Rio

Connecting Midwives and Knowledge

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DESIGNHÖGSKOLAN
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Abstract

Mothers around the world experience preventable medical complications during labor and delivery that can lead to maternal and newborn mortality. In addition, some expectant mothers can experience abuse, neglect, and discrimination from attending midwives. This lack of quality care has more connection to maternal mortality than lack of access to health services itself, and it is shown that the most effective way to improve care is through training and continuous education of the midwife, the primary obstetric care-giver.

The collaboration partner of this thesis was Laerdal Global Health [LGH, a not-for-profit company whose work is dedicated to saving the lives of mothers and newborns in low income regions, through high-impact, low-cost solutions involving educational materials and training programs for midwives. The aim of the partnership with LGH was to support competency development for labor management, with a focus on continuous training and education for midwives in Tanzania, sub Saharan Africa. Continuous training is on-going education of midwives through various methods of training and learning, with the goal of keeping skill sets current and evolving with best practice knowledge.

Around the world, as well as in in sub Saharan Africa, medical systems can be stressed by a range of factors, including lack of resources and lack experienced midwives, which leads to challenges to follow standardized obstetric guidelines and an over-burdening workload for the midwife. (LGH, 2019). There is also a high frequency of midwife turnover within clinics and hospitals, making it difficult to train a fluctuating staff of varying competencies and knowledge sets. (LGH, 2019). The net effect of these challenges and beyond, made it imperative to address how midwives could be supported in their efforts to engage in continuous education and training.

To facilitate and support continuous education, a hybrid chat and professional education platform, Rio, was created, powered by social interaction, knowledge exchange, and democratization of information. This platform's aim was to give form and body to existing digital and social behaviors, and midwives' continuous education efforts, something that comes in many shapes and sizes, and levels of tangibility. A proposal in the digital space was determined to be optimal due to its ability to increase access to information, and its adaptability to user needs and environments. Rio also challenges the ubiquitous nature of WhatsApp in the medical context by addressing and rethinking the generation, use, and storage of patient data. In tandem, Rio maintains the successful social platform use patterns, while utilizing these traits to propel and facilitate professional education and knowledge exchange.

All photographs in this report which are uncited have been taken by the author, Carolyn Wegner.

1.0 Introduction

1.1 Context

Childbirth is one of the most significant events of a woman's life, being impactful, transformative and extraordinary. It can also, however, be a time of great stress, vulnerability, and full of avoidable complications, which themselves can lead to maternal and newborn mortality or morbidity. Per year, there are nearly three million neonatal deaths and 300,000 maternal deaths (LGH, 2019).

It is also known that a safe and positive birth experience is also about respectful care. Some expectant mothers, especially those who are younger and less educated, can experience negative treatment such as neglect and lack of consent for medical procedures (Bohren et al., 2019). In a study by the medical journal, The Lancet, conducted across several middle to low income countries with observations of two-thousand women in labor, over forty percent experienced discrimination and physical and verbal abuse (Bohren et al., 2019). This mistreatment creates not only a lack of trust in the medical staff and system, but it also has ramifications mentally and physically for the mother and child and discourages "future health-seeking behaviors" (Bohren et al., 2019).

> *"Lack of quality care has more connection to maternal mortality than lack of access to health services itself*
> *Bohren et al. 2019*

It has been shown that improvement of obstetric care is necessary to help reduce incidents of both mortality and morbidity, and increase respectful care of the mother. (LGH, 2019). As one midwife explains, "there is a huge need globally to have better care. These skills are linked to the ability to identify the beginning of abnormal and potentially dangerous complications, and improve the mother's overall birthing experience (Implementation Specialist 1, 2020). Throughout history, and into the present day, midwives are often the primary provider of this essential obstetric care for most expecting mothers.

1.2 Role of the Midwife

Midwives have a very demanding, difficult, and critical job, being responsible for both the life and health of the mother, and child. (For more information on mental health, see Appendix 12.1) Over ten midwives were interviewed around the globe to understand how they see their role and responsibilities. On average, they saw their responsibilities spanning across the full spectrum of support that a mother may need, including pregnancy, antenatal care, labour, childbirth, and postpartum care. This entails everything from "hard" technical obstetric skills that require medical expertise to "soft," qualitative skills like emotional compassion and support for the mother and the ability to read her needs. (For comprehensive midwife role description, see Appendix 12.2)

The ability to sustain and improve this range of midwifery skills is deeply linked to education, training and competency development, which in turn impacts the overall quality of care midwives give expecting mothers.

1.3 Collaboration

Laerdal Global Health (LGH), a not for profit organization that focuses on education solutions for obstetric care givers such as midwives, was partnered with for this thesis. LGH strives to reduce maternal and newborn morbidity and mortality by developing training systems and educational material that are implemented through programs around the world.

The collaboration with LGH took place in Tanzania, sub Saharan Africa, where continuous education for midwives is the focus. It is particularly crucial to address obstetric care in sub Saharan Africa, since expecting mothers in this region have a high rate of maternal and perinatal mortality. (LGH, 2019). According to the IHME Maternal Health Atlas (2017), there are 5000 deaths annually in Tanzania, and a maternal mortality ratio of 247 per 100,000. With there being 27.7 million women of child bearing age, with an average number of 4.8 live births per woman, it is essential to address maternal care through midwifery competency development and continuous education (IHME Maternal Health Atlas, 2017).

1.4 What is Continuous Education?

Continuous training is on-going education of midwives through various methods of training and learning, with the goal of keeping skill sets current and evolving with best practice knowledge. Continuous training can be "in-house and is is increasingly becoming the recommended approach for strengthening competencies in both low and high-resource clinical practices" (Maaløe, 2018). Continuous education for labour and delivery also encompasses soft skills such as communication with and emotional support of the mother. One former midwife emphasises that equal attention needs to be given to these soft skills like respectful care since they are "very much related to knowledge and attitude of the midwife and can have a strong physiological and psychological impact on the mother. It's not just a hard skill to suggest a different position or allow a companion; it also relies on changing how the midwife thinks and her attitude" (LGH Implementation Specialist 1, 2020). It is through this continuous education that the midwives' own self confidence and attitude can be progressed as well.

1.5 Essentials of Continuous Education

The following are essential elements that make up the fundamentals of continuous education.

Education Methods

Simulation Training
Simulation training is role play, focusing on working through scenarios that may occur in real life and in a safe environment. As discussed by Egenberg et al. (2016), simulation "lets participants practice (skills and procedures) without harming patients, allowing participants to act without the fear of negative consequences (Egenberg et al., 2016). A major element of simulation is human interaction, communication, decision making, and teamwork. According to Doris Østergaard, head of the Danish Institute for Medical Simulation, "simulation training makes it natural and positive to discuss errors in constructive ways – thereby creating great potential for changes in healthcare cultures, and helping reduce the number of fatal errors" (Saving More Lives Together, 2018, p.33). Simulation training is one of the most ubiquitous and effective education methods in the medical field.

Peer To Peer
Peer to peer learning focuses on using one's peers to practice and develop competencies. As noted by a former midwife, "repeated peer to peer discussions and feedback...will help to create a safe learning environment" (LGH Implementation Specialist 1, 2020). Peer to peer learning encourages collaborative learning, sharing feedback with fellow midwives, and a safe space to learn.

Mentorship
Mentorship of midwives can provide support and encouragement needed to promote a healthy, positive learning and working environment. According to a midwife previously working in Malawi, "midwives need to be encouraged by a trusted and respected person who is there every day, who understands the culture. They are moral support for the midwife" (Midwife 6, 2020). The mentor also plays a crucial role in making continuous training feasible. In order to have continuous learning, "you need someone who follows up and provides that guidance and motivation, and encourages asking questions" (LGH Implementation Specialist 2, 2020).

Educational Content
Content should be created together with those who will be doing the training, and it should be appropriately tailored to their settings and needs. According to Nanna Maaløe, researcher of prolonged labour, there is widespread evidence that "participatory development of standards that are simple and easy to understand have a greater chance of implementation" (Maaløe et al., 2012). By collaboratively creating context appropriate training, efforts will have greater chance of being relevant and valued.

> *"For any effort in quality improvement and diagnosing what should be focused on in training, you need data*
>
> *Implementation Specialist 2, 2020*

Progress Measurement
For all efforts made during education and training, one must be able to track progress to show improvement and efficacy of methods.This quality improvement is gauged through data collection indicators. These indicators are selected to be tracked, collected, and analyzed since they have been deemed relevant to show if progress has been made within the scope of interest. With analysis from the indicator measurements, training can be adjusted and optimized accordingly (LGH Implementation Specialist 2, 2020). There are some principles, however, that can be followed to ensure that data is being used in the best way possible. (For data use principles, see Appendix 12.3).

1.6 Barriers to Best Practice Midwifery and Continuous Education

Midwives encounter many barriers to sustaining continuous education. There is no exception in sub Saharan Africa and Tanzania. Often, the challenges lay not in the initial training, but in the ability to continue to implement training moments in day to day practice (LGH Project Manager, 2019). This is due to a range of barriers from larger systemic issues to facility based challenges. The following is not comprehensive, rather, a collection of some of the more prominent and long standing barriers.

Turnover
Another systemic barrier that has wide reaching consequences for continuous training and building a skilled midwife team is high turnover. Turnover often happens "when people get more educated and more skilled, and better opportunities open up to them. Then they tend to leave" (LGH Project Manager, 2020). Reinforcing this, the Partoma study describes how "at any time (during research), a considerable proportion of staff had limited experience in maternity care....(and was) dominated by young, non-specialized providers (Maaløe, 2018). With a workforce of inexperienced and shifting midwives, training and developing competencies is extremely difficult, and resource consuming with little return on investment or progress in improving quality of care.

Understaffed and Overworked
Midwives often are working in environments where there is a poor ratio of skilled midwives to expecting mothers. The challenge of understaffing can expand beyond the lack of ability to provide emotional support for expecting mothers. In many cases, especially as seen in a study conducted in Zanzibar, the ability to perform basic medical care is impeded. A midwife in Zanzibar explains that "Here we have six beds [for deliveries], and there are times where you have ten cases waiting and everyone [is] about fully dilated...you find that it is overwhelming" (Maaløe, 2018).
This creates the situation where a midwife's "management will not be appropriate...It's just, remove the baby, you put it there and you go to another woman" (Maaloe et al., 2012). It has been shown that in cases as just described, that expecting mothers in latent phase labour were often also monitored insufficiently. These overworked, understaffed conditions lead to lack of ability to engage with continuous training.

Support and Resources
In order for continuous training to be sustained and effective, there needs to be approval and support from the upper management of the hospital or clinic. Training requires logistics and negotiations pertaining to time, scheduling, human resources, and finances. These all must come from management. As explained by a former midwife in Ethiopia, "any (training) efforts also need to be continuous and supportive, and routines that are established should be enforced by upper management" (LGH Implementation Specialist 1, 2020). Training must also be "integrated into the workday, not separate from duties" to be fully supported by the staff participating (LGH Implementation Specialist 1, 2020). This is particularly important in facilities where midwives are overburdened and where there are many items on the agenda that could be prioritized over training (LGH Implementation Specialist 2, 2020).

Hierarchical System
For many midwives, the work environment can be a challenging place. This is often due to hierarchies built into the health system and beyond. Maaløe (2018) adds that midwives' ability to provide quality care is hindered "due to steep hierarchies of authority and power, with health officials at the top and frontline health workers too often at the bottom" (Maaløe, 2018). This hierarchy is also expressed within interactions between colleagues: "the way you communicate with your boss and subordinates is not based on mutual respect; it is based on hierarchy, and feedback is often based on blame and shame. This means that talking about issues is associated with a form of consequence and makes people defensive" (LGH Implementation Specialist, 2020). This creates an environment not conducive to open discussion, learning, and education-seeking behavior.

2.0 Approach

2.1 End Goal

The overarching goal of this project is to address some of these challenges in order to increase midwife access to, and engagement with, continuous education. This is with the long term intent to reduce maternal and newborn morbidity rates and improve the quality of care for expecting mothers.

2.2 Research Question

How might we improve the quality of care mothers receive during labor and birth through supporting midwives' efforts to participate in competency development and continuous education?

2.3 The Medium: Digital Space

Integration into the Existing
This thesis focuses on how a digital space can be utilized to help midwives sustain and improve their competencies. Through observation and use of current digital platforms used by midwives in their personal and work life in Tanzania, and their patterns of use, existing applications and associated behaviors were identified to be built upon to provide familiar, yet novel continuous education opportunities.

Flexibility and Educational Access
The digital medium was chosen as my target space to use in the context of this thesis since it has the capabilities to provide a flexible solution which adapts to its users and their diverse set of individual and community-based educational needs across geographic regions. The digital space also serves to democratize learning by increase access to training and educational content.

Data Use
A digital medium also has the ability to provide data to LGH to inform training improvements, and to the local and global community to uncover health trends. As added by UNICEF (2019), "digital health interventions have demonstrated impacts on a wide range of outcomes, [including]...improving quality of care offered at the community level" (Unicef's Approach To Digital Health, 2018). Therefore, I posed another question:

2.4 Additional Question

How might operating in a digital space provide opportunity for an adaptable and inclusive continuous education platform to support midwives' competency development?

2.5 Methodology

Design Methodology

Human Centered Design
This thesis is about human life and the caregivers that support and care for it. This makes a human centered design approach the natural methodology running through the veins of this process. A human centered approach ensures that people, and their values, and voices, remain at the epicenter. With this overarching methodology, the design process is afforded the opportunity to learn from and create from the lens of the human, to encompass the foundation of their identity.

Humble Design
This thesis is founded on the values of humble designing, a methodology that urges designers' processes to be guided and shaped by the diverse sets of knowledge and worldviews of the people, especially when engaging with communities external to their own (Torretta & Reitsma, 2019). Inherent in this methodology is the acknowledgement that all participants of the design process enter the equation with partial perspectives of the whole, with an emphasis on bringing self awareness to the designer's own implicit biases. With this knowledge, the design process should strive to embrace the perspectives of those engaged, and find a dynamic of balance between power hierarchies that may innately govern systems within which the design process is situated (Torretta & Reitsma, 2019). Ultimately, this methodology is about nurturing participation, building equality, and making decisions through the lense of openness and humbleness.

Research Methodology

Ethnographic

The research conducted during this thesis used ethnographic principles to drive its methodology and approach. This entailed research based around engagement in various forms, with the users' presence and immersion in the users' environment central to the thesis.

User Engagement : Interviews
In-person interviews were an integral way to develop relationships and trust with my users. The most critical purpose of these relationships was to elevate the voice of the midwife, and have his or her viewpoints and opinions present throughout my thesis. These relationships were established and then maintained to varying degrees for the duration of the design process.

Immersion
Observations and shadowing of midwives in their work environment served the crucial purpose of gaining an immersive and revealing glimpse inside the day to day realities and challenges of the midwife. This real-time, observational research also helped to paint a more comprehensive picture of the user's environment, culture, relationships, and community structure.

Participation
Taking part in simulation training with practicing midwives provided the opportunity to change perspectives and gain a more comprehensive understanding of logistics and resources required to carry out the training and to create the role play experience of the simulations. This built a base knowledge of the midwife's primary form of training, which helped to orient and situate observations and interview insights from in-field research surrounding continuous education.

Secondary Research
An underlying backbone of my methodology was secondary research. Engagement with the user and immersion experiences were supported by this foundational research which included study of literature, such as scientific journals, academic papers, medical studies, and articles from health organizations. Laerdal Global Health also provided an immense contribution of knowledge pertaining to maternal and newborn health, midwifery, training and continuous education, and implementation.

Synthesis Methodology

Remote Engagement
A reality of sustaining contact with my users for the latter half of the process was the need to utilize remote methodology. This meant that all exchanges with users after the ideation and validation phase were digital, in part due to their location in Tanzania and across the world, and also due to the Covid-19 pandemic that cancelled in-person workshops, interviews, and user testing. Remote engagement included communication via text and voice call, multimedia exchange on WhatsApp, Gmail, Facetime phone calls, Zoom meetings, and web based collaborative boards. Although it reduced innate learnings and observations that can arise from in person contact, the nature of remote engagement contributed other, unexpected insights pertaining to the digital space within which the thesis is situated.

Recycling, Reconfigure, Repurpose
This methodology strives to take existing societal structures, methodologies, behaviors, technologies, etc. that live within a community or environment, and recycle and repurpose them in the design process and proposition. This method is not about reinventing the wheel; rather, it means taking elements of the existing that are successful and advantageous to the user, and giving them life in new form. This methodology was central to the process and propoposal of this thesis.

2.6 Thesis Wishes

My wish is for this thesis to be a relevant contributor to the positive development of continuous education of midwives in Tanzania, and beyond. I hope that the research, insights, and the final design proposition that arose from this project will contribute to this goal and help guide Laerdal Global Health in other future digital endeavors. Ideally, this work will be applicable elsewhere in the world of maternal and newborn health and will give inspiration to novel, alternative framings and perspectives to an extensively studied space of midwifery education. This thesis will also address the United Nations' Sustainable Development Goal 3.1 which strives to reduce maternal deaths to less than 70 per 100,000 live deliveries by 2030 (IMHE Maternal Health Atlas, 2020).

2.7 Challenges

Understanding Contexts
The main challenge in this project was designing in a community outside of my own, in a foreign country. It was impossible to fully understand the perspectives, biases, values, behavioral norms, and professional and social structures in the medical setting of Tanzania in such a short period of time. It was also a challenge to keep an awareness of my own biases and perspectives that I bring to the research and design process.

Remote Methodology
Designing with remote engagement proved to be difficult, as there were many friction points that barred user interaction and receiving feedback. This was in part due to working in the context of Tanzania and in part due to Covid-19. For example, in Tanzania, multiple contacts that were established had access only to poor internet connection once they were sent home from the hospital due to the virus. This greatly altered their ability to be involved in the process. Subsequently, alternative forms of user engagement were employed to navigate these challenges encountered, which was a learning in itself.

Data Use
This thesis employs the use of user generated content, such as photos and videos of patients and training sessions, to help facilitate continuous education through a digital platform. The creation and use of this patient data carries challenges and controversies with it. The main challenge revolved around how to safely collect, store, and utilize user generated data on a digital platform, in a medical context. Another challenge was to create trust in the system by verifying and regulating user generated content. Lastly, controversy arose over whether or not using patient data to support education is appropriate.

The Design Process

Figure 1. Foetal Monitoring.

3.0 Field Research

Field Research

The field research phase focused on integrating midwives into my research and having immersive experiences in their place of work. The primary goal was to learn from midwives and other participants in the birthing experience and to gain insights from the environment in which midwives work. My research was conducted in two phases: phase one in Norway, Sweden, and remotely in the USA; and phase two in Tanzania. The following information reviews the details of each phase, capped by aggregated key learnings from phase one and two.

3.1 Phase One

This phase was focused on gathering foundational obstetric knowledge; preliminary insights from practicing midwives about their work environment, their role as a midwife, and continuing education barriers and facilitators; and training knowledge from Laerdal Global Health.

Location
Stavanger, Norway
(Stavanger University Hospital)
Umea, Sweden,
United States (Remote)

User Engagement
All interviews apart from Norway and Sweden were conducted remotely. Relationships were mained throughout the process, except for doulas and parents. Contacts ranged in age from late twenties to mid seventies. English was the native language of some, while others had Swedish, Norwegian, and German as their native language, with fluency in English. The primary contact exchange was by email, text message, and audio/video conference.

Contacts
1 Nurse (Illinois, Utah, USA)
2 Midwives (Colorado, USA)
1 Midwife (Sweden)
5 Midwives (Norway)
1 Midwife (Austria)
1 Doctor (Austria)
1 Medical Attendant (Norway)
2 Doulas (Washington, California, USA)
4 Sets of Parents (Washington, California, USA)

Activities

Laerdal Global Health Expert Interviews:
Discussions with industrial designers, education specialists, former midwives, project managers, and program implementation specialists who have expertise in midwife training and competency development globally.

Safer Simulation training:
Simulation training of a pre-eclampsia scenario with midwives from the University Hospital to gain first hand knowledge of how role play education is organized, facilitated, and executed.

Shadowing and Expert Interviews:
Observation of midwives in the postpartum and delivery ward at Stavanger University Hospital. Interviews were conducted during free time throughout their workday both individually, and in group sessions.

Remote interviews:
Interviews with nurses, midwives, doulas, and parents in the United States.

Secondary Research:
Desk research to both build foundational knowledge, and deepen field research phase one learnings.

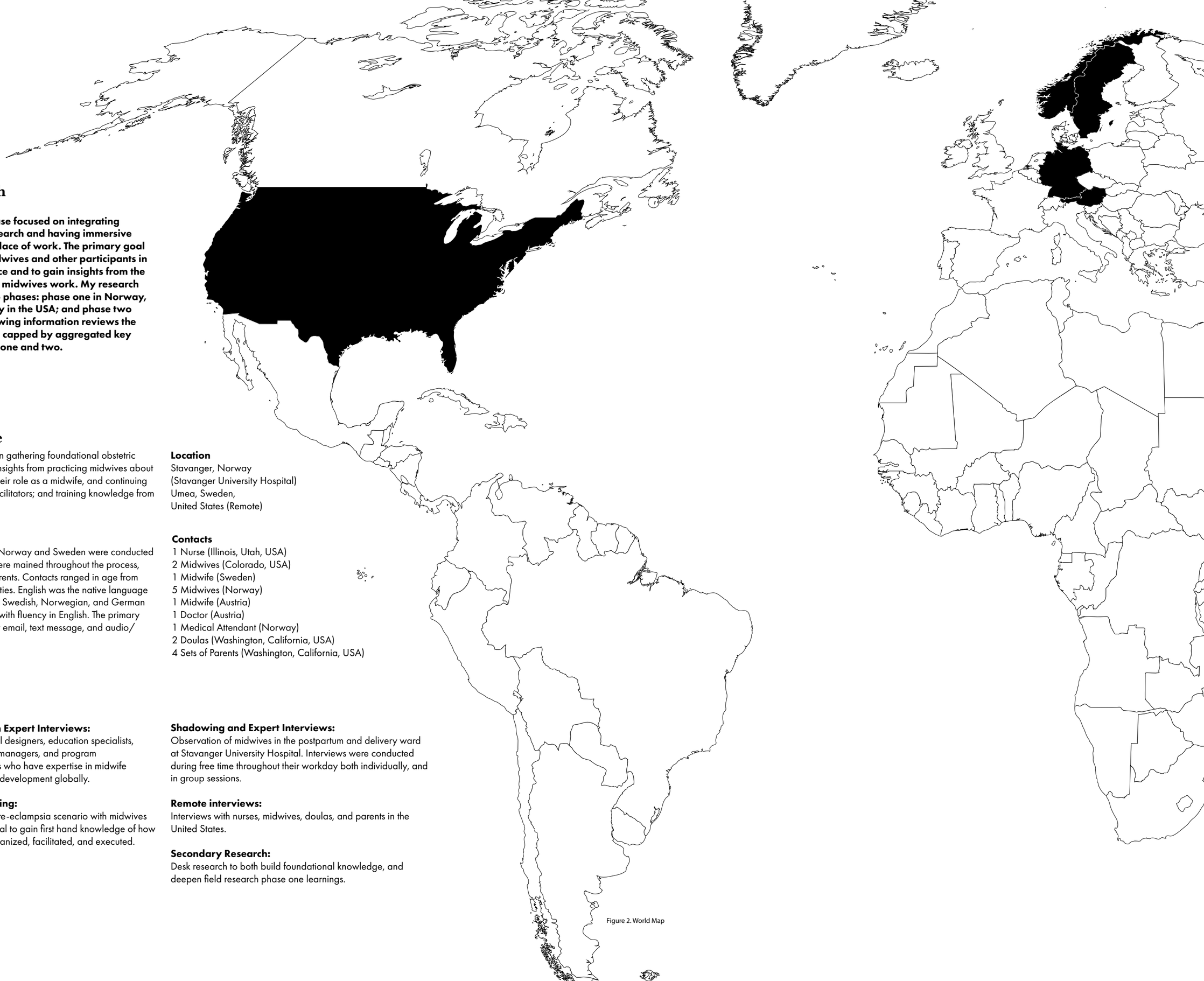
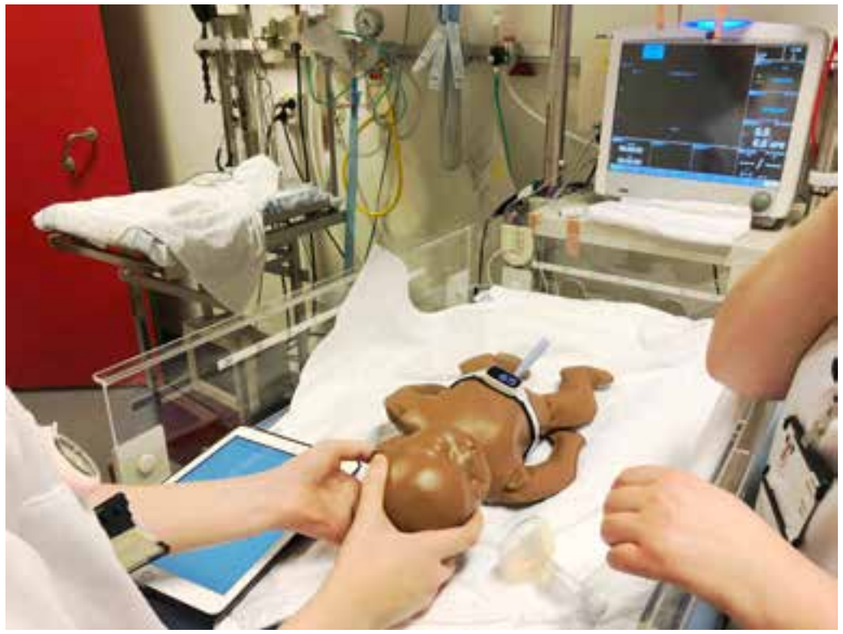


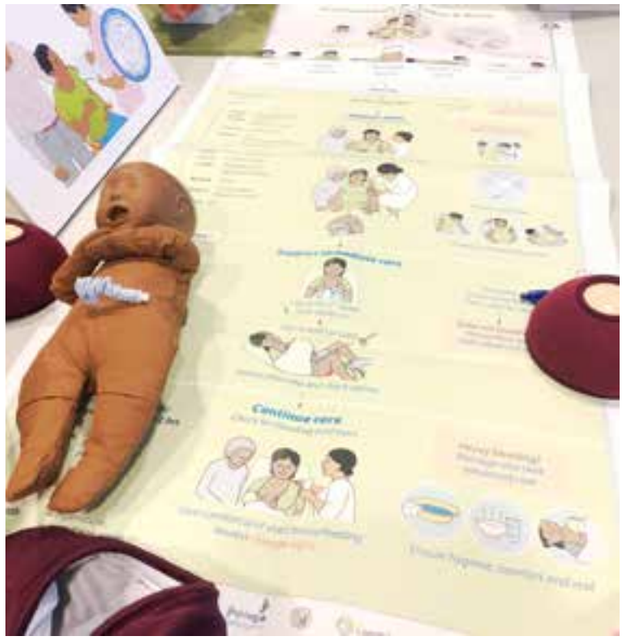
Figure 2. World Map

Stavanger University Hospital, Delivery Ward, Stavanger, Norway

Stavanger University Hospital, Delivery Ward, Stavanger, Norway



Stavanger University Hospital, Delivery Ward Training, Stavanger, Norway



Training Material, LGH, Stavanger, Norway

Simulation Training, Stavanger, Norway

Simulation Training, Stavanger, Norway

Figure 3. World Map

3.2 Phase Two

This phase both challenged and validated insights from the first phase of research to help further define the brief. This phase also identified the needs of midwives in Tanzania specifically, helped to shape my understanding of their work environment, and gave a glimpse into the local culture, norms, and value systems. Many of the novel insights in this phase revealed key challenges and facilitators of training and competency development.
(For more photo documentation of Phase Two, see Appendix 12.4)

Location
Moshi, Tanzania
Sub-Saharan Africa

(Kilimanjaro Christian Medical Center (KCMC)
(Mawenzi Hospital)

User Engagement
During the field research in Tanzania, numerous doctors and midwives were interviewed and from these interactions, four primary contacts were established: a clinical instructor and midwife, a head midwife, a volunteer midwife, and an intern midwife on clinical rotation in the delivery ward. All established relationships were within KCMC and its partner university, Kilimanjaro Christian Medical University College (KCMUCo). They ranged in age from their early twenties to mid sixties. Their native language was Kiswahili, and varied from a working knowledge to fluency in English. The primary means of contact was WhatApp, followed by email.

Contacts
5+ Midwives
1 clinical instructor
2 volunteer midwife
1 intern midwife
1 doctor

Activities

Midwife Interviews:
Expert Interviews with midwives, volunteer midwives, clinical instructors, and intern midwives from KCMC and KCMCo, conducted in the ward. Several of these interviews were aided by a translator.

Meetings:
Meetings with directors and senior staff of Obstetrics Units at Mawenzi Hospital and Kilimanjaro Christian Medical Center for a concurrent research project facilitated by a midwife PhD from Stavanger University Hospital

Simulation Demonstrations:
Simulation Training Demonstrations Mawenzi Hospital and Kilimanjaro Christian Medical Center with midwives and managerial staff.

Observations:
Labour ward and delivery ward observations at KCMC and tours of facilities at Mawenzi Hospital

KCMC, Moshi, Tanzania

KCMC, Moshi, Tanzania

KCMC, Moshi, Tanzania

3.3 Key Learnings

The core of the key learnings are from field research in Tanzania, as this is the context in which my thesis is situated, with supportive findings and validation from phase one of field research. (For details of the Tanzania field research, see Appendix 12.5)

The underlying inquiry of the field research in both phases revolved around several themes:

- Current continuous training and educational efforts
- Current digital system/platform use patterns and habits
- Barriers to and facilitators of continuous training and education

General Observations

Education and Training in all Shapes & Sizes
As observed during both phases of research, from the United States to Scandinavia to sub Saharan Africa, approaches to continuous education and training are diverse. The systems and structures that guide them, the methodologies used, and the formality assigned to these learning moments differ within and between medical facilities and those who participate in them.

In KCMC, there is a spectrum of educational efforts. For instance, on one end of the spectrum there is a formal, organized orientation for all staff, including midwives, entering the hospital. There is also a structured, routine Tuesday lecture, organized by a "Continuous Education Office"- yet another formalized effort on the behalf of the hospital. Falling in the middle of the spectrum are semi-organized simulation trainings that occur sporadically, with midwives who happen to be on shift at the time. Also falling in the center, but moving towards the other end of the formality spectrum, is the mentorship between senior and junior midwives. As juniors are mentored and learn through observation and hands on practice, they are participating in continuous education, yet it largely goes undocumented, with little structure or reflection on process and learnings. On the farthest end of the formality spectrum, is the exchange of knowledge through WhatsApp. While there are formal groups for the wards, the flow of information and how midwives utilize the platform and information is completely left to the the user, with no organization, tracking, or reflection. When it came to general communication about upcoming training, it was also quite informal at KCMC. As one midwife explained, "you can talk to the midwives who are there that day and tell them. In most cases, we encourage everyone to talk to those who were not around to let them know too. Then everyone will get excited and be prepared for it (the training or presentation)" (Intern Midwife, 2020).

Desire for Cross-Department Collaboration
As voiced by some midwives in KCMC, their continuous education would be "enriched by sharing knowledge between departments" (Intern Midwife, 2020), while the clinical instructor even suggested that training efforts could be multi disciplinary including doctors, attending nurses, medical students, etc." (Clinical Instructor, 2020). Unfortunately, today at KCMC, there is no platform to share information or continuous education efforts. When asked when knowledge sharing between departments could happen, one intern midwife referenced morning reports, which happen in rooms for doctors and, separately, in rooms for midwives. In one instance, a case had been discussed by OBGYN doctors in the morning report that one of the doctors thought would be beneficial for midwives to hear as well. He offered that, " If the doctor's morning report would have been together with the midwives, it would've been beneficial" since the midwives most likely had knowledge to contribute, and the doctors could have learned from them, and vice versa. He added, however, that "there would need to be a system change for this (joint reports) to happen" (Intern Midwife, 2020).

Facilitators of Continuous Educatuion

Mentorship
A mentorship structure, of varying degrees of formality and structure, is often built into the labour and delivery ward system. This was described in numerous interviews with doulas, midwives, and nurses, and seen at KCMC. Here, all midwives work in junior - senior pairs during shifts, which provides a crucial educational mentorship support for less experienced midwives. It is a largely successful and beneficial relationship that creates hands-on learning moments. Mentorship also allows for the intake of volunteers and interns which helps alleviate pressure of the workload. The pairing of senior and junior midwives also establishes essential and foundational relationships within the midwife community. As less experienced midwives enter the workforce, having mentors to work side by side with juniors throughout their shifts allows for a hands on learning environment, encourages asking questions, and generally builds camaraderie and bonds that serve to strengthen teamwork and trust. As a head midwife states, "we encourage (junior midwives) to seek advice from other (more experienced) midwives. If you are not sure about something, tell a friend or a senior, have them come check and discuss together. Always seek advice before you do something you are unsure of" (Midwife 1, 2020). As seen from the perspective of a junior midwife, "this means they are practicing all the time, always." This mentorship creates informal "learning moments throughout the day," as explained by the volunteer midwife; "if there is a newborn asphyxia, for instance, you can go observe how the (senior) midwife handles it" (Volunteer Midwife, 2020). The senior midwives can enjoy this teaching role too; "I enjoy teaching the students. I have students observe me delivering a baby for instance, and then the next day they try and I help them" (Clinical Instructor, 2020).

> *"Mentorship is fantastic. You experience things, see how the midwife works, and learn from it. It's a very supportive atmosphere for teaching*
> *Intern Midwife, 2020*

Educational Togetherness
There was a sense of camaraderie and togetherness that was apparent in all the midwives spoken to. A young midwife stressed that, "we work as a group, never work alone, and always are encouraged to ask for help" (Volunteer Midwife, 2020). This mentality of sharing and communal work was deep rooted, as it was apparent in continuous learning and training as well. One intern midwife in his clinical rotation said, "I like to share with my peers, especially if I have learned something new today in the wards (Intern Midwife, 2020). For newer midwives with less in-ward experience, sharing learnings from the ward can greatly enrich their own knowledge. This was supported by a volunteer midwife, who added, "I think it's nice to be in a group training since there we can share our views and opinions and learn from one another" (Volunteer Midwife, 2020).

> *"We always work together in pairs. I really like this of course. We are like a family, community*
> *Volunteer Midwife, 2020*

Multi-Generational Learning
The methods of learning that occur in the ward, such as simulation, presentation, and mentor observation, pave the way for multi generational learning moments, where information flows from both the junior and senior midwives. In the established mentorship, the less experienced learn from those with more in-ward experience. The intern midwife explains, "You go work in the ward, and you find things you haven't learned in school, through your seniors, the ones who are experts" (Intern Midwife, 2020). However, information can flow both ways. An intern described to me how everyone contributes to training according to their experiences. "Some of the midwives were educated twenty years ago, and us younger midwives, we can contribute with new knowledge from literature" (Intern Midwife, 2020). He added that this is highly important, because information is continually being updated.

> *"The more experienced midwives certainly want to be part of continuous education*
> *Intern Midwife, 2020*

Simulation and Presentations
Across the board, medical professionals spoken to chose simulation as the preferable training method. At KCMC, this held true as well. Group simulations and presentations were identified as the go to method of formal education moments in the ward, outside of mentorship. It was stressed that these group simulations or presentations should always be followed by a debrief, so there is room for participation and discussion. One volunteer midwife commented how, "simulation role play helps because then when you go to a real mother, and reflect on what you practiced, like a pelvic examination, you correlate what you learned in training to the real exam" (Volunteer Midwife, 2020). It was noted, however, that different kinds of knowledge can be taught in different ways. For instance, to recognise and identify stages of labour complications in birth, presentations, and visuals are beneficial, while to train procedures and physical tasks, simulation is more appropriate. The senior midwives can enjoy this teaching role too; "I enjoy teaching the students. I have students observe me delivering a baby for instance, and then the next day they try and I help them" (Clinical Instructor, 2020).

> *"Role play is best to learn, rather than just seeing it theoretically in a presentation.*
> *Intern Midwife, 2020*

Frequency & Consistency
As midwives were interviewed around the globe, ranging from interns to seniors, they all spoke of the importance of training, and desire for more frequent opportunities. The clinical instructor midwife at KCMC added that training needs to be consistent, and perhaps "even every week since it would increase our skills and knowledge" (Clinical Instructor 2020). The volunteer midwife reinforced that, "small doses of training helps, and the more, the better, because you know, practice makes perfect." She continued, echoing other midwives that to be most effective, training needs to be kept with a regular schedule (Volunteer Midwife 2020). This consistency and habit-building is key to retain information learned.

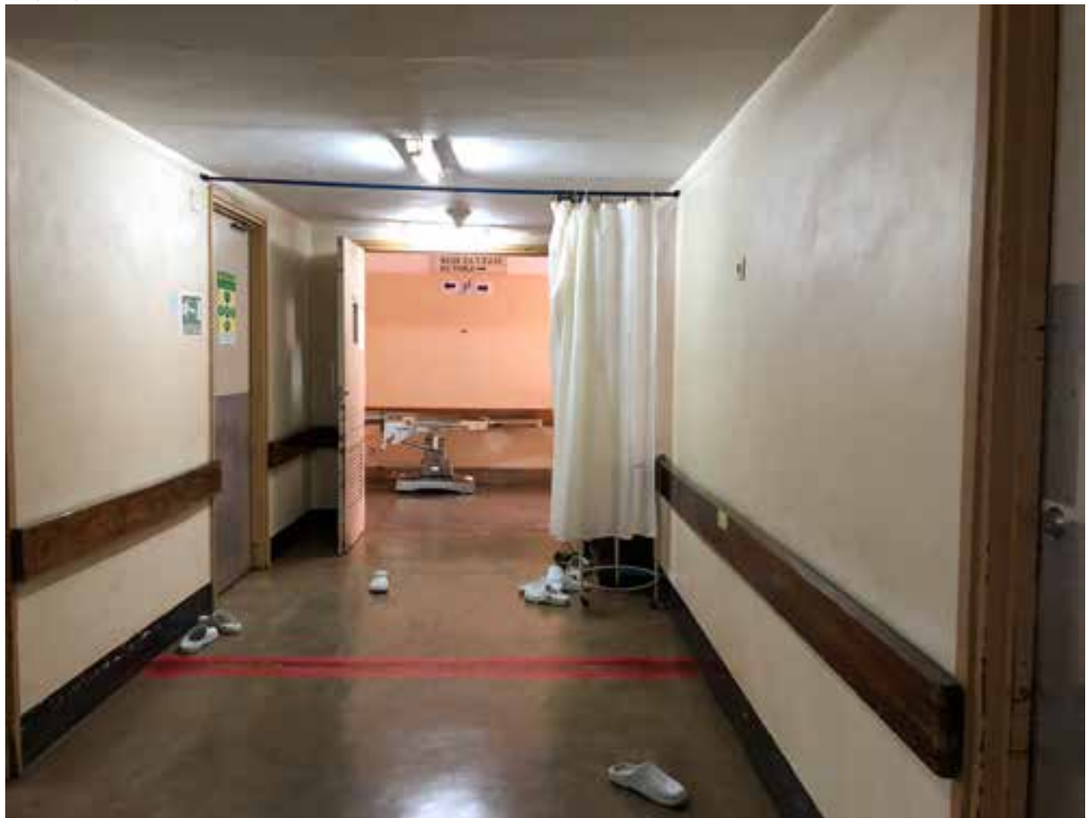
> *"Practice makes perfect*
> *Volunteer Midwife, 2020*

Tracking of Learning & Confidence Building
For new midwives in particular, confidence building was an important part of their initial experience in the ward. One midwife describes, "it's scary when you are a new midwife. At the beginning it can be very hard. You learn a lot in the first months since everything is new and exciting" (Volunteer Midwife 2020). Part of building confidence is about being able to see your progress, and track it. As explained by another midwife, she was required to track everything she did during her onboarding training. This included recording forty deliveries required to pass the program. She noted that for her, "every birth is so special, and I learn from all of them, so it's important to record it" (Midwife 3, 2020). Digital tracking of learning was also an on-going practice as described by several other midwives, "we get continuing education credits through using a digital platform. It's a great way to incentivise tracking what we are learning" (Midwife 2, 2020). For more on confidence and self-efficacy, see Appendix 12.6).

KCMC, Moshi, Tanzania

KCMC, Moshi, Tanzania

KCMC, Moshi, Tanzania



Maternity Ward Courtyard, Mawenzi Hospital, Moshi, Tanzania

WhatsApp cell phone use, Mawenzi Hospital, Moshi, Tanzania

3.3 Key Learnings, Continued

Recognition
Recognition of midwives' hard work and learning achievements comes from various sources, and at KCMC, though there is no formal system for it. When asked how the clinical instructor motivates the other midwives, she explained that she gives verbal reassurance when she sees midwives working hard. "I tell them that they did a good job, and we can discuss how things are going" (Clinical Instructor, 2020).

Communication
Cell phone usage in the KCMC hospital delivery ward and labour ward was widely observed. Cell phones were used for several main purposes, the first being for communicating between midwives working in the different wards and rooms within each. As described by one midwife, WhatsApp is the app used to organize channels for each ward, which "is an easy way of communicating, but difficult if a midwife doesn't have a phone" (Midwife 1, 2020). Volunteer midwives are included in these ward groups, but interns have a separate WhatsApp group. Another senior midwife explained that this communication platform is for "all information concerning patients, for calling if we need help, or needs advice" (Clinical Instructor 2020). It was observed that during a c-section, the surgeon received texts from Whatsapp, but was able to quickly dismiss them as a non priority. This is in place of receiving a phone call that could cause greater distraction from the patient. The intern midwife also commented that WhatsApp could be used to communicate about upcoming training: "if a leader took responsibility, "a WhatsApp group for this could be created so midwives can share our information pertaining to everything that is happening in the ward (in continuous education)" (Intern Midwife, 2020).

Content Generation
The second main purpose of cell phones and Whatsapp use in KCMC was to record moments during training or in-ward procedures. These videos and pictures were then sent to fellow peers or added into their Whatsapp ward groups. For example, during simulation training, the majority of midwives and doctors participating used Whatsapp to record and document the scenario. Another time, the observation of a cesarean section, an intern doctor recorded and annotated the video of the operation on Whatsapp. When asked about this seemingly routine behavior, the intern midwife, on rotation in the delivery ward responded, "when you observe in the ward, you can take pictures and send them to your peers so they can understand how things happened" (Intern Midwife, 2020).

Content Generation for Case-Based Training
Content for training can also be generated from capturing moments in the ward, that are relevant, and realistic. The intern midwife elaborated that being able to see cases in the ward indeed created valuable learning content, especially for new midwives and doctors, recently out of school, who may not yet have seen real life cases of what they study in school. He was particularly proud of one instance, where he observed a birth of a baby with a rare chromosomal condition, trisomy 13. He recorded the event, and through the documentation, was able to help identify the disease, which then led to a presentation on the condition for the department the following week.

Capturing Training Moments
Recording patient cases in the ward were not the only content desired to be documented. In the cases of presentations and simulations that were missed by a midwife, recordings of the event were seen to be beneficial for later viewings. According to the intern midwife, in his school WhatsApp group, "if there was a presentation, you'd send it to our group so people can see what happened in class, so even if you are not around you can learn" (Intern Midwife, 2020). He added that if he was a full time midwife, he wishes that this would also be true of presentations and simulations that occur in the ward, so midwives don't' miss events due to being overloaded with work and unable to attend or being off rotation at the time of training.

3.3 Key Learnings, Continued

Barriers to Continuous Education

(For more barriers, see Appendix 12.7)

Hiring Freeze & Lack of of Experienced Midwives
KCMC lacks experienced midwives. This is primarily due to a public service hiring freeze in Tanzania that bars the hospital from hiring midwives. KCMC has circumnavigated the freeze to meet the need for midwives through a volunteering policy that has been initiated to bring in midwives without formal hiring. These volunteers are typically recent graduates, with little hands-on experience. A head midwife explained one facet of the problem; "we need more experienced midwives since it is the senior midwives that need to make sure no mistakes are made by new midwives" (Midwife 1, 2020). With nearly half of the midwife workforce being younger, inexperienced midwives, it creates extra pressure on the senior midwives to teach the newcomers, and makes continuous training and education overwhelming.

Staffing Challenges: High Turnover
Another reason for lack of experienced midwives is high turnover. This is an issue that is not only specific to KCMC. Turnover creates hurdles to maintaining a team with a standard level of skill and competency, since there is often a steady stream of new midwives entering the workforce with varying levels of knowledge. The head midwife at KCMC discusses the challenge: "movement is a problem. We will train this midwife for two to three years, she is a good midwife, and then she leaves the hospital for another job. This leaves you waiting here to get in new midwives to train them all over again" (Midwife 1, 2020). It is particularly hard for KCMC to keep midwives due to the hiring freeze as well. "If a volunteer midwife is offered a paid job, she will take it. The same is often true for midwives that have gained experience and then leave for better opportunities in larger cities" (Midwife 1, 2020). To bring this point home, even as the thesis was in progress, one primary contact, the senior midwife and clinical instructor, left KCMC for a larger hospital in the capital, Dar es Salaam.

Mentorship as a Stress
For all its benefits, mentorship can cause stress and extra burden for the mentor, a problem that is not unique to KCMC, as they take on the role of a teacher alongside their duty as a midwife. With mentorship being a common practice, multiple midwives around the globe mentioned this same problem. In Illinois, a midwife explained, "at first it's okay (being a mentor), but it's exhausting, and gets tiresome" (Midwife 4, 2020). Further, for the senior midwife, mentorship means that they are responsible for the junior's actions, which compounds their stress and workload. A head midwife at KCMC elaborates, "It's hard as a busy senior midwife. You have people (junior midwives) who are not able to perform duties alone. You must check on them, and remember that you are also teaching them." (Midwife 1, 2020). Additionally, the uneven ratio of seniors and juniors at KCMC also puts strain on the senior midwives when they are required to take extra shifts to ensure all juniors are always paired with someone more experienced in the ward rotations.

Need for more Communication and Organization
There were multiple mentions of the need for more formal efforts towards organizing and maintaining continuous training and education at KCMC. As described by the clinical instructor, "there is a lack of education on the importance of updating knowledge itself", which then translates into lack of emphasis on creating routine around training" (Clinical Instructor, 2020). The intern midwife added, "there is not much focus on promoting simulations or presentations. It's not part of the routine. It depends on the commitment of the leaders" (Intern Midwife, 2020). This reinforced the idea that in order for continuous training to be sustained and successful, it needs to have ownership.

3.4 Themes from Key Learnings & Opportunity Spaces

Themes

After collecting my key learnings, main themes were synthesized, running throughout the two phases of research. This was followed by identification of opportunity spaces, derived from each theme.

Staffing and Organizational Challenges

Opportunity Spaces

- Work load reduction on senior midwives due to role as mentor
- Ownership, support and organization of continuous education efforts
- Flexible and resource-light on-boarding and continuous education system

Diverse Educational Needs and Preferences

Opportunity Spaces

- Adaptable solution to accommodate a general range of systems, education methods, resources and formalities
- Open and inclusive educational efforts to be cross-generational and cross departmental for knowledge exchange
- Tracking education, achievements and receiving recognition

Strong Social Digital Presence

Opportunity Spaces

- Utilization of user fluency and use habits on digital platform
- Integration of digital chat platform principles
- Utilization of digital, user-generated content for structured knowledge sharing
- Blending of social and professional use cases

Social and Community Based Learning

Opportunity Spaces

- Bridging of digital social platform with social/group learning preferences
- Integrate social component of learning into continuous education system

3.5 Research Question, Focused

These themes and opportunity spaces lead me to focus my objective. This focus was around the ubiquitous digital presence in both the users' social and work life, and the specific potential to merge a social digital platform and its preexisting, established use patterns with continuous training efforts and organization. Space in the research question was still left for exploration of the digital platform possibilities during ideation. Therefore, the updated research question became;

How might we support midwives' efforts to engage in continuous education and knowledge exchange through a relatable, adaptable, and social digital platform?

4.0 Ideation & Validation

4.1 Synthesis Methods

Ideation and validation was based on the key learnings, opportunity areas, and focused research question. This phase was conducted in three different modes of activity, involving both the users in Tanzania and peer designers from Umea Institute of Design (UID). Beginning with a workshop at UID to stimulate ideas, a questionnaire was run with midwives, and adjunct Whatsapp correspondence with midwives from Tanzania was maintained in parallel. This phase, in turn, led to developing values and principles that guide concept development.

Ideation Workshop

This workshop was held with design students from Umea Institute of Design. Its main purpose was to spark quick ideas revolving around themes from key learnings. Because the design students were not midwives, nor were they well acquainted with the profession, the workshop was situated in their own perspective, set in their own context. The workshop was therefore in relation to continuous education of something currently in their life that they chose in pairs. They were given elements that facilitate continuous learning, according to the field research learnings. This served as a foundation to build upon.

The foundational elements

- Mentor support
- Communal space
- Communication channel
- Collaborative learning

Additional facilitators of continuous education included for inspiration:

- Motivational moments
- Consistency
- Tracking progress
- Subjective and objective information
- Self assessment and reflection
- Peer learning

For each system created, the digital and analog properties were asked to be considered, specified, and for what purpose. After pairs discussed and ideated around their continuous education system, a single barrier was assigned to each pair to address in the continuous learning system they created.
These barriers included:

- Overburdened mentor
- Need for organization
- Frequent turnover/frequent onboardings

Results
The results of this workshop were diverse and helped to spark ideas for concept development. Suggestions included:

Answers reiterated the following preferences:

- Peer buddy systems to alleviate pressure on the mentor
- Learning apps based on personal skill levels
- Physical communal boards to communicate upcoming training
- Services that allow for democratically chosen education material and methodology
- Formalized rituals for onboarding
- System for teaching seniors with up to date knowledge from juniors.

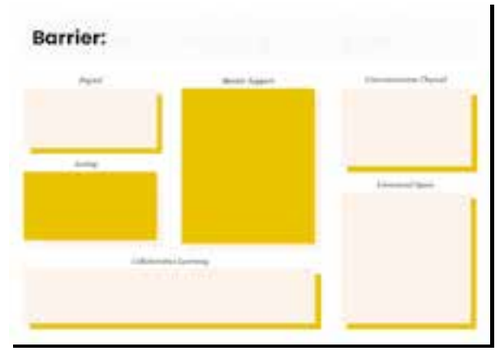


Figure 4. Workshop worksheet of barrier and boosters.

Figure 5. Workshop worksheet of additional boosters.

4.1 Synthesis Methods, Continued

Ideation Workshop

Results
The results of this workshop were diverse and helped to spark ideas for concept development. Suggestions included:

Answers reiterated the following preferences:
- Peer buddy systems to alleviate pressure on the mentor
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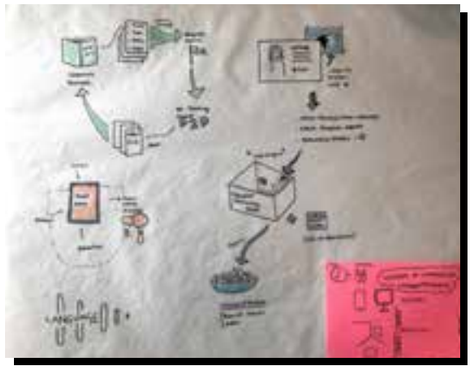


Figure 6. Workshop idea translations

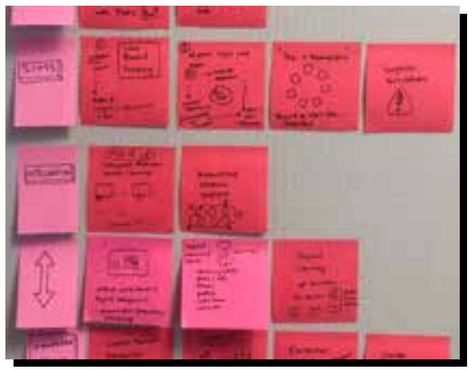


Figure 7. Workshop ideation

Figure 8. Workshop session

Figure 9. Workshop session

Questionnaire

The questionnaire was sent to four primary contacts in Tanzania; a midwife/clinical instructor, a head midwife, a volunteer midwife, and an intern midwife. The questionnaire consisted of eleven focused questions that were born from the themes and opportunity area. It aimed to unearth the underlying origins of these findings, and explore them in more detail. They pertained to the following topics:

- Current training/education practices and habits
- Achievement/progress measurement methods
- Sources of Motivation
- Continuous education/training preferences
- Continuous educational deterrents
- Ideal future scenario around the future continuous education
- Foreseen future barriers

Results
- Preference for social, community based-learning
- Preference for methodology including simulations and presentations followed by group discussion
- Need for cross department sharing of knowledge
- Challenges to training included lack of resources, lack of time, and lack of organization/support from management

Answers reiterated the following preferences:
- Overburdened mentor
- Need for organization
- Frequent turnover/frequent onboardings

Results
The results of this workshop were diverse and helped to spark ideas for concept development. Suggestions included:

Answers reiterated the following preferences:
- Peer buddy systems to alleviate pressure on the mentor
- Learning apps based on personal skill levels
- Physical communal boards to communicate upcoming training
- Services that allow for democratically chosen education material and methodology
- Formalized rituals for onboarding
- System for teaching seniors with up to date knowledge from juniors.

Figure 10. Survey with Tanazanian Midwives

4.1 Synthesis Methods Continued

WhatsApp Communication

Throughout the ideation and validation phase, there was correspondence with three of the Tanzanian midwives via WhatsApp chat and voice call: the midwife/clinical instructor, the volunteer midwife, and the intern midwife. This quick and social form of correspondence was used to keep the relationship established. Continuous, real-time feedback was also collected about training and education that the midwives were participating in at KCMC, regarding how it was organized, the methodology used, and opinion on efficacy. This informal mode of conversation with the users also made it easy to ask validation questions about ideas and values as they arose during this phase.

Figure 11. WhatsApp Conversations with Tanzanian Midwives

4.2 Values and Principles

This phase culminated in the creation of design principles and values that would guide concept development. These principles are based on the themes of key learnings, opportunity areas, and ideation phase results. First, values were established, which in turn informed the design principle.

Flexible	1	Easy Adaptation to context and needs by user
Inclusive	2	Accessible and Usable by Many
Grounded	3	Design within existing methods and technologies
Humanized	4	System Driven by social, human interaction
Collaborative	5	Network built by people, knowledge exchange
Trustworthy	6	Transparency in knowledge source and validation
Motivating	7	Measured and visible learning progress

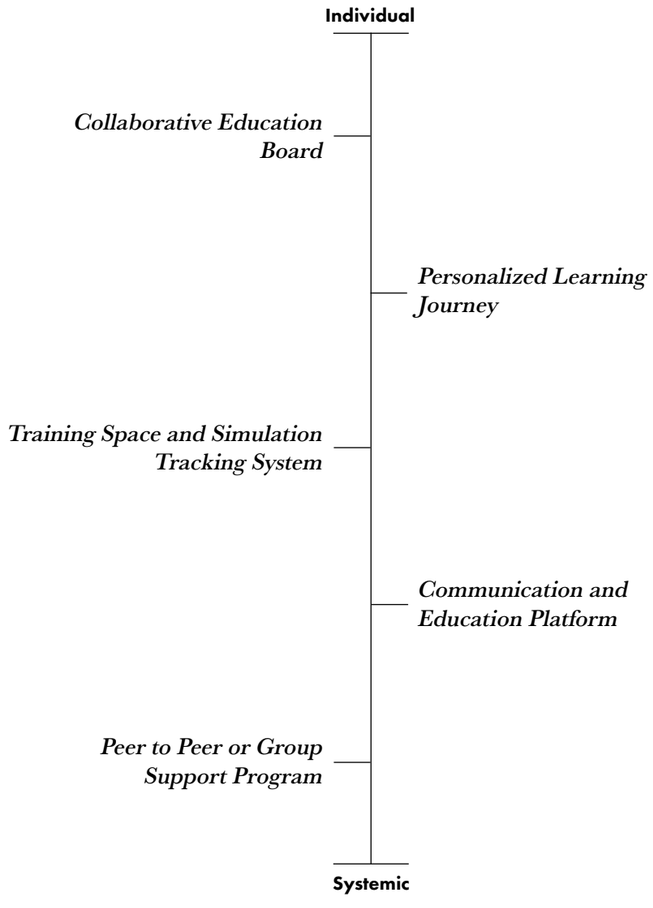
5.0 Preliminary Concepts

5.1 Concept Building

I created the following concepts as derivatives of my themes from key learnings, opportunity areas, and the focused research question;

How might we support midwives' efforts to engage in continuous education and knowledge exchange through an adaptable, social digital platform?

A Spectrum of Concepts
The propositions ranged from larger systems to individual platforms. This spectrum emerged naturally and allowed me to start thinking about the scale and framing of my approach. The following are descriptions of my concepts, moving from the individual to the systemic.



5.1 Concept Building, Continued

Collaborative Education Board

Type: Digital and Physical Platform

Goal: To Provide a platform for midwives to individually develop their competencies, on their own time, and at their own speed. The insight this targets is the stress on mentors to teach new midwives skills, paired with the high turnover rates which lead to a large percentage of inexperienced midwives in the workforce.

The Concept: This would be a digital platform that includes an entry exam for each new midwife that assesses their skill level, and pinpoints gaps in their knowledge. Based on their level of theory based knowledge, a digital program would be created that is tailored to their specific needs. The format of the platform could be a progression of topics in various formats; e.g., quizzes, games, flashcards, etc. with the goal of supplying knowledge and testing retention. This platform could be used at any point during the day when they have freetime, and learning progress would be tracked and made visible.

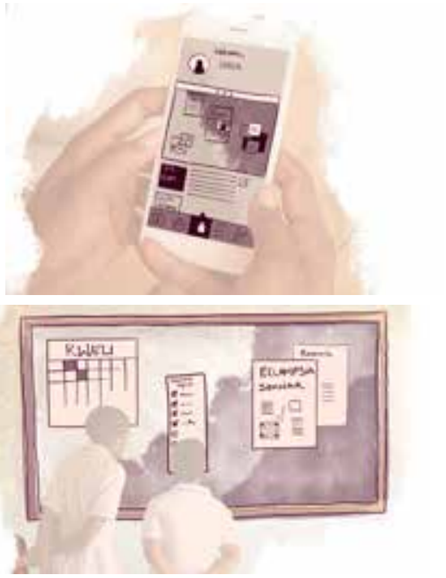


Figure 12. Collaborative Education Board

Figure 13. Personalized Learning Journey Concept

Personalized Learning Journey

Type: Digital and Physical Platform

Goal: The primary purpose of this concept is to provide structure and organization to on-going training and education efforts in a maternity ward, as well as greater visibility of other departments continuous training.

The Concept: This concept could be in a digital or physical form, or both. The main focus is a live board that can be accessed and edited by everyone in the ward. Information on this board could be calendars with up-coming training, sign up sheets, midwife related learning materials, announcements, etc. The possibility to view other department's boards is another feature which would allow for cross departmental sharing and awareness. If there was both a physical and digital version of this board, there would need to be access points into the digital space such as QR codes, and a way to easily mirror updates occuring. Both digital and physical boards would require a system of use to optimize its functionality and ensure management. In the instance of a digital board, posts could be tracked and analyzed to inform future continuous education efforts, such as ability to see who is most active, which topics are addressed frequently, etc.

Training Space and Simulation Tracking System

Type: Physical Space & Connected Digital Platform

Goal: Design a space for simulation training and a system to record simulation sessions. This addresses lack of organization around training and lack of dedicated space for training, and preference for, and desire for more simulations.

The Concept: This concept would consist of a space for a physical simulator and accompanying equipment, and a way to securely store it after use. A digital system used in combination with the physical simulator would help guide the simulation facilitator to conduct the session and debriefs after, as well as track the outcome of the scenario. Based on simulations run and debriefings, the data could inform future training; e.g., show what topics need to be improved upon, and where there are gaps in knowledge.

Figure 14. Training Space and Simulation Tracking vConcept

Figure 15. Communication and Education Platform

Communication and Education Platform

Type: Digital Platform/Service

Goal: The goal of this platform would be to use existing, successful digital communication platforms to promote knowledge sharing and continuous education. It would address the need for more organization around training, and amplify the strong sense of community and social aspect of learning.

The Concept: This digital platform would be an extension of an existing chat platform such as WhatsApp or be a novel communication platform with the same successful values and principles of the existing. It could have the same chat communication capabilities, but its main focus would be the facilitation of continuous education and training. It would also utilize user-generated content such as videos and photos taken during patient care or training sessions, for educational purposes, and to connect midwives and their knowledge

5.1 Concept Building, Continued

Peer to Peer or Group Support Program

Type: Service/System

Goal: Relieve pressure on the senior midwives to be both a teacher to incoming midwives and continue to perform duties as a midwife. It also addresses the issue of high turnover and resources dedicated to train individual midwives. Lastly, it enhances the strong community that already exists.

The Concept: This onboarding program that starts with a four week mentorship between senior and junior midwife, concluding with a debrief and assessment to determine learning goals moving forward. The second phase of the program is a peer to peer partnership or group formation of junior midwives. This partnership/grouping is to provide support for new midwives, to both bond with their peers, create community, and have a safe place to learn. A rotation of senior midwives would have a check-in weekly with the group to ensure their progress and trouble shoot for any arising concerns. The beginning of each month would be a longer meeting to discuss a topic of the month for the junior group. The juniors would focus on this topic throughout the month. This could mean observing midwives attending to a case of this particular topic, interviewing midwives with experience in it, and/or doing their own research and discussing with peers. At the end of each month the juniors would give a small presentation on their topic of the month. Throughout this program, juniors would carry a learning journal with them to record progress, questions, and other miscellaneous notes. At the end of the third month, the learning journal would be reviewed together with the original mentor of the junior midwife to assess progress and future goals. To cap the program, there would be a graduation and celebration as recognition.

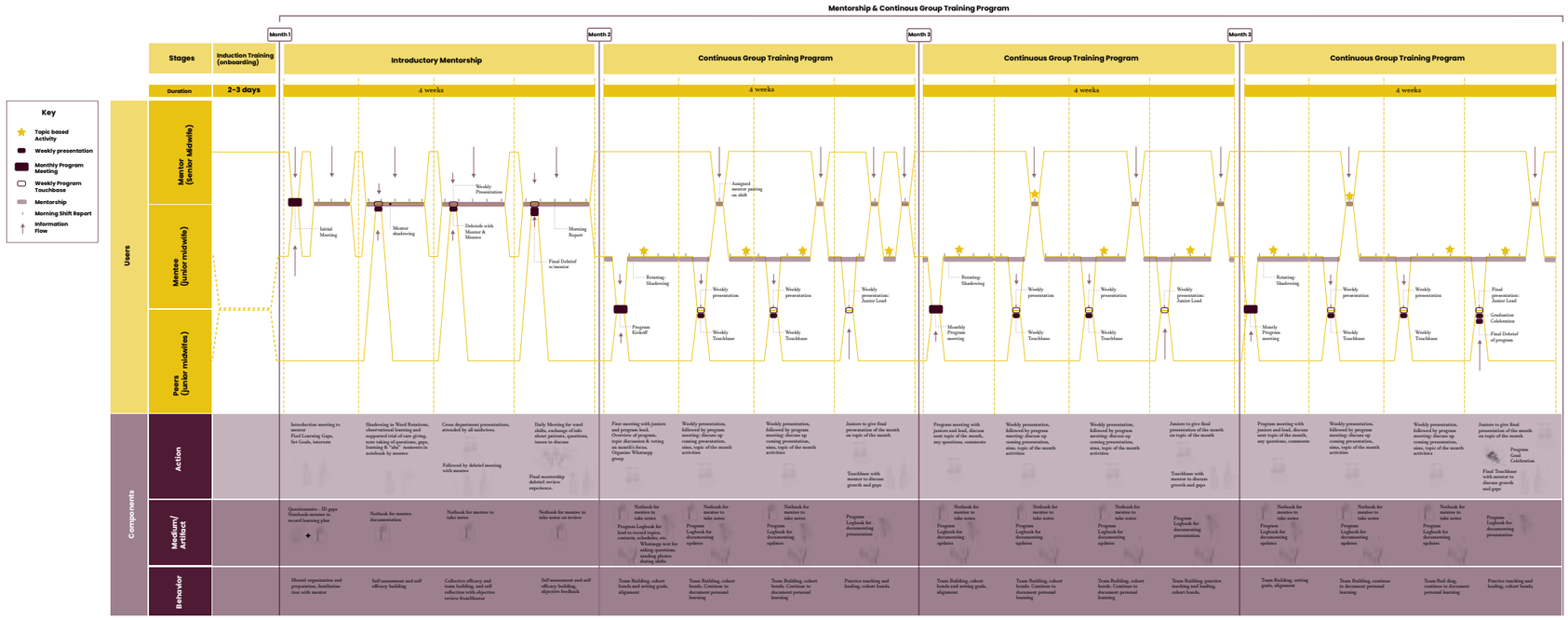


Figure 16. Peer to Peer or Group Support Program Blueprint

6.0 Choosing a Direction

6.1 User Promps & Testing

To choose a concept, reviews were held with midwives from Tanzania to generate feedback on my spectrum of concepts. The methods employed were solely digital and needed to operate within the scope of the existing technology they use in their day-to-day life. This methodology of digital communication itself gave me concept insights.

Figure 17. Digital Board with Concept for Testing

Live Digital Canvas

For the first prompt, a Mural Board for digital collaboration was created to reach outside the ubiquitous WhatsApp and Gmail platforms. This canvas included an illustrative sketch of each concept, goals of the concept, short descriptive text, and a one shot video of the concept with my narration. Following each concept was a section for pros, cons, and votes for favorite concept, and why. Digital Post Its were left for comments.

Learnings

Unfortunately, this attempt to engage users failed. Those invited to the board by email either did not go through the required login, or were resistant to using the novel interface as it was unfamiliar. It is important to mention that it was difficult to zoom in and navigate around the details of the canvas, as well as add comments while using a smartphone, which was the device that the users in Tanzania used. The fact that smartphones were the primary viewing devices made it imperative that any future prompts sent were appropriate for the realestate of a smartphone screen. This is also an important insight to consider when developing the concept itself.

Figure 18. Email Correspondence for Testing

Email Prompts

Following the failure of the digital canvas, a more traditional form of media exchange was decided upon: email. Concept one-shot videos and duplicative information in a PDF format with text concept explanation and illustration was sent, but this proved itself to be a failure as well. It seemed that this was due to the fact that there was not a seamless way to respond to each individual file sent. Additionally, the volunteer and intern midwives spoken to were at home due Covid19 shelter-in-place order. This meant that they were no longer on KCMC's stable internet, and instead were on slower, less reliable networks at home that made it difficult to download large files. The intern midwife from the KCMUCo, was not allowed on campus to use the internet, so he even purchased more data to attempt to view one of my files in the email, but eventually resorted to a WhatsApp phone call to get a verbal explanation from me.

Learnings

Needing to access heavy files, video files in particular, can cause significant barriers when operating on a network with low bandwidth, or when the user is relying on wifi with a limited data plan. Secondly, the lack of seamless feedback system can create speed bumps when engaging users.

6.1 User Promps & Testing, Continued

WhatsApp Prompts

WhatsApp was turned to in order to conduct the remainder of the concept prompts. The midwives in Tanzania were most fluent in this platform, using it in both their professional and personal lives. The most common use patterns were short texts back and forth between individuals and groups, often including multimedia such as videos and photos. To mirror this communication style, brief texts were sent explaining one concept at a time with a corresponding photo of the illustration. To provide an alternative viewing format to demonstrate the concept, one shot concept videos were uploaded into the WhatsApp status, another feature of the platform the midwives used habitually.

Learnings

Shorter concept prompts on a familiar platform had a higher success rate. The ability to easily access the concept, quickly interpret it, and effortlessly respond inside the same chat boosted engagement immensely. Response time on the chat was also far more synchronous than on gmail, where response times averaged several days.

Figure 19. WhatsApp Correspondence for Testing

6.2 User Promps & Testing Summary

Concept Feedback: Learnings

Digital Communication and Education Platform

The majority of responses gave enthusiasm for the Digital Communication and Education Platform which would extend a mobile chat platform functionality into media sharing and organization to promote knowledge exchange and continuous learning between community members.

> *“This is a good idea; we could create a group where we share more information through video, and chat, and those who remain in the ward could even get a concept of the day though the WhatsApp Group*
>
> *Volunteer Midwife, 2020*

Remote Engagement: Learnings

The failures and successes witnessed in sharing my concepts on digital platforms during this phase also gave insights. Several things were also learned and confirmed about the digital space that was intended to work within this during the design process.

1

Learning through Failures: Utilizing Friction-Filled Methods: Too much friction in the prompt digital format, lead to failure to engage with users. This friction came from a variety of sources.

Discontinuous Experience, User Flow

Requiring multiple steps to open and view individual files, with lack of ability to respond directly.

Discontinuous Experience, Connectivity

Low bandwidth, and/or lack of stable connectivity and access to data also created barriers to viewing heavier files.

Physical Barriers

The real estate of a smartphone screen does not allow for easy viewing, interacting with, or editing of, collaborative digital boards and the information stored within them.

2

Learning through Successes: Existing Product Use Methods: By engaging with users on both a smartphone, and on a platform similar in principle to that which was being explored as a concept, it was possible to test the smartphone’s appropriateness, and the platform’s functionality and value. The following are ways in which communicating via mobile chat platform succeeded.

Smartphone Validation

It was possible to verify that smart phones were widely used, being the primary mode of non verbal communication between midwives and beyond.

Generational Fluency

Midwives, spanning generations, showed deft use of WhatsApp, with a proficiency across its features.

Seamlessness and Frequency of Interactions

It was evident that the midwives used the platform with great frequency, showing high responsiveness to texts, consistent “online” status, and regularly updated personal video “statuses.” Due to this high use frequency observed, and attention-demanding medical context within which they use this platform, effortless interaction and exchanges with low-friction-to-completion of task, are deemed necessary.

7.0 Validating Research
The Digital Space

7.1 Validation Approach

With the knowledge that the Digital Communication and Education Platform was the preferable concept, additional research was conducted in this direction. This research focused what it would entail to position the design in the digital space. As found in key learnings of the field research, the use of the digital chat WhatsApp, and capturing content on this platform is a deeply rooted practice within the midwife community in Tanzania. Therefore, there was specific interest in exploring digital chat platforms like WhatsApp and user generated content as facilitator of education. This investigation helped to establish a better understanding of this particular digital space, and to ensure that it was a valid concept direction, four activities were conducted:

1. Research on connectivity, smartphone use, and WhatsApp statistics in sub Saharan Africa and beyond
2. Literature research on theory behind on digital chat platforms and mobile learning
3. Interviews with midwives, nurses, and doctors about their professional digital communication and education habits, focusing on WhatsApp and content generation
4. Market research on other existing digital chat and education apps (mobile learning). (For Market Research and positioning, see Appendix 12.8).

7.2 Validation Findings

1. The Numbers

Connectivity
Sub Saharan Africa, a region of 831 million people and 47 countries, is quickly growing in connectivity. According to a study by Aljazeera (2019), "With a penetration rate of 38 percent and more than 330 million unique subscribers, sub-Saharan Africa has become, in the past five years, the world's fastest growing region in terms of subscribers and single connections." In Tanzania, specifically, there were an estimated 25.8 internet users at 46% penetration rate, and a recorded 47.7 million mobile network subscriptions (Tanzania Communications Regulatory Authority, 2019). These rising numbers across the region of sub Saharan Africa show the potential of relevance for digital platforms in the present day and in the years to come.

> *"Industry projections suggest that the smartphone adoption rate in sub-Saharan Africa will double by 2025*
> *Pew Research, 2018*

Apps and Media
Social functions of smartphones, such as text messaging (78%), video and photo creation (59%), and accessing social networking sites (78%), are the three most common activities in sub Saharan Africa. (Pew Research, 2018). Active social media users increased by over 12% in 2017-2018 as well, and of the social media platforms used, WhatsApp and Facebook are the top ranking applications. (Internet World Stats, 2018).

> *"Around four-in-ten phone owners (in sub Saharan Africa also use their mobile phones to access social networking sites*
> *Pew Research, 2018*

Learnings: Mobile Phones, Connectivity, WhatsApp Use
Overall, in sub Saharan Africa, there is an increase in connectivity, ownership, and use of smartphones, which is to be noted, as it mirrors one of my design values: inclusivity and accessibility. Therefore, the ability to access and utilize a digital platform is of utmost importance for this design. The widespread use of WhatsApp in sub Saharan Africa was also a key insight that is of relevance to this thesis. The popularity of the platform could be a forecast of the adoption and success of a platform with similar qualities.

7.2 Validation Findings, Continued

2. WhatsApp & Digital Chat Platform Research

Follow Up Interviews and Literature Review

Connectivity
As mentioned, the purpose of this research was to explore practices found in the context of midwifery in Tanzania, such as the digital chat platform, WhatsApp, and utilization of user generated content. Therefore, it was explored if these practices held true outside of Tanzania, in what capacity, and which other digital and or educational habits there might be within the medical care context. The potential use of user generated content as a facilitator and supporter of continuous education was also investigated.

To conduct this research, midwife contacts from phase one of field research were interviewed, with the addition of several new contacts. There were follow up interviews with two midwives from the USA, one midwife from Sweden and one new midwife and Urologist, both from Austria. Related literature was reviewed in parallel to support and contribute the interview findings.

The following findings are organized by possible pros and cons of WhatsApp and digital chat platforms generally speaking, based on my interviews with medical professionals and literature studies. Some novel information was found, and along with validating information. This second begins with the cons:

Where the WhatsApp & Digital Chat Platforms Can Break

Need for Ownership and Management
In using a chat platform for communication, organization, and knowledge exchange in a professional context, there is a particular need for the app's facilitation and support by management (McGregor et al., 2019).

Information Disorganization
In most chat platforms, WhatsApp included, all media files uploaded and sent by users are stored chronologically in the individual chat feed to which it belongs. Dr. Henry Claireaux of Oxford University expands upon this; "group chats (in WhatsApp) produce a string of text without any method of assigning tasks, or monitoring workflow" (Health Service Journal NHS, 2019). This creates lack of organizational flexibility, rendering the navigation of information and communication difficult. One doctor described how he circumnavigated this; "I save the patient pictures on my mobile phone in a separate folder because I need these the most. That way, if I want to show a case to a doctor at another hospital, I can find them easily" (Doctor 1, 2020).

> *"That is the difficult point for us, to get the right picture at the right moment. There is definitely a need for an organized and safe way to store my file*
>
> *Doctor 1, 2020*

Data Overload
Phones with little storage and low bandwidth also can face challenges from heavy data generation that often comes with chat apps (Wyche et al., 2010). During one study, there were even reports of users wiping their app off their phone to clear the data and free space on their smartphone. This overwhelming accumulation of user generated data is coined as the "chat data deluge" (McGregor et al., 2019).

Oversharing with Colleagues
In some chat platforms, particularly those used in both professional and private life, such as WhatsApp, sharing too much personal information can become an issue.

Employee Surveillance
Employees in professional chats may not feel the ability to speak freely if their superiors are in the same group, and in other cases, management may use the platform as an opportunity to monitor employee activity (McGregor et al., 2019).

Synchronous Communication Barriers
Communication on chat platforms can run into challenges and friction when members of the conversation have differing levels of connection, either losing connectivity, or have a reduction in network bandwidth. This will limit the ability to maintain synchronicity while trying to send or receive multimedia and messages and disrupt the flow of communication and information exchange (Wyche et al., 2010)

Digital Colonialism
There is the omnipresent risk of implicitly imposing a monopoly of power through the use of digital applications, which can effectively saturate cultures with western values, opinions, and norms (Aljazeera, 2019).

Where WhatsApp & Digital Chat Platforms Can Break, ***Medical Context***

Dangers of Misinformation
The spread of misinformation through user generated content can be a general problem in large chat groups like WhatsApp if there are no source checks and information validation (McGregor et al., 20). This is perhaps due to the fact that "there is an intimacy to WhatsApp that makes people ready to listen to a message. That is why the platform is so popular" (What's Up with WhatsApp, 2018). Further, disseminated information within medical and health care communities, in particular, can be dangerous to patient safety (Midwife 6, 2020).

Data Security
Personal user data, and user generated content exchanged on mobile chat platforms, such as photos and videos, is often not stored securely by the user and can violate data security laws. This is especially true of WhatsApp. With its ubiquitous use by medical professionals to exchange patient photos and videos, confidential patient data risks exposure (McGregor et al., 2019). A doctor interviewed in Austria revealed that he and all of his colleagues at a large hospital use WhatsApp for primary communication, organization, and sharing of patient cases, against recommendation. He explains "in Austria it's not advised to use WhatsApp in any case for work because it's not safe. The hospital doesn't like that we use whatsapp either, even for things like schedule changes" (Doctor 1, 2020). As data security comes to the forefront of discussion, more and more medical establishments are becoming aware of the risks associated with the use of WhatsApp.

> *"Using WhatsApp in my hospital is not illegal, but it's in the grey zone*
>
> *Doctor 1, 2020*

Although the recent update of the platform's end-to-end message encryption has been said to fix data security issues, many debate the validity of this, and raise other concerns as well. As noted by Dr. Henry Claireaux, the security measures of WhatsApp fall short in the following ways:

"Data transits through servers located internationally, constituting transfer of information overseas.

Data is decrypted onto each smartphone, yet unlike online banking applications, WhatsApp does not require password protected login. Any misplaced or stolen phone can serve as a gateway to patient data.

Clinical images received via WhatsApp are by default downloaded to phone memory and often uploaded to cloud servers automatically, accessible on linked devices and transmitted abroad" (Health Service Journal NHS, 2019).

> *"Medical professionals' use of WhatsApp in the workplace is 'a privacy and clinical safety timebomb'*
>
> *Health Service Journal NHS, 2019*

Learnings Summary:
Where WhatsApp & Digital Chat Platforms Can Break
Digital chat platforms have a diverse set of potential risks and challenges, with several themes emerging. The main theme revolves around data and the various forms of creation, organizing, sharing, and storage of user-generated content. Utilizing technology for one's own benefit, at another's detriment, such as in the case of surveillance, data use, and digital colonialism, is another theme of which to be cognizant. This thesis is unable to address every one of these challenges, but it was important to be aware of their presence and to design with them in mind, to the best ability.

Where WhatsApp & Digital Chat Platforms Can Succeed

Flexibility
Digital chat platforms allow for greater flexibility in service and user experience. As mentioned previously in this report, the formula for continuous education and training will differ to varying degrees. Moments of learning, methods, routines, and organization will come in different levels of formality, and will change with staff, management, resources, and knowledge. To account for this diversity across medical facilities and maternity wards, the system created must be adaptable to each context and the users within.

Ability to Function on Low Speed Connectivity
Chat platforms can allow for functionality on low bandwidth connectivity, making it accessible to those with little access to high speed internet or wifi (O'Neill et al., 2016). Expanded upon by another study, "chat apps have become immensely popular across the Global South, because of their ability to work on low-speed intermittent connectivity" (McGregor et al., 2019).

Ease and Expressiveness of Communication
Communication on mobile chat platforms is a quick, informal and transparent mode of communication that lowers the barrier of maintaining contact with individuals, groups, and communities both personal and professional. Digital chat platforms allow for diverse andrich interactions, including multimedia files.

7.2 Validation Findings, Continued

Supports Organizational Productivity
Digital chat platforms have the potential to assist in real-world coordination and the "promise of improved organisational productivity" (McGregor et al., 2019). In a survey by Oxford University, across 60 hospitals, it was shown that "ninety-two per cent of doctors would find a purpose built workflow app useful or very useful" (Health Service Journal NHS, 2019).

Social Learning
Mobile chat platforms are an excellent way to build connections to others in one's community and beyond (Church and Oliveira, 2013). In the context of midwifery, a highly human centric and social profession, mobile chats and digital platforms can provide an extension of this characteristic, by bridging real life interactions with individuals and communities in the digital space. As described in my field research findings, continuous education and training in midwifery are also highly group oriented, thriving off of social engagement and support from peers, which is in keeping with the understanding that sharing knowledge is a "deeply social practice" (Tate Siddique, 2016). As expounded by Amry (2014), Social interactions improve the effectiveness of learning and teaching. This advantage help students easily construct and share knowledge through WhatsApp social networking. This makes a digital chat space a good candidate for education facilitation in the context of midwifery. (For more social learning theories see Appendix 12.9).

> *"Learning is becoming more personal and is increasingly based on online social interactions that enable networked processes...this is through social cooperation and collaboration between students to improve construction and knowledge sharing*
>
> *Amry, 2014*

Seamless and Spontaneous Knowledge Sharing
Information can be shared, requested, downloaded, and edited quickly and efficiently. Mobile chat platforms also facilitate and support in-person knowledge exchange. As elaborated by Boulos et al. (2016), WhatsApp has been successful "in health and medical education and learning as its discussions enrich clinical knowledge, not only with regard to particular clinical casediscussions, but generally by sharing learning resources

> *"The discourse of spontaneous interaction is assuming increasing importance as we begin to apprehend the power and potential of mobile learning and information exchange*
>
> *Amry, 2014*

Where WhatsApp & Digital Chat Platforms Can Succeed, ***Medical Context***

Mixed Digital Teams Creates Opportunities
Mobile chat platforms allow for the interaction and communication between individuals, groups of people, and larger communities that might not otherwise have the opportunity to connect (McGregor et al., 2019). In the medical context, time is short, and cross department meetings and exchange of knowledge can be far and few between, even though they can be greatly beneficial. With mobile chat platforms, digital, cross department exchanges can occur without interfering with workflow (Doctor 1, 2020).

Reduce of Hierarchy Social Cues
Mobile platforms have been shown to "break traditional communication barriers..." due to the fact that "power differentials between experts and novices disappear" in the digital chat environment (Boulos et al., 2016). Specifically, WhatsApp group-chat dynamic also enables junior doctors to contact, and learn from, senior doctors more easily where they may not previously have felt able to phone them directly (Boulos et al., 2016). Overall, Dr. Henry Claireaux emphasizes this point as he notes that this chat platform "helps to overcome human factor challenges around hierarchies" in the medical work environment (Health Service Journal NHS, 2019).

> *"Interaction up and down the organisational hierarchy is made easier by chat because of the absence of hierarchical social cues in the chat groups*
>
> *McGregor et. al., 2019*

Mobile Chat is a Less Obtrusive Form of Communication
When used appropriately, mobile chat solutions, such as WhatsApp, can be less of a distraction than incoming, non-urgent phone calls or pages for health workers while they are caring for patients. As put succinctly by Dr. Harry Claireaux, with the use of other communication devices such as pagers, "the recipient is unaware who is bleeping, why, and how urgently. Work is interrupted, time is wasted, prioritisation is difficult, and the evidence trail remains limited." (Health Service Journal NHS, 2019). Conversely, a chat platform in the medical environment offers a quick, efficient, and unobtrusive way to send and receive files.

User Generated Content for Education
Generating content for knowledge exchange, such as taking videos and photos, on a mobile chat platform is a highly ubiquitous practice in medicine, as observed and discussed prior in this report. As expanded upon by McGregor et al., (2019) group chat stream becomes a repository for conversations between colleagues resulting in user-generated information relating to shared communities of practice, potentially accessible for the purpose of ongoing digital learning. Although there are data security issues and patient confidentiality challenges to be solved in this arena, this user generated content can be extremely beneficial for educational purposes. This is due to several factors:

Visual Nature of the Content
According to those interviewed who used WhatsApp in their professional work, the most common user generated content is photos and videos of patient cases, to help with identification and to share findings with peers. One doctor explained, "we post pictures from the operating theater for instance, if there is something rare or interesting for others to see and learn from" (Doctor 1, 2020). He noted that often he will use these same photos in presentations he gives to his peers. Another midwife interviewed from Austria utilized this user generated content on another platform, Facebook. She was part of a country-wide midwife group where midwives posted photos of cases they had questions about. She explained; "I love it. You learn so much just from seeing the photos and reading what the other midwives are discussing and the tips they give" (Midwife 5, 2020).

Additional Content Generation Ability
Text files like Word documents and PFDs of trainings, schedules, trials, papers, and lectures were also shared between medical professionals on WhatsApp in individual and group chats. The doctor mentioned that "If there is an interesting article, I can also give my colleagues a link, or if it's short, I will take a photograph and post it." He went on to explain that Whatsapp is not the main source of medical literature however since he has subscriptions to journals or can look material up online (Doctor 1, 2019).

Democratization of Educational Material
On mobile devices, the barrier to educational content can be reduced as access to material increases. Further, "chat app platforms can thus encourage those who may otherwise be excluded in traditional classroom settings, to pursue skills and training in a way that they can manage" (McGregor et al., 2019). In some cases, the democratization of information can be the matter of life and death. As described in one study, patient images were sent from a resource-limited clinic via WhatsApp to an expert who was then able to assess, diagnose, and give treatment advice (Boulos et al, 2016).

Data to Inform and Aid Educational Efforts
Data generated by a digital platform has the capability tracking educational progress. This data can be collected and turned into actionable insights, which greatly help to inform and improve continuous education and training efforts. A digital platform also allows a more streamlined and automated process of capturing and analyzing this data, which relieves medical professionals from the stress of taking on a second role: manual data handling (LGH 2019).

Data to Contribute to Health Research
Digital applications also allow for integration into open source health platforms which gives the opportunity to contribute data to the larger health community. This can help to reveal health trends on local and global scales. UNICEF (2019) states that creating united digital health platforms "aligns health priorities ... harmonizes health related data investments...and supports countries to coordinate resources for data focused solutions" (Unicef's Approach to Digital Health, 2018).

7.3 Learnings

WhatsApp and digital chat platforms possess the structure and functionality to create social and content rich interactions, with the potential to build and strengthen relationships both inside and outside of the professional environment. Due to their flexible qualities, these platforms also pave the way for knowledge exchange and organizational efforts required for continuous education. Content generation as a way of facilitating training moments is also a viable and unique way to frame continuous training, so long as data security is taken into account. Many of these findings in this validation and digital exploration reflected or built upon my observations in Tanzania. This helped to solidify the direction as the thesis moved towards development of a Digital Communication and Education Platform concept. Two additional opportunity spaces around data from these learnings were also identified:

Additional Opportunity Space:

- Safe and secure use of user and patient data
- Smart use of user generated data to inform continuous education, local and global health initiatives, research

8.0 Concept Development

Digital Communication and Education Platform

8.1 Concept Overview

This first iteration of the concept was based on the net synthesis from the design process thus far. It combined elements of continuous education and existing digital habits already proven to be successful in Tanzania and beyond, and it integrated new systemic functionality that addresses the learnings, challenges and design principles born from this process.

Intent
The intent is to provide a flexible yet comprehensive chat, organizer, and knowledge exchange platform that encourages continuous learning through greater access to educational material, social interaction and community support. In doing so, the current common method of communication and informal knowledge exchange between midwives is to be challenged with a proposal that has more intention, awareness, privacy, and structure.

This Concept Recycles the Existing to Create the New

- Using the principles and use patterns of WhatsApp platform
- Building on the established learning behaviors of midwives and social nature of knowledge sharing
- Using content already generated to promote continuous education

Three Goals
There are three goals of the concept. Corresponding functions and opportunity spaces addressed are mapped to each goal. To review the comprehensive list of opportunity spaces, please reference Section 4.0, Themes of Key Learnings & Opportunity Spaces.

Functionality Overview

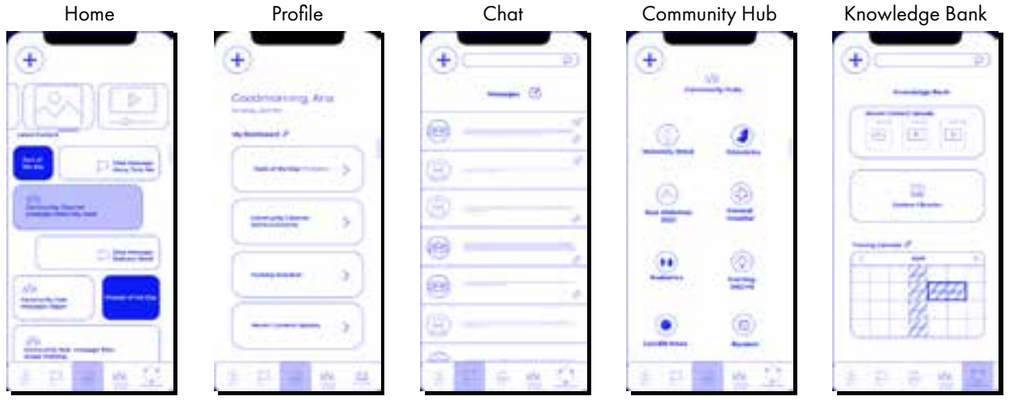


Figure 20. Preliminary Concept Screens

8.2 Primary Goal

Knowledge Exchange & Continuous Education Support

Provide inclusive access to information, connect midwives and their knowledge, utilize user-generated content, enable midwives to take ownership of continuous education efforts through social, community support.

Functionality

- User Profile (Social, Asynchronous, Map)
- Knowledge Bank (Professional, Formal Asynchronous, Map and Path)
- Laerdal and Midwife Chatbot (Professional, Synchronous, Path)

Opportunity Spaces Addressed

- Utilization of digital, user-generated content for structured knowledge sharing
- Integration of social component of learning into continuous education system
- Tracking education, achievements and receiving recognition
- Open and inclusive educational efforts: cross-generational and cross departmental for knowledge exchange
- Bridging of digital social platform with IRL social/group learning preferences

Knowledge Bank

The Knowledge Bank is the source of user generated content, and access to a Training Calendar.

The Content Library gives access to all users' uploaded content such as videos, photos of training and patient cases. It is organized by categories as determinded by hospital/ facility.

Content Libraries are organized by user generated content topics, with an option to view experts in the subject.

By clicking on a topic, the user will navigate to the topic page, where they can view both latest and verified user generate content.
The user can also toggle between type of content: training and/or case study.

By clicking on an Expert, the user is directed to the Expert's Profile page, where they can message them for advice and questions on the topic.

Figure 21. Preliminary Concept Screens

8.3 Secondary Goal

Communication and Organization

Provide a flexible yet comprehensive chat platform that encourages social interaction and community support and organization

Functionality

- Chat (Social-Professional, Synchronous,Path)
- Broadcast Channel (Social-professional, informal-formal, asynchronous, map-path)

Opportunity Spaces Addressed

- Ownership, support and organization of continuous education efforts
- Integration of digital chat platform principles in communication and organization efforts
- Adaptable solution to accommodate a general range of systems, education methods, resources and formalities.

Chat & Community Hub

Group Chat is discussing a patient case. Laerdal ChatAid is asked to provide a scenario that would help to train this case specifically.

Laerdal ChatAid provides a simulation. It is forwarded from the Group Chat and into a Communicty Hub.

The Simulation which was broadcast into the Community Hub is discussed by members of the Hub, and a training session is agreed upon.

This simulation session also automatically gets posted to the Home feed of anyone in this Community Hub so they have the opportunity to participate or share further.

Figure 22. Preliminary Concept Screens

8.4 Tertiary Goal

Smart, Secure Data Use

Provide safety to, and create awareness about patient data, and use data to inform continuous education, global and local health initiatives.

Note:
The tertiary goal was not addressed specifically in this concept development, rather, it was used as a backdrop to the primary and secondary goal. This was to maintain awareness of how the functionality of the first two goals could potential integrate and contribute to smart and secure data use. Therefore, a diagram of how data can be utilzed and secured is presented instead of user flows.

Functionality

- Security
- Analysis Patient Data (Anonymity, security)

Opportunity Spaces Addressed (See Section 7.2 for reference)

- Safe and secure use of user and patient data
- Smart use of user generated data to inform continuous education, local and global health initiatives, research

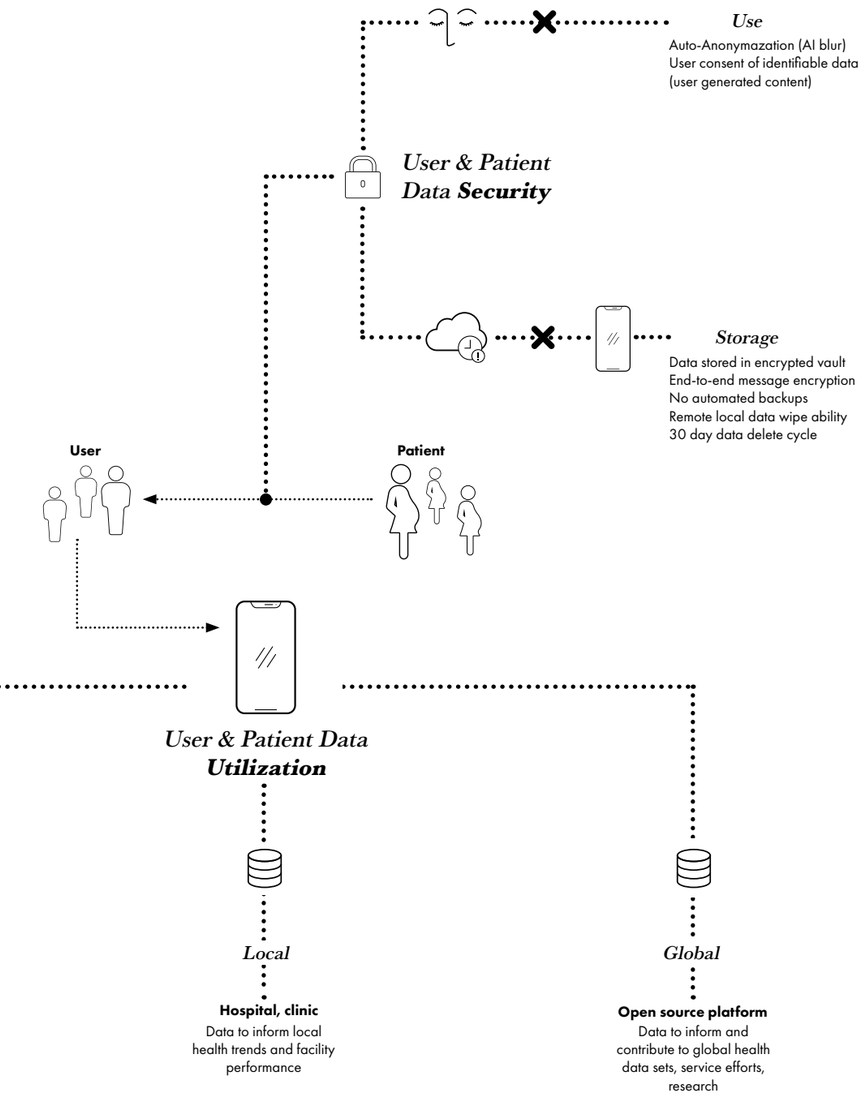


Figure 23. Data Use Diagram

9.0 Concept Testing

9.1 Testing Methods

To receive feedback on the concept, remote reviews were conducted with a midwife and doctor in Austria, a midwife in Sweden, and two midwives in the USA. A worksheet for asynchronous feedback was also distributed. Unfortunately, due to Covid19, contacts in Tanzania were at home with varied access to the internet or wifi, so WhatsApp feedback from them during this phase was minimal. Concepts were also reviewed with the design and implementation team at Laerdal Global Health. During the testing sessions, the flow of the digital platform and its functionality was reviewed. The following is a summary of the main learnings.

9.2 Feedback Summary

Community Building and Knowledge Exchange Appreciation
Across the board, the knowledge exchange and connection of midwives afforded by the platform was viewed as highly beneficial and in keeping with current values and practices already within the midwife community. One midwife commented, "I think midwives would be very open to something like this. I'm in a midwife facebook group (that discusses cases) and I feel like we are a big family. I can see they are interested in communicating with each other. There are so many members and so many interesting cases posted every day, and midwives from all over the country are giving advice back" (Midwife, 3). Another midwife in Sweden, who works alone often with little peer support added, "this is super needed. It would help us meet and discuss and learn from one another" (Midwife 6, 2020).

> *"This would change how we learn*
>
> *Midwife 6, 2020*

Need for More Reach and Inclusivity
The critique to this revolved around access and inclusivity, with several midwives suggesting that the networking and communication functionality be expanded to a national or global scale. This was so midwives in small teams with fewer resources could still seek advice and knowledge from other midwives outside their workplace. A midwife explains, "when the (networking ability) just inside your hospital, it could be difficult. Some hospitals are smaller and it would be good to be able to access knowledge or advice outside of your own facility" (Midwife 3, 2020). This midwife had also worked in Tanzania as a midwife for several years and continued, "for instance where I worked in Tanzania, it was a small clinic, and it would have been so helpful for them to be able to ask people outside their facility" (Midwife 3, 2020).

> *"I would love to be in a group with midwives from Tanzania and exchange advice*
>
> *Midwife 3, 2020*

Need for Trust in the System: Content and Training Verfication

Several questions arose from user testing on this topic, which lead to larger discussion:

- How might trust be established in a medical education chat app?
- How might this digital platform verify content?

Content Verification and Trust
It was noted by multiple midwives and doctors that content which is generated by users must be verified, to ensure that the information uploaded is correct. This is critical in medical context, where the spread of misinformation could be misleading and dangerous, both for patient safety, and legally. A content verification mechanism would also serve to establish trust in the system. Evidence based medicine guidelines was the unanimous suggestion as a primary means by which to judge content and create trust. A midwife explains "if you can trust the system; if you can trust that the guidelines get updated, and trust that somebody is looking through the user generated content and verifying if adheres to the guidelines, then this would work. There would need to be a sense of accountability" (Midwife 2, 2020).

> *"There's an evidence based way, and then there's a myriad of ways people have been doing things for decades, so you need some kind of standard*
>
> *Midwife 6, 2020*

Evidence Based Medicine Guidelines
Evidence based medicine is the practice of health care based on the most up to date medical knowledge. This knowledge is stated in the form of guidelines to which medical institutions adhere. Most countries or regions have their own set of guidelines, and as one doctor pointed out, "evidence based practices differ from Europe to Africa to Asia. A doctor from Austria continued, "African countries sometimes don't have guidelines of their own, so they meet a committee in Austria once a year, and work on taking the European guidelines and tailoring it to their region. This is because to get guidelines, this is a huge process" (Doctor 1, 2020).
There are also institutionalized guidelines or Standard Operating Procedures (SOP). These are protocols established by individual institutions, such as a hospital, which are based on the region's evidence based guidelines. A midwife explains, "these much more specific, such as detailed, agreed upon protocols that a facility will adhere to" (Midwife 2, 2020).

> *"Guidelines are so important because there is so much misinformation that could be spread*
>
> *Midwife 6, 2020*

9.3 Specific User Suggestions

There were several suggestions for how user generated content and guidelines could be used in the digital platform.

Manual Review

According to two medical professionals, they saw a potential solution revolving around a system for manual review: "I believe you will need a curator in charge of validating information, as well as making sure guidelines and SOPs are up to date in the app. This means that most realistically, there would be a position or group of people who are in charge of this." (Doctor 1, 2020) One midwife mused that perhaps this review could happen after posting content, since it "could be a barrier if you had to go through a filter of the guidelines first, before posting the video or photo of training" (Midwife 2, 2020). This friction would, in essence, defeat the successful principle of WhatsApp, which is instantaneous and quick and seamless content generation and access. Having manual review by someone of greater experience would allow for senior midwives to be exposed to up to date information on a regular basis as well.

Reference Guideline Access

Another midwife built on the previous suggestion, offering a solution which create a place for guidelines within the platform to increase access to them and encourage review of up to date practices. Specifically, WHO recommendations were suggested as suitable since they "work closely with maternity care and have a lot of obstetric guidelines, which is good because even though every hospital has their own version of guidelines, there is still a point of baseline reference." She expounds, noting that WHO recommendations were used frequently in a clinic in Tanzania, and could be beneficial "in sub Saharan Africa, where guidelines might not always be in place" (Midwife 3, 2020). (For more on guidelines in sub Saharan Africa, see Appendix 12.10). Another midwife in the USA confirmed this: "if you could partner with an organization like WHO, where they already have EBP guidelines and data that you could use as a back bone for midwives to reference, that might be really helpful" (Midwife 2, 2020).

> *"The culture of the healthcare field is typically more evidence based. Everyone is always following the guidelines or looking them up*
> *Midwife 2, 2020*

Evidence Based practice was also referenced by the intern midwife at KCMC. During discussions and training sessions, he explained how typically midwives will "contribute an idea based on evidence based practice together with evidence based opinion" (Intern Midwife, 2020).

> *"Everyone is eager to learn new things and discuss, because (information) keeps changing nowadays. We must keep our knowledge up to date*
> *Intern Midwife, 2020*

Training Guides

As discussed with Laerdal Global Health, having access to their suite of training materials and simulators could also provide guidance, as their content and equipment are founded on evidence based guidelines. By including instructions and practical "how-to's"of this material on the digital platform, continuous education could become more approachable, and ubiquitous. Futher, having "expert" midwives accessible via the chat platform for training advice or simulation facilitation support could also be of great use.

Overall Take-aways from User Testing

- Community oriented platform for communication, knowledge exchange, training facilitation appreciated
- Need for trust in the system: verification of content through manual review and/or increased guideline access, and training material.
- Desire for expanded network ability outside of midwife's own facility

Figure 24. Remote Concept Testing

Figure 25. Remote Concept Worksheet

10.0 Final Design Proposition

10.1 Concept Evolution

Through insights and confirmations from the validating research and testing of the initial concept, the proposition evolved into its final form.

The transition of the goals set in the inital concept are addressed with a decription of the specific functionality that allow the digital communication and education platform to achieve them. The majority of evolution occured in the primary goal, Knowledge Exchange and Continuous Education Support. The Secondary and Tertiary goals remained similar in form and function.

1 *Knowledge Exchange & Continuous Education Support* ·····► *Training Facilitation & Supportive Knowledge*

The continuous education focus on the platform will shift from user generated content as the primary producer of this education and knowledge exchange, to being an initiator and supporter of it. Instead, training will be directed by Laerdal Global Health Training materials and evidence based medicine references.

2 *Communication and Organization* ·····► *Communication and Organization*

The engaging, social nature of the platform that drives and facilitates training, through sharing of user generated content on chats and broadcast groups, remains the same. The the ability to network will expand to include users outside of the user's hospital network.

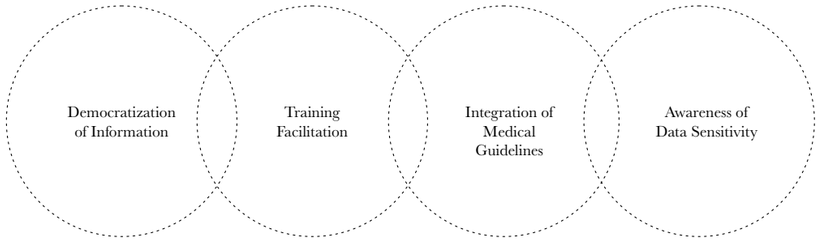
3 *Smart, Secure Data Use* ·····► *Data Awareness*

Through auto-anonymizing photos and videos, the use of vault storage (no content-synch to phone or personal cloud), and user generated content experation dates, an awareness for the sensivity of data will be brought into the user's everyday digital interactions.

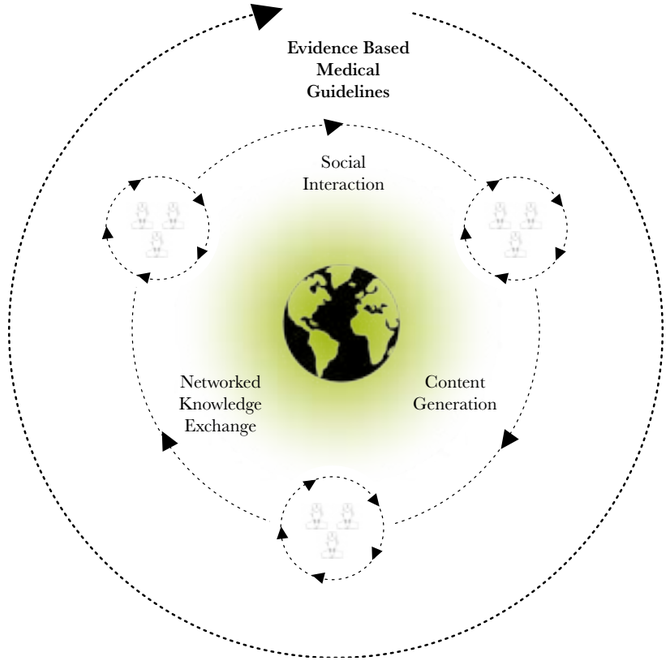
10.2 Concept Identity

Introducing Rio, a hybrid, social-professional digital chat and education platform for midwives.

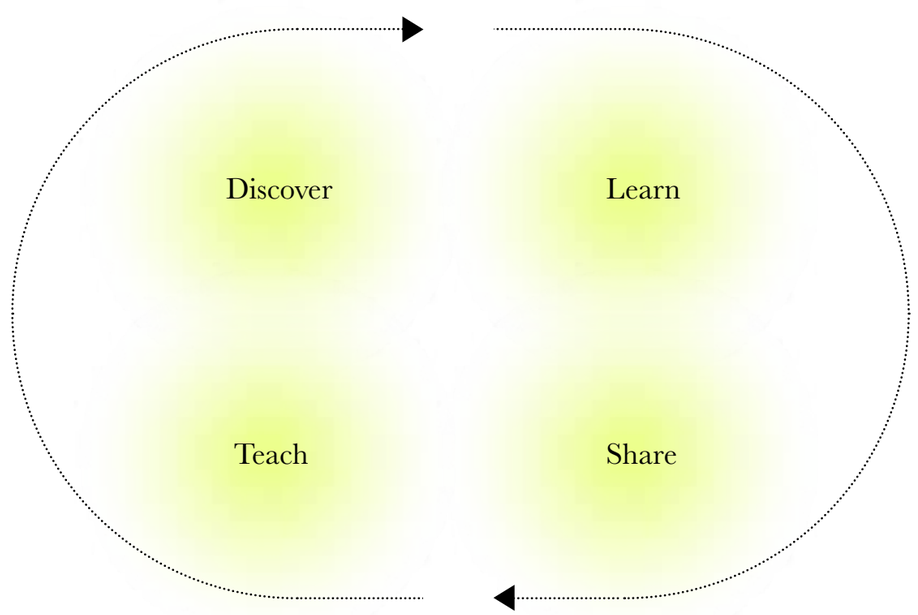
Rio is a tool to facilitate systemic change through:



Rio connects midwives and their knowledge through networked communication channels, and facilitates continuous education through an interactive training hub. Rio's system is driven by social interaction, content generation and knowledge exchange, operating on a foundation of evidence based medical guidelines.



10.3 Action Cycle



10.4 Zones

Rio is composed of two zones. A secondary, supportive zone, and a primary core zone.

Secondary: Supportive

The secondary and supportive zone of Rio lays a foundation for the core, educational zone of Rio's system through its faciliatation of social interaction and knowledge exchange. It consists of a home chat with a hybrid feed of activity, a community hub of networked groups in broadcast channels, a traditional chat, and a profile page.

Primary: Core

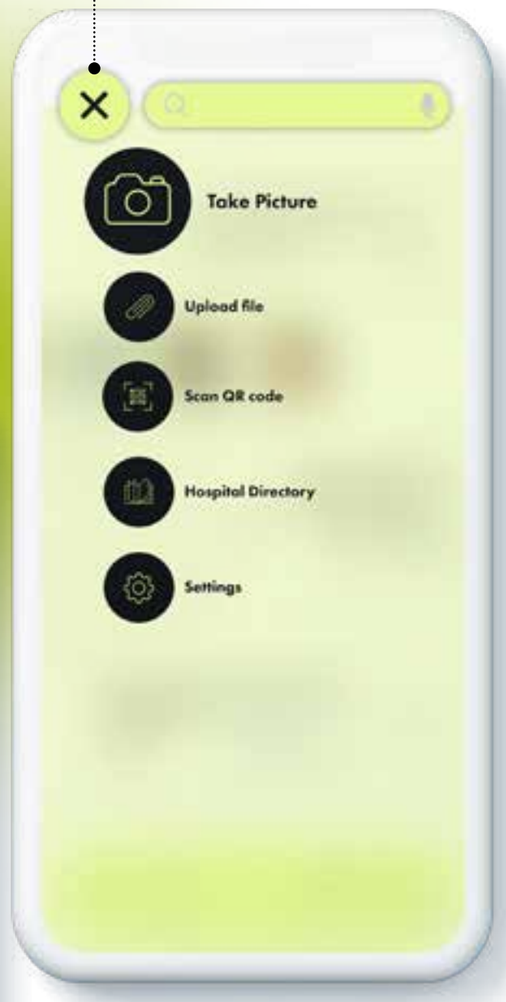
The heart of continuous education on the platform is a Training Hub which is organized through Laerdal Global Health training materials, with training sessions and corresponding content recorded in a network based log book. User generated training content will serve to bring visibility to training moments, and encourage others to train, as well as provide peer reference material. As a foundation of the training hub, globally-recognized, evidence-based guidelines and facility-specific protocols are accessible here for reference. The elevation of this standardized material will serve to increase the access and familiarity of guidelines and evidence-based practice.

A personal learning log is integrated into the private profile, and linked to activity recorded the Training Hub.

Home: Supportive

Hybrid Home Landing Page
The home function is a hybrid feed of the Chat, Community Hub, and Training Hub activity, as well as user status video updates. The feed's activity visibility settings can be customized per user.

Navigation present throughout Rio for quick access to camera and other essential features. All photos stored in encrypted vault, not on a personal device or cloud.



Chat Feed

User Status

Chat Activity

Community Hub Activity

Figure 26. Home Function

Communicty Hub: Supportive

Broadcast Communication
The community hub is a broadcast channel for communication. The hub is comprised of user-created groups, both inside a users own facility's network, and outside. This allows for networking and knowledge sharing capabilities around the globe, between midwife communities. Due to this extended networking, there is a range of privacy settings to accommodate security needs.

Home Page of a Community Hub Group

Members

Saved Media and Files

Communuity Hub Groups with a range of use, purpose, security, and membership size

Figure 27. Community Hub Function

Chat: Supportive

Messaging System

The chat function serves as a traditional synchronous chat, allowing for quick and seamless communication between midwives in and outside of their networks. Training activities can be shared within chats, directly linking users to the Training Hub.

All chats deleted after 30 days for security and data accumulation purposes, unless specifically saved by user.

Chat Home

Linked Training Activity

Link to Training Activity Options Embedded in Chat

Send Training Activity

Save Training Activity

Open Training Activity

Training Activity sent to Community Hub Feed

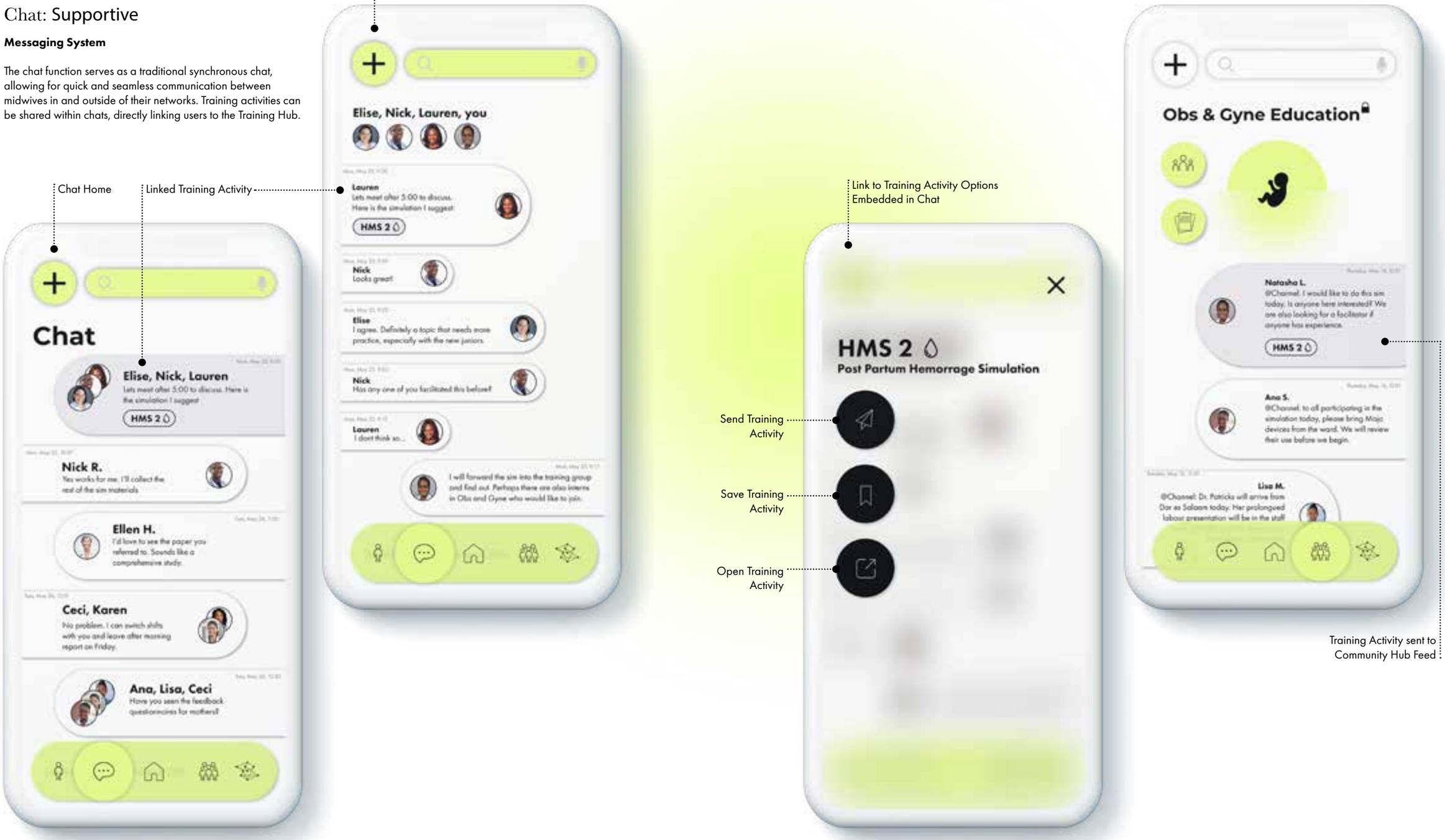


Figure 28. Chat Function

Engagement Prompts: Supportive

Engagement prompts serve to initiate and spark training, social interaction, recognition of peer's professional efforts. These prompts also function as reminders to take breaks throughout the day to maintain a healthy mentality in a potentially stressful and work-loaded environment.

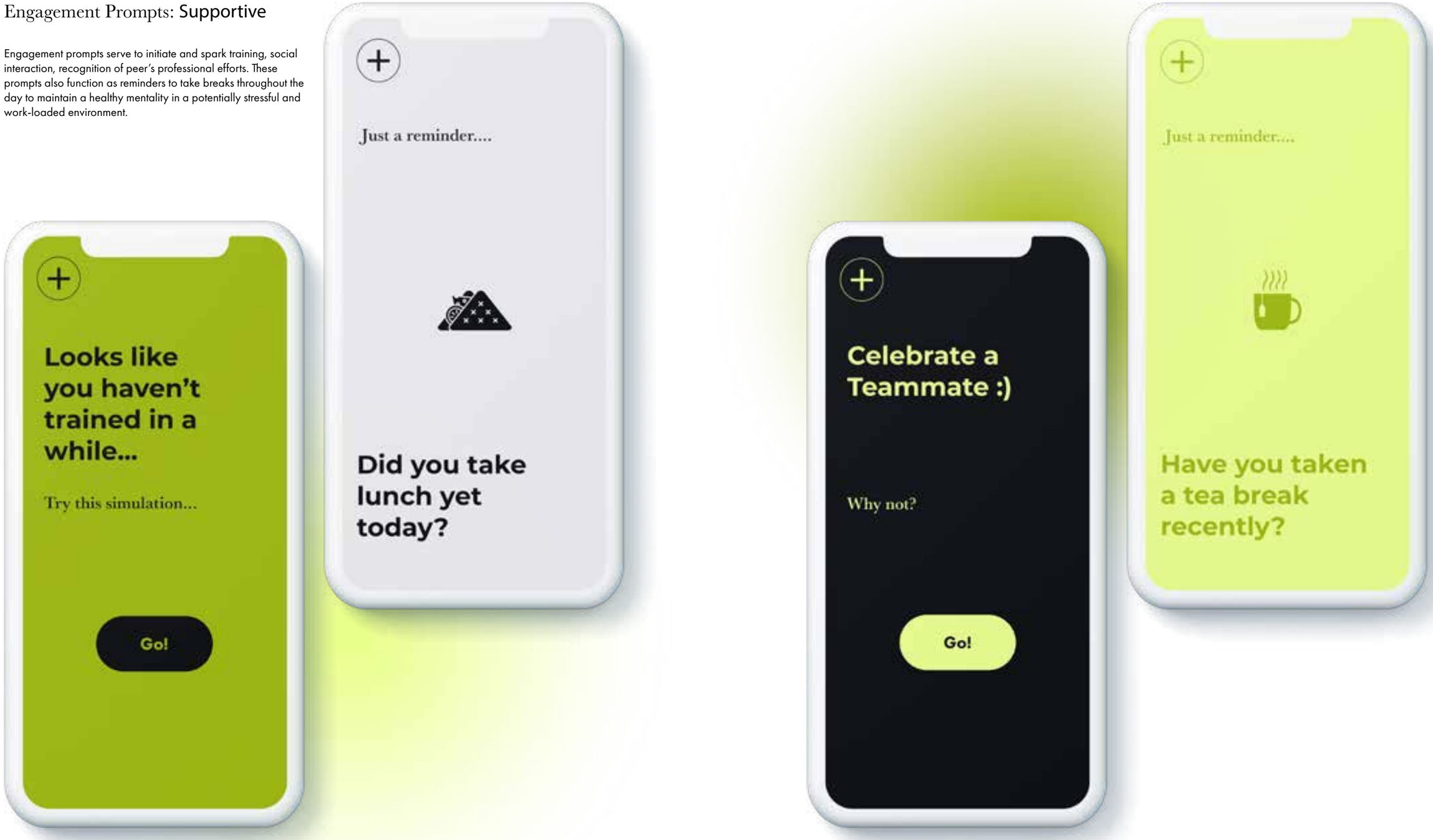


Figure 29. Social Prompt Function

Profile: Supportive & Primary

Profile and Learning Log

The profile bridges both the core of Rio, and the secondary, supportive zone of the platform. There are three main functions of the profile. Livingin the core is the organization and accessibility of user generated content, and the Learning Log. In the supportive zone is the underlying ability of the profile to allow for connections with other health workers in and outside of a user's network.

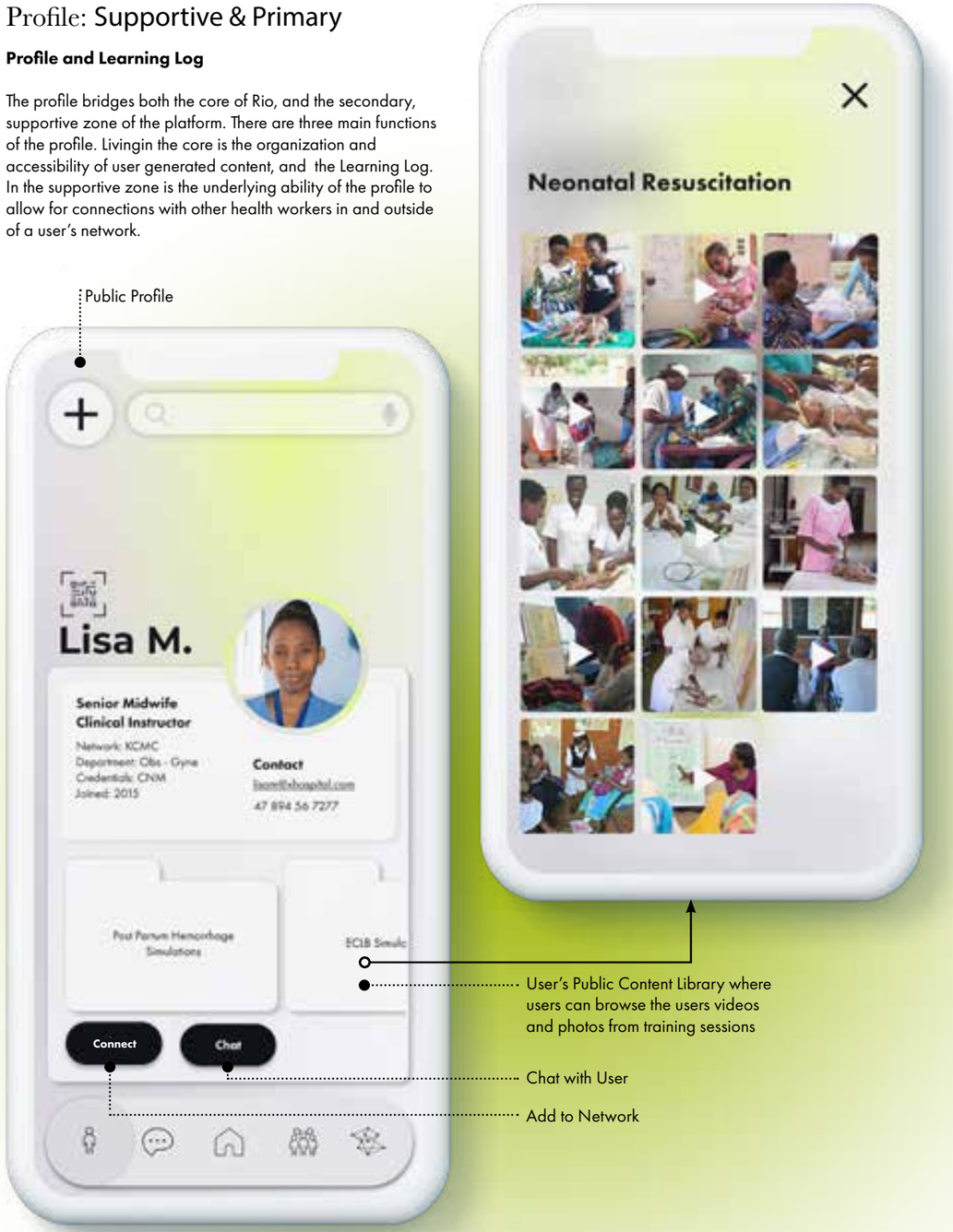


Figure 30. Profile Function

Training Hub: Core

Laerdal Global Health Training Suite

The training hub is organized by the suite of Laerdal Global Health training programs. Upon selecting a program, the user is directed to specific topics within the program, where they can then choose from a variety of training activities such as simulations and practice assessments, and debriefing guides.

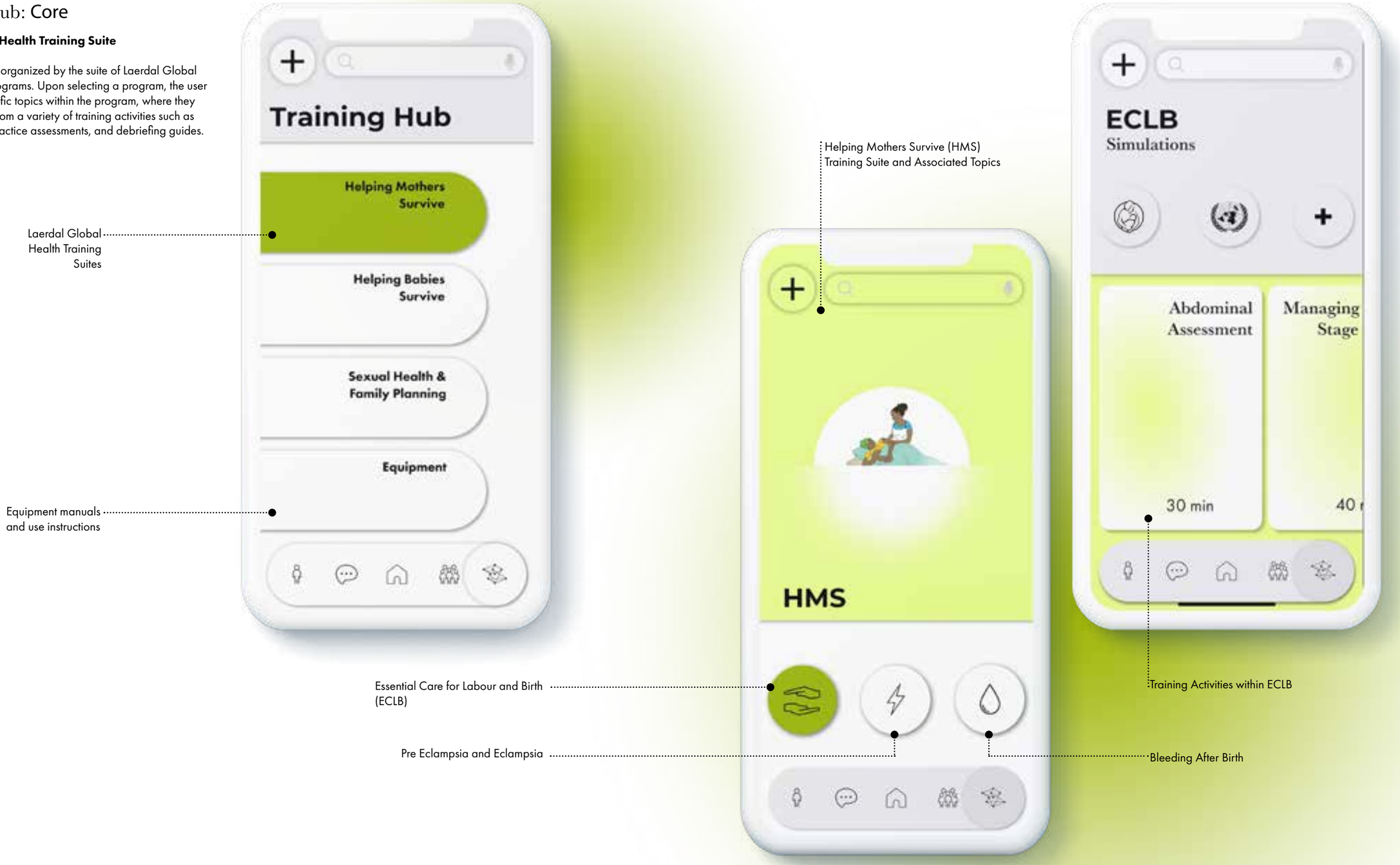


Figure 31. Training Hub Main Function

Training Hub: Core

Laerdal Global Health Training Activities

Within each training topic are a series of activities from which the user can choose. Upon selecting an activity, the user will be presented with materials to help guide them through the training session, organized by preparations (Prep), activity instructions (Activity), and history log of previous sessions (Log) for reference material and peer and or facilitator contact.

Send Training in Chat or Community Hub Channel

Save Training

User Generated Content from Past Training Sessions

Preparation requirements for training including objective, duration, materials, participants, etc.

Step by Step Training Instructions

History Log of Training Sessions, including participants, facilitator (including direct chat access with these users) and associated media.

Log entries are created by those with administrative rights such as senior midwives, and these training entries are then linked to users personal learning logs to help midwives track their education.

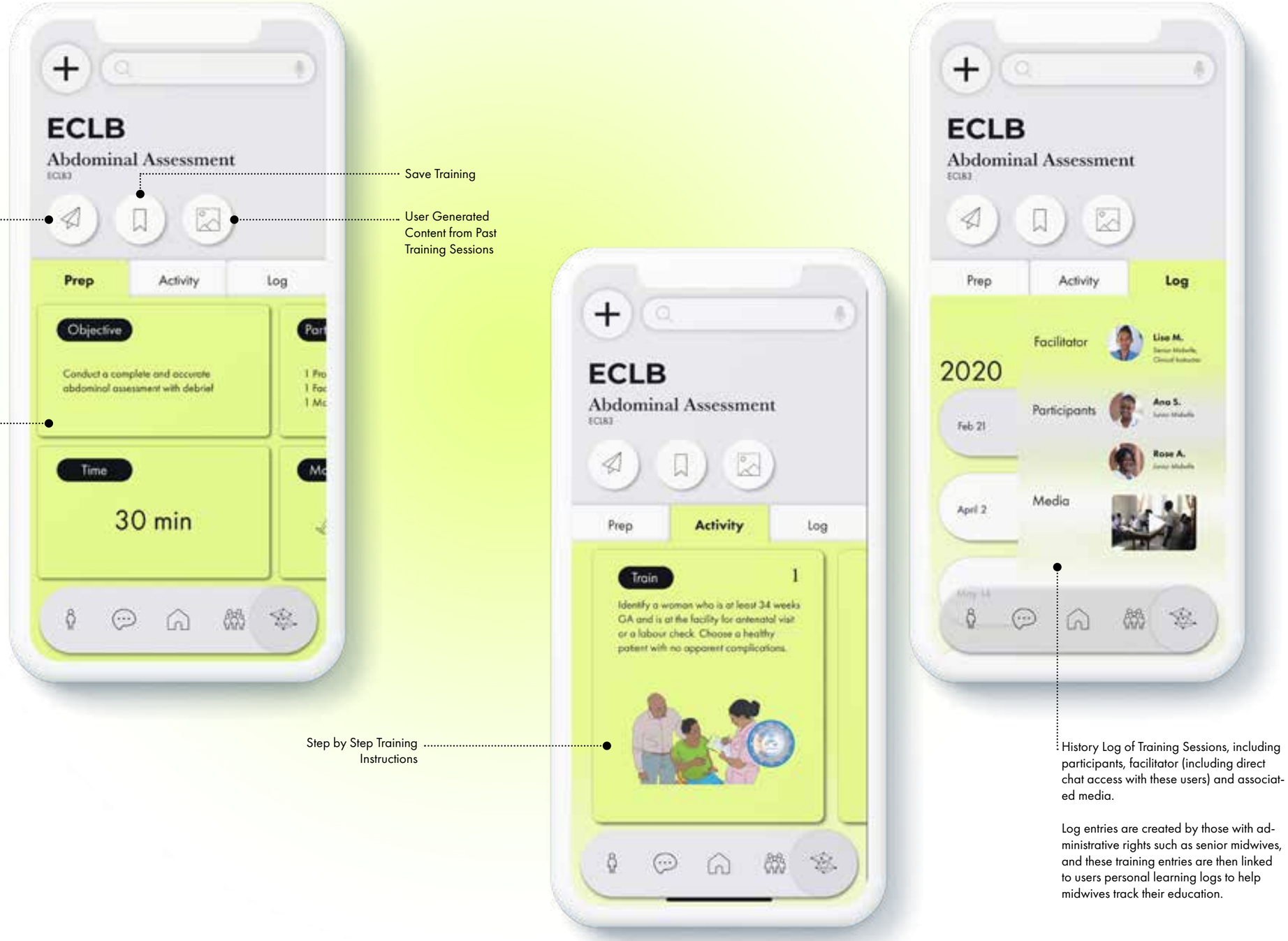


Figure 32. Training Hub Materials Function

Training Hub: Core

Reference Material: Evidence Based Guidelines & Recommendations

For every topic of training there is an associated set of Laerdal Global Health training standards, global guidelines, and a space for uploaded, institution specific standard operating procedures (SOPs). This serves as a foundation for training and and elevates the access and presence of evidence based guideline for midwives. Further, all video and photo content that is saved into the Training Hub must be verified by an administrator, and these guidelines can serve as support for this.

Laerdal Global Health Training Standards

Global Recommendations

Institution SOPs

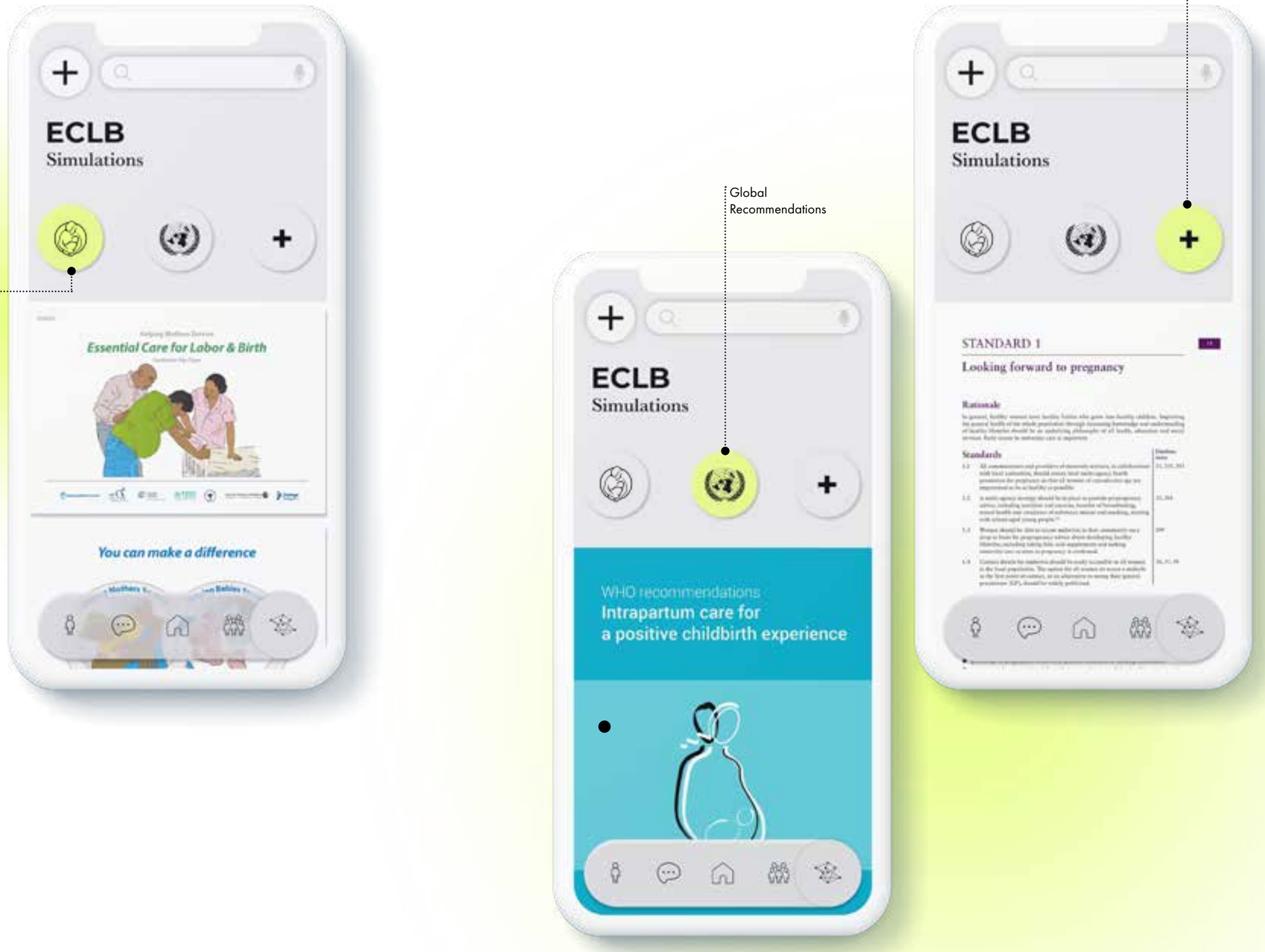
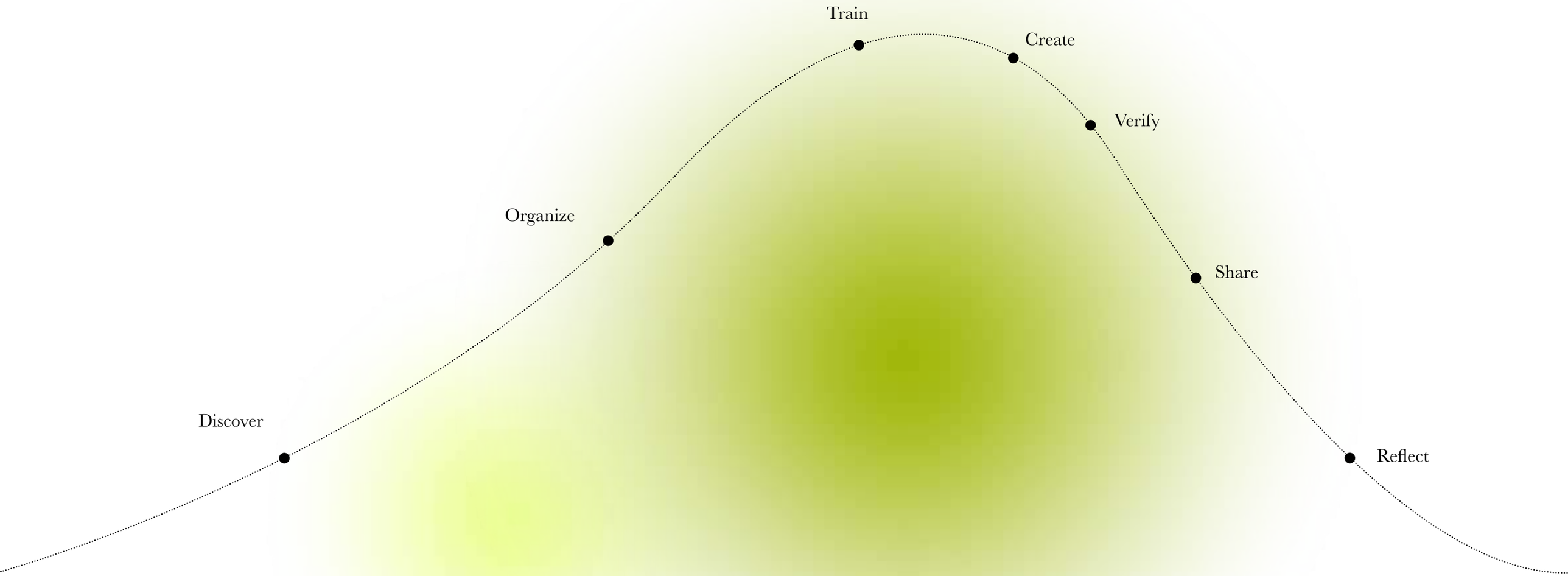


Figure 33. Training Hub References Function

12.5 User Journey



12.5 User Journey, Continued

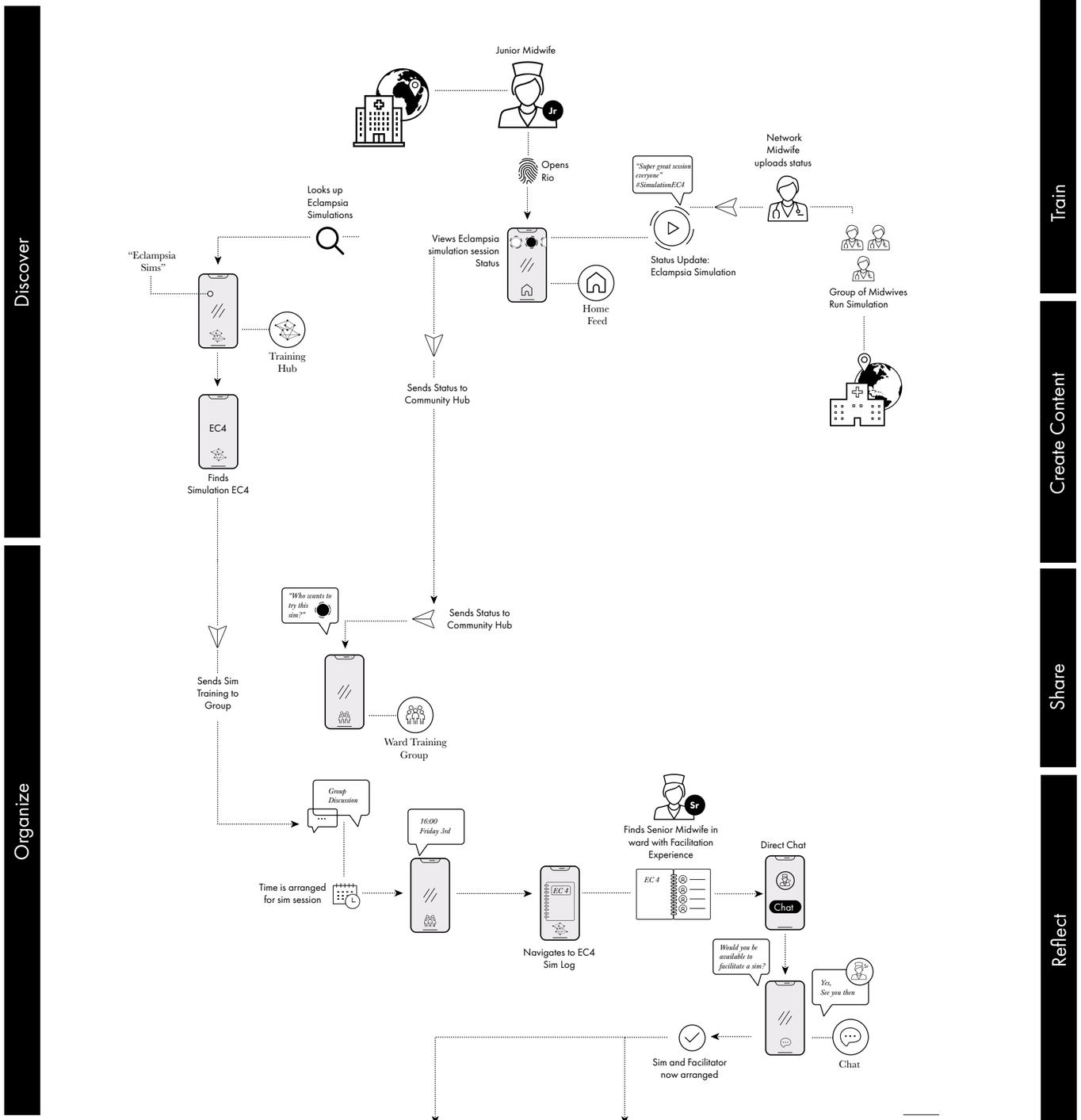


Figure 34. User Journey

11.0 Reflection

Start to Finish

Initial Intent
The intent of this project was to support midwife continuous education to improve the mother's childbirth experience and reduce maternal morbidity and mortality rates. The initial brief of the project asked, "how might we improve the quality of care mothers receive during labor and birth through supporting midwives' efforts to participate in competency development and continuous education? Along the design journey I added a sub question to the brief, as a way of focusing and elaborating on the framing: "How might we support midwives' efforts to engage in continuous education and knowledge exchange through a relatable, social digital platform?" The approach I set for myself was human centered, with a focus on utilizing existing technology habits and learning behaviors demonstrated by the midwives, and in their social landscape and work environment. I anticipated that I would create a service design proposal, with elements of supportive digital touch points.

The Outcome
The result of this project was a system design proposal, experienced through a digital application, with a critique on existing methods of communication and knowledge sharing in the medical field. The final design proposition combined the ubiquitous chat platform WhatsApp's successful principles, accommodated the existing array of continuous education methods found within the midwifery community, and supported the social landscape of the maternity ward in Tanzania. In doing so, the proposition addressed a spectrum of barriers midwives encounter and produced a concept that is flexible in nature to accommodate diversity of need and use.

Project Learnings

Scale Matters
I began this thesis with the hope of addressing systemic, foundational challenges that exist in the midwife's environment as a way of framing my project and creating an entry point for my research. These challenges included the topic of respectful care for mothers, from a societal and cultural lens, and the mental health of health care workers, such as midwives. These topics are, in fact, deeply intertwined with my goal of this project, but are also incredibly vast and complex in nature. I quickly discovered, while in the Field Research phase, that they warranted far more time and study than I could dedicate in the time frame and resource allotment of this thesis. I therefore turned to challenges that were more approachable and appropriate for the scale of the project but would still allow for a thoughtful and relevant study.

Prioritization
These challenges, found to be more approachable, were still diverse and numerous. This meant that the latter half of the project was truly an exercise in prioritization and understanding which pain points could be addressed realistically, with the most impact. One topic that I was unfortunately unable to address, but find to be an interesting exercise in problem solving, is how to design a digital service that can withstand failures within the system, such as loss or inconsistencies of user connection to the internet, low bandwidth, limited smartphone data capacity, etc. I acknowledge this is a major topic, especially due to the context of this thesis, but due to time constraints, I will not further address these issues here.

The Aesthetics of Remote Engagements

I learned that navigating professional remote relationships in a highly informal and social digital environment can be a unique dance. On one hand I tried to remain professional and keep an appropriate formality and distance in my tone of communication, but on the other hand, I primarily conversed over WhatsApp with the midwives, which is a fundamentally relaxed, and personable chat facilitator.

As commonly happens with any communication between two people, verbal or written, I realized I began to mimic my contacts' style of writing, use of emojis, etc, and other chat habits, in an attempt to make myself feel more familiar, or approachable. In hindsight, of course, this imitation of style was not needed perhaps, but it was something that felt natural and necessary at the time.

In this situation, I would argue that taking a more personal tone with one's users, if the context begs it, is not a problem, and that forcing a more distanced approach, out of character for the situation, might not be conducive to establishing trust or openness. From my perspective, this form of communication also served the principles of humble design methodology, where participants are engaged and relationships are established and experienced in an equal and non-hierarchical manner. This is in keeping with the finding that WhatsApp is a social equalizer in the workplace.

Regardless of whether or not adopting one's users' communication patterns is deemed appropriate or not, it did give me pause to reflect on the relationships we establish as researchers or designers, and how we can design our own conduct and interactions. I also learned that I could use the exchange with the midwives over WhatsApp as a form of research and user testing in its own right. In other words, by engaging over a digital platform from which I was borrowing principles already, it was a perfect opportunity to use the actual user interactions and use patterns of their communication with me to inform my concept.

Contributions

Remote Explorations
I believe that remote engagement methodologies explored in this thesis contribute to the future field of interaction design and research. These remote interactions, I believe, will become more and more relevant and utilized, as we enter a time where climate change comes to the forefront of discussion and increasingly drives decision making. Efforts to lower carbon footprint will alter our travel habits, including work-related research and user engagement trips. This means that if we continue to engage with communities outside of our own, such as this project does, we will need to consider alternative methods of contact and participation, and we must study the ramifications of this shift.

Where Service, Systems, and User Experience Design Collide

In keeping with the ongoing industry debate over the fundamental differences between service design and user experience design, my project personally provoked many questions about this topic, which I also hope will serve to add to the discussion in the larger interaction community.

I began this thesis with the assumption that I would create a proposition revolving around a service. As I progressed with my research and insights, I discovered the diverse nature of continuous training efforts across midwife communities and medical institutions, within Tanzania and globally. In seeing the spectrum of challenges, resources, methodology, systems, and social constructs present, I began to question just what kind of service would be appropriate for such a range of situations. One of the fundamental tenets of humble, social design, is to propose designs that do not impose or create burden on its users or the environment it would live within. I asked myself, would a service with prescribed, built-in touch points, do just that, or would a service that acts as an flexible system with adaptable touch points be a more apposite proposition? Deciding that the latter would be more apropos, I continued on this path, only to discover that in following my design process "north arrows," (research, learnings, opportunity spaces and values, etc.) I had created something unintended. In giving an identity and form to this idea of a flexible system, I was quite literally building a digital app. One might argue that I began this thesis discussing the use of digital space, but this was a broad brush stroke that I had assumed would take the form of smaller, secondary digital moments within a prominent, and defined service.

In retrospect, I would argue that my thesis is still at its core, service design, in both its approach, research methodology and intent, with designed user experience through a vessel of a digital app, allowing for user interaction and adaptation of the system. This musing lands me back at square one: identifying words such as "service," "system," and "user experience" may entail certain scales of thought process and creation, but when all is said and done, they are inextricably linked and co-reliant.

Critique of Existing Practice
This project was also an attempt to provide critique to Whatsapp practices in the medical field, because as discussed previously, WhatsApp is a "timebomb" of patient data, among other potential misuse cases. There are other attempts to design replacements for WhatsApp for health care professionals. These digital applications have varying degrees of success and functionality, (see Appendix 12.8 for market analysis) but none emphasize the inherently communal nature of humans, nor the social aspect of learning, particularly as seen in adult education preferences. These medical "WhatsApp" platforms do not emphasize continuous education, nor do they attempt to utilize user generated content for knowledge exchange to supplement training efforts.

Recycle, Reconfigure, Repurpose
The methodology of recycling, reconfiguring, and repurposing was an attempt to give a structured and visible way of working with humble and human centered design to create a proposal that is familiar and in keeping with the user's existing values and habits.

This consisted of identifying and analyzing elements within the existing environment to determine whether or not they were in keeping with the goals, values, and research learnings of the thesis. Once these elements were selected, their functionality was reconfigured to suit the context of the design concept to give them a new purpose in the experience of the user. For example, I identified that user generated content and sharing was a highly popular and habitual practice on the WhatsApp social platform. Therefore, I asked myself how I could take this use case and associated behaviors and transform it into something that would serve the goals and opportunity spaces of the thesis. In this case, I transformed the WhatsApp practice of user generated content sharing into a promoter of knowledge exchange and facilitator of training, in a safer and more secure way for the protection of patient data. The process of identifying these elements to be amplified and brought into being was an experimental and non linear process, and requires further investigation to understand its potential or weak points. I believe this exploration can spark methodology ideas for interaction designers in the future.

Concluding Words
It is understood that learning is both an individual and social activity, both physical and mental, and it inhabits people's social and professional lives in many different ways. This diverse intersection requires both flexibility and inclusivity, and I strived to apply these in my overarching approach and design process, as well as in the the final proposal. Rio aimed to reflect these values as well, while serving as a support for midwives. This proposal is not meant to prescribe a method for how midwives should approach continuous education, rather, it proposes a scaffolding that they can use within their communities ---as they wish--- to sustain their education.

12.0 Appendix

12.1 Midwife Mental Health

> *'Empathy' and 'exposure' have been identified as the two key factors for the risk of secondary traumatic stress. The work of midwives touches both of these*
> *Leinweber, 2010*

There is a tendency to blur the line between professionalism and maternal emotional support, which means that there can be a 'cost' to midwives for fulfilling their roles. Midwives themselves are at risk of having compassion fatigue and stress, as well as secondary trauma. Secondary trauma is "repeated exposure to different duty-related traumatic events," rather than a single incident (Leinweber, 2010). Compassion fatigue and secondary trauma and stress for midwives is typically from sustained emotional support giving, and "adverse pregnancy outcomes and their unacceptable working conditions, (which can) caus(e) feelings of guilt, anger, and sadness" (Maaløe, 2018). As one midwife explained, "this can go from being the happiest job in the world to the worst when you deliver a dead baby that you didn't expect. That can be really hard for midwives and career changing (Midwife 5 2020). In addition to these adverse pregnancy experiences, "general working conditions...may result in exhaustion, demotivation, (and) demoralization..., with impaired performance, negative attitudes, illness, absenteeism, and escape from the health care system – thus worsening maternal health care further" (Maaløe, 2018). Emotional exhaustion can also lead to high rates of burnout and turnover, "which can be a frequent problem in midwifery and the larger health care provider community" (Leinweber, 2010).

12.2 Role of the Midwife: Range of Responsibilities

Hard Skills
Hard skills include all the medical monitoring and care the mother and child receive from pregnancy to postpartum. This includes antenatal care check ins, consisting of assessing mother's vitals, baby's position, and womb measurements, and clinic entrance examinations to record hemoglobin count, blood pressure, heart rate, stage of labour, and the baby's health. During labour before delivery , midwives also monitor the mother's labour progression, including cervical dilation, head descent of the baby, and maternal and fetal heart rate. If complications are identified, however, it is also the responsibility of the midwife to treat and/or monitor the mother and baby accordingly, or refer her to a specialist doctor. In the event of a cesarean section or specific complications, a doctor will be called for assistance. For example, "in the case of newborn asphyxia, the pediatrician is called and comes to receive the baby" (Midwife 1, 2020). The midwife is also responsible for the delivery of the child and post-natal care of the mother and infant, including newborn vaccines, and education of the mother if she so requires, such as breastfeeding.

Soft Skills
Not only are midwives there to provide medical care for the expecting mother and newborn, "but she should be able to read what the woman needs, encourage the mother's own strengths, and support her" (Maja 6, 2020). Overall, it was agreed that "the midwife should try to create a relaxing environment for the mother" (Midwife 5, 2020). A former midwife in Ethiopia added that "these soft skills can have a strong physiological and psychological impact on the mother and make her feel less stressed. If she is in a calm environment, the baby will be better off, the labour will be smoother" (LGH Implementation Specialist 1, 2020). Decision making and communication between team members, as well as the mother, is also noted as an "essential component of midwifery" and can help to identify complications before they become life - threatening (Midwife 5, 2020).

12.3 Best Practices of Data Principles

There should also be a direct return to the mothers from whom the data is being collected; "the golden standard is that if you capture a data point, there should be benefit as directly as possible" (Project Manager, 2020). Data should also be actionable and useful, "not just any data, for data's sake. The data should help you change what you are doing" (LGH Industrial Designer, 2020). While collecting data can be highly useful to help identify gaps in knowledge, define training programs and show improvement, it can also be overwhelming. As explained by an implementation specialist at LGH, data must be approachable: "be careful not to overload with data. If you give too many data points to someone, it's not very helpful either" (Implementation Specialist 2, 2020). Further, if the method of data collection and analysis is too complex, and it is not clear how to use the data to inform training, "that will create an overwhelming situation which will demotivate or build up a barrier for someone to actually implement any type of change" (LGH Industrial Designer 2, 2020).

> *Recognizing an indicator to measure, designing a system to capture and analyze it, and then utilizing it to inform quality improvement measures in a timely, effective, and respectful way can be challenging, though, especially due to its subjective nature*
> *LGH Implementation Specialist, 2020*

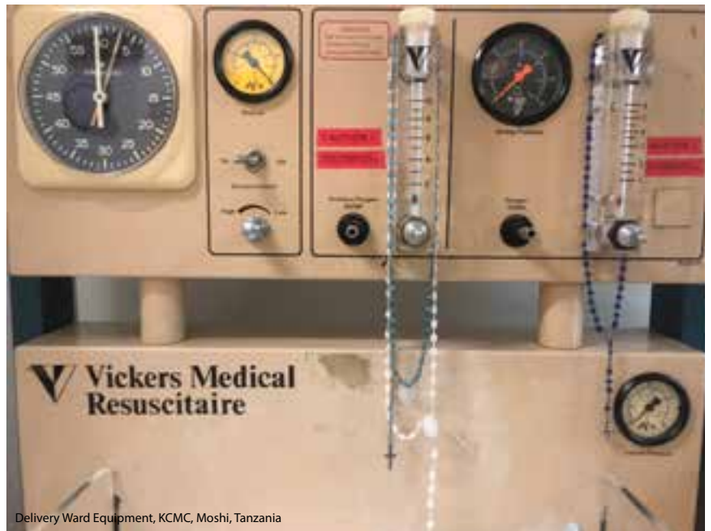
Medical Supplies Moshi, Tanzania

Medical Supplies, Moshi, Tanzania

Delivery Ward, Mawenzi Hospital, Moshi, Tanzania

12.4 Field Research Documentation, Phase Two, Continued

Mawenzi Hospital Corridor Moshi, Tanzania



Delivery Ward Equipment, KCMC, Moshi, Tanzania

Mawenzi Hospital, Moshi, Tanzania

KCMC Classroom, Moshi, Tanzania

Mawenzi Hospital Entrance, Moshi, Tanzania

12.5 KCMC Field Research

The Context

Hospital Background
Kilimanjaro Christian Medical Center, founded in 1971, is a large hospital facility located in Moshi, Tanzania, and serves over 15 million patients across northern Tanzania. It has an affiliated university, Kilimanjaro Christian Medical University College (KCMUCo), and is partnered with Kilimanjaro Clinical Research Institute. (Kilimanjaro Christian Medical Center, 2020).
Due to its large size and number of specialty departments, it serves as the main referral hospital for the region. It has around 1300 staff, and 1900 students. Yearly, there are around 4000 deliveries (Kilimanjaro Christian Medical Center, 2014).

Ward Layout
There are a total of four units within two departments: Delivery Unit (Labour Ward), Obstetrics Unit and Gynaecology Unit (OG 1), and several clinics in the outpatient unit. The Obstetrics Unit, with fifty nine beds, is where the admissions area for all incoming pregnant women is located. Upon being admitted, the women are given routine entrance exams to determine their stage of labour, any complications they may be experiencing, and vitals such as hemoglobin, blood pressure, heart rate, etc. According to these results, the expecting mother is placed either in the Obstetrics Unit, or, if she has gynaecological problems, the Gynaecology Unit, with fifty two beds. If the mother is seven centimeters dilated, KCMC classifies it as active labour, and she is taken directly to the labour ward.
There are a range of rooms in OG1: antenatal, latent phase labour, pregnancy complications (e.g. pre-eclampsia), high risk, long-term pregnancy complications (e.g pregnancy induced diabetes), general medical conditions, as well as postnatal care for normal and cesarean section deliveries, nursery for newborn vaccination, and parental education. There can be upwards of 50-60 women in this ward at one time, and it is consistently busy.
The second ward is the delivery unit, or labour ward, with four delivery cubicles and two operating theaters for cesarean section operations. Depending on the number of women in active phase labour, the delivery unit can either be busy or have hours of relatively low traffic.

Main Objectives of the Department of Obstetrics and Gynaecology (Kilimanjaro Christian Medical Center, 2014).

- Maintain good interpersonal relationships, team spirit and good harmony among the staff, students, clients, and relatives in order to promote a conductive working atmosphere.
- Provide quality services to all patients admitted to the department; identify patients at high risk and act promptly.
- Prevent and manage obstetric complications so as to reduce maternal/neonatal morbidity and mortalit y rate.
- To provide practical oriented clinical teaching to students and staff as continuing education.
- To conduct evidence based clinical research.

KCMC Floor Plan
(approximate)

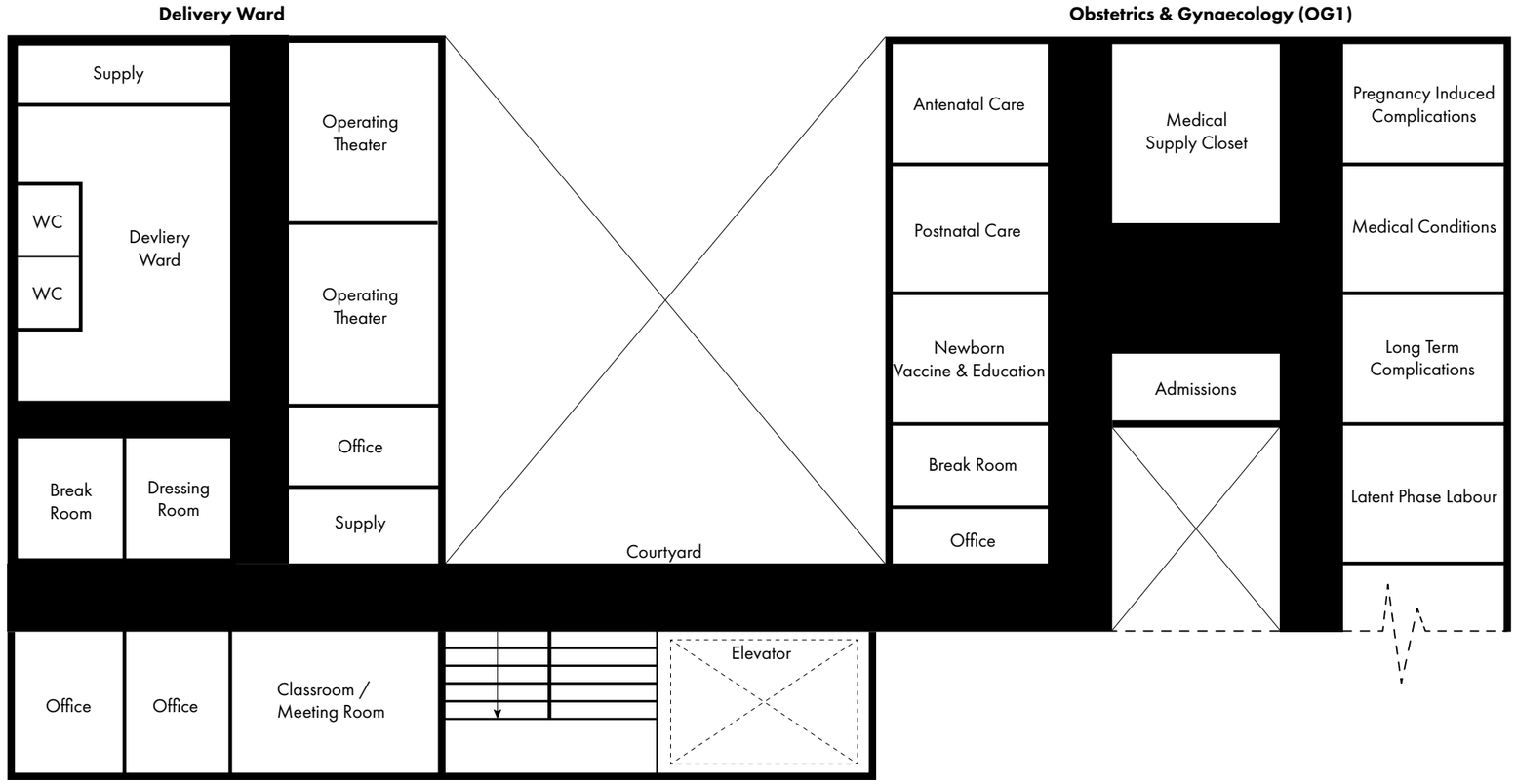
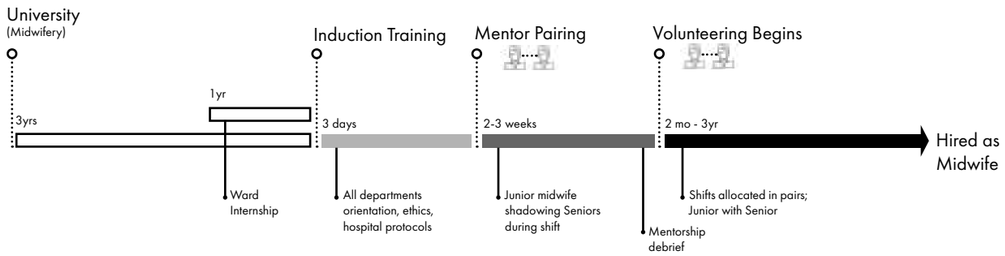


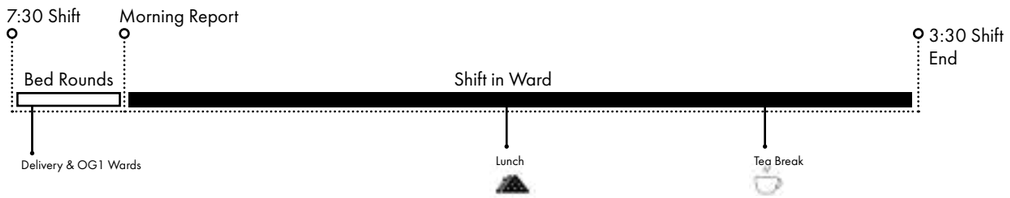
Figure 35. KCMC Approximate Ward Floorplan

12.5 KCMC Field Research Continued

Onboarding & Training at KCMC



Day Schedule of Midwife at KCMC



Weekly Schedule of Midwife at KCMC & Spectrum of Educational Moments

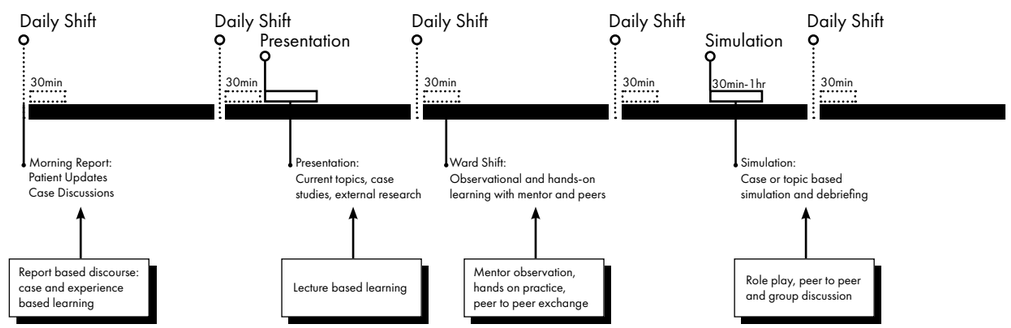


Figure 36. KCMC Schedules & Programs

Landscape of Midwives

Hiring Freeze
A hiring freeze has been placed on public service jobs in Tanzania since 2016. This includes medical workers such as midwives. Kilimanjaro Christinan Medical Center has not escaped the hiring freeze, and as seen in the labour and delivery wards, workplace conditions are adversely impacted.

Volunteer and Intern Midwives
To find a solution to the hiring freeze and to keep up with demand for midwives, KCMC has consequently created roles for volunteer midwives. This means that men and women with a degree in midwifery can enroll as volunteers at the hospital, without pay, except for overtime shifts that are paid minimally. These volunteer midwives are often recently out of school, and are looking for in-ward experience that will make them more desirable once the hiring freeze is lifted. Their volunteer service can run from several months to several years. Since there is a university (Kilimanjaro Christian Medical University College (KCMUCo) affiliated with KCMC, , the university has a program for students to intern as midwives in the wards during clinical rotation. These two positions of intern and volunteer results in an uneven ratio of junior, less experienced midwives to hired, senior midwives. At the time of my visit there were seven volunteer midwives and four student interns. Intern numbers fluctuate with each clinical rotation.

Hired Staff

Medical Attendants
Medical attendants have duties such as cleaning, bed-making, feeding patients, and assisting with low-risk tasks in the ward. They go through a one year certificate training program for education and receive basic training on the job. On average at KCMC, there are around 20 medical attendants. These attendants are not included in continuous education and competency development efforts at KCMC, but some argue that this should be changed. Due to the high patient load, some believe that these medical attendants can be instrumental in helping to identify arising complications in patients and notify busy midwives who may not have had time to notice. According to the head midwife, "we encourage them to follow us (midwives) around the ward so they become aware of the patients, so even if they are doing their cleaning, they can see if something is wrong. They are never far from the mothers" (Midwife 1, 2020).

Midwives
The midwives have the same duties as the volunteer midwives, attending to pregnant women in OG 1, or in the delivery room, assisting the woman through labour and catching the newborn. In the case of cesarean section, a team of surgeons operate, and the midwife receives the baby. In the event of newborn asphyxia and other critical complications, a pediatrician is called.

Head Midwives
The head midwife has additional, managerial duties. She or he has the responsibility of conducting introductory orientation of the ward for incoming midwives, as well following up with them to see that their training is progressing and they are handling the position well. The head midwife is also in charge of patient documentation, morning report, following up on specific problems in the ward or with patients, and ensuring that shifts are filled by midwives, and ensuring that supplies and equipment are stocked and functioning. Overall, she or he ensures that the wards are running smoothly and that the midwives are in good spirits.

Clinical Instructor Midwives
The clinical instructor is also a midwife and is in charge of arranging the organization and training of the interns coming from clinical rotation in KCMUCo.

Initial Training: Onboarding Mentorship
New midwives are typically recruited in groups of ten to fifteen. To introduce these new midwives to KCMC, there is a hospital-wide orientation called Induction Training, where they receive sessions on ethics and protocols, and the hospital environment. Following the induction training, they are brought to their department where the head midwife will give a tour of the wards and introduce the ward activities and routines.
To begin their ward rotations, they are partnered with a more experienced, senior midwife for the first two-three weeks. During this period of mentorship, they shadow the senior, observing, asking questions, and giving care with supervision. At this time, the senior midwives should "observe the junior to make sure she is coping and learning" (Midwife 1, 2020). The head midwife also noted that she takes it upon herself to "remind them (the experienced midwives) of their coaching duties" (Midwife 1, 2020). To conclude this mentoring period and before being allocated to regular shifts, discussions are often held to receive the incoming midwives' feedback, give them the opportunity to ask questions, and see if there are gaps in their knowledge.

12.5 KCMC Field Research, Continued

Continuous Learning: Mentorship
After the conclusion of this first period of introductory mentorship, junior midwives are allocated to shifts alongside the rest of the midwives at KCMC. It is the hospital policy that all midwives must work in pairs, with each junior midwife being paired with a senior. It is agreed that this is a policy to ensure quality of care and safety for both midwives and mothers and is a good way to train new midwives. In this way, juniors are learning while simultaneously working, by getting hands on experience, and observing more experienced midwives in their day to day routines, and interacting with patients.

Continuous Learning: Morning Meetings
Other learning moments, simultaneous to work, happen during the report that occurs each time a shift of midwives changes. In the morning report for instance, the night shift midwives relay the current number of the patients, conditions of patients and any issues that have arisen, and anything concerning labor progression and deliveries. As described by one midwive, the report is followed by discussion about what should be done differently, any problems that they have faced, and how they can be solved" (Clinical Instructor, 2020). It is during this time that continuous learning can happen, based on on-going cases in the ward.

Continuous Training: Tuesday Presentations
The primary moment of formalized, continuous education is an hour long presentation every Tuesday morning. The Continuous Education Office of KCMC organizes these routine lectures by rotating presentation responsibility around every nursing department each week. The presentations are given by a senior midwife, and "if anyone wants to share something in particular like a burning issue within midwifery or from her own experience, she can do that when it's her ward's time" (Clinical Instructor, 2020). She continued, "if the midwives are not aware of an issue, it's important to present it so that we share. That's how we educate" (Midwife 1, 2020). Occasionally, midwives and students from outside KCMC will be invited to present relevant research and expertise. There is typically a group discussion following the presentations.

Continuous Training: Simulations
Other continuous education occurs during an occasional simulation training or demonstration throughout the month. These are not routine simulations; rather, they occur when an external specialist will come in with training equipment to practice a particular skill. KCMC now has its own simulators, so perhaps the frequency with which simulations occur will increase.

Progressive attempts at improving mother's experience
There were many indicators of efforts to improve the mothers' labour and birthing experience. When asked about how midwifery has changed over the past 25 years, a senior midwife explained that before, the midwife's word was not questioned, and the patient was unable to contribute or have a say in decisions. "Patients are increasingly more and more aware and want to know what is going (in childbirth). They know it is their right. Midwifery practices need to reflect this,"she continued (Midwife 1, 2020). Demonstrating this progressive mentality of the midwives is a questionnaire filled out by mothers, after normal deliveries, which covers her experience and treatment during labour and childbirth. The entry page has an explanation which translates to "This form is to help modify our service" and "every answer is correct." The questions range from inquiry into the communication with midwife, the quality of the environment, whether the husband was allowed to be present during delivery, to suggestions for improvement. These forms provide the mother an opportunity to share her experience and help shape how midwives may practice in the future.

> *"Mothers know their rights and midwives are moving with the changes*
> *Midwife 1, 2020*

12.6 Confidence Building: Self Efficacy and Self Assessment

Self Efficacy
Self efficacy is the "belief in one's capability to perform tasks or actions" which can largely influence whether or not one will achieve their goal (Egenberg, et al., 2016). Incorporating self assessment and reflection, such as tracking one's learning into daily practice and training can encourage self efficacy, promote a positive self image, and boost morale. According to an industrial designer of LGH, "based on learning theory, self-assessment is the best way for people to take in critique and learn" (LGH Industrial Designer, 2020) Self assessment "and identifying one's own learning needs through self-reflection and inquiry" is also listed as a required element of training according to the Tanzania Nursing and Midwifery Council. (Tanzania Nursing and Midwifery Council, 2014).
Judging one's own performance through self assessment can be challenging, however. Self efficacy and self assessment are subjective, and there must be objective measures in place to guide one's perception of one's own performance and skill. As emphasized by an Education Specialist of LGH, "the only way to improve the objective level radically, is to first work with the subjective level" (LGH Education Specialist, 2020). There are ways to incorporate objective information to help bring perspective to the subjective information, however. These include "mastery experiences" which are successes that strengthen beliefs in one's abilities, "vicarious experiences" such as observing role models perform tasks to increase one's capability of doing the same, and "social or verbal persuasion" which helps people believe in their own mastery (Egenberg et al., 2016).

Collective Efficacy
Collective efficacy is the belief of ability through unified effort, which impacts team performance and achievements. The belief in collective efficacy will encourage and promote teamwork to accomplish a task. Debriefing after training on a team level "seems to have contributed to a strong and shared sense of collective efficacy among training participants" (Egenberg et al., 2016). Regardless of the efficacy being individual or collective, efforts to boost belief in ability is a key component of any training program and progression in competency development.

12.7 Barriers to Continuous Education

Facility Challenges: Lack of Equipment
There is a lack of equipment in the Delivery Ward and OG1, in particular "lack of delivery beds that can accommodate mother and her new born baby, as reported in the KCMC annual report (KCMC Annual Report, 2014).This still holds true today. As discussed with a midwife in the delivery unit, a "lack of beds is hard. There is overcrowding. When you need to do a procedure, you want to give privacy to a patient and that isn't always possible" (Clinical Instructor, 2020). There were instances of equipment, being present but barriers arising that prevent usage. For instance, "there is a birthing tub in the delivery ward, but we don't have a place to hook up water, so we don't use it" (Clinical Instructor, 2014). In another case, a gynaecologist acknowledged, "we have the equipment (for monitoring neonatal heart rate), but not the training to implement it into daily practices," effectively rendering it useless as well. (Doctor 2, 2020). The combination of lack of equipment, or barriers to use, make the midwife's job all the more difficult.

No Dedicated Training Space
Currently there is no dedicated space set up at all times for continuous training. When asked what the ward needs for training, the clinical instructor answered, "we need a teaching model (simulation manikin) and a place so everyone can practice at any time. A dedicated space. Then midwives can remind each other to train. It's good to have (it) in the working place and to arrange the day to have a simulation" (Clinical Instructor, 2020).

Hierarchy
Hierarchy within the hospital is also a factor that can add a challenging stress to midwives' work. In an environment where doctors' opinions and decisions can be weighted more heavily than midwives, it can be discouraging for those who feel unheard or undervalued. A head doctor at a local hospital in Moshi, Tanzania, described how new, inexperienced doctors' decisions will be recognized more than the opinion of a midwife with 25 years of experience. He added that unfortunately, "the doctor's word is law, while the midwife's is nothing" (Doctor 2, 2020). The hierarchy can also lead to situations where employees seen as higher ranked come from other hospitals and are not questioned about their practices: "one doctor was performing c sections here incorrectly for three years before someone stood up and told him" another manager mentioned in Tanzania (Hospital Director, 2020).

> *"New doctors will come in with little experience and basically walk over decisions made by midwives who have been there 20 years. It's all about hierarchy, and they get frustrated*
> *Hospital Director, 2020*

Understaffing Challenges

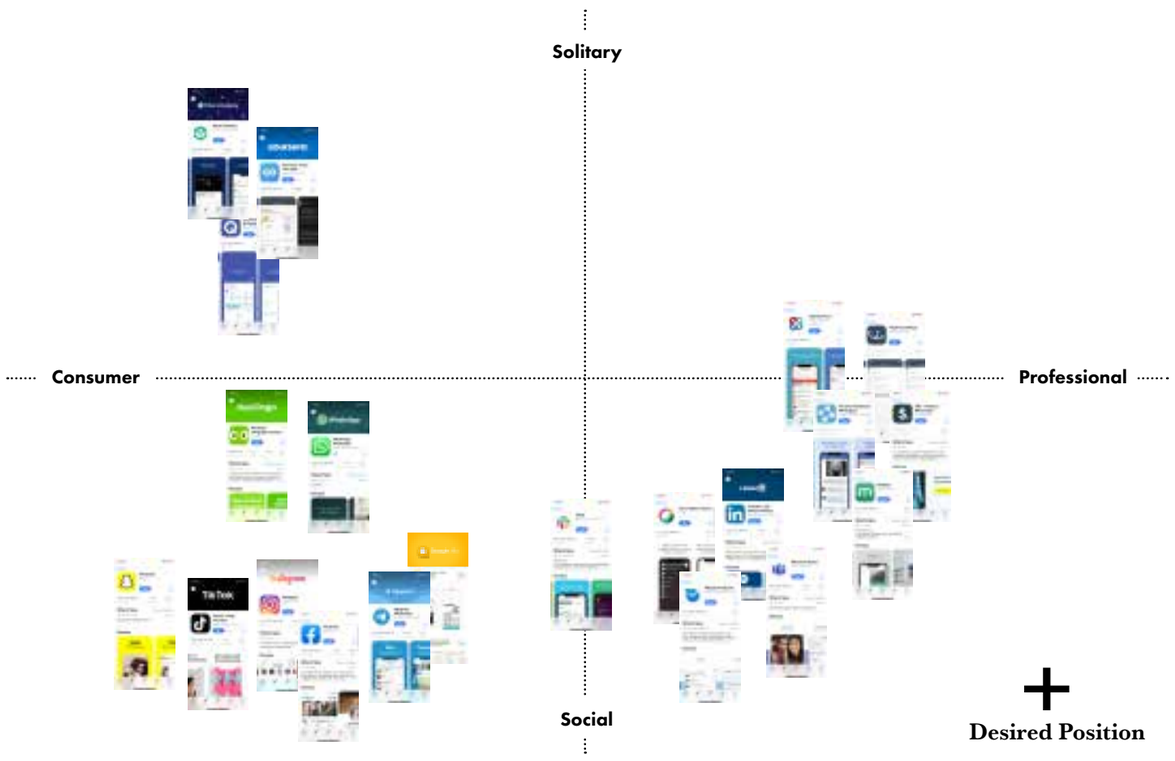
Mental Health
Understaffing also exacerbates mental stress and compassion fatigue. As exemplified by a midwife on a break from the operating theater, she explains, "we give so much of ourselves every day, and that's why when you see that the baby will die, it's really really difficult (Midwife 1, 2020). Another, who just found a baby she recently delivered has life threatening congenital deformities, reflected, shaking her head, "it's just heavy, I take a loss like this hard. I don't want to accept that these things happen" (Clinical Instructor, 2020).

Overworked
Generally speaking, large workloads due to understaffing are also a difficulty. As described to me by the head midwife at KCMC, "the great challenge of the job is understaffing in the ward. For example, there are two rooms with five patients each and another fourteen patients in the postoperative area taken care of by one" (Midwife 1, 2020). This understaffing is reported in an annual KCMC in 2014 report as "Inadequate number of nursing staff (KCMC annual report, 2014). This means that midwives are working long hard hours, tending to many patients, and rarely take the time for lunch. Another midwife echoed with her own experience, "we are extremely busy. I don't have a break. If I get five minutes to rest, I can go have juice that I bring from home" (Midwife 7, 2020). Another midwife noted that since they work in pairs, they try to remind one another to take rests in the staff area, where the hospital motivates them with tea and white bread (Volunteer Midwife, 2020). Breaks also come when a pair is assisting a cesarean-section, and one will clean the operating theatre while the other takes a break.

12.7 Barriers to Continuous Education

Short on Time
General understaffing, lack of experienced midwives, and over-crowded patient schedule at KCMC makes it difficult to time for training moments in the week. The clinical instructor explains, since there is a shortage of staff, and there are too many patients, learning cannot take place easily (Clinical Instructor, 2020). For example, it is hard for a mentor to find time to teach their junior partner when they have difficulty finding time to attend all their patients to begin with. When asked about how training is affected by understaffing, the intern midwife gave the example that realistically, "if you want to train after morning report, you must prepare (the lesson) in a shortened way. Those who were in the night shifts, they are tired, and the day shift midwives must go to their allocation and start working" (Intern Midwife, 2020).

12.8 Market Research



12.9 Social Learning Theory

Social Learning Theory
By keeping education social, community building and peer interaction can be facilitated. According to Social Constructivism, sharing knowledge is fundamentally a social practice, with the knowledge itself being created through interactions with others. The theory of collectivism even asserts that knowledge lives in the network of minds that connect it. As these social interactions become more positive, the effectiveness and retention of information also increases (Amry, 2014). Andragogy, or the practice of adult education, also stresses the significance of collaborative and social learning methods; if the learning environment can facilitate active participation, digitally or physically, adults are more likely to engage and invest time and energy. Peer support as a medium to one's learning process is also a pillar of paragogy, a branch of andragogy. Peer to peer learning is a fundamental learning method that is practiced widely in the medical and midwifery educational community today.

12.10 Guidelines, sub Saharan Africa

Generally speaking, there are challenges adhering to guidelines. According to Maaløe et al. (2012), "insufficient and sometimes contradictory guidelines, internationally and nationally, compromise proper use of [midwife] interventions by causing confusion as to what is considered 'good practice'" (Maaløe et al., 2012). Failing to adhere to obstetric guidelines after training is common as well. As observed in a Tanzanian clinic by the PartoMa research group at the University of Copenhagen, Department of Public Health, lack of adherence to standards is also due to the often overwhelming circumstances found in low resource clinics, where other more pressing matters take precedence over following detailed, globally oriented guidelines (Maaløe et al., 2012). Tarek Meguid, Consultant Obstetrician and Gynaecologist in Mnazi Mmoja Hospital in Zanzibar, Africa, offers that guidelines and interventions must be first adapted to the context. It is only then, that the adverse contextual situation will begin to change itself (Maaløe, 2018).

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