



UNIVERSITY OF CAPE TOWN

DEPARTMENT OF COMPUTER SCIENCE



COMPUTER SCIENCE HONOURS
FINAL PAPER
2016

Title: Milk Matters: Milk Donor Motivation and Education

Author: Chelsea-Joy Wardle

Project Abbreviation: MilkMatters

Supervisor(s): Melissa Densmore

Category	Min	Max	Chosen
Requirement Analysis and Design	0	20	15
Theoretical Analysis	0	25	0
Experiment Design and Execution	0	20	0
System Development and Implementation	0	15	15
Results, Findings and Conclusion	10	20	15
Aim Formulation and Background Work	10	15	15
Quality of Paper Writing and Presentation	10		10
Quality of Deliverables	10		10
Overall General Project Evaluation (<i>this section allowed only with motivation letter from supervisor</i>)	0	10	0
Total marks	80		80

Milk Matters: Milk Donor Motivation and Education

Chelsea-Joy Wardle
University of Cape Town
Private Bag X3, Rondebosch 7701
+27 21 650 2663
Wrdche003@myuct.ac.za

ABSTRACT

This paper presents the approach, design, findings and analysis for a donor motivation and education software engineering project. The nature of milk donor motivation is explored with the aid of educational resources. The aim of the project was to provide a means for milk donor motivation and encouragement and has resulted in the development of an application that provides Milk Matters with a platform for communication with current and potential donor mothers. This paper examines the motivation and encouragement donor mothers feel by providing them with educational content and functionality that make the donation process easier, more inclusive and satisfactory. It will also discuss the sensitivity and limitations present when working with donor mothers and an NPO client.

CCS Concepts

• Human-centered computing → Mobile computing

Keywords

Mobile application; Android studio; Human Computer Interaction; Motivation; Persuasion; Education

1. INTRODUCTION

Milk banks, such as Milk Matters, are responsible for feeding dozens of neonatal intensive care unit (NICU) babies annually [18]. These babies rely on the human milk donated to the NGO, from lactating mothers, for sustenance and nutrition [18, 20]. Some mothers find the donation and screening process to be extensive, deterring them from joining the milk bank and donating. Milk donor motivation is a problem experienced globally, and in South Africa this is compounded by a lack of education and awareness about donation [14, 21, 22].

This project aims to investigate how technology, specifically a mobile application, can be used to help Milk Matters to motivate their current donors and encourage potential donor mothers to donate their excess milk. During the project, I also examined the use of education as a tool for learning and creating awareness.

Currently Milk Matters only means of communicating with their donors is through channels like Facebook¹ and email². This was primarily a software engineering project for the development of an application to facilitate additional communication, motivation and education of donor mothers.

The human milk bank, Milk Matters, was chosen as the primary client because of their accessibility and willingness to participate. The primary users consist of their current donor mothers, who in the future would be using the application. A co-design approach was used to maximize their input and critical evaluation [5, 16, 28].

Throughout the project we maintained communication with Milk Matters through meetings and email correspondence. Their input was crucial for development. Initially they expressed their desire for a platform to communicate with their donors (requirements discussed in section 6). They critiqued every iteration of the application, to establish what was acceptable for their donors and what they could manage to maintain upon completion and release of the application. The clients were also the source of a majority of the information needed to populate the application. Additionally, they played the middleman for communication with our user base.

The donor mothers' evaluations was integral to creating a viable application, one that they would be inclined to use. We used workshops and surveys to critique the effect of each function, in motivating them and how useful the mothers' found it. Without the users' constant input, several ideas may have been overlooked, or functionality included that they may find offensive. The co-design process was used to make all stakeholders feel included, and satisfied with the final application [5, 28, 16].

The significance of this project lies in the greater function it serves to the Milk Bank. This includes motivating their donors, by providing them with a platform for communication, motivation and encouragement. It also makes the milk bank more accessible to donors, and simplifies several of their processes, such as dropping off milk at the depot.

The project provides a section for educational learning on several important topics, such as pumping, latching, donating, mastitis and nutrition. These affect all mothers and in the context of this project, pumping information is necessary for donors who need to do this to donate [18].

Through the use of technology, this project aims to motivate and encourage current donor mothers to continue or increase their donation as well as entice potential donors to join Milk Matters.

By encouraging donor mothers, and hopefully increasing the supply of donated breast milk, this project indirectly aims to help feed more premature and sick babies in the NICU. These babies rely on the milk supplied to them by human milk banks [18, 20] and hopefully increased quantities of milk, or more milk in times of crisis, will allow hospitals to feed more of them.

We also want positive health outcomes by educating mothers about childcare practice for their own baby, while donating [25, 26, 35].

2. BACKGROUND

2.1 Milk Matters

Milk Matters is a non-profit human milk bank [18]. The organizations core activities include motivating lactating mothers and then facilitating their donation of human breast milk. The World Health Organisation³ (WHO) stresses the importance of

¹ <https://www.facebook.com/MilkMatters>

² info@milkmaters.org

³ <http://www.who.int/topics/breastfeeding/en>

human breast milk, as an ideal source of sustenance and vital medical resource for infants [21, 22]. Mothers Own Milk (MOM) contains nutrients that cannot be replicated in formula [22]. As such, improved health and positive immunological results are seen in infants fed human breast milk [19, 22].

Donated milk collected by Milk Matters is distributed to fragile infants [20], such as those sick or premature in the Neonatal Intensive Care Units (NICUs). These babies rely on the formula from milk banks to avoid harmful complications that may arise from being fed alternative substances, like formula [22]. Unfortunately, the fluctuating demand for Mothers Own Milk cannot always be met [33], as supply of human breast milk to organizations, like Milk Matters, is less than it should be and often inconsistent [14, 21].

2.2 Breast Milk Donation

The current process Milk Matters uses for recruiting donors is primarily through posters⁴ in maternity wards, flyers handed to new mothers and word-of-mouth. For additional information, mothers are directed to the Milk Matters website⁵, Facebook page, email address or telephone line⁶. Potential donors get in contact with Milk Matters, who has them complete a donor screening form and submit to a blood test. This screening process is a necessary but challenging process, and mothers are often deterred by the effort [14]. Furthermore, once accepted, majority of donors then have to go through the task of identifying a near depot off a list of locations, and find the time and means to drop off their milk at a chosen location for collection [14, 19].

Participants in the project mentioned that correspondence between Milk Matters and their donor mothers is minimal. Channels for communication includes the emailing of the depot locations followed by a notification when Mothers have donated their first three litres. Articles and updates are posted to the Facebook page and emailed to mothers if they have subscribed to their monthly newsletter.

Milk Matters offers no compensation for donor mothers. For first-time, unknowledgeable mothers, they can email or visit the Milk Matters office and refer to their website and Facebook page for more information or help.

3. RELATED WORK

3.1 Education

There is a correlation between education and better healthcare practice [35]. Improved lifestyle and healthy habits are adopted in cases where the knowledge was lacking beforehand [25]. When this knowledge/teaching is presented by reputable, authoritative sources, learners are more inclined to adopt the lesson [25, 26]. As such, health education has been called upon regularly to reinforce good habits, safety and correct procedures [26]. Enhanced by the use of technology, teaching and learning has become more accessible, broader, contributed to by more sources of knowledge

and is more easily distributed [23].

3.2 Motivation and Persuasion

3.2.1 Motivating education

Molapo and Marsden illustrate the effect empowering users, to create or suggest their own content, may have [24]. In their study, they found that learning material supplied by the local users, in addition to general-use/global content that exists, produced local and contextually relevant information that was more able to address educational needs in the local communities. The curated information also worked as a source of motivation for users to refer to the material and suggest additional content.

Visual stimulation in the form of pictures or videos can also be used to motivate interest in the content and maintain the readers attention [15]. With increased use of mobile devices in the past century, learning styles have changed to become more holistic in the kind of material education can occur through [3], such as by reading an article, news snippets, picture diagrams and testimonials.

Education is passed on through personal connections [6]. Users tell their friends and family about specific sources of information, to appear clever and in-the-know [2, 6]. In this manner, the rate of “popularity” or views of educational content online increase at exponential rates. Similarly, news contents or educational resources could be used to attract users to a site or application.

3.2.2 Persuasion in technology

Users presented with technology that offers them something useful makes them more inclined to give something back [9]. For example, if they are learning something useful from an app, they want to share it with their peers to “help” the site become more popular. This reciprocation may be directed at the device or the source of the “offering” [8, 9]. If it appears that effort has been put into the technology, like curated information, users are more persuaded and motivated to actually read and explore the offered information [12]. A byproduct may be their reciprocation by informing others or “liking” the site.

4. APPROACH

4.1 Software Engineering

This software engineering project was conducted in partnership with Milk Matters as the primary clients, and donating mothers as the primary users. Aspects and functionality of the application have been developed to satisfy both stakeholders’ requirements. In this regard the approach to this project was very user-centered, in order to develop a system that is both reliable and effective in use.

4.2 Platform

An Android application was chosen, as it met all the requirements for this project. The platform offers openness and requires minimal resources to develop for it [10], which suited time and resource constraints for this project. To meet the optimal number of users, and be distributed easily and effectively, Android was chosen because it has the majority share of the worldwide smartphone operating system market [31]. In comparison, iOS would have been more restrictive to the project scope, and more costly in development and testing [11].

⁴ https://scontent.fjnb4-1.fna.fbcdn.net/v/t1.0-9/11755405_10153584965353217_2897609640217780099_n.jpg?oh=b13d91e418236c9589519f7e6c23f7e8&oe=588F4949

⁵ <http://milkmmatters.org>

⁶ +27 21 659 5599

Android Studio Integrated Development Environment (IDE)⁷ was used to build and develop the application. This IDE was chosen because it is the recommended option by the Android community [1]. Android studio is also well supported and documented [1, 10], which made meeting development within the project scope possible. Standard Android Software Development Kit and development tools were also used.

The application was coded in Java, which is both the native language for Android and the preferred coding language of both developers (Mitchell and Chelsea). Git⁸ version control was used to manage the code and collaboration.

The application has been designed with a large back-end, which feeds into the front-end display. Contained/stored in the back-end is the application database and any additional content added by the user. This content is called upon by the front-end for display. The front-end has been designed to meet stakeholder requirements whilst adhering to android design standards [7]. The interface is consistent with the Milk Matters aesthetics, appealing, interactive and easy-to-use for the user (e.g. one-handed, intermittent use while the mother is pumping).

4.3 Testing and Development

This was a software engineering project and as such it was developed through co-design with Milk Matters and their milk donor mothers. To better accommodate this process and gain constant input from all stakeholders, an iterative software development methodology was used. Agile development meant the project followed a cycle of requirement analysis (with key stakeholders), designing (prototyping), development, testing (use cases), implementing and evaluating [29]. The agile development methodology was suited to meeting time constraints on this project (See Figure 1) and accommodate the calendar/schedule of the small number of key stakeholders who were available for analysis and evaluation [5]. Additionally, this method allowed more flexibility towards accommodating evolving requirements and specifications for the application [4, 5].

After collecting initial requirements from Milk Matters, low-fidelity prototypes of the proposed application were made (see Figure 1, paper prototyping and brainstorming stage). Sketches were chosen because they are plentiful, easy to do and do not intimidate the user from giving their honest critique on the design [38]. Unlike a high-fidelity prototype that appears to be worth more effort, users don't solely focus on minute, aesthetic details.

The donor mothers were presented the prototypes in a workshop session, after discussing their requirements for a donor application. Their evaluation was incorporated into the original requirements to produce an improved iteration of the initial prototype (from the paper prototyping and brainstorming stage in Figure 1), which was then assessed by both stakeholders during iteration 1 (see Figure 1). This approach was used to ensure there were no conflicting features or bias towards either stakeholder's requirements.

Development began by building a skeleton layout of the application, containing fragments for each section (iteration 2 in Figure 1). This provided a base from which functionality could be added. The purpose for keeping it modular was so that each feature/function in the application could be developed independently. Specifically in the team, both partners could work on different functions and merge them seamlessly.

Peer review coding practice was used for majority of the functionality. This improved design consistency across the platform, naming conventions, identifying bugs and learning for each partner [34]. Any code produced independently was checked and tested by the other person, to ensure correctness and completeness of the application.

Interviews with donor mothers and Milk Matters were used to evaluate the initial version of the application (developed in iteration 2, see Figure 1), to ensure we had met the overall requirements of both stakeholders. A Survey was used to evaluate the final (current) version of the application in live deployment.

4.4 Ethics

4.4.1 Testing

Ethical clearance was obtained from the UCT Human Research Ethics Committee before interaction with the donor mothers. This was accomplished by submitting an ethical admittance form to the committee prior to the initial workshop session and interviews. The donor mothers were then emailed a description of the project, their roles in it and their rights. Attached was the ethics statement form that they would be required to give consent to at the physical session. The form and meaning of it was explained at every donor meeting/interaction. Furthermore they were assured that any records (audio recording, pictures and names) would be anonymized and they could withdraw from the project at any time.

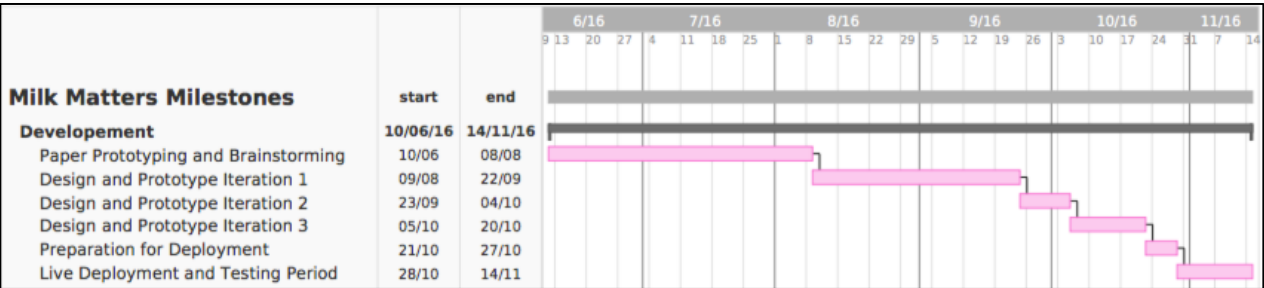


Figure 1: Gantt chart of the development timeline followed during the project

⁷ <http://developer.android.com/sdk/index.html>

⁸ <https://github.com/mitch-a-green/MilkMatters>

4.4.2 Software

The software and report are property of the University of Cape Town⁹. The Milk Matters application has been made open source, and freely available for download on the Google Playstore¹⁰ for any Android device.

4.4.3 Educational content

The educational content is taken from authoritative breastfeeding sources online. Each site has been given attribution/credit, to let users know where the information comes from, with a link and the corresponding site logo/icon. The information is not used for profit in any way, only for education, and users are directed to the original source to read a complete article.

4.4.4 Data

No personal information obtained during use of the app is sent to Milk Matters or elsewhere. All confidential data is stored on the users own phone for their personal use, which is stated in a disclaimer on first-use of the application.

Our professional obligation to the client was to treat this project with respect and provide Milk Matters with an effective and reliable application upon completion.

The intellectual property of the project belongs to Mitchell Green, Chelsea-Joy Wardle and the University of Cape Town.

4.5 Co-design

Essentially the aim of this project was to provide Milk Matters with a mobile application they can use to communicate and interact with their potential and current donor mothers. To achieve this goal, we required intimate knowledge on what mothers would find appealing in such an application. The intention of co-design was to increase the likelihood of them using it, by meeting all their requirements. Similarly we had to adhere to the specifications and functions Milk Matters required from the application.

A co-design development process was chosen to better understand our stakeholders and create something they would be inclined to use because it caters to their needs, not our preconceived ideas. In an ICT/HCI project, the best asset could be the users own innovation, creative thinking and designing [30]. Rogers and Gary [30] say we need to empower/give more control to the users no matter whom they may be. The users shouldn't be thought of in the third-person.

By giving agency to the mothers the intention was to validate that the application being made was in-line with what they required. Additionally we wanted them to suggest any ideas or features that hadn't yet been considered. We also wanted to know if the focus of the project was on something the users don't actually want, and then refocus on what they do in fact desire [30].

By using co-design to drive the design and functionality of the application, the aim of the project was to create something appealing for the donor mothers. Ultimately if they want to and

enjoy using the application, they may be motivated to continue, increase or begin donating their excess breast milk to Milk Matters.

Initially there was a needs assessment discussion with Milk Matters (see Figure 1, the paper prototyping and brainstorming stage). A less formal approach was taken to make brainstorming and creativity more prevalent. The objective was to identify what the milk bank was lacking, and what would gain them more donors, as well as work as a platform for communicating with the current donors.

Following this, there was a brainstorming needs assessment with two donor mothers. Participants were recruited by Milk Matters, who contacted mothers within the workshop location and would be most likely to attend and contribute to the project. The format used for the needs assessment was a structured discussion, whereby mothers were able to discuss their thoughts on an application and what they wanted from it. Rather than interviews one-on-one, in a workshop ideas could be bounced off each mother and prompt more creative thinking [16]. There was no limit on the discussion/topics besides several guiding questions to direct the conversation and keep it on track. Questions included: what is your current experience with Milk Matters, what would you change and what would you find useful. Near the end of the session the mothers were shown the initial low-fidelity prototypes and asked to comment/critique them. Their feedback was incorporated into a second paper prototype (iteration 1 in Figure 1).

An online survey¹¹ was sent out to the entire Milk Matters mailing list and used to reach the maximum number of mothers, who didn't have the capacity to meet. The aim was to get a more statistical representation of feelings towards the prototype developed in iteration 1. Online the mothers could also put more thought into their comments and suggestions. A similar survey was used on the final version of the application (iteration 3 in Figure 1), which was made available for download on the Playstore for the users to test (live deployment in Figure 1).

One-on-one interviews were utilized to evaluate iteration 2 (see Figure 1) of the application. This method was preferred over meeting the mothers in a group, as we valued their individual opinion and wanted to witness their use of the app. In this manner we conducted scenario-based evaluations, and watching how the application responded to how the user wanted to complete each scenario [13]. Individually they couldn't be influenced by anyone else, or feel inadequate to another mother. To be consistent with how they would be using it in real life, which would be on their own, the one-on-one interaction was preferred.

Throughout the project there were several "check-in" informal meetings and emails with Milk Matters, to consistently update them on progress made and receive their commentary.

5. DESIGN

5.1 Home Screen

The home screen (Figure 2) is the first impression users have of the app when they open it. It is also the base screen, whenever the

⁹ <http://uct.ac.za>

¹⁰ <https://play.google.com>

¹¹ <https://goo.gl/forms/8EWcRdEy45AONeNh1>

back button is pressed it brings them back here. Items shown on the screen include a snapshot total of the quantity in ml's the user has donated/pumped to-date (based on the amount the user has been logging). Adjacent to the bottle icon is the baby icon, which displays, in whole numbers, the number of babies the donor has potentially "fed". There is a disclaimer that states the conversion from milk to babies amount.

A single newsfeed/announcement item is displayed in the middle. Articles are randomly displayed (users will be shown a new one each time). At the bottom of the screen is an article from the education section.

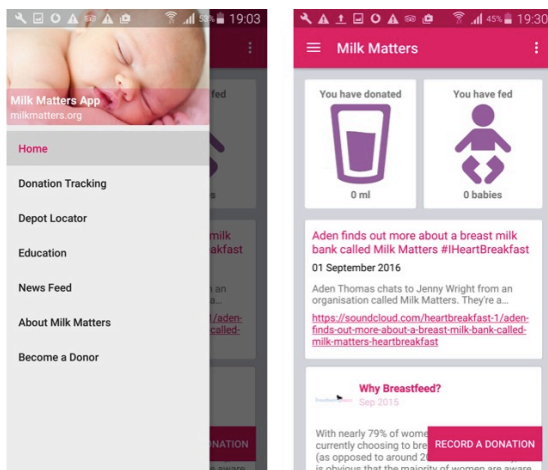


Figure 2: Home Screen

5.2 Depot Locator

On this screen (Figure 3) users can find depot locations, shown as points on a Google maps¹² interface. The map is interactive, allowing users to do the following:

- Zoom in and out
- Click on a location which:
 - Displays information on the depot (name, place, hours, type of location)
 - Displays Google maps navigation buttons in the bottom right corner, when a location is "clicked". When selected, Google maps is opened to direct the user (if they have Google maps downloaded)
- Highlight in yellow the nearest depot by clicking on the "find nearest depot" button located at the bottom.

The Google maps API was utilized to achieve this functionality.

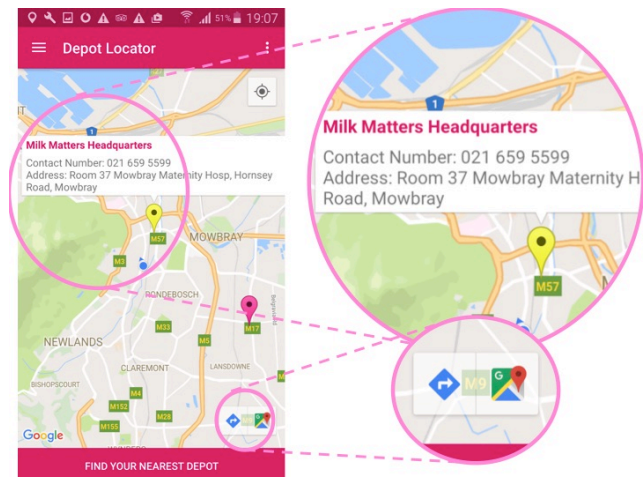


Figure 3: Depot Locator

5.3 Newsfeed

This screen (Figure 4) displays news and announcements posted by Milk Matters (mirroring what they have on their Facebook page). Each item has the heading of the feed item, the first two lines of the content, a "show more" option to read the rest of it and a clickable link to the original article/event.

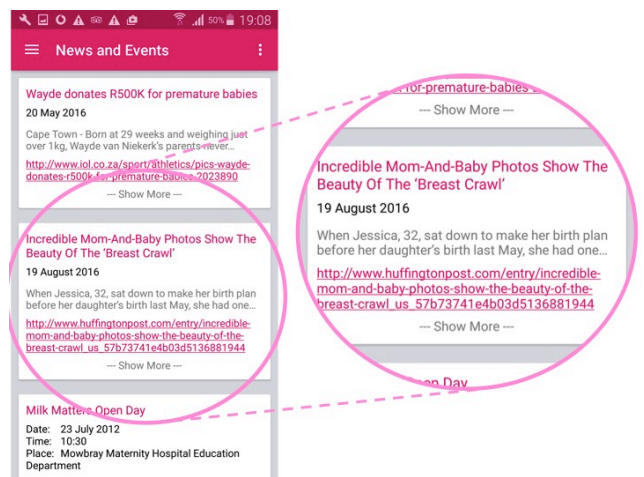


Figure 4: Newsfeed

5.4 Education

The user is presented with a visual menu for each subject covered on the application, when they open this section (Figure 5, Left). Upon selecting a topic, the user is presented with a Facebook¹³-like feed displaying several curated articles for that subject area (Figure 5, Right). Each article has a "profile picture", for users to easily identify their source, a title, date, summary of the article, a link to the original article and a picture from the article. Not every article has all of these features.

Majority of the articles come from popular, reputable parenting

¹² <https://www.google.com/maps>

¹³ <http://facebook.com>

websites like Breastfeeding Basics¹⁴, Kelly Mom¹⁵, Belly Belly¹⁶ and Milk Matters.

If a mother wants to suggest an article/site to Milk Matters, from the initial menu she can select the “suggest an article or website” category option at the bottom, which opens an email addressed to Milk Matters.

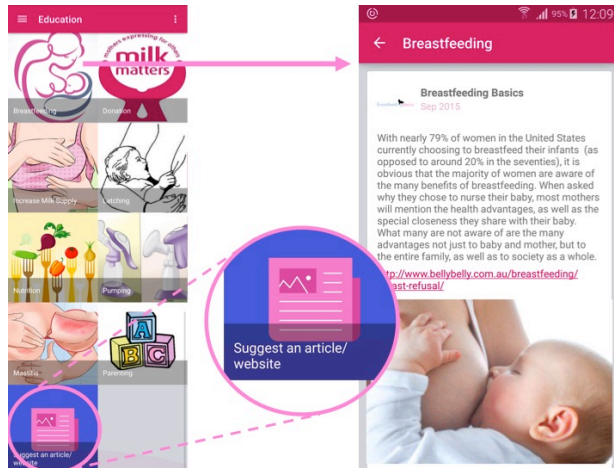


Figure 5: Education Screen

5.5 About Milk Matters

This screen (Figure 6) is meant for mothers thinking about becoming a donor, or mothers who downloaded the application and want to know more about the milk bank and donating. Milk Matters mission statement is presented to the user, which provides a summary of who they are and what they do. The user can select the clickable website address, which will open the Milk Matters website, for more information.

If the user is interested in Milk Matters and likes the sound of them, they can select the button “become a donor” to open the potential donor quiz.

Clickable contact information can be found at the bottom of the screen, as well as an explicit “email us” button. This opens the users email with an editable auto filled introduction: “I was on the app and became interested”.

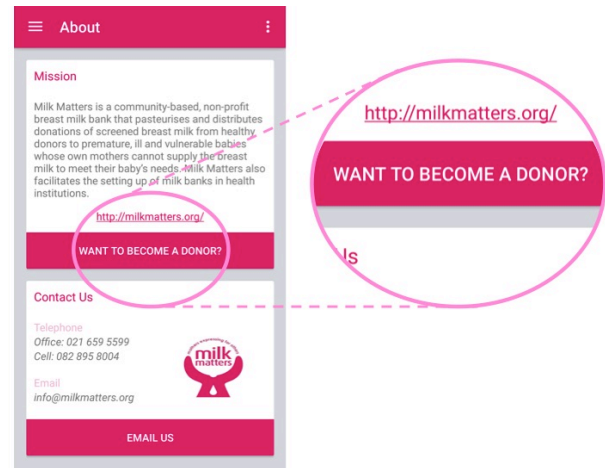


Figure 6: About Milk Matters screen

5.6 Become a Donor

The user can access this screen from the drawer menu or the About Milk Matters screen (Figure 7, Left). When opened, the user is presented with a yes/no quiz with five questions to determine if they could potentially become a donor (further screening with Milk Matters will determine) or if it is unlikely they could be. However anyone willing to complete the quiz is still re-directed to Milk Matters for discussion about their options. The quiz is not all-encompassing and is meant as a fun, rewarding activity.

The result screen (Figure 7, Right) shows stars filled-in for the number of correct or incorrect answers the user has provided. Incorrect answers occur from any ‘no’ answers. If the users aren’t inclined to respond yes to a question, there is a second appealing answer, such as “I can make a plan”, “yes if it is free”. The questions and answers are:

- Would you be willing to complete a donor screening form?
 - Yes/no
 - As long as it is not too long
- Would you be willing to do a HIV and Hepatitis B blood test?
 - Yes/no
 - As long as it is free
- Are you able to collect sterile jars for milk from Milk Matters?
 - Yes/no
 - Depends on how often
- Do you storage facilities to freeze your milk at home?
 - Yes/no
 - I can make a plan
- Are you able to drop off donations at a depot location?
 - Yes/no
 - It will be challenging, but I will try

¹⁴ <https://www.breastfeedingbasics.com>

¹⁵ <http://kellymom.com>

¹⁶ <http://www.bellybelly.com.au>

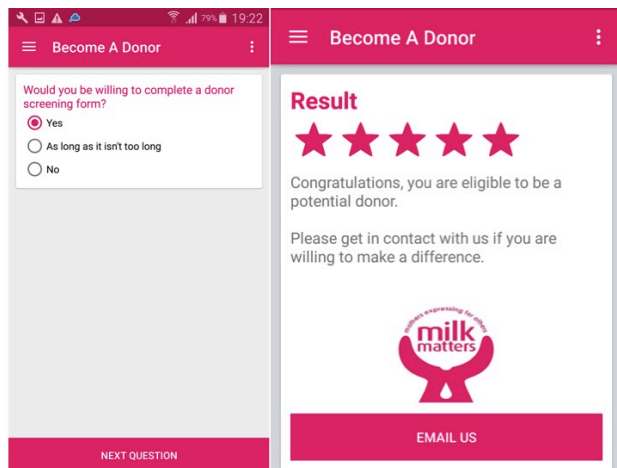


Figure 7: Become a donor quiz

6. FINDINGS

6.1 Milk Matters Requirements

In the initial brainstorming discussion with Milk Matters (see Figure 1, paper prototyping and brainstorming stage), they indicated the need for an application that would allow them to “communicate” with their donors, in the hope of motivating them and persuading more mothers to become donors. Through discussion this was narrowed down to a list of features they required from the application:

- An educational aspect. In particular, information that would attract new mothers to the application. This may include content on how to donate, the pumping process, increasing breast milk production and how to get your child to latch during breastfeeding. Additionally they wanted information on donation while nursing your own child, a question Milk Matters gets asked regularly.
- A request for donation or any other contribution, like equipment, money or partaking in charity events, when donating breast milk is not an option.
- Depot locations, so mothers can identify the closest depot and navigate there for milk drop-offs.
- A platform for Milk Matters to make notifications and announcements about news or events (Like those on their Facebook page).

6.2 Donor Mother Workshop

Findings from the brainstorming workshop with two donor mothers indicated that they required similar features from a Milk Matters donor application as the milk bank. For the brainstorming workshop we would have preferred input from more mothers, but only two donors were willing and able to meet. However, both participants were a fair representation of our target population: donor mothers or mothers interested in donating, who are familiar and comfortable using mobile applications.

6.2.1 The Depot Locator

Participants said they would prefer to drop off their donations at a close or familiar (in the sense that they know something about it) address. Current practice does not afford this, as the list of locations is not ordered by distance, and they don’t always have the information for each location on-hand when they are

delivering their milk. Therefore, it was suggested that the users would be more motivated to donate and donate more regularly if the application contained information about each location, such as where it is, opening times, nurses on duty and type of depot (clinic or hospital). They want the option to “go to a familiar clinic” and that “it would be nice to know who is at [that] clinic”.

Participants indicated they would also like to know nearest depot locations at any time, such as if they were driving around doing errands in unfamiliar areas, they would like to know where they may also drop off their milk. Users made it clear that “mothers are always out and about, and it would be nice to know if there is a depot close to you or where you are going for the day”.

6.2.2 The News Feed

News and announcements often get “lost” when Milk Matters shares it on the Facebook page or via emails (there is an information overload from these channels and the participants said they “often miss notices or announcements”). Both participants said they would benefit from having all information in a central, easily accessible location on their mobile. There is also potential for Milk Matters to share more personal, impactful and motivating stories using this avenue on the application, which is a less public platform. Participants said this would be motivating for them, reiterating the personal mantra, “I am making a difference! Keep it up!”

6.2.3 Education

During discussion, participants raised several important topics new mothers should know about and should be covered in the application. These include: breastfeeding, pumping/expressing as “[users] will need this for donating”, latching (how-to, reassurance and positions), increasing milk supply, nutrition (what food and medication can be consumed while breastfeeding) and mastitis.

Participants admitted to currently attaining their information from Google, when family, friends or lactation consultants are not helpful/available. However this is an “untrustworthy solution”, particularly in a South African context, where content is not relevant or outdated. It is also the least direct and time-consuming process to finding information on a particular topic.

Mother’s referred to reading articles on breastfeeding sites, such as Kellymom¹⁷, which has expert commentary, “professional opinions” and covers relevant information. They prefer reading articles compared to watching videos, which can be “noisy and too distracting for [a] baby”.

6.3 Survey

A survey on the redesigned prototypes (iteration 1 in Figure 1), based on feedback from the donor workshop, was sent to the Milk Matters mailing list. 41 respondents completed the online Google form¹⁸, answering questions about usability, function and design of each feature (See Figure 8).

31 answered that the depot locator would be the most useful, suggesting additional information on whether “depots are in baby clinics- can help busy moms coincide milk drop offs and bottle collections with baby check ups”. Users said this feature would be “Empowering to be in control of deliveries rather than feel you are inconveniencing some kind person who collects from you.”

¹⁷ <http://kellymom.com>

¹⁸ <https://goo.gl/forms/rzTiyKPVzGjU0prj2>

Respondents said all three functions would improve the donation experience. In reference to the educational aspect they said: “This would be great. Most moms are looking up resources all the time”. More experienced mothers they said it would have been particularly helpful and they “would have loved this info first time around”. There were additional suggestions for sources of information and topics that could be covered.

16 mothers said the newsfeed and announcements section would motivate them to donate more. In particular, “if I know that [Milk Matters] are low on milk it will definitely motivate me to express and donate more.” A respondent said this would make her feel more “connected emotionally and know when needs are especially high”. There were several suggestions on the kind of stories and announcements Milk Matters should post, such as when there is high demand and stories about premature babies who have been helped.

General comments reflected positively on the use of the application as a whole. A few mothers responded that an application would help them motivate and encourage their friends to join the program, or work as a medium to better explain what it is they do.

6.4 Follow-up Interviews

Findings from the follow-up interviews with the two donor mothers indicated that the application developed in iteration 2 (see Figure 1) met majority of their needs and revealed bugs/fixes that needed to be made.

The participants found navigation intuitive and could easily move between screens by using the menu. The users said it was logical however a separator for Milk Matters related screens, such as the quiz, was unnecessary. They said the interface was “enticing and [gave] a professional feel”, “consistent with Milk Matters aesthetics”. Both donor mothers said they would use it; in particular they would be “interested in reading the educational articles” and “recommend it to friends interested in donating”.

6.4.1 The Depot Locator

The participants were able to identify their current location, find the nearest depot to their location, find additional information on a selected depot and navigate to it. This was easier and more intuitive for users who had prior experience with Google maps¹⁹. Participants suggested a first-time tutorial for those who do not, as well as the actual address of the location in case they want to log it into their car GPS system. Other additional information that would have been useful to the donors includes the type of depot location it is, such as a breastfeeding clinic or pharmacy. Users

said this would “help [them] drop-off their milk at unfamiliar spots”, as they would “know what kind of depot to look for”. This would also help them accomplish other errands, such as collect medication if they know the depot is in a pharmacy.

6.4.2 The News Feed

Participants responded positively to this feature. They said the content was “all in there”, given Milk Matters constantly updates it. There was some discussion, with a difference of opinions, on the potential inclusion of images related to each feed item.

6.4.3 Education

Participants were able to browse the range of topics covered and pick one of interest, to learn more about it. They said the content was appropriate and important information, especially for first-time mothers, was covered in each section. The graphics for each educational category were called “colorful and eye catching”. However, participants stated they would prefer more consistency in them (either all symbols or all pictures).

Participants found the content and sources of information familiar and reputable. The users said they trusted majority of the sources and could easily discern, “just by reading an article”, the accuracy of any unknown source.

A participant suggested that mothers should also be able to suggest sources and information to Milk Matters. In this way, there would be more “peer-reviewed” content.

6.4.4 The About Milk Matters Screen

Participants said the information on Milk Matters was “clear and sufficient”. They liked the email button, which allowed them to get in touch with Milk Matters immediately. They were unaware they could also use the application to call Milk Matters, as there was no indication the numbers were “clickable”, like an underline or italics.

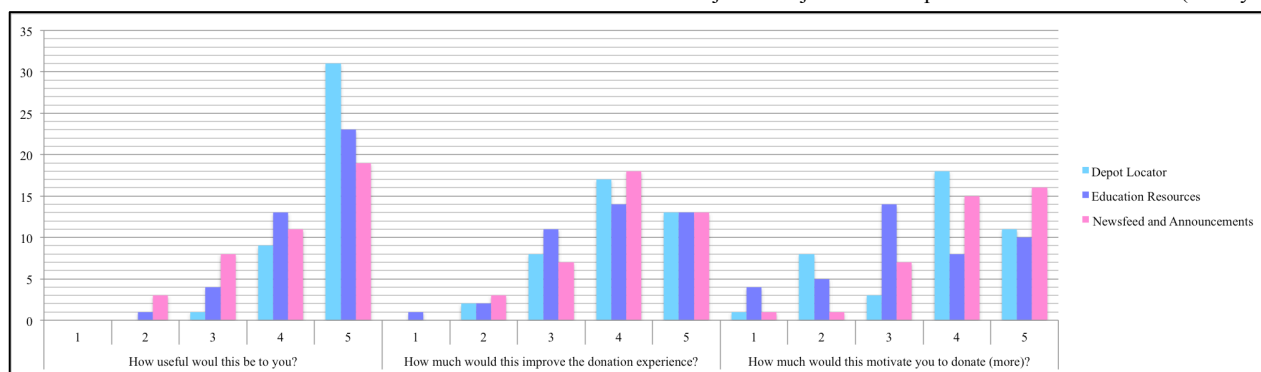
There was a suggestion to include a link to the website, for more information on Milk Matters, if the summary was not enough.

The users hinted at curiosity towards the “become a donor” button on this screen. Even though they were already donors, they wanted to see what the button did.

6.4.5 The Become a Donor Quiz

Both participants completed the quiz with positive results. Findings for the quiz revealed that the light pink color, chosen for the “Next question” button, made it appear disabled.

There was discussion about the result page, in particular how a negative result would be displayed. It was expressed that, rather than just a rejection and plea for other donations (money or



¹⁹ <https://www.google.com/maps>

Figure 8: Bar graph showing the initial prototype survey

equipment), mothers should still be put in contact with the milk bank. They should be told to “contact [Milk Matters] to clarify logistics”, as they could still be a potential donor even if they “failed” the quiz. There was a suggestion that the quiz results be sent directly to Milk Matters regardless.

6.5 Survey

A survey on iteration 3 of the application (see Figure 1) was sent to the Milk Matters mailing list. There was only 1 respondent, even though 14 users downloaded it from the Playstore. The feedback was positive, yet without more responses we are unable to report any findings on the success of this iteration.

7. DISCUSSION AND ANALYSIS

7.1 Evolution of Features

The application has evolved throughout the project, each iteration producing new insights and further development of the application.

7.1.1 The Depot Locator

The depot locator began as a simple Google Map with the navigational location for each depot displayed. Through testing and evaluation, it was discovered that this needed to be more explicit for users. For users who haven’t used Google Maps before, needed a prompt/hint at the maps functionality. This discovery led to the introduction of a “Find nearest depot” button, which makes the interface easier to use and navigate for any user. Similarly, by disregarding the assumption that users know Google Maps, we also added the written-out address to each point. This was added to allow users who aren’t comfortable or able to use Maps to navigate, can put the address into their regular navigation system.

The project also revealed that users wanted to know more about a location before they use it as a depot. This includes hours, type of depot, nurse in charge and contact number. Donor mothers don’t like feeling that they are leaving their milk with a complete stranger, at a place they don’t know or at a time when the depot may not be open. Having this extra information easily accessible to donors through the app, aims to motivate donors to rather refer to it, over picking one off the list Milk Matters sends them.

In findings, this function was rated the most useful for users. Hopefully it will be a motivating feature for donor mothers to drop off their milk more regularly, as now they can do it wherever they are, by referring to the app for the nearest location. It should also make the donation process easier and friendlier, as it requires less effort to find the nearest depot and find a time to drop it off.

7.1.2 Education

The initial prototype for the education screen included segregation for types of content, such as videos, diagrams and articles. It was revealed through discussion with the donor mothers, that they needed content more appropriate to when they would be using the application. With a small baby, use of the educational section would most likely be while they were nursing or holding their baby. Loud noises and flashing displays can be distracting for the baby and would have deterred mothers from using this aspect of the application.

Therefore the content has been filtered to only include articles that can be read with pictures or diagrams. Instead of separating by type, articles are now separated into categories/topics. An introductory screen, visually displaying each topic, was added.

Users can easily identify what they would like to read or learn about, by referring to the image or title of each section. After clicking on their chosen topic they may scroll at their own leisure.

A “suggestion” option was added to the education section, so users can suggest their own articles or sources to Milk Matters. It was revealed that mothers like to have their own say in this context. Now the educational content is more peer-reviewed and will potentially become more relevant to a South African context. If it is local South African moms suggesting content they find useful and applicable, it will most likely apply to other local donors.

By witnessing the effort put into this section, mothers should feel inclined to share it with their friends or tell others about where they can find helpful information [8, 9, 15]. The intention of this section is to encourage more downloads of the application, and through exploration of the other sections, motivate more mothers to become donors.

7.1.3 The About Milk Matters Screen

The about screen was created for users to find out more information about Milk Matters. A secondary objective has become to include all channels of communication with Milk Matters. The screen is meant to make exploration and communication with Milk Matters as simple and easy as possible. Its purpose is to persuade mothers to find out more about the milk bank, motivate them to become a donor or tell their friends about it.

To rectify the original version (iteration 2 in Figure 1), missing sources, such as the website link, were added to this page. Hidden affordances, such as clicking the telephone number to call Milk Matters, were emphasized by making it italicized.

The email function was made the focal action of the screen, by making it a button. This was introduced when Milk Matters stated this is their preferred method for signing up new donors, communicating with them or adding them to the mailing list.

7.1.4 The Become a Donor Quiz

The quiz has been refined throughout the project. From iteration 2 (see Figure 1), where users thought the “next question” button was disabled and current donors would have gotten a negative result from the quiz, there have been several changes to improve usability.

The originally light pink “next question” button has been darkened, so there is no confusion about its function. Similarly the negative result message has been changed, to tell the user that even though they did not pass the quiz, they should still get in contact with Milk Matters.

Users who receive a negative result can contact Milk Matters to “work out the logistics” which may lead them to become a donor, or choose to donate other items like money or equipment.

There has been much discussion about automatically sending the results to Milk Matters, and due to mixed opinions it has been included as possible future development.

7.2 Sensitivity

When working with the users who are mothers and pregnant women, sensitivity becomes a big concern. Throughout the project there was discussion with Milk about what is acceptable in an application for this user group.

It was decided from the outset of the project that the application would never insinuate competitive or negative donation. Lactating

women produce varying amounts of milk, and at no point should they be told they are producing too little or not donating enough. The purpose of the application is to motivate and encourage mothers to donate what they can, but to never neglect their own child or feel bad about quantities. The application is meant to make the donation process easier, make donors feel more appreciated and in-touch with Milk Matters and milk donation community.

Specifically to the education section, it was important to not dictate any childcare practice. Each parent is different in his or her methods, and the educational content is only meant to raise awareness on common issues experienced by first-time mothers. At no point did this project aim to tell mothers explicitly how to raise or feed their child. To prevent making this mistake, content and messages in the application were well thought-out and users reactions monitored during testing. Milk Matters also screened all feed items before live deployment.

This project also had to be sensitive towards different demographics of donor mothers. No assumptions were made on the status or race of the donors, besides that they have an android smartphone. This assumption was made to accommodate the scope of the project, but we hope the application itself reflects an unbiased, fair experience for all donor mothers.

7.3 Limitations

By choosing a co-design development process, this project placed heavy reliance on our client Milk Matters and users, the donor mothers. As such, there were limitations experienced with both stakeholders.

It is a challenge to work with mothers who have young children. Their schedules are often volatile (especially if they work and take care of a baby) and there is not much time for them to meet or partake in sessions. Participants who did manage to attend workshops and interviews were very helpful, but it is hard to maintain focus on the project when they have their child with them. A babysitter was offered, but mothers are understandably unwilling to part with their very young children to a stranger.

To accommodate the mothers who could not meet, email correspondence and online forms were used. This approach greatly improved the number of responses. Although not as descriptive, it provided a representation of general donor mother feelings towards aspects of the application.

Limitations were also placed on the technicality of the application, when working with an older, less technologically knowledgeable generation. Consideration for relatively new mobile services, such as Google Maps, had to be made.

The manner in which users interact with the application was also limited, as mothers often have their child in one arm and are constricted to one-handed, intermittent use of their phone. This limited the complexity of the interface and led development toward something simpler and streamlined. The application has been designed to be similar to and consistent with other applications the users may have experience with.

Heavy reliance on the client, Milk Matters was limiting due to their availability. A lot of features in the application rely on information collected from the milk bank. Specifically with regards to the depot locator, there was a time delay as Milk Matters first had to get in touch with the depots to validate that their information could be shared on the app. Only after approval could they send the location to us. There was also a delay in the

initial testing phase of the project, when Milk Matters had to get in touch with the donor mothers before we could approach them.

A slow response rate may have detracted from the range and diversity of our user evaluation feedback. In future projects of this nature, buffer periods and time consideration towards email responses should be made. Otherwise, alternative ways to get in touch with stakeholders should be found.

8. CONCLUSIONS AND FUTURE WORK

The aim of this project was to provide a platform for motivation, communication and education to donor mothers. By using co-design, the application has been developed to meet specifications from the clients, Milk Matters, and users, the donor mothers.

Android standards and principles of donation and persuasion were used to make a wholesome application [7]. Sources of authority were used for the educational component, to provide users with accurate and interesting learning.

By providing Milk Matters with an additional platform to communicate with current and potential donor mothers, this project aimed to increase and motivate the donation of human breast milk. By providing the users with motivating and informative functionality, that makes the donation process easier, we hope we have accomplished this goal.

Future work would be studying in more depth success of a donor motivation application, and what features may have contributed to this. Within the scope of this project, time available for more extensive evaluation was not possible.

Future work may also include the marketability of the application, and using it as a platform to create more awareness and sign-up more donors. The quiz functionality in the application was a point of much discussion. Development on that feature may create something more effective and fun for mothers.

Additionally, the focus of this project was solely on the donor mothers. Future work may incorporate recipient mothers/babies and study from the point of milk being dropped off at the depot. Many users expressed their desire to “track” the use of their milk.

Ideally we want to see every child receiving breast milk, be it their own mothers or donated milk. Education in this application was limited, but there is an opportunity to make more mothers aware of the importance of human breast milk over formula [18].

9. ACKNOWLEDGMENTS

Our thanks to Milk Matters and their donor mothers whose participation and contribution throughout this project was essential to its completion. We would also like to extend our gratitude to Melissa Densmore and Jorgina Paihama. Your support was invaluable.

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