action Plan? (knowledge acquisition and skills practice)
3. Have you encountered similar cases in your practice? (application)
4. What went well
5. What could have gone better?
3. Final questions for the group
1. What did you learn?
2. What will you do differently next time?
Finish training

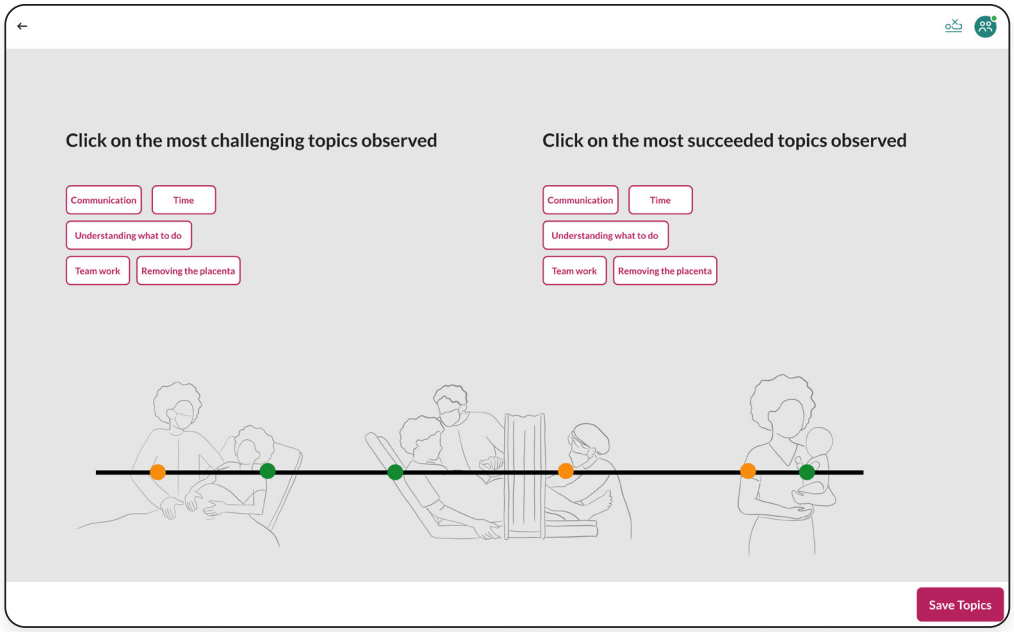


Figure 57: The facilitator's screen during the first part of the documentation

- After the debrief, the screen from figure 57 appears. Documenting after the training is one of the most challenging parts of training. Laerdal wants data from how the training is conducted to know better how it works and to make it easier for them to enhance their products. However, writing afterward is time-consuming and often a cumbersome process. This step is added to gather important data on what worked and what did not work well, without the facilitator needing to write anything—just clicking on some boxes. The data that is being gathered is also easier for Laerdal to analyze compared to free written texts.

8. Discussion, Limitations & Future Scenario

8.1 Designing To Reduce Cognitive Load

Healthcare workers in Tanzania are extremely passionate about their work. They are eager to learn more to enhance their skills. However, this is hard due to the demanding working conditions and shortage of staff. Foreign companies offer various training products, both digital and physical, and also other equipment to assist the healthcare workers. However, the focus is often on the utilization of the products rather than doing a comprehensive need assessment.

The problem lies in introducing new products that demand additional learning from already overworked healthcare workers. It is easy to sit in a foreign country and assume that digital solutions result in more data collected and better flexibility. It is also tempting to make complex solutions that will solve many challenges at the same time. However, today the adoption of digital solutions require too high of a cognitive load. Even though we find it user-friendly, the overall implementation is too complex.

Even though the products are properly made, their value diminishes significantly if they remain unused. The key is to collaborate with Tanzanian healthcare workers and develop ideas together. By involving them in the ideation and development process, the solutions will align more closely with their actual needs and challenges. Understanding how they want to implement a solution will further streamline the implementation process and new learning.

Feedback from midwives in Tanzania emphasizes the preference of familiar tools like calendars and WhatsApp. They find these tools user-friendly and are motivated by their ease of use. This insight highlights the importance of considering their familiarity and level of digital literacy when implementing solutions.

8.2 Applicability Of Service Design In Maternity Care In Developing Countries

Service design is definitely applicable in maternity care in developing countries. Healthcare workers face a lot of challenges, and they work in demanding environments. This makes it a complex environment to approach. Service design tools can make it easier to identify pain points and issues to solve. As a foreigner, it might feel overwhelming or extremely challenging to start to figure out what to do and where to focus. Service design is an appropriate method to look at the whole training flow, identify how the training products are being used, and what types of services and systems they use today. In this way, the designer gets a holistic view of the challenges and can include the different users and stakeholders in the process. It can help to break up the challenges into smaller parts, which are more tangible and easier to approach. It also addresses what types of methods and services that are already being used today and try to adapt a solution to these instead of making something completely new.

8.3 Value Of Co-Design In Developing Countries

Making people use your design is a lot easier if they have been a part of the process. They will be less skeptical of implementation if the solution is based on their own thoughts and ideas. The healthcare workers know more than you about their working habits. By including the healthcare workers throughout the process, they also feel more ownership of the solution. The goal is to design something more tangible, not just a report or a framework. In this way, the healthcare workers can see their thoughts and ideas being brought into action. Their voices have been heard and taken seriously, and they appreciate more that you really are trying to help them make

maternal care better. Trust is being built, and mutual intentions are found.

8.4 Digital Co-Design Session Bridging Geographical Distances

When designing for foreign cultures and countries, it is extremely important to analyze the culture through an emic view. The best thing is to travel there and connect with the users. However, this is often both expensive and challenging to accomplish. It is possible to conduct a digital co-design session as a first step. Then you have direct insights from the end users in a more informal setting. This can avoid the initial work being based on biases. It also prepares you for a potential field trip.

Having a digital co-design session with the healthcare workers worked very well. I was nervous about them not talking or not understanding the tasks, but that was not the case. They seemed to be comfortable and ended up giving me a lot of valuable knowledge. Even though you are geographically far from your end users, it is possible to interact with them. However, visiting them is the most valuable.

8.5 Designing Not For Perfection

It is impossible to reach a perfect solution where no improvement can be made. In complex and foreign environments like maternal healthcare in Tanzania, it is impossible to focus on all the variables and the factors that come into play. There are a lot of challenges in the maternity ward and it is impossible to solve all of them at once. It is important to take advantage of their existing systems, implement small changes, and work towards a main goal. Then you need feedback on how the solution is used and if they can adapt it into their everyday life. Implementing complex services might increase their cognitive load even more and become unused.

8.6 Designing For A Foreign Culture

Visiting the culture you are designing for is important. Something that works in your culture, might be done in a completely different way in another. An example is my pre-study. I thought my design was developed for midwives with low digital literacy. However, after visiting Tanzania, I figured out it was far too digital.

Adaptability is an important aspect when designing for a foreign culture. When you are designing for them, you have to adapt and respect their culture. Do not expect them to adapt to yours. Visiting several hospitals also widens perspectives, and ensures a more comprehensive understanding of how things work.

8.7 Politeness Is Not Equal To Honesty

When talking to healthcare workers in developing countries, it might be difficult to get their honest feedback. Collaborations between hospitals and companies providing training solutions might lead to biased communication. Healthcare workers may either overstate success to maintain a positive relationship or understate it to seek more products. Creating a comfortable, safe space by spending time together, fosters honest feedback. You show that you are there to learn from them, not the other way around.

8.8 Low Maintenance, Low Resources

Balancing product affordability and maintenance becomes a challenge when designing for developing countries. The problem is to at what extent the price of the product can decrease without significantly impacting the maintenance. It is also important to look at how healthcare workers are trained to utilize the products. With frequent staff rotation in the different wards, healthcare workers often encounter situations where product usage knowledge is lacking, leading to improper usage. My design solution emphasizes comprehensive training on product usage as an effective strategy. It helps prevent incorrect usage, thereby reducing potential maintenance issues.

8.9 Limitations

This project encounters some limitations. The main one is the time spent with the midwives in Tanzania. Spending more time with them is necessary to better understand their culture, context, and everyday life. Another limitation is the language barrier. Talking to the midwives in English instead of their native language Swahili might result in loss of important nuances in their communication. Additionally, valuable information might be lost in translation.

The solutions could also be tested more. I wanted to implement the short-term solution to be able to test it in real life. It would have been valuable to see how the healthcare workers would use the system and adapt it to their everyday life. Due to lack of time I was not able to do this. However, the solution is ready to be implemented, and Laerdal is planning to do so in the near future.

Another limitation of this project is the portfolio size I have been analyzing. Focusing solely on training in maternal healthcare excludes other types of training. To develop a comprehensive system applicable to healthcare training overall, it is necessary to analyze diverse training types rather than exclusively concentrating on maternal healthcare training.

8.10 Future Scenario

In the present it is important to keep the training as simple as possible. It is expected that the skills and education of healthcare workers will increase gradually. The overall educational level in Tanzania, together with digital literacy, is also expected to increase. With digital solutions it is possible to update the teaching materials regularly. It is also easier to reach more healthcare workers and spread knowledge more effectively. In this development there will always be a place for service design.

9. Conclusion

9. Conclusion

At the end of this project, I have the following conclusions on the research questions I proposed at the beginning of this thesis.

RQ1: To investigate how service design can be applied to reduce cognitive load of training tools for maternal healthcare workers in low-resource countries.

In addressing the needs and challenges of maternal healthcare workers in low-resource settings, service design emerges as a valuable approach. It can address the total picture finding the issues and challenges. You can have a great training product that will never be used if the users lack the time, the knowledge and the initiative to use it. This aspect highlights the applicability of service design, allowing for a comprehensive understanding of the healthcare workers' work life. Using this methodology helped me understand that organizing and preparing scenario-training were the main issues. By employing a human-centered process, service design can help address existing systems familiar to healthcare workers. By using these already known methods and making them more effective, the training is made easier without increasing the intrinsic load.

RQ2: To explore the value of co-design during various stages of the design process when designing for foreign and low-resource countries.

When designing for a foreign and low-resource country, it is extremely important to approach the project with an open mind. The healthcare workers are the experts of their working environment. Approaching their challenges is not possible without including the healthcare workers in the process from the beginning. It is important to pinpoint where the problems start. You need to understand how the culture works by making the healthcare workers themselves address the issues and problems they face every day. Then you can start designing a solution together. I developed different concepts based on their ideas, and they gave me feedback. They could then choose the solution they felt best met their needs. In this way, they felt heard and respected. Implementing a new design solution will meet less skepticism if they have been a part of the process. The midwives liked to see their own ideas and thoughts being brought into the design solution. Working together like this we all felt we had a mutual goal.

I started the project with digital meetings, and was surprised that communication felt natural and that the healthcare workers seemed enthusiastic. However, visiting them in Tanzania gave me a much broader understanding of the challenges they are facing. Personal and informal meetings on-site will always be valuable.

10. Acknowledgements

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Healthcare workers in Tanzania

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In the end, I want to give a big thanks to the rest of the staff at Laerdal for being extremely welcoming, providing me with a lot of valuable insight, and connecting me with interesting people to talk to.

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12. Appendix

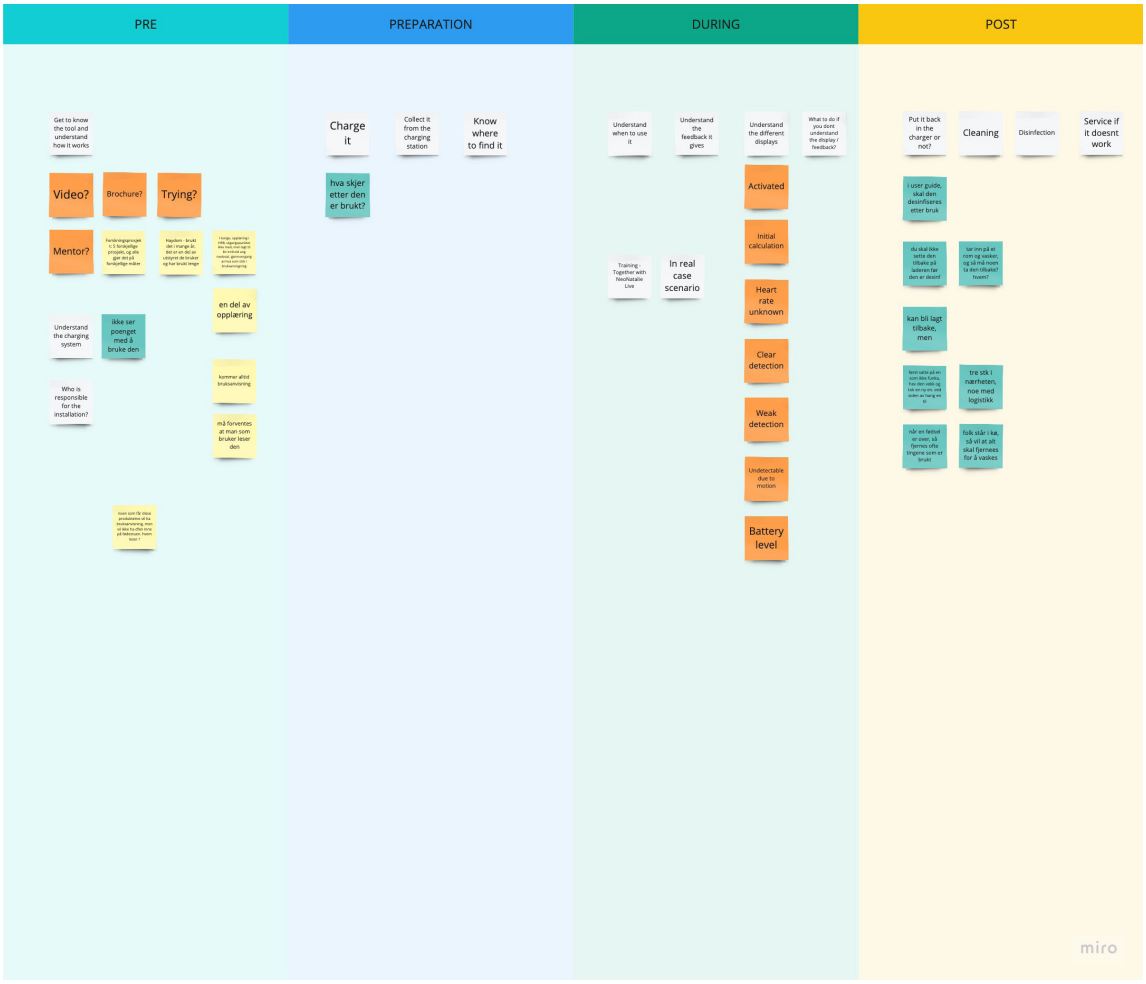
Appendix 1: Pre-Study Result

Here is a link to a video showing the result of my Desing 9 course I did in my Pre-Study:

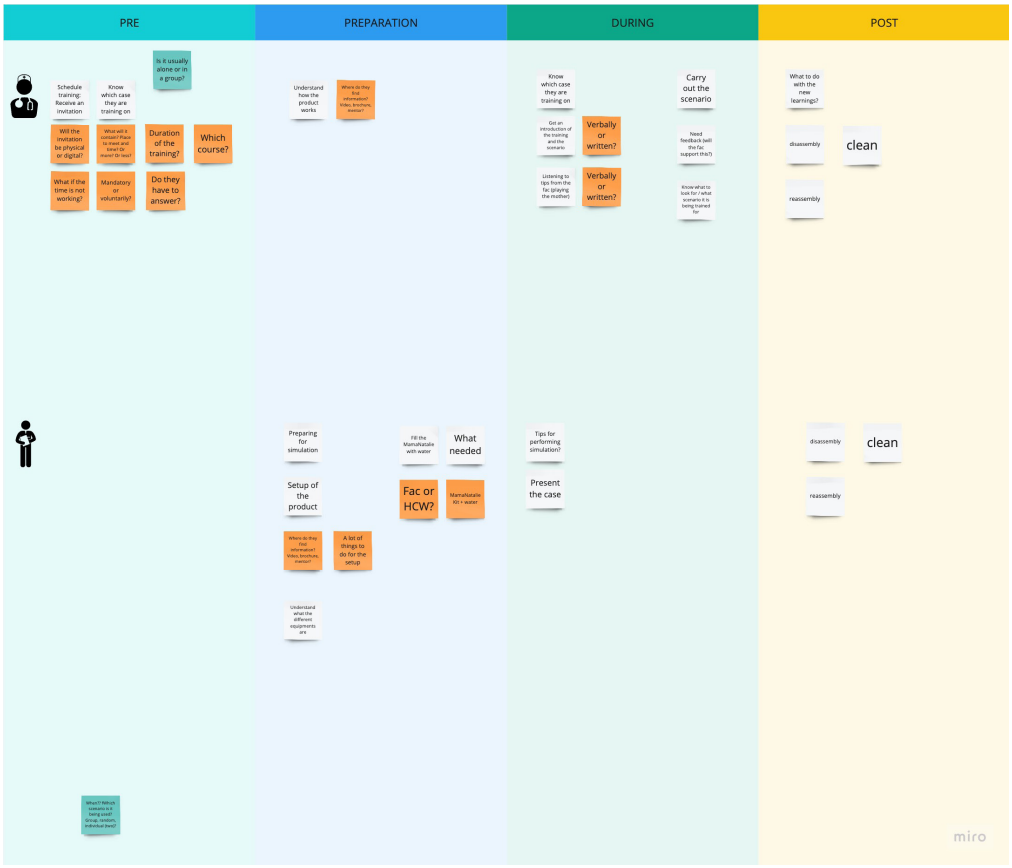
https://drive.google.com/file/d/1mjcA6CmJydrgcYgL1-8FClJEC302ILvn/view

Appendix 2: User Journey Maps

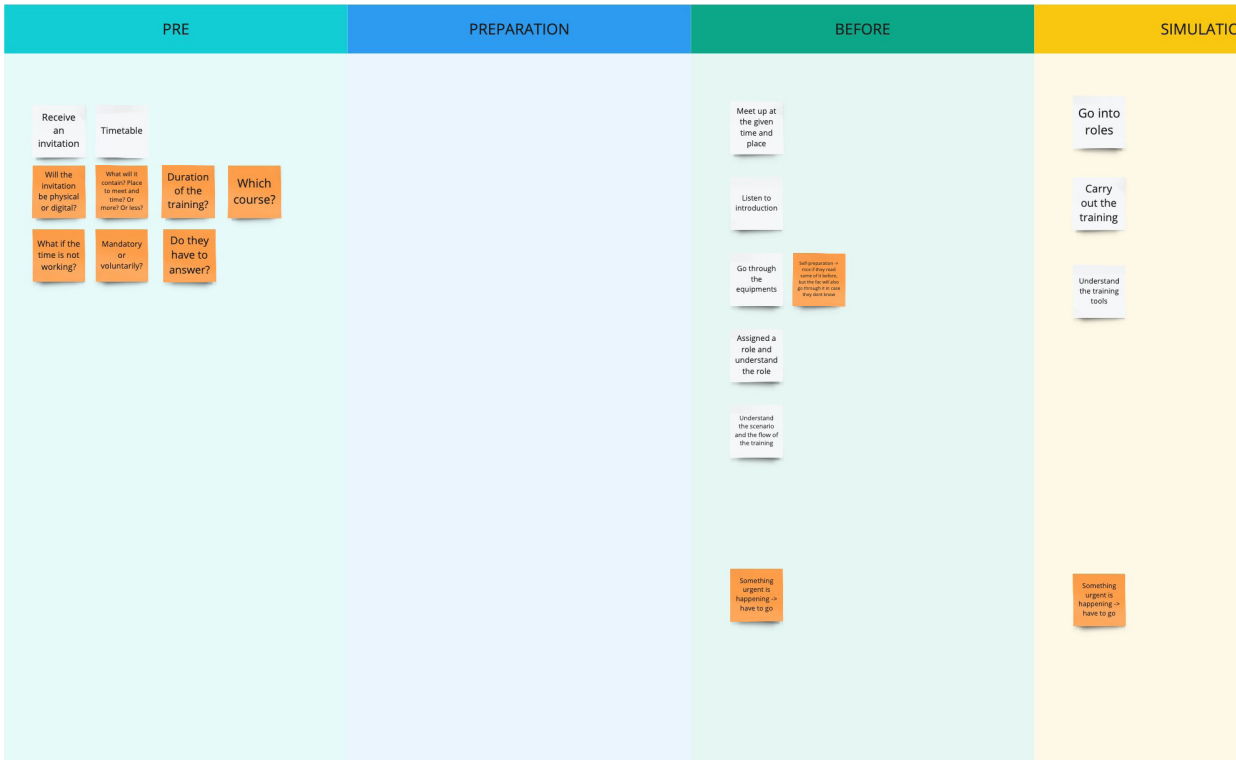
User Journey Maps - NeoBeat



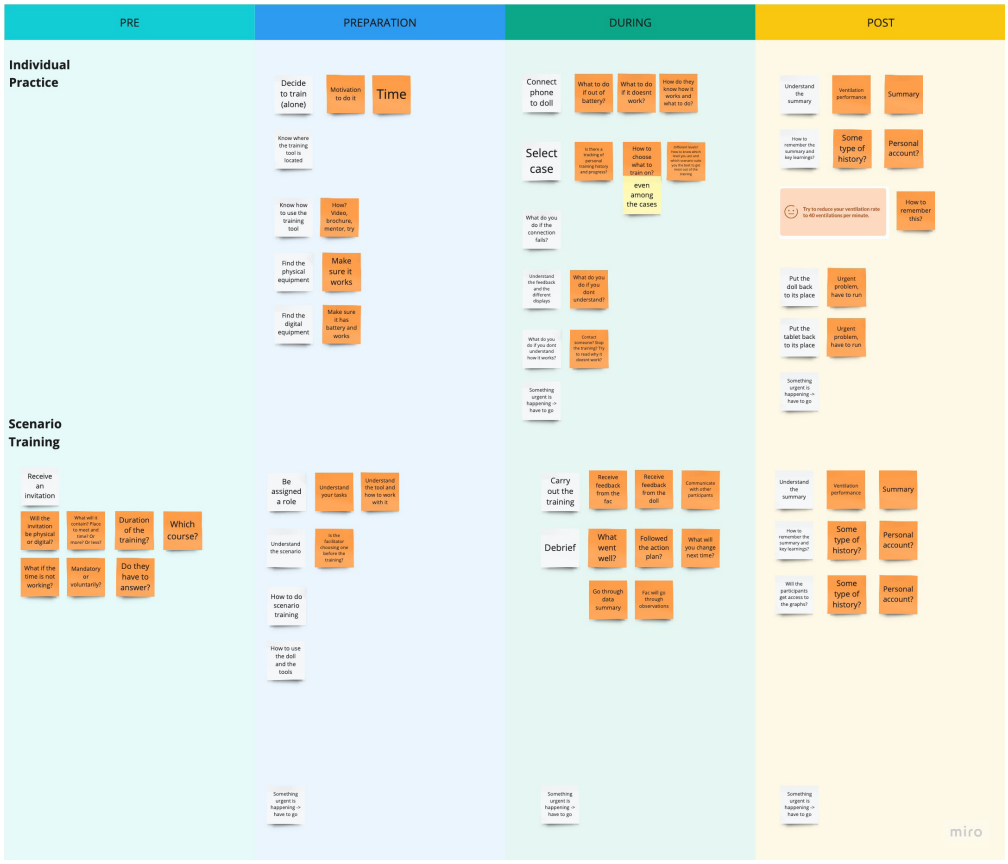
User Journey Maps - MamaNatalie

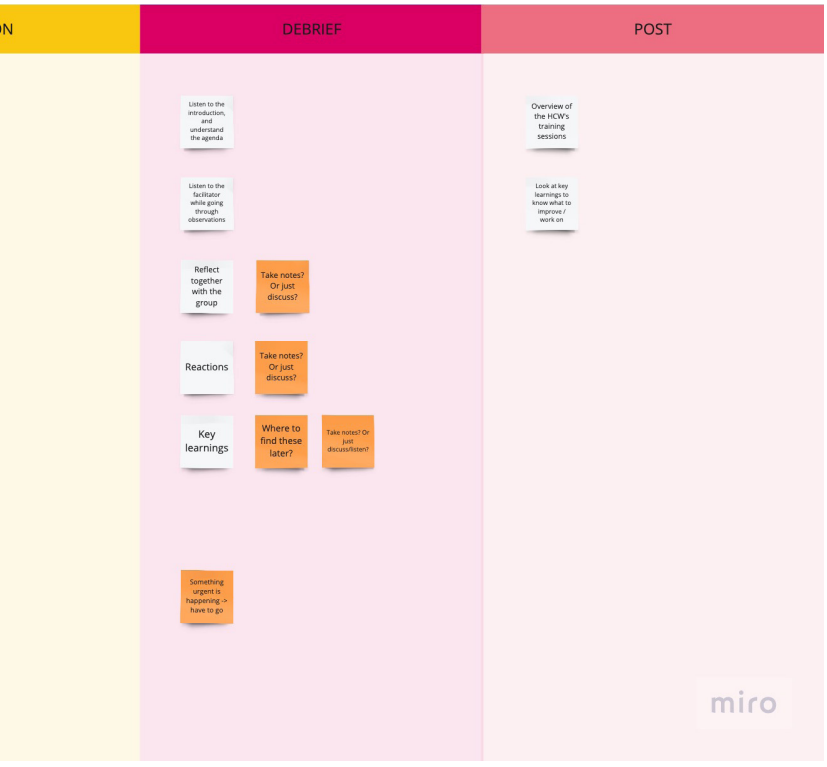


User Journey Maps - LIFT

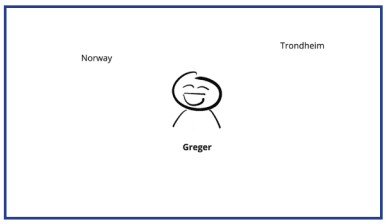


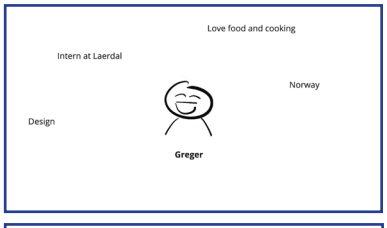
User Journey Maps - NeoNatalie Live

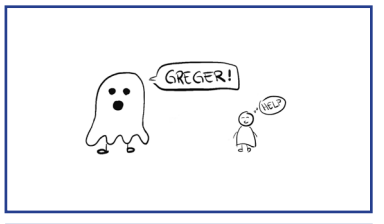


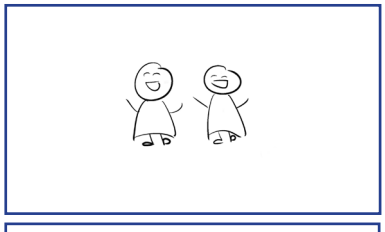


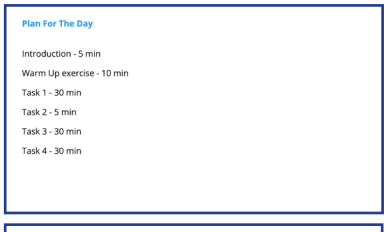
Appendix 3: Presentation from digital co-design session

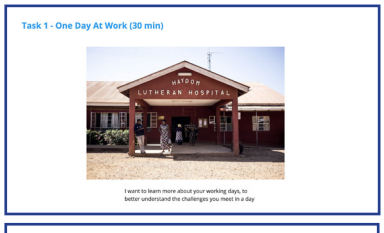


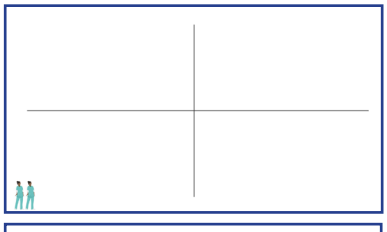


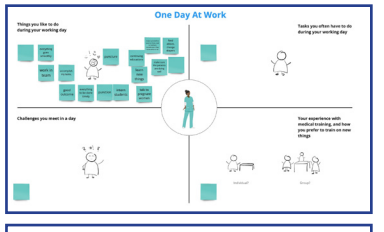


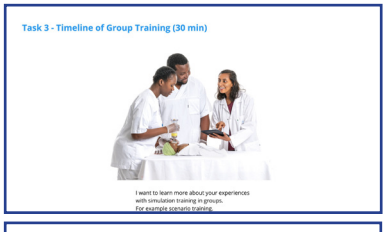


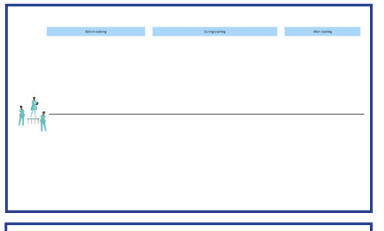


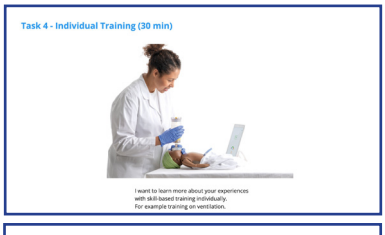


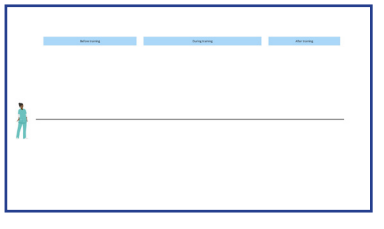


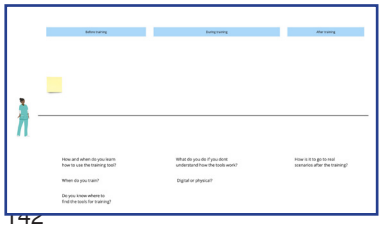


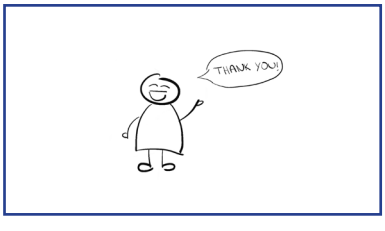




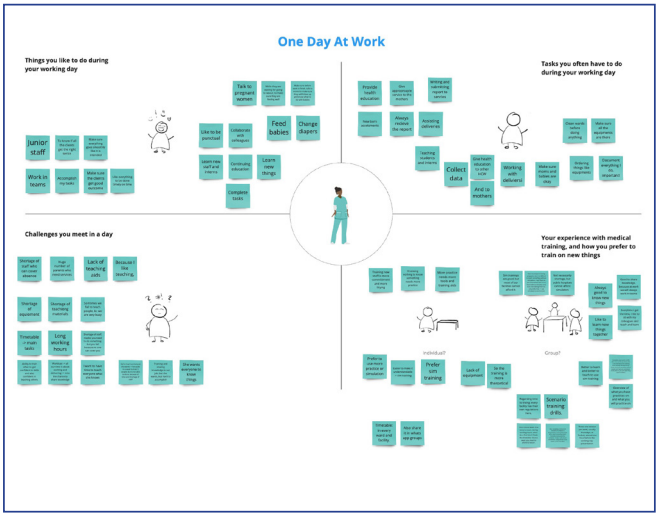


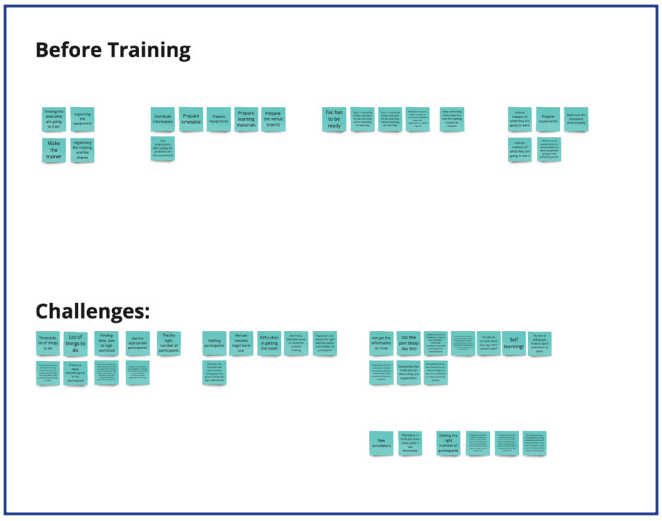




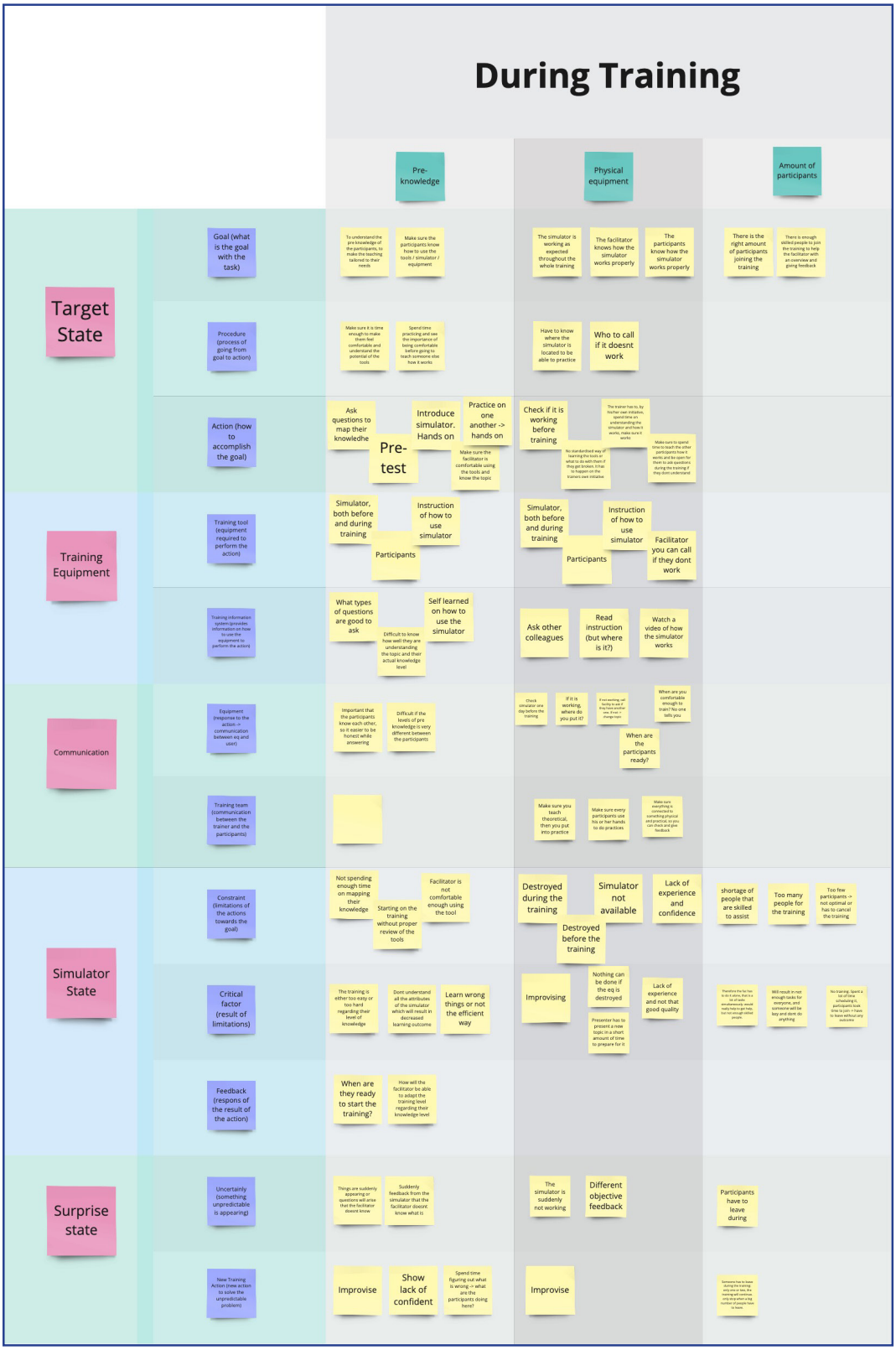


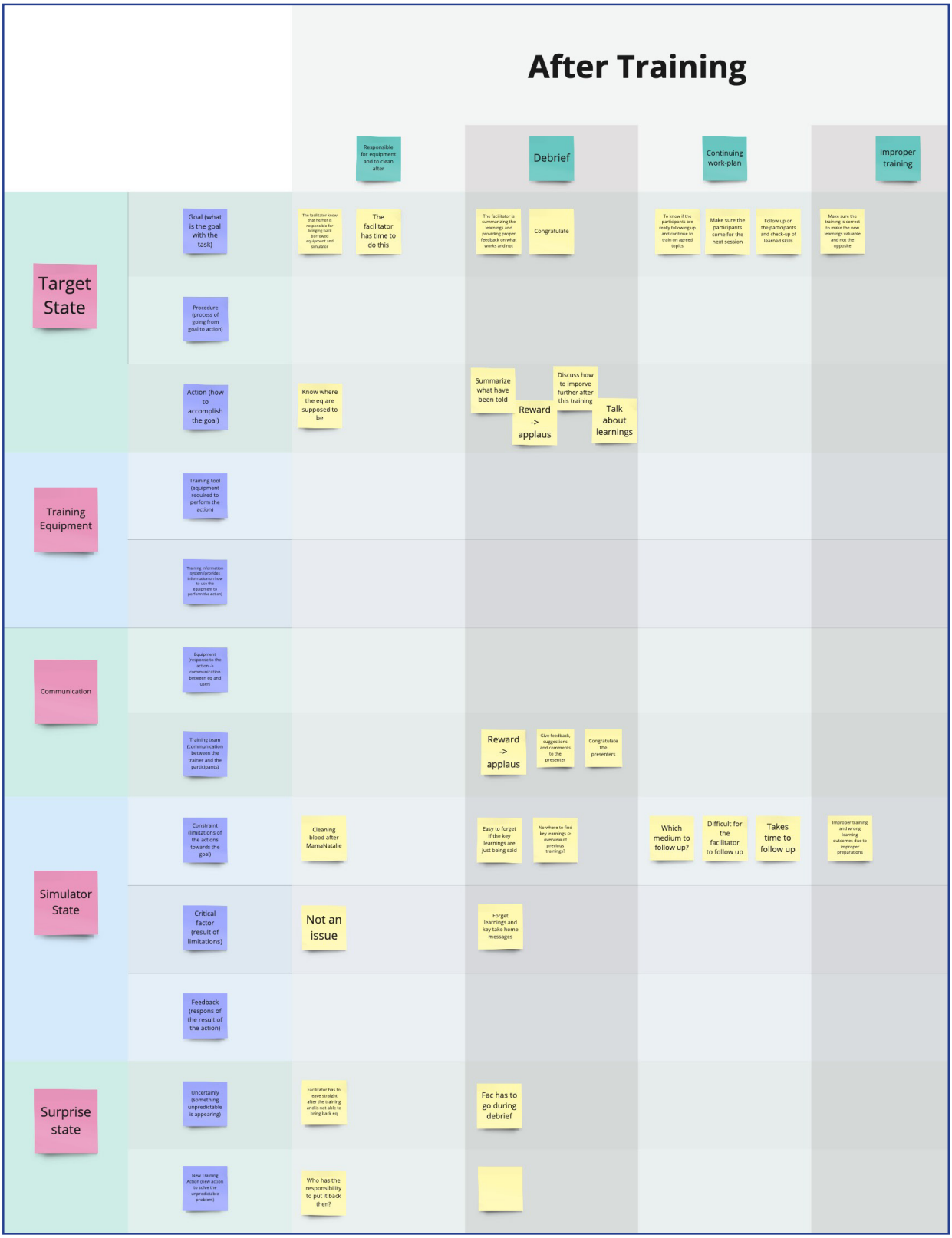
Appendix 4: Key takeaways from digital co-design session

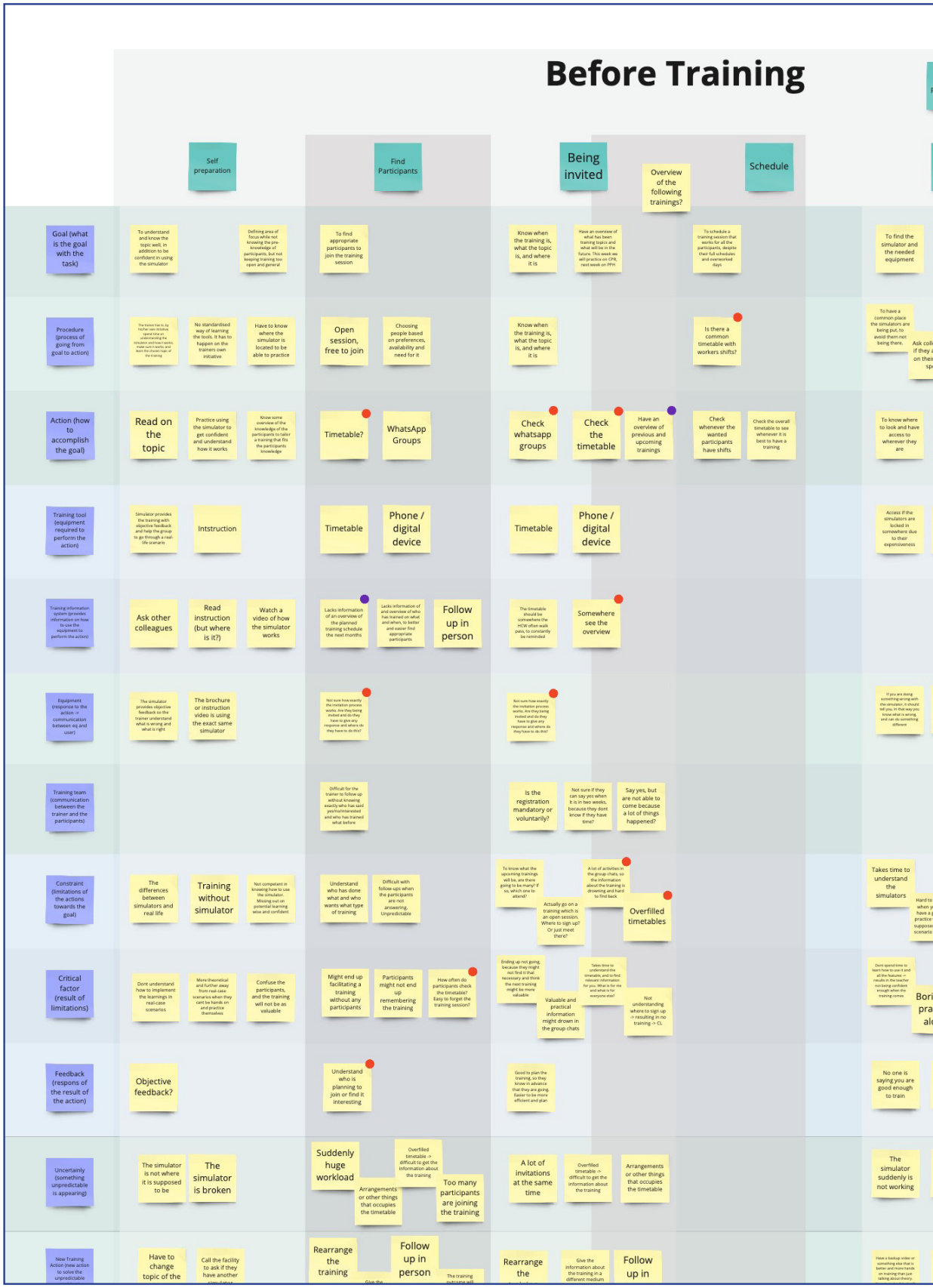




Appendix 5: Analyzing key findings from digital co-design session using WIM

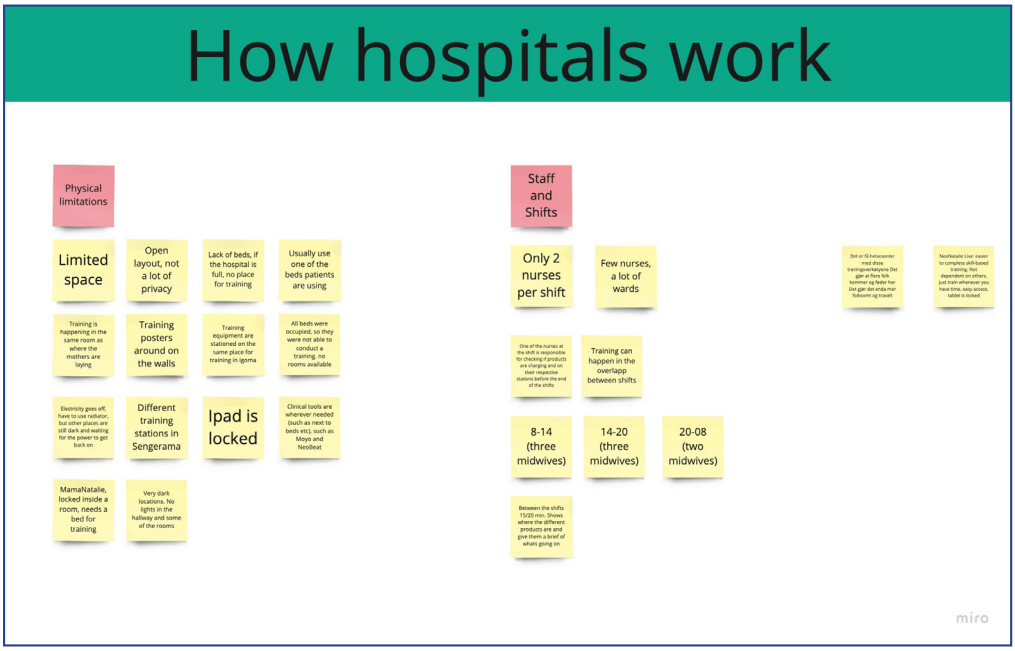


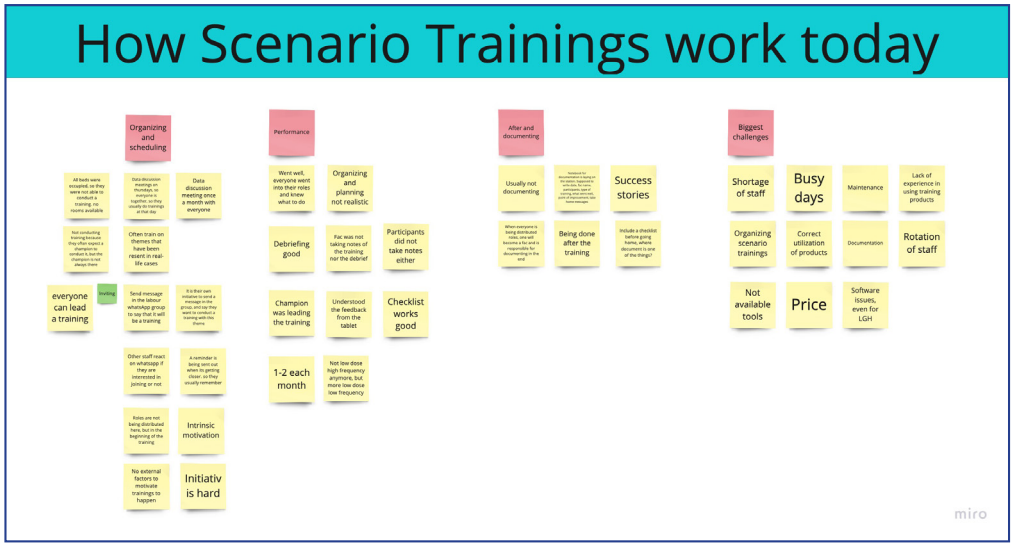

After Training
Responsible for equipment and to clean after
Debrief
Continuing work-plan
Improper training
Target State
Goal (what is the goal with the task)
The facilitator know that he/her is responsible for bringing back borrowed equipment and simulator
The facilitator has time to do this
The facilitator is summarizing the learnings and providing proper feedback on what works and not
Congratulate
To know if the participants are really following up and continue to train on agreed topics
Make sure the participants coma for the next session
Follow up on the participants and check-up of learned skills
Make sure the training is correct to make the new learnings valuable and not the opposite
Procedure (process of going from goal to action)
Action (how to accomplish the goal)
Know where the eq are supposed to be
Summarize what have been told
Reward -> applaus
Discuss how to imporve further after this training
Talk about learnings
Training Equipment
Training tool (equipment required to perform the action)
Training information system (provides information on how to use the equipment to perform the action)
Communication
Equipment (response to the action -> communication between eq and user)
Training team (communication between the trainer and the participants)
Reward -> applaus
Give feedback, suggestions and comments to the presenter
Congratulate the presenters
Simulator State
Constraint (limitations of the actions towards the goal)
Cleaning blood after MamaNatalie
Easy to forget if the key learnings are just being said
No where to find key learnings -> overview of previous trainings?
Which medium to follow up?
Difficult for the facilitator to follow up
Takes time to follow up
Improper training and wrong learning outcomes due to improper preparations
Critical factor (result of limitations)
Not an issue
Forget learnings and key take home messages
Feedback (respons of the result of the action)
Surprise state
Uncertainly (something unpredictable is appearing)
Facilitator has to leave straight after the training and is not able to bring back eq
Fac has to go during debrief
New Training Action (new action to solve the unpredictable problem)
Who has the responsibility to put it back then?


Before Training
Self preparation
Find Participants
Being invited
Overview of the following trainings?
Schedule
Goal (what is the goal with the task)
To understand and know the topic well, in addition to be confident in using the simulator
Defining area of focus while not knowing the pre-knowledge of participants, but not keeping training too open and general
To find appropriate participants to join the training session
Know when the training is, what the topic is, and where it is
Have an overview of what has been training topics and what will be in the future. This week we will practice on CPR, next week on PPH
To schedule a training session that works for all the participants, despite their full schedules and overworked days
To find the simulator and the needed equipment
Procedure (process of going from goal to action)
No standardised way of learning the tools. It has to happen on the trainers own initiative
Have to know where the simulator is located to be able to practice
Open session, free to join
Choosing people based on preferences, availability and need for it
Know when the training is, what the topic is, and where it is
Is there a common timetable with workers shifts?
To have a common place the simulators are being put, to avoid them not being there.
Action (how to accomplish the goal)
Read on the topic
Practice using the simulator to get confident and understand how it works
Know some overview of the knowledge of the participants to tailor a training that fits the participants knowledge
Timetable?
WhatsApp Groups
Check whatsapp groups
Check the timetable
Have an overview of previous and upcoming trainings
Check whenever the wanted participants have shifts
Check the overall timetable to see whenever it is best to have a training
To know where to look and have access to wherever they are
Training tool (equipment required to perform the action)
Simulator provides the training with objective feedback and help the group to go through a real-life scenario
Intstruction
Timetable
Phone / digital device
Timetable
Phone / digital device
Access if the simulators are locked in somewhere due to their expensiveness
Training information system (provides information on how to use the equipment to perform the action)
Ask other colleagues
Read instruction (but where is it?)
Watch a video of how the simulator works
Lacks information of an overview of the planned training schedule the next months
Lacks information of and overview of who has trained on what and when, to better and easier find appropriate participants
Follow up in person
The timetable should be somewhere the HCW often walk pass, to constantly be reminded
Somewhere see the overview
Equipment (response to the action -> communication between eq and user)
The simulator provides objective feedback so the trainer understand what is wrong and what is right
The brochure or instruction video is using the exact same simulator
Not sure how exactly the invitation process works. Are they being invited and do they have to give any response and where do they have to do this?
Not sure how exactly the invitation process works. Are they being invited and do they have to give any response and where do they have to do this?
If you are doing something wrong with the simulator, it should tell you. In that way you know what is wrong, and can do something different
Training team (communication between the trainer and the participants)
Difficult for the trainer to follow up without knowing exactly who has said yes/no/interested and who has trained what before
Is the registration mandatory or voluntarily?
Not sure if they can say yes when it is in two weeks, because they dont know if they have time?
Say yes, but are not able to come because a lot of things happened?
Constraint (limitations of the actions towards the goal)
The differences between simulators and real life
Training without simulator
Not competent in knowing how to use the simulator. Missing out on potential learning wise and confident
Understand who has done what and who wants what type of training
Difficult with follow-ups when the participants are not answering. Unpredictable
To know what the upcoming trainings will be, are there going to be many? If so, which one to attend?
A lot of activities in the group chats, so the information about the training is drowning and hard to find back
Actually go on a training which is an open session. Where to sign up? Or just meet there?
Overfilled timetables
Takes time to understand the simulators
Critical factor (result of limitations)
Dont understand how to implement the learnings in real-case scenarios
More theoretical and further away from real-case scenarios when they cant be hands on and practice themselves
Confuse the participants, and the training will not be as valuable
Might end up facilitating a training without any participants
Participants might not end up remembering the training
How often do participants check the timetable? Easy to forget the training session?
Ending up not going, because they might not find it that necessary and think the next training might be more valuable
Takes time to understand the timetable, and to find relevant information for you. What is for me and what is for everyone else?
Valuable and practical information might drown in the group chats
Not understanding where to sign up -> resulting in no training -> CL
Dont spend time to learn how to use it and all the features -> results in the teacher not being confident enough when the training comes
Feedback (respons of the result of the action)
Objective feedback?
Understand who is planning to join or find it interesting
Good to plan the training, so they know in advance that they are going. Easier to be more efficient and plan
No one is saying you are good enough to train
Uncertainly (something unpredictable is appearing)
The simulator is not where it is supposed to be
The simulator is broken
Suddenly huge workload
Overfilled timetable -> difficult to get the information about the training
Arrangements or other things that occupies the timetable
Too many participants are joining the training
A lot of invitations at the same time
Overfilled timetable -> difficult to get the information about the training
Arrangements or other things that occupies the timetable
The simulator suddenly is not working
New Training Action (new action to solve the unpredictable
Have to change topic of the
Call the facility to ask if they have another
Rearrange the training
Follow up in person
The training intrigues self
Rearrange the
Give the information about the training in a different medium
Follow up in

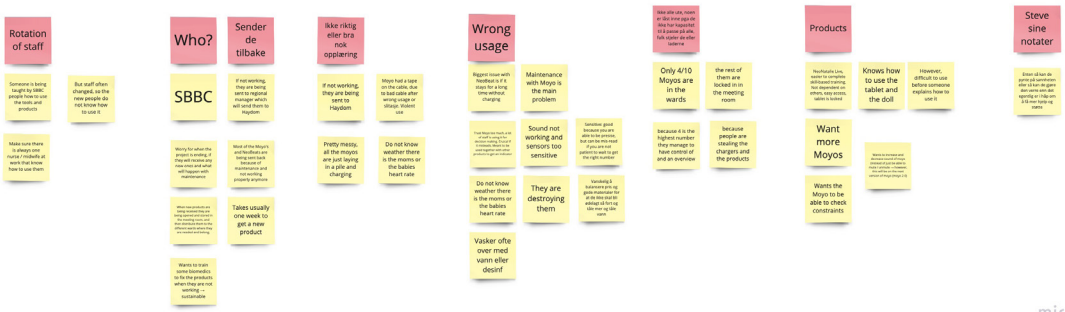

Remind Participants
Find Equipment
Prepare the Venue
Make sure they work properly
Make sure the room is vacant
Ask colleagues that know how it works
Is there a system where you can book rooms?
Timetable?
Take some extra time off to prepare the room
Book a room
Prepare room for training
Know how long the training will be
Learning materials on how to use the simulator
Simulator and equipment
Able to book a room
Overview of rooms and the vacancies of them
To know if the room will be vacant at the given time for the training
To know if someone else is using it
Trainer has to tell the participants where to meet and which room
Only small rooms available
Not able to train nor to get the simulator for the training session
The room is not properly prepared and set up
The room is not suitable for training
Feedback on that the room is yours in the specific time
The room is occupied and the trainer has to find a new room
Inform participants on where the new room is

Appendix 6: Main fidnings from Primary Studies





How Maintenance work today



Appendix 7: Four concepts from iteration 1 of the short-term solution

Concept 1.1

Idea
To have a large, printed poster on a visible place in the ward. The champion can distribute responsibility to the nurse in charge to facilitate a training for a specific week. The nurse in charge can write the type of scenario and title. Then everyone who is interested in joining this training can write their name on the interested column. After the training, the facilitator/champion can check off if the training is conducted and if someone has documented it.

Challenges

Difficulties of scheduling training sessions.
Not knowing who is responsible for trainings.
Less pressure on champions to conduct trainings.
Not knowing about the upcoming training sessions.
Low frequency between the training sessions.

Aims / objectives
Easier to facilitate and conduct a scenario training when the responsibility is distributed and everyone knows that this week "midwife 1" is responsible for conducting it. And to make a common goal of being better together, by checking off when it is conducted so everyone can see that the training has happened and it will motivate the next nurse in charge to conduct a training. It also works as an overview to see previous and upcoming training sessions.

Concept 1.2

Idea
It can work together with concept 1.1, and will take advantage of the WhatsApp message the facilitator is already sending to the labour group whenever a training is happening. Together with this message, the facilitator can distribute roles and add this PDF to the message. It is a description of the scheduled training, tutorial on how to use the product and a description of the different roles. So the participants are able to prepare themselves for the training, whenever it suits them, and on their own phones. There will exist one PDF for each training, and it will already be made. So the nurse in charge is not responsible for making it, just distribute it to the other participants.

Challenges

Lack of confidence in using the products and equipment.
Decrease the cognitive load, by making it more flexible to prepare and you can do it whenever it suits you the best.
When you know you have a specific role during the training, the motivation to go to the training will increase

Aims / objectives

The confidence among the participants will increase, so in the future more people will be able to conduct and facilitate trainings.
By knowing how to use a product properly, misusage will decrease which will turn out positive for the maintenance and the products will last longer.
Easier for the champion to distribute roles and responsibilities, when the other participants can be trained through the PDF instead of being only trained by the champion

miro

Concept 2

Idea

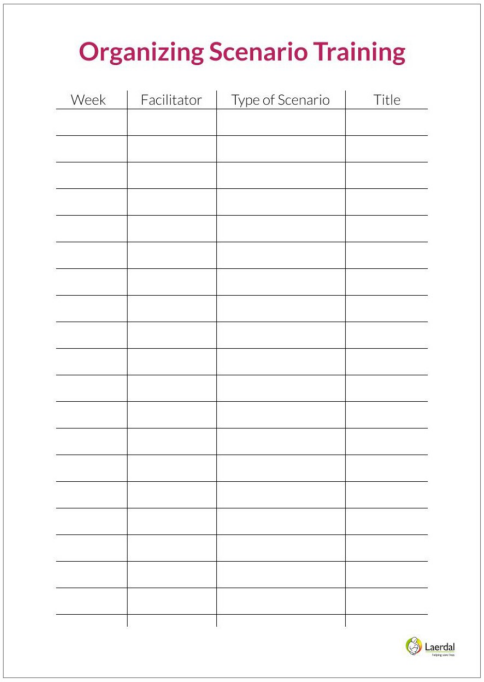
Same idea as concept 1.1, but with less options to fill in.
To have a large, printed poster on a visible place in the ward. The champion can distribute responsibility to the nurse in charge to facilitate a training for a specific week. The nurse in charge can write type of scenario and title.

Challenges

Difficulties of scheduling training sessions.
Not knowing who is responsible for trainings.
Less pressure on champions to conduct trainings.
Not knowing about the upcoming training sessions.
Low frequency between the training sessions.

Aims / objectives

Easier to facilitate and conduct a scenario training when the responsibility is distributed and everyone knows that this week "midwife 1" is responsible for conducting it. It also works as an overview to see previous and upcoming training sessions.



Concept 3

Idea

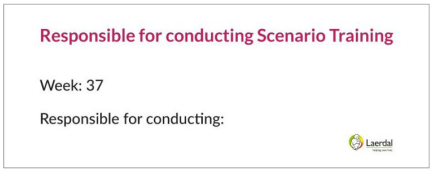
The champion will distribute responsibility for conducting scenario training every week. Typical to the nurse in charge. The champion will put the poster on the wall (top picture below), to visualize the responsibility to the ward. It requires nothing from the facilitator nor the participants. Then the person responsible for conducting the training can arrange it in the most convenient manner.
It can also be possible for everyone to write their interest in facilitating a specific type of scenario, if they have something they want to teach the others (bottom picture below).

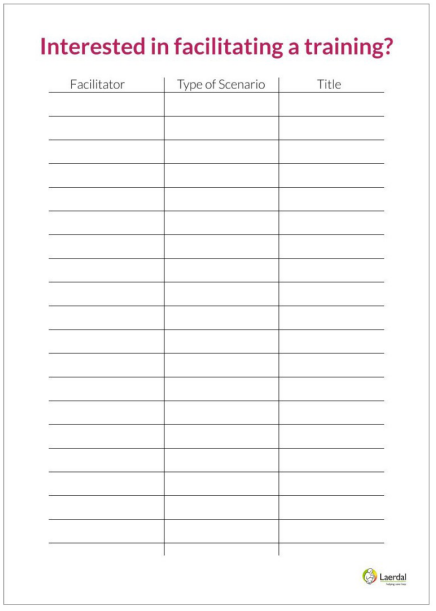
Challenges

Difficulties of scheduling training sessions.
Not knowing who is responsible for trainings.
Less pressure on champions to conduct trainings.
Low frequency between the training sessions.

Aims / objectives

Easier to facilitate and conduct a scenario training when the responsibility is distributed and everyone knows that this week "midwife 1" is responsible for conducting it.
Promotes motivation to conduct a training if you have something you are eager to share with your colleagues.





Concept 4

Idea

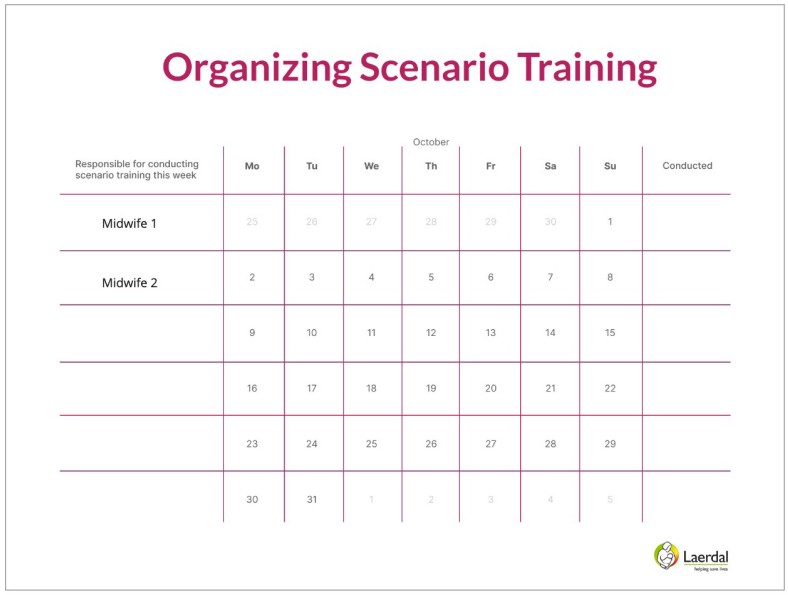
To have a large, printed poster on a visible place in the ward. The champion can distribute responsibility to the nurse in charge to facilitate a training for a specific week. Visualized by a calendar. The nurse in charge can check off which day it is planned on the calendar. So everyone will pass it and see whenever the training is planned. After the training, the facilitator/champion can check off if the training is conducted.

Challenge

Difficulties of scheduling training sessions.
Not knowing who is responsible for trainings.
Less pressure on champions to conduct trainings.
Not knowing about the upcoming training sessions.
Low frequency between the training sessions.

Aims / objectives

Easier to facilitate and conduct a scenario training when the responsibility is distributed and everyone knows that this week "midwife 1" is responsible for conducting it. It also works as an overview to see previous and upcoming training sessions.
Easier to visualize the dates and week when you see it on a calendar, rather than a table.



Appendix 8: Three concepts from iteration 3 of the short-term solution

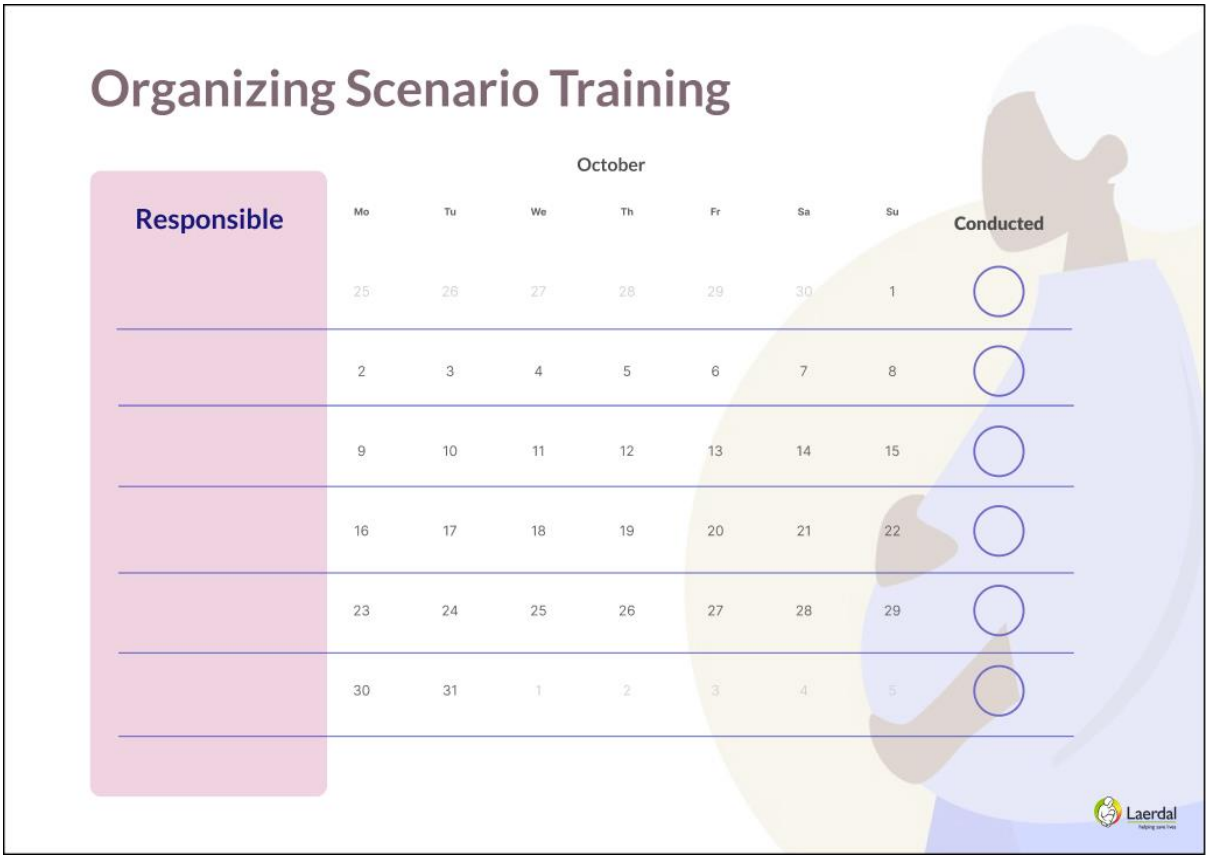
Concept 1

Name:
Coordinated Training Duties: Integrating a Training Responsibility Calendar with Google Calendar

Features of the Concept:
Physical Calendar, PDF, WhatsApp, Google Calendar

The Challenges:
Self-initiative to conduct a training, difficult to remember to conduct a training, lack of a training overview, and unprepared for training.

Description:
The physical calendar will be on a wall in a visib
It will display each nurse in-charge's assigned tr
indicate their responsibility for conducting a sce
given week. The champion will coordinate this a
Calendar reminders to them as well. When the
sends a WhatsApp message regarding the traini
group, they can assign roles and share a PDF co
overview, product tutorial, and task description



le place in the ward.
aining weeks and
enario training a
and send Google
nurse in-charge
ng to the labor
ntaining case
s.

How the Concept Will Solve the Challenge:

Using the ward's physical calendar and recurring Google Calendar events reminds each nurse in-charge of their training responsibility weekly. Distributing roles fosters readiness and accountability among participants. The visible overview on the calendar tracks weekly training, aligning with the ward's goal of conducting regular sessions and tracking who has conducted one and who has not.

Calendar

Scenario Training Preparation

Type of Scenario: Helping Mothers Survice
Title: PPH

Scenario Overview

Maya Angelou, G3 P2 L2 (Gravida 3, para 2, living children 2), who has attended 3 antenatal visits at your facility, arrived with 40 weeks pregnancy (full term) full dilatation and is delivering now.
You have the required logistics to conduct a normal delivery and manage any common complications for the mother and baby postpartum.
You have already identified a helper, prepared the labour room, washed your hands, and checked your equipment.
The baby is born, the amniotic fluid is clear. You have to manage the mother hereon.

During the training you will use MamaNatalie

MamaNatalie is ideal for training for active management of the third stage of labor, and prevention and management of postpartum hemorrhage. It can realistically bleed up to one liter of blood.
Click here to learn how to use it

Roles

Mother

Tasks
- How to operate MamaNatalie
  - Wear on the body
  - Hold onto the placenta and don't release it after the AMTSL is performed
  - Wait for the facilitator's cue before you release the placenta
- When there is much activity happening around you for removal of placenta- you become anxious and start asking questions frequently.

Midwife

Tasks
- How to operate MamaNatalie
  - Wear on the body
  - Hold onto the placenta and don't release it after the AMTSL is performed
  - Wait for the facilitator's cue before you release the placenta
- When there is much activity happening around you for removal of placenta- you become anxious and start asking questions frequently.

Doctor

Tasks
- How to operate MamaNatalie
  - Wear on the body
  - Hold onto the placenta and don't release it after the AMTSL is performed
  - Wait for the facilitator's cue before you release the placenta
- When there is much activity happening around you for removal of placenta- you become anxious and start asking questions frequently.

Nurse

Tasks
- How to operate MamaNatalie
  - Wear on the body
  - Hold onto the placenta and don't release it after the AMTSL is performed
  - Wait for the facilitator's cue before you release the placenta
- When there is much activity happening around you for removal of placenta- you become anxious and start asking questions frequently.

Mother-in-law

Tasks
- How to operate MamaNatalie
  - Wear on the body
  - Hold onto the placenta and don't release it after the AMTSL is performed
  - Wait for the facilitator's cue before you release the placenta
- When there is much activity happening around you for removal of placenta- you become anxious and start asking questions frequently.

Laerdal

PDF

Concept 2

Name:

Physical Training Overview Synced with Google Calendar and Detailed Role Descriptions

Features of the Concept:

Physical Table, PDF, WhatsApp, Google Calendar

The Challenges:

Self-initiative to conduct a training, difficult to remember the training both for the facilitator and the participants, lack of a training overview, and unprepared for training.

Description:

The physical table will be on a wall in a visible plac
nurse in-charge's assigned training weeks and indi
conducting a scenario training a given week. The r
of scenario and title, and the other healthcare wo
training can also write their names on the table. T
Calendar reminders to the nurses in-charge, who
participants. Additionally, the nurse sends WhatsA
assigning roles and sharing a comprehensive PDF
and task descriptions.

ce in the ward. It will display each
cate their responsibility for
nurse in charge can write the type
rkers interested in joining this
he champion sends Google
can further invite the chosen
App messages to the labor group,
with case details, product tutorials,

How the Concept Will Solve the Challenge:

Using the ward's physical table and recurring Google Calendar events reminds each nurse in-charge of their training responsibility weekly. The participants can also add the training to their personal calendars when invited. Distributing roles fosters readiness and accountability among participants. The visible overview on the table tracks weekly training, aligning with the ward's goal of conducting regular sessions and tracking who has conducted one and who has not.

Table

Scenario Training Preparation

Type of Scenario: Helping Mothers Service
Title: PPH

Scenario Overview

Maya Angelou, G3 P2 L2 (Gravida 3, para 2, living children 2), who has attended 3 antenatal visits at your facility, arrived with 40 weeks pregnancy (full term) full dilatation and is delivering now. You have the required logistics to conduct a normal delivery and manage any common complications for the mother and baby postpartum.
You have already identified a helper, prepared the labour room, washed your hands, and checked your equipment.
The baby is born, the amniotic fluid is clear. You have to manage the mother hereon.

During the training you will use MamaNatalie

MamaNatalie is ideal for training for active management of the third stage of labor, and prevention and management of postpartum hemorrhage. It can realistically bleed up to one liter of blood.
Click here to learn how to use it

Roles

Mother

Tasks
- How to operate MamaNatalie
  - Wear on the body
  - Hold onto the placenta and don't release it after the AMTSL is performed
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Midwife

Tasks
- How to operate MamaNatalie
  - Wear on the body
  - Hold onto the placenta and don't release it after the AMTSL is performed
  - Wait for the facilitator's cue before you release the placenta
- When there is much activity happening around you for removal of placenta- you become anxious and start asking questions frequently.

Doctor

Tasks
- How to operate MamaNatalie
  - Wear on the body
  - Hold onto the placenta and don't release it after the AMTSL is performed
  - Wait for the facilitator's cue before you release the placenta
- When there is much activity happening around you for removal of placenta- you become anxious and start asking questions frequently.

Nurse

Tasks
- How to operate MamaNatalie
  - Wear on the body
  - Hold onto the placenta and don't release it after the AMTSL is performed
  - Wait for the facilitator's cue before you release the placenta
- When there is much activity happening around you for removal of placenta- you become anxious and start asking questions frequently.

Mother-in-law

Tasks
- How to operate MamaNatalie
  - Wear on the body
  - Hold onto the placenta and don't release it after the AMTSL is performed
  - Wait for the facilitator's cue before you release the placenta
- When there is much activity happening around you for removal of placenta- you become anxious and start asking questions frequently.

Laerdal

PDF

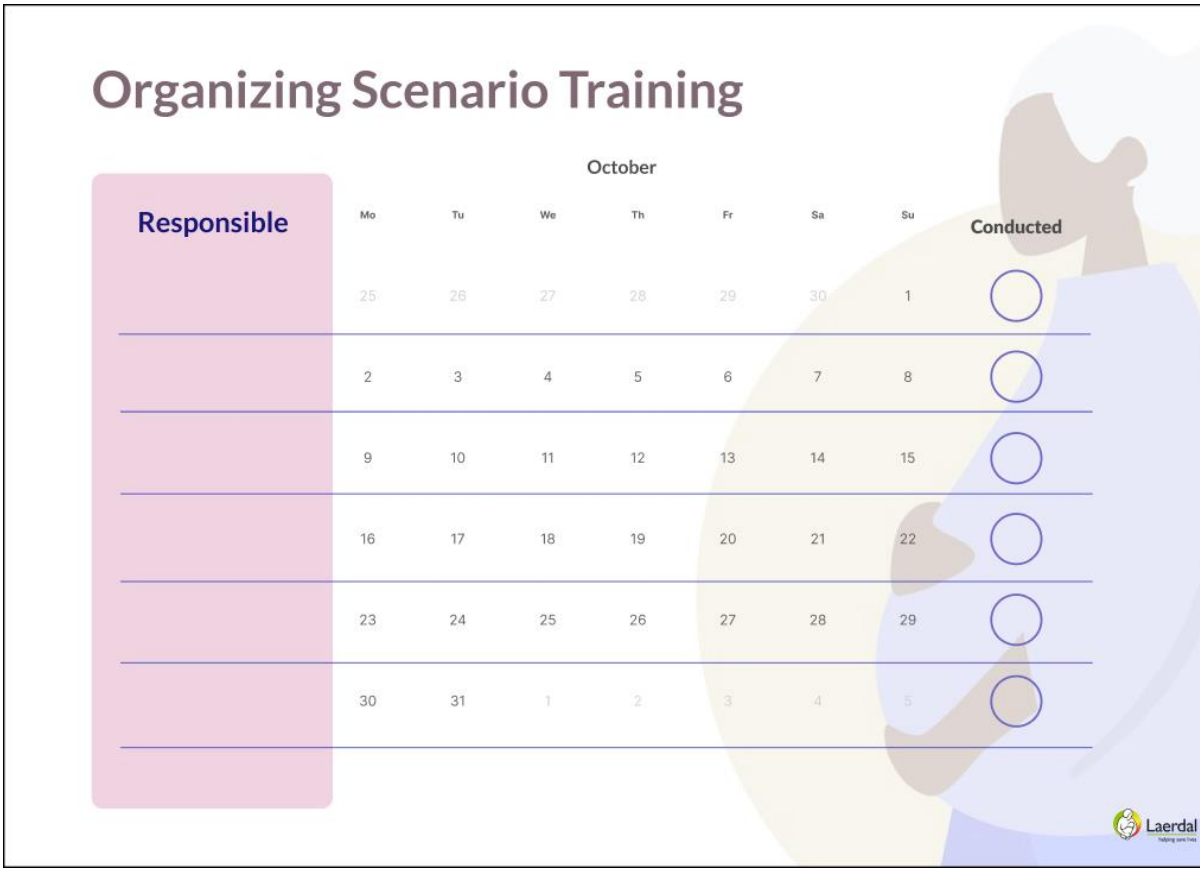
Concept 3

Name:
Training Responsibility Calendar and Role Distribution

Features of the Concept:
Physical Calendar, PDF, WhatsApp

The Challenges:
Self-initiative to conduct a training, lack of a training overview, and unprepared for training.

Description:
The physical calendar will be on a wall in a visible place in t
nurse in-charge's assigned training weeks and indicate the
scenario training a given week. It serves as a training overv
easier for the nurse in-charge to remember when they are
the champion will send a WhatsApp message to the nurse
them who is responsible for conducting a scenario training
month. Additionally, the nurse in-charge sends WhatsApp
assigning roles and sharing a comprehensive PDF with case
task descriptions.



the ward. It will display each
ir responsibility for conducting a
view and reminder. To make it
e being responsible for trainings,
in-charge once a month and tell
g each week in the following
messages to the labor group,
e details, product tutorials, and

How the Concept Will Solve the Challenge:

Using the ward's physical calendar and receiving a WhatsApp message from the champion once a month will remind the nurses in-charge of their training responsibilities. Distributing roles fosters readiness and accountability among participants. The visible overview on the calendar tracks weekly training, aligning with the ward's goal of conducting regular sessions and tracking who has conducted one and who has not.

Calendar

Scenario Training Preparation

Type of Scenario: Helping Mothers Survice
Title: PPH

Scenario Overview

Maya Angelou, G3 P2 L2 (Gravida 3, para 2, living children 2), who has attended 3 antenatal visits at your facility, arrived with 40 weeks pregnancy (full term) full dilatation and is delivering now. You have the required logistics to conduct a normal delivery and manage any common complications for the mother and baby postpartum.
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Roles

Mother

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  - Wear on the body
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Tasks
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Doctor

Tasks
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Nurse

Tasks
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Mother-in-law

Tasks
- How to operate MamaNatalie
  - Wear on the body
  - Hold onto the placenta and don't release it after the AMTSL is performed
  - Wait for the facilitator's cue before you release the placenta
- When there is much activity happening around you for removal of placenta- you become anxious and start asking questions frequently.

Laerdal

PDF

Appendix 9: Stakeholder user journey of short-term solution

PRE

PREPARATION

Laerdal Global Health

Tasks:
- Make the calendar
- Make one PDF for all the training scenarios

Challenges today:
- Difficulties of scheduling training sessions
- Low frequency between the training sessions
- Lack of confidence in using the products and equipment
- Maintenance

Value these tasks will give:
- By giving everyone clear roles, it is easier to understand what to do. Responsibility will increase the motivation to conduct a training and prepare themselves to get the most out of it
- By giving the nurse in charge responsibility for scheduling a training once a week, the training will follow more the low-dose high-frequency model
- By distributing roles early, all the participants are able to prepare themselves for their tasks, in addition to learn how to use the tools before the training has started to become more confident
- Using methods they are familiar with like printing out papers and sending messages through WhatsApp will make the implementation easier
- Proper use of products leads to a longer life of the products

Tasks:
- Send physical print outs (with the regional managers)
- Teach champions how the system works
- Tell the champion to show HCWs how to use it

Challenges:
- System is not used properly
- Everyone is not familiar with how it works
- Rotation of staff

Value:
- By delivering the overviews in a format they are used to, it is easier for them to use it without too many new learnings
- All the hospitals are working differently, so the system is not too rigid, but adaptable to be used how they want to
- By sending the PDFs it opens up for self-learning, which releases the burdens for the facilitator and champions

Champion

Tasks:
- Learn how the system works
- Put up the calendar on the wall in the ward
- Teach the healthcare workers how it works

Challenges:
- Takes time to learn new things and spend t implementation
- Rotation of staff
- Laerdal is not able to implement everything hospital
- Laerdal is not able to teach all the healthcar in all the different hospitals and wards
- Healthcare workers are not conducting any because they dont feel any responsibility ar therefor they are just waiting for the champ conduct one

Value:
- To make it easier to conduct scenario traini being able to expand the project
- Less pressure on champions to conduct tra
- Easier for the champion to distribute roles responsibilities, when the other participants trained through the PDF instead of being or by the champion
- Make it simple enough, so each hospital car their own training system to make it sustain
- The champion knows the hospitals better, s make the system fit the culture inside the h

Features

PDF

CALENDAR

WhatsApp

	DURING	POST
	Tasks: • Distribute responsibility to nurse in-charge via Google Calendar • Fill out the physical calendar on the wall • Distribute PDFs to the nurses in charge **Challenge:** • Nurse in charge does not know where to find the materials to send out • Lack of initiative to conduct trainings **Value:** • When the nurse in charge is getting the responsibility to conduct a training, it is easier to actually do it because it is a specific task	**Tasks:** • Google Calendar will remind the nurse in-charge that he/she is responsible for conducting training this week

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31 Calendar

PRE

PREPARATION

Nurse in-charge

Tasks:
- Receive Google Calendar event of when he/she is responsible for conducting a scenario training
- Invite the chosen participants to join the scenario training via Google Calendar
- Distribute roles
- Send out WhatsApp message to the labour ward group

Challenges:
- Lack of self initiative to conduct a training
- They are busy, but they have time
- That everyone relies on others or the champion to conduct the training, so it ends up not happening
- The facilitator is not comfortable with neither the product nor the theme he/she is going to conduct a training with
- Waiting for the champion to conduct a training

Value:
- External motivation to conduct training by receiving specific roles
- When the participants know how to use the different tools and their roles and case overview before training, their confidence throughout the training will increase, and the focus can be on communication and following the action plan throughout the training
- More frequent training sessions
- Physical calendar and Google Calendar works as different touchpoints, to increase the chance of remember to conduct a training

Healthcare Worker

Tasks:
- Receive Google Calendar event of scenario training
- Check out the physical calendar

Challenges:
- Not knowing about the upcoming training sessions
- Lack of overview
- Not knowing who is responsible for trainings

Value:
- To get an overview of the different training sessions
- Extra touchpoints to remember the training

Features

PDF

CALENDAR

WhatsApp

DURING

POST

Calendar will remind nurse in-charge of the
calendar will remind the nurse in-charge and
of the ward, so if one forget they can
er together
for training

per and feel the call to conduct a training
kills and confidence regarding conducting
trainings

er and willingness to teach other exist among
vives, but arranging the trainings in busy
h a short amount of staff is hard. This system
them to organize and distribute roles, so
e has smaller and more specific tasks to do
ll be more manageable to conduct and
a training.
conduct a training if you are more prepared
know the particpants are prepared, so
e has some kind of basis knowledge.
ldence and skills are increasing

Tasks:
- Conduct Training
- Go through debrief

Tasks:
- Clean after the training
- Document
- Check off on conducted on the calendar after the training session

Challenge:
- Not documenting
- Overview of trainings that have been conducted and future trainings

Value:
- Documentation may increase as it becomes easier to identify instances where someone has not documented.
- By being able to check off if you have conducted a training, the goal is to make some kind of a common goal that everyone will do their jobs and motivate each other. It is very clearly if someone is skipping one of the steps

a WhatsApp message with roles and the PDF
information
t your role
r tasks
yourself on the case and make sure you
w to use the equipment
e not able to go, make sure you tell the
r or get someone else to be your substitute.

o prepare due to lack of specific tasks and
dy given roles
s and tight schedules, so it depends when
able to prepare for the training
nts are not getting all the value from the
due to lack of preparations and knowledge
o use the different tools and not
nding their roles.
where to find tutorials on how to use the
, or if it even exists
wing who is responsible for trainings

e to deal with it when you are busy
the cognitive load, by making it more
o prepare and you can do it whenever suits
best and you are not dependent on the tablet
rd with all the distractions around
u know you have a specific role during the
the motivation to go to the training will

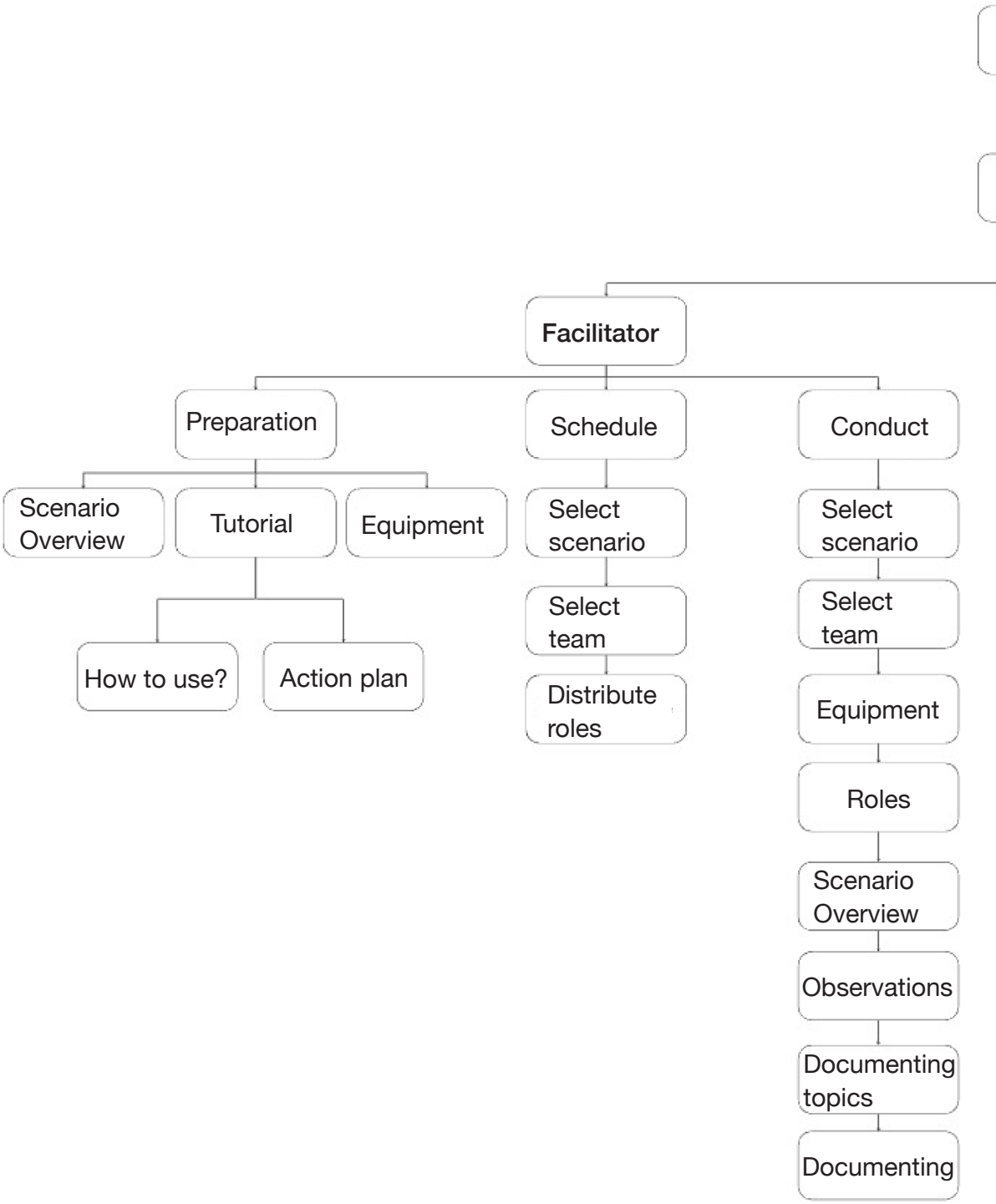
idence among the participants will increase,
future more people will be able to conduct
tate trainings
ng how to use a product properly, misusage
ease which will turn out positive for the
nce and the products will last longer

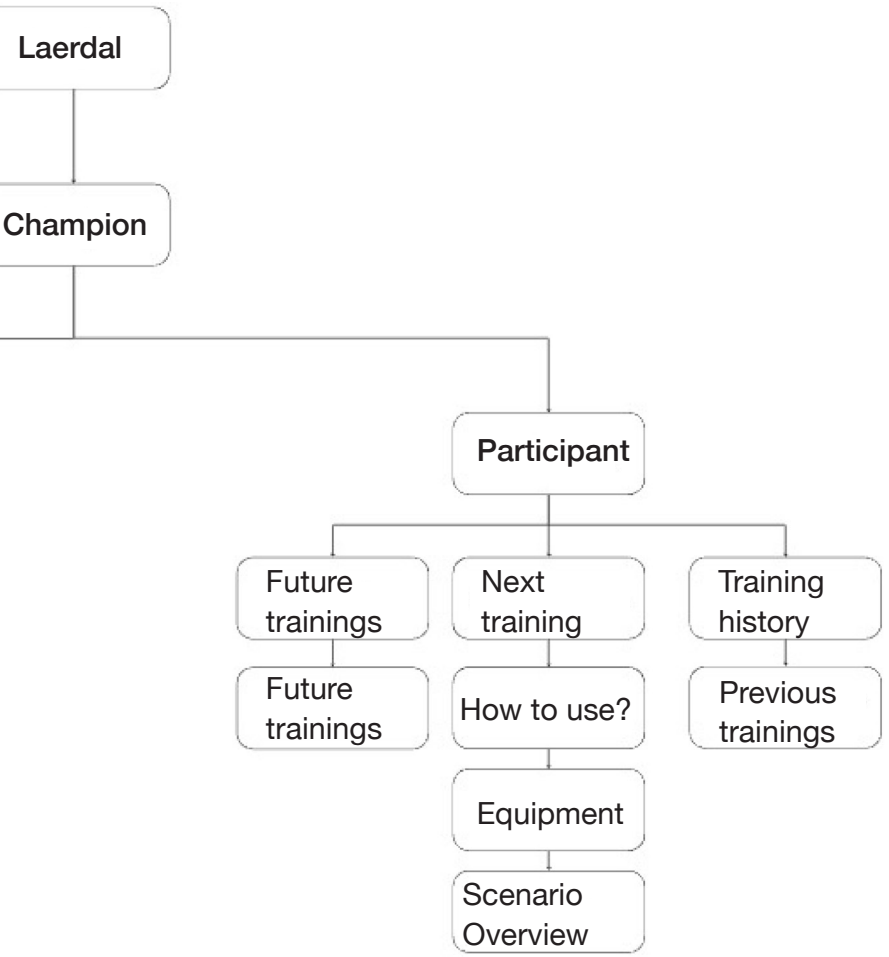
Tasks:
- Conduct Training

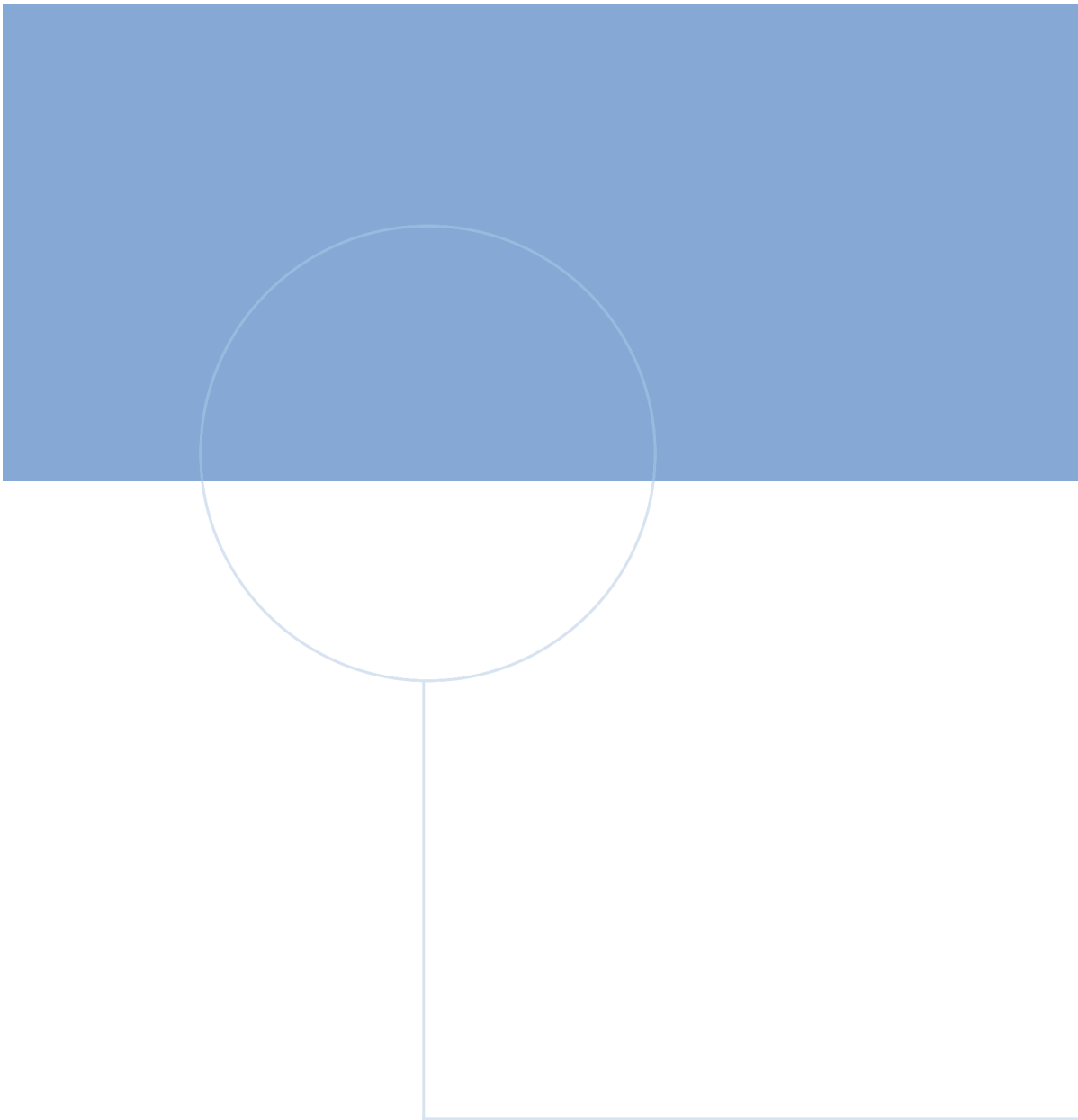
Value:
- By knowing how things work and the different roles and tasks, everyone will get more out of the training session
- Maintenance will increase, due to the proper usage of the tools
- The confidence and skills among the staff are increasing

31 Calendar

Appendix 10: Information architecture of long-term solution




Laerdal
Champion
Participant
Future trainings
Next training
Training history
Future trainings
How to use?
Previous trainings
Equipment
Scenario Overview



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Norwegian University of
Science and Technology

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helping save lives