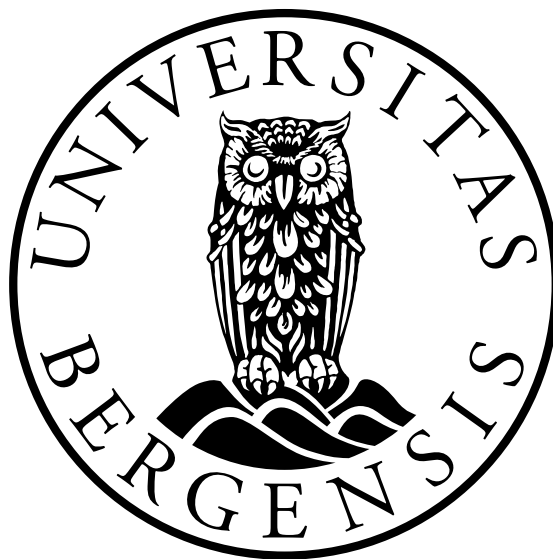


Designing an Online Intervention for Adults with ADHD

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Abstract

Attention-deficit/hyperactivity disorder (ADHD) affects humans across a life span. However, the available treatment resources are quite limited for adults with ADHD. In this study, a mobile application is designed to help support interaction in-between group therapy sessions. The Companion app is designed to be a part of an intervention targeting emotional issues in adults with ADHD, based on principles from Dialectical behavior therapy (DBT).

The methodology applied in this thesis is Research through Design (RtD), and participatory design methods were applied in the design and research process. Hence, this research included participation from clinical experts, adults with ADHD, and UX/HCI experts ensuring that researchers from relevant fields and potential users were involved in the design of the intervention.

Previous research finds that users' participation in the design process is important to ensure valuable products. In the context of mental health applications, the involvement of users with lived experience can contribute to a better understanding of user needs and limit the risk of low usability. Furthermore, several features were found to be useful in supporting interaction in-between group therapy sessions. By implementing peer support, homework, journals, and other resources, principles from DBT can be transferred into a digital format.

This research resulted in a prototype of the Companion app, including several features based on data from previous research and the design process. The results indicate that ADHD users are positive to the use of online interfaces in the context of therapy. Nevertheless, the Companion app should be tested in the context of a therapy intervention to ensure effectiveness.

Contents

Acknowledgements	i
Abstract	iii
1 Introduction	1
1.1 Research questions	2
1.2 Contribution	3
1.3 Thesis outline	4
2 Background and related work	5
2.1 Human Computer Interaction	5
2.1.1 User Experience (UX)	7
2.2 Attention deficit hyperactivity disorder (ADHD)	8
2.2.1 Diagnosis	9
2.2.2 Treatment	9
2.2.3 Adults and ADHD	10
2.3 Computer-aided psychotherapy	11
2.4 Dialectical behaviour therapy	12
2.5 Online interventions for mental health	13
2.5.1 Existing applications for ADHD	14
2.5.2 Useful resources	14
2.5.3 Barriers in online interventions	15
2.5.4 Participation in the design process	16
2.6 Design Considerations	18
2.6.1 ADHD	18
2.6.2 Mental health	19
2.7 Chapter Summary	20
3 Methodology	21

3.1	Research through design	21
3.1.1	Wicked problems	21
3.1.2	Why RtD?	22
3.2	Design methods	22
3.2.1	Participatory design	22
3.2.2	Prototyping	24
3.2.3	Establishing requirements	24
3.2.4	Design workshops	25
3.2.5	Conceptual design	25
3.2.6	Design sprint	25
3.3	Ethics	26
3.4	Evaluation	26
3.4.1	Data gathering	27
3.4.2	Participatory evaluation: workshop	28
3.4.3	Sampling participants	28
3.4.4	Evaluation of RtD	29
3.5	Chapter Summary	30
4	Conceptual design and requirements	31
4.1	Tools	32
4.2	Phase one: initial ideas	32
4.2.1	First meeting: introducing the Companion app	32
4.2.2	Literature review: barriers and opportunities	34
4.2.3	First set of requirements	36
4.2.4	Summary	36
4.3	Phase two: user involvement	36
4.3.1	Design workshop	36
4.3.2	Establishing requirements	39
4.3.3	Low-fidelity prototype	40
4.3.4	Summary	43
4.4	Chapter summary	43
5	Prototyping and evaluation	45
5.1	Design sprint	45
5.1.1	Design critiquing and new ideas	46
5.1.2	Expanding and mapping the prototype	48
5.1.3	Interactive prototype	49
5.1.4	Final design critiquing	53

5.1.5	Summary	54
5.2	Evaluation workshop	54
5.2.1	Additional requirements	56
5.2.2	Summary	57
5.3	Chapter summary	57
6	Results: final prototype	59
6.1	Final requirements	59
6.2	Companion-app	60
6.2.1	Peer-support	60
6.2.2	Favourite exercises	61
6.2.3	Calendar	61
6.2.4	Settings	62
6.2.5	Exercises	62
6.2.6	Journal for post exercises	63
6.2.7	Journal for emotions	64
6.2.8	Psychometric assessment	65
6.2.9	Conceptual model - proof of concept	65
6.3	Chapter summary	66
7	Discussion	67
7.1	Designing online interventions: possibilities and challenges	68
7.1.1	Design implications: useful features	69
7.1.2	Design considerations	70
7.1.3	Participation in the design process	72
7.2	Research contribution	73
7.3	Research questions	74
7.4	Limitations	76
7.5	Chapter summary	76
8	Conclusions and Future Work	77
8.1	Future work	78
	Appendix A: NSD approval	91
	Appendix B: Consent-form	95

List of Figures

- 2.1 Resource-demand imbalance in adults with ADHD. 11

- 4.1 Proof of concept: outline of the intervention 34
- 4.2 Low fidelity prototype of the home screen and weekly modules . . 40
- 4.3 Low fidelity prototype of the resource centre and psychometric assessment 41
- 4.4 Low fidelity prototype of the calendar and journal features 42

- 5.1 Flow-chart visualizing the structure of the interface 48
- 5.2 Prototype visualizing the "main page", "my page", and calendar . 50
- 5.3 Error message 50
- 5.4 Prototype visualizing modules, weekly module example, and one exercise 51
- 5.5 Low fidelity prototype visualizing post-exercise evaluation and sharing 52
- 5.6 Prototype visualizing the journal, resources, and settings 53

- 6.1 Final prototype of the "main page" and "happenings" 60
- 6.2 Final prototype of "My page", calendar, and settings 61
- 6.3 Final prototype of weekly modules and example of a weekly module and exercise 62
- 6.4 Evaluation post-exercises and sharing 63
- 6.5 Final prototype of the journal 64
- 6.6 Final prototype of the psychometric assessment 65
- 6.7 Final conceptual model 66

List of Tables

- 3.1 The design process: project phases 30
- 5.1 Design sprint: main activities 45

Chapter 1

Introduction

Everyone may experience mood swings, demanding emotions, or fluctuating energy levels throughout their lives. Such reactions can make it harder to manage time properly, stay focused on challenging tasks, or give spontaneous desires to do something new. For most people, such emotional characteristics will not affect their well-being or quality of life, as they are merely a part of being human. However, some people experience it so frequently and strongly that their emotional reactions impact their day-to-day life and make it more difficult to function properly. Attention-deficit/hyperactivity disorder (ADHD) is a neurodevelopmental disorder which is characterised by impairment levels of inattention, impulsivity and/or hyperactivity (American Psychiatric Association, 2013b, p.32).

ADHD may generate an inability to focus, stay on task, and pay attention (ADHD Norge, n.d). Further, ADHD can also entail the inability to remain seated and may induce over-activity and restlessness. ADHD tends to persist into adulthood, often leading to difficulties in social, occupational, and academic functioning (American Psychiatric Association, 2013b, p.32). The number of people living with ADHD is uncertain as different studies indicate different numbers depending on sample population, methods, and use of diagnostic criteria. The Norwegian Directorate of Health estimates that ADHD occurs in approximately 5% of children and approximately 2.5 % of adults (Helsedirektoratet, 2018a). In childhood, boys are more frequently diagnosed with ADHD relative to girls. This gender difference appears to be less prominent in adulthood, which may indicate that many girls are overlooked and thus receives the diagnosis later in life (Biederman et al., 2004).

Medications are the primary treatment for adults with ADHD, but many seek additional psychological treatment (National Institute for Health and Care Excellence, 2019; Solberg et al., 2019). Among available psychological approaches for ADHD, Dialectic Behavioral Therapy (DBT) is shown to be a promising approach (Fullen et al., 2020). The treatment is based on individual therapy and group therapy focusing on skill training, mindfulness, and distress tolerance (Cole et al., 2016). Computer-aided Psychotherapy (CP) has also become a more accepted treatment method during the last few decades (Lungu, 2015). Some of the many benefits of computer-aided therapy are its low cost, high accessibility, low stigma, and its potential elimination of several logistic problems.

The access to smartphone applications providing some sort of ADHD management or skill training is quite high, although most of these focus on children or parental guidance (Spiel et al., 2022). Furthermore, there is a disproportion between available applications and applications connected to research, indicating that most available apps are not thoroughly tested and evaluated (Păsărelu et al., 2020). While research suggests online interventions to be a promising method, new interventions should be assessed in the context of treatment and effectiveness.

This thesis work is a part of a more extensive therapy intervention focusing on the emotional challenges in ADHD patients. The intervention uses DBT methods to target these challenges and is based upon a multi-modal approach, including in-person therapy and an online intervention. Within this project, a subproject is to design the online intervention that participants can use in between group therapy sessions. The research is conducted in collaboration with the Division of Psychiatry at Haukeland University Hospital, Department of Biological and Medical Psychology at the University of Bergen, and Department of Information Science and Media Studies at the University of Bergen.

1.1 Research questions

This thesis project aims to find out how we can design an online intervention that supports interaction between group therapy sessions, focusing on adults with ADHD. More concretely, the problem space aims to examine how we can design the intervention and transfer principles from Dialectical Behavior Therapy to a digital format. The research questions of this thesis are:

RQ1: How can we support interaction in-between group therapy sessions for adults with ADHD?

RQ2: How can we design an intervention based on principles from dialectical behavior therapy?

The literature review provides information about previous research on related topics. Furthermore, participation from both potential users and clinical experts in the design process enabled a better understanding of requirements. In order to answer the two research questions above, both existing literature and findings during the design process was highly relevant.

1.2 Contribution

Most existing research in this specific field today have mainly three relevant limitations. (1) Most studies on ADHD-related research in the field of HCI targets children specifically (Husain, 2020; Spiel et al., 2022, p.36). Nevertheless, ADHD still occurs in approximately 2.5% of the adult population, making it important to focus such research on the adult patient group. (2) The number of available mobile applications for adults with ADHD is high. However, there exists a gap between the number of available resources and research on this topic, indicating that most available resources are not appropriately evaluated (Păsărelu et al., 2020). (3) Additionally, the involvement of potential users in the design/development process is relatively low in existing research (Spiel et al., 2022), although including users in the design process is found to enable better working technology, as researchers lack the lived experience (Flobak et al., 2021; Yardley et al., 2015). These three factors motivated the research objective of this thesis. Furthermore, the novelty of this thesis is based on the inclusion of DBT principles in the intervention and the fact that the intervention should support interaction in between therapy sessions. This research will contribute to the field by providing a prototype designed in collaboration with both potential users and relevant health care experts.

1.3 Thesis outline

Chapter 1: Presents the research questions for this thesis, as well as the research contribution.

Chapter 2: Presents relevant background and literature to this research.

Chapter 3: Presents the methodology and methods used in the research process.

Chapter 4: Describes the initial design phase, including the design workshop.

Chapter 5: Describes the third and fourth phases, including the design sprint and the evaluation workshop.

Chapter 6: Describes the final prototype and conceptual model.

Chapter 7: Provides a discussion of both concept, results, and the research questions.

Chapter 8: Presents the conclusion of this thesis and future work.

Chapter 2

Background and related work

This chapter focuses on topics that are pertinent to the master's thesis. Firstly, an introduction to human-computer interaction (HCI) will be presented, as this is the thesis's primary research area. Secondly, an overview of ADHD will be presented, focusing on the diagnosis, occurrence, and treatment. Further, a review of computer-aided psychotherapy and Dialectical Behavior Therapy will be conducted, as these two therapy methods are the foundation of this thesis. Research on excising applications, participation in the design process, and design considerations will also be included. Lastly, a summary of the main findings will be presented.

2.1 Human Computer Interaction

As human computer interaction (HCI) evolves around human involvement, it is often stated to be quite a complex research area (Lazar et al., 2017, p.1). The field of study is broad and therefore not easily defined, but Hewett et al. (1992) suggests:

Human-computer interaction is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them.

Hewett et al. (1992)

Interaction is the centre of HCI research, especially regarding the interaction between humans and computers. Today, HCI research can be seen as a

broad, interdisciplinary field covering computer science, sociology, psychology, communication and industrial engineering, amongst many (Lazar et al., 2017, p.2).

As a field of research, HCI was officially founded in 1982, but there however exist some preliminary studies that relate to modern HCI, tracing all the way back to the 1950's (Lazar et al., 2017, p.1). With the emergence of computers constituting a significantly greater role in humans' daily and work lives, the need for well-developed and functional technology has surged. This emergence has also created an opportunity space for not only improvement, but for research and development of new and undiscovered opportunities. As technological change is highly eminent, HCI is a dynamic field constantly adapting to what is relevant (Lazar et al., 2017, p.3). For instance, in the early 90s, the acceptance of the web and the Internet shifted the focus of HCI research as new interfaces such as email and web pages arrived. Around 2004, the focus of research shifted to user-generated content, like blogs, wikis, and videos. The most prominent focus today is users' satisfaction when using artifacts, as the product space and possible choices for users have grown massively. Offering a well-designed interface is therefore crucial in today's environment.

There are several types of research contributions in the field of HCI (Lazar et al., 2017, p.3). Empirical and artifact contributions are the most common, but methodological, theoretical, dataset and opinion contributions occur. This thesis will contribute with an artifact, meaning the design and research of a new artifact.

HCI research should always be relevant and practical to either people, designers, or organizations (Lazar et al., 2017, p.7). Historically, the field of HCI has had a strong focus on achieving practical results that may improve the quality of life of users. Oulasvirta & Hornbæk (2016) shifts the focus from being concerned with "valid" research or following the "right" approach to rather focusing on solving important problems in human use of computers by applying an agile, problem-solving approach. This perspective enables less discipline-oriented approaches to HCI research by rather focusing on solving the issue at hand (Oulasvirta & Hornbæk, 2016, p.4965). They further divide research problems within HCI into three different categories: empirical, conceptual, and constructive (Oulasvirta & Hornbæk, 2016, p.4958). While empirical problems are defined by "creating or elaborating descriptions of real-world phenomena related to human use of computing", conceptual problems focus on "explaining previously

unconnected phenomena accruing in interaction". Constructive problems, on the other hand, are defined by "producing understanding about the construction of an interactive artifact for some purpose in human use of computing". This type of problem either has no known solution, partial or ineffective solutions, or insufficient knowledge or resources for implementation or deployment (Oulasvirta & Hornbæk, 2016, p.4959). The latter is relevant for this thesis as the research will focus on an unsolved matter, which can be described as a constructive problem by the overlying definitions. Evaluating the outcome after attempting to solve a constructive problem is quite common, something this thesis also will do.

2.1.1 User Experience (UX)

User experience, also referred to as UX, reflects all aspects of user interaction with a product (Sharp et al., 2019, p.13). UX is concerned with how people feel about a product, as well as their level of satisfaction and pleasure in connection with the use. UX is not exclusive to digital products, in fact it is relevant to every product that is used by someone. Both the overall impression and minor details can effect how well a user feels about the product at hand, and the UX spans from visual impressions to the actual interaction. As mentioned, today's HCI research and design practice has become very concerned with creating good experiences for the users, which in turn makes UX an important element in the field. Understanding end-users thoroughly is crucial in a successful design process.

Phil Turner (2017) defined UX from a psychological perspective using three dimensions; involvement, affect and aesthetics. Involvement focuses on our use of technology and the finding that we are not independent nor uninterested when we use technology (Turner, 2017, p.24). Different relations may arise with different digital tools, so understanding the involvement aspect of use is therefore far-reaching. In relation, affect defines the feelings, mood and impressions users get from the interaction (Turner, 2017, p.75). Emotions are especially important as they help users to decide how they feel about a product. While affect focuses on how we receive things, aesthetics defines how attractive an artifact is, either by its design and/or functionalities (Turner, 2017, p.109). Creating inviting functionalities and appealing design may greatly improve user experience. In total, these three dimensions are important to consider when creating user-interfaces.

Several aspects of user experience can be taken into consideration in the design process. Nevertheless, there are some of central importance that always should

be kept in mind; usability, functionality, aesthetics, content, look and feel, and emotional appeal (Sharp et al., 2019, p.15). Another characteristic elaborated as an important feature is the aspect of fun. John Carroll highlights how fun can be used to provoke user engagement, saying "... in circumstances where human-computer interaction is discretionary, and especially where it involves sustained user activity, ease and simplicity are just not enough" (Carroll, 2004, p.38). Further, Carroll mentions awareness that users may be quite differentiated as a substantial focus area in the design process. He mentions user characteristics such as health, social capital, cultural identity and education.

2.2 Attention deficit hyperactivity disorder (ADHD)

Attention deficit hyperactivity disorder (ADHD) is a persistent and prevalent neurodevelopmental disorder (American Psychiatric Association, 2013a). Although ADHD debuts in childhood, the symptoms persist into adulthood for the majority of those diagnosed as children (Sibley et al., 2021).

The main symptoms of ADHD can be divided into three categories: hyperactivity, impulsivity and inattention (Helsedirektoratet, 2018a). Prominently, inattention is a core characteristic of ADHD, whereas people with ADHD may have shorter attention span than others, making it harder for them to focus properly on tasks. Inattention can lead to avoidance of boring tasks (e.g. school, work tasks etc), forgetfulness (e.g. losing things and forget planned meetings) and, distractions (e.g. having difficulties paying attention in conversations). Additionally, people with ADHD often experience an increased feeling of unrest/hyperactivity, a symptom that may reduce their ability to remain still. Symptoms of unrest can be noticed as exterior symptoms like fiddling or restlessness in legs, but they can also appear as completely internal symptoms of unrest. Further, impulsivity is also a common symptom in ADHD, and it may induce patients to make rash decisions. Impulsivity can affect different areas of behavior, such as emotional reactions, riskiness, degree of patience and ability to communicate with others composedly.

The symptoms of ADHD is often similar for kids, teens and young adults, but there are often variation in how the different age groups cope with it (Helsedirektoratet, 2018a). Research show that approximately 3-5 percent of people under 18 has ADHD, and the gender distribution is 4:1 in favour of males. In adulthood however, 2-3 percent of the population is estimated to have ADHD, indicating that some of them may have considerably lessened symptoms when becoming adults.

Despite this trend, symptoms are highly varied and individual, implying that the individual needs for treatment are differentiated (Simon et al., 2009).

Somewhere between 34-70 percent of adults with ADHD have deficits in emotion regulation (Shaw et al., 2014). Emotion dysregulation in co-occurrence with ADHD is directly associated with poor outcomes in academic, social and cognitive domains (Franke et al., 2018; Wehmeier et al., 2010). For this particular group, the risk of self-harm and suicidal ideation is quite high (Hinshaw et al., 2012; Van Eck et al., 2015).

2.2.1 Diagnosis

ADHD is often divided into three sub types: ADHD predominately hyperactive-impulsive type, ADHD combined type (i.e. inattention, impulsivity and hyperactivity) and ADHD predominantly inattentive type (previously known as ADD) (ADHD Norge n.d). As the three different types often overlap and induce similar symptoms, this thesis will not differentiate them, and use ADHD as a general term.

ADHD have overlapping features with other mental health conditions, such as depression, bipolar disorder and anxiety, making it challenging to diagnose (ADHD Norge, 2016). However, since ADHD is hereditary, awareness of diagnosis in either the parents or children may help diagnosing the other generation. To diagnose ADHD patients, clinical tests, conversational analysis and examining background history is vital elements. In practice, the most recognized self-report form used for diagnosing adults is Adult ADHD Self-Report Scale (ASRS), however, these self-report questionnaires are not sufficient to obtain a diagnosis. The diagnostic evaluation of ADHD must be conducted by a qualified healthcare professional and commonly include elements such as clinical interviews, information from significant others, review of developmental and medical history, psychometric tests, and neuropsychological tests.

2.2.2 Treatment

Adults with ADHD usually receive pharmacological treatment as the main treatment, which is a well-established and effective treatment approach (Cortese et al., 2020). However, 20-50% of adult patients are either non-responders in terms of sufficient symptom reduction, and/or intolerant to the side effect of medication. Additionally, patients who do respond to medicine only have symptom reduction in approximately 50% or less of the main symptoms of

ADHD (Hirvikoski et al., 2011, p.175). Resultingly, ADHD treatment is argued to be optimally managed with a multi-modal approach, which involves educational interventions, appropriate psychological management, and judicious use of medication (Greydanus et al., 2007). In general, the main methods used with multi-modal approaches are Cognitive Behavior Therapy, coaching, Computer-Based therapy and drug treatment. The main focus of multi-modal approaches is to help ADHD patients reach their maximum potential, independent of age. As elaborated, ADHD patients can experience daily life more difficult than others, both at home, at work and in social settings. Also mentioned, treatment needs for ADHD is highly differentiated due to the heterogeneity in demographics and symptoms. Therefore, using multi-modal approaches easily adjustable to individual needs is of massive benefit. Understanding how to optimize such approaches may therefore also generate great value for patients (Helsedirektoratet, 2016).

2.2.3 Adults and ADHD

For adult ADHD patients, the persistent symptoms can be hard to deal with on their own. Concentration inability can lead to difficulties meeting deadlines and staying on task. Hyperactivity may often generate inner disturbance in adults, but can also give outward tension, restlessness, and inability to stay in one place over time. Impulsivity may induce impatience and less-thought through actions (Helsedirektoratet, 2018b). Research show that these factors may have negative consequences for socio-economic conditions as private economy, education, and employment. A heightened risk for drug abuse is also found in research (Fletcher, 2014).

Additionally, it is found that while demands, duties and responsibilities grow larger with patients' age, supportive resources available for them are reduced, as children receive more medical attention than adults (Turgay et al., 2012). The increasing demands surrounds occupational, financial, social, and academic expectations in adults in general. Resources include all treatment, helpful relationships and other factors that eases the burden of living with ADHD. The illustration in Figure 2.1 shows how the demands increase by age, and how the resources decrease.

Children diagnosed with ADHD today have access to a help system, which often consists of adapted learning and teaching situations, guidance for their parents, medication, and adaptive technology (Turgay et al., 2012). However, as

elaborated in the previous paragraph, resources for adult patients with ADHD is considerably more limited. Treatment for adults with ADHD are usually restricted to pharmacological methods, although many adults request other alternatives (Solberg et al., 2019). Computer-aided psychotherapy are expected to benefit adults with ADHD, but psychological treatments are not easily accessible to adults with ADHD (Kenter et al., 2021), creating an opportunity space for use of technology to supports adults with ADHD (Cibrian et al., 2020).

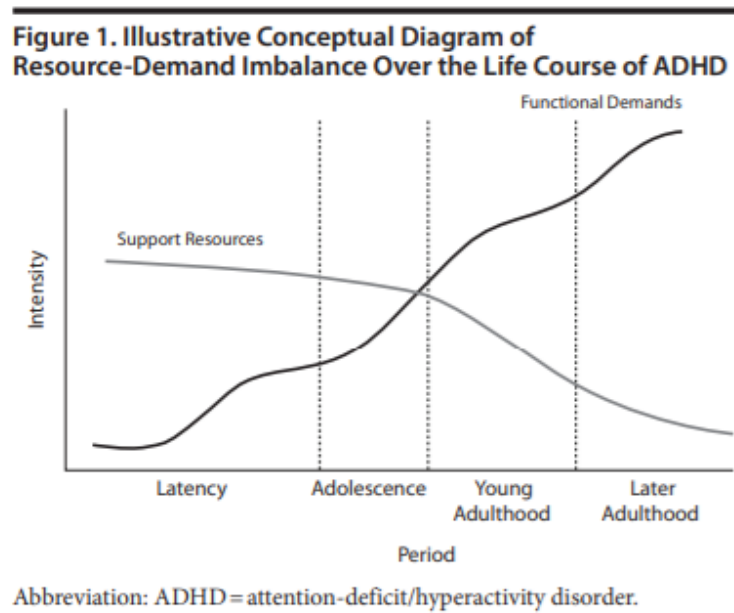


Figure 2.1: Resource-demand imbalance in adults with ADHD.

2.3 Computer-aided psychotherapy

Broadly, one can define computer aided psychotherapy as methods to provide therapy to patients using different devices (Cuijpers et al., 2009, p.67). Such devices can be all from computers, smartphones, phone-interactive voice response (IVR), USB sticks, cell phones, DVD's to virtual reality equipment.

Computer-aided psychotherapy (CP) has evolved to an increasingly accepted treatment method over the last few decades (Lungu, 2015). Many argue that CP reduces several of the existing challenges and barriers with in-person treatment. In-person therapy is often quite costly, inherits logistical issues and are somewhat limited by mental health stigma. Further, the overall low availability of trained practitioners also often produce hindrances. On the contrary, computer-aided psychotherapy may allow patients to work at their own pace, enable progress reports and increase the possibility of personalization (Cuijpers et al., 2009;

Newman et al., 1997). The CP system itself can easily be updated, does not need training and in general has no geographical limitations, opposed to in-person therapy. Previous research also show that CP can be very cost-efficient, estimating that the savings per client can be somewhere between 540-630 US\$ (Newman et al., 1997). Moreover, research has showed that patients find it easier to provide sensitive information to a computer rather than a human practitioner (Claassen & Larkin, 2005). Such information may for instance be criminal records, suicide attempts or suicide risk to a computer. Also, research show that there are none-significant differences between CP and in-person therapy in terms of efficiency and quality (Lungu, 2015). However, this does not imply that CP directly can replace in-person therapy, but rather a positive implication that CP may be included successfully with other traditional therapy methods. Further research is however needed to ensure quality in integration with other methods.

Despite being a promising resource in therapeutic settings, CP also come with some limitations (Cuijpers et al., 2009). Firstly, as CP consist of digital interfaces, it poses limitations in regard to conversational efficiency, whereas patients may not fully be able to express their feelings in a digital format. Important communication may hereby be slowed or reduced. Secondly, technophobic patients may be unwilling to use it, possibly complicating their treatment significantly. Also worth mentioning, patients without technophobia may be sceptical or unwilling to use digital interfaces in their treatment as well. Thirdly, as many of the treatment programs include a planned set of homework and tasks provided by therapists, patients may selectively choose to only complete a share of their planned tasks (Newman, 2004). Despite these efficiency bottlenecks, research do show that unfamiliar and/or CP sceptical patients show great end-results when enrolled on a CP program. As dropout rates are high and low engagement still is an issue in most CP programs, understanding how to optimally develop programs and engage users sustainably is therefore a matter of great importance (Pettersson et al., 2017).

2.4 Dialectical behaviour therapy

Dialectical Behavior Therapy (DBT) was initially developed as a treatment method for women diagnosed with borderline personality disorder (Feigenbaum, 2007, p.51). Widely accepted for its initial use, DBT has also gained popularity for treating other diagnoses. The main objectives of DBT are to enhance individual

capabilities, enforce skilful behavior, improve/maintain patients' motivation, ensure change, and to assist the patient in a way which supports progress and achievement of goals (Lungu, 2015). DBT consists of different components, mainly structured individual training and group skills training. In terms of methodology, psychotherapy and telephone contact with therapists have been a part of the original program (Dimeff & Linehan, 2001, p.1).

The treatment program is often separated into different stages (1-4). The first stage focuses on achieving behavioural control, while the following stages aim to achieve ordinary happiness, joy and reduced personal problems among patients (Dimeff & Linehan, 2001). In the individual training of DBT there is no predetermined manual, but there are principles, strategies, and protocols which the therapy is often based upon (Linehan, 2015).

Anita Lungu (2015) researched the efficiency of combining DBT and CP on patients with different mental health disorders. Her study found that participants, in the course of treatment, improved on all dimensions of interest: skill-use, mindfulness, emotional dysregulation and distress, as well as psychopathology. Further, Lungu also found that treatment with CP and DBT combined was as satisfactory as regular treatment methods not involving CP. Overall, this may indicate that computerized treatment methods can be a promising alternative to traditional treatment methods.

2.5 Online interventions for mental health

The accessibility of smartphone applications for mental health (mHealth apps) has grown increasingly over the last few years, resulting in a large number of options on the market (Aitken, 2015). In 2015, there was reported 165.000 mHealth apps available for users on Google Play and iTunes Store, whereas 1/4 of the applications were focusing on disease treatment, and 1/3 of these were applications for mental health.

The opportunity to improve users' mental health with smartphone applications can seem like a prominent solution, but there is however a need to measure how well these applications actually work. Today, no single, standardized guide for development of mHealth apps exist, making it harder to measure effect and success (Bakker et al., 2016). Additionally, some of the existing applications lack valuable functionality, and they are rarely documented by trial-based validation. From a clinical perspective, both application benefits, harms, and acceptability can be

evaluated through randomized controlled trials (Olf, 2015; Wykes & Schueller, 2019), while from a HCI perspective, application usability needs to be evaluated (Inal et al., 2020). Bakker et al. (2016) suggest that all mental health apps should be based on recognized therapy methods. Further, they also underline the need for developers to be familiar with both with such approaches, before developing mental-health apps.

2.5.1 Existing applications for ADHD

Previous research show that there are limited studies on ADHD in HCI literature (Husain, 2020; Spiel et al., 2022). It is also found that most available studies on the topic focuses on children and parental assistance, and therefore there exists a shortage of studies focusing on treatment for adults with ADHD. Furthermore, a lack of long-term commitment in this research field (HCI and ADHD), implying that most research is not developed further upon publication, also limits the research (Spiel et al., 2022).

There exist many different types of mobile applications for people with ADHD. Primarily, such apps are created for parents tracking their children's' progress and feelings, but there are also some alternatives for adults, of which some have been evaluated in existing research. In terms of the overall quality in ADHD apps, Păsărelu et al. (2020) conducted a systematic review of applications for ADHD on iTunes/iOS and Google Play between 2017 and 2019. Their goal was to evaluate the general characteristics, empirical support, and effectiveness of such interfaces. The applications they reviewed was varying, as both self-report applications and treatment apps with several different therapeutic methods (e.g. hypnosis, cognitive therapy, music therapy) was analysed in the review. Importantly, they found that there is a disproportion between research on efficiency and the number of commercial apps in the market, as the number of apps relative to conducted research appeared too high. They hereby underlined the need for strong collaboration between technological developers and specialists on ADHD, ensuring high app efficiency.

2.5.2 Useful resources

Regarding interfaces for ADHD that is related to research, there are several findings regarding functionality that recur. Research show that implementation of mindfulness exercises, positive reinforcements, and time management tools have improved both users mental symptoms and ability to concentrate (Dibia,

2016). Additionally, including information about ADHD and providing users with knowledge about their diagnosis were found to be helpful (Ehrler et al., 2018; Torous et al., 2018, p.249). Lastly, involvement of either health clinicians or peer support can help users engage as they are involved with others. Peer support can be described as the involvement of peers with similar experiences, or similar conditions (O'Leary et al., 2017). Peer support has shown promising results regarding engagement in treatment, prevent drop out, increase of confidence, and mental health improvement (Alvarez-Jimenez et al., 2014; Faulkner & Basset, 2012). Furthermore, peer supports allows for peers to function as role models for each others and enables conversations about stigma, disability, and recovery (Davidson et al., 2012). Consequently, including peer support in group based treatment program is found to be effective by adults with ADHD (Philipsen, 2012).

2.5.3 Barriers in online interventions

Engagement and user involvement is fundamental for online interventions to serve any type of value to the user. In general, the reason for low engagement can differ between different applications, but usability factors and safety issues are both found to contribute to low engagement and no-use.

Engagement in online interventions

Research show that some of the reasons behind this issue could be poor usability, concerns about privacy, lack of user-centric design and trust, and unhelpful emergencies (Kenny et al., 2016; Torous et al., 2018). Firstly, poor usability is an occurring issue in the field of HCI, as users may find it difficult to navigate through the interface and its tasks. Also, a considerable lack of technical functionality may leave the user frustrated and result in no-use. In general, these factors may induce low or no engagement in the app, and the importance of understanding what the users need is therefore crucial (Torous et al., 2018).

Fortunately, research show that lack of engagement can be improved by different measures. Including health education, peer support, and therapist involvement are all factors which are found to increase engagement (Ehrler et al., 2018; Torous et al., 2018). Additionally, the importance of user-involvement in the developing process, and the understanding of scenarios in which the application is used, is repeated in both regular HCI research and in terms of developing mental-health applications as a measure to ensure useful applications (Sharp et al., 2019).

Safety

The General Data Protection Regulation (GDPR) from 2018, states that people have a right to access information stored about them by companies (Intersoft Consulting, 2018). Additionally, GDPR introduced obligations for data management for companies. As a consequence, as of 2018, the market of user-data consisting of personal information is legally regulated by EU-law.

One part of mHealth apps mission is to collect user data and provide users with some sort of insight to their own life. Privacy and concerns about security can therefore be an issue, especially regarding the health domain (Torous et al., 2018). Unfortunately, application safety and privacy concerns and are eminent challenges regarding mHealth apps. Many of the existing mental health apps does not have a privacy policy with information for users about how their data is handled, used, and stored (Kenny et al., 2016). Particularly, low safety of personal data is a concern of users, especially for users storing sensitive data in the process of using such apps.

Woldaregay et al. (2018) researched motivational factors connected to prolonged use of mobile health applications. The goal was to investigate which motivational factors and what issues such applications face in regard to long term use. Their research found that the study participants were sceptical to how their data was handled and had reservations regarding privacy. The providers should therefore be greatly interested in maintaining transparent and clear information about how user data is handled.

2.5.4 Participation in the design process

In the process of designing online interventions for mental health, researchers and designers should take experts' opinions into consideration. Both clinical experts and users has valuable insight to what such an intervention should consist of, in terms of content and functionality.

Prominently, Flobak et al. (2021) conducted a participatory design study on how to optimally design videos with and for ADHD patients, for an online intervention. The goal was to discover how participants' everyday life experiences could be used in such an intervention. Their research found that "...careful consideration of representing the diversity of experiences and identities of the target group is necessary to be inclusive of a variety of identities", meaning that diversity is quite central in a participatory design process. They further argue that including people

with first-hand experiences of the relevant mental health issue is an appropriate method, as this partakes in balancing the lived experience and the therapeutic expertise in the design process.

While Flobak et al. (2021) focuses on participatory design in one specific context, Yardley et al. (2015) researched how to generally develop successful digital interventions in context of health. Their research proposes a person-based approach focusing on users reporting on their own experience, which is rooted in user-centered design methods. Further, Yardley et al states that "...users are naturally expert at telling us what they like or dislike about interventions, but most users are understandably less able to generate effective behavior change techniques or good design solutions", underlining the importance of diversity in the design process, as both users, designers and clinicians have different ways of contributing with valuable insight.

A more critical point of view is presented by Spiel et al. (2022), they presented a literature review on technologies designed for ADHD patients. Their goal was to investigate, from a insider perspective (neurodivergent researchers), the existing technologies and their research approaches, as well as their participation from ADHD representatives in the development process, and what types of systems that were made. Their research found that the minority of studies included ADHD patients in the process of constructing new technology, this also applies to neurodivergent experts. Additionally, their research found that many of these technologies are used to mitigate ADHD symptoms which are seen as negative or disruptive to neurotypical standards. Lastly, their research indicates that the frames of which the study is based on can inhibit resistant from participants. They argue that it is not enough to simply involve potential users in evaluations of such interventions, but that participants should be included in the beginning of the project as well as in the evaluation phase.

It is possible to fulfil therapeutic goals, and at the same time include user experiences in the participatory design process (Flobak et al., 2021). By including users in the whole development process, researchers and developers can achieve insight and perspectives in which would be hard to contain without the lived experience (Spiel et al., 2022). Nevertheless, participants in design processes are found "less able" to create e.g. behaviour change techniques (Yardley et al., 2015), meaning that the perspective of clinical psychologists or other relevant specialists is present. The inclusion of users should not be at the expense of well-grounded theory in psychology and therapy methods (Craig et al., 2008; Michie et al., 2011).

Flobak et al. (2021) recommend that the design and research-process of new online interventions uses a co-design approach with the target group, designers and other experts all included in the process, underlining that "...there is no one-size-fits-all approach to meaningful co-design".

2.6 Design Considerations

An established fact is that the principles of universal design are important when designing applications (Story, 2001). One should also be cautious that users with ADHD can benefit from alternative design methods (Sonne et al., 2016). Considering that there often exist different stakeholders, it is important to both consider therapists (clinicians) and the patient-group when designing mHealth apps. Additionally, there are general considerations to be made when designing mHealth applications.

2.6.1 ADHD

McKnight (2010) presented a set of design principles to be applied when designing technology for children without excluding children with ADHD. The presented design principles mostly coincide with ordinary design principles, and consist of fifteen suggestions. Among other things, some of these suggestions are concerned with limiting distractions, organize items logically, providing a calm environment, and short textual information.

Sonne et al. (2016) present a design framework for ADHD technology, by both conceptual dimensions and a set of strategies for development. As mentioned previously, people with ADHD experience the disorder in varying degrees and forms, whereas some may experience high degree of inattention, while other struggle more with impulse control (Sonne et al., 2016, p.2). Nevertheless, the methods for treating ADHD is highly generalized, and Sonne et al. emphasize four main areas to focus on when creating ADHD designs:

- *Providing structure:* is proven to be important for the ADHD group, as studies find this to induce a significant support in their daily life. Particularly, the use of charts and checklists has been emphasised to be valuable.
- *Minimizing Distractions:* is important to maintain optimal focus levels among users when using the application.

- *Encouraging Praise and Rewards*: can motivate the users to either finish tasks, perform activities or obtain preferred behaviour. This is primarily focused around kids, but could however be relevant for all kinds of user bases.
- *Integrating and reporting standardized ADHD measures*: is vital to ensure transparency and representative users, and allow researchers to further evaluate the technology. This may be important for future work and further development.

(Sonne et al., 2016, p.8)

Even though McKnight (2010) principles are directed at children, most of these design principles can be applied in the design process of adult interfaces. The principles also correlates with Sonne et al. (2016) design framework. Importantly, when designing for people with ADHD, designers should be focused on minimizing distractions, provide structure, clear information, include information about users behaviour, and focusing on praise and rewards.

2.6.2 Mental health

In the process of designing applications in which focuses on mental health (mHealth apps), there are some additional recommendations. Doherty et al. (2010) researched how previous research could be encapsulated into guidelines for mental health technology. The goal was to collect findings from previous research project into a set of design-guidelines. Their research resulted in twelve guidelines for the design process, important factors, and evaluation. Many of these guidelines are repeated in the previous subsection, including the importance of participation from users and health care experts. Amongst other recommendations are the involvement of technology in which are familiar to the users due to the fact that its easier to learn and do not acquire much resources in technical support. The data-security is also expressed as an important focus area, ensuring that users feel safe about products should be prioritized.

Additionally, the evaluation process need to obtain ethical approval for evaluations. Systems should also be evaluated in all distinct stages. Evaluation should happen in togetherness with users, mental health care experts, ensuring that the product meets it intended purpose for users. Lastly, evaluating the product in clinical practice should be included, mainly to ensure that the product usability is adequate in the context of therapy (Doherty et al., 2010).

2.7 Chapter Summary

Somewhere between 2-3% of adults are affected by ADHD, and this induce different challenges in their everyday life. The symptoms vary and are vastly individual, generates day-to-day limitations and pose long-run challenges in patients' lives. Research show that people with ADHD tend to have higher risk of exclusion in terms of education, finances, and social/familiar relationships. In regard to treatment, DBT have showed promising results by enabling ADHD patients to cope better with difficult situations, learn new skills and change unhealthy habits. Further, the use of CP combined with a DBT treatment program can be of great value for patients, as CP has lower costs, higher accessibility and provides functionality that cannot be available with the use of traditional face-to-face therapy. The challenges of CP can hopefully be balanced out when used in combination with traditional DBT.

Regarding design considerations, there are several key factors to be aware of when creating applications for people affected by ADHD. Sonne et al propose four main factors to be aware of when designing: providing structure, minimizing distractions, encouraging praise and rewards, and integrating and reporting standardized ADHD measures. These should definitely be taken into consideration in the design process. In sum, there are promising results from existing research on the area, and by using principles from DBT combined with CP, the result can be beneficial in several areas.

Chapter 3

Methodology

In order to answer the research questions of this thesis, involving users in the process is quite essential. Therefore, a user-centred design process was chosen for this thesis. This chapter presents methodology and methods used in this process, including research through design methodology, methods for evaluation, and prototyping. This thesis applies qualitative methods in the research process.

3.1 Research through design

Research through Design (RtD) is a research approach which aims to employ methods, practices, and processes of design practice to generate new knowledge. Zimmerman et al. (2007) propose a framework for RtD as well as a set of criteria for evaluation. As the goal of the master-thesis is to find out how we can design an intervention for Dialectical Behavior Therapy, we find this methodology to be suitable as it allows for research while designing. This is especially appropriate as there have been done limited research on the area.

The benefits of using this method includes (i) identification of opportunities for new technology (ii) identification of important gaps in existing theory (iii) discovery of unanticipated effects in the evaluation process (Zimmerman et al., 2007, p.497-498).

3.1.1 Wicked problems

Wicked problems can be defined as a problem there is no definite formulation to, no stopping rule and with solutions that are not true-or-false, but rather good-or-bad (von Thienen et al., 2014). Zimmerman et. al (2007, p.497) underlines the

importance of this types of problems, as they are often present in HCI research. With wicked problems, the solution is rarely obvious, and the problem cannot be correctly modelled. Wicked problems can also be paradoxical, for example by not wanting to disrupt the users with notifications while at the same time wanting to remind the user to take advantage of the intervention. The conception is a result of the inability to use scientific methods and models to tackle different problems with traditional methods. Further, here lies an expectation of novelty, as there should not be a clarification of something that already exist (Zimmerman et al., 2007, p.499).

This thesis aims to understand how we can design an intervention for adults with ADHD by using principles from dialectical behaviour therapy. Existing research by Lungu (2015) shows promising results on using web-based services combined with treatment for other mental health issues. The novelty in this thesis is the focus adults with ADHD, and the implementation of DBT principles in an online intervention with the purpose of supporting interaction in-between group therapy sessions.

3.1.2 Why RtD?

Research through design is suited for this thesis as it allows for an investigative research project, as well as the ability to involve users, evaluate and make changes. It also enables the ability to discover different aspects, potential problems, and shortcomings. By using RtD in this project, the goal is to find the best way to design the intervention so that it serves its purpose for the users. There is no defined outcome, and the focus is therefor on how it can be designed in the best way. RtD also opens up for collaborative research, which is highly relevant to this thesis.

3.2 Design methods

This section presents the design methods and approach applied in this thesis.

3.2.1 Participatory design

Participatory design (PD) is an approach that focuses on the active involvement of stakeholders in the process of design (Bratteteig & Wagner, 2016; Robertson & Simonsen, 2012). *Participatory design* can be defined as the process of understanding, investigating, developing, establishing, reflecting upon, and supporting

mutual learning between multiple participants (Robertson & Simonsen, 2012, p.2). Over time, the focus on designing for users have shifted to also design with users (Sanders, 2002). Using a PD approach includes the belief that people, if given the appropriate tools, have something to offer in the design process. Consequently, users are an essential part of the design process, contributing to decisions regarding both design and content/features.

'Genuine' participation describes the user as a legitimate and acknowledged participant in the design process, not only as an informant (Robertson & Simonsen, 2012, p.5). Involving the users in design activities, rather than limiting their involvement through interviews, allows the users to play a more significant part in the design process. Including users in the design process is found to be a valuable asset to both the design process itself and to the end product, resulting in better working technologies (Robertson & Simonsen, 2012, p.6).

Bratteteig (2021) suggests "design for, with and by users" ¹ as an approach for user-involvement. There are three main reasons for choosing this approach (i) the knowledge base in the design process becomes more solid (ii) it is easier to introduce new systems when the users have been part of the design process (iii) the users of the new system have to have the opportunity for influence, especially if it is to affect their lives (Bratteteig, 2021, p.18). Further, Bratteteig suggests six main activities for the process of such design processes (Bratteteig, 2021, p.198):

- Organization and planing, mapping the problem space
- Investigate practise
- Problem identification: identify needs and desire
- Evaluation criteria and demand specification
- Problem solution: materializing and concretization
- Testing and evaluation

In this thesis, a Participatory Design approach was applied, by including potential users in all project phases. The following sections will describe the inclusion of users in the design workshop, design sprint and evaluation.

¹This is the thesis author translation and interpretation

3.2.2 Prototyping

Prototypes allows users to interact with the artifact, and it enables communication of design and ideas in a different way than simply communication. A prototype is defined to be "...one manifestation of a design that allows stakeholders to interact with it and explore its suitability" (Sharp et al., 2019, p.422). Prototypes can be everything from paper-based sketches to advanced software, in this thesis the use of both sketches and semi-functional prototypes in Figma will be presented. Initial prototypes, often referred to as *Low-Fidelity Prototyping* does not imitate the final product, and its lacking the future functionality (Sharp et al., 2019, p.426). Low-fidelity prototypes are useful as they are both simple, cheap, and quick to produce. Using this type of prototyping in early stages enables the opportunities to explore different design ideas and explore modification. Further, High-fidelity prototypes often resembles the final products and entails some functionality (Sharp et al., 2019, p.428). This can be developed by both programming languages and prototyping tools. Prototyping tools like *Figma* (Figma, 2022) is suitable for high-fidelity prototyping as it both allows for design interfaces as well as functionality. In this thesis, both low- and high-fidelity prototypes was created. The low-fidelity prototype is presented in Chapter 4 and 5, and Chapter 6 presents the final prototype of this thesis.

3.2.3 Establishing requirements

Establishment of requirements involves the process of defining the problem at hand, and how to solve it (Sharp et al., 2019, p.385). It also involves understanding the users and their capabilities, the need for support in everyday life, users goals, tasks and contexts. Requirements can be discovered in several ways, including targeted activities, during evaluation, prototyping and design/construction (Sharp et al., 2019, p.386). Establishing requirements evolves with the research and design-process. As requirements can be established at different parts of the process, it is wise to define when this is relevant so that there is some structure to the process. For the intervention, establishment of requirements happened in interaction with participants. Requirements are differentiated in two groups: functional- and non-functional requirements. Functional requirements focuses on what the product will do, and the non-functional requirements focuses on the characteristics of the artifact (Sharp et al., 2019, p.390).

3.2.4 Design workshops

A design workshop is a common technique to involve the users in the design process (Kensing & Blomberg, 1998). There is no set manual or framework on how to perform design workshops, but Harrington et al. (2019) proposes that design workshops are "...a spatially situated and temporally bounded coming together of participant groups and researchers to envision new design futures, which employ particular materials, tools, and goals." In other words, design workshops supports collaboration between different participants working together towards a mutual goal. In this thesis, a design workshop was conducted in advance of the prototyping process. Section 4.3 in Chapter 4 describes the design workshop. By focusing on participation from the beginning stages of the project, potential users can be involved in all stages and are considered from the get go. Participants includes both adults with ADHD, and clinical psychologists which also works as domain experts in this context.

3.2.5 Conceptual design

To visualize how users can interact with the intended product, one can use conceptual design. Conceptual design is the process of transforming requirements into a conceptual model (Sharp et al., 2019, p.389-398). The purpose with conceptual designs is to provide understanding of what the domain is, what type of interaction, terminology and interface they will use, as well as who the user group will be. It was created an initial conceptual model in based on the first project phase (see Section 4.2.1), the model was expanded and updated in after the last phase (see Section 6.2.9).

3.2.6 Design sprint

Design sprint is a framework created by Google Ventures (GV) to better tackle issues of designing value in the product (Sari & Tedjasaputra, 2017, p.391). The technique have gained wide spread attention, as its both applied internally for Google products, as well as applied in the development process of award-winning products. The goal is to validate different ideas by rapid prototyping and user testing. The framework consist of five steps (Sari & Tedjasaputra, 2017, p.392):

Step 1- Understand: The teams participants evaluate the problem at hand, potential personas, and the tools they are going to use.

Step 2 - Diverge: focus on "no stupid ideas", the participants come up with as many ideas as they can.

Step 3: - Decide: the team decide on an idea to go further with.

Step 4- Prototype: sketching and design of prototyping idea, the focus lies on User Interface flow

Step 5- Validate: including user-tests, this can happen several times during the process.

This framework is often applied in teams, in this thesis the approach will be used in varying teams, including both UX-designers and clinical experts. The process will include establishment of requirements, low- and high-fidelity prototyping and critiquing. This thesis applied the design-sprint method to include both UX-designers and clinical experts in the design process. The process and results of the design sprint is presented in Section 5.1 in Chapter 5.

3.3 Ethics

Prior to collecting data in both design and evaluation workshops, the Norwegian Centre of Research Data (NSD) approved the project. In both workshops, there were only taken notes on paper and no further personal information was collected about participants. The NSD approval can be found in Appendix A. Furthermore, participants signed a consent form which described the project, participation, and information about data storage. The consent form can be located in Appendix B.

3.4 Evaluation

This section describes methods of evaluation, presenting both data gathering and evaluation methods relevant to this research. Evaluation is an indispensable part of the design process. Evaluation involves collecting and analysing data from users experience with the artifact (Sharp et al., 2019, p.496). The following sections describes the evaluation methods of this thesis, focusing on data gathering, evaluation workshop and evaluation of RtD.

3.4.1 Data gathering

Data gathering is seen as a central part of the process of discovering requirements and evaluation (Sharp et al., 2019, p.259-265). Sharp et al. (2019) present five key issues which require attention to conduct a successful data gathering; Setting goals, identifying participants, relationship with participants, triangulation and pilot studies.

Setting goals In every data gathering process there are some forms of goal(s), often focusing on fetching information about users, their behavior or reaction to technology. Goals should be defined and specified before the data gathering process and should be clearly and concisely defined. In the field of interaction design, these goals are often informal.

Identifying participants The identification of participants can often be indicated by the predetermined goals, the process of identifying participants which fits this profile results in a study population. In most cases, the hole study population is either not available or needed in the research project. As a result, the use of sampling, which is the processes of choosing which participants to include, is applied. Sampling is divided into different types of sampling, mainly probability or non-probability sampling. The main difference between the two approaches is the opportunity to generalize over a whole population, probability sampling selects random participants which makes it a more generalizing approach than non-probability sampling. This research uses non-probability sampling, selecting participants available for evaluation rather than randomly selected participants.

Relationship with participants The relationship between the data collector and the participants needs to be professional. This is important as it helps clarifying both the goal and nature of the study. This can be achieved by using a consent form which includes information about the project, the data gathering process and information about how participants can withdraw from the study. This is useful as it protects both researchers and participants.

Triangulation Triangulation refers to dual perspectives when investigating a phenomenon. There are different types of triangulations (Jupp, 2006). Most relevant for this research is investigator triangulation, which entails that different researchers partake in the interpretation of the collected data.

Pilot studies A pilot study is a small test run of the main study, where the goal is to make sure that the proposed method is suitable before starting the real

project (Sharp et al., 2019, p.230). Although pilot studies could be quite useful, limited resources could make it difficult to conduct a thorough test trial using real participants. In this thesis, it was not possible to conduct a pilot study. Limited resources and a broad project scope made it difficult to test the idea without acquiring additional resources. Therefore, feedback from colleges and peers worked as an substitute for the pilot study.

3.4.2 Participatory evaluation: workshop

Similarly to the workshop described in 3.2.4, a evaluation workshop was included in the last project phase. In the Evaluation workshop, the prototype was evaluated both by participants and clinical experts. The workshop was based on *demonstration*, which is a common way to evaluate the interface content and features (Ledo et al., 2018). Demonstrations can be useful when describing the design, purpose, and discussing the included tools. In this thesis, the evaluation workshop consisted of the demonstration combined with a discussion of the prototype. Participants was encouraged to ask questions, and the facilitator had the responsibility of leading this discussion.

Based on the aim of this thesis, it was considered appropriate to use workshop evaluation. The process and results of the evaluation workshop is presented in Section 5.2. As the research aims to transfer DBT principles into a digital format and provide features that support interaction in between therapy sessions, the main focus of the evaluation was to gather participants' insight into whether these requirements were met. Additionally, the evaluation could provide a discussion based upon existing features and new features which should be included in the intervention. The method of evaluation is also consistent with the participatory design approach, supporting the inclusion of potential users.

3.4.3 Sampling participants

The study populating consists of adults with ADHD living in Bergen, Norway. The participants were recruited from a previous advertisement, where they originally had been recruited from a local ADHD patient association. Participants received a gift certificate of 400 NOK for their participation in the trial. The inclusion criteria is; (1) the participants must be above 18 years of age, (2) have a diagnosis of ADHD, and (3) be able to attend two physical meetings in Bergen.

3.4.4 Evaluation of RtD

Zimmerman et al. (2007) suggest 4 steps of evaluation in coherence with using RtD as a research approach. The four steps are a functioning guide to what a high quality research contribution should be, and consist of process, invention, relevance and extensibility.

Process involves a well explained design process, so that the process can be reproduced as well as a rational explanation of the selected methods. In regard to this project, the process will consist of a well described design method, using participatory design and methods for prototyping. The combined methods for research, prototyping, and evaluation will be thoroughly explained.

Invention should contain an extensive literature review and explain how the result improves or advance the state of the art (Zimmerman et al., 2007, p.499). As previously mentioned, there are limited amounts of previous research on this specific topic, but there is conducted research on web-based applications, as described in Chapter 2. Also, there are research on related topics available that will serve as valuable sources of information for this research. Therefore, the invention of this research process will contribute to new knowledge and a prototype.

Relevance is important, as it explains both the desired state, as well as why. The goal for this project is to develop a high fidelity prototype, and during this process, evaluate the prototype with help from the user-group. The end-goal is therefor to create a prototype which can be used as a blueprint for further development.

Extensibility involves a well described and documented research project, enabling further work and available knowledge for the community. This is especially important, as the desired product of this master thesis is to develop a high-fidelity prototype. A well-defined prototype with design, content and functionality is key to make this valuable for possible future technical implementation.

User evaluations enable collection of feedback from potential users during the development process. Additionally, the evaluation of the research process is relevant when applying RtD methodology. Section 7.2 in Chapter 7 presents the evaluation of this thesis research process.

3.5 Chapter Summary

This chapter have described the framework for this thesis research as Research through Design (RtD), as well as the methods applied in both the design and evaluation process. Table 3.1 shows the different stages of the data gathering process, including method, why, sample size, participants, and data type.

Method	Why	Sample size	Participants	Data
Initial meeting	Clarify project scope	N=4	HCI experts and clinical expert	Notes
Literature review	Research relevant literature	N=1	Thesis author	Notes
Design Workshop	Requirements gathering, understanding potential users	N = 9	HCI experts, clinical experts and user group	Notes
Design sprint	Discover requirements and design opportunities	N=4	HCI experts and clinical expert	Sketches, prto-type in Figma and notes
User evaluation	Evaluation of the prototype	N = 8	HCI experts, clinical experts and user group	Notes

Table 3.1: The design process: project phases

Chapter 4

Conceptual design and requirements

This chapter aims to present the tools used in the design process, as well as the two phases in the initial process of design. This includes a design workshop, establishing requirements, and low-fidelity prototyping.

- **The first phase** of the project included a meeting, as well as a literature review.
- **The second phase** included a design workshop with ADHD patients, clinical experts and design experts. Additionally, low-fidelity prototypes was sketched.

The author of this thesis have had the role of researcher as well as designer in the design process. Additionally, there have been several participants in the design and research process which are described bellow:

- **Clinical psychologists (domain experts):** There where two clinical experts involved in this project. One of which participated in only the design workshops, while the second one also participated in the design sprint and the user evaluation.
- **User group:** volunteer adults with ADHD attending both design workshop and evaluation.
- **Designers:** as a part of the design sprint, two designers participated in the prototyping process.
- **HCI expert:** an expert in human-computer interaction was part of both workshops

4.1 Tools

Different tools for sketching, modelling, and prototyping were used in the design-process. The relevant tools are described below:

Figma Prototypes were created with Figma (Figma, 2022). Figma is a vector graphics editor and prototyping tool. Figma is especially useful when prototyping mobile applications as it enables functionality and can be available on mobile telephones. Figma also offer different types of UI kits for UX design, making it less time-consuming to create a realistic-looking high-fidelity prototypes. In the design process, two UI libraries where downloaded: the Nucleus UI: Mobile App UI Component Library (Juinal & Budiman, 2021) and the iOS 15 UI Kit for Figma (Banks, 2021). The UI components where mainly used for prototyping iOS system features.

Draw.io was used to create flowcharts and conceptual models (Google Workspace Marketplace, 2022). Draw.io is connected to Google Drive, allowing users to crate free diagrams. The tool was used to create conceptual design models.

Miro was used to create the conceptual models (Miro, 2022). Miro provides online whiteboards to use for visualization, and can be used both for wire-frames, creating personas, and other sketches.

4.2 Phase one: initial ideas

The initial phase consisted of three key tasks, (1) specify the project scope and goals, (2) collecting relevant research on similar technologies, as well as other relevant topics to the research area, and (3) specify what the interface should contain. The project was initialized with a meeting between project participants, including one clinical psychologist specialized in clinical neuropsychology, one PhD Candidate in clinical psychology, one HCI researcher, and the author of this thesis.

4.2.1 First meeting: introducing the Companion app

The first meeting focused on the online intervention, specifying what it should contain in terms of features and informational content. Both the online intervention and the therapy intervention should build on principles from Dialectical Behavior Therapy. As the interface should contribute to a multi-modal intervention focusing on emotional challenges in adults with ADHD, it was important to clarify

what the interface needed to contain in order to meet the requirements.

In this meeting, it was discussed whether the intervention should be web or application-based. Project participants agreed that smartphone applications would provide users with high accessibility and flexibility. A web-based intervention was also considered, but project participants found smartphone applications to be easier to use, and the opportunities for push notifications and synchronizations were emphasized. Consequently, the online intervention was decided to be a smartphone application, hereby referred to as the Companion app.

In the meeting, clinical experts also described the specifications of the DBT modules for emotional dysregulation. All therapy interventions based on DBT are based on similar principles, but there is no set manual for the individual skill training. Therefore, a plan for the therapeutic content of this intervention was provided. This included mindfulness, emotional regulation, problem-solving, and reducing vulnerability modules. The interventions' modules consist of informational content for group-therapy sessions and belonging exercises. The therapy manual was based on eight sessions, where mindfulness and emotion regulation would last over the course of multiple weeks.

Conceptualizing the intervention

The intervention needed to contain some specific features in order to accommodate the treatment program.

1. Firstly, the intervention needed to support homework assessment. Users should be able to view and complete DBT exercises in the intervention. This is directly related to DBT as a treatment method, as skill training is a part of it.
2. Secondly, users should be able to find useful resources in the intervention. Such resources could consist of information about ADHD and resources on different techniques and ways to cope better.
3. Lastly, the intervention must contain psychometric assessment forms. These forms would serve as a way for users to report to therapists how they are progressing in the course. Additionally, it would be a part of evaluating how successful the treatment program was for the individual.

A conceptual model was created to visualize relationships of the intervention and map the main features that the application should contain (see Figure 4.1).

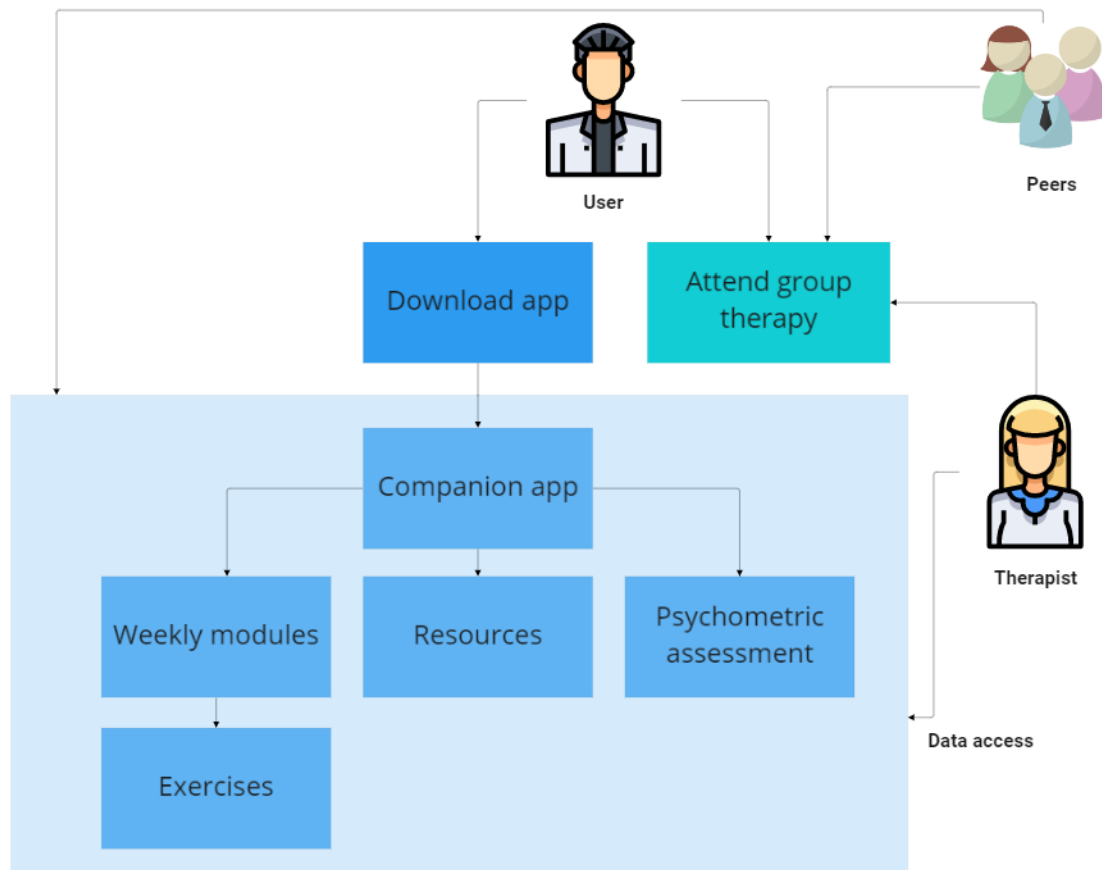


Figure 4.1: Proof of concept: outline of the intervention

The relationships in the conceptual model are based on the participants in this intervention: the user, peers, and therapist. All participants attend group therapy sessions and have access to the Companion app. The intervention consists of the Companion app in which users can perform three main tasks: access weekly modules and exercises, find resources, and complete psychometric assessment. Additionally, the therapist should have access to relevant data gathered in the online intervention.

4.2.2 Literature review: barriers and opportunities

The literature review (Chapter 2) provided insight into different topics of interest for this thesis. The review presents several opportunities and barriers related to similar interventions and interfaces. Additionally, design considerations to be made are included.

Potential of online interventions

Previous literature revealed the potential of online interventions to include (1) online interventions can be quite cost-efficient as in-person therapy is expensive, (2) online interventions limit logistical issues (3) enables users to work at their own phase (4) the possibility to implement valuable features, and the possibility of personalization provides users with a broader treatment option.

Barriers of online interventions

There are several challenges presented by literature. These challenges are mainly connected to existing research and the lack of it. Firstly, no single standardized guide exists for developing mental health interventions, making it difficult to measure the effect. Second, online interventions lack valuable functionality, making such interventions less engaging for the users. Furthermore, the lack of participation of users in research processes is problematic. The inclusion of potential users can provide researchers with valuable insight, which they may not achieve independently. By including potential users in the research process, one can achieve better working technology.

This thesis address these challenges by providing a through description of the process and including potential users and clinical experts in the design process.

Design considerations

The interface should meet the users' needs and provide a logical and easy structure for the users. Designing for ADHD users implicates further design considerations as it is essential for the interface to be a resource and not a distraction or a source of frustration. As elaborated in Section 2.6, users prefer the volume of content to be minimal, as they experience a high volume of content to be tiring. This also applies to the exercises included in the app. Too much text is found to decrease the likelihood of users completing tasks. By providing structure and minimizing distractions, it is found that the negative consequences of different distractions can be eliminated (Sonne et al., 2016).

4.2.3 First set of requirements

Based on the insight from the initial phase, requirements were set.

The functional requirements:

- Enable users to do homework and access weekly modules
- Provide relevant resources to users.
- Provide functionality which enables psychometric assessment.

The non-functional requirements

- The Companion app must be aesthetically pleasing.
- Keep the interface-design simple and limit distractions.
- The interface should be well structured.

4.2.4 Summary

The first project phase resulted in a defined project scope and initial requirements. The online intervention will be designed and developed as a smartphone application (the Companion app) and consist of pre-determined therapy topics based on DBT. Additionally, the interface should contain helpful resources and enable psychometric assessment.

4.3 Phase two: user involvement

In the second phase of the design process the goal was to create a low fidelity prototype of the interface. The phase consisted of a design workshop, which included potential users and experts. The design workshop enabled valuable insight from the workshop participants and provided several ideas/inputs to consider in the following design process. Based on the data from the workshop, a low fidelity prototype was created.

4.3.1 Design workshop

The workshop's goal was to examine the needs and preferences of adults with ADHD, focusing on what will contribute to an effective intervention. By including users in a design workshop, we may allow the identification of novel and unexpected perceptions, which could be otherwise overlooked.

Participants The workshop participants consisted of a HCI expert, two experts in clinical psychology, a designer and five potential users with an ADHD diagnosis. All participants were resident in the Bergen area.

Design workshop The four professional participants' main role was to take notes, provide questions and contribute to discussion with project participants. Initially, participants were presented with information about the intervention. Further, the participants were presented with three different tasks; (1) to provide 3-5 examples of everyday scenarios where emotions could take over or prevent them to achieve their goals, (2) provide strategies to solve the problems from task 1, (3) discussion of how these strategies could be transferred to a digital format.

Participants provided several everyday issues, which could be categorized into three main categories. Firstly, participants stated that *distraction* was an everyday issue. The participants explained the distraction as hindrance to get started with different tasks. They further expressed that once they had started the tasks, they easily found themselves distracted from it. Users suggested that time management tools could be helpful to cope better with these issues. Following distractions, the next main-issue was *time*, participants tend to experience a lack of time, which leads to issues with being on time, as well as getting tasks done in time. Distractions and time management can be seen in correlation, as many of the user-statements included both. The ability to set aside time for different tasks was difficult for the participants, as well as losing time when distracted.

Lastly, the participants expressed several different examples involving *Emotions*. The difficult emotions differed from anxiety, aggression, sadness, and inappropriate reactions (e.g. laughing in wrong settings). Difficult emotions could also be directly connected to both time and distractions as participants experienced not feeling adequate. The participants suggested several different coping mechanisms to deal with this, some examples were; ask for a break, leave the situation, forgive yourself, and hand to heart. Several of the solution-suggestions are not directly transferable to an online intervention, but will be a part of group therapy sessions. Based on feedback and discussions of these three questions, four main features/considerations were suggested connected to Task 3:

Journal entries

As people with ADHD often can experience difficult situations, the participants expressed a need to reflect and document different situations. Journal entries is a way users both can reflect on a current situation, as well as looking back to see

how they coped in the past. It was also expressed that reflecting on problems in the present, can be an asset to avoid similar problems in the future. One participant expressed the need to both be able to write or leave voice recordings in the journal, as it can be easier to express oneself with voice.

Peer-support

Participants expressed peer support to be an important asset. It was discussed how peer-support could be used in this context, and suggestions surrounded chats, forums, and being able to post videos and statements to the rest of the group. The fact that participants find peer-support to be a valuable feature in such an intervention matches previous research on similar interventions. Therefore, it should be evaluated whether users should be able to communicate in the Companion app. Peer support can be included in the intervention in several ways. Some examples are feeds, direct messaging, and group chats. Although peer support has many advantages, implementing a feature that opens for unsupervised communication could be problematic. Unwanted communication could occur, e.g., by participants receiving inappropriate messages or by some participants simply not wanting to be a part of communication outside of the therapy sessions. This problem is solvable by, for example, including supervised communication where therapists have the role of moderator. If such features should be included, the intervention will require more resources than intended. Peer-support needs to be provided in a way that supports the goals of the intervention. The clinical expert participants were sceptic to include chats or open forums, as this either could result in problematic communication or the need for more resources in the intervention. It could also be argued that peer-support already is a part of this multi-modal intervention, as the therapy-sessions are group-based.

Design considerations

Feedback regarding how information is communicated in the interface was important to participants. They expressed that the homework assignments connected to the treatment program should contain clear instructions on how to complete them without too much text. Unnecessary long instructions can be frustrating for users, leaving them unmotivated to complete tasks.

Resources

Participants suggested several resources which could be valuable in the online intervention. For example, information about emotions and emotion identification

was important. In cases where one feel confused or emotional, participants want to use the application as an informational asset. Further, participants suggests both mindfulness and yoga exercises to be a part of the application, for example by exercises. Mindfulness is one of the predetermined topics of therapy and will be included as a weekly module. Nevertheless, it could be extended by providing additional resources and exercises.

Lastly, participants suggested to include a calendar function which provides them with both opportunities to plan ahead and also a check list enabling them to plan the day. The calendar feature in the app should be optional to use, as some expressed no desire to use such features. This relates to the level of personalization in the app, as the participants needs varies.

4.3.2 Establishing requirements

The process of establishing requirements post design workshop was based on participants input, and would build further on the already established requirements. In this project, the therapist is both a stakeholder and a potential user of this interface, their input is therefor important to take into consideration when establishing requirements. Further, there are some features that needs to be available in conjunction with the treatment program. Users' needs to be able to complete and deliver homework, journal the homework complement, and evaluate the task. Additionally, the interface must contain relevant resources and the possibility of forced psychometric evaluations.

The users expressed a need for a form of diary or possibility to journal. This function was well received from a therapeutic point of view. The participants should be able to journal the exercises, but it is also possible to enable a general function for journal entries in everyday life. Further, users expressed the importance of peer-support, enabling some form of interaction between users/therapist. Even though the users wanted a form of chat, making it possible to communicate directly, it was considered to be problematic from the therapists' point of view. The chat would need to be facilitated by a therapist or someone responsible for the messages, but this would demand more resources. Consequently, peer support became a additional requirement for the Companion interface, without further specification at this project stage.

Additional requirements

- Provide a calendar function so that users can plan ahead.
- Provide a journal in which users can track their progress.
- Provide Peer-support features.

4.3.3 Low-fidelity prototype

Initial sketches were made based on the defined requirements from the first two phases. This prototype consists of the main features which are described in the requirements: (1) available weekly modules with homework, (2) providing relevant resources, (3) psychometric assessments, (4) calendar and journal features.

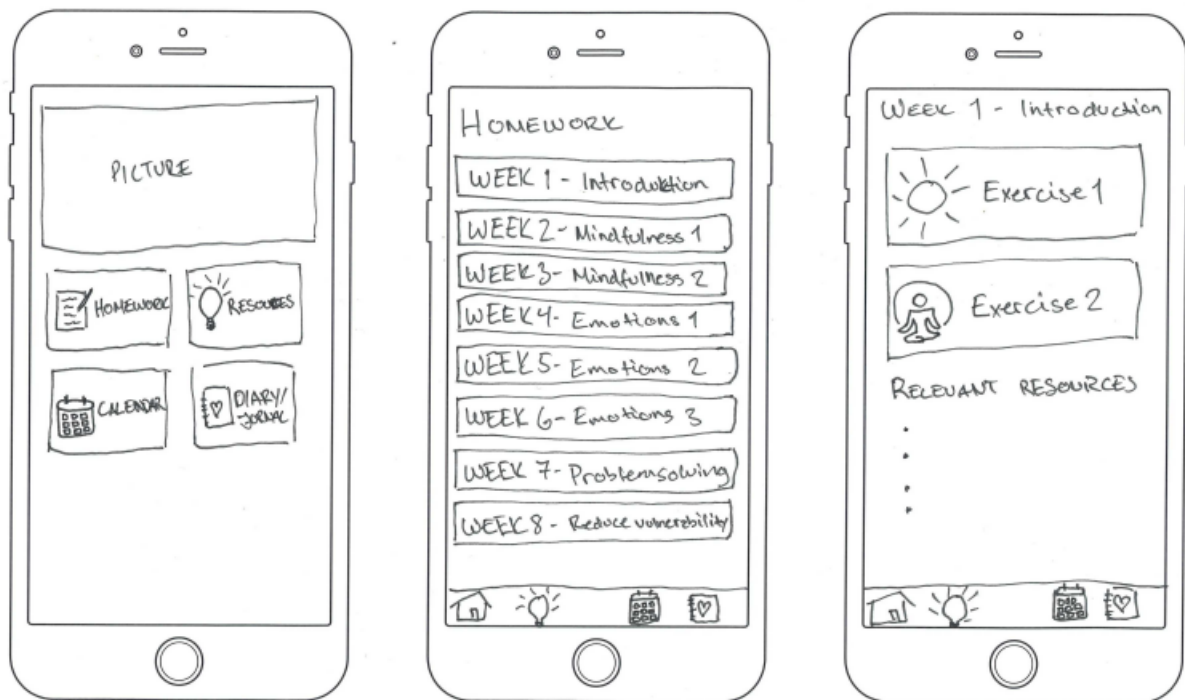


Figure 4.2: Low fidelity prototype of the home screen and weekly modules

Weekly modules

Figure 4.2 shows the first prototype of the interfaces home page, weekly modules and an example of what the homework page could contain. On the home page, the main focus is the four buttons, linking the users to either homework, resources, calendar or journal. It is used icons as well as text to explain the content of the different buttons. When entering the homework page, users are presented with eight buttons linking to the weekly modules. The buttons contain information about the weekly modules content. Additionally, a bar was added on the bottom

of the screen, enabling users to maneuver to different parts of the interface. The same icons used on the homepage buttons are used in the bottom bar, in addition to the house icon indicating "home" (home page). On the weekly page, users are presented with two buttons leading to different exercises, as well as a list of resources.

Resources

Further, the resource and psychometric assessment pages were included in the prototype. Figure 4.3 presents the two screens. The first screen is the resource page, including big buttons leading to information about ADHD and other exercises. It is not decided whether these resources should be external or internal, meaning if all information should be contained in the app, or lead to e.g., web based resources as ADHD Norge (interest organization for people with ADHD)(ADHD Norge, 2022).

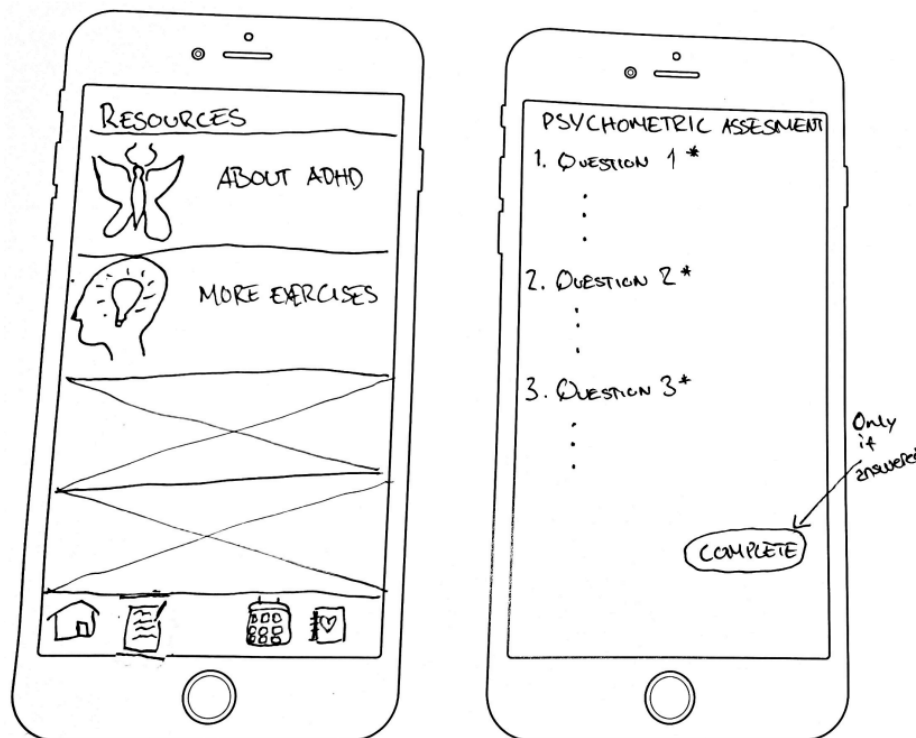


Figure 4.3: Low fidelity prototype of the resource centre and psychometric assessment

Psychometric assessment

The psychometric assessment should be forced and contain some questions users must answer to be able to continue using the application. The psychometric assessment is meant to pop-up on therapists' request, forcing participants to

answer the questions before the app can be used as normal. As a result, the bottom bar is removed on this page (Figure 4.3).

Calendar and journal entries

From the main page, users can go directly to the calendar screen which includes a regular calendar at the top of the page (see Figure 4.4). The users should be able to add chores and appointments in the calendar, which is then added to the to-do list which is placed underneath the calendar. The goal with this feature is to help users plan ahead. Users should also be able to choose whether they want to receive notifications in connection to the calendar, as some users may find it useful while others find it distracting. Similar calendar features already exist in most mobile operating systems today. Consequently, this feature may seem excess to some users. Nevertheless, workshop participants requested such features to be a part of the interface, and it could be argued that having all resources collected in one interface could provide further structure to the user group.

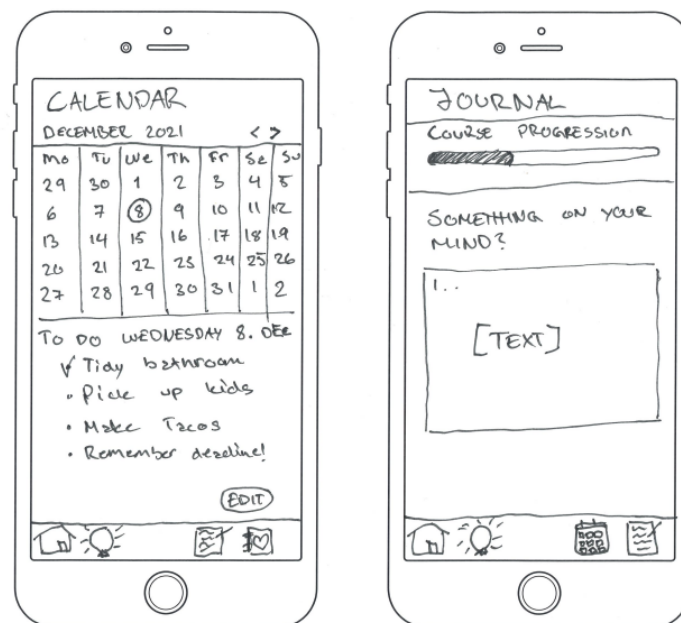


Figure 4.4: Low fidelity prototype of the calendar and journal features

Lastly, a prototype screen for the journal was designed (Figure 4.4). The goal with the journal is to enable users to express themselves in different situations. The design-workshop participants were especially interested in being able to write down how they cope with difficult situations in everyday life. In the top part of the screen, there is a progress-bar implying how far the user has come in the therapy course. Additionally, a text field enables users to write down their thoughts and submit to the journal.

4.3.4 Summary

The second project phase resulted in multiple requirements for the Companion app. The additional requirements are mainly based on additional features which workshop participants suggested. Based on requirements from the current and the initial phase, a low fidelity prototype was created to envision how the features could be presented in the intervention.

4.4 Chapter summary

This chapter described the first two project phases, including first meeting, literature review and the design workshop. The goal of the initial phases was to gain insight to what an app such as the Companion app should contain, and how it could support interaction. The two phases resulted in several requirements and a low-fidelity prototype of the intervention.

Chapter 5

Prototyping and evaluation

This chapter presents the further design process and evaluation of the prototype. Similarly to Chapter 4, the defined roles apply to this chapter as well.

The third phase is based on data from both the first and second project phases. During the design-sprint, a updated prototype was created.

The fourth phase of the project is the evaluation workshop including potential users and domain experts.

5.1 Design sprint

The goal of the design sprint was to finish the prototype for the upcoming evaluation. Table 4.2 shows the activities.

Day	Participants	Goal
Day 1	Designer and Psychologist	Critiquing of the low-fid prototype
Day 2	Designer and UX-expert	Finishing the low-fid prototype
Day 3	Designer	From low-fid to mid-fid
Day 4	Designer and UX-expert	Finish the prototype design for evaluation
Day 5	Designer and Psychologist	Critiquing from a clinical perspective

Table 5.1: Design sprint: main activities

The design sprint was conducted over the course of five days. The activities were planned ahead, and both one clinical expert and two UX designers were invited to participate in the sprint. The design sprint addresses the necessity for triangulation (see Section 3.4.1), allowing for several perspectives on the evaluation of the acquired data. Additionally, the involvement of other designers enabled a broader design perspective in the process of prototyping. The thesis author was involved in every activity, while UX and clinical experts were brought in separately. One clinical expert was included in both the beginning phase (day 1) and the critiquing phase (day 5) to ensure that the interface met the clinical experts' expectations and requests. Furthermore, the prototyping phases were done in collaboration with the designers (days 2 and 4).

5.1.1 Design critiquing and new ideas

On the first day, the meeting's objectives were to find new solutions for implementation of requirements, critiquing of the prototype, and identify potential features to include.

Peer support Predominantly, the need for peer support was discussed extensively. The benefits and need for peer support in such interventions are emphasized by both workshop participants and in existing literature. According to the clinical expert, implementing peer support can have ethical implications in this intervention. The interface is a part of a treatment intervention, and thus, it is under stringent protocols and guidelines regarding data handling issues and therapy demands. Furthermore, such interventions often include sensitive and personal information about users, making it quite resource-intensive to develop safe solutions. Consequently, supervised communication would necessitate resources not included in the project budget. As a result, it was discussed how to facilitate peer support without allowing direct message exchange.

It is possible to provide a peer support feature without enabling direct messaging between participants. One suggested solution is to enable users to communicate by viewing and reacting to the achievements of others. Because the program participants will be completing exercises, it was decided to incorporate a feed in which they may report their achievements. The expert suggested that evaluating the module exercises would be a good method to analyze and communicate how the exercise went with the rest of the group. As a result, it was decided to incorporate a brief evaluation form after completing each task. The form should request information about (1) how useful the exercise was, (2) whether the user

would like to revisit it, and (3) opportunity for other comments. Based on this feedback, only answers from users based on predetermined options would be posted to the rest of the group.

Contact with therapist Both existing literature and participants of the design workshop expressed a need to be able to contact their therapist. This could serve as a shortcut to e-mail the responsible therapist. The clinical expert was positive about the idea of including a message feature in the interface but underlined the need to clearly communicate to users how and when they get a response to their submitted questions.

Exercises The weekly module and exercises pages were also discussed. The intervention consists of an 8-week course covering different topics in which the ADHD group can learn new skills. The clinical expert wanted the modules which had not been covered yet to be closed for users. This was to prevent users from running to the course by themselves. Therefore, users should only be able to access the modules that already had been covered in group therapy sessions.

Additionally, it was discussed how to use praise and rewards to motivate the users. The expert suggested to include a screen with a positive message where users can choose to share their achievements or not. Research finds that praise and rewards can be motivating for the users to finish tasks and perform activities (see Section 2.6).

Notifications Push notifications are a natural part of smartphone applications. Nevertheless, one of the main considerations when designing for ADHD users is to minimize distractions. In this intervention, notifications can be useful to remind participants of weekly homework. At the same time, this can be frustrating for some of the participants, distracting them from other weekly tasks. Consequently, it was decided to make notifications customizable in the intervention.

Worth mentioning is the fact that users could choose to have no notifications at all by making their operating system block notifications. Nevertheless, providing users with personal options for notifications was seen as a prominent solution, whereas the users know themselves best.

A list of additional requirements was created based on the feedback from this meeting:

- Provide users the opportunity to share accomplishments in the course
- Provide short evaluation forms for users to evaluate exercises

- Enable users to message therapists
- Disable users to visit future modules
- Include motivating message upon finishing exercises
- Users should be able to personalize notifications

5.1.2 Expanding and mapping the prototype

After establishing additional requirements, the volume of pages in the prototype increased. It was therefore created a flow-chart to get a better overview of how the interface should be structured.

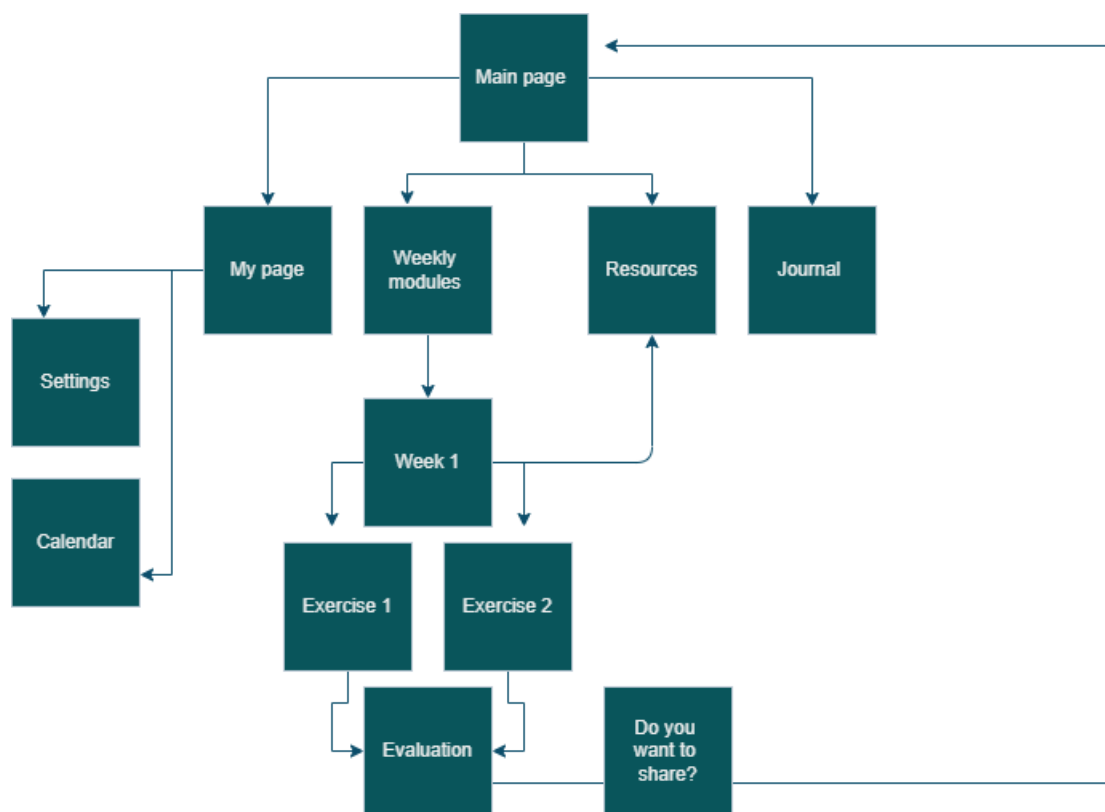


Figure 5.1: Flow-chart visualizing the structure of the interface

The flow-chart in Figure 5.1 provides an overview of the interface. Users should be met with the main page containing buttons for the application's most important features: my page, weekly modules, resources, and the journal. The peer-support feed is placed on the main page, so users do not have to seek it specifically. The 'My page' was added to the interface to assemble some features, both personal calendar and settings can be found on 'my page'. The reason for removing the calendar from the main page was based on the fact that it was not seen as useful by

all design-workshop participants. Thus, it should not be a part of the interventions main page.

The weekly module page contains links to the weekly exercises, but the flow chart in Figure 5.1 is limited to one week due to the extent. In addition to access exercises, the weekly pages can contain informational resources. The resources may vary from week to week and can consist of written information or other multi-modal features. These resources should be directly linked to the resource page of the interface.

Lastly, the exercises should be evaluated by the users. Therefore, the exercise pages link to a form where the users can answer questions. All users may not be willing/comfortable sharing their data with the other intervention participants. Therefore, it is optional to share information in the peer-support feed.

5.1.3 Interactive prototype

Upon establishing the interface structure, the low-fidelity prototype was transferred into Figma. The goal was to transfer the ideas from the previous days into a mid-fidelity prototype. The focus was the transferring of the useful features, and due to time restrictions, visual design choices such as color-choices was not prioritized. Furthermore, the prototype was written in Norwegian because Norwegian participants would later assess the prototype, and the finished product would likewise be in the participants native language.

Main page

Figure 5.2 show the new main page. The main difference on the main page is the feed of 'happenings', which includes the username and a short description of what has happened. Additionally, users should be able to react, and it is therefore added both a like button and heart button to enable peer support interaction in the interface. Further, the plan is to place an image on the top part of the main page. These images could be customized by users or chosen by designers.

My page

When tapping 'min side' (my page), the user is directed to the second image in Figure 5.2. The pages' main feature is to guide users to settings or the calendar. Additionally, users can insert their goals directly underneath the top buttons. The goals should be defined by the users and is an optional feature. Lastly, direct links to both the Journal and the resources are added to the interface to enable users to have access to most features when visiting the page.

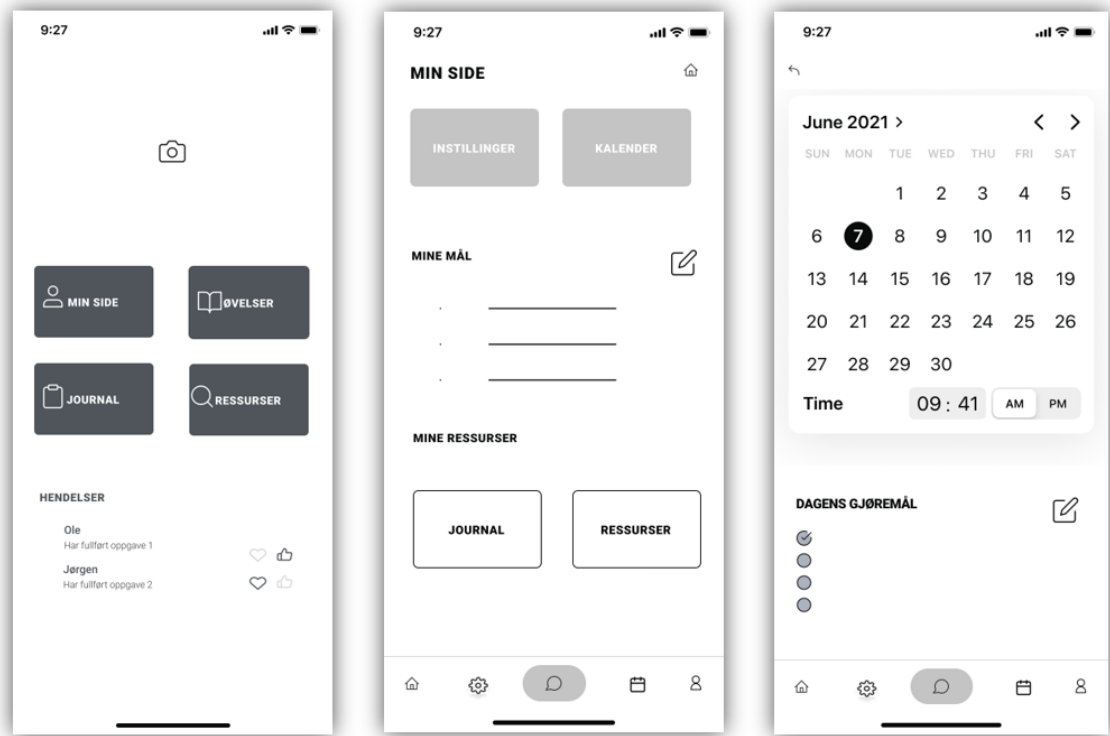


Figure 5.2: Prototype visualizing the "main page", "my page", and calendar

The calendar is quite similar to the low-fidelity prototype, consisting of a regular calendar and a to-do list underneath. The calendar design resembles other available calendars on mobile and computer applications. As discussed in Section 2.6, using a familiar design may help users to navigate and use the features. Further, the to-do list should belong to the selected day of the calendar, and users should be able to check of the to-do list. Furthermore, an edit button is placed in the top right corner, which enables users to add and delete input.

Weekly modules and exercises

The homework modules can be accessed from the main page. Figure 5.4 shows how the prototype of the weekly modules is structured. The lock icons on the buttons indicate whether the module is available or not, and the color separates these two categories as well. This feature was added to the interface as the clinical experts would like users to stay on the weekly topics. If users tap the locked buttons, an error message pops up (see Figure 5.3) informing users that the module is locked, and the users can choose to either return to the modules or the home screen. Further,



Figure 5.3: Error message

the top part of the page shows the progress bar, which indicates how far into the course the user is.

Users can access the weekly module by clicking on "UKE 3" (week 3). The modules include exercises, and the number of exercises may vary from week to week. Additionally, two resources are available in the prototype, including other relevant exercises and relevant information. The design of the different weekly modules will be kept the same, but the resources and number of mandatory assignments may vary.

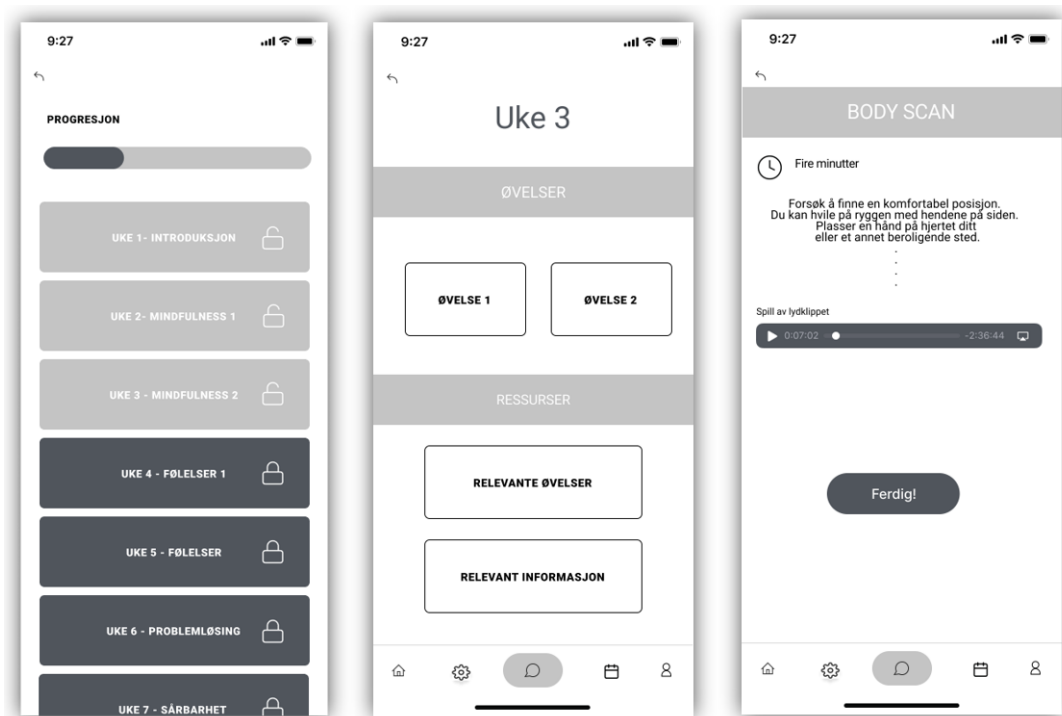


Figure 5.4: Prototype visualizing modules, weekly module example, and one exercise

It was important for designers to understand the content of the weekly exercises, especially in the context of user evaluation. To retrieve feedback on the exercises-page design, it was created realistic examples of how this could look. The exercise included in the prototype is an example of the DBT modules that will be included in the intervention. Figure 5.4 shows an example of a weekly exercise. All exercises should contain information about the duration and additional instructions on what to do. After finishing the exercise, users can tap the "Ferdig!" (finished) button.

Evaluation and sharing

When finishing the exercise, users are directly led to the evaluation page, (see Figure 5.5). The evaluation page includes three questions. The first one can be answered using the scale (0-100), the second one is a yes and no question, and

lastly, participants can choose to elaborate on their experience. Upon finishing the evaluations, users should be given the choice of whether or not they want to share their accomplishments with their peers.

Clinical experts expressed that one can motivate the intervention users by using positive reinforcements. Therefore, a "Job well done!" message was included on the sharing screen as a successor to the task screen. Users should be able to choose whether they want to share their accomplishments with participants. Therefore, users are asked upon finishing the evaluation screen if they wish to share or not.

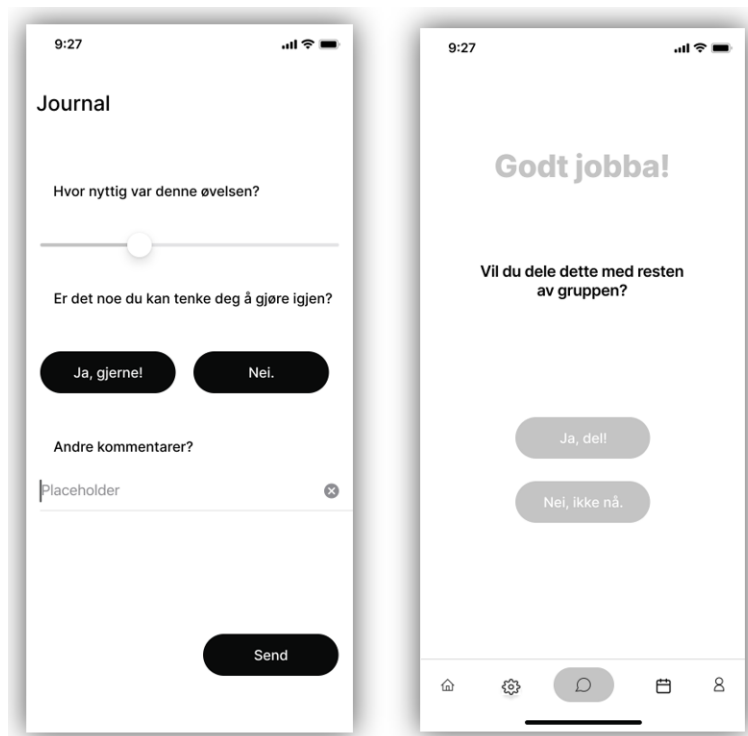


Figure 5.5: Low fidelity prototype visualizing post-exercise evaluation and sharing

Journal and resources

The journal page (see Figure 5.6) was slightly changed as designers found a logical error in the low-fidelity prototype. The "my log" function was changed into a list where users can revisit previous private logs. Additionally, there was added a plus icon on the top of the element. The plus button could be used to add new notes to the logs. In the previous prototype, there was no visible log of previous notes, making it difficult for users to revisit.

The resource center was made with a similar design to the front page, containing buttons with different resources. Examples of what could be relevant and useful for ADHD users are added to the prototype. Whether these resources could be

links to external pages was not decided. If all resources should be internal, further work on the design of these would be needed.

Furthermore, users should be able to personalize settings in the application regarding push notifications. Users should be able to decide if they want notifications on homework assignments, other users' activities, and the calendar function. Although users could turn off the notifications completely in their mobile operating system, the interface should have an internal option. Some users might find it useful to get notified about exercises, and some may additionally want notifications from the calendar.

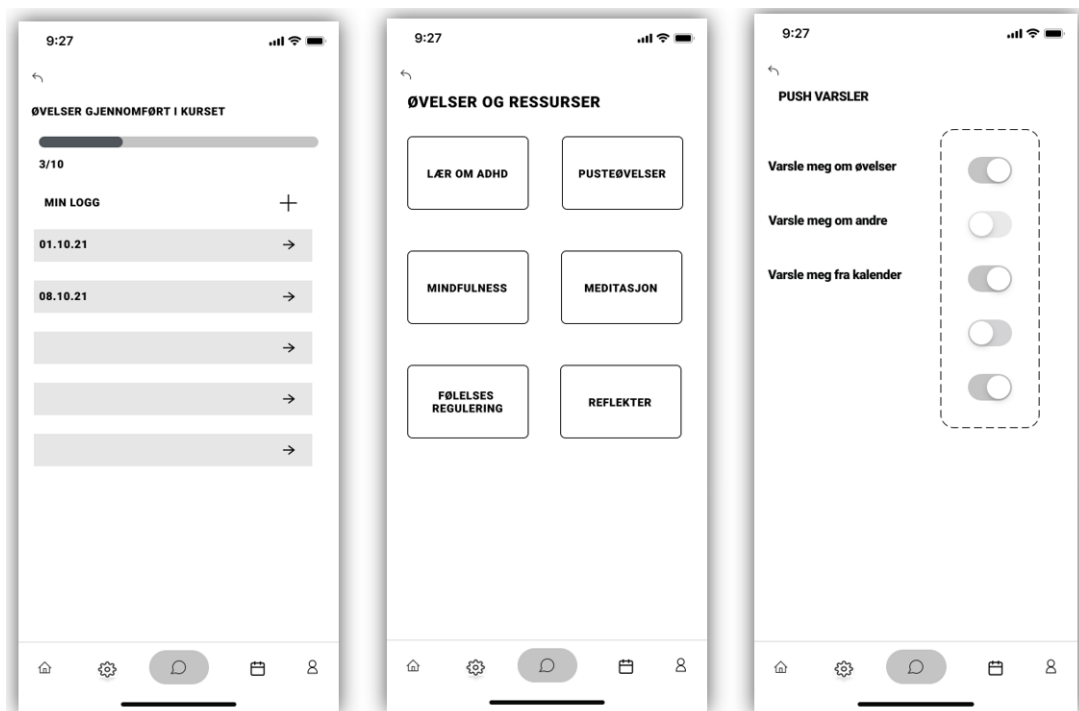


Figure 5.6: Prototype visualizing the journal, resources, and settings

5.1.4 Final design critiquing

In the final phase of the design-sprint, one clinical expert and the designer revisited the requirements and conducted a walk-through of the new prototype. The feedback resulted in additional requirements for the interface, both based on the presented prototype and additional discussion;

- The resources should be internally available in the interface.
- Provide users with information about their data.
- Enable users to edit their profile and choose a nick-name.

5.1.5 Summary

The third project phase resulted in a mid-fidelity prototype. Additionally, multiple requirements were implemented and discovered in the design-sprint process.

5.2 Evaluation workshop

The goal of the evaluation workshop was to evaluate the prototype in collaboration with potential users. The participants were presented with the background of the study and a summary from the last workshop. Additionally, researchers found it important to clarify what the intervention should contain, separating the intention with group therapy from the companion app. The prototype was presented to the users in a group setting by walking through the interface with clickable buttons.

Participants The workshop participants consisted of a designer, HCI expert, one expert in clinical psychology, and five potential users with an ADHD diagnosis. Demographically, all participants are residents of the Bergen area.

Evaluation workshop All three professional participants' roles were to ask questions, take notes and participate in the discussion. The remaining participants (the ADHD group) provided information and input. The prototype was walked through screen by screen, and applicable screens and features were discussed during this process. This provided several topics of discussion and general feedback from users. Most of the participants' feedback regarded the different features; homework and assessment, journal, peer support, calendar, and rewards.

Homework and assessment

When evaluating the exercise page, users expressed that the text in the example assignment was too comprehensive. It was a general consensus among participants that the assignment text should be as short as possible, rather than giving them too much information. Participants were positive to short yes/no questions, which were included on the page, rather than an expectation of written answers. They also preferred concrete answer opportunities over scales, as they found it difficult to place their experience on such scales. Additionally, participants proposed a function to save 'favorite exercises', making it possible for them to save their enjoyed exercises in some form of a list and making it easier for them to revisit.

The exercises should also be named in such a way that users are able to understand their content and remember them.

Journal

Participants were mostly positive to the journal function in the prototype but had some additional suggestions regarding the feature. Firstly, participants would like to revisit their previous notes so that they could re-evaluate situations and emotions. It was therefore important for participants to be able to access these notes, preferably by a log. Secondly, they would prefer the journal to possess a 'speech-to-text' function for noting. Some participants found it tiring to write down situations on their phones and preferred to rather record themselves. Today, most mobile operating systems (iOS and Android) provide speech-to-text by their default keyboard settings. Nevertheless, this needs to be investigated further to see what data processor agreements are needed. Lastly, it was suggested to use a word cloud to describe their day. This could be accomplished by providing a couple of questions to which users could respond by selecting the most suitable word.

Peer-support

The solution of peer support was well received by the workshop participants. They were engaged by the idea of a feed where users could support each other and simultaneously limit unwanted communication. Participants had additional suggestions to the content of the feed, expanding content sharing to not be limited by tasks completed.

Firstly, participants suggested an opportunity to describe the completed exercise: 'I thought the exercise was ...', preferable with some pre-defined words from which they could choose. This feature could be connected to the post-exercise evaluation, and users could choose to describe the exercise from a selection of pre-defined words. Secondly, participants suggested making it possible to post how their feeling, e.g. 'Tom feels 'Happy!', by selecting between different emotions and being able to post this to the group. It was suggested to be an extension to the journal, enabling users to choose to share parts of their journal. Lastly, an opportunity for therapist announcements to the group was requested. This was expressed in the context of messaging the therapist. Participants suggested that some messages to the therapist may be relevant for everyone in the group. Consequently, a feature, enabling therapist to make announcements and provide reminders, amongst other things, could be useful.

Calendar and notifications

Regarding the calendar feature, some participants found it to be a useful asset, while others found it to be sufficient with notifications on exercises and meetings. Participants expressed that the calendar would be more useful if it was possible to connect it with their other calendars. Further, the use of notifications in the app should be quite limited, as they can be more disruptive than helpful. Participants liked the fact that notifications could be adjusted in the applications, as several would only prefer notifications on the 'mandatory' part of the interventions.

Rewards

Users' engagement is essential for this intervention, as parts of the treatment program are app-exclusive (e.g homework assessment). Participants stated that the app should contain engaging features such that users find it both easy and fun to use. Additionally, suggestions on some sort of reward for using the app were proposed. The rewards could simply be limited to reactions from other users on their posts, or it could be provided by using different badges on how well the user has progressed/how far he/she has come.

5.2.1 Additional requirements

Based on participants feedback the following requirements were set:

- Simplify text and concretize
- Provide pre-determined answer opportunities
- Provide functionality enabling saving of favourite exercises
- Provide word-cloud in the journal
- Enable users to share what they think about exercises
- Enable users to share emotions
- Enable therapists to make announcements
- Enable speech to text in all text-boxes
- Create a reward and badges system

5.2.2 Summary

The fourth phase included the evaluation workshop. The evaluation workshop resulted in a through discussion of the prototype, and enabled the discovery of several new requirements. Workshop participants were positive to the features included in the prototype on this stage, but requested additional features.

5.3 Chapter summary

This chapter described the third and fourth design phases, including the design sprint and the evaluation workshop. The design sprint revised new requirements based on critiquing and resulted in a mid-fidelity prototype. Furthermore, the evaluation workshop resulted in a discussion regarding existing features and several new requirements for the further design process.

Chapter 6

Results: final prototype

This chapter presents the final prototype. Several of the new requirements were implemented as a result of the evaluation workshop, while some remain for future work due to time restrictions.

6.1 Final requirements

Requirements implemented:

- Simplify text and concretize
- Provide pre-determined answer opportunities
- Provide functionality enabling saving of favourite exercises
- Provide word-cloud in the journal
- Enable users to share what they think about exercises
- Enable users to share emotions
- Enable therapists to make announcements

Requirement remaining for future work:

- Enable speech to text in all textboxes
- Create a reward and badges system

6.2 Companion-app

The Companion app serves users multiple purposes, and the main activities in the application are; completing weekly exercises, managing feelings and situations in the journal, time management in the calendar, and peer support through controlled sharing.

6.2.1 Peer-support

Peer support in online interventions has shown promising results in previous research, indicating a positive impact on user engagement. Including such features appropriately was a high priority during the design process. Figure 6.1 shows the final prototype of both 'Main page' and 'Happenings'.

The main page now includes an updated happenings box, where users can view the latest updates from the feed. In cases where users want to see more, a button leading them to the full feed is marked with "see more". The peer support feed page includes happenings divided into today, yesterday, and the previous. The happenings are presented chronologically. Furthermore, the therapist announcement is displayed differently from the other publications so that users can see whether the therapist has posted something or not. Additionally, comments about how users feel about different tasks are placed directly under their announcements.

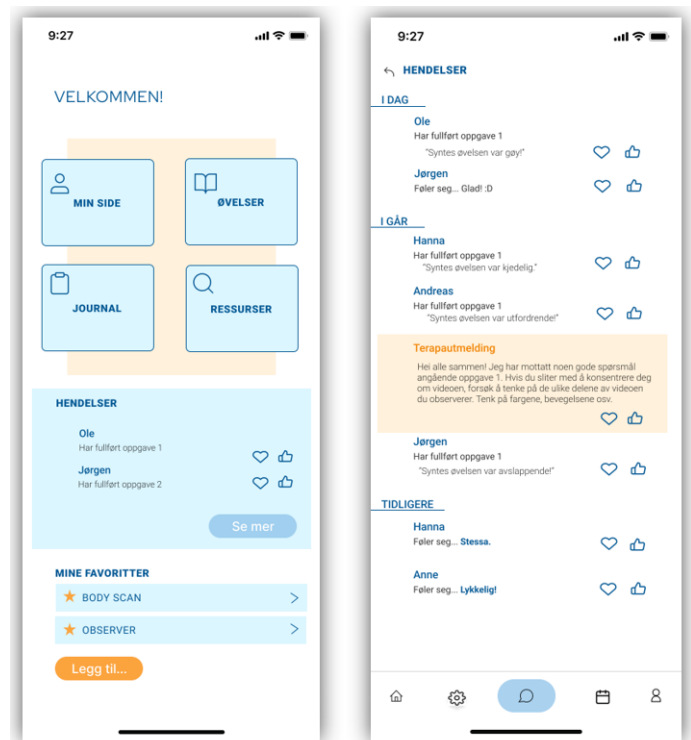


Figure 6.1: Final prototype of the "main page" and "happenings"

Lastly, users can post status reports on how they feel. These publications can only be posted from the journal. The emotions which users can post are pre-defined and selected by therapists. This limitation is due to the fact that free text allows users to write sensitive information that may be too much for other participants to handle. Additionally, participants can regret such publications later.

6.2.2 Favourite exercises

The prototype contains both exercises relevant to the weekly modules and additional exercises that can benefit users regardless of the treatment program. A way to assemble these two categories of exercises is to provide users with a "Favourite" list feature. Workshop participants suggested that including a favorite list would make it easier to revisit preferred exercises. Furthermore, collecting these exercises in one list would help users create their personal resource center. This list was placed on both the main page (Figure 6.1) and "my page" (Figure 6.2) of the interface so that it is easily accessible to the users. Users could either add exercises by using the button underneath the list or by choosing to save finished exercises to the list.

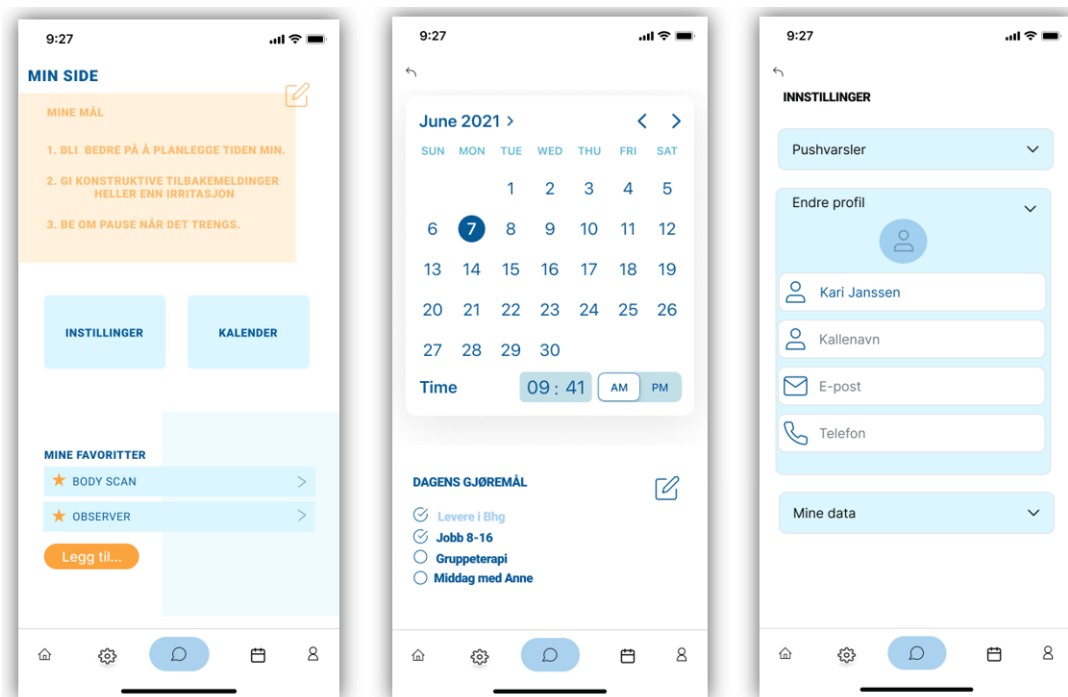


Figure 6.2: Final prototype of "My page", calendar, and settings

6.2.3 Calendar

There were limited changes made to the calendar design. On the top part of the screen, users can access a calendar which they can maneuver through by clicking on relevant dates (see Figure 6.2). The to-do list placed underneath the calendar is related to the date chosen in the calendar. Further, users can add and check off elements on the list, including chores, appointments, or other things they must remember, by using the edit button in the top right corner. The check-list is provided based on participants' feedback in the initial design workshop.

6.2.4 Settings

For the settings page, the functionality was expanded to include profile editing and information about user data, see Figure 6.2. The settings page is kept relatively minimal, and a drop-down menu enables users to select the different profile settings. In the push notification settings, users should be able to turn on and off different push notifications, including calendar, exercises, and peer support notifications. Workshop participants' opinions on whether they wanted to be notified by the different features varied in the workshops. Consequently, providing users with the opportunity to self decide was seen as the best alternative. Profile settings enable users to write their name or nickname, contact information, and choose a profile picture. The contact information could be essential to enable the messaging feature, providing the therapist a point of contact with the participants. Lastly, the data settings should include information about how participants personal data is being handled and stored in the intervention, keeping the communication on data storage and handling transparent.

6.2.5 Exercises

One of the main features in terms of the therapeutic metrics is the opportunity to complete the tasks provided by therapists. Individual skill training is one of the two main parts of DBT, and thus a big part of the Companion app.

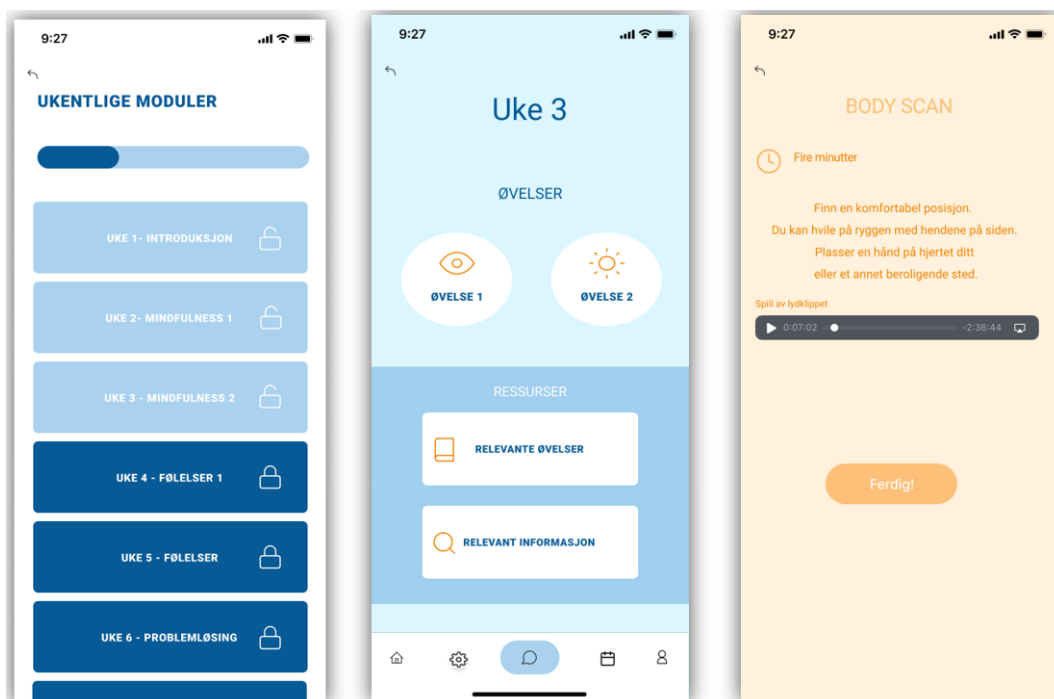


Figure 6.3: Final prototype of weekly modules and example of a weekly module and exercise

Figure 6.3 presents the exercise modules, an example of a weekly module, and an example exercise. Users can access the module page directly from the main page and choose the current week accordingly. Weeks which are colored light blue with an open lock, are accessible to the users, while the dark blue buttons with the closed lock are not accessible. The color difference and icons are used to communicate which modules are available and which are not. This ensures that users can not run through the entire program in one week.

The example week ('Uke 3') shows two exercises and a resource center on the bottom part of the screen. Furthermore, the last screen shows an example exercise where the information text is kept short and clear, explaining what to do in the exercise.

6.2.6 Journal for post exercises

Evaluation post-exercise is a central part in DBT-skill training. Figure 6.4 presents the post-exercise journal.

The evaluation/journal provides users with three questions. Firstly, users are asked to provide a description of their experience. Secondly, users are provided the option to save the exercise in their favorite list. Lastly, the user can provide additional feedback and notes, which are sent to the therapist. It is important to note that the post-exercise journal probably will be expanded, as clinical experts have not decided exactly what it should contain.

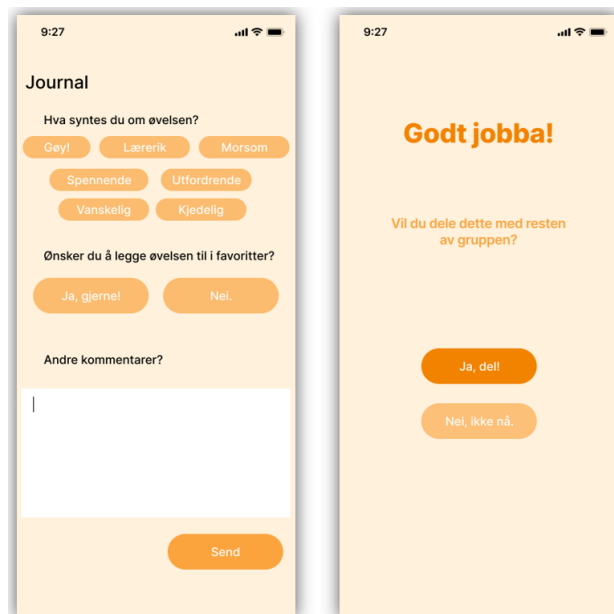


Figure 6.4: Evaluation post-exercises and sharing

Further, users are asked whether they want to share what they have done. If users choose to share with their fellow peers, their answer to the first question in the post-exercise journal will be shared with the rest of the group. Examples of how this would be presented can be found in Figure 6.1. Users who would not like to share are directly redirected to the home page.

6.2.7 Journal for emotions

Users who would like to journal emotions can do so by clicking the journal button on the main page. The journal includes a progress bar connected to the course and a log of previous journals. By pressing the plus sign, users are guided to the next screen, where they can answer questions. Based on feedback in the evaluation workshop, "word bubbles" were created in which the users could choose the most suitable word to answer the questions. Additionally, the text box on the bottom of the page enables users to write personal notes.

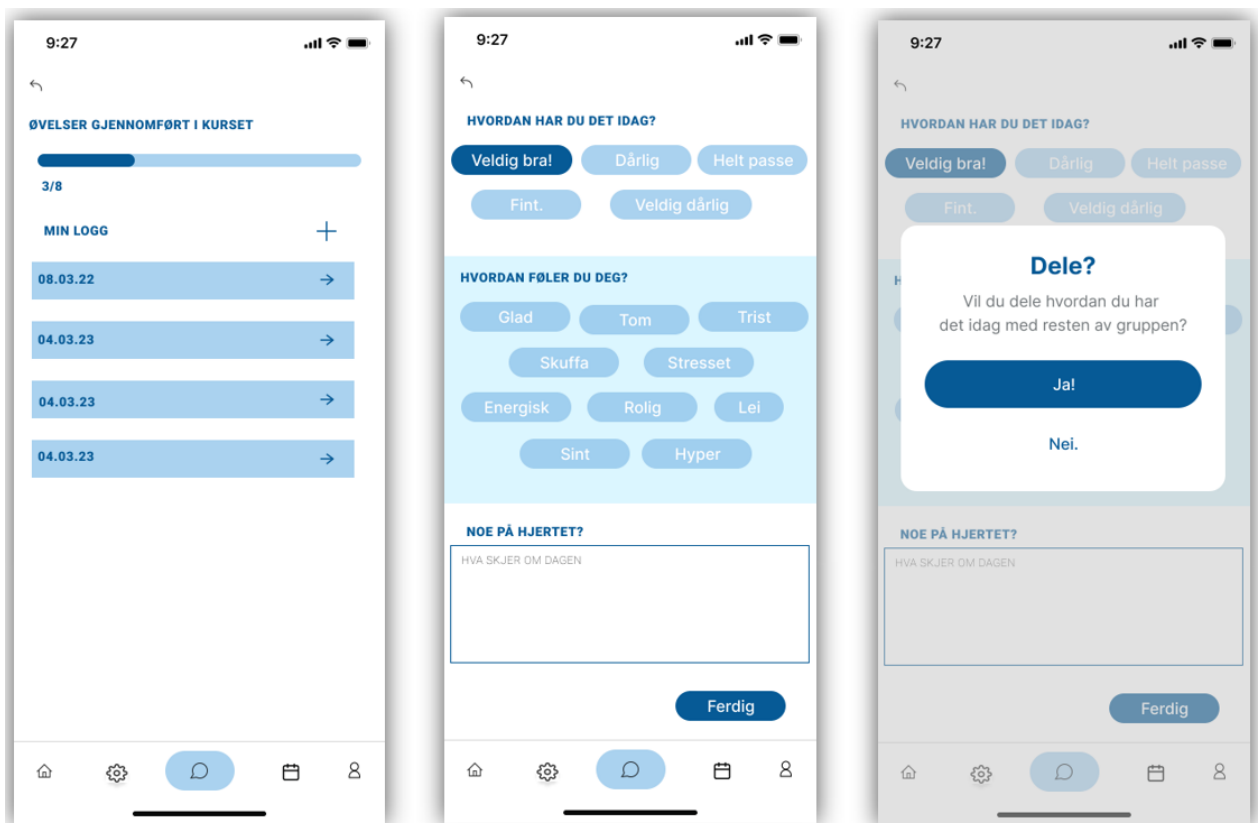


Figure 6.5: Final prototype of the journal

The Companion app also enables users to share emotions with their peers. The journal was initially thought to be a private feature where users could store journal logs on different situations. Based on participants' feedback, it was decided to enable sharing of emotions through the journal. Therefore, the journal functions as both a private log and a peer support feature. Users can share how they feel by sharing the answer to the first question in the journal. Similar to the post-exercise journal, this feature supports DBT principles by allowing users to evaluate and reassess. The journal could be expanded to include more questions, and the words used in the prototype are only the designers' suggestions.

6.2.8 Psychometric assessment

The Psychometric assessment feature is not connected to features that support DBT or interaction in-between group therapy sessions. Nevertheless, psychometric evaluation is essential to help clinical researchers evaluate the effectiveness of the intervention. Furthermore, it can be relevant for future evaluation of the online intervention, and it was therefore decided to include this feature in this thesis.

The psychometric assessment shown in Figure 6.6 consists of a scheme with different questions. The bottom bar is removed, as the scheme is mandatory in the process of researching the intervention, and participants must answer the questions. Additionally, information about what the scheme is used for and other relevant information should be included above the questions.

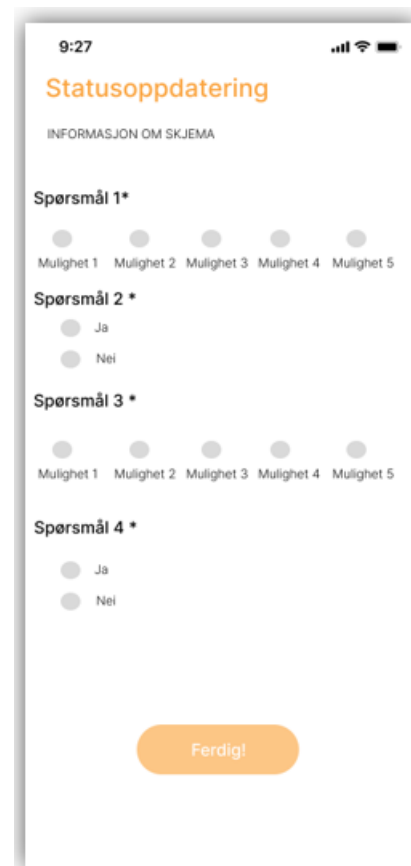


Figure 6.6: Final prototype of the psychometric assessment

6.2.9 Conceptual model - proof of concept

As the requirements increased, the conceptual model was updated during the design process. Relative to the first model, the final conceptual model shown in Figure 6.7, also includes the journal, peer support, and therapist contact. The final conceptual model captures the DBT-based treatment intervention but focuses on the Companion app features and relationships.

The conceptual model includes the therapist, user, and group-therapy peers. The peers are connected to the Companion app as the peer-support features include posting by other group members. Additionally, the therapist is present in the intervention both through the message function and therapist announcements.

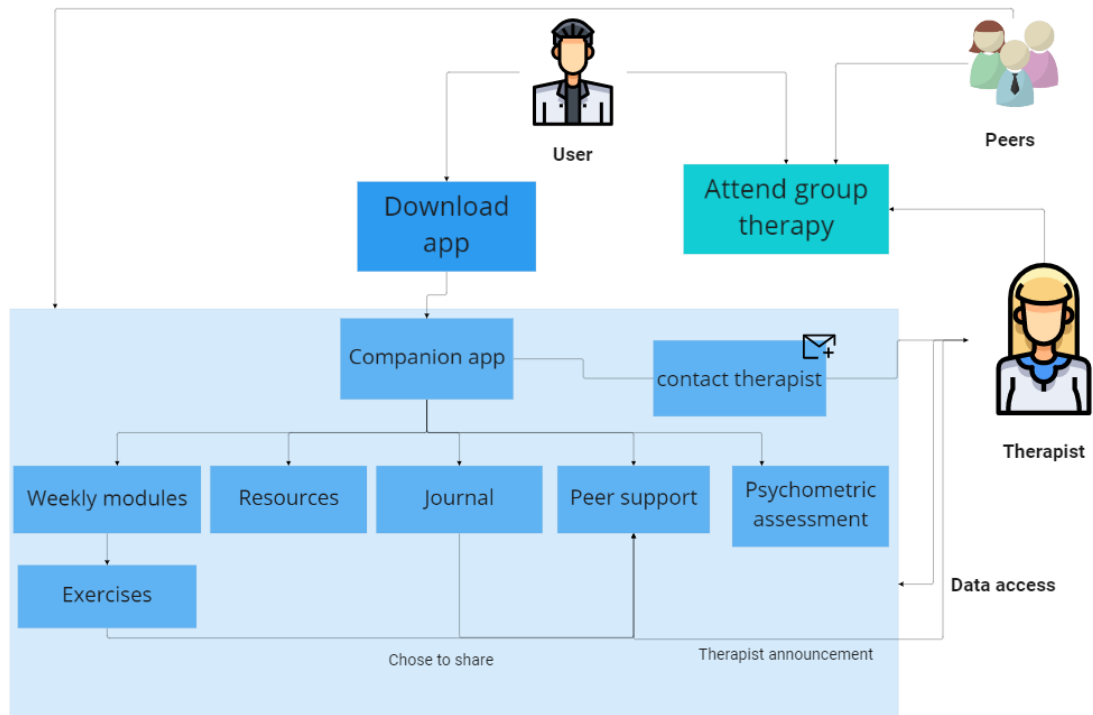


Figure 6.7: Final conceptual model

6.3 Chapter summary

This chapter described the high-fidelity prototype of the companion app for adults with ADHD. Although the prototype entails several important features, the prototype still has potential for improvement and further evaluation. Changes remaining will be described in the next chapter.

Chapter 7

Discussion

This thesis aimed to answer the following research questions:

RQ1: How can we support interaction in-between group therapy sessions for adults with ADHD?

RQ2: How can we design an intervention based on principles from dialectical behavior therapy?

The goal was to investigate how we can design an online intervention based on principles from DBT for adults with ADHD, supporting interaction between group therapy sessions. Firstly, a literature review was conducted to investigate state-of-the-art and previous findings regarding design considerations and useful features. Secondly, a Participatory Design process including users in both design- and evaluation workshops to investigate users' perceptions and opinions to design and content. To answer the research questions, relevant literature presented in Chapter 2 and a Participatory Design process presented in Chapter 4 and 5 was conducted.

This chapter provides a discussion of sever relevant topics. Additionally, the research contribution of this thesis in light of RtD evaluation will be discussed. Additionally, answers to this thesis research questions will be presented, and last, the limitations of the this thesis will be discussed.

7.1 Designing online interventions: possibilities and challenges

The thesis research is connected to a blended intervention for adults with ADHD focusing on emotional dysregulation. The blended intervention consists of in-person therapy in groups and a online intervention. Consequently, this has influenced the design process and choices made in the design and research process. In order to support interaction between group therapy sessions, it was decided to create a mobile application.

The use of online interventions in the context of therapy has gained more acceptance (Lungu, 2015). Online interventions tend to be cost-efficient and provide higher accessibility and flexibility to the users (Cuijpers et al., 2009; Newman et al., 1997). Consequently, the use of online interventions can make it easier and more flexible for patients to commit to such treatment programs (Newman et al., 1997). Furthermore, the opportunity of personalization makes it easier to provide relevant functionality. One can accommodate different user needs by providing, e.g., journal and calendar features. ADHD is a highly individual diagnosis, and thus ADHD patients may inquire differentiated therapy. Both design and evaluation workshops revealed a high engagement related to the features which could be included in the online intervention.

Despite these advantages, some challenges should be considered. Online interventions often suffer from high drop-out rates and low engagement. By combining traditional therapy with an online intervention, the goal is to utilize the opportunities of online interventions while limiting the negative consequences of online interventions which are not combined with traditional therapy. As of today, resources assigned to adults with ADHD are quite limited, and many patients experience a lack of treatment options (Turgay et al., 2012).

One can argue that including online interventions in treatment programs may enable a broader specter of opportunities to provide patients with guidance without acquiring too many healthcare resources. While on the other hand, demanding participation through mobile applications in such interventions could be a source of frustration and distraction for some users. People diagnosed with ADHD often struggle with distractions and hyperactivity, and whether or not mobile applications are the best tool for such interventions should be further researched. The benefits must be weighed against the potential challenges, as it is clear that technology may enable better opportunities for future treatment

options.

7.1.1 Design implications: useful features

In a successful online intervention, commitment and engagement are the core factors separating successful and unsuccessful interventions. The literature review summarized the reasons behind low engagement to be: poor usability, unhelpful in emergencies, lack of technical features, and design flaws (Kenny et al., 2016; Torous et al., 2018). There were several design choices made in the process of designing the prototype of the Companion app. Chapter 4 and 5 describes the process and the new requirements. This section discusses some of the choices made during this process.

Homework and assessment The possibility to complete exercises is a central part of the Companion app. Workshop participants were also quite excited about this feature and suggested new functionality to provide a favorite list of exercises they like. Exercises are a big part of DBT skill training and providing functionality that enables users to retake liked exercises was seen as a great resource by clinical experts. It was also decided to provide users with additional exercises not directly connected to the mandatory modules to not limit the interface to mandatory tasks. This would provide users with additional options, and may enable further skill training.

Time management Time management tools are found to be useful for ADHD management (Dibia, 2016), and this was also confirmed by workshop participants. People with ADHD can often have difficulties managing time and remembering appointments and chores (Helsedirektoratet, 2018b). Therefore, tools which may help users keep better track of their time can be helpful. Thus, a calendar was included in the interface on workshop-participants requests. The calendar also consists of a checklist, enabling users to keep track of what they have done. This feature was not seen as valuable by all workshop participants and was therefore placed on the personal page of the app.

Journal emotions Workshop participants requested a journal to be a part of the interface. They expressed that the opportunity to write down different situations could be an important asset to reflecting upon daily situations. Additionally, it was proposed to contribute to the peer support feed by posting how their day has been. Therefore, it was decided to provide users with different answer options so that they could post such statements without allowing for free text. This was due to the fact that therapists did not want users to be able to post on sensitive

topics (e.g., suicide risks).

Providing resources There were several resources included in the Companion app. Firstly, research finds that including health education and informational resources adapted to users' health conditions can be quite engaging. Based on this, resources were early included in the interface. The Companion app contains a resource center for users to learn more about their diagnosis and to entail other relevant resources (e.g., information about breathing techniques). Additionally, including resources based upon user wants may lead to higher engagement. The calendar included in the Companion app are not directly related to DBT principles, but was suggested as a useful feature by participants. Not limiting the inclusion to DBT related features may enable a more engaging interventions where users can access additional resources.

Peer support The importance of peer support is established in previous literature but was also brought up by workshop participants as an important factor. Previous literature finds peer support to be an engaging factor in similar interventions (Torous et al., 2018). This also applies to supporting communication between users and responsible therapists. Consequently, the discussion of how to include peer support in the Companion app became highly prioritized by project participants. Although peer support often includes direct communication between peers, this was not seen as an opportunity in this research project. The reason was based on both available resources and limitations due to the fact that it is a part of a larger intervention offering treatment to adults with ADHD and therefore is under strict guidelines. The decision to include peer support by enabling users to react to each other's accomplishments was therefore made. This may enable a sense of community without direct communication. The feed will also offer some variety by including peer support features directly connected to the exercises, journal entries, and therapist announcements. Additionally, the peer support feed enables praise and rewards by enabling users to like each other's actions, supporting the design considerations for ADHD.

7.1.2 Design considerations

In the process of designing mHealth apps, there are several considerations to be made. Section 2.6 describes the design considerations for ADHD and mental health.

Designing for ADHD Providing structure is found to be important when designing for ADHD. In structuring the Companion app, it was discussed how the

app should be structured logically, only including relevant links on the different pages. The structure of the Companion app is predominantly based on the main activities.

It is also important to minimize distractions when designing for ADHD. In the interface itself, one should focus on minimizing distractions so that users are not presented with unnecessary content. Therefore, the app's design was kept simple, and the content was kept to a minimum. A different aspect is the risk that the app itself could be distracting. Mobile applications and smartphones may contribute to distracting users from other daily tasks. By providing users with push notifications, some may find them more disruptive than helpful. It is difficult to provide this user group with reminders of exercises without distracting them. It was therefore decided that the users themselves must decide whether notifications would be a helpful reminder or another distraction.

Encouraging praise and rewards is also taken into consideration. It was central to discover how one could motivate the users to finish exercises and engage in the interface. The peer support functionality in the Companion app is highly connected to praise and rewards, especially by enabling the posting of achievements and the 'like' functionality, which enables peers to support each other.

Designing for mental health It is important to be aware of the end users in design processes, designing and developing health care technology should involve potential users (Flobak et al., 2021; Spiel et al., 2022; Yardley et al., 2015). In this thesis, a participatory design method was applied to involve users both in the design and evaluation phase of the design process. Additionally, relevant literature was gathered, and findings from previous research are taken into consideration.

Further, mHealth applications should be based on traditions of mental health psychology and accepted theories (Bakker et al., 2016). The Companion app is based on DBT and is additionally a part of a larger intervention in which participants partake in group therapy sessions. Nevertheless, the design of the Companion app is only evaluated in the evaluation workshop and not in connection to clinical practice. Consequently, it needs to be further evaluated and tested in the context of use (Doherty et al., 2010).

7.1.3 Participation in the design process

In designing mHealth interventions, being aware of both issues to avoid and which resources to include is important. By developing and designing such interfaces in collaboration with users and clinical experts, potential issues and/or opportunities can easier be discovered (Spiel et al., 2022; Yardley et al., 2015).

Research finds that involving potential users in the design process can contribute to better working technology (Yardley et al., 2015). By including users, researchers gain the perspective of lived experience, which is difficult to gain without user input. While including users in the design process is seen as a great resource, the means by which they are included is essential. Users should not be exclusively included in evaluations of systems but also in the initial stages (Spiel et al., 2022). By only including users in the evaluation, the framework and how the product is designed limits the users in their feedback. This also applies to research experts, as HCI research often requires multiple disciplines, including researchers from relevant fields is seen as decisive. In this thesis, *participants* included both clinical psychologists and potential users with ADHD. The participants were included from start to finish and partook in all stages of the design process.

Bratteteig (2021) proposed six suggestions of activities (see Section 3.3.2). Firstly, the Participatory Design process was planned, Figure 3.1 shows the project phases. The plan consists of two main workshops in which potential users participated and a design sprint in which clinical experts and designers participated. Additionally, the relevant practice was investigated through the literature review and conversations with clinical experts. Findings in the literature review supported the use of a Participatory Design approach in the design process of this interface. As a result, multiple features were included in the intervention based on participants' input. As described in the section above, all implemented functions were either based on clinical perceptions, ADHD participants' wants, and previous findings in the literature review.

It should be discussed whether or not the user involvement in the design process was adequate. The high-fidelity prototype presented in Chapter 6 could have been re-evaluated with a new evaluation workshop, as there were multiple changes made to the prototype. Simultaneously, the prototype changes were mainly based on user feedback, and no major changes separate from this were made. Additionally, the further development process of this interface will enable researchers to test the application in the context of therapy. This will enable more precise user feedback, and new requirements and needs can become clearer.

7.2 Research contribution

Process This thesis presents the process of design for the Companion app. The research design is provided in Chapter 3, providing a argumentation of the selected methods and methodology used in this thesis project. RtD was chosen as the methodology for this thesis due to the fact that it acknowledges prototypes as a source of knowledge. Additionally, RtD allows for exploratory research, by recognising an artifact to be a research contribution in it self. Further, a Participatory Design approach was considered to be suitable as it focuses on involving the user in the design process. This was seen as especially important when working with the ADHD group, as they have experiences and struggles in which are unknown to the designer/researcher. Involvement of potential users was essential to answer this thesis research questions.

Invention The invention was ensured based on the literature review, exploring existing research on the topic of interventions for adults with ADHD. This reviled several issues, recommendations and considerations for future work. Firstly, available apps for managing ADHD is high relative to existing research, and most existing research on the topic concerns children with ADHD and parental guiding. Secondly, most relevant research do not involve potential users and/or mental health experts, making it hard to measure effect and success of these interfaces. Thirdly, studies which involve the user group, often tend to involve potential users in evaluation of the product, making it harder for users to influence the design and functionalities of such products. This research focused directly on these challenges, by including users through the Participatory Design process, enabling users to partake in the process before prototyping and implementing features in which they find useful.

Relevance The aim of this research was to discover how DBT principles can be transferred into an online intervention, and how the intervention can support interaction in-between group therapy sessions. This thesis contributes toward this goal, however, the focus has lied on what features to include both from users and domain experts points of view and not on the usability of the intervention. Thus, more research and evaluation is needed to understand how to best provide users with a Companion app that supports this thesis objective.

Extensibility The design process of this research have been thoroughly documented through the previous chapters. This include descriptions on the design process, involvement of users and evaluation. Additionally, a set of

requirements is presented throughout the chapters, enabling future research to extend these requirements and apply them in further research.

7.3 Research questions

RQ1: How can we support interaction in between group therapy sessions for adults with ADHD?

Involve When designing technology for adults with ADHD, one important factor is to involve potential users. One way to achieve this is to include the user in the design process, which can be done by applying the Participatory Design method to the research. Participatory Design enables potential users to contribute to the design process by providing information and lived experience which is unknown to the designer. Additionally, it is important to be familiar with the therapy methods used in the intervention. Understanding the context can help the designer better provide functionality that is suitable to the context of use.

Consider Secondly, previous literature presented in Chapter 2 provides different aspects to consider in the process of design. The task of supporting interaction can be solved with a mobile application but is not limited to this technology. Additionally, the proposed design considerations in Section 2.6 should be taken into consideration. The technology should be helpful to the user and not provide them with a feeling of frustration or being distracted.

Engage Lastly, including engaging features is seen as important. Online interventions are dependent on user engagement. Including peer support is found to be engaging, providing users with a sense of community. While traditional peer support often includes direct communication, the high resource demand contributed to alternative peer support. Enabling users to interact by providing feeds where they can support each other was found to be engaging. The peer support feature also enables users to offer each other praise and rewards, which can be motivating for users.

Additionally, relevant exercises should be made available so that users need to interact with the interface during participation in the treatment intervention. By including favorite exercises, users may revisit exercises they find useful and thus support further interaction.

Including features that support everyday situations can also support interaction. Providing informational resources in the intervention can help users learn and

discover new information in between group therapy sessions. This research also finds that providing journal and calendar features in the interface could be of value to ADHD users. Providing users with optional features which they can choose to engage with may contribute to further interaction and participation in the intervention.

RQ2: How can we design an intervention based on principles from dialectical behaviour therapy?

The foundation of DBT consists of group therapy sessions and individual skill training. While DBT-based treatment programs may vary in content and intervention framework, they all build on the same principles, strategies, and protocols (Linehan, 2015). The goal of DBT interventions is for participants to achieve behavioral control, happiness, joy, and reduce personal problems (Lungu, 2015). The intervention in this thesis focuses on emotional dysregulation specifically, and the therapeutic content of the intervention was based on skill-training targeting emotional dysregulation.

Exercises The main task of the online intervention is to contribute to the individual skill training. The most prominent way to implement parts of DBT skill training in the online intervention is to include the exercises and weekly modules attached to the planned therapy. A central part of DBT is the individual training which includes homework assignments connected to the weekly modules presented in group therapy sessions. Providing participants with exercises through the online intervention can also contribute to more flexibility as the exercises are available on their smartphones.

Resources Further, providing additional resources in online interventions can support DBT principles. Firstly, by including additional exercises, users can choose to partake in more individual skill training than the minimum demand. DBT also consists of informational resources which may be useful for participants to access. Learning about skills and other relevant information provides users with a better understanding.

Journal Additionally, keeping a journal and evaluating situations is quite central in DBT. Thus, including journal and evaluation features in online interventions can help support DBT. Firstly, implementing journal post-exercises enables users to evaluate the effect of the exercise. Second, DBT focuses on evaluating daily situations where participants experience difficult or demanding emotions. By enabling participants to journal difficult situations and evaluate what, why, and

how things happened, the intervention can support DBT principles.

Peers Lastly, even though group-skill training is mostly connected to the in-person therapy sessions, peer support features can contribute to transferring the dynamic into the online intervention. Peer support features are another way to transfer DBT principles into an online intervention. Group-skill training and therapy sessions focus on the involvement of others in similar situations, and the peer support feature can be an extension of this supportive peer dynamic.

7.4 Limitations

This thesis has provided a description of the process, requirements, and a prototype of the Companion app, but the application has not been developed, or usability tested. Participants were excited about the idea, but further evaluation and user testing is needed. Furthermore, the two workshops, which included participants, only consisted of five adults with ADHD, which is quite limited. The same adults participated in both the design and evaluation workshop, which may be seen as narrow participation. As this thesis applied participatory design to the design process, one could argue that it would be necessary to include potential users in a second evaluation and increase the number of participants.

Additionally, the Companion app is designed to be a part of a blended treatment intervention for adults with ADHD. Consequently, the interface should be tested in this context, focusing on existing features, usability, and other possible deficiencies. This thesis provides several features that can support DBT principles, but whether the features are sufficient can not be answered. The limitations of this study imply that more research in the development process of this interface is needed, as the results from this thesis are limited to the beginning stages of the design and development process. Nevertheless, the gathered data in this research is sufficient to answer this thesis research questions.

7.5 Chapter summary

This chapter discusses the findings from the literature review and the design process. Additionally, all research questions were answered, followed by the limitations of this thesis.

Chapter 8

Conclusions and Future Work

The research presented in this thesis was conducted as a part of a larger research project focusing on a multi-modal treatment intervention targeting emotional challenges in adults with ADHD. The aim of this thesis was to design an online intervention supporting interaction between group therapy sessions based on principles from Dialectical Behaviour Therapy (DBT). The main contribution of this thesis is a prototype, including several features which support this thesis goal. Additionally, the research resulted in multiple requirements which can be applied in future research.

Findings in the existing literature provide several limitations regarding online interventions. Firstly, available applications for managing ADHD are high relative to existing research, and most existing research on the topic concerns children with ADHD and parental guidance. Secondly, most relevant research does not involve potential users and/or mental health experts, making it hard to measure the effect and success of these interfaces. Thirdly, studies involving the user group often tend to involve potential users in evaluating the product, making it harder for users to influence the design and features of such products. This research focused directly on these challenges. Firstly, this thesis target adults with ADHD specifically. Additionally, including users through the participatory design process enables potential users to influence the process and partake in design decisions.

This thesis methodology was Research through Design, and a Participatory Design approach was applied. Clinical experts and potential users were directly involved in the design process through several project phases. The two initial phases contributed to a set of requirements that laid the prototyping process's foundation. The initial prototype consisted of weekly modules and homework,

a resource center, psychometric assessment, calendar, and journal features. In the following phase, a design sprint was conducted. The design sprint included clinical experts and UX experts to support the need for triangulation in the data gathering process. A mid-fidelity prototype was created in this phase, focusing on the requirements and findings from the initial project phases. The fourth phase included the evaluation workshop with users and domain experts. The evaluation workshop resulted in new requirements, mainly expanding the existing features.

The Companion app prototype consists of several features; homework and assessment, resources, journal, peer support, psychometric assessment, and calendar. Most of these features support principles from DBT, focusing on skill training. The homework feature enables users to practice new skills, and users can evaluate and reassess post-exercise. The journal also enables users to evaluate daily situations. These features are highly relevant in DBT practice, enabling users to learn new skills and reassess difficult situations. Additionally, peer support enables the extension of support in such interventions, not limiting peer support to group therapy sessions.

It should be emphasized that the Companion app was limited to be tested as a prototype, in which the evaluation focused on useful features and gathering requirements. The prototype was not possible to test in the context of therapy, and therefore the findings in this thesis are limited to the concept of supporting interaction. Nonetheless, this thesis provides findings from several perspectives. The features presented are found to be useful by ADHD participants and clinical experts and support DBT principles. Thus, this thesis encourages further development of both the prototype and a technical functioning intervention.

8.1 Future work

Based on the research presented in this thesis, there are multiple concepts that could be interesting for future research. Firstly, the Companion app prototype could be further developed, enabling usability testing with potential users. Including new participants in the evaluation process could also provide researchers with new points of view and additional requirements. In addition, an expert evaluation, including clinical experts, could be conducted to ensure that the features in the Companion app are sufficient and whether additional features should be included in the intervention.

Secondly, the Companion app could be developed for testing in context. As the Companion app is designed to be part of a multi-modal treatment intervention, the app should be tested with participants attending group therapy sessions. Evaluating the Companion app in this context may induce new requirements and design implications.

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Appendix A: NSD approval

25.11.2021, 10:49

Meldeskjema for behandling av personopplysninger



NSD sin vurdering

Prosjekttittel

Utvikling av en digital intervensjon for voksne med ADHD

Referansenummer

849784

Registrert

15.11.2021 av Hedda Bakken - Hedda.Bakken@student.uib.no

Behandlingsansvarlig institusjon

Universitetet i Bergen / Det samfunnsvitenskapelige fakultet / Institutt for informasjons- og medievitenskap

Prosjektansvarlig (vitenskapelig ansatt/veileder eller stipendiat)

Frode Guribye , Frode.Guribye@uib.no, tlf: 41237111

Type prosjekt

Studentprosjekt, masterstudium

Kontaktinformasjon, student

Hedda Bakken , hba035@uib.no, tlf: 46765687

Prosjektperiode

29.11.2021 - 31.05.2022

Status

25.11.2021 - Vurdert

Vurdering (1)**25.11.2021 - Vurdert**

Det er vår vurdering at behandlingen vil være i samsvar med personvernlovgivningen, så fremt den gjennomføres i tråd med det som er dokumentert i meldeskjemaet 25.11.2021 med vedlegg. Behandlingen kan starte.

TYPE OPPLYSNINGER OG VARIGHET

Prosjektet vil behandle alminnelige personopplysninger, særlige kategorier av personopplysninger om helseopplysninger frem til 31.05.2022.

LOVLIG GRUNNLAG

<https://meldeskjema.nsd.no/vurdering/61792aeb-b503-49bd-a3c1-b80224d8da1e>

1/3

25.11.2021, 10:49

Meldeskjema for behandling av personopplysninger

Prosjektet vil innhente samtykke fra de registrerte til behandlingen av personopplysninger. Vår vurdering er at prosjektet legger opp til et samtykke i samsvar med kravene i art. 4 nr. 11 og 7, ved at det er en frivillig, spesifikk, informert og utvetydig bekreftelse, som kan dokumenteres, og som den registrerte kan trekke tilbake.

For alminnelige personopplysninger vil lovlig grunnlag for behandlingen være den registrertes samtykke, jf. personvernforordningen art. 6 nr. 1 a.

For særlige kategorier av personopplysninger vil lovlig grunnlag for behandlingen være den registrertes uttrykkelige samtykke, jf. personvernforordningen art. 9 nr. 2 bokstav a, jf. personopplysningsloven § 10, jf. § 9 (2).

PERSONVERNPRINSIPPER

NSD vurderer at den planlagte behandlingen av personopplysninger vil følge prinsippene i personvernforordningen:

- om lovlighet, rettferdighet og åpenhet (art. 5.1 a), ved at de registrerte får tilfredsstillende informasjon om og samtykker til behandlingen
- formålsbegrensning (art. 5.1 b), ved at personopplysninger samles inn for spesifikke, uttrykkelig angitte og berettigede formål, og ikke viderebehandles til nye uforenlige formål
- dataminimering (art. 5.1 c), ved at det kun behandles opplysninger som er adekvate, relevante og nødvendige for formålet med prosjektet
- lagringsbegrensning (art. 5.1 e), ved at personopplysningene ikke lagres lengre enn nødvendig for å oppfylle formålet.

DE REGISTRERTES RETTIGHETER

NSD vurderer at informasjonen om behandlingen som de registrerte vil motta oppfyller lovens krav til form og innhold, jf. art. 12.1 og art. 13.

Så lenge de registrerte kan identifiseres i datamaterialet vil de ha følgende rettigheter: innsyn (art. 15), retting (art. 16), sletting (art. 17), begrensning (art. 18) og dataportabilitet (art. 20).

Vi minner om at hvis en registrert tar kontakt om sine rettigheter, har behandlingsansvarlig institusjon plikt til å svare innen en måned.

FØLG DIN INSTITUSJONS RETNINGSLINJER

NSD legger til grunn at behandlingen oppfyller kravene i personvernforordningen om riktighet (art. 5.1 d), integritet og konfidensialitet (art. 5.1. f) og sikkerhet (art. 32).

For å forsikre dere om at kravene oppfylles, må prosjektansvarlig følge interne retningslinjer/rådføre dere med behandlingsansvarlig institusjon.

MELD VESENTLIGE ENDRINGER

Dersom det skjer vesentlige endringer i behandlingen av personopplysninger, kan det være nødvendig å melde dette til NSD ved å oppdatere meldeskjemaet. Før du melder inn en endring, oppfordrer vi deg til å lese om hvilken type endringer det er nødvendig å melde:

<https://www.nsd.no/personverntjenester/fylle-ut-meldeskjema-for-personopplysninger/melde-endringer-i-meldeskjema>

Du må vente på svar fra NSD før endringen gjennomføres.

OPPFØLGING AV PROSJEKTET

NSD vil følge opp ved planlagt avslutning for å avklare om behandlingen av personopplysningene er avsluttet i tråd med den behandlingen som er dokumentert.

Kontaktperson hos NSD: Olav Rosness, rådgiver.

Lykke til med prosjektet!

Appendix B: Consent-form

Vil du delta i forskningsprosjektet «digital intervensjon for voksne med ADHD»?

Dette er et spørsmål til deg om å delta i et forskningsprosjekt hvor formålet er å undersøke hvordan vi kan designe et applikasjonsverktøy for voksne med ADHD. I dette skrivet gir vi deg informasjon om målene for prosjektet og hva deltakelse vil innebære for deg.

Formål

Formålet med prosjektet er å finne ut hvordan applikasjonen kan designes og hvilke funksjonaliteter den bør inneha slik at den er nyttig for brukergruppen. Dette er en del av datainnsamlingen for en mastergrad i Informasjonsvitenskap. Opplysningene vil også kunne bli brukt som en del av en doktorgrad.

Hvem er ansvarlig for forskningsprosjektet?

Institutt for informasjon- og medievitenskap er ansvarlig for prosjektet. Prosjektet er et samarbeid mellom institutt for informasjon- og medievitenskap og psykologisk fakultet, masteroppgaven skrives av Hedda Bakken med veileder Frode Guribye, mens Emilie Nordby representerer psykologisk fakultet.

Hvorfor får du spørsmål om å delta?

Du får spørsmål om å delta da du har meldt din interesse for prosjektet gjennom ADHD foreningen. Vi har fått dine kontaktopplysninger fra foreningen.

Hva innebærer det for deg å delta?

Du vil delta i både intervju og workshops. Den første runden vil bestå av et gruppeintervju hvor vi diskuterer ulike funksjonaliteter i applikasjonen. Den andre runden vil du delta i en evaluering av en prototype basert på det som ble funnet i første runde. Hvis du velger å delta i prosjektet, innebærer det at du samtykker til opptak. Dataen vil bli lagret elektronisk.

Det er frivillig å delta

Det er frivillig å delta i prosjektet. Hvis du velger å delta, kan du når som helst trekke samtykket tilbake uten å oppgi noen grunn. Alle dine personopplysninger vil da bli slettet. Det vil ikke ha noen negative konsekvenser for deg hvis du ikke vil delta eller senere velger å trekke deg.

Ditt personvern – hvordan vi oppbevarer og bruker dine opplysninger

Vi vil bare bruke opplysningene om deg til formålene vi har fortalt om i dette skrivet. Vi behandler opplysningene konfidensielt og i samsvar med personvernregelverket.

- Hedda Bakken (master), Frode Guribye (veileder) og Emilie Nordby (Phd Cand) vil ha tilgang til dataene gjennom prosjektet.
- Data vil anonymiseres ved transkribering.

Deltakere vil ikke kunne identifiseres ved publisering.

Hva skjer med opplysningene dine når vi avslutter forskningsprosjektet?

Opplysningene anonymiseres når prosjektet avsluttes/oppgaven er godkjent, noe som etter planen er en uke etter gjennomført intervju/workshops. Ved prosjektslutt vil kunn anonymisert informasjon lagres. .

Hva gir oss rett til å behandle personopplysninger om deg?

Vi behandler opplysninger om deg basert på ditt samtykke.

På oppdrag fra institutt for informasjon- og medievitenskap har NSD – Norsk senter for forskningsdata AS vurdert at behandlingen av personopplysninger i dette prosjektet er i samsvar med personvernregelverket.

Dine rettigheter

Så lenge du kan identifiseres i datamaterialet, har du rett til:

- innsyn i hvilke opplysninger vi behandler om deg, og å få utlevert en kopi av opplysningene
- å få rettet opplysninger om deg som er feil eller misvisende
- å få slettet personopplysninger om deg
- å sende klage til Datatilsynet om behandlingen av dine personopplysninger

Hvis du har spørsmål til studien, eller ønsker å vite mer om eller benytte deg av dine rettigheter, ta kontakt med:

- Institutt for informasjon- og medievitenskap ved Hedda Bakken, 46765687, hba035@uib.no eller Frode Guribye, Frode.Guribye@uib.no.
- Vårt personvernombud: Janecke Helene Veim, personvernombud@uib.no

Hvis du har spørsmål knyttet til NSD sin vurdering av prosjektet, kan du ta kontakt med:

- NSD – Norsk senter for forskningsdata AS på epost (personvertjenester@nsd.no) eller på telefon: 53 21 15 00.

Med vennlig hilsen

Frode Guribye

Hedda Bakken

Samtykkeerklæring

Jeg har mottatt og forstått informasjon om prosjektet *Digital intervensjon for voksne med ADHD*, og har fått anledning til å stille spørsmål. Jeg samtykker til:

- å delta i gruppeintervju
- å delta i designworkshop

Jeg samtykker til at mine opplysninger behandles frem til prosjektet er avsluttet

(Signert av prosjektdeltaker, dato)