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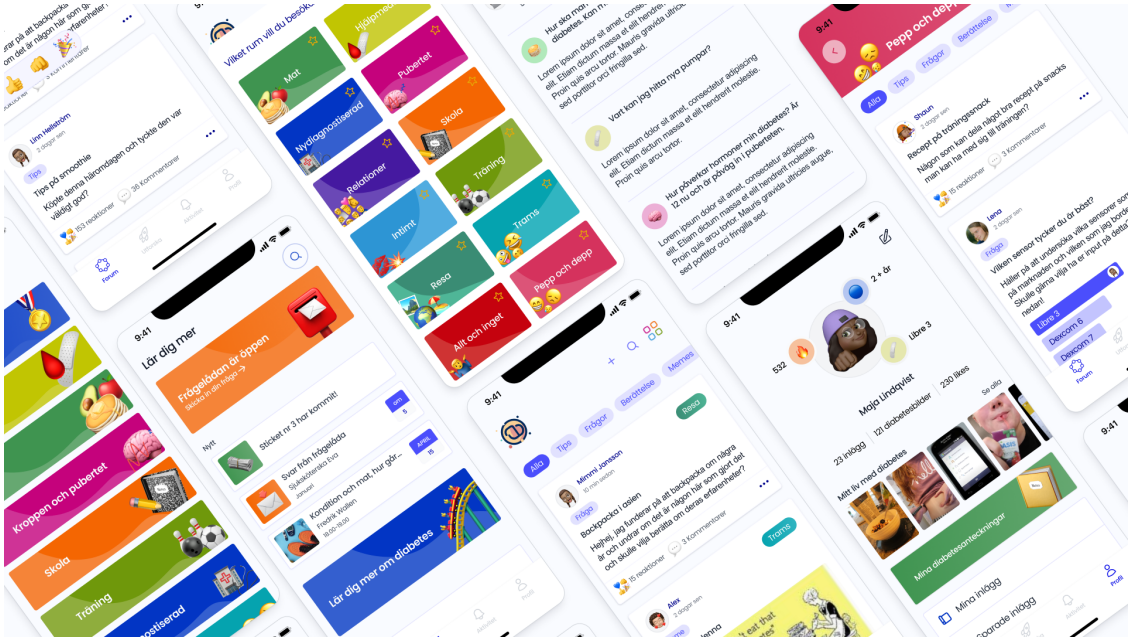

Designing a Peer-Support Application for Teenagers with Diabetes Type 1

Identifying important factors to consider by Research Through Design

Master's thesis in Computer science and engineering

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Gothenburg, Sweden 2023

Master's thesis 2023

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Abstract

Type 1 diabetes is an incurable disease affecting children, with 900 new cases diagnosed annually in Sweden. Managing diabetes is challenging for young people due to the need for constant blood sugar monitoring and strict treatment. This master thesis aims to design a smartphone app using a Human-centred design process and Research Through Design approach to address these challenges and provide peer support for teenagers with type 1 diabetes. The design process involved reviewing prior research, conducting interviews, user testing, and prototyping with teenagers, adolescents and parents. A high-fidelity prototype was developed, along with seven key factors for designing a peer-support app for teenagers with type 1 diabetes. While there may be additional factors to consider, this research emphasizes the importance of these factors as fundamental building blocks for future testing and research.

Keywords: diabetes type 1, user experience (UX), user interface (UI), user research, interaction design, prototyping, design process, evaluation, peer support.

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LINNEA ADIELSSON AND REBECKA HANSSON, Gothenburg, 2023-05-25

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1

Introduction

Diabetes type 1 is a chronic condition that affects millions of children and adolescents worldwide [1]. In Sweden, there are around 18,000 individuals under the age of 20 living with diabetes type 1 [2]. This makes Sweden, together with Finland, the most affected country in the world [3].

Type 1 diabetes management requires constant monitoring of blood sugar levels and following a strict treatment regimen, which can be challenging for young people to do independently [4]. To support the self-management of diabetes type 1, various tools and technologies are available, such as glucose monitoring devices, insulin pumps, and smartphone apps for tracking blood sugar levels and medication. Diabetes is a lifelong condition with no developed cure.

The stress of type 1 diabetes also affects the surrounding people, such as friends and family. Studies have shown that it is especially difficult for mothers, who often become the primary caregiver and are responsible for determining the treatment. This results in 44% of mothers having a child with type 1 diabetes suffering from exhaustion and burnout [5].

However, managing a chronic condition like diabetes type 1 also involves addressing the emotional and social aspects, which can be particularly challenging for young people [6]. Studies have shown that young people with type 1 diabetes experience higher levels of anxiety and depression compared to their friends without diabetes [7].

Peer support is an effective way for individuals to cope with chronic conditions, providing a sense of community, validation, and practical support [6]. However, there is a lack of tailored, digital peer-support platforms specifically for teenagers with type 1 diabetes in Sweden.

1.1 Purpose and Aim

The purpose of this project is to explore and address challenges faced by teenagers (13-19 years old) with type 1 diabetes and their parents. Through research and analysis, the project seeks to identify the pain points and practical obstacles that teenagers with type 1 diabetes and their parents encounter on a daily basis.

The primary aim of this project is to design and develop an interactive and high-

fidelity smartphone application prototype. This prototype will serve as a demonstration of how the identified challenges can be effectively addressed through the implementation of peer support functionalities.

Lastly, the project aims to generate a set of factors that should be taken into consideration when designing a peer-support application for teenagers with type 1 diabetes to serve as a guide for future development.

1.2 Research question

This thesis aims to address the following research question:

What are important factors to consider when designing a peer-support application for teenagers with diabetes type 1?

1.3 Ethics

While designing a digital platform for teenagers with type 1 diabetes, some ethical aspects should be considered.

In the project, users with type 1 diabetes and their caregivers will be heard. Therefore, the language used in the process and product should be respectful, and we shall be mindful of using the appropriate terminology.

The users will have diabetes in common, but it is important to consider that they may differ in background, culture, and other disabilities. According to the European Institute for Design and Disability [8], "Design for All" everyone should have equal opportunities to participate in every aspect of society. This is achieved through designing products and services that are accessible, convenient and responsive to the diverse needs of all individuals. Therefore, considering the needs and perspectives of different users and making sure that the design is inclusive and accessible is important.

During this project, user studies and evaluation processes will be carried out, and it will be important to conduct them ethically. The best practices for conducting user research include obtaining informed consent and maintaining confidentiality [9]. The involvement of the users will therefore be on their terms. They will be fully informed of their rights and can refuse or withdraw their participation at any time in compliance with the General Data Protection Regulation (GDPR). The participants' anonymity and privacy will be protected, all data will be collected and stored securely, and all identifying information will be removed from the final report. Additionally, recordings will be removed after the project is finished.

The potential chance of involving users under 18 years old during the process will require more ethical considerations, for example, parental consent and possibly accompaniment. This can be avoided by interviewing young adults and allowing them to reflect on their experiences. In addition, this might not be fully representative

of today's experience, for example, due to the advancement of technology. However, interviewing parents might compensate for this gap.

Using a digital platform as the medium also raises ethical considerations, such as privacy, confidence, and security [10]. Targeting younger users, the risk of them having limited knowledge and understanding of these issues increases. A peer support platform might involve users sharing personal information; therefore, the system must handle the data ethically and try to inform the user of this. Users misinterpreting the content is also a risk that has to be considered [11].

1.3.1 Sustainability

The United Nations' Sustainable Development Goals (SDG) are 17 goals adopted by all UN member states for the 2030 Agenda for Sustainable Development [12]. These goals address sustainable development's social, economic, and environmental dimensions and aim to promote prosperity while protecting the planet.

Adolescents with type 1 diabetes are experiencing widespread mental health issues [7]. Studies also show that young people with type 1 diabetes have weaker academic performance, lower educational results and lower average income [13].

The project aims to positively impact SDG goals 3 promoting good health and well-being and goal 4 promoting well-being and providing quality education.

1.4 Demarcations

This section describes what issues will not be dealt with in the project.

This project will be limited to participants from Sweden. Although international papers will be included in the literature review, the user study itself will be conducted solely with participants from Sweden.

This project's scope is limited to creating a prototype rather than a fully functioning digital platform. This prototype will prioritise key aspects of the system that convey an understanding of its purpose and function rather than including all possible flows and features. Furthermore, a coded prototype will not be developed, and the technical aspects of implementation will not be examined.

The application will exclude any aspects in which it could be considered a medical app in which many additional frameworks and rules would have to be followed.

1.5 Stakeholders

The project has two key stakeholders: RISE, Research Institutes of Sweden, and Barndiabetesfonden. RISE is a research institute that focuses on applied research and innovation for sustainability, and they are supporting us in our project. Barndiabetesfonden is a non-profit organisation in Sweden that wants to create a positive impact in the fight against diabetes. We are collaborating with Barndiabetesfonden,

as they are working on a similar project which aims to create a safe and supportive online platform for young people with type 1 diabetes. This platform will allow individuals to share their experiences, support each other, and receive motivation to manage their condition effectively. The goal is to create a safe, simple, and enjoyable space exclusively designed for young people with type 1 diabetes.

2

Background

The following chapter contains more background to the subject of the project including more in-depth information about diabetes, its history, complications and views in society. The chapter also explains peer support followed by related work considering both diabetes and peer support. Lastly, some existing solutions, a result of the competitive analysis are accounted for.

2.1 What is diabetes

Diabetes is a chronic condition in which the body's function to produce insulin, a hormone that regulates blood sugar (glucose) levels, is affected [14]. There are two main types of diabetes, type 1 and type 2.

Type 1 diabetes is a condition where the body's immune system attacks and destroys the insulin-producing cells in the pancreas, making the body unable to produce the hormone [14]. Why the immune system reacts this way is unknown [15]. This results in a lack of insulin, which is necessary for the body to use glucose for energy. Diabetes type 1 is most commonly developed in childhood and adolescence, but can also occur later in life. Individuals diagnosed with diabetes type 1 will require ongoing management and treatment for the duration of their lives, since there is no developed cure.

Type 2 diabetes is a metabolic disorder where the body does not properly manage insulin. This can be due to the body not producing enough insulin or the cells becoming resistant to insulin. It is more common in adults but is increasingly being seen in children and adolescents as well. Diabetes type 2 can often be managed through lifestyle changes such as diet and exercise.

Annually, nearly 900 children in Sweden get diagnosed with diabetes type 1, leading to significant life changes for affected children and their families [16]. The treatment typically involves a combination of insulin therapy and lifestyle management. Insulin is injected to the body, multiple times a day, using an insulin pump or an insulin pen [17]. Additionally, lifestyle modifications such as monitoring of blood sugar levels, regular physical activity, and adapting to a healthy and balanced diet are implemented to manage the condition.

2.1.1 Complications from diabetes type 1

Type 1 diabetes requires treatment around the clock, every day of the year [18]. Despite significant advancements in insulin and technology, many people with type 1 diabetes experience serious short-term and long-term complications. Hypoglycemia, or low blood sugar, is a common complication that can lead to unconsciousness, coma, and even death. Severe ketoacidosis, a condition that leads to acid poisoning due to insulin deficiency, although relatively rare in Sweden, but can be life-threatening and requires intensive care. Later complications that can develop over time due to high blood sugar levels, such as retinopathy (eye damage that can cause vision loss or blindness), nephropathy (kidney damage that can lead to dialysis, transplantation, or death), neuropathy (nerve damage that can cause reduced sensation and contribute to slow-healing foot sores that may require amputation), and heart and vascular diseases (the most common cause of death among people with type 1 diabetes). In addition, the risk of developing various types of cancer is higher for people with type 1 diabetes.

2.1.2 Teenagers and diabetes type 1

Handling diabetes type 1 during the teenage years can be particularly demanding since puberty comes with both physical and psychological changes [19]. Research shows that young people with type 1 diabetes tend to have higher HbA1c levels, making them more vulnerable to diabetes complications. The risk of developing psychological problems, such as depression, anxiety, and eating disorders, is also greater among young people with type 1 diabetes. Although there is a need for psychological support, it is often lacking in public healthcare.

A study was conducted with 31 adolescents, aged 13-18, to explore their perceptions of how diabetes impacts their overall quality of life and relationships with parents and peers [20]. The participants generally viewed diabetes as a daily hassle rather than something awful to live with. However, they also felt that diabetes had big control over their lives and required them to take more responsibility than their friends. Many thought that living with diabetes had forced them to grow up faster and become more mature. The younger participants tended to view diabetes more as a pain or annoyance, while the older ones accepted it as a part of their lives. Some felt that diabetes did not affect them in a drastic way but acknowledged that it was time-consuming and required organization and responsibility.

Furthermore, the study discussed how diabetes affects relationships between adolescents and their parents. The perceptions were split into three subthemes: parental concern and overbearing behaviours, parental support, and letting go of control. Many teens felt their parents were overbearing, resulting in conflict and frustration. However, participants also acknowledged their parents' support, including scheduling appointments and ensuring they had the necessary supplies. Finally, as they got older, they wanted their parents to let go of control and trust them to manage their diabetes independently.

2.1.3 Society's knowledge about diabetes in Sweden

Living with diabetes can be challenging, especially when society has a limited understanding of the disease [18]. Barndiabetesfonden, a foundation for diabetes took, steps to address this issue by conducting an investigation through Sifo in 2022 to assess the knowledge about diabetes type 1. Unfortunately, the results showed a lack of knowledge about type 1 diabetes in society. Only 50% of the respondents knew that type 1 diabetes is the most serious incurable disease affecting children and young people, and only 1 in 4 understood that it is not related to lifestyle factors. In addition, 7 out of 10 respondents believed that heredity was the cause of type 1 diabetes, which is incorrect and 9 out of 10 do not have any close relatives with the disease. In addition, 1 in 4 believed that insulin should be administered to an unconscious person with type 1 diabetes which could be life-threatening if doing so.

The lack of knowledge about type 1 diabetes can lead to negative consequences such as prejudice, mental health issues, and less support in schools and research [18]. Moreover, only 45% of respondents knew the difference between type 1 and type 2 diabetes, which leads to the false belief that type 1 diabetes is self-inflicted and caused by poor lifestyle habits. It is important to understand that type 1 diabetes is not caused by lifestyle factors and that it requires continuous management, including insulin injections or pump therapy, to maintain healthy blood sugar levels.

2.1.4 Diabetes throughout history and the world

Diabetes dates back to ancient times and has been recorded in Egyptian papyri as increased urination and thirst [21]. However, it took until the early 20th century that the disease was better understood. In 1910, researchers discovered that removing the pancreas caused diabetes realising that it was the root of the disease.

Before the discovery of insulin, diabetes was deadly with a life expectancy of a few years after diagnosis[22]. However, in 1921 two Canadian scientists Frederick Banting and Charles Best discovered insulin. This discovery revolutionised diabetes treatment allowing people to live longer with the disease. In 1923 the Nobel Prize in medicine was awarded to the scientist for their discovery.

Insulin, a life-saving medication for those with diabetes, is inaccessible to many people worldwide [23]. In fact, 50% of those who require insulin cannot afford or access it. In the United States, the list price of insulin has increased by 1400%, from $20 to $285 over the last two decades. Developing countries are particularly affected, with 4 out of 5 people with diabetes living in countries where adequate care is lacking and in some places, a child getting the diagnosis has a life expectancy of less than 1 year. While 80% of high-income countries always have insulin available, the availability is as low as 13% in the world's poorest countries.

2.2 Peer-support

Peer support is a form of support provided by individuals who have gone through similar experiences or challenges [24]. It is based on the idea that people who have

experience with a particular issue can provide unique and valuable support to others who are also dealing with that issue.

Alrobai et al. [25] discuss the design and implementation of online peer support groups. Observational studies concluded that there are eight essential building blocks for such platforms: conversation, sharing, reputation, identity, presence, collaboration, awareness and assessment. Additionally, the article mentions that online support should not be judgemental, should be less confronting, and focused on awareness building. The article also discusses the interface of the online peer group observed, noting that it was relatively simple and designed to discourage in-person communication.

Incorporating aspects of peer support in digital products has shown a potential to improve outcomes such as self-management, quality of life, and mental health [24]. However, many articles also emphasise the need for additional research into the topic as the evidence base still is limited. More research is necessary to understand the potential of digital peer interventions and identify best practices.

Hollard Bloorview, a children's rehabilitation hospital, presented a toolkit with models for different types of peer support. These included an overview and key characteristics, potential challenges for families, and key considerations when developing programs [26]. For online peer support, some potential challenges are access to computers and the internet as well as struggling with technical problems. Also, the online form increases the risk of miscommunication due to the inability to hear the tone of voice and see non-verbal expressions. Additionally, creating meaningful relationships online provides a bigger challenge as it usually takes a longer time to do so.

2.2.1 Best practices for peer support

Peer support interventions are thought to be effective due to certain key ingredients, including social support, experiential knowledge, trust, confidentiality, and easy access [27]. Social support from peers is important as it includes emotional support, information and advice, practical assistance, and help in understanding or interpreting events. Experiential knowledge refers to the knowledge base of the peer supporter, which is derived from actual experience. Peer supporters who have similar experiences to those being supported have greater credibility as experts in dealing with the problems and challenges faced by the person seeking support.

Peers for Progress, a global initiative developed out of the world health organisation (WHO) has developed key features for best practices for peer support [28]. The first principle introduced is assistance in daily health management meaning applying disease management or prevention plans into daily life. This entails setting goals, building skills, practising and rehearsing behaviours, and problem-solving. The second key feature is emotional and social support by providing encouragement to use skills, helping with dealing with stress and the ability to share negative emotions. The third feature presented is a linkage to clinical care which emphasised the importance of empowering individuals to take an active role in their own healthcare.

This can include things like helping individuals understand their condition and treatment options, and teaching them how to communicate effectively with healthcare. Additionally, the last feature presented is ongoing support which refers to continued support over an extended time period. The support should be proactive, flexible, and as-needed/on-demand as the user needs. The support should meet the needs of the individual and offer support only when required, and not necessarily in a fixed schedule.

2.3 Related work

The following section presents related studies and existing solutions to the project. Firstly, a study made in Sweden examining the experience of living with diabetes with young people followed by a collection of studies investigating the effect of peer support interventions for people with different chronic conditions is presented.

The studies provide further evidence on the effect of peer support and provide guidelines and aspects to take into consideration during the project. Existing solutions highlight the most common system used for managing diabetes.

2.3.1 Related studies

2.3.1.1 Co-designing a digital social network for young people with type 1 diabetes

The study aimed to design and explore a digital social network for young people with type 1 diabetes and their experiences when using it [29]. The study used a co-design approach, with 36 adolescents with diabetes type 1 participating.

The findings suggest that usability is important for the interpersonal values of supporting, learning, and relating to emerging. The study emphasises the importance of social networks as complementary to the support healthcare professionals can offer. It also highlights the potential benefits of social networks for young people with type 1 diabetes, such as sharing experiences with others who understand them on a deeper level, providing support, and learning from each other's lived experiences.

The study identified the importance of an appropriate framework for the social network, including access and rules. Young adults preferred to be invited to the network, and issues about the transition into adult care and preparing for independence were important topics to raise. Ongoing activity from members was also important to serve the purpose of the network

2.3.1.2 Living with diabetes 2020, a survey by Ung diabetes

Ung Diabetes, a youth association in Sweden, regularly surveys young people with diabetes [30]. The survey conducted in 2020 received 531 answers with the majority of respondents being between the ages of 15 to 30. The gender distribution was 78% female and 21% male. The purpose of the survey was to gather information about

the living situation of people with diabetes. The survey covers a variety of questions focusing on resources, their experience, and psychosocial support.

On the question "What do you experience is the worst with having diabetes" the top alternatives: "To never get time off from the disease!" (32%),"Worry about future complications" (19%), "To never be able to be spontaneous/always to have to plan" (18%), and "The feeling of loneliness/ that no one understands you" (9%) [30]. The opposite question, "What do you feel is the best with having diabetes" where the alternative "There is nothing positive about having diabetes" stands out with 37% followed by "I have greater self-awareness" (32%) and "I have become more health conscious" (30%). The survey also highlights the difference between females and males in some instances for example women represented 87% of the answers on the alternative "The feeling of loneliness/ that no one understands you".

The studies also highlight the need for psychosocial support where six out of ten respondents have or have had a need for psychosocial support, four out of ten have been offered support from their healthcare provider but only 25% of them were satisfied by the support provided [30]. One quote given in the survey is: *"I have missed a contact person who knows what I am going through and can support me, who is not a doctor or nurse. There isn't much compassion and sympathy in healthcare when you are in a tough period. They just want to solve the problem quickly by phone and then I am in it myself again"*

Similar skewed gender distribution is present in regard to psychosocial support where women represent 85% and the need is also most present in the age category of 15-30 years old. In addition, the survey highlights the frequency the respondents think of their diabetes. In this category, 15-30 years olds are overrepresented in the group that thinks about it several times an hour. Lastly, the survey asked if the respondents wanted to talk about things other than their insulin treatment in appointments with their healthcare provider. The two highest ranking categories were quality of life, their diabetes effect on their life as well as the psychosocial effect of their diabetes.

In conclusion, The survey summarised that it identified the need for more psychosocial support with an emphasis that the need is bigger for ages 15-30 years old as well as for females.

2.3.1.3 Studies examining the effectiveness of peer support

Thompson et al. [31] conducted a comprehensive review of studies that investigated the effectiveness of peer support for individuals with chronic conditions. Peer support was delivered in groups or one-to-one both online and face-to-face. The common components were education, self-management techniques, and sharing personal experiences. The training and screening of peer supporters were also included. The study found that the most frequently reported outcomes were quality of life and self-efficacy, where the reviews showed positive effects of peer support, but the results were not statistically significant. The article also concludes that more research is needed to fully understand the effects of peer support for people with chronic conditions.

A systematic review of 15 independent studies, examining the peer support interventions for children with type 1 diabetes and their caregivers, found that digital platforms can effectively provide peer support for individuals with diabetes [32]. The studies showed improvements in self-care behaviours, quality of life, and psychosocial well-being among individuals with diabetes who participated in peer support interventions delivered via digital platforms. Furthermore, the platform provides a sense of community and support but highlights the difficulty of gaining trust through a digital medium. Therefore, it also highlights the need for further research to find the optimal design and delivery of these interventions where the challenge lies in building trust and creating personal interaction in an online setting.

A study aimed to assess the effectiveness of peer support for diabetes management and identify success factors for the program found that peer support improved diabetes management outcomes [33]. The specific outcomes measured were blood sugar control and self-care behaviours. The success factors identified were the quality of the peer support, the level of trust between peer supporters and the people getting support, and the availability of resources.

A review investigating research on the topic of web-based peer support interventions for adults living with chronic conditions. This review included diabetes, mental health conditions, and cancer, and found that peer support had positive effects on self-management, quality of life, and mental health [34]. Another benefit of web-based peer support is that the availability of online solutions can reduce the feeling of isolation and access to support. However, more research is needed to understand its potential and to identify best practices for their implementation and evaluation.

To summarise, all related studies highlight the effectiveness of peer support on the users' quality of life and self-management. The need for further research is also a recurrent fact, especially in identifying best practices and the optimal design for an intervention, something this project aims to answer.

2.3.2 Existing solutions

The following section presents current solutions, comprising mobile applications, social media platforms, and community platforms, identified through our competitive analysis (see section 6.1.2).

2.3.2.1 Mobile Applications

When it comes to managing diabetes, there are many apps available on the market, as indicated by the 30 apps we discovered on the app store by searching for "diabetes." These apps are primarily designed to help users practically manage their diabetes, providing guidance on how to manage their diagnosis and improve their health outcomes.

One strength of many of these apps is that they have been developed and reviewed by healthcare professionals, which adds a degree of trustworthiness and credibility. For example, Scandinavia's most widely used app for type 1 diabetes (**T1D**) is developed in collaboration with Karolinska University Hospital. Another strength

and feature offered by the app **Aibetic** was the use of machine learning to provide personalised recommendations based on user data, which can help users manage their diabetes more effectively.

In addition, the app **Chronos Care** offered the added benefit of video meetings with healthcare professionals, which can provide valuable guidance and support for managing diabetes. This features is particularly useful for individuals who are new to living with diabetes or who may need additional help with managing their condition.

The only community-based mobile application available was an American app named **Beyond Type 1**. Their goal is to create a community and a collection of practical ideas, stories and resources for those living with type 1 diabetes. Beyond Type 1 includes features like a chat for connecting with others in the same situation and a community page for sharing and asking questions.

However, it is important to note that there are also some weaknesses associated with these apps. For example, we found that only one app offered emotional support (Beyond type 1) and it was only available in English and designed for a broader public. This is a significant gap, as emotional support and community features are important aspects of managing a chronic condition like diabetes.

2.3.2.2 Social media platforms

Different social media forums provide a community for people with type 1 diabetes or their caregivers [35]. Members identify peer support as having a big impact through giving and receiving technical, emotional, and medical support.

From our competitive analysis, many different community-groups were discovered to be available on **Facebook** where diabetics and parents can share their experiences and insights. This subjective sharing allows for a more personal and relatable connection between users, providing a sense of community and support. The interaction level between people is high and happens through posts and comments, making it a great platform for those looking for advice or support from others who have gone through similar experiences.

Furthermore, there is an online community on the market called **Diamigo** which is a community for people living with type 1 diabetes between 13-30 years old. Diamigo primarly provides digital meetings for people living with type 1 diabetes and operates mainly on Instagram and Facebook. It offers a safe space for members to connect, share experiences and learn from each other.

YouTube and **podcasts** offer an engaging format for people to share their stories, experiences, and information with a broad audience. The content on these platforms is often centred around specific topics, such as diabetes or personal life experiences, and features individuals sharing their own experiences and insights. This can be highly informative and relatable for viewers, as they are able to follow the journey of the content creator and gain a deeper understanding of how they handle various situations.

However, it is important to note that subjective experiences shared on these plat-

forms may carry a risk of misinformation. While some advice may be helpful, it may not be based on scientific evidence or may not be appropriate for every situation.

3

Theory

This chapter explores the theory considered relevant to this project. It first accounts for how teenagers use the internet in Sweden. This is then followed by design theory considered in the design phase such as usability, design systems, accessibility and visual interface design principles to consider.

3.1 How teenagers use the internet

Internet is a big part of life for children and adolescents between the ages of 8-19 years old's lives according to a report by the Swedish Internet Foundation from 2022 [36]. The report, which provides insights into the online habits of Swedes across different age groups, found that almost all children and teenagers (99%) in this age range use the internet daily.

Social media platforms such as YouTube, Snapchat, TikTok, Instagram, and Facebook are the most popular among teenagers in Sweden. YouTube is popular across generations, but daily usage is lower compared to platforms like Facebook and Instagram. Snapchat is more prevalent among teenagers, with nearly 80% using it daily. TikTok is almost exclusively popular among younger generations, with more than half of adolescents 13-23 years old accessing it daily. Facebook usage is more common among people born in the 80s or earlier, and the usage in the age group 13-23 is decreasing with only 20% using it daily. In the age group under 13 years old almost nobody uses Facebook. Compared to Instagram, which has a daily usage of 63% in the same age group.

Facebook and Instagram are the most common places to post personal content. Snapchat, on the other hand, is primarily used for snapping and chatting with people one knows in real life. On YouTube and TikTok most of the users consume other users' posts.

More than a quarter (29%) of children between the age of 8-19 years old have online friends they have not met in real life. At the middle school level, 24% of the children have online friends; by high school 38%. Furthermore, it has been found that parents are generally not well-informed about their children's online friendships, and this knowledge gap tends to widen as their children grow older.

In the same report by the Swedish Internet Foundation [36], written text is still the most common method for sending messages and seeking information on the Internet.

However, younger generations are adopting voice, video, and image messages as new ways to communicate. Young people born in the 2000s, in particular, send video messages significantly more often than other age groups.

Furthermore, in all generations, a more significant proportion of people find it easier to communicate with their friends physically than digitally online [36]. However, among individuals born in the 2000s, only a third believe it is easier to talk to their friends face-to-face outside the internet.

Finally, according to the Swedish Internet Foundations report from 2019 [37], which surveyed children aged 11-19, children primarily use mobile devices to access the internet, with 90% of children using a smartphone or mobile phone for this purpose on a daily bases. Around 65% of children also use a computer, while 27% use a tablet.

3.2 Design Theory

3.2.1 Usability

Usability refers to the ease of use and learnability of a product or system [38]. It is a big aspect of user experience since it affects the user's ability to accomplish their goals efficiently and satisfactorily [39]. Moreover, Nielsen also adds learnability, memorability, and errors to the list of important aspects when measuring good usability. Nielsen [40] and Krug [41] emphasise the importance of usability in creating a positive user experience.

3.2.2 Design Systems

A design system is standardly used to create a shared language and visual consistency in a product or system [42]. A design system usually comprises components, styles, and patterns along with documentation all gathered in one place. A good system helps ensure consistent visual language, typography, icons, and interface elements all contributing to a better user experience. A well-implemented design system can reduce redundancy, and increase the pace of designing by creating and replicating work quickly. It also alleviates strain on design resources which allows for more focus on complex problems. In addition, a consistent design system can aid brand recognition. Lastly, the system requires regular maintenance to keep it up to date.

3.2.3 Accessibility

Considering accessibility when designing means accounting for people with cognitive, sensory or motor impairments [43]. The world health organisation (WHO) estimates 750 million people in the world live with a disability and they are often overlooked when it comes to the design of products. The goal is to ensure that the user can understand, manipulate and navigate the system with ease. Some accessibility guidelines provided are leveraging tools and guidelines, using simple and clear language and keeping layouts and task flows consistently.

The European Accessibility Act (EAA) is a legislation and initiative from the European Union, that aims to improve the accessibility of products and services for people with disabilities, coming into play in June 2025 [44]. It entails requirements for products and services, including websites, mobile applications, electronic devices, and public transportation.

The EAA requires that all digital products and services in the EU must be accessible to people with disabilities. This will require designers to prioritize accessibility in their design process. Designers must follow specific accessibility guidelines based on WCAG 2.1 (Web Content Accessibility Guidelines 2.1) [45], including providing text alternatives for non-text content, clear labelling for all user interface components, keyboard-only access, and compatibility with assistive technologies. It is important for designers to stay up-to-date on the guidelines to ensure compliance.

3.2.4 Visual interface design principles

The human brain excels at recognizing patterns and interpreting large amounts of visual information in our surroundings. To most effectively take advantage of this there are many principles a designer can use. In their book "About Face", Cooper et al. present some of the most essential principles for designing user interfaces [43]. A selection of these principles are outlined in the sections below.

3.2.4.1 Convey a tone/communicate the brand

The designer should prioritise users' goals over brand considerations. However, a well-designed interface should also reflect the brand's promise and values. To achieve this, it is essential to have a clear understanding of the brand's message and expression. One approach to establishing the desired tone and effectively communicating the brand is by identifying experience attributes - a set of adjectives that collectively define the desired user experience and how it should feel when interacting with the product or service.

3.2.4.2 Lead users through the visual hierarchy

When users view a set of visual elements, their brains instinctively want to decide what is important and how things are related. Therefore, it is important to provide answers to those questions in user interfaces by establishing hierarchy and relationships.

To accomplish this, prioritise controls and data based on scenarios and determine which elements users need to understand instantly, which are secondary, and which are only needed by exception. This ranking will guide the visual hierarchy.

Use basic visual elements like colour, size, and position to differentiate levels of importance. The most important elements should be larger, have greater contrast, and be positioned above and indented or outdented in relation to less important items. If two elements of different importance compete for attention, it is usually best to "turn down" the less important one rather than "turn up" the more important one.

To show which elements are related, revisit scenarios to identify which elements have similar functions and which are commonly used together. Group spatially those that are typically used together, and visually group those that have similar functions but are not necessarily used together.

3.2.4.3 Provide visual structure and flow at each level of organization

When designing a product, aligning visual elements is effective in providing a well-organised and systematic user experience. Grouped elements should be aligned both horizontally and vertically. It is best to align every element on the screen with as many other elements as possible.

A grid system is a powerful tool for visual designers. To maximise its effectiveness, use bold and exact proportions. Western users read from top to bottom and left to right, make sure your design is consistent with this reading pattern if the design is for a western target audience.

3.2.4.4 Signal what users can do on a given screen

When a user encounters a new screen or function, the visual design can help them understand what actions they can take. This is known as the principle of affordance.

Icons not only serve a functional purpose but have a role in communicating desired brand attributes. Bold, cartoonish icons may be suitable for a website aimed at kids, while conservatively rendered icons may be better suited for a productivity application. The key is to maintain consistency in style throughout the design.

3.2.4.5 Keep it simple

When designing a visual interface, less is usually more. A design with unnecessary variation can be confusing and difficult to use. Consistency is key therefore if two spacings are nearly the same change them to be exactly the same. Every visual element, including colour, size, and other visual properties, should serve a purpose. Avoid adding any elements that don not contribute to the overall usability of the design.

3.2.5 Color theory

Besides having a functional application it also has to be appealing to its users where colours are a significant factor [46]. It affects users' interaction with the product, affecting both navigation and information retention. This supports the fact that colour is an essential aspect of UX design. The right use of colours can create an emotional connection with users and evoke specific feelings and reactions. Colour theory in UX design is the study of how different colours interact with each other and how they can be used to create a meaningful user experience [47].

Different colours are associated with different emotions and convey different feelings [48]. Red can symbolize both strength and aggression, orange can bring energy and playfulness, yellow conveys cheerfulness, green can evoke nature or success, blue

is calming and trustworthy, purple can signify elegance and loyalty, pink can be nurturing or passionate, white represents simplicity and purity, brown is earthy and wholesome, grey is neutral and versatile, and black is powerful and sophisticated. By using a combination of colours you can create a diverse and well-rounded design that conveys your message effectively. Important to note however that depending on culture and background these might differ.

The saturation meaning how intense or bright the colours chosen are also affect its reception [49]. Happy colours are usually associated to be bright and warm, such as yellow, orange, pink, and red. Combining many colours can also create a youthful and colourful effect that can promote happy emotions.

4

Methodology

The following chapter will offer an overview of the methodology and scientific approaches relevant to the work of this project.

4.1 Research through design

Research through design (RtD) is an iterative and flexible approach used by designers in human-computer interaction (HCI) to generate knowledge through design activities [50]. RtD aims to transform the world from its current state to a preferred state by engaging in wicked problems. Rittel and Webber describe a wicked problem as a complex, ill-defined problem that is difficult to solve [51]. Pietrzyk argues that RtD is well-suited to addressing such problems because it allows for exploring multiple solutions and considering various perspectives [52]. It allows for a more holistic understanding of the problem and user needs, resulting in creative solutions considering users' and stakeholders' needs, wants, and context.

4.2 Human Centred Design

In this project we are using the Human Centred Design framework following an iterative process focusing on the users [53]. There are essential steps to incorporate this into the project; plan the human-centred design process, understand and specify the context of use, specify the user requirements, produce designs and prototypes, evaluate design against requirements, and iterate.

4.3 Understanding and specifying the context of use

In this phase, we focused on empathising with our users, specifically teenagers living with diabetes, and gaining a thorough understanding of the context we are designing within. We recognised numerous factors in this context, and we wanted to understand how it is to live with and around a person with type 1 diabetes.

4.3.1 Competitive analysis

Competitive analysis is a method of evaluating the strengths and weaknesses of competitors to identify opportunities and threats for a business [54]. Conducting a competitive analysis can provide valuable insights into the market, and by understanding the competitors in which a company operates, you can make informed decisions. By evaluating the strengths and weaknesses of competitors' products, it is possible to pinpoint any gaps in the market. This information can also be used to inform and support design decisions, resulting in a more effective and differentiated product.

4.3.2 Literature review

The literature review, often referred to as secondary research, is a method that involves collecting and analysing existing data. According to Stewart [55], this type of research is frequently used to gain a general understanding of a topic and to identify trends. Secondary research has the advantage of being less time-consuming and less expensive than primary research. However, secondary research also has the disadvantage of being less relevant to the specific research question, and data may be of low quality. When gathering secondary research, it is important to consider the validity and reliability of data and use it in conjunction with primary research to understand the topic better. Moreover, Secondary data is also often used to validate insights gathered from primary data [56].

4.3.3 Interviews

Interviews are part of qualitative research and are used to gather information and understanding about individuals' experiences, perspectives, and opinions [57]. Interviews can be conducted over the phone or take the form of structured interviews, where questions are pre-determined and fixed, or unstructured interviews, where questions are open-ended and allow for a more relaxed and natural conversation. Semi-structured interviews involve a combination of prepared questions while maintaining an open-minded approach.

When conducting interviews, researchers ensure that participants' rights and well-being are considered [57]. Some key ethical considerations that must be considered include the consent of voluntary participation and confidentiality of personal information and responses to questions. As an effect of interviewees' potential attitudes to different topics, trade with caution with sensitive issues. To avoid making someone uncomfortable, informing them about their right to dismiss the interview at any point is also important.

4.3.4 Affinity diagramming

Affinity diagramming is a method for data organisation and analysis and is also referred to as thematic analysis or KJ analysis [58]. This approach involves separating the collected data into different post-its or cards and grouping them to discover

and define various themes. This method helps the designers base their insights on research and avoid bias.

4.4 Specifying User Requirements

This phase will use the insights from the previous step more clearly define the users and their needs and preferences.

4.4.1 Archetypes

Archetypes are a user research tool that helps gain a better understanding of users [59]. They are more abstract than personas and represent user types in a broader sense. Unlike personas, which tend to use human faces and more specific personality traits to describe users, archetypes focus on defining users' core needs and behaviours.

4.4.2 User journey map

A journey map can be used as a tool in UX (user experience) design for various reasons and outcomes but always visualises a user's journey from start to finish [60]. The scope of the journey map should be clearly defined to ensure that it captures the relevant customer segment and touchpoints. Furthermore, the data collected should give insights into the users' emotions, thoughts and behaviours at each touchpoint. To create the map, the collected data should be used to visually represent the customer journey, including key touchpoints and the customer's emotions and actions at each stage. By utilising journey maps, organisations can gain a comprehensive understanding of the customer experience, allowing them to identify areas for improvement and create more satisfactory interactions.

4.4.3 User stories

User stories are a method used to pinpoint the requirements and goals of a user in a concise format [61]. They describe a specific feature or functionality that a user needs to achieve a particular goal concerning the product. A user story is often written in the following format: "As a [type of user], I want [some feature or functionality], so that [some benefit or goal is achieved]." This format helps to identify the user's needs and goals and the feature or functionality required to meet those needs. The stories are then used to discuss users' needs further and guide the development process.

4.5 Producing Design Solutions

The third phase focuses on creating design solutions through various methods aimed at either creating ideas or evaluating ideas.

4.5.1 Brainstorming

Brainstorming is a method used for generating many ideas to solve a specific problem. Practical brainstorming sessions can be utilised by following some guidelines put forth by Tom Kelly in his paper "The Perfect Brainstorm" [62]. These include keeping the session to around an hour, having a clearly defined problem statement, utilising playful rules to encourage idea generation, building on previously generated ideas, and making all ideas visible to the group.

4.5.2 MoSCoW

The MoSCoW method is an acronym for ”Must have”, ”Should have”, ”Could have”, and ”Will not have” [63]. The method prioritises and classifies requirements by categorising them by their importance. The ”Must have” category includes requirements that must be included in the product for it to be considered a success. The ”Should have” category includes important but not essential requirements. These are included if possible and otherwise they are deferred to later. The ”Could have” category includes requirements that would be nice but are not essential. The ”Will not have” category includes requirements that will not be considered for the current project but might be considered for the future.

The MoSCoW method effectively focuses on the essential requirements and helps the project stay on track and deliver on time [64]. It is also an effective tool to use in communication with stakeholders since it communicates the project’s priorities.

4.5.3 User flows

A user flow diagram outlines the steps a user must take to accomplish a specific task or goal within a digital product such as a website or mobile application [65]. It focuses on the interactions and navigation within the development and disregards other external factors. This tool can evaluate how the system reaches the intended goal and identify any steps that may need improvement.

4.5.4 Low-fidelity prototypes

Low-fidelity prototypes are preliminary representations of a design concept and are often created using pen and paper [66]. They serve as a tool for designers to explore the design and generate new ideas, as they facilitate the creative process by allowing for quick iteration and experimentation.

4.5.5 Mid-fidelity prototypes

Mid-fidelity prototypes bridge initial concepts and the final product, allowing for further exploration and refinement of design ideas [67]. They have an important role in the design process by providing a more detailed representation of the solution.

The mid-fidelity prototype should be more polished and finished than the final high-fidelity prototype. This is beneficial in testing, as it allows for more room for changes and improvements [68]. Furthermore, prototypes with lower fidelity are more accessible for users to understand as test prototypes rather than final products, which can lead to more honest feedback and suggestions for improvement from users [68].

4.5.6 High-Fidelity prototype

High-fidelity prototypes are essential in the design process as they provide a realistic representation of the final solution [68]. These prototypes are suitable for communicating the design vision to stakeholders inside and outside the team, as they provide a detailed and graspable representation of the design [69]. They allow for testing various design ideas, including workflow, specific UI components, graphical elements such as affordance and page hierarchy, type legibility, image quality, and engagement. High-fidelity prototypes often resemble live software, leading test participants to behave more realistically as if interacting with a natural system [68]. Creating high-fidelity prototypes should be iterative, allowing design ideas to be tested and refined between iterations.

4.6 Evaluating the design

The last phase evaluates the design against user requirements. This is done through both user tests and a heuristic evaluation.

4.6.1 User testing

User testing is a method used to evaluate a design's usability, functionality, and overall effectiveness and understand how users interact with a product [70]. User testing allows designers to gather feedback from their target users, identify usability issues, and improve the overall user experience.

User testing can be conducted in different ways depending on the design or product being evaluated, and the goals of the testing [70]. One standard method is usability testing, where users are asked to complete specific tasks using the design or product, and researchers observe and record their interactions. This can help to identify usability issues, such as difficulty navigating a website or understanding the functionality of a product.

User testing should be an iterative process conducted at different stages in the design process [70]. Depending on the user testing stage, the result can be used differently. In the early stages, it is called formative testing, and it is used to inform design decisions. In the later stages, it is called summative testing and is used to

evaluate the usability of the final product. This iterative approach allows designers to improve the product's usability and make necessary adjustments based on user feedback.

The amount of participants needed depends on the stage of the design process and goals tested, but Hertzum [70] argues that generally, 5-8 participants reveal up to 85 % of the issues. In addition, he suggests a minimum of 3 participants, as it can reveal around 50%.

4.6.2 Heuristic evaluation

Usability heuristics are guidelines created to ensure that a user interface (UI) is easy to use, efficient, and satisfying for users. Nilsen and Molich [71] developed ten principles that cover a wide range of UI design issues. These heuristics are not a set of hard and fast rules but rather a set of guidelines that can be used to evaluate the usability of a UI. The principles are:

- Visibility of system status
- The match between the system and the real world
- User control and freedom
- Consistency and standards
- Error prevention
- Recognition rather than recall
- Flexibility and efficiency of use
- Aesthetic and minimalist design
- Help users recognise
- Diagnose
- Recover from errors, and help and documentation.

A heuristic evaluation is a method of usability testing that involves a team of experts, such as usability experts, UI designers, or developers, evaluating a user interface (UI) against a set of established usability heuristics [71]. The experts are asked to identify violations of the chosen heuristics and provide specific design recommendations for improvement.

5

Planning

In accordance with Research Through Design, the goal is to let the design activities contribute to acquiring knowledge and letting it inform the following stage (see section 4.1). Our goal is to apply a human-centred design process and at the end of each phase summarise our findings and let them inform the following methods.

To plan the project we used a Gantt schedule which can be seen in Appendix A.

5.1 Phase 1 - Understanding and specifying the context of use

The first phase of the context of use specification aims to gain a deeper understanding of users. Secondary research, mainly literature studies, will provide a broad understanding of the topic and prior related studies. Complementing the secondary research, primary research using interviews focuses on users' perspectives and experiences. The interview's goal is to identify the biggest challenges and issues faced by children and caregivers living with and around type 1 diabetes, this will then be used to guide the project's direction.

Different interview techniques will be examined, with the possibility of using scenarios or situations as a tool in order to make the participants more comfortable. The goal of the interviews is to highlight the issues and struggles connected to diabetes. Depending on the resources provided we will strive to interview both experts, adolescents and parents. Ethical considerations may limit interviews with children under 16. However, interviewing older adolescents might be beneficial in terms of them being able to reflect on their experiences. Interviewing younger children might be possible with parental approval and accompaniment. Another alternative is to ask parents to ask their children a few questions and then share the results. There are a lot of interesting perspectives on the subject, and not all perspectives may provide the same picture, so careful consideration must be given in determining the direction to take. The goal is to interview around 10 people divided into experts, parents and young adults.

Along with identifying the challenges faced by both children and parents and allowing that to guide what type of solution is made, we also hope it will reveal the best medium for the digital platform. Therefore the choice of desktop or mobile application will be left undetermined until then.

5.2 Phase 2 - Specifying User Requirements

The objective of this phase is to analyse the data and findings from the previous phase. This will be accomplished by the use of an affinity diagram, archetypes, and user stories.

The affinity diagram will be used as a visual tool to organise and categorise the information. In this case, it will be used to sort the data and findings from the previous phase into meaningful themes. This will help us to understand better the key patterns that emerge from the data and will provide a foundation for the remaining part of the phase.

The archetypes will represent the key behaviours and needs of our target group. We will use them to concretize the key findings from the user interviews, making it easier to understand what the concepts need to meet in order to be successful. We can use the personas to provide a clear and concise picture of our target group which we can use to present their motivations and needs for our stakeholders.

Short concise user stories will be used to concretize the use scenarios and motivations behind using the product. This will help us to understand better the context in which the product will be used. The user stories will provide valuable insights into the user experience and help us to identify further potential challenges that need to be addressed in the next phase.

5.3 Phase 3 - Producing Design Solutions

The first step in this phase will be brainstorming as a tool to help us explore the big design space and come up with a broad variety of ideas and directions the project can go. When we have iterated the brainstorming several times, we need to gather and structure our concepts and ideas and for this, we will use an affinity diagram either as a part of the initial brainstorming or as a further iteration we want to implement some co-creation with other designers or the users. We want to use this as a method to reach beyond our creativity and get new eyes and insights into the problem.

With all of our ideas, we will need to prioritise and that is why we will use the MoSCoW method as a next step. This will help us evaluate all the ideas we have generated for our future concept. Furthermore, we will want to merge, analyse and improve our initial ideas and iterate the process.

At this stage, we will have a base of concepts and we will start with the design. As a quick start, we will use rapid prototyping. We will iteratively prototype designs, using recurrent feedback and testing with users to test different aspects of the prototypes. We will need to iterate our designs as we receive feedback, making changes and additions as needed.

Finally, we can start creating high-fidelity designs. This will include creating a brand identity, look and feel, and colour scheme. The phase will end in a interactive

high-fidelity prototype of our concept which we can evaluate and test further in the next phase.

5.4 Phase 4 - Evaluating the design

A two-sided evaluation will be the final stage of the process. The goal is to evaluate the design both with users through user testing, as well as a heuristic evaluation with usability experts. The user testing will focus on examining the usability of the final design through a think-aloud approach allowing. The heuristic evaluation will allow a couple of experts to examine the design against a chosen set of heuristics. Feedback from both evaluations will provide valuable insight for future improvements.

6

Execution and Process

The following chapter contains the sequential execution of all previously presented methods and their outcome.

6.1 Understanding and specifying context of use

This section presents the initial phase, during which our main objective was to gain a thorough understanding of the context, while also empathizing with the problem and the needs of the users.

6.1.1 Secondary research

Secondary research was performed as the initial step of the first phase where related literature was studied. The findings were meant to complement the primary research as well as motivate the scientific background on which the project was based. The findings from the secondary research are presented previously in the chapters Background and Theory. The background covers topics related to the research question such as a deep dive into what diabetes is. The background also contains relevant studies done previously both on the effect of peer support and a survey mapping the experience of living with diabetes in Sweden performed by Ung Diabetes (a youth diabetes association in Sweden). The theory chapter contains additional concepts relevant to the thesis with a focus on theoretical frameworks that inspired the project.

6.1.2 Competitive analysis

To evaluate the available tools for managing and supporting diabetes, a competitive analysis exercise was conducted. The primary objective of this analysis was to identify any gaps or opportunities in the market that could be used as inspiration for the project. We began by defining the scope of our analysis and decided to focus on a broad range of services not to miss potential opportunities.

The analysis was conducted online, by researching and testing various available apps and digital platforms. Two groups of management and support tools were identified: mobile applications and social media platforms. The criteria for evaluation were later defined. These criteria included:

- Blood sugar monitoring
- Meal and activity logging
- Carb and insulin calculator
- Individual recommendations
- News and information about diabetes (science-based)
- Knowledge training (ex quiz)
- Emotional support
- Recognition
- Ease of use
- Accessibility
- User experience

Once the apps and platforms were identified, the evaluation process began. We downloaded the apps and joined social platforms to explore each one, making notes of their strengths and weaknesses. User reviews and ratings were also considered to understand how users were responding to these different apps and platforms. This exercise helped identify areas where improvements could be made to our project or how it could differentiate itself from the competition.

Finally, the findings were summarised in the Existing solution (see section 2.3.2). The full table with analysis is shown in Appendix E.

6.1.3 Interviews

The following section describes the preparations and execution of the interviews.

6.1.3.1 Experience timeline

As a mediating tool for the interviews, we created, what we named, the experience timeline (see figure 6.1). Taking inspiration from the customer journey, this timeline maps out the participant's journey from their initial diagnosis up to the present day. On the y-axis, smileys represent the participants' feelings and the x-axis represents time.

Adjacent to the timeline, we included a box with instructions on how to perform the task and how to use the online collaboration tool. Additionally, we provided helpful prompts to guide the user while filling out the timeline, including an explanation of the term "well-being" and considerations for parents completing the tool.

Before the interview, the participants were asked to mark a number of instances, around five, on the timeline having the vertical axis representing how they felt and write short about what that dot represented. The purpose of the experience timeline was two-sided. Firstly allowing the participant to prepare and reflect on their experience, and secondly using the experience map during the interview as

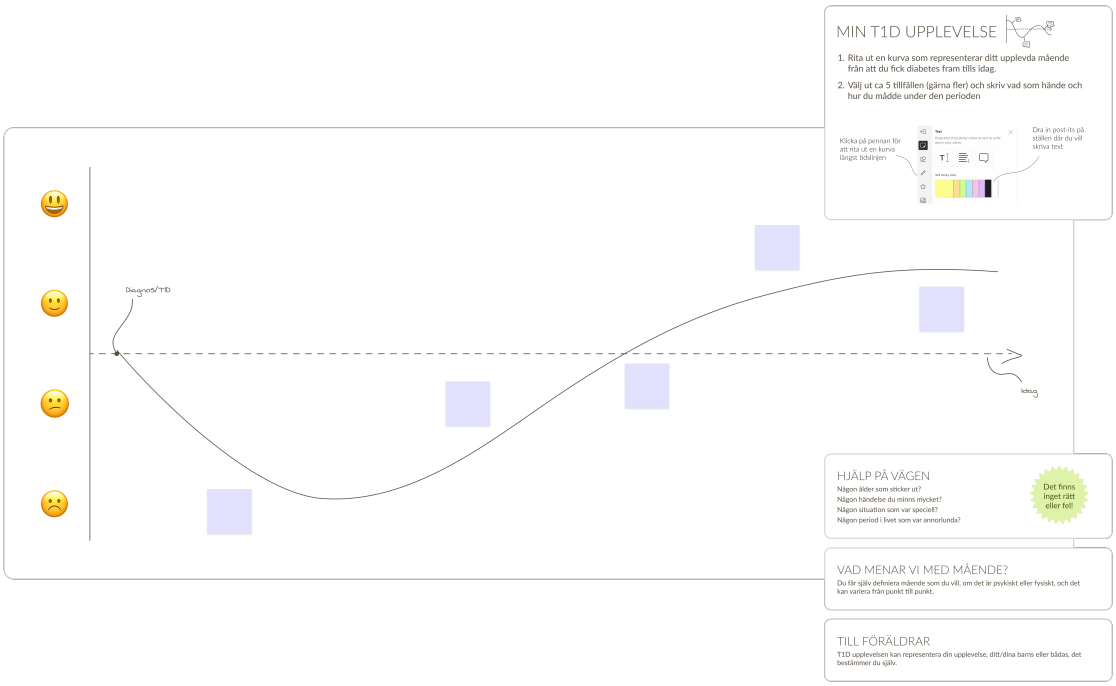

Figure 6.1: The experience timeline used during the interviews

a mediating tool to talk around instead of just asking questions. The experience timeline would also aid in asking about challenges and hard times since we could refer to the timeline and ask them to tell us about a dot placed on the bottom side of the timeline. Three examples of received experience timelines from our participants can be seen in Appendix F.

6.1.3.2 Participants

Participants were gathered through recommendations from supervisors and through diabetes-related Facebook groups. A short questionnaire was posted in two different Facebook groups, one towards parents and one towards everyone with type 1 diabetes. Members could, if interested in participating in interviews or user tests later in the process, declare their interest by answering and leaving their email addresses. They also submitted information about their age if diabetic, or the age of children as well as time since diagnosis if parents. The form received approximately 30 responses and the additional information about them helped the selection of suitable participants. An additional form with different time slots was thereafter sent out which helped with creating a schedule for all interviews.

The first group of participants interviewed was people who themselves have type 1 diabetes. Five people, where one also had a daughter with diabetes type, were interviewed. The participants were from the ages 21-35 and had gotten their diabetes in different stages of life from ages 13-22. To compensate for not including teenagers in our interviews the young adults were asked to reflect back on their teenage years during the interviews.

The second group of participants interviewed were parents of individuals with type 1 diabetes. In total, 6 parents were interviewed with a range of experiences some having lived with the diagnosis for a couple of months to many years. The parents discussed both their and their child's experiences.

6.1.3.3 Set up and Preparations

Due to the interviews targeting two different groups two sets of interview questions were created. These were tailored to each groups different needs and interests. A time booking was sent to allocate dedicated time slots for each interviewee. A consent form was also sent out for the participants to sign digitally to ensure they were comfortable with participating and understood how their information would be used (see Appendix B). Furthermore, the experience timeline was provided to the participants through Mural, an online collaboration tool.

Prior to each interview, the questions were altered to fit each individual. This involved looking at their background and connection to diabetes type 1, which we had received from the questioners. The purpose was to tailor the questions to the individual's experiences making the interview more engaging and insightful.

6.1.3.4 Execution of interviews

A pilot interview was conducted in order to test and refine the questions and procedures before implementing them on a larger scale. During the pilot interview, the questions were evaluated for their ability to reveal desired information and in addition, the experience timeline was assessed. The primary finding from the pilot interview was that the visual aid of the experience timeline facilitated the conversation and allowed the participant to prepare and reflect on their experiences beforehand. However, the experience timeline was revised to include a clearer scale of smileys representing emotions. Additional instructions and questions to help the participants reflect were added.

All 11 interviews were conducted online using Microsoft Teams and lasted between 30 to 45 minutes. The main focus of the interviews was the experience timeline. However, some participants couldn't fill in the timeline due to time constraints. In these cases, the timeline was still used as a guide for the participants to discuss their experiences, but it wasn't as helpful as it was for those who prepared in advance. The interview relied on the semi-structured guide made as well as follow-up questions from the experience timeline making every interview unique.

Because the interviews were conducted digitally, the automatic record and transcribe function in Teams was utilised, resulting in a document with transcriptions which aided the analysis of the interviews.

6.1.4 Analysis of Interviews

The execution of our affinity diagram started with the extraction of interesting findings from the transcribed interviews and experience timeline (see Appendix G).

This allowed us to visualise and create a clear understanding of what the participants shared with us. To ensure that we remained unbiased and didn't miss any patterns, we kept the findings on the post-its broad and comprehensive. We then organised the post-its into the first iteration of themes by grouping those with similar content together. We then summarised these themes in bullet points and compared them to iterate new themes. As we continued to analyse the post-its, we chose the ones that fit into the new themes and added them accordingly. To make the process structured and easy to follow, we made head themes and under themes. Finally, we summarised the findings we discovered through the themes and structured them in a way that was easy to understand, resulting in a clear and concise presentation of our analysis (see Appendix H).

The affinity diagramming eventually resulted in themes each with their sub-themes. These are presented below together with quotes (translated from Swedish) from the interviews.

6.1.4.1 A disease that never sleeps

The first theme highlights how constant diabetes and its management is, and how it affects both parents and children. The theme presents parents hard balance between having control and not affecting independence and integrity.

Control and responsibility

Participants frequently discussed the need for 24/7 surveillance and the subject of control in relation to managing blood sugar levels. Continuous monitoring devices are used to track blood sugar levels every 5 minutes, and alarms are triggered when a high or low value is detected. This also affected the sleep of many parents having to wake up and adjust the child's insulin levels if needed. One parent is estimated to spend between 25-40 hours every week on their child's diabetes.

Take care of someone else's body and predict what you will do the rest of your day. It is hard as hell to be someone else's pancreas. - parent

Diabetes is a disease with an emphasis on self-medicating, which can lead to a heavy burden of responsibility, particularly for parents with younger children. After the diagnose the child and parent are at the hospital to get the blood sugar under control and get educated. Thereafter they are expected to be self-sufficient and handle everything on their own. They expressed stress about the number of things to learn in such a short period of time and then being alone in the care of their child.

Many parents spoke about the challenges of balancing the need to control their child's blood sugar levels and allowing them to be children. They discussed the difficulty of finding the right balance between managing their child's diabetes and ensuring they have a fulfilling childhood. Parents expressed fear of future consequences and complications as motivators to uphold a high level of control over their children's life.

Sometimes I can remind myself, but now we checked 2 minutes ago. I don not need to check again. - parent

Autonomy and integrity

The development of children's autonomy and independence is often constrained by the high level of parental involvement in their lives, particularly when it comes to managing their diabetes. This can hinder their progress in taking care of themselves as they grow up and attempt to become more self-sufficient.

I would say it is a balance between all the possibilities of control versus integrity, at least that is something I deal with. - parent

Moreover, the issue of integrity was raised concerning the need to share everything with their parents in regard to their diabetes management. The complicated relationship between blood sugar levels and various factors in one's life was also discussed, highlighting how it can provide insight into someone's daily routine and habits. Sharing their location for safety reasons can also compromise a child's privacy and personal boundaries.

6.1.4.2 The constant fight for perfect blood sugar

This theme accounts for how complex diabetes is and the goal of having a perfect blood sugar can feel limiting and impossible due to its complexity.

Complexity

The participants expressed how living with diabetes type 1 is a complex experience for both children and parents. The disease is highly individualised, constantly changing, and affected by hormones, which makes it challenging to manage. Healthcare providers and parents can place pressure on children to keep their blood sugar levels in check. Despite their best efforts, they still struggle to manage their diabetes, which can lead to them feeling external pressure and that they are being criticised for factors they can not control. Even when being extremely precise, the blood sugar might still not react as wished, and the reasons why are not always clear.

But I think the best advice I got myself was how it does not always turn out the way you want even if you do everything by the book. There is always something you can not know such as hormones or the weather if it was hot or cold, or adrenaline. - diabetic

There are various approaches to managing diabetes, and the families we talked to had different opinions on how strict they need to be with their dietary restrictions. Some individuals count carbohydrates to help manage their blood sugar levels, while others may not. Parents often monitor their children's food intake closely to ensure they receive the correct insulin dosage, which sometimes adds additional pressure and stress.

New technology, such as insulin pumps, can make mealtime more enjoyable and flexible for children. However, despite advances in diabetes management, food remains a significant focus for individuals with type 1 diabetes. It is often the primary focus

of daily management, as families plan meals and track carbohydrate intake. This can be mentally exhausting and time-consuming, especially for children who want to eat the same things and at the same time as their friends.

All of these factors contribute to the complexity of managing type 1 diabetes for both children and their parents.

Limitations and restrictions

It can be a limiting and restrictive experience for both children and parents when living with diabetes type 1. It can be challenging to be spontaneous and requires constant planning and preparation. Parents must always be aware of their child's blood sugar levels and may need to pause activities to administer insulin or to inform them to stay still. This can be particularly difficult for parents as they must take over the role of managing their child's diabetes, rather than letting their child become more independent as they grow older.

It is a lot of planning, we will not be able to be spontaneous and go out to eat together or leave him alone. - parent

Furthermore, managing diabetes can also be challenging because it requires frequent replacement of many supplies. Families must ensure that they have enough insulin, glucose monitoring supplies, and other necessary equipment on hand. This can be expensive and time-consuming, as they may need to order supplies in advance or deal with broken equipment.

6.1.4.3 A roller coaster of emotions

Living with and around diabetes causes a roller coaster of emotions for both parents and children and how the importance of acceptance has affected them for the better.

Different reactions at diagnosis

During the interviews, both parents and adolescents with type 1 diabetes discussed the range of reactions that can occur following a diagnosis. Some children experienced a sense of excitement with all the new things and attention from friends and family, while others faced significant challenges, particularly when it came to the fear of needles. For parents, the news was described as shocking and often led to feelings of grief and sadness. They must learn to navigate a whole new world of managing their child's condition, from constant monitoring to administering insulin injections, which often required hospitalisation during the first two weeks after diagnosis. Despite the difficulties, parents also discussed a strong sense of focus and determination to help their child manage their diabetes, with all their energy devoted to this goal.

Shame, fear and anger

The interviews also shed light on some different emotions that are common when living with type 1 diabetes. Some adolescents with the diagnosis empathise that puberty is the hardest part, often feeling ashamed and wanting to be like their friends. Denial and shame are common feelings, making it difficult to accept the

situation which often affected their diabetes management. Parents of young children often reported being more open about the disease and discussing it with their child's friends, while adolescents may feel a desire to blend in and not stand out. Anger and frustration are common responses to having to adjust to new routines such as changes in their food intake. Participants in our interviews highlighted that one of the biggest challenges that triggered these emotions was having to eat more than they wanted or eating when they did not feel like it.

But also like when you are 15, you are kind of ashamed of everything. In other words. You do not want to show it, you don not want to talk about it and you do not want anyone to know. - diabetic

Parents frequently reported feeling lonely with the responsibility of managing their child's diabetes, as all the information and decision-making ultimately falls on them.

Importance of Acceptance

Acceptance emerged as the most commonly mentioned factor for success in achieving a sense of well-being and effective diabetes management. Participants highlighted the importance of accepting the diagnosis and the lifestyle changes it requires, as well as accepting the emotions and challenges that come with it. Furthermore, participants emphasised the importance of finding a balance between striving for optimal diabetes care and living a fulfilling life. Accepting that there may be times when things don not go perfectly and allowing for flexibility in managing diabetes can help reduce stress and promote overall well-being.

The success factors are to accept and to let it become an everyday thing. - parent

You have to mix things up a bit sometimes. You can not live hard all the time. Atleast I do not think so. I had not felt good about it. Yes, the values may be a bit high because, like life, it happens. You are on your way, it is fun and stuff. Sometimes it gets a little high the blood sugar. It might be worth it sometimes. - diabetic

You have to learn to control diabetes and not let diabetes control your life. - diabetic

6.1.4.4 Support

Another important theme was the supporting accounting for both the effect technology has had throughout diabetes management as well as how personal support focused on experience-based knowledge is important.

Technology

The interviews revealed that the development of technology has had a significant impact on the lives of individuals with diabetes. Many participants expressed their hope and optimism for the future of technology in diabetes management. Technology was identified as the most important support in the daily lives of those with diabetes. Participants discussed how various technologies, such as continuous glucose monitoring devices and insulin pumps, have greatly impacted their ability to manage their diabetes.

I put my hope in the technology completely and I hope that it will become more independent and more safe. - parent

Moreover, the impact of technology on individuals who had lived with diabetes for an extended period was particularly impactful. They shared how technology, especially insulin pumps, drastically improved their quality of life, allowing them to feel like their lives were returning to normal.

The participants emphasised the importance of staying up-to-date with technology and having the courage to try new things, as they recognized the potential benefits it could bring to their diabetes management.

Personal support

During the interviews, the participants frequently expressed that the exchange of experiences was the most sought-after form of support. They found that the hospital did not have enough insight into what it means to live with type 1 diabetes on a daily basis, and therefore, they sought advice and recommendations from other sources. This exchange of experiences was found to be essential for both parents and individuals with diabetes. Positive experiences were shared, such as attending meetings, diabetes camps, and engaging in social media communities.

It is above all the experience exchange we want. And we also felt that the hospital could not not give us the experience-based theory that we needed. - parent

It was also mentioned that they received emotional support from their family, which they found to be particularly important during their teenage years. They recognized the challenges of managing diabetes during this time, and the support they received from family members was helpful.

My child has probably found a lot of support in us, his parents. So it is us, it is us who are like an umbrella above him in this. - parent

I needed someone to hold my hand instead of pressure and pointers. - diabetic

6.1.4.5 Society's treatment and resources

The participants expressed that one contributing factor to the challenges of living with diabetes is the lack of knowledge about type 1 diabetes in society. Many had faced the question "Did you get diabetes because of your intake of sugar" confusing it with diabetes type 2. This prejudice increases the feeling of the same about the disease many had the experience of hiding from friends.

The interviews also revealed that the resources one receives often depend on geographic location. Diabetic children are entitled to the school hiring a resource person whose task it is to tend to the child's diabetes. However, the process of obtaining this varies a lot. Some participants had no issue receiving this resource whereas others had to fight long and hard through multiple discussions with the school board. Access to help early in getting the diagnosis facilitated the transition to life with diabetes. In some cases, parents witnessed of having to take time from work to stay

with their child in school due to the lack of help. This discrepancy can result in unequal educational opportunities and outcomes.

The issue of resources also extends to healthcare, where the experiences also varied. Somewhere very satisfied with their diabetes team whereas others were not. Especially the difference in support between the child and adult clinics became apparent, where the participant who had gotten the diagnosis after the age of 18 had received almost no support and guidance from the adult clinic. In addition, participants expressed that they had experienced judgement and pointers from healthcare providers when not performing as well as expected.

Furthermore, cultural and socio-economic background can also play a role in access to resources. One participant highlighted that people who are not fluent in the dominant language of a country may face additional challenges in obtaining the necessary resources. For instance, they may struggle to communicate their needs effectively or may not have access to information that is only available in the dominant language.

6.1.5 Summarised insights

The previously conducted methods were summarised into five primary insights, considered the most important moving forward.

6.1.5.1 Responsibility in diabetes management

The findings from the research highlight the significant responsibility and time commitment involved in caring for someone with diabetes. The interviews conducted align with existing literature, confirming that diabetes management is an incredibly time-consuming and demanding task, primarily falling on the shoulders of parents. Moreover, parents often make adjustments to their daily lives to ensure their children can maintain some feeling of normality. It is essential to recognize and acknowledge the immense load and responsibility that parents carry when caring for a child with diabetes.

While parents have a significant responsibility, ultimately it is the child who has the condition and they too have to take a lot of responsibility, sometimes from an early age. Findings from the research indicate that children and teenagers appreciate the assistance they receive from their parents, but they may also experience frustration from constant monitoring and nagging. This is particularly challenging during the teenage years when one desires more independence and transitions towards adulthood. However, as a diabetic, it can be difficult to navigate this development and its associated challenges, as certain thoughts may be challenging to discuss with parents or healthcare providers.

Hence, creating a supportive environment that aids in managing this complex condition should be our top priority.

6.1.5.2 Knowledge exchange is the key

Knowledge exchange is the primary kind of support teenagers and parents dealing with type 1 diabetes need. Through sharing experiences, tips, and advice, individuals can feel better equipped to manage their condition. Facebook groups have emerged as a popular platform for this exchange, allowing people to connect with others in similar situations and ask all sorts of questions and get answers from other people in the same situation. Our competitive analysis confirmed the importance of these groups, highlighting their role in facilitating knowledge exchange and providing a wealth of practical advice. Interviews also testified that the most useful advices always came from someone having similar experiences.

As such, we will take with us the importance of creating a space for people to share their experiences and connect with others who can offer valuable insights and support.

6.1.5.3 Compromised integrity as a diabetic

One of our key insights is that compromised integrity is a common issue for individuals with diabetes. Being a diabetic means that one's life is constantly monitored, and suddenly many people can follow every aspect of their body. This can feel intrusive and lead to a sense of being controlled. Additionally, there are many factors that can affect blood sugar levels, such as stress or being in love, which individuals may not want to share with others.

Therefore, it is essential to find a balance where diabetics do not feel that their integrity is compromised and can feel safe sharing only what they choose to share. Creating an open and non-judgmental environment where individuals can freely discuss their concerns and feelings is important for promoting effective diabetes management.

6.1.5.4 Finding your own way and the importance of acceptance

One insight was the importance of acceptance. Despite best efforts, it can never be perfect or completely error-free since blood sugar levels are affected by much more than food. Additionally, diabetes is an individual disease and everyone must find their own way of managing it. We should avoid pointing fingers or placing blame, instead encouraging each person to find their own path with the help of others.

Overall, we should focus on fostering a culture of acceptance and support.

6.1.5.5 Technology development gives hope

Over the past few years, significant advancements have been made in technology, which has provided hope and improved the lives of those living with the condition. While choosing and setting up devices can be challenging, people with diabetes are generally receptive to trying new technology to help manage their condition. However, it can be hard to know what device is best for you where recommendations from others can be helpful.

Therefore, encouraging people to try new technology and staying up to date with new technology can lead to even more positive outcomes and improve the quality of life for those living with Type 1 diabetes.

6.2 Specifying users and context of use

The following section entails the execution of the methods from phase two. Based on the outcome from previous methods the phase aimed to more clearly identify the user's needs and preferences.

6.2.1 Archetypes characteristics

Rather than fully developing archetypes, we chose to focus on the key characteristics of each archetype and separate them into distinct categories (see figure 6.2). Our decision to take this approach was based on the belief that these categories, including user type, stage of diabetes, attitude towards community, and level of knowledge seeking, would be the most valuable for our project. Each of the categories has two subcategories that represent distinct characteristics. These characteristics are described in terms of core needs and behaviours that we observed in our research.

By breaking down the archetypes in this way, we can combine the different subcategories to form real archetypes. Furthermore, by dividing the archetypes into distinct categories, we can randomly combine the different characteristics. This approach helps us reduce bias and take into account all perspectives of our target audience. We can use this approach as a tool to evaluate our concepts and ensure that they align with our users' needs and preferences. For example, one archetype created from the archetype characteristic by combining one subcategory from each category could be a diabetic, which is newly diagnosed, that is a non-community seeker but frequently seek knowledge.

6.2.2 User Journey map

A user journey map was created to illustrate the various touch points a user has with the product, from awareness to advocacy. The stages were adjusted to fit the project and included awareness, usage, loyalty, and advocacy (see figure 6.3).

The awareness phase focuses on how users discover the product, while the usage phase focuses on how they use it. The loyalty phase focuses on how users become loyal and use it regularly, and the advocacy phase focuses on how to encourage users to advocate for and spread the product.

Within each phase, categories such as key activities, user goals, opportunities, and pain points were used to gain a better understanding of the user and their needs. The different archetypes' characteristics, created in the previous method, were considered in each category.

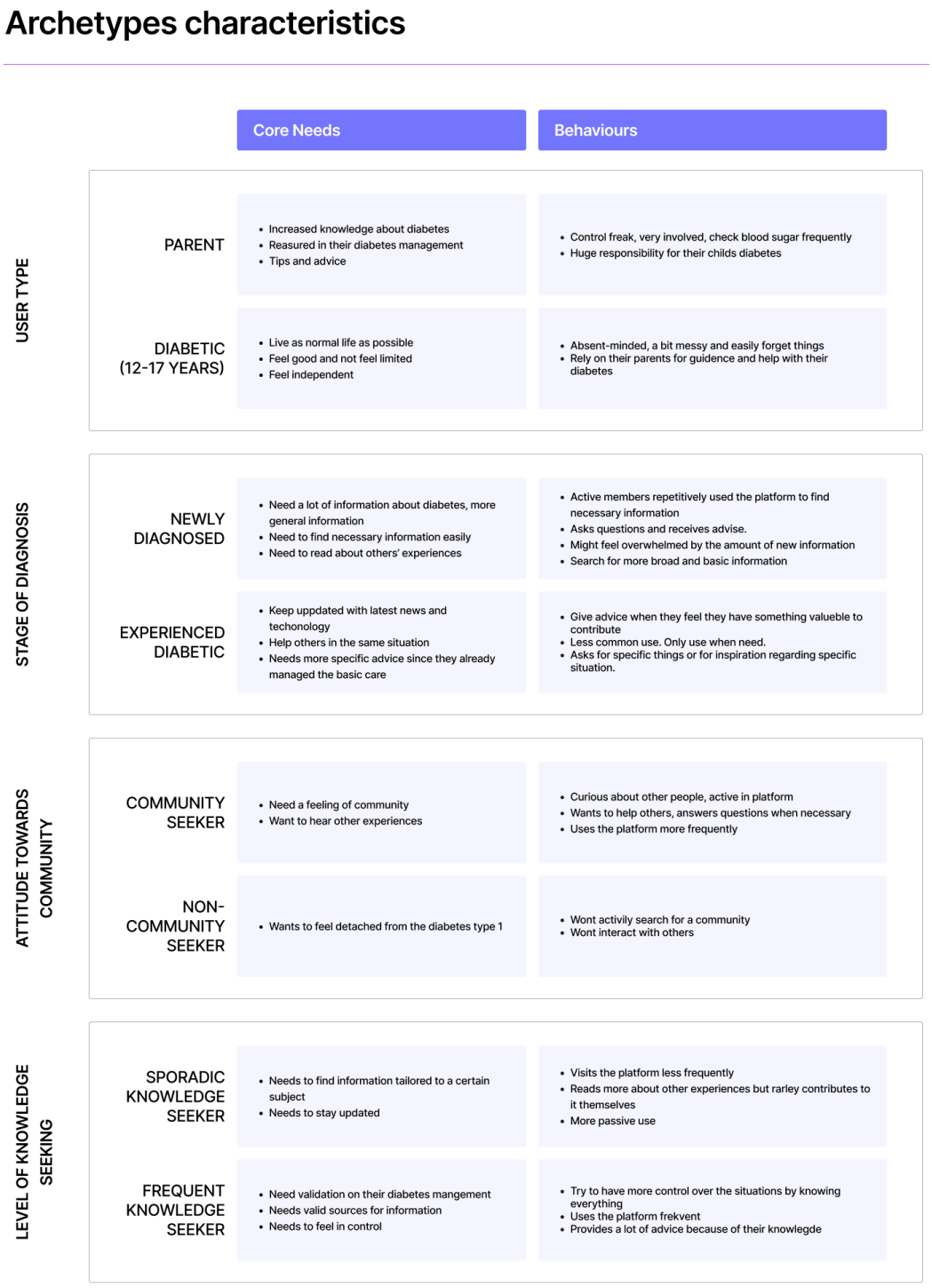

Figure 6.2: The archetypes characteristics created and visualized

The user journey map revealed some interesting opportunities and pain points to consider and be aware of. A pain point in the awareness and/or usage phase is inactivity in the application can deter from usage of the app. This creates the opportunity to facilitate activity, especially in the beginning through recruiting users who are more active. The journey map also highlighted the opportunity to aid in the finding of specific information quickly. Safety and feeling comfortable sharing experiences are also important factors in order to use the application.

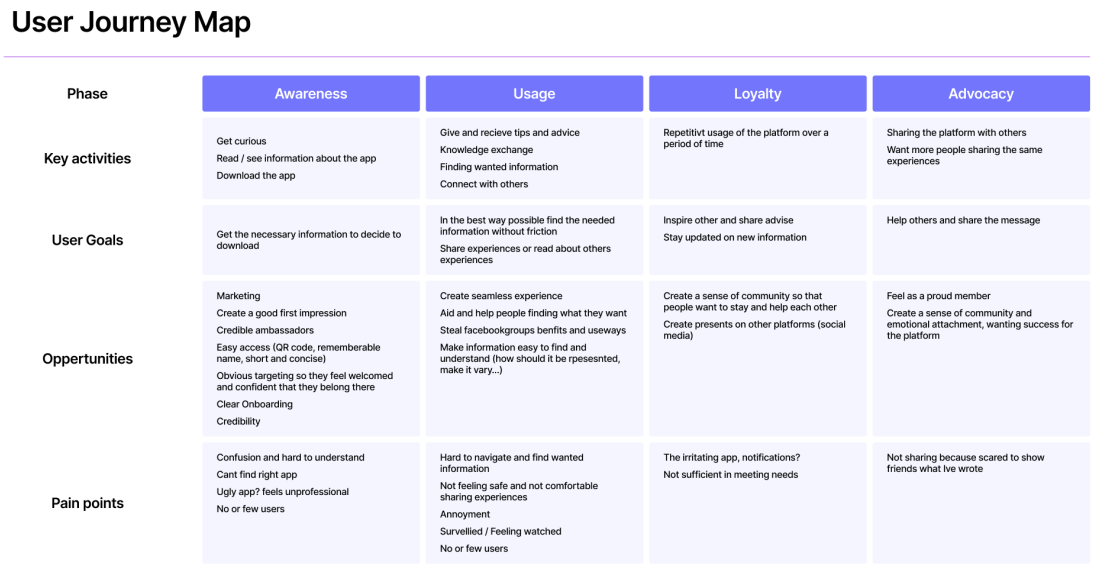

Figure 6.3: User journey map visualizing the user interaction with the product

6.2.3 User stories

User stories were created with both the archetype characteristics and the user journey map in mind. These stories exemplify and illustrate user goals and motivations. While the archetypes were kept abstract, the user stories were used to provide concrete examples of how users might use the product, emphasising their needs and desires. All the user stories are found in Appendix I.

6.2.4 Defining target group and scope

During the process so far the project has had a broad focus examining both the experiences of parents and people that have diabetes. However, moving into the design phase a clearer target audience and scope of the project had to be determined.

Even though the need for support is present for both audiences (teenagers and parents), the choice is motivated by the lack of resources towards teenagers along with the challenges faced during these years. Parents are better equipped to take action towards finding necessary knowledge and are more frequently using forums such as Facebook to ask others for advice. However, this platform is not to the same

extent used by a younger audience [36]. In addition, the audience primarily uses smartphones which impacted the choice of platform for the design [37].

Together with Barndiabetesfonden, it was decided to focus on teenagers with a target audience of 13-17. However, it is expected that the actual user group extends it a couple of years in both directions guessing approximately ages 11-25.

6.3 Producing Design Solutions

This section accounts for the creative design phase where the final designs iteratively were created. The phase was divided into three design iterations focusing on different levels of fidelity where the insights from each iteration inspired the next.

6.3.1 Design iteration 1

The first design iteration focused on broad iteration through brainstorming and low-fidelity sketching.

6.3.1.1 Ideation

During the brainstorming session, a structured approach was followed to generate ideas. We used Post-it notes to brainstorm different ideas and worked in rounds based on our insights, journey map and archetypes. This method allowed us to come up with a diverse set of ideas quickly. After generating the ideas, we then divided them into four categories - Must have, Should have, Could have, and Won't have - using the MoSCoW prioritisation technique (see figure 6.4).

This helped us prioritise our ideas based on their importance and feasibility. The main takeaways:

- Creating a forum that facilitates sharing stories, asking/answering questions, giving/receiving tips and advice, and finding inspiration. We discussed the possibility of using templates to make it easier for users to share their stories and experiences.
- Adopting an opt-out approach to create a sense of belonging for the user from the beginning, rather than requiring them to join actively. We discussed using nudges to encourage users to engage with the platform.
- Incorporating a robust filtering system within the forum to help users quickly find the information they are looking for.
- Designing the platform with flexibility in mind, so it can be adapted to cater to different target audiences.
- Implementing a personal profile feature that allows users to create a profile and save different types of content. This would enable users to easily access their saved content and improve their overall experience on the platform.

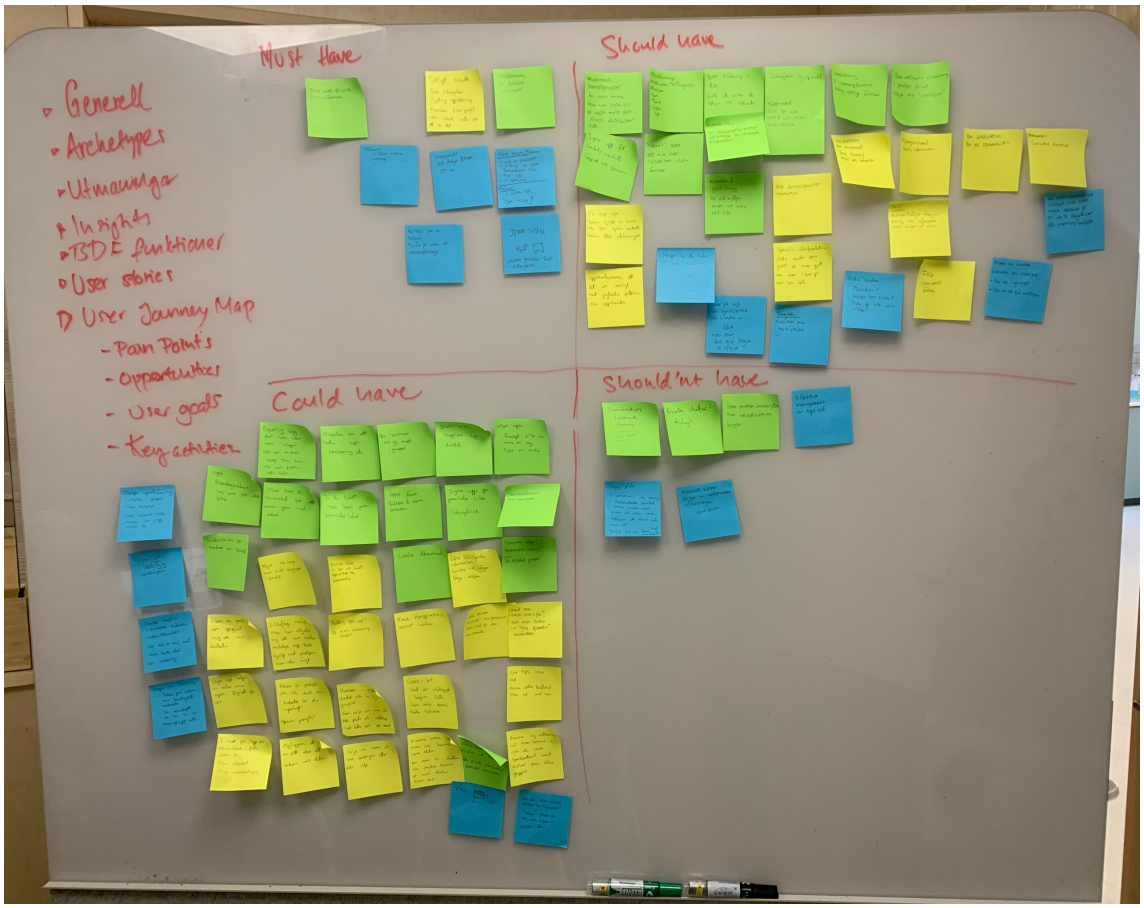

Figure 6.4: MosSCoW prioritisation of brainstorming session

6.3.1.2 Low-fidelity wireframing

To build upon our previous method, we decided to utilise low-fidelity sketching as a way to further develop the ideas. This was done both analogue by hand and in Figma. We began by sketching out various ideas, focusing on "key frames" or critical parts that we could develop further. This approach allowed us to continue ideating while still keeping the overall concept in mind.

During the low-fidelity sketching process, we also prioritised broad ideation, focusing on generating as many ideas as possible. By doing so, we were able to explore a range of potential design options and features. This approach also allowed us to identify and address potential issues early on in the design process.

As we sketched out our ideas, we also made notes and annotations to provide more context and clarify any questions or uncertainties we had. This helped us to understand better how our ideas would translate into a functional platform.

Overall, the low-fidelity sketching process allowed us to develop further and refine our ideas, providing us with a solid foundation upon which we could build a successful platform.

6.3.1.3 Results of design iteration 1

The first ideation solidified the main focal points of the application including some sort of community, an explore page for educational material and events as well as a profile with personal information and settings. The possibility of direct messages between users was also discussed. In addition, an activity page for notifications was considered (see figure 6.5 & 6.6).

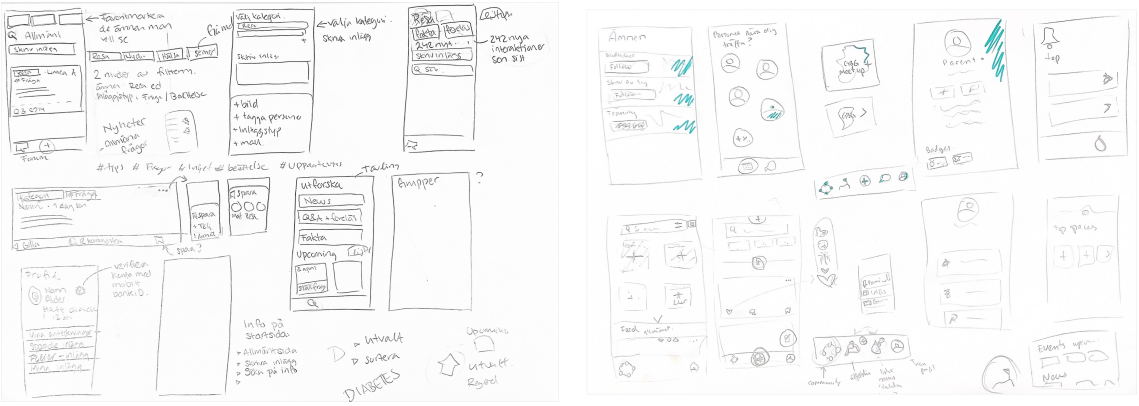

Figure 6.5: Low-fidelity sketching from design iteration 1

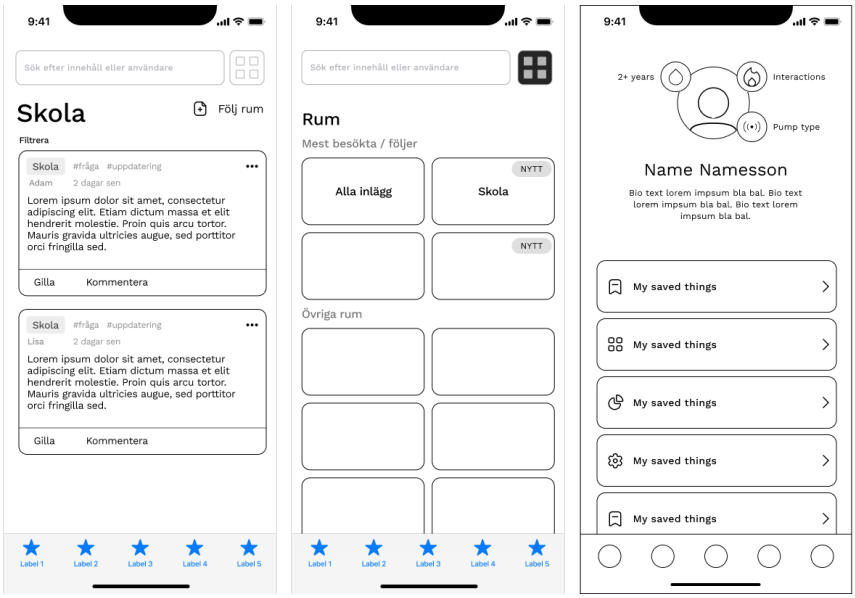

Figure 6.6: Low-fidelity sketching in Figma

The first ideation dived deeper into the aspect of finding necessary information and explored how this could be done more effectively. Using separate spaces for different subjects were also included and ideated around how this could be structured.

6.3.2 Design iteration 2

The second design iteration iterated on the insights from the previous iteration with a higher level of fidelity. The result was also briefly tested and presented to the stakeholders for feedback.

6.3.2.1 User flows

To identify what features we needed in our pages, we created user flows. They focused on the five pages; community, activity, explore, chat, and profile page, with a focus on community, explore and profile page. By mapping out the user's journey through these pages, we identified the necessary features for each page and prioritised those that provide the most value to our users and the project. For a full view of the user flows, see appendix J.

6.3.2.2 Mid-fidelity wireframing

The next step in our app development process was to continue sketching in Figma and based on the user flows we had developed, we proceeded to create wireframes for the pages. We explored different filtering mechanisms and approaches to simplify information retrieval for the community page. For the explore page, we focused on how to engage users in various activities, while for the profile page, we looked for ways to make it personalised and engaging.

Furthermore, we created a base for our design system. By doing this, we were able to ensure consistency across all the pages of the app. This allowed us to design quickly and efficiently, and it made it easier to make changes or updates in the future.

6.3.2.3 Evaluation

The final part of iteration 2 was gaining feedback from users and stakeholders. Two feedback sessions were held, one with users and one together with Barndiabetesfonden.

The mid-fidelity sketches created were evaluated by 4 people to test their usability. Due to the wireframes' simple layout and lack of interactivity, the feedback sessions consisted of us explaining and showing the main features so that the testers could validate the concepts and give their thoughts and feedback. A Wizard of Oz approach was used where the participants through a mobile phone looked at one screen at a time and asked how they perceived it. When asked how they would perform a certain task, they pointed to the screen and we manually changed it on the computer, simulating the navigation actually happening.

Moreover, we conducted a feedback session in collaboration with Barndiabetsfonden, during which we presented the wireframes along with a comprehensive explanation of the concept. Subsequently, we had a discussion to exchange insights and viewpoints.

6.3.2.4 Results of design iteration 2

In the second iteration, we concluded that the community, explore, and profile page should be the key pages. We deprioritized the activity page as it provided the least value to the concept at present, and we removed the chat page to possibly integrate it into the activity page later.

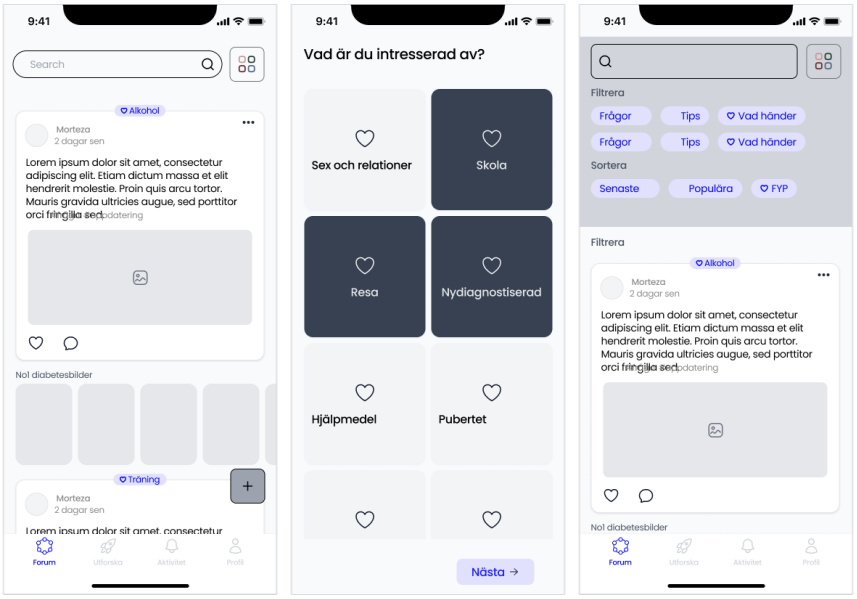

Figure 6.7: Mid-fidelity of community, iteration 2

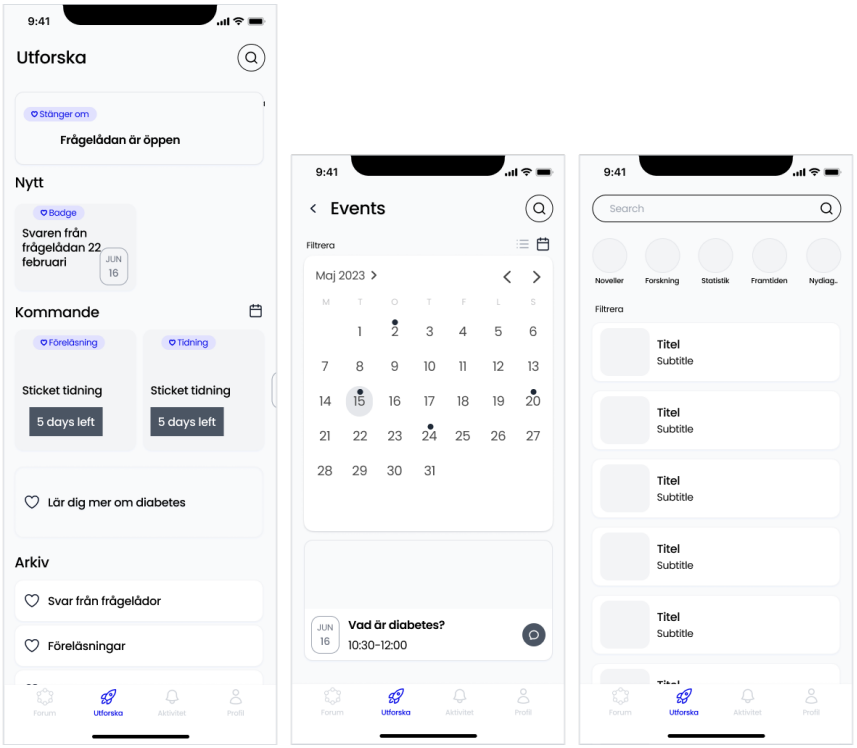

Figure 6.8: Mid-fidelity of exploring, iteration 2

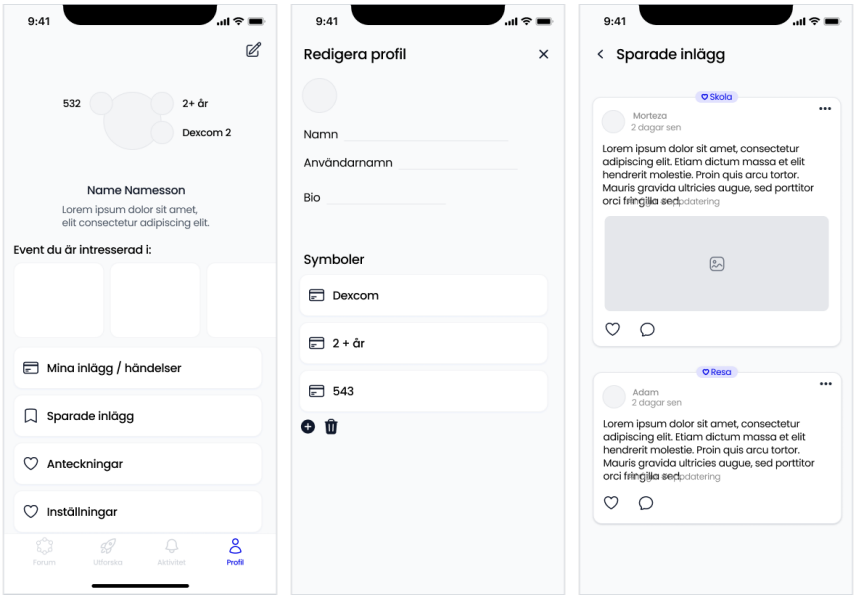

Figure 6.9: Mid-fidelity of the profile page, iteration 2

On the community page, the main purpose will be the experience exchange by reading, sharing and interacting with posts. For the filtering, the user can see all posts in a main room and then choose to go into certain rooms with specific themes. Furthermore, we implemented the option to create shortcuts for different rooms, which will be displayed at the top of the screen. This feature allows users to quickly access the rooms they want to visit, making the process more efficient and convenient. The user will also be able to filter the posts depending on the type, for example, a question, story or poll. Some of the features discussed are shown in our mid-fidelity prototype seen in figure 6.7.

For the explore page the goal is to make upcoming events appear fun and exciting and present information (see figure 6.8. Firstly, we showcased new events to give them good visibility. Secondly, we included a countdown timer for upcoming events, and the number of participants is displayed to increase user interest and encourage participation.

The profile page allows users to personalize their profile and add icons which represent different diabetes-related elements (see figure 6.9). Additionally, we implemented an interaction score, which tallies all user interactions with the app. To further highlight events, we also added a horizontal list of cards displaying events in which the user is participating.

User Feedback

During our iteration 2 design test with users, we received valuable feedback that highlighted important aspects to consider. Firstly, it is important to balance knowledge exchange through a forum while making it appealing to a younger age group. While the primary focus of the knowledge exchange is to share information, the feedback emphasized the importance of making it feel fun and unique to encourage

usage.

Secondly, the division of rooms and filters needs to be intuitive, as the success of the knowledge exchange relies on this. We also received feedback regarding the onboarding process. Users suggested using it as an opportunity to understand them better and personalize the experience accordingly.

Lastly, we received feedback on the shortcut design. Users raised concerns about the necessity of the shortcut design if they don not frequently visit specific rooms, as it may be confusing. Therefore, we took with us that we had to ensure ensure that the shortcut design was functional and straightforward for all users.

Stakeholder Feedback

A feedback session was held together with Barndiabetsfonden. One element discussed was keeping users engaged with the app and encouraging them to use it frequently. It was suggested that creating more opportunities for interaction within the app would be a helpful way to achieve this. However, it was also emphasised that it was important to consider the target audience and ensure the app felt attractive and interesting to them. Barndiabetesfonden also highlighted the importance of the fun and light feeling of the app.

Secondly, we received feedback regarding the explore page. There the events had a significant emphasis. However, the feedback revealed that there will not be as many events as we thought. Therefore, allocating too much space to promote events that will not exist may be counterproductive.

6.3.3 Design iteration 3

The third and final iteration focused more on high fidelity and creating the final designs of the project. With the feedback from Barndiabetesfonden to better engage and attract the target group, we further examined the social media they used (see section 3.1).

During this iteration, the designs from the second iteration were iterated upon to create high-fidelity designs. Common design patterns such as content structuring, navigation and hierarchy were considered and incorporated throughout this process to ensure the best user experience.

When it came to creating illustrations, we considered creating original ones. However, after consideration, we opted for combining iOS emojis to achieve a more realistic 3D appearance and alleviate a time-consuming task. This decision helped to create a more cohesive visual language across the illustrations.

During this process, the design system was built on and extended to ensure consistency across all designs. The designs were created with common design patterns in mind, such as consistent spacing in increments of four and appropriate margins (see figure 6.10).

During the high-fidelity prototyping, there were conscious limitations on which parts

of the design not to focus on, such as excluding the login and onboarding and the page activities. Also, a lot of alternative states, for example, empty conditions was excluded. This due to them not adding enough value in relation to our timeframe.

The final step was to create an interactive prototype, with the tools available in Figma, suitable for user testing the product.

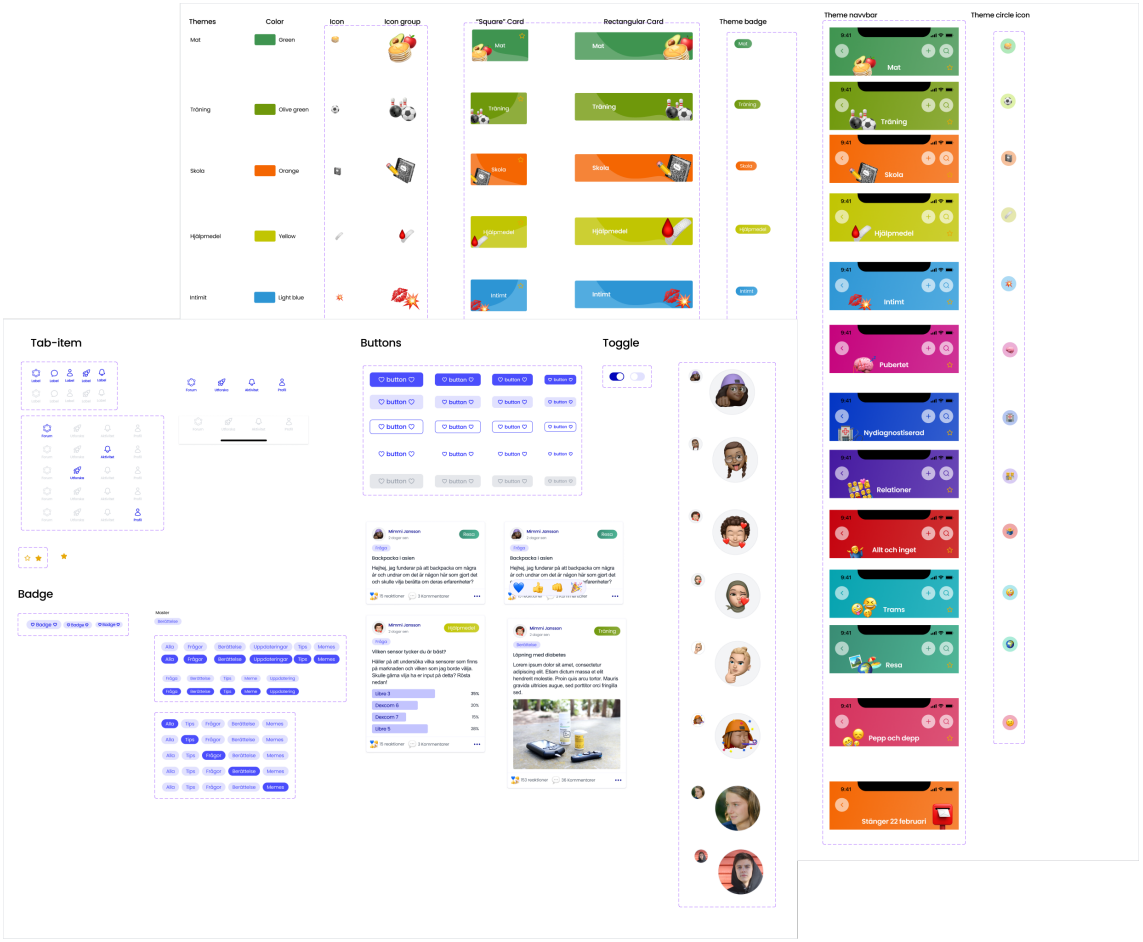

Figure 6.10: Components

6.3.3.1 Colours and typography

The selected colours are intended to convey actions, status and directions within the interface effectively and should help guide the user rather than distract it. To ensure accessibility the colour contrast was considered and strived to achieve these standards as much as possible. However, due to our large number of theme-specific colours, the contrast sometimes was deprioritized for the variety required.

The colour palette for the project was inspired by feelings of joy and encouragement. The primary colour chosen was blue, which is often associated with diabetes. This colour was also used to connect the project with Barndiabetesfonden, who also uses blue as their primary colour, however, a more vibrant shade was selected to fit the theme and expression better.

To differentiate between subjects, we designated specific colours for each room, including three different shades and a gradient between the two of them (see figure 6.11). The colours were all of the same hue and saturation to align with each other visually. The colourful theme aimed to create a joyful feel as mentioned in section 3.2.5.

Figure 6.11: The color styles guides created

All colours were converted into colour styles to allow for easy use and updating throughout the project. Besides the colourful colours, a neutral palette consisting of blueish greys was created for text within the application.

The choice of typography relied on the graphical profile of Barndiabetesfonden. However, due to not having access to the primary font, we tried to find a similar one

(see figure 6.12. The choice landed on Poppins as a font for headings. For paragraph texts, Arial was picked since Barndiabetesfonden used it and met the requirements for easy readability.

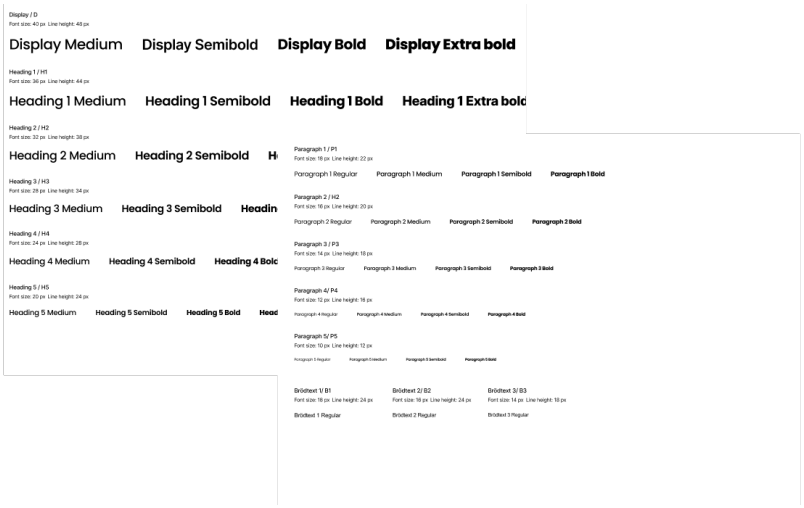

Figure 6.12: The typography guides created

Throughout the design, different sizes and shades of the neutral colour palette were used to show the hierarchy of content and direct focus.

6.4 Evaluating the design

The final evaluation of the designs where divided into three parts, one heuristic evaluation with a UX designer focusing on usability and two user tests within the target group. The review also included stakeholder feedback. The evaluation revealed strengths and weaknesses and gave recommendations for future work, see section 8.5.

6.4.1 User testing

The final designs were tested by users to evaluate the usability of the product. User testing of the high-fidelity prototype was conducted with two potential users within the target group, ages 14 and 18. The participants were identified through connections to their parents facilitated by Barndiabetsfonden.

6.4.1.1 Set up and execution

Due to geographical location, the user tests were conducted remotely, inspired by the description of synchronous remote user testing approach [72]. The structure of the user test was as follows: an introduction to the project and its current state, the user's role in the project, and explaining how they contribute. The user test itself was also explained, and how it will be performed also encouraged that all feedback is valuable.

The test was conducted online through Microsoft Teams and took approximately 30 minutes. During the tests, the interactive prototype was shared via screen share. The participants were given different scenarios to complete and could navigate through, given the control of the evaluator's screen. However, the function was unavailable during the tests, so we guided the screen according to the user's instructions; this may have affected the results.

The scenarios were as follows:

Community

- You have just downloaded the app. After you have logged in this is the screen you will see. Tell us what you see and how you interpret it.
- In the app, there are several rooms with specific themes. You are interested in how type 1 diabetes and food affects each other.
- You now remember that the first post on the start page was interesting and want to go in and read the comments.
- You now want to save the post so you can go back to it later.
- You have a question you want to get input on. The question is related to school and you do not want it to be anonymous.

Explore

- Navigate to the Explore page and tell us what you see and how you interpret it.
- You see that the question box is open and want to ask a question.
- You think the last question box was interesting and want to read these.
- You now want to read more about diabetes and how food affects you.

Profile

- Navigate to your profile and tell us what you see and how you interpret it.
- You now want to see your saved posts.

After finishing the user test a short interview was held following these interview questions:

- What was your first impression?
- Did you understand the app?
- Looking back at your journey with diabetes, have there been things you have wondered about but didn not know where to turn?
- Would you feel comfortable asking those questions in such a forum or question box?
- What would be important to you in order to feel comfortable posting in such an app?

- How much does your diabetes play a role in your regular social media? Do you post about it/follow anything related to it?
- Are there any topics you would find more interesting to read about?
- Do you feel there is anything important missing?
- How do you think we can improve our concept?
- What do you think about the application's aesthetic, what feelings do you think it conveys?

6.4.1.2 Results

The participants were generally positive about the application and said they would likely use it. The main page was easy to understand, and the room categories were clear. However, when asked to navigate to the room overview, the correct action was not immediately apparent. Participants suggested finding them on the search or explore page. One participant also needed more clarity about the difference between rooms and other filters when creating a new post and browsing the main page whereas the second participant understood it. Due to the content not updating all alterations made resulting in the effect of actions did not become apparent. The remote control did not work during the tests, affecting the participants' ability to explore and understand, but everything else worked without any problems.

The Explore page was easy to understand and logically organized. The question box feature for healthcare-provided consultations received positive feedback. However, the news section needed clarity as it lacked further details. Participants found the "learn more about diabetes" section helpful as it provided easy access to relevant information.

The participants spent little time on the profile section during the tests but still understood the content. One question was whether more information than the post could be saved, which is a function that has been discussed in the design but excluded due to time constraints. The interaction score did not explain itself as expected and needs more explanation, but participants could guess it related to the app's activity for example a streak och number of posts.

The follow-up interview questions provided valuable feedback. Both participants expressed high positivity towards the application and indicated they would use it. One participant even inquired about the possibility of releasing the application after the project and mentioned that they would likely use it daily to read, ask, and answer questions. The overall structure and layout of the application were clear and easy to understand, according to the participants.

The mix of content, creating one uniform space for everything, was appreciated, and being able to access questions, stories and tips from various categories in one place. Adding more factual content was also appreciated since this was something they never sought out themselves but would like to be enlightened about in an accessible setting. One participant also exemplified how they thought it was important to stay

updated on how the physiology of diabetes. Including knowledge exchange from peers and information from secure sources was a good combination.

When reflecting on using the product, both participants expressed positively and had encountered situations where they required guidance but had nowhere to turn for it. They also mentioned that they did not want their diabetes to be a part of their presence on other social media platforms, as they did not want to be associated with their condition.

The participants enjoyed the application's aesthetics, explaining that it felt like a fun place to be and that using colour and emojis as illustrations was good.

During the feedback session, participants were asked for suggestions to improve the application and which categories they found exciting and would use. One participant requested to message other users to get to know them better. Additionally, they suggested adding types for camps and research. The participant had attended many camps when they were younger and wanted to access information about them through the application. They also expressed interest in receiving brief updates about research in a forum format.

Both participants also express some interest in age-specific groups validating the importance of being able to relate to users. This highlights the idea of being able to filter content on age or have specific groups targeted to age intervals.

In general, the user tests yielded positive outcomes concerning the application's usability and intended purpose. However, given the limited size of the sample, we cannot draw any significant conclusions. While the feedback obtained can aid in refining the designs, further rigorous testing is required to verify its potential.

6.4.2 Heuristic evaluation

The heuristic evaluation was performed to identify usability issues based on some predefined heuristics. Due to the state of the product, all heuristics presented in section 4.6.2 are relevant for the evaluation. However, we chose some of them for the review:

- Consistency and standards, refer to consistency across all labels, elements and actions.
- Recognition, rather than recall, refers to the user's ability to quickly recognise elements across the platform, not relying on them having to remember them actively.
- Flexibility and efficiency of use refer to the product's ability to be flexible and suit all users.
- Aesthetic and minimalist design relates to interfaces not being crowded and not containing any unnecessary elements.
- The match between the system and the natural world refers to the design speaking the user's language and using logical and familiar concepts.

6.4.2.1 Set up and Execution

One user experience (UX) designer performed the heuristic evaluation. The designer was tasked to look through the designs in the interactive prototypes and the still screens and identify any violations of the heuristics presented. If specified, a description of the breach was written on a Post-it with the colour relating to the appropriate heuristic.

The evaluation took place live and started with the UX designer getting an introduction to the project, the product created and its intended user group. After that, the UX designer got access to the interactive prototype to do a walkthrough. This walkthrough was on the initiative of the designer, however, some guidance was necessary to mitigate issues due to actions not being included in the interactive prototype. The UX designer was allowed to navigate freely around to around, and notes captured any feedback given. The heuristic evaluation sheet was after that opened in Figma, and the UX designer could go through one screen at a time and notify any feedback or violations of heuristics with post-its.

6.4.2.2 Result

The heuristic evaluation gave a positive result with not much to touch upon. The consistency and standard heuristic were followed and the feedback given was that the design looked cohesive and was complimented on the aesthetics and look and feel. Aesthetics and minimalist design were given good feedback and the design looked good and did not have many cluttered elements. The majority of the design elements were easy to recognise besides some elements that were evaluated and needed iteration for not relying on recall. Due to the incomplete prototype as well as it only being done in Figma and not code, a lot of the common heuristic violations were not able to assess. It was not able to access error handling, coverage of all states and feedback on actions. The heuristic evaluation more or less confirmed the app's functionality and basic usability but was not able to give the extent of feedback probably necessary. In the future, with a developed application, a more extensive heuristic evaluation might yield more results.

6.4.3 Stakeholder feedback

Barndiabetesfonden and three people from two different design agencies in Stockholm also participated in a feedback session on high-fidelity design. A brief walkthrough of the design process and the results were presented at the feedback session. The results were not shown or explained in detail but focused on the main concepts and features. Due to the design agency's first attendance, the meeting focused on our previous insights, challenges, and designs. We got praise for our thorough user studies where the identified importance of integrity and independence was raised and discussed as something they wanted to get inspired by more. Two participants had children and partners with type 1 diabetes and could relate to the insights.

Related to the design, they gave very positive feedback and thought the design could work effectively for knowledge exchange. However, since they are currently working

on the minimum viable product (MVP) of a similar product they discussed which features would work in an initial implementation. The pros and cons of anonymity and the division into rooms were highlighted, which will be discussed further in chapter 8.

6.4.4 Summarised insights

In summary, the application received positive feedback from all three parties regarding its functionality and aesthetics. However, further refinement and user testing with the target audience are necessary, but the test results have provided a first direction for development. One takeaway from the feedback was the appreciation for consistency across all screens, emphasizing the importance of maintaining this aspect in future development. Additionally, the ability to filter information in multiple ways was identified as a valuable feature.

7

Results

In this chapter, the outcome of this project is presented. First, the design is presented through screenshots of the final prototype followed by an explanation of how the research through design has revealed some important factors to consider when designing a supportive application for teenagers with type 1 diabetes.

7.1 Final Design - Diko

The final design is a high-fidelity interactive prototype created in Figma. This app is a community-based peer-support platform, featuring three primary pages: the community page, the explore page, and the profile page (see figure 7.1).

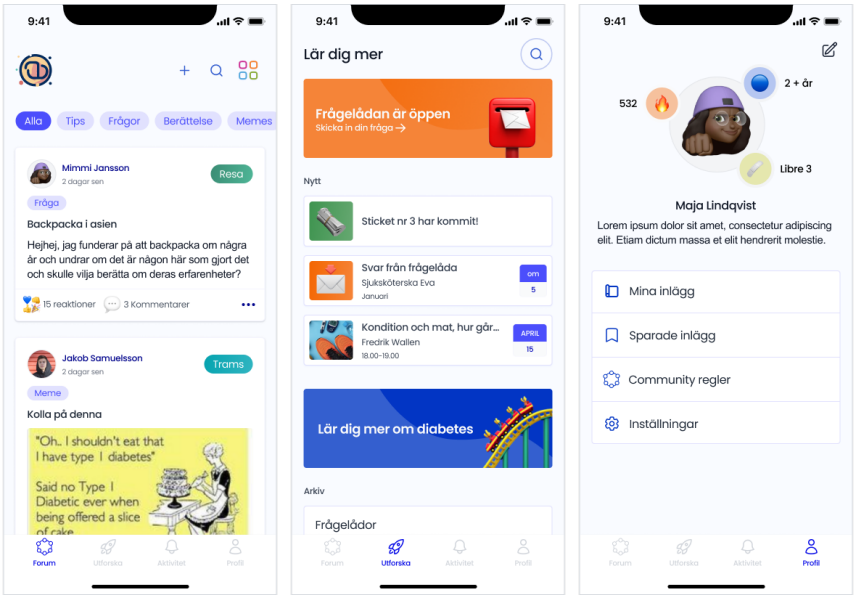

Figure 7.1: Overview of application

The working name for the app is "Diko," which aims to emphasize its purpose of being a companion and support system for individuals with diabetes. The name is derived from combining two Swedish words: "Diabeteskompis" (Diabetes friend) and the English "Diabetes Connect," both of which convey the app's core functionalities.

7.1.1 Community page

The landing page of the application is the community presented below. The following sections explain the design and motivate some of the functions included.

7.1.1.1 Main forum and posts

The community part of the design is based on the base principle of peer support where people with shared experiences can help and support each other [24] as mentioned in section 2.2. Through posting and commenting conversations are created to exchange knowledge and experience. The forum is divided into separate spaces but in order to get an overview of all new content the main forum containing all posts is set as default (see figure 7.2). All posts are tagged with both the theme they belong to in the top right corner as well as the filtering tags explaining what type of content it is. By pressing the bottom corner three dots additional settings are opened where the users can save a post or report it. Comments on posts can be read by clicking the comment button and a separate window will be opened. When adding a comment the option to publish anonymously is available.

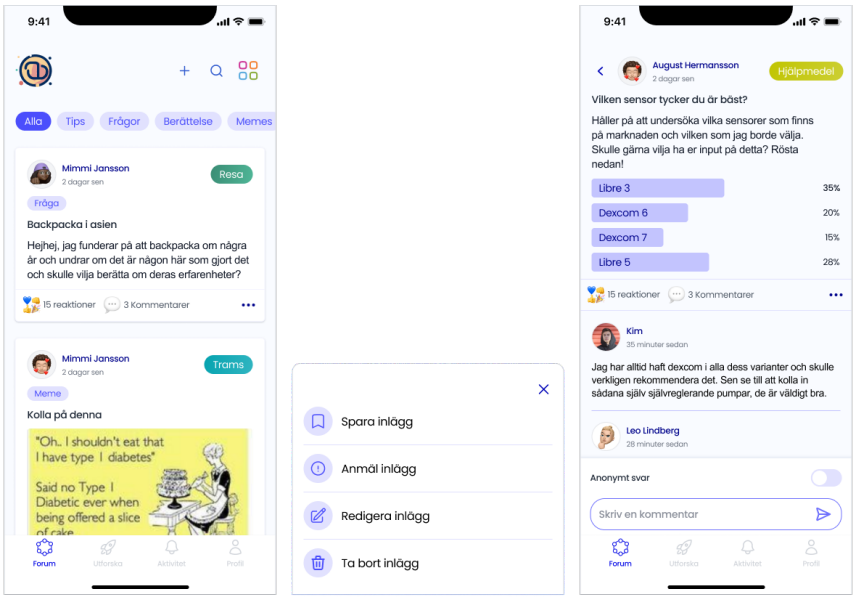

Figure 7.2: Community screens

A search function is also added to once again aid the finding of necessary information (see figure 7.3). Pressing the search button opens a window for searching, the user's previous search terms are also visible there. The search feed works similarly to the main with the exception of the content matching the search request. The same options in regard to saving posts and commenting are available.

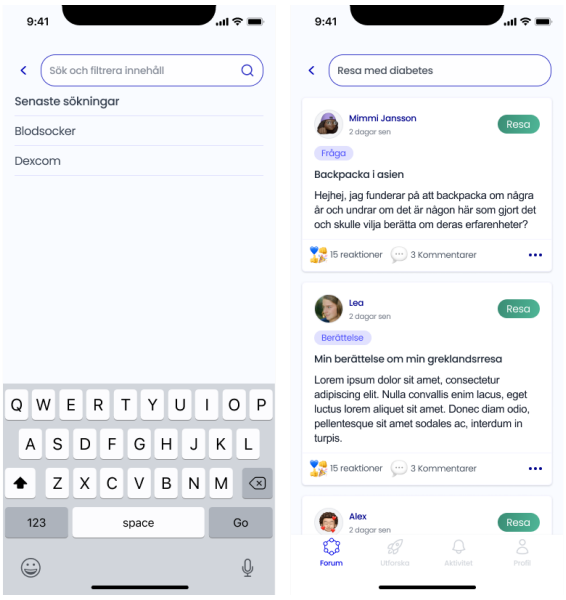

Figure 7.3: Search in community

7.1.1.2 Rooms and filters

In order to make the knowledge exchange as effective as possible aiding the process of finding the right information was important, trouble doing this with today's resources was also revealed during the interviews. Therefore, two different systems for filtering the content were applied in the form of rooms for different themes and filters on the type of content in the post.

The room filters represented separate spaces where users could read about the specific subject. Pressing the top right button opens up an overlay displaying the different rooms available (see figure 7.4). These are both colour coded with an illustration representing the theme of the room. Within each room, the colour and illustration are used in the navigation bar for consistency and memorability. The selection of rooms was based on suggestions from barndiabetesfonden and aimed to cover all areas necessary broadly. The design now includes the following rooms (translated from Swedish):

- Food
- Workout
- Devices
- Newly diagnosed
- Puberty
- Relationships
- Ups and downs
- Intimate

- Travel
- Fun things
- School
- Other

The rooms can also be marked as a favourite by pressing the yellow star, this will affect the order the cards will be sorted in the overlay (see figure 7.5).

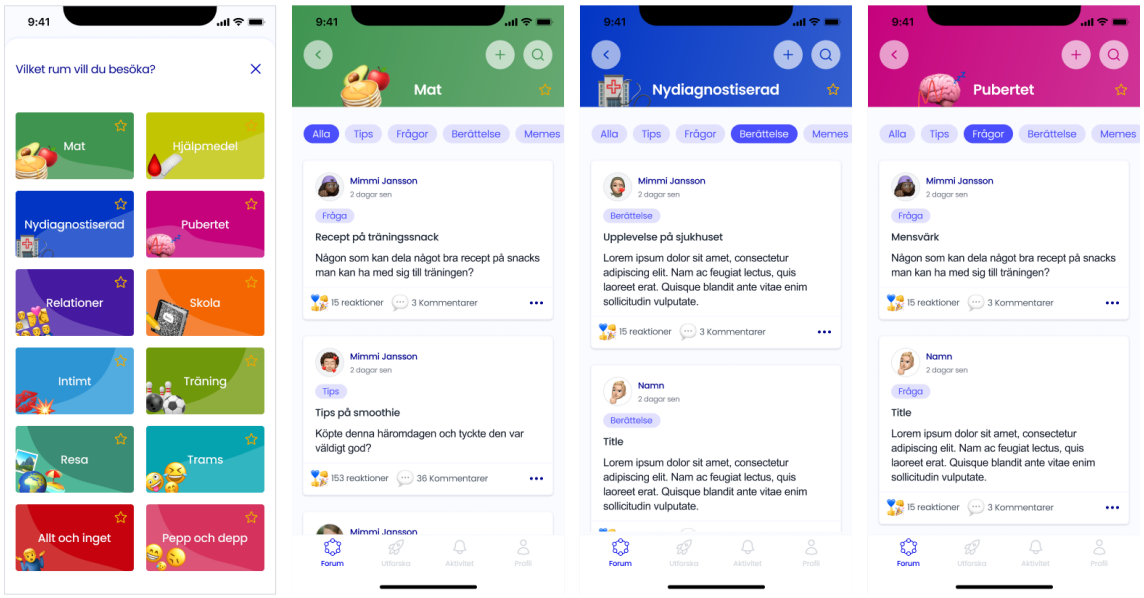

Figure 7.4: Selection of rooms and view of different rooms

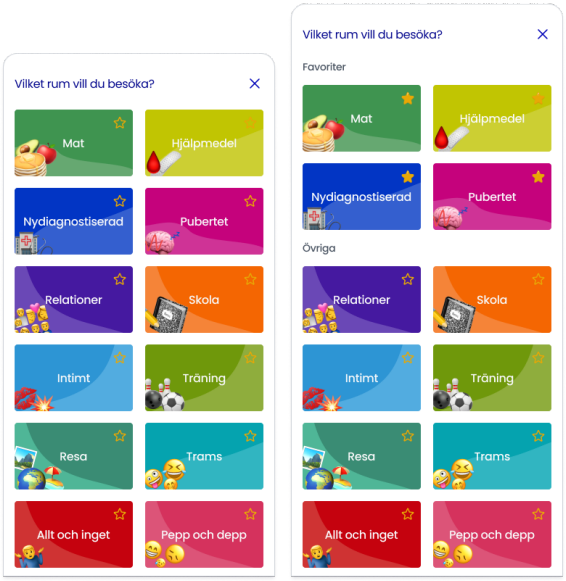

Figure 7.5: Rooms marked as favourites

Additional filters are shown as tags in a horizontal line in both the main forum and

the different rooms. By pressing these tags, the posts filter accordingly to better aid in finding certain information. Which alternatives should be available here needs further development and the picked ones, questions, tips, stories, updates and memes are only suggestions.

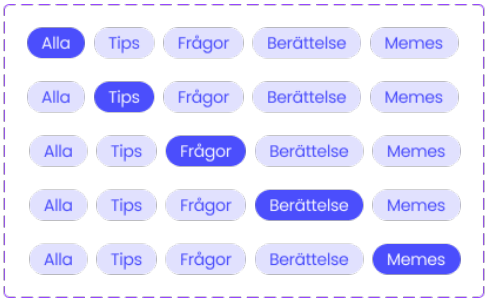

Figure 7.6: Filter tags in different states

7.1.1.3 Creating posts

Creating posts is done by simply pressing the plus button in either the main forum or one of the rooms and a separate page will open (see figure 7.7). The first question to answer is in which room to upload the post, this option will be preselected if the plus button is selected from inside a room. The question of integrity and security was discussed at length during the project, to ensure this the option to make posts anonymously was added. Allowing this might make users more comfortable asking the questions they need.

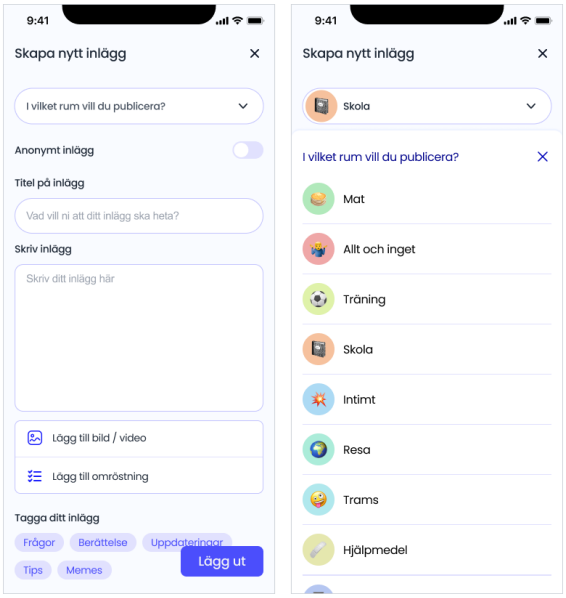

Figure 7.7: Create a new post

Additional information possibly added is a title for the post, which will aid an easier overview of the posts, following the input box for the post itself. Pictures and videos can thereafter be added (see figure 7.8). The possibility of adding polls to a post

was also added to increase interactivity and provide flexibility in the content created. Last but not least, the user can tag the post according to what fits its content.

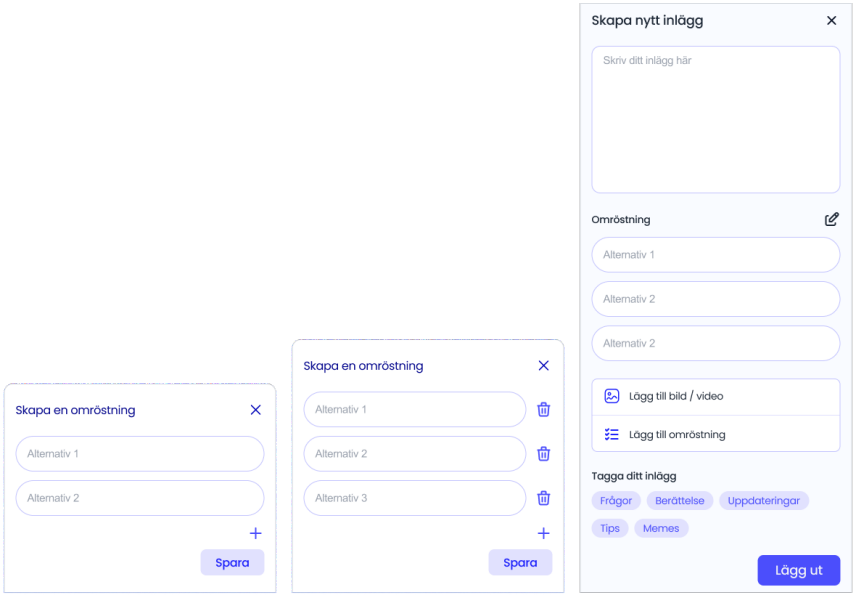

Figure 7.8: Create a new post with poll

7.1.2 Explore page

The Explore page offers users app-moderated features, including a question box and a section to learn more about diabetes. The two main features are highlighted on large cards, with more details provided in the following sections. Additionally, news and event updates, such as the release of Barndiabetesfondens newspaper Sticket and upcoming lectures, will be posted. Users can also access archives containing old content, including previous question boxes, recorded lectures, and newspapers.

7.1.2.1 The Questionbox

A diabetes professional will manage the question box, receiving and answering written questions before posting the responses. All questions will be anonymous, creating a safe space for teenagers to ask questions to a professional without involving their parents or healthcare providers (see figure 7.9).

Occasionally, the question box may feature guest responses, such as famous people from Sweden with diabetes. This will add a fun element and make the platform more appealing to the target audience.

When the Question box opens, it will appear on the top of the Explore page. Clicking on it will open an overlay that pop-up from the bottom of the screen, allowing users to ask questions. The overlay will also provide information about who will be answering the questions. Additionally, users will have the option to include pictures.

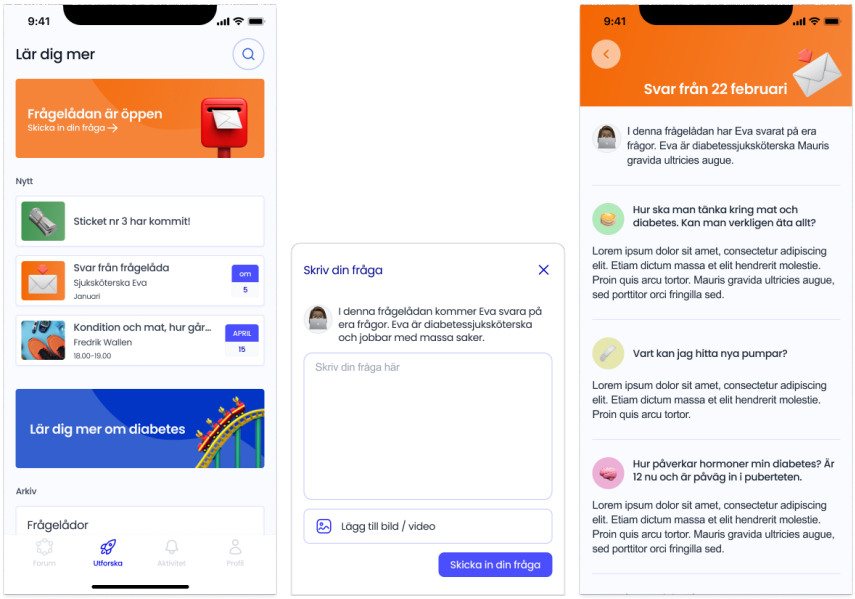

Figure 7.9: Questionbox

7.1.2.2 Learn more about diabetes

As a complement to the primary experience-based knowledge source, the app also provides science-based knowledge on the Explore page (see figure 7.10). Here the user can find the most relevant topics for our target group and the information presented in a short and easy-to-understand way. Additionally, a quiz format is also included to provide a fun and easy way to approach knowledge regarding diabetes.

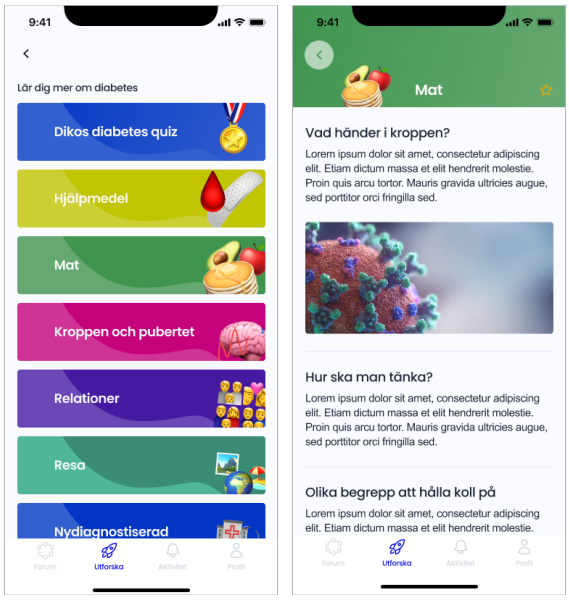

Figure 7.10: Learn more about diabetes

7.2 Profile

On the profile page, we allow users to create a "Diabetes alias". They can choose either an avatar or a real picture as a profile picture and choose what username they want to show in their profile (see figure 7.11). This allows users to choose how anonymous they want to be.

Figure 7.11: My profile

Furthermore, users can customize their profiles by adding personalized icons related to their diabetes. These are visualized floating around the user's avatar. This feature adds a fun way to personalize the profile but also enhances the credibility of the user's profile by showing they are familiar with diabetes. It promotes self-expression and creates a sense of community within the app as users can identify with each other through the icons they display.

Additionally, we have implemented an interaction score which is visualized as one of the icons next to the user's profile picture. The score counts all user activity within the app, including for example likes, comments, and posts. This allows users to track their progress, feel a sense of accomplishment, and see that other people are using the app when looking at their profiles. By wanting to improve the interaction score the users get encouraged to remain active in the forum.

Lastly, the profile page contains information such as all the saved posts as well as the ones made by the user (see figure 7.12).

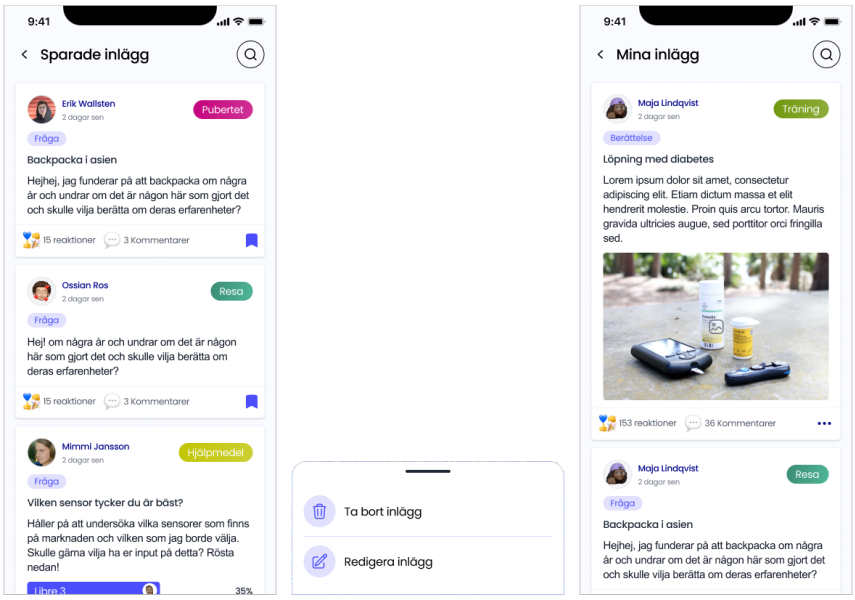

Figure 7.12: My posts and saved posts

7.2.1 Consistency

Since the themes were recurrent in multiple places in the design, consistency of the design was key to ensuring good memorability as a part of good usability. Both the use of colour and illustrations were used to achieve this. The illustrations were scaled in different variations in order to use them throughout. The use of illustrated icons was also primarily limited to the themes, whereas regular outlined icons were used everywhere else to, even more, create a distinct connection to the themes (see figure 7.13 & 7.14).

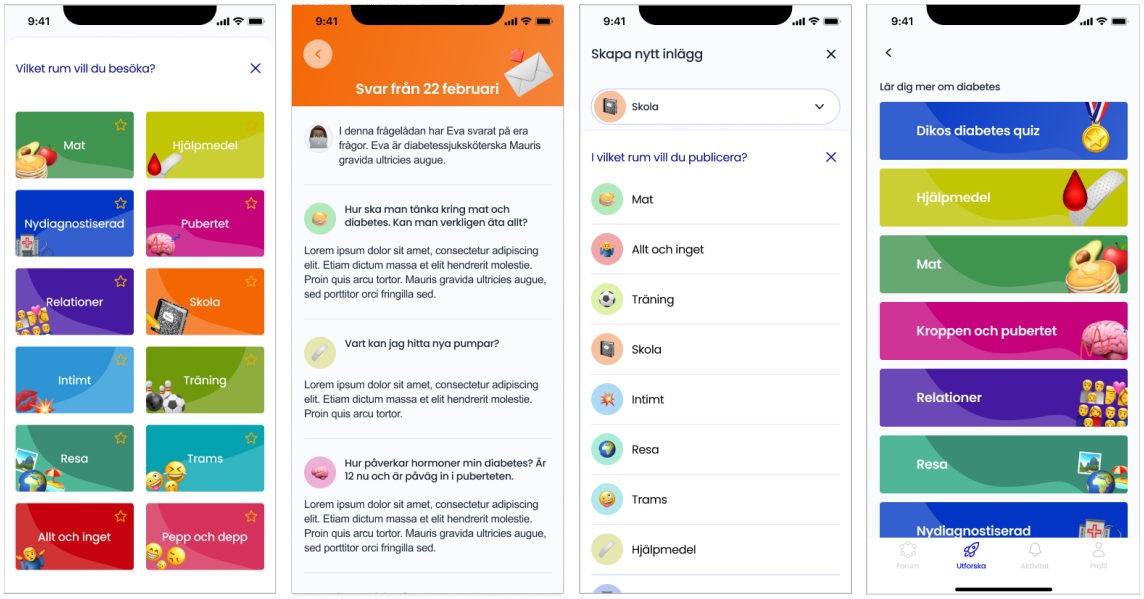

Figure 7.13: Examples of how the consistency was achieved

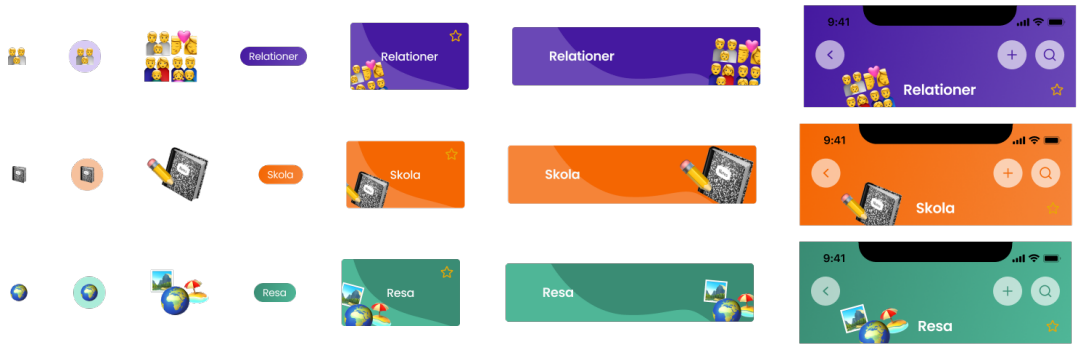

Figure 7.14: Consistency amongst components

7.2.2 Additional features

One challenge was how to encourage continuous usage over time and ensure activity throughout the application. To achieve this, two ideas to increase interactivity and possibilities for use were created. However, these were due to time constraints and were not able to be finished and developed fully.

Inspired by social media, where posting pictures is often in focus, the idea to include pictures to depict life with diabetes was derived. Even though diabetes is a huge part of life, users often exclude it from other social media platforms. The idea here was to allow users to share these pictures without them interfering with the feed as much. The pictures would then be scattered throughout the feed and opened as a slideshow when clicked (see figure 7.15). Different ideas on how this would function would operate were discussed, for example, prompting the action of posting a picture daily or on occasion or just having the function open for posting whenever. Sharing pictures amongst the user might also increase the feeling of community, amplifying the feeling of not being alone. Allowing to post pictures might also lower the threshold to engage since it feels like a smaller commitment to do so than uploading text posts. In the user profile, their own pictures would be shown as a little diary (see figure 7.15).

Additionally, creating more ways of using the application could potentially increase usage. One way of doing this was by the proposed idea of taking personal notes related to the user's diabetes (see figure 7.15). Creating a diary function where users could record their notes and feelings could be useful. This function could also be tailored to easily record the user's diabetes management with easy input of blood sugar levels, for example.

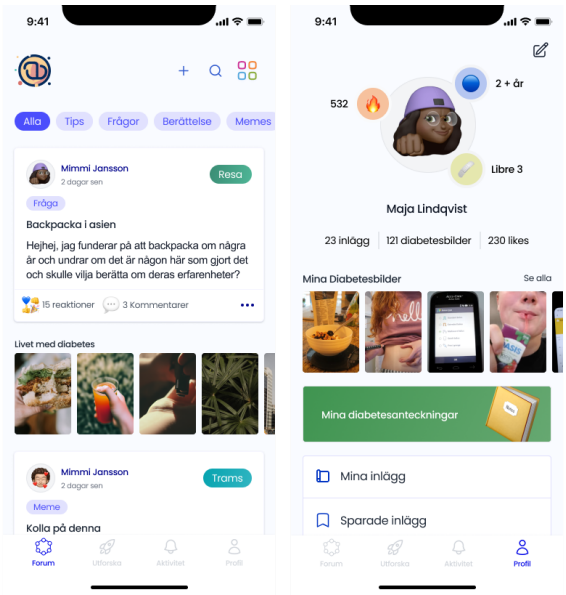

Figure 7.15: Additional pictures

7.3 Important Factors

This section provides a list of the factors which are important to consider when designing a peer-support application for teenagers with type 1 diabetes. A factor refers to a specific aspect or element that needs to be taken into consideration during the design process. Factors can be various elements that impact the app's usability, functionality, user experience, or overall success. These factors have been identified through previous research and research conducted during the current project, including user research, design, and testing. They are listed in no particular order of importance.

7.3.1 Peer support for knowledge exchange

Diabetes is a time-consuming diagnosis and requires both healthcare and lifestyle changes [17]. The interviews revealed the informational overload faced upon getting the diagnosis and how figuring out the best way forward is hard and confusing. It was also revealed through secondary and primary research that healthcare providers often do not have full insight into what it means to live with diabetes and, therefore can not always give sufficient advice. Many testified on how the most effective help came through people having had similar experiences guiding and giving them advice on how to handle mundane everyday things (see section 6.1.3), confirming the previous research suggesting peer support as an effective tool [24]. Creating structures that facilitate this support amongst peers is important for successful application. Peer support was also identified as having the potential to improve management outcomes and quality of life [24].

7.3.2 Favour independence

Teenagers with type 1 diabetes feel forced to grow up fast in order to manage such a complex disease [19]. At the same time, our interviews revealed that teenagers with diabetes tend to develop a strong dependency on their parents while dealing with the disease (see section 6.1.4.1).

Furthermore, teenagers with type 1 diabetes stated the importance of talking about preparing for independence when they are going towards adult life (see section 2.3.1.1)

Giving teenagers a place to get information on their own with support from others can increase confidence and knowledge in managing their disease and in turn allow them to become more independent. Enhancing knowledge can foster trust among parents, thereby reducing the necessity for excessive control as mentioned in section 2.1.2.

7.3.3 Preserve integrity

As discussed in the interview analysis in section 6.1.5.3, the constant surveillance of diabetes can lead to a feeling of intrusion of integrity. This is especially true in the case of parental surveillance and control. It is, therefore, important to consider how not to exacerbate this feeling. Allowing people to be anonymous can also preserve integrity. Moreover, prioritizing the users' preferences and allowing them to choose how they present themselves and their diabetes can be an effective way to maintain their integrity.

7.3.4 Promote ongoing activity

Previous research suggests that ongoing activity from members is important to serve the purpose of a peer support community [29] also mentioned in section 2.3.1.1. How to ensure activity was discussed at length during the project and many ideas were generated. Low activity was also identified as a pain point, possibly detouring users from using the app in the user journey mapping (see section 6.2.2) and through previous research (see section 2.3.1.1. Combating this issue, two possible sub-factors were suggested, lowering the threshold of publishing and increasing the ways of interacting within the application.

A lower threshold for publishing is important since a community relies on user participation. Aiding this process, the anonymity of identity when posting and commenting were included. Also, creating multiple ways for interaction between the user, the application, and between users. The additional features refer to posting images and increasing usage by taking notes within the app.

In addition, having additional features outside of the community, as suggested in the question box, can also promote ongoing activity. The more interesting things are included in the app the more reasons the user has to enter.

7.3.5 Sense of community

The lack of knowledge about diabetes in society became prevalent, examining previous research, with only 50% aware that it is the most severe disease affecting children [18]. The findings from the user research confirm the prejudice faced by diabetics and that it can feel alienating not to be understood and judged, this also aligned with the survey analysed where respondents testified feeling misunderstood and lonely (see section 2.3.1.2). Providing an online space where lived experiences are shared and understood can create a sense of community. This ties back to the importance of peer support in diabetes management, where help from others is crucial to find the best way forward (see section 6.1.5.4).

7.3.6 An easy and seamless user experience

Besides including the proper structure for peer support, ensuring an easy and seamless user experience is essential. The competitive analysis examining similar products (see appendix E) shows a lack of products efficiently delivering knowledge exchange. One important factor in this is finding the wanted information to avoid the same question being asked repeatedly. A seamless experience also increases user retention.

7.3.7 A positive and empowering environment

Teenagers with Type 1 diabetes often feel like they never get a break from managing their disease, making it a constant struggle in their daily lives [20], [30]. By fostering a positive and empowering environment, the community can provide a counterbalance to those feelings and offer support, encouragement, and motivation.

Furthermore, research showed the importance of a peer-support forum being non-judgmental [25]. During the interviews, it was also emphasized that teenagers with Type 1 diabetes preferred a helping hand rather than just receiving pointers (see section 6.1.5). Therefore, the focus should be on guiding and empowering the individual in finding their one way.

8

Discussion

This chapter discusses the project's result, process, ethical considerations and future work.

8.1 Project results

The design process's factors were identified through literature research, user research, user testing and prototyping. A complex consideration made throughout the design process was balancing the best design choices to achieve knowledge exchange and creating an attractive and desirable application for the target audience. Many of the design choices were based on how we can aid knowledge exchange the most efficiently, which led to filtering functions and searching. Confirming the product evaluation's success against the factors would be good to monitor. Achieving this would require further development into a functional product, something included in the demarcations of the project. However, being able to do this would clearly show how well the prototype fulfils the factors, if the peer-support structure is effective and if this can positively affect self-management and independence amongst youth with type 1 diabetes. What measures or features effectively promote activity and how to improve this would also become clearer through testing the prototype in real life.

During the design process, we acknowledged that not all of the features we included would necessarily be feasible for the initial implementation of the application. Instead, we focused on creating something that would resemble the final product as closely as possible in the future. However, not considering the minimal viable product (MVP) suitable for the initial implementation may have uncovered issues with the result. The issue primarily relates to how using separate sections could lead to an emptiness in the app because of the need for more content at the start. This could deter users from using the app if many of the rooms need more content in an early stage. To address this, intentional effort is required to create posts, it is crucial in the early stages to engage users by recruiting them for the task of creating posts.

Creating rooms can be advantageous in terms of lower the barrier to publishing content since it provides a designated area for specific topics to be discussed. However, determining the most suitable rooms can be a challenging task. This correlates to the previous objective of minimizing empty rooms, which requires consideration of

category selection. Ideally, a user should be able to find a suitable room for their content efficiently, but it may also be helpful to offer the option of posting in a catch-all room for users unsure where their content belongs. Minimizing the risk of confusion over where a user's content belongs would benefit the community's activity.

Many people can relate to the hesitation of sharing personal thoughts and opinions on public forums like social media, especially when their name is attachedthe option to remain anonymous when publishing or commenting was implemented to address this concern. However, the impact of anonymity on user perception can be discussed. Revealing people's identities can add credibility to posts and increase security. Despite this, the decision to retain the anonymity option was deemed more important to encourage community activity, lower the publishing threshold and preserve users' integrity.

The question box was added in order to complement the subjective input from users with scientific-based information. It is however important to consider the limitations and restrictions of not being a application providing medical advice. Therefore, some consideration in which questions are suitable to answer as well as how they are answered to not diverge from this limitation is needed. More research into this aspect and what the limit for medical advice is needs to be done.

8.1.1 Accessibility

As highlighted in section 3.2.3, considering accessibility was influential throughout the design phase to ensure simplicity and consistency across the app's interface. Colour and contrast have been discussed, especially considering the diverse colour requirements for different rooms. Striving to meet contrast standards posed a challenge due to the need for many various colours. To optimize the chances of meeting these requirements, we predominantly used deep colours and incorporated text and illustrations as complementary elements. In addition, colour was primarily employed within the rooms for consistency and recognition rather than conveying necessary actions. In cases where colour was used to indicate actions, such as on buttons, the contrast was examined to meet the necessary standards.

It's important to note that several aspects of accessibility outlined in the European Accessibility Act refer to technical implementation, which falls outside this project's scope. However, it is important to consider these aspects during the next development phase in future work.

8.2 Generalizability

During the project, it was decided to target users primarily between the ages of 13-17 years old. However, the need for a similar platform aimed at parents was also discussed as a potential future development or adaptation. Although the design focused on creating something specifically for the intended target group, scalability for different user groups was also in our minds.

As mentioned earlier, the creative process significantly emphasises creating frameworks for efficient knowledge exchange. This focus resulted from the thought of scalability. The final prototype structure could effectively work towards parents and relatives as well. However, the branding could be iterated and scaled back to appeal to a larger audience. A product could have different separated forums in the application for different audiences. Here some verification would have to be included to assure people are only using the forum intended for them.

Research on peer support studied (see section 2.2) in the literature review often referred to its success on chronic conditions in general. We can therefore argue that the application could be applied as a method for peer support in other diseases. Nevertheless, diabetes is a lifelong condition that requires ongoing disease management, unlike other illnesses where the goal may be to regain health. The demands of diabetes necessitate regular guidance, which makes the application well-suited for this purpose.

8.3 Process

This section discusses the process including the involvement of users, how remote interviews and testing affected the process and lastly some self-reflection.

8.3.1 User involvement

At the beginning of our project, we chose to keep it broad, focusing on the whole picture of living with diabetes for both parents and children. An alternative could have been to narrow the scope from the beginning and focus solely on teenagers and their experiences. By doing this, it would be easier to establish user requirements in phase two, which was based on data from our users. However, by broadening the scope and considering more perspectives, we landed insights we would have missed otherwise. For instance, data from the parent interviews led to insight regarding integrity and respecting the teenager's privacy. Even though the insight was strengthened by input from the young adults, the result could have been different and more insightful from the parent's perspective.

We used a convenience sampling method to select participants, where we distributed a form in various Facebook groups and reached out to personal contacts. Our primary focus was ensuring we had a representative sample regarding diabetes. For instance, we interviewed a parent whose child was recently diagnosed with diabetes and was managing the child's glucose levels at preschool. While we interviewed, another parent had two children and a husband with diabetes hence having much experience. This approach allowed us to gather various perspectives to interview people with different experiences.

However, focusing on getting representative selection regarding diabetes made us overlook some other factors. For example, we can not assure that our participants had a diverse socio-economic background or were native Swedish speakers or had good knowledge of the Swedish healthcare system. A parent mentioned this in an

interview as something which they believed would have affected the diabetes management situation a lot (see section 6.1.4.5). We could have gained more valuable insights by including more of these perspectives.

8.3.2 Remote interviews and testing

We decided to conduct all of our interviews remotely. One of the most significant benefits of remote user testing is its time efficiency. If we had conducted user tests in person, we would have needed to travel to the users' workplace or another location, which could have been time-consuming. Remote user tests allowed us to evaluate our work with multiple users in less time.

Furthermore, remote user testing also makes it easier to find participants since their geographic location is no longer a limitation. For us, participants could now be from all over Sweden. In our case, this was an even more significant advantage as it allowed us to gather insights from different regions where diabetes healthcare varies depending on the participants' region. Additionally, participants save time since they do not have to travel anywhere and can choose where they feel the most comfortable to be when having the interview.

During the interviews, we created the "Experience Timeline". We hoped it would positively affect the interview, which was proved right. We conducted two interviews without it; during those, it was harder to keep track, and the participant did not feel as comfortable with where to start and how much to add to their story. Moreover, starting with the timeline and asking users to describe their journey and critical points was practical. It allowed us to gather the information we could use to continue the conversation and ask more specific questions.

We prepared an interactive prototype for the user test to ensure an authentic experience. However, during our tests, we encountered challenges with remotely sharing control of the prototype with the participant. As a result, we had to adapt our approach, focus more on the think-aloud method, and allow the participant to guide us by verbally indicating where we should click instead. While this approach was less practical than allowing the participant to click independently, it still provided valuable feedback from the test.

Furthermore, conducting user tests in person would give the advantage of placing the prototype on the phone, making it even more realistic and more accessible for users to grasp. We considered this when planning the heuristic evaluation. We were, therefore, keen to conduct the tests in person since they focused heavily on usability, and the context is even more critical.

8.3.3 Self-reflection on the process

Overall we are happy with our process. We did face a wicked problem and utilized Research Through Design in an good way to come up with a solution. As stated in the background, there is a significant knowledge gap regarding diabetes in society today and we also had low knowledge about diabetes (see section 2.1.3). There-

fore, we worked extra hard empathizing with our users, which was extra important since we worked in a context without previous knowledge. The phases leading up to designing the application were essential for the project's success. By gaining these insights and reflecting them in our final designs, our result was based on real problems, not biased assumptions.

During the design phase, we intended to include an additional iteration between the second and third. During this phase, we would have evaluated the design with our target group and made refinements before progressing to the look and feel in the last iteration. This approach could have resulted in a final product that was even more aligned with the needs of our target group. Additionally, feedback gathered during the evaluation could have been more effectively incorporated into the design.

8.4 Ethical considerations

At the beginning of the process, some ethical considerations regarding the project and process were discussed. The ethical considerations involving users were identified as one of the more important things to consider. As mentioned in the previous section, participants under the age of 18 were not used during the interview, and this was due to ethical considerations. Interviewing young adults and parents hopes to fill in this gap instead. Nevertheless, we highly prioritized ethics during the interviews, where a consent form with a digital signature was required before the interview, ensuring they knew the terms of the interviews. Therefore, we maintained the process ethically and are satiated with the result.

During our user tests, see section 6.4, we included a 14-year-old participant. Ethically, we considered this approach to be justifiable compared to conducting an interview. The reasoning behind this decision lies in the fact that during the user test, the participant is only required to provide feedback on the app we present to them, without disclosing any personal information. In contrast, interviews typically delve into more personal matters, including medical aspects, which significantly differ from the context of our user tests.

8.4.1 Product risks

Along the same lines as the anonymity discussed above, interview participants expressed the need to ensure that the platform was exclusively for users (teenagers) and prevent parents from accessing content. This exclusivity was seen as a way to foster a stronger community and a safe space. However, allowing anonymity in posts can make it easier for unauthorized users to join the platform. To combat this, it was discussed to allow users to verify their identity using tools like mobile bank id, not for their identity to be published but for the application to know the actual user behind each account. One option could be to only allow the anonymity feature to verified users.

An online platform based on personal advice from individuals is prone to misinformation. Though clear community guidelines are necessary, it is challenging to

regulate user-generated content. While moderators may be required, we have to ensure that users do not feel restricted or monitored, as it may impact their sense of integrity. This risk of misinformation to users is a concern, given the platform's focus on diabetes. Thus, it is essential to address this issue. Hopefully, guidelines, mindful moderators and the ability to report alarming content can help address and minimize these issues.

Having diabetes comes with many challenges, and as mentioned in the introduction (see chapter 1), anxiety, depression, and eating disorders are common in the group. While connecting with others through a platform can be beneficial for such individuals, there is also the concern of sharing risky information related to the psychological issues mentioned above. Additionally, it is essential to consider the potential sense of isolation that users may experience if they cannot relate to the content posted by others.

8.5 Future work

Considering the project's time constraints, certain aspects will require additional attention in future work. Moving forward, the design needs to be iterated, incorporating the feedback from the evaluation, which is the final method of the project. Additionally, conducting more user research and testing with the target audience is crucial to ensure that the final product meets their needs and requirements.

In our final designs, we explored additional features aimed at creating a more engaging user experience with interactive elements (see section 7.2.2). One particular aspect we discussed was the potential incorporation of gamification in the interaction score. This opens up opportunities for further exploration in future work.

It is important to remember that the current selection of rooms has been chosen based on our own assumptions and biases, which may not necessarily exactly align with the needs and preferences of the target group. It is therefore important for future work to revise and reassess these room choices together with the target audience to ensure an inclusive and relevant selection. In addition, it is important to consider the possibility of low usage during the initial stages of the app's launch. It is worth considering whether it would be beneficial to temporarily exclude certain rooms that may not have many user posts initially. Having empty rooms without any posts can be counterproductive and may detract from the overall user experience. Designing the initial launch phase is a critical aspect to consider for future work if this app were to be launched.For a marketable product it is also important to consider its launch and how to get users, and also how to promote usage over time can be done.

Last but not least, as the project revealed, obtaining the diagnosis is hard for everyone involved, and the amount of knowledge needed can be overwhelming. To ensure the highest impact, support has to be provided for both parents and diabetics. Finding ways to scale the product into more target audiences while keeping the forums separated would be the optimal goal.

9

Conclusion

The purpose of this project was to investigate the experience of people affected by diabetes either as diabetics themselves or close relatives. The project thereafter aimed to meet the identified challenges by designing a mobile application to help teenagers get the knowledge necessary to confidently and successfully manage their diabetes. Through research through design the thesis aimed to answer the following research question:

What are important factors to consider when designing a peer-support application for teenagers with diabetes type 1?

The answer to this question was found by interacting with potential users and their parents where the everyday challenges were identified. This was then used for iteratively creating a design of an application meeting these needs. The prototype created is of an application called Diko and can be seen in the the result (see section 7.1). The factors identified are explained at length in section 7.3 however they are listed as follows:

- Peer support for knowledge exchange
- Favour independence
- Preserve integrity
- Promote ongoing activity
- Sense of community
- An easy and seamless experience
- A positive and empowering environment

These are all important factors to consider when designing a peer-support application for teenagers with type 1 diabetes. It is important to acknowledge the possibility of more factors not being identified through the process, motivating further research. However, this gives an initial ground to build upon and the final prototype gives inspiration on how an application could look.

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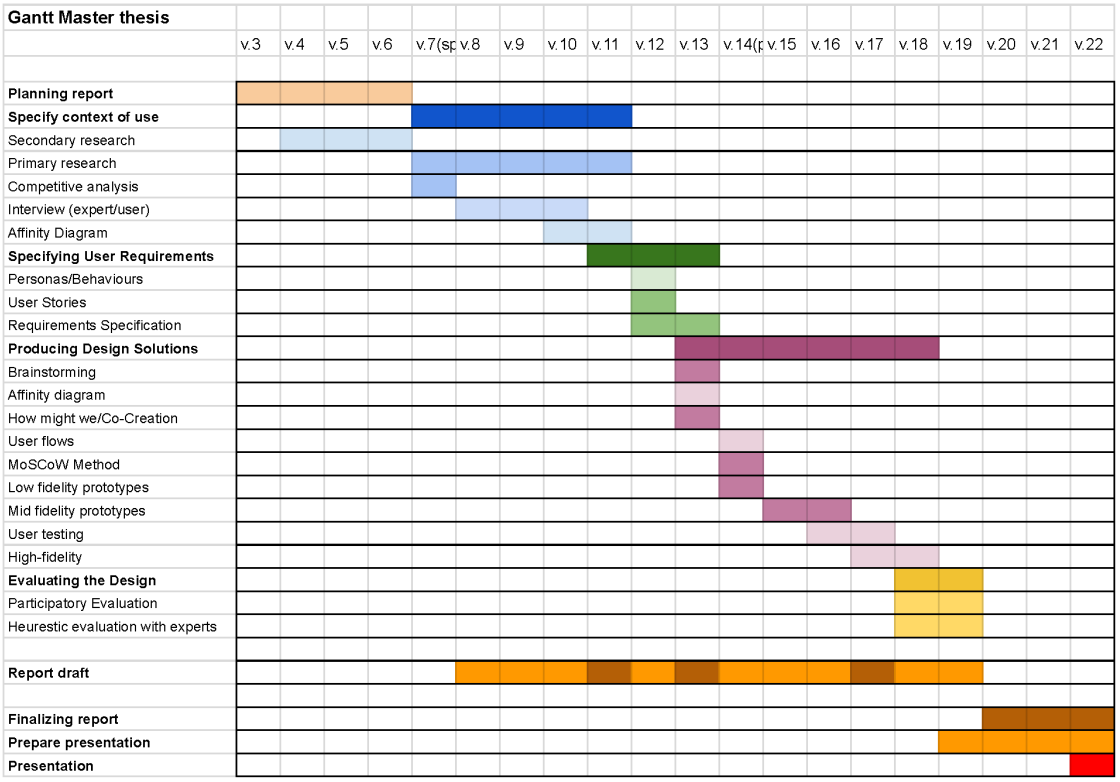
A

Appendix: Planning



B

Appendix: Information letter and Concent form

Informationsbrev och godkännande av medverkan i intervjustudie

Preliminär projekttitel: Utformning av en stödjande digital plattform för personer som lever med eller kring diabetes typ 1.

Genomför intervjun: Rebecka Hansson & Linnéa Adielsson

Syftet med denna intervju är att få en djupare förståelse för hur det är att leva med diabetes typ 1, antingen som en person som själv har diagnosen eller som en nära anhörig. Målet är att genom insikter kunna identifiera upplevelsen och de utmaningar som finns. Baserat på dessa insikter kommer vi att undersöka hur teknik och design kan används för att stödja personer påverkade av diabetes typ 1.

Tack för att du har visat intresse för att bli intervjuad som en del av ovan nämnda projektet. Etiska rutiner för akademiskt skrivande kräver att intervjuade ger sitt samtycke angående hur informationen som finns i deras intervju kommer att användas. Detta samtyckesformulär är nödvändigt för att säkerställa att du förstår syftet med din medverkan och godkänner deltagarvillkoren. Vi skulle därför vilja att du läser igenom det informationen nedan och sedan skriver under detta formulär för att intyga att du godkänner följande: Intervjun kommer att spelas in och kommer därefter transkriberas.

Transkriptionen av intervjun kommer att analyseras av Rebecka Hansson och Linnéa Adielsson. Tillgång till intervjun kommer att begränsas till Rebecka Hansson och Linnéa Adielsson samt handledare och samarbetspartners som är den del av projektet. Utdrag av intervjuinnehållet eller direkta citat från intervjun som används i rapport kommer att anonymiseras så att du inte kan identifieras.

Faktiska inspelningar kommer att bevaras till godkänd masteruppsatsen och sedan raderas.

Genom att signera dokument samtycker jag till att:

- Jag har läst dokumentet
- Jag deltar frivilligt i denna intervjun och att jag kan avbryta medverkan när som helst. Vid avbruten intervju kan även tidigare inspelat material raderas

vid önskan.

- Jag förstår att intervjun kommer spelas in och transkriberas, materialet användas som beskrivet ovan
- Jag har fått möjlighet att ställa frågor och jag förstår att jag kan kontakta Rebecka Hansson eller Linnéa Adielsson om fler frågor skulle uppstå.

C

Appendix: Interview Questions Adolescence with T1D

Introduction to Master Thesis
Masteruppsats på Chalmers Tekniska Högskola inom interaktionsdesign, vilket fokuserar på design av digitala produkter. Tillsammans med RISE (Research Institute of Sweden) vill vi undersöka upplevelsen av att leva med diabetes typ 1 och hur teknik och design kan används för att stödja personer påverkade av diagnosen.

Såhär tidigt i processen håller vi de öppet och vill kartlägga upplevelsen som finns och vart de finns möjligheten att skapa en produkt som kan underlätta och hjälpa. Intresserade av dig och dina tankar.

Vi kommer använda resultaten för att ta fram en digital produkt och vi har dialog med Barndiabetesförbundet redan nu och kommer dela alla resultat med dom.

Vi kommer börja intervjun med lite frågor om dig och din koppling till diabetes, därefter kommer vi gå igenom och prata kring den upplevelse karta du fyllt i. Därefter kommer vi gå in på övriga frågor kring ditt liv och hur diabetes har påverkat det, vi kommer både fråga frågor om som rör ditt barns upplevelse och om dig själv. Har du några frågor till oss innan vi börjar, kring intervjun/consent from ex.

Introductory questions
Börja med att introducera dig själv och din koppling till diabetes?

The experience timeline
Kan du ta oss igenom kurvan du fyllt i för din tidslinje och de händelser du valde ut?

Ending questions
Kan du berätta om en vanlig dag i ditt liv, om alla interaktioner du har med din diabetes?

Vilka produkter / tekniker använder du dig av i din vardag för att hantera din diabetes?

Var vänder du dig för stöttning?

Hur har behovet ändrat sig över åren, när behövdes det mer eller mindre?

- Hur/vart har stödet ändrats

Vården, har den varit bra, hur ser er interaktion ut?

Hur upplever du att omgivningen bemöter dig då de får veta att du har diabetes?

- Känslor? - Hur har upplevelsen i skolan varit? - Vänner / Familj - Känner du dig förstådd?

Största motivationsfaktorn?

Vad tror du är framgångsfaktorerna för att må bra med diabetes?

Vilket råd skulle du ge till någon som nyligen fått diagnosen typ 1-diabetes?

Finns det något du saknar? Om du skulle få gå tillbaka när du fick/under åren diagnosen vad hade du önskat?

Är det något mer du vill tillägga?

D

Appendix: Interview Questions Parent to Child with T1D

Introduction to Master Thesis
Masteruppsats på Chalmers Tekniska Högskola inom interaktionsdesign, vilket fokuserar på design av digitala produkter. Tillsammans med RISE (Research Institute of Sweden) vill vi undersöka upplevelsen av att leva med diabetes typ 1 och hur teknik och design kan används för att stödja personer påverkade av diagnosen.

Såhär tidigt i processen håller vi de öppet och vill kartlägga upplevelsen som finns och vart de finns möjligheten att skapa en produkt som kan underlätta och hjälpa. Intresserade av dig och dina tankar.

Vi kommer använda resultaten för att ta fram en digital produkt och vi har dialog med Barndiabetesförbundet redan nu och kommer dela alla resultat med dom.

Vi kommer börja intervjun med lite frågor om dig och din koppling till diabetes, därefter kommer vi gå igenom och prata kring den upplevelse karta du fyllt i. Därefter kommer vi gå in på övriga frågor kring ditt liv och hur diabetes har påverkat det, vi kommer både fråga frågor om som rör ditt barns upplevelse och om dig själv. Har du några frågor till oss innan vi börjar, kring intervjun/consent from ex.

Introductory questions
Börja med att introducera dig själv och din koppling till diabetes?

Frågor kring tidslinjen
Kan du ta oss igenom kurvan du fyllt i för din tidslinje och de händelser du valde ut?

Skillnad på din och ditt barns upplevelse?

Ending questions
Kan du berätta om en vanlig dag i ditt liv, om alla interaktioner du har med ditt barns diabetes?

Vad är den största skillnaden på innan och efter ditt barns diagnos?

Hur hjälper du ditt barn att förstå och hantera sin diabetes?

Hur känner ditt barn om sin diabetes och hur får dom stöd?

Hur har ditt barns diabetes påverkat deras relation med vänner?

Vilka resurser, produkter eller stödsystem förlitar du dig/ditt barn på för att hantera hens diabetes?

Vart finner du stöd? Vilka resuser finns det för er föräldrar?

Vilka råd skulle du ge till andra föräldrar till barn med typ 1-diabetes?

Vad tror du är framgångsfaktorerna för att må bra med diabetes? Både för familjen och barnet

Något du vill tillägga?

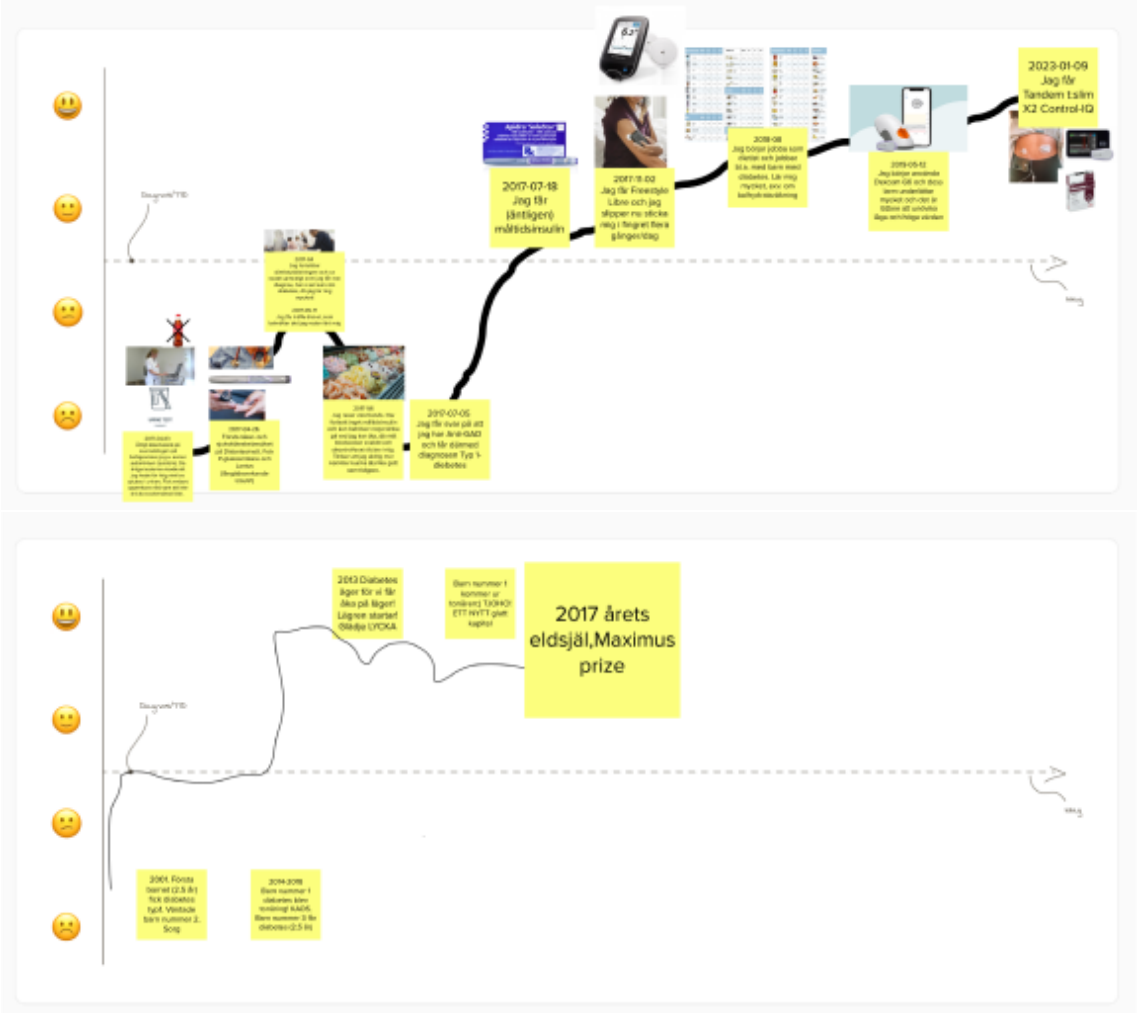
E

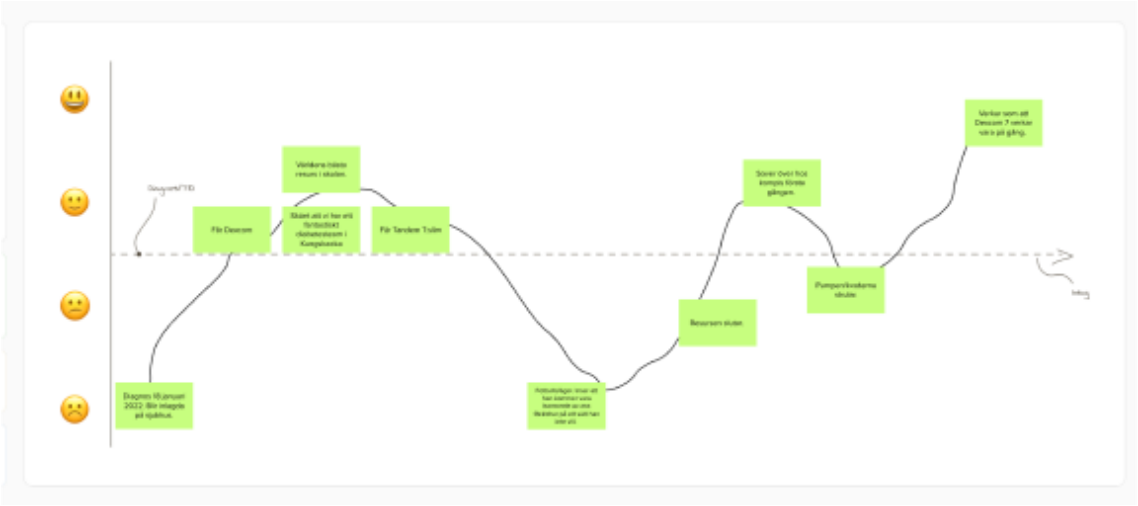
Appendix: Competitive analysis

ServiceFeature	T1D	Aibetic	MySugr	Diabetesnirja	Bezzy Type 2 Diabetes	The diabetes app	Chronos Care: Diabetesvård	Facebook: Föräldrar till barn med diabetes typ 1	Podcast	Youtube	Tiktok	Svenska diabetesförbundet
Blood sugar monitoring	X	X	X	X								
Meal and activity logg	X	X	X	X								
Carb and insulin calculator	X	X		X								
Individual recomendations		X					X	X				
News and information about diabetes (science)	X	X										X
Knowledge training diabetes (ex quiz)	X	X	X	X			X					X
Emotional support / recognition						X	X	X	X	X	X	X
Community/User interaction						X		X				X
Design/Usability	Good design and is easy to navigate	Good design	Poor design				Good design	-			Not online	
Strengths	Need to input data manually, the AI is dependant on how much you input	Machine learning to offer personalized diabetes recommendations based on inputted data				In english. For adults, not used in sweden i think	Only for diabetes type 2	Subjective and personal experience s, risk of misinformation. Not science backed	Subjective experience s, risk of misinformation	Subjective experience s, risk of misinformation	Subjective experience s, risk of misinformation	Not online, your support is based on where you
Weaknesses	No emotional support or community	Developed together with Karolinska universitets sjukhuset High credibility and widely used		For type 2 diabetes			Video-meeting app with healthcare professionals. Guiding and help with handling diabetes type 2	Communication between parents on personal issues and tips. Subjective sharing of experiences. Possible to search for peoples previous enteries	Listening to other peoples experience s.	Listening to other peoples experience s.	Listening to other peoples experience	live. Bigger commitments needed to participate
General notes	The biggest app in scandinavia											

F

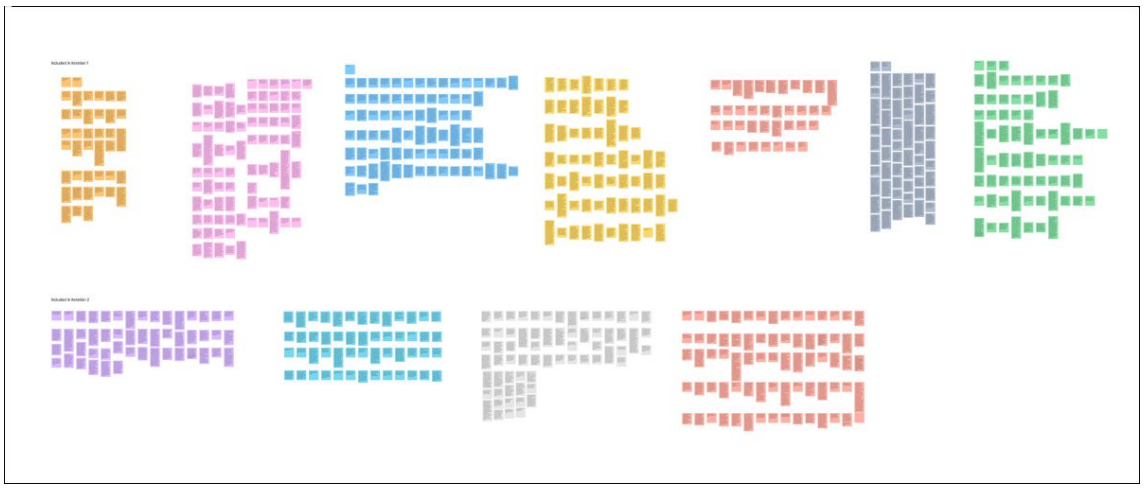
Appendix: Experience Timline Examples





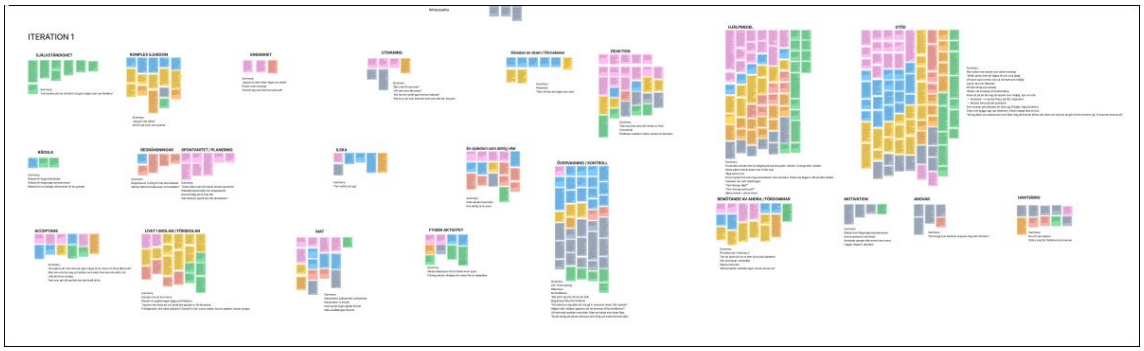
G

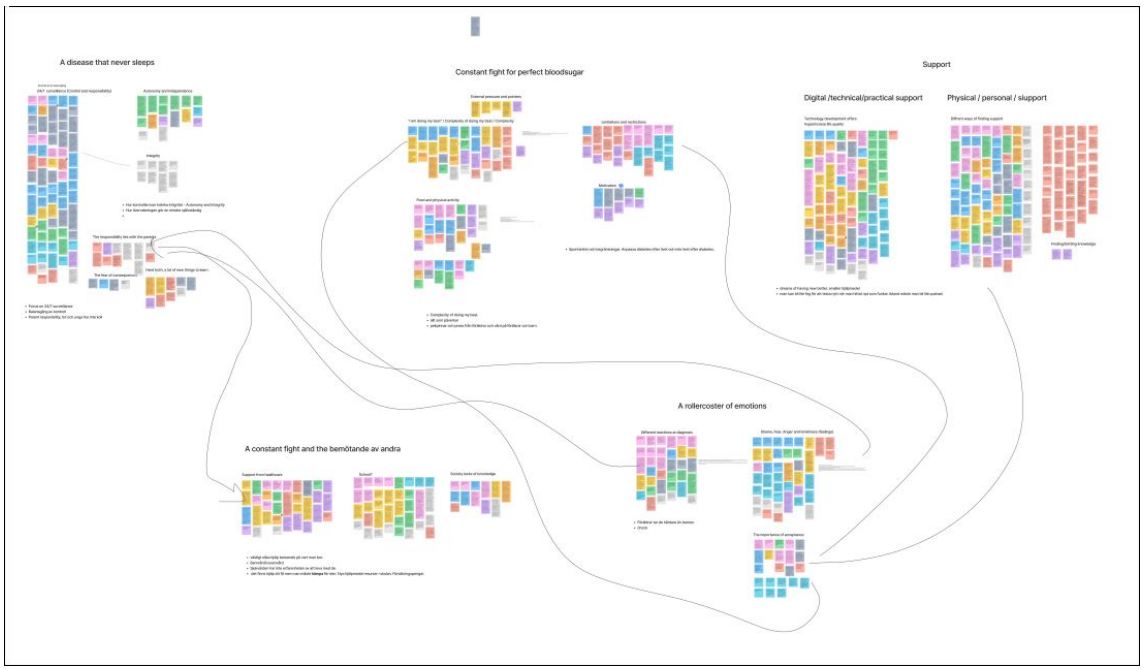
Appendix: Post-its from transcription



H

Appendix: Analysis of interviews





I

Appendix: User stories

Parent

- As a parent to a child with diabetes 2+ years, I want to read about parents with older children, to know what is coming.
- As a parent to a child with diabetes for 2+ years, I want to share my experiences, so that others can learn from my journey.
- As a parent to a child with diabetes 2+ years, I want to stay updated on new technology to provide my child with freedom.
- As a parent to a newly diagnosed child, I want to be able to ask for advice, so that I can be inspired by how others manage their child's diabetes
- As a parent to a newly diagnosed child, I want to be able to find other parents, so that I can relate and donẗt feel so alone
- As a parent to a child with diabetes 2+ years, I want to hear about others' success stories, to see how to inspire and motivate my child.
- As a parent to a newly diagnosed child, I want to read information from credible sources about diabetes to learn more about the disease.
- As a parent to a newly diagnosed child, I want to ask for tips and advice, so that I can focus on medical question when I go to the hospital.
- As a parent to a newly diagnosed child, I want to hear that everything will be okey from people talking out of experience, so that I can feel less frightened.
- As a parent to a child with diabetes for 2+ years, I want to share my experiences, so that others can learn from my journey.
- As a parent to a child with diabetes 2+ years, I want to read about parents with older children, to know what is coming.
- As a parent to a child with diabetes 2+ years, I want to talk to other children, to see how I can help my child.
- As a parent of a teenager with diabetes, I want to read more about puberty and alcohols effect on diabetes, so that I can prepare my child for those experiences.
- As a parent to a teenager with diabetes

- As a parent to a child with diabetes, I want to talk to others, so that I can learn more

Diabetic

- As a person newly diagnosed with diabetes, I want to read stories from others, so that I don't feel alone.
- As a person newly diagnosed with diabetes, I want to read stories from others, so that I feel empowered.
- As a person experienced with diabetes, I want to get quick answers about new problems I find in my everyday life, so that I can find a good solution without having to try too many options.
- As a person newly diagnosed with diabetes, I want to read stories from others, so that I dont feel alone.
- As a person newly diagnosed with diabetes, I want to read stories from others, so that I feel empowered.
- As a person newly diagnosed with diabetes, I want to read stories from others, so that I feel I will be able to live a fullfilling and normal life.
- As a person newly diagnosed with diabetes, I want to connect with others with diabetes so that I have someone to talk to.
- As a person experienced with diabetes, I want to stay updated on new technology, so that I can improve my managment.
- As a person experienced with diabetes, I want to handle my diabetes on my own, so that I can feel as something more than my diabetes

J

Appendix: User flows