Digital health interventions to reduce stress in adolescents

Development of an accessible, digital preventive health tool to promote stress recovery

Jessica Kågeman & Linnea Wenäll

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Abstract

Mental illness among Swedish adolescents is increasing, which partly might be a result of an observed increase in stress. Consequently, the number of adolescents seeking and receiving psychiatric care from pediatric psychiatry is higher than ever, and has resulted in a worsened accessibility with longer waiting times for appointments and treatment. As such, preventive care and health promotion interventions are more important than ever, and using digital solutions and tools to achieve this can be particularly suitable for adolescents as they possess the technical skills to use them.

This master's thesis was performed on behalf of Region Skåne and their project Ungdomsportalen, which is developed in collaboration with Innovation Skåne. Ungdomsportalen is part of a digital platform to promote mental health for children and adolescents currently under development. The purpose of the thesis was to identify what needs adolescents have in regards to stress, develop and communicate a concept for content in Ungdomsportalen that could solve these, as well as simultaneously investigating suitable methods for co-designing a digital health intervention together with adolescents. In the early stages of the project, several needs were discovered and identified through interviews and questionnaires, where the need for increased recovery was chosen to move forward with. With this in mind, an iterative phase began where several concepts for digital solutions were generated and then evaluated through workshops and other evaluation methods. The final concept consists of three self-tests in which the user is able to identify their need for more recovery, find out which activities they can do to increase recovery and evaluate the success of these activities. This concept has the potential to increase recovery among adolescents, however, this needs to be further evaluated with the target group.

Keywords: Co-designing with adolescents, mental health, digital health intervention, eHealth, interaction design, stress

Sammanfattning

Psykisk ohälsa ökar hos svenska ungdomar, vilket delvis kan bero på den ökning av stress som också påvisats. Följaktligen är antalet ungdomar som söker och får vård av Barn- och Ungdomsspykiatrin (BUP) högre än någonsin, vilket har resulterat i sämre tillgänglighet med längre väntetider för tidsbokning och behandling. Därav är preventiv vård och hälsofrämjande insatser mer relevanta än någonsin, och användningen av digitala lösningar och verktyg för att åstadkomma detta kan vara speciellt lämpliga för ungdomar då de besitter den tekniska kompetensen att bruka dem.

Detta examensarbete har utförts på uppdrag av Region Skåne och deras projekt Ungdomsportalen, som utvecklas i samarbete med Innovation Skåne. Ungdomsportalen är en del av en digital plattform för att främja psykisk hälsa riktad mot barn och ungdomar, som för tillfället är under utveckling. Syftet med arbetet var att identifiera vilka behov ungdomar har gällande stress, utveckla och kommunicera ett koncept för innehåll i Ungdomsportalen som skulle kunna lösa dessa, samt att samtidigt undersöka lämpliga metoder för att designa digitala hälsointerventioner med ungdomar. I ett tidigt skede av projektet upptäcktes ett flertal behov tack vare genomförandet av intervjuer och enkäter, där behovet av ökad återhämtning valdes att gå vidare med. Med detta i åtanke påbörjades en iterativ fas där ett flertal koncept för digitala lösningar genererades och sedan utvärderades med hjälp av workshops och andra evalueringsmetoder. Det slutgiltiga konceptet består av tre självtester där användaren har möjlighet att först identifiera om de har ett behov av ökad återhämtning, sedan ta reda på vilka aktiviteter de kan göra för att öka sin återhämtning, och sist få hjälp med att utvärdera aktiviteternas framgång. Detta koncept har potential att kunna öka återhämtningen hos ungdomar, men detta måste utvärderas ytterligare med målgruppen.

Nyckelord: Design med ungdomar, psykisk hälsa, digital hälsointervention, e-hälsa, interaktionsdesign, stress

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Lund, June 2021
Jessica Kågeman and Linnea Wenäll

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1. Introduction

This chapter gives a short introduction to the thesis area, the purpose and delimitations of the thesis as well as the disposition of the report.

Stress and mental illness among Swedish adolescents is increasing and has been for many years [1, 2]. Stress is not a disease in itself, however, it may very well lead to physical and mental illness if there is not sufficient recovery [3]. For Swedish adolescents, stress can be considered a contributing factor to mental illness, where an increase in stress related to school and schoolwork has been observed [2]. Mental illness can be of varying degrees and longevity, and may also present somatically, i.e. physically, which is more common in young people [4, 5].

This increase has consequently caused a dramatic increase in the number of adolescents seeking and receiving psychiatric care [6]. As a result, accessibility has worsened with longer waiting times for appointments and treatment [7]. In order to reduce the inflow of patients needing specialist psychiatric care, the usage of health promotion, illness prevention and early interventions is of high importance [8]. One method of achieving this for adolescents could be by the use of digital tools and programs. In addition to there being scientific evidence to suggest the benefit of these [9, 10], they are well-suited to the digital skills of today's adolescents.

Pediatric psychiatry (Swe. Barn- och ungdomspsykiatrin, BUP) within Region Skåne runs the project *Ungdomsportalen* in collaboration with Innovation Skåne. Ungdomsportalen is part of a digital platform for children and adolescents aiming to prevent mental illness and promote mental health, which is currently under development. The platform will provide support and advice for various topics, as well as easy ways to contact healthcare professionals. Topics to be included are, for example, sleep, nutrition, body image and also, stress.

1.1 Purpose

The purpose of this master's thesis, as part of the project for developing Ungdomsportalen, is concluded as follows.

- Identifying the needs of adolescents aged 12-17 in regards to preventing stress leading to mental illness.
- Developing and communicating a concept for a digital solution that could solve these.
- Investigating suitable methods for co-designing a digital health intervention together with adolescents.

The results, or part of the results, from the first two parts of the purpose of this master's thesis might later be included in Ungdomsportalen as part of a stress module. The results from

the third part of the purpose might be of use for the continued development of Ungdomsportalen as well as digital health interventions in general. To fulfill the purpose of the master's thesis, a user-centered design methodology was chosen to proceed with.

1.2 Delimitations

For this thesis, the stress that is researched and examined is the type of stress that can be found in everyday life. This means that more severe stress-related illnesses, such as Post-traumatic Stress Disorder (PTSD), are not included. As this thesis is part of the larger project that is developing Ungdomsportalen, there are technical limitations as to what kind of solutions could be implemented. The solution has to fit into the overall purpose and functionality of the platform. Furthermore, the thesis primarily focuses on delivering a conceptual result, with less focus on the design and look of the graphical user interface. Lastly, this thesis was performed in the context of Skåne county, including all the people who participated in any way during the process.

1.3 Disposition

Following the introduction, additional background to the project is given for a deeper understanding of the issue at hand.

The methodology and design framework that was used are then described. The following chapters contain the steps of the design framework, meaning the user research, problem definition, concept generation, concept evaluation and the final results of the thesis. The report ends with a discussion regarding the methods and steps of the process, as well as a conclusion which aims to answer the initial purpose.

2. Background

This chapter aims to give a deeper understanding of the current situation regarding mental illness, recovery and stress in Swedish adolescents as well as how this affects pediatric psychiatry. Digital interventions for mental health as a possible solution is described along with the purpose of Ungdomsportalen. Finally, theoretical models for behavior change are presented as these played an important role in concept development further on in the project.

2.1 Mental Illness in Adolescents

Mental health is often used to describe good mental health, well-being, mental illness, mental disorders and psychiatric conditions [4]. According to the World Health Organization (WHO) [11], mental health is defined as a state of mental well-being where each individual is able to achieve their own possibilities, manage daily stresses, work productively and contribute to the society she or he lives in. Mental illness includes varying degrees of severity and longevity, which may be lighter conditions such as worrying and feeling down, or more severe psychiatric conditions [4]. Mental disorders may also present somatically, i.e. physically, such as aches which is common in children. These types of bodily symptoms of psychic, emotional or mental origin are called psychosomatic symptoms [5].

The National Board of Health and Welfare (Swe. Socialstyrelsen) reports that young people with mental illness in greater occurrence have difficulties in completing education, as this group of people may more often be of lower level of education than those who have not received care for depression or anxiety [12]. The number of psychosomatic issues throughout adolescence have also been proven to correlate in a dose-response relationship with the appearance of mental disorders later in life such as chronic depression, suicidal behavior, bipolar episodes and psychotic episodes [13].

The international study *Health Behavior in School-aged Children*, which is conducted every 4 years in 50 countries, surveys 11-, 13- and 15-year-old pupils on their health, lifestyle and living conditions. Since the study's start in the mid-80's, it has shown a significant increase in mental illness among school children. For example, the number of pupils in ages 13 and 15 who report about recurring psychosomatic symptoms has doubled since the study's start [1].

2.2 Stress and Recovery

Stress is a natural biological reaction to perceived threats, and has allowed the human race to survive for thousands of years by providing energy for the fight-or-flight response. When stress occurs, different hormones are excreted in the body which help raise the blood pressure and heart rate, as well as provide energy to the brain and the muscles [14]. As such, stress in itself

is not a disease but may cause illness, both physically and mentally, if recovery is neglected. Illness due to stress is in fact one of the most common reasons for long-term sick leave today [3]. Recovery refers to lowering the physical activity level, recharging and experiencing calm and peace [15]. After periods of high stress levels, recovery is a must in order to prevent long-term fatigue and exhaustion [16]. During recovery, the body stops receiving signals about the perceived threat and the physiological readiness to fight or flight decreases. There are many types of recovery and what may be recharging for one person may not for another. However, the most important source of recovery, no matter the person, is a good night's sleep [15]. Other examples of what could enable recovery include going for a walk, reading a book, exercising, talking to a friend and watching a movie.

2.3 Stress in Adolescents

Following the rise of mental illness in general, stress among adolescents also appears to increase. The Ombudsman for Children states that almost every other girl and every third boy between 10 and 17 experiences stress at least once a week, and the most common reported reason for this is schoolwork [17]. In addition, the latest Health Behaviour in School-aged Children study reports that stress due to schoolwork has increased for girls in all age categories as well as for the 15-year-old boys [1]. As such, school and school-related stress seems to be a contributing factor to the mental illness among children and adolescents, as well as psychosomatic symptoms being more common with those who state that they are stressed as a result of schoolwork. Possible reasons for the increase in stress among adolescents could be higher demands in the labour market. As the market is more insecure and requires a higher level of education than before, this creates an increased pressure to perform well in school [2].

2.4 Effects on Pediatric Psychiatry

An increase in mental illness among children and adolescents will consequently increase the number seeking and receiving care. The survey *Psychiatry by the numbers* (Swe. Psykiatrin i Siffror), which contains statistics from all regions in Sweden, finds that the number of appointments within the pediatric psychiatry has increased by 33% from 2016 to 2019 [6]. The report *Development of mental illness in children and young adults* (Swe. Utvecklingen av psykisk ohälsa bland barn och unga vuxna), performed by The National Board of Health and Welfare, shows that the amount of children and adolescents receiving care in the psychiatric open care increased between 2013 and 2017. It also finds that the accessibility to pediatric psychiatry has worsened with longer waiting times to first-time appointments and for investigation and treatment [7]. Health promotion and illness prevention then appears to be of high importance, and early interventions for those who showcase symptoms of mental illness might stop them from needing specialist care [8].

2.5 Digital Interventions for Mental Health

Digital health interventions (DHI) are defined as health services delivered electronically through formal or informal care, and can range between anything from digital journal systems used by

healthcare personnel to health apps used by the consumer and/or patient [18]. If successfully developed, DHI's can help people manage their health or illness [19], and provide high-reach and accessible interventions to a low cost for large patient populations [20].

Today's generation of adolescents use a variety of digital technologies on a daily basis [21], and in 2018, 96% of Swedish adolescents aged 16-25 had access to a smartphone [22]. Thus, the target group can be assumed to be suitable for the delivery of DHI's. Evidence states that DHI's for children and young people with mental health issues are clinically beneficial [10]. There is also evidence to suggest that web and computer based interventions for stress management are effective [9], and the use of health promoting mobile apps have shown to improve stress management in older adolescents [23].

2.6 Ungdomsportalen

The Swedish government set a goal in 2016 called *Vision for eHealth 2025*, stating that Sweden should strive to be the best nation in the world when it comes to utilizing the opportunities of digitization and eHealth [24]. eHealth is a term encompassed by digital health [25], and refers to the use of digital tools and sharing information digitally to achieve and maintain health [26]. The UN Convention on the Rights of the Child, states that all children should have access to information about mental health and preventative care [27], and Region Skåne states in their Program of Operations and Budget 2021 (Swe. Verksamhetsplan och Budget 2021) that they will make investments to develop digital mental health interventions [28].

The Swedish Association of Local Authorities and Regions (Swe. Sveriges Kommuner och Regioner) has initiated a project for mental health, which is a long-term and cross-sectional investment in improving mental health in Sweden [29]. One theme of this project is called *A health-promoting digital life*, which for the pediatric psychiatry within Region Skåne has resulted in a project aiming to develop a digital platform for mental health.

Today, the first contact with pediatric psychiatry in Skåne county is made by telephone, using a system called *One Way In* (Swe. En Väg In). The main purpose of One Way In is to provide support and advice about mental health, but appointments with pediatric psychiatry can be made if deemed necessary by the personnel taking the phone calls [8]. The purpose of the platform is to act as a digital version of One Way In for the young people of Skåne county, as they will be able to go there to find advice, support, information and ways to reach out to professionals. The platform will be directed towards those who are not yet patients within pediatric psychiatry and instead focus on preventive care and health promotion, in the hopes of increasing availability, improving mental health and decreasing the patient inflow. Figure 2.1 describes the levels of the healthcare system that the digital platform aims to target. It is important to point out that the digital platform is currently under development and has not yet been launched.

Within the digital platform, content will be tailored specifically based on the platform user. The target group for the platform can be divided into different subgroups: younger children, older children, adolescents and relatives. The content for the subgroup adolescents currently has the working title *Ungdomsportalen*, which is where the focus of this thesis lies. Ungdomsportalen will contain the same basic functions as mentioned previously, but will also allow for a logged-in mode. When logged in, the user is able to, for example, keep a digital diary for tracking their mental state and bookmark certain articles.

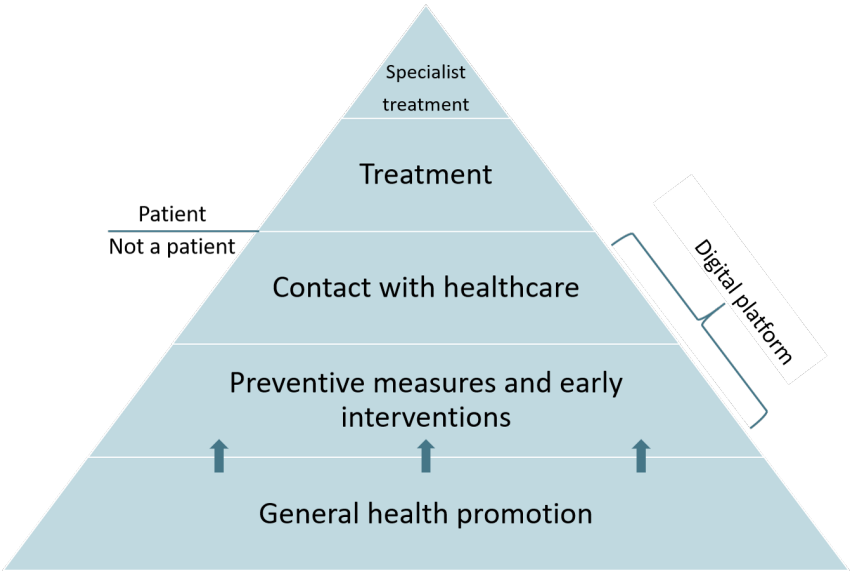


Figure 2.1: The levels of the healthcare system, including the levels targeted by the digital platform.

2.7 Behavior Change Theory

Indications exist that successful DHI's link technology with theoretical knowledge about behavior change [30]. Behavior change interventions means a set of activities wisely coordinated to target and change specific behavior patterns [31]. As the implementation of evidence-based practice and public health depends on achieving and maintaining behavior change [31], understanding how behavior change theory might be used in DHI's is of high importance. Examples of techniques that might achieve this are presented below, along with two models of behavior change that were used when developing the concepts for this project.

2.7.1 Behavior Change in Digital Health Interventions

Tailoring, or personalization, is one technique that can enable behavior change by increasing motivation [32, 33]. In particular, when it comes to adolescents and engaging them in DHI's, including personalization seems to be important in increasing the willingness to use the intervention [34]. By tailoring content, access to information that is personally relevant to the user will be enabled, which is especially reassuring when it comes to health interventions [32]. However, persuasion of the user to consider tailored suggestions may only work if the arguments themselves are convincing [32].

The performance and maintenance of any behavior will be more likely if the behavior is performed out of a sense of choice and free will, i.e. autonomously motivated [32]. This might be achieved by allowing the users to select their own goals or inviting them to try out different suggestions for behavioral change, rather than instructing them to follow a specific directive [32].

Additionally, behavior change techniques (BCT's) such as goal-setting, self-monitoring and feedback are often well-employed within health interventions [32, 33]. In order to set effective goals, they should be specific, achievable in the short-term but sufficiently challenging, as well as linked to a long-term goal. To enable autonomous motivation, users might be given the

option to choose from a set of pre-determined goals. However, it should be made clear when these goals are created as a result of the user's input [32].

2.7.2 Transtheoretical Model

The Transtheoretical model, also known as Stages Of Change, is a model that describes health behavior change as a process of going through six stages. Within this theory, the individual goes through the stages of pre-contemplation, contemplation, preparation, action, maintenance, and finally termination of the behavior aimed to change (figure 2.2) [35].

Within the Transtheoretical model, there are processes of change that move the individual to progress from an early stage to a stage closer to termination. A few examples of processes of change are consciousness raising, counterconditioning and contingency management [35]. Consciousness raising means increasing awareness about causes, consequences and cures whereas counterconditioning means learning of healthier behaviors that can substitute for problem behaviors. Contingency management means providing positive feedback when moving in a certain direction.

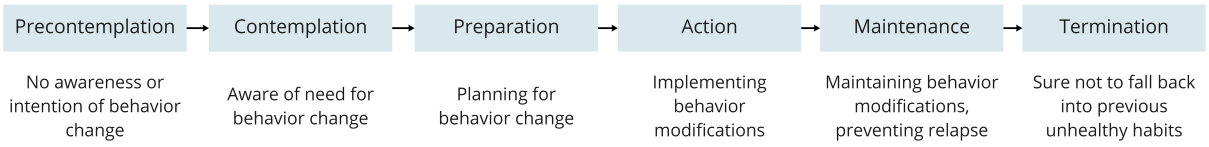


Figure 2.2: The stages of change described in the Transtheoretical model [35].

2.7.3 Behavior Change Wheel

Another model for behavior change is the Behavior Change Wheel (BCW). The BCW is built up by three layers: sources of behavior, intervention functions and policy categories (figure 2.3) [31].

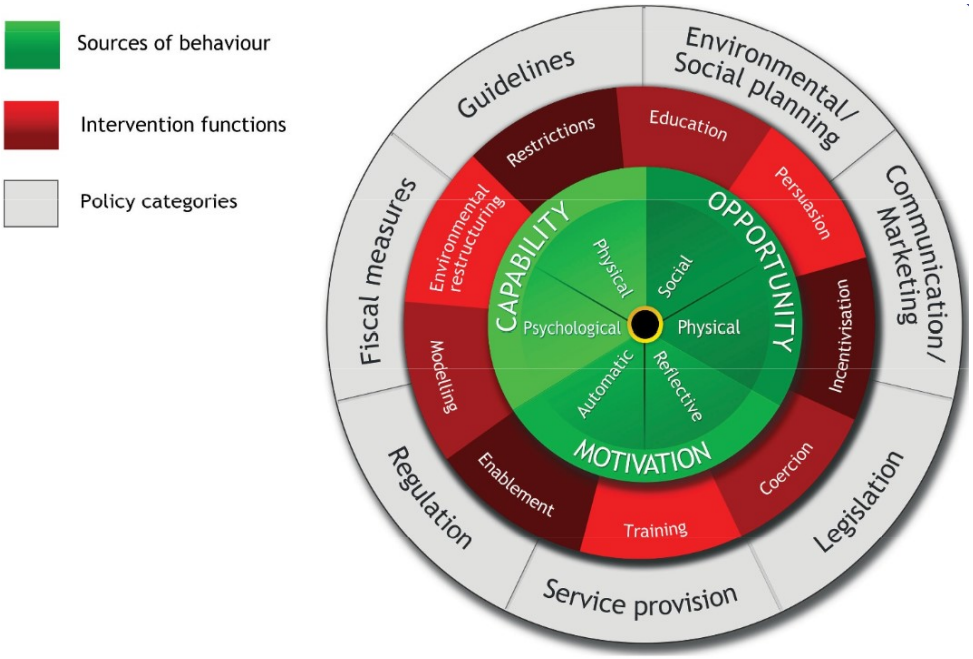


Figure 2.3: Behavior change wheel as proposed by Miche et al [31].

The inner circle of the wheel is made up of three components which are the sources of behavior. This inner circle is also referred to as the COM-B model, standing for Capability, Opportunity, Motivation and Behavior, and describes what needs to change for behavior change to occur. The outer layers of the BCW describes the intervention functions and policy categories that can be used to develop successful behavior change interventions. The intervention functions and policy categories thus describe *how* to achieve behavior change, whereas the sources of behavior describe *what* needs to be changed [36].

3. Methodology

This chapter aims to describe the design methodology and framework used during the thesis project, as well as theory regarding co-designing with adolescents. The thesis' design process is also explained in more detail.

3.1 User Centered Design

User-centered design (UCD) is a broad term which describes design processes in which the end-users influence how the design takes shape. This could take form as the users either being consulted about their needs and being involved in certain times during the process, or that the users have a deep impact on the process as they are involved as partners [37]. As user involvement has been shown to result in positive effects on user satisfaction [38], consulting the users and involving them in the design process might result in a better final product.

UCD is an iterative design process [39]. Iterative design is the process of testing prototypes that have been developed to meet identified user needs, taking what you have learned from the testing and then amending the design. As such, a new prototype is created and the process begins all over again until a satisfactory prototype is achieved [40].

3.2 Co-designing With Adolescents

Adolescents are often under-represented when it comes to healthcare research, which means that some medical devices and products they use are not appropriate or pleasant. While adult and child user groups are often taken into consideration during development, adolescents are often over-looked and by default required to use devices manufactured for the other two groups [41]. Although many researchers are hesitant to include adolescents in studies because of fears associated with navigating ethical review, planned and well conceived research can engage adolescents to be motivated participants [41]. According to Thabrew et al. [42], co-designing can be successfully undertaken with this age group, but extra thought needs to be given to settings and techniques to ensure engagement from the participants. Examples of digital interventions that were successfully co-designed with adolescence include a self-monitoring app for use during treatment of depression [42], Quest - Te Whitianga, an app for Māori and Pasifika youth that uses a series of activities and games to learn CBT (Cognitive Behavioral Therapy) skills [43], and Mellow, an app for self-help holistic crisis planning [44].

There are, however, challenges that can come with co-designing together with adolescents. First, there is more direct communication with the adolescents, compared to when co-designing with children where parents are more involved, which can be challenging. According to Yip et al. [45], many adolescents are busy and have active lives and thus, they can be more difficult

to reach and schedule meetings with. Hence, recruiting adolescents is not always easy since they would need to take time from their busy lives to participate, and even the use of rewards as extrinsic motivation might not always work [45].

3.3 Project Framework

There are many existing frameworks for design processes [46]. For example, Design Thinking is a design methodology that provides a framework for solving problems which includes 5 phases: Empathize, Define, Ideate, Prototype, Test [47]. This type of process is useful for understanding the human needs that are involved and re-framing the problem in a human-centric way [47]. The process is non-linear and iterative in its nature, which means that the phases do not always occur sequentially.

3.3.1 Double Diamond

A popular way of implementing Design Thinking is using the Double Diamond framework, which was developed by the Design Council in 2004 [46]. The two diamonds in the model represent the process of diverging and converging, which means exploring an issue more widely and then taking more focused action. This framework consists of four non-linear phases, which are the four D's: Discover, Define, Develop and Deliver [46]. A visual representation of the model can be seen in figure 3.1.

The Double Diamond model emphasizes the use of design principles such as being people centered, communicating both visually and inclusively, collaborating and co-creating as well as iterating [46].

As this model is non-linear, information and results learned in later phases might cause a return to an earlier phase or change circumstances for the current phase. This may also cause that methods normally used for later phases might end up being used in earlier phases [46].

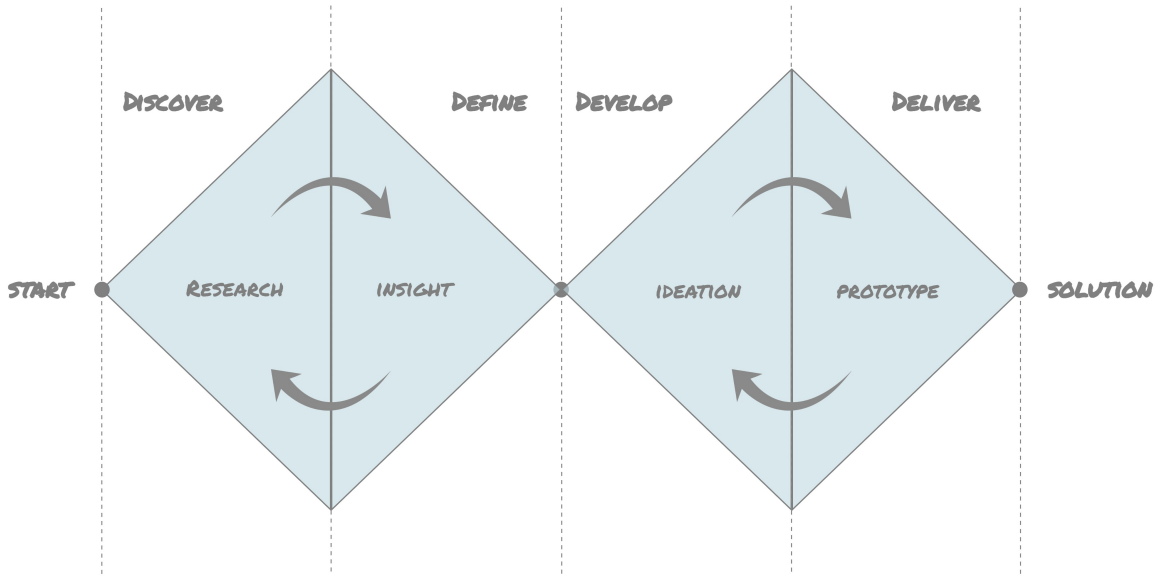


Figure 3.1: Double Diamond model as proposed by Design Council [46].

3.3.2 The Thesis Process

For the process of this thesis project, the Double Diamond model and its four phases was used as a guide. The four phases each make up a chapter, and in these chapters the methods used are first described, followed by the results. The process used in this thesis can be seen in figure 3.2, where the work within each phase of the Double Diamond model is further described in the corresponding chapter.

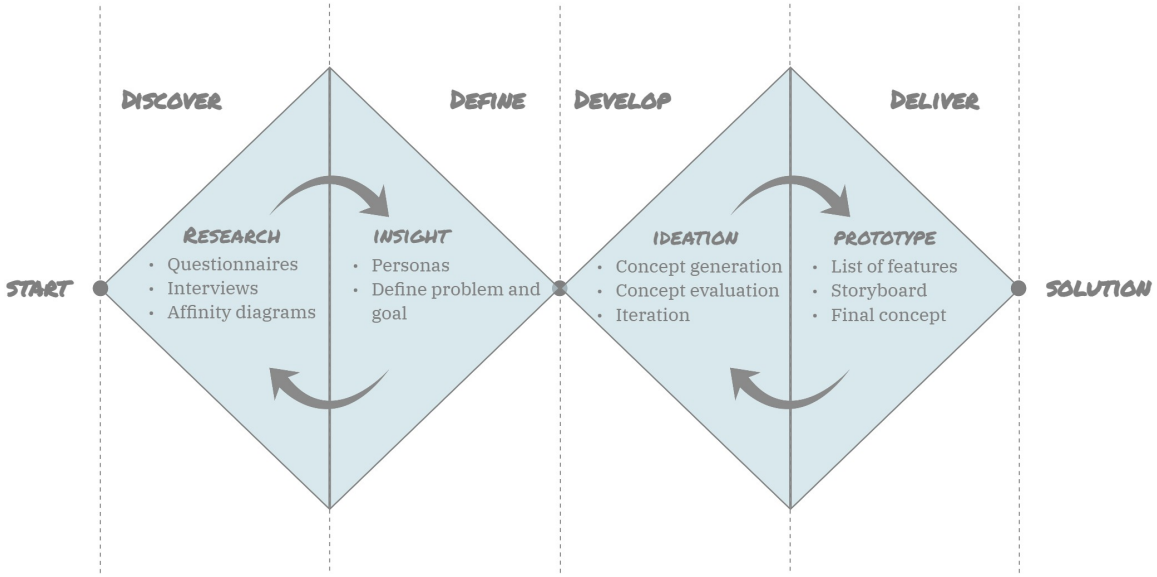


Figure 3.2: The process for this thesis within the Double Diamond framework.

Simultaneously, the methods used during each phase were investigated. These results will also be presented in the chapter corresponding to the final phase of the process.

4. Discover

This chapter presents the Discover phase in the Double diamond model (figure 4.1). The Discover phase in the Double Diamond model puts emphasis on understanding what the problem is rather than making assumptions about the problem. The Discover phase hence involves user research, to explore the issue more widely and deeply to fully understand the target group and their needs [46]. In this thesis project, an understanding of the target group and their needs is gained by using interviews and questionnaires, and affinity diagrams and bar graphs are used to analyze data.

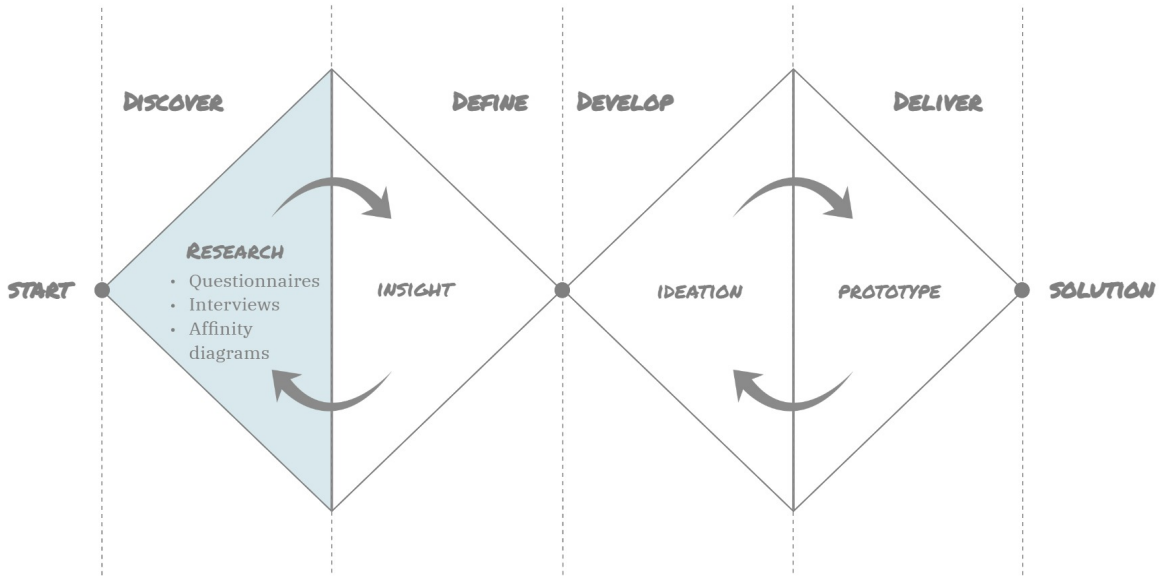


Figure 4.1: Methodology used during Discover phase in the Double Diamond model.

4.1 User Research Methods

To broaden the understanding of what problems adolescents have in their stress management, a mixed methodology of qualitative and quantitative methods were used as suggested by Mazzola et al [48]. Mixed methods research focuses on triangulation by using multiple methodologies [49], and this is also known as methodological triangulation where different data gathering techniques are used [50]. Triangulation is used to validate the results from one data gathering technique by the use of another [50]. As all methods have imperfections, triangulation can be used to cancel or minimize these imperfections [49].

Using a mixed methodology when conducting research is useful when wanting to avoid making assumptions about needs within the target group. By not only using quantitative scales,

biases arising from the authors can be minimized [48]. Using qualitative research is of extra importance when studying understudied populations [48], such as adolescents [41].

Triangulation of data was achieved by the use of both interviews and questionnaires. Semi-structured expert interviews were used to collect qualitative data from personnel working clinically with the target group's mental health. Questionnaires were used to collect both quantitative and qualitative data. The questionnaires were distributed by Swedish high schools (Swe. gymnasium) in Skåne county.

4.1.1 Semi-Structured Expert Interviews

As issues related to mental health, such as stress, might be sensitive topics for some people, using an expert to gather data instead of approaching the target group directly might be beneficial [51]. Additionally, using an expert to gain knowledge during the exploratory phase is an efficient and concentrated method of gathering data, particularly if these experts are interviewed as a surrogate for a wider group of users [51].

Within the Swedish School System, having access to a school health team for students is mandatory. The responsibilities of the school health team is mainly to work with prevention and health promotion [52]. The team consists of various professions, such as nurses, counselors, special pedagogues, doctors and psychologists. The nurse is the only staff member in the school health team who meets all of the school's students, as the nurse is responsible for health examinations and vaccinations. The counselor gives support to students both individually and on group levels, such as talking about stress with entire school classes or one on one counseling [53]. Adolescents with milder mental illness, but more severe than what is handled by school health teams, can get support and advice from counselors, psychologists and doctors working at the pediatric psychiatry clinics [54]. Thus, counselors from both pediatric psychiatry and school health teams and nurses from school health teams were chosen to be suitable experts for data gathering as they could be expected to have deep insights about the target group.

The purpose of the interviews was to better understand stress in adolescents from an expert's point of view and thereby quickly gain insights about causes for stress and how stress is managed to identify needs. In total, 7 interviews were held with 6 counselors and 1 nurse working at pediatric psychiatry clinics, high schools and secondary schools (Swe. högstadieskolor). The interviews were organized around a set of predetermined open questions, but if other questions were to emerge from the conversation they were asked as well. According to DiCicco-Bloom and Crabtree [55], this method of conducting a semi-structured interview is widely used for qualitative research. As semi-structured interviews are valuable for gaining insight about the experiences, behaviors and perceptions of the interviewee in his or her own words [56], this interviewing format appeared suitable.

The general topics covered in the semi-structured interviews can be seen in Table 4.1, and the form of consent that all interviewees read and consented to is presented in Appendix A.2.

Table 4.1: Predetermined set of interview questions asked during semi-structured interviews

Predetermined interview questions
What do the adolescents that you come in contact with say causes them to feel stressed?
What would you say causes stress among these adolescents?
Who are the adolescents that seek help for stress-related issues?
How is the stress expressed in these adolescents?
Do adolescents seeking your help for stress also suffer from other mental illnesses?
What do the adolescents themselves state that they do to manage their stress?
What would you say is preventing adolescents from successfully managing stress?
What would you say is the most prominent needs that adolescents have that seek help for stress-related issues?
How do you work with stress and stress management together with these adolescents?

4.1.2 Questionnaires

Questionnaires were used to collect both quantitative and qualitative data from third year high school students aged 18 to 20. Questionnaires, also known as surveys, can target a large amount of people as well as providing anonymity which makes them suitable when targeting sensitive information [57], such as mental health where stigma is high [58]. Studies have shown that sensitive information is more frequently reported in surveys rather than interviews, as people tend to communicate a certain image of themselves or not admitting sensitive things to themselves or others [59]. The main purpose of the questionnaire was to gain a better understanding of what causes stress in adolescents and why, as well as how they manage stress and why. This purpose was decided as these factors were deemed important for understanding the target group needs.

Collecting data from children aged 18 and below is a debated subject in Sweden, where the law SFS 2003:460 states that children above 15 years of age can participate in data collection without the approval of a guardian [60], whereas the Ombudsman for Children according to the National Board of Health and Welfare recommends the guardian's approval below 18 years of age [61]. Due to unclear standards of data gathering from under-aged people, the survey was aimed towards adolescents of legal age to avoid any issues arising from this.

The survey was pilot tested on the authors' peers, to make sure the questions were easy to understand and gathered relevant data. After pilot testing, high schools in various cities in Skåne county were contacted regarding participation in the survey. High school programs for pupils with special needs were excluded from participation to avoid confounders due to comorbidity. No other exclusion criteria for high school programs was set.

The survey had both multi-choice questions as well as open answer questions. The multi-choice questions were questions of the type "What do you think causes stress for you?" and "What do you do on your own if you experience stress?". The open answer questions were for example "Choose one or several of the options chosen above and explain in further detail why these cause stress for you". Two identical versions of the survey were created in Swedish as well as English. The English version can be seen in Appendix A.1.

Initially, 33 high schools were contacted for participation in the survey. These schools were located in several different municipalities in Skåne county to ensure a variation of answers. Out of these, only two high schools agreed to participate and distribute the survey digitally to their third-year students. Third-year students were chosen as they are all above legal age, thus not needing the approval of a guardian or parent to participate. Although they would not be in the

exact age range of the target group, they would be close to it. The surveys were sent to a contact person of each school, and was then distributed using the school's own communication system or platform. Thus, the exact number of students that were reached by the survey is unknown. In total, 24 answers were collected out of which 5 were disregarded as they originated from students below legal age or from students above 21 years old. Two additional answers were disregarded as they were doublets. This resulted in a final survey response of 17 answers.

4.1.3 Affinity Diagrams

Affinity diagrams were used to analyze qualitative data gathered during user research. Interviews as well as open-ended responses from questionnaires were considered qualitative data.

Affinity diagrams were used as the method allows for gathering large amounts of data and organizing them into themes or clusters based on their relationships [62]. Typically, data such as quotes, observations and facts are put onto post-it notes and put on a board. Post-it notes allows for moving the data around in order to cluster data with similar themes. The clustering procedure looks as follows:

1. Take one post-it note and make it the first post-it note on the board, being the first group.
2. Take another post-it note and decide whether it is similar to the first one or not. Similar notes are put together in groups, whereas different notes are used as the first note in a new group.
3. This procedure is repeated until all post-it notes are grouped.
4. Groups of post-it notes are named based on the themes in each cluster. Naming of clusters helps to discover themes.
5. Ranking clusters based on importance. The importance of different themes depends on the perspective out of which ranking is made, such as the user's, the company's or the markets. Ranking decides which themes to put more emphasis on [62].

4.1.4 Bar Graphs

Bar graphs were used to analyze quantitative data from user research, with quantitative data being result from multi-choice questions in the questionnaire.

4.2 User Research Results

The results from user research are presented below, where quantitative data and qualitative data were analyzed using bar graphs and affinity diagrams respectively.

4.2.1 Quantitative Data

The multiple-choice answers from the questionnaires were transformed into bar graphs for easier analysis. These tables are presented below.

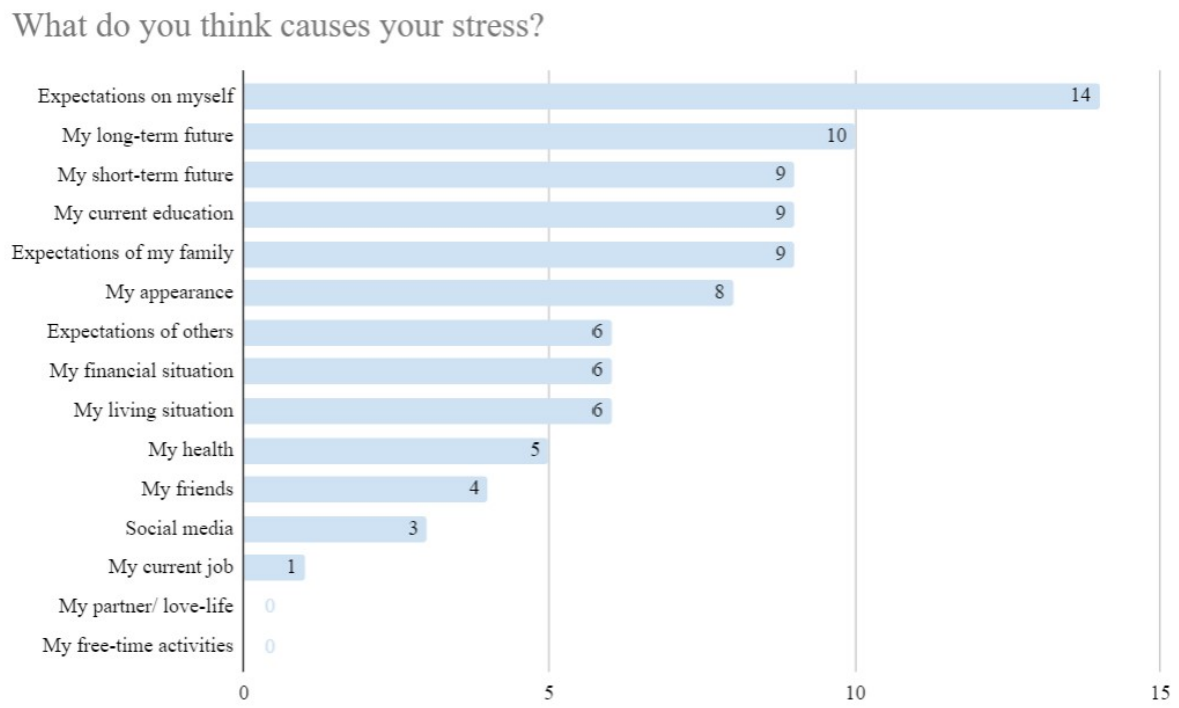


Figure 4.2: Results from the question "What do you think causes your stress?".

Figure 4.3: Results from the question "At which locations do you experience stress?".

Figure 4.4: Results from the question "What do you do on your own to manage stress?".

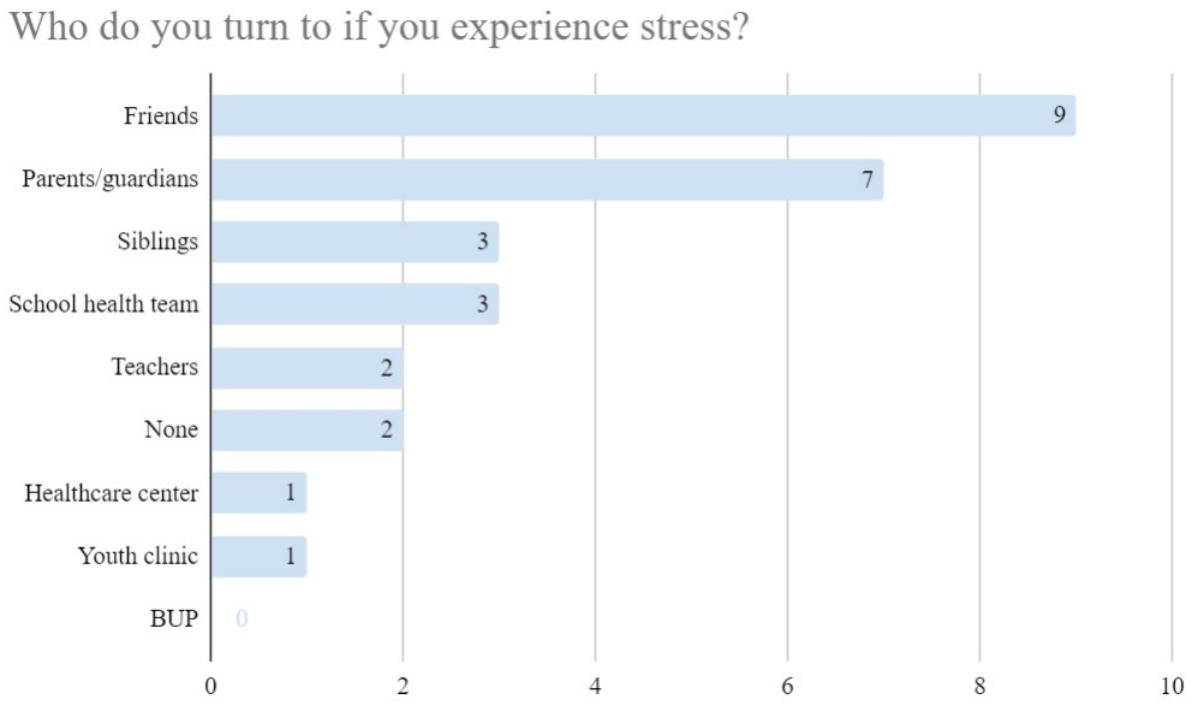


Figure 4.5: Results from the question "Who do you turn to if you experience stress?".

As presented in figure 4.2, the single most chosen option was expectations on myself. This shows that many adolescents have very high expectations on themselves which causes stress. The future, both long and short-term, also seems to be a common cause of stress, as well as their

current education and expectations from family. Consequently, most survey participants said they feel the most stress either at home or at school (figure 4.3). When it comes to managing stress, most answered that they either listen to music or watch a movie or tv-show. Stress-preventive methods such as exercising and mindfulness were much less voted for (figure 4.4). Lastly, most participants answered that they prefer to turn to friends if they feel stressed, with parents or guardians coming in second (figure 4.5).

4.2.2 Qualitative Data

The qualitative data from the user research phase consisted of interview data as well as open-ended responses from the survey. The results from the qualitative data gathered were structured using affinity diagrams in the online collaborative whiteboard platform Miro. Quotes and sentences relevant for the scope of the thesis were written down on post-it notes and clustered together as themes relating to stress emerged, giving cues for topics to further investigate. An example of an affinity diagram can be found in Appendix A.3, to exemplify the data analysis that was carried out.

The themes that emerged during data analysis are presented in the list below.

- Time Management
- Future
- Social Media
- Performative Behavior
- Sleep
- Knowledge About Stress
- Daily Routines
- Support System

4.2.3 Conclusion from User Research

The findings from the analysis of the qualitative data were compared to the results from the quantitative data. In the quantitative data, the theme of *Future* was prevalent as many stated that both the short-term and long-term future caused stress as seen in figure 4.2. The theme of *Time management* was not explicitly mentioned in the quantitative data, however, when analyzed along with the qualitative data it appeared to be a theme that was strongly related to causes of stress such as high expectations and education. The themes *Future* and *Time management* were as such chosen to proceed with. The main reasons being that they had a high prevalence in the data, would not be covered by other areas in Ungdomsportalen, and seemed possible to develop concepts for. The themes of *Future* and *Time management* are presented in more detail in tables 4.2 and 4.3 respectively.

Some of the themes that emerged from the qualitative and quantitative data were chosen not to proceed with due to low prevalence in data or that the need expressed by the theme would already be covered by other planned functions or modules in Ungdomsportalen, such as sleep. The theme of *Performative Behavior*, if assumed to be closely related to the stressor of high expectations on oneself, had high prevalence in both qualitative and quantitative data. Despite this, it was disregarded as it was deemed to be too complex to create a simple solution for. For example, some interviewees expressed during interviews that lowering expectations and

decreasing performative behavior requires more intense treatment and might take several years to achieve.

The theme of *Social Media* had high prevalence in qualitative data gathered during interviews, but was not considered to be a common cause for stress according to the quantitative data in figure 4.2. As the theme of *Social Media* was not disregarded until later on in the project during the *Define* phase, it is presented in more detail in Appendix A.4.

Table 4.2: Sub-themes, key findings and quotes related to the theme Future.

Theme: Future		
Sub-theme	***Key findings***	***Quote***
The number of choices	Many feel stressed about the number of choices that need to be made in the near future regarding which high school or university to attend, and choosing a profession.	*"Who am I and what am I going to do with my life-stress"* - High school student *"[You are] Expected by society to know what you want to do by the age of 18"* - High school student
Outcomes of actions	Many believe that the grades they achieve and the decisions they make will determine their entire future, and are not aware of consequences and different paths.	*"Outcomes/decisions at school can have negative effect on future"* - High school student *"Students in the last year of secondary school are very stressed about choosing the right high school"* - School counselor
Family pressure	There are expectations coming from home to reach certain goals, as some parents have specific wishes about what grades and professions their children should have.	*"In my family, failing is not accepted"* - High school student

Table 4.3: Sub-themes, key findings and quotes related to the theme Time management.

Theme: Time management		
Sub-theme	***Key findings***	***Quote***
Trouble getting started	Many feel that they don't know where to start with schoolwork, and some often choose to do the fun things instead. This becomes a downward spiral where more work piles up and stress increases.	*"They don't know where to start, so the work they have to do then becomes a huge obstacle for them to overcome"* - School counselor *"Some students live only in the present - they rather do the fun stuff first"* - School counselor
Can't stop studying	Others seem to not be able to stop studying, as they think studying more and staying up late will reduce stress levels. They never feel quite finished and always think they can study just a little bit more.	*"Sometimes I'm not in the mood to study after school but I know I have to"* - High school student *"Some stay up until midnight to study because they want to receive the highest grade"* - School counselor
Very busy schedule	Many young people are involved in too many activities outside of school, and some also take on a lot of responsibility at home. Their schedule is therefore very pressed, with barely any room for other things.	*"Apart from school they have several activities, one student I met had 6 activities a week"* - School counselor *"I experience feelings of guilt when not at A-game at home, like when I'm not helping my old parents or my sick mother"* - High school student
High workload	There is a high workload in school and many deadlines, especially before school breaks. School also takes up a lot of time outside of school hours.	*"During periods with many exams, such as before school breaks, many students experience stress"* - School counselor *"Enormous workload"* - High school student

5. Define

This chapter presents the Define phase in the Double diamond model (figure 5.1). The Define phase is where the insights gathered from the discovery phase help define the challenge in a different way [46]. To define the data collected in the Discover phase, personas were used and a more defined goal was decided.

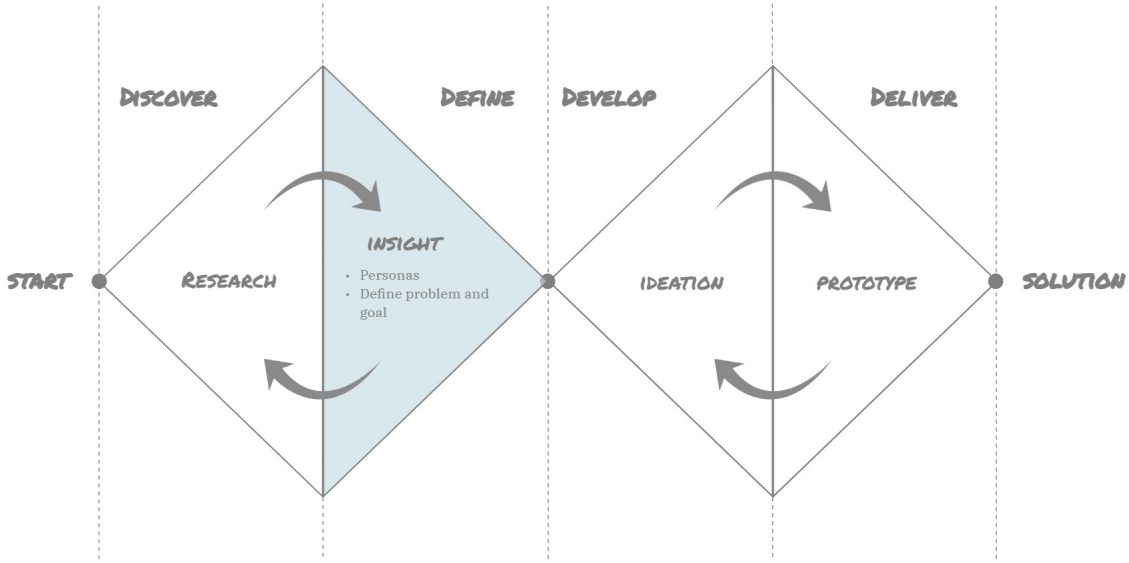


Figure 5.1: Define phase in the Double Diamond model.

5.1 Personas

In order to better understand the users' needs, experiences, behaviors and goals, personas may be used. A persona is a fictional character which is created based on the collected data, and represents a certain type of user [63]. Thus, it is not based on one person but rather on the data collected from multiple individuals. Using a persona may help in realizing the different needs of different people and guide the ideation process, as they make the design task less complex [63]. As such, the personas were used not only to help define the problem but also when generating and testing concepts and prototypes.

Based on the results from the data gathering, four original personas were created to represent different kinds of users. The two personas based on the themes *Time Management* and *Future*, are presented in figures 5.2 and 5.3. The two remaining personas can be found in Appendix B.1. These were personas that were created based on themes that were later disregarded to proceed with.

In order to better understand their needs; their goals, desires, pain points and daily routines were included. Furthermore, their age, spare time activities, technical skills and grades were presented as well. The images of the personas are stock photos taken from Unsplash.com, and were used in order to make the personas appear more realistic.

5.1.1 Agnes - The Overachiever

Agnes (figure 5.2) represents the users that have a very strong drive and trouble feeling like they have done enough. She experiences stress caused by high expectations on receiving high grades, high workload in school and worries about the future. The character of Agnes is mostly based on the results presented in tables 4.3 and 4.2, as well as in figure 4.2. Agnes would be the typical user needing help to set boundaries for studying and help to focus more on the joyful things in life that make her unwind.

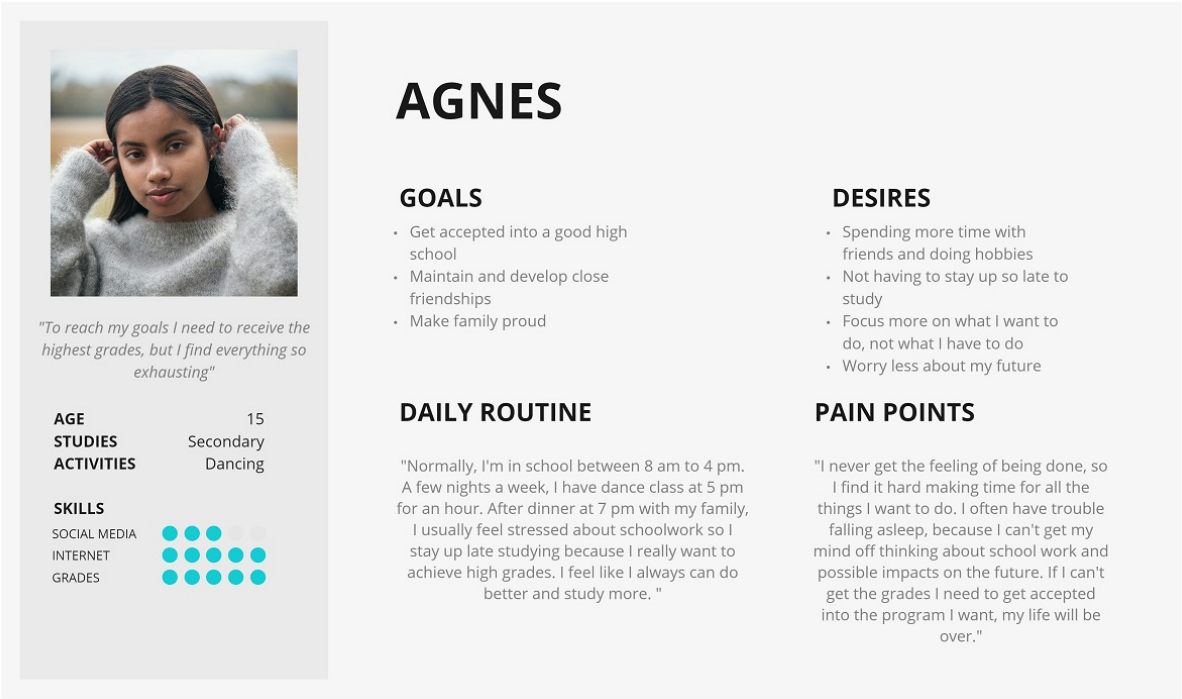


Figure 5.2: Agnes - The Overachiever.

5.1.2 Marcus - The Busy One

Marcus (figure 5.3) represents the users that have so many activities and things happening around them that they never have time for a breather. He experiences stress from partaking in too many activities in his free time and having expectations on himself to always participate, which ultimately leads to a lack of time to relax. The character of Marcus is mostly based on the results presented in tables 4.3 and 4.2. Marcus needs help prioritizing what to do with his time as he needs to find time for relaxation and joyful things in life.

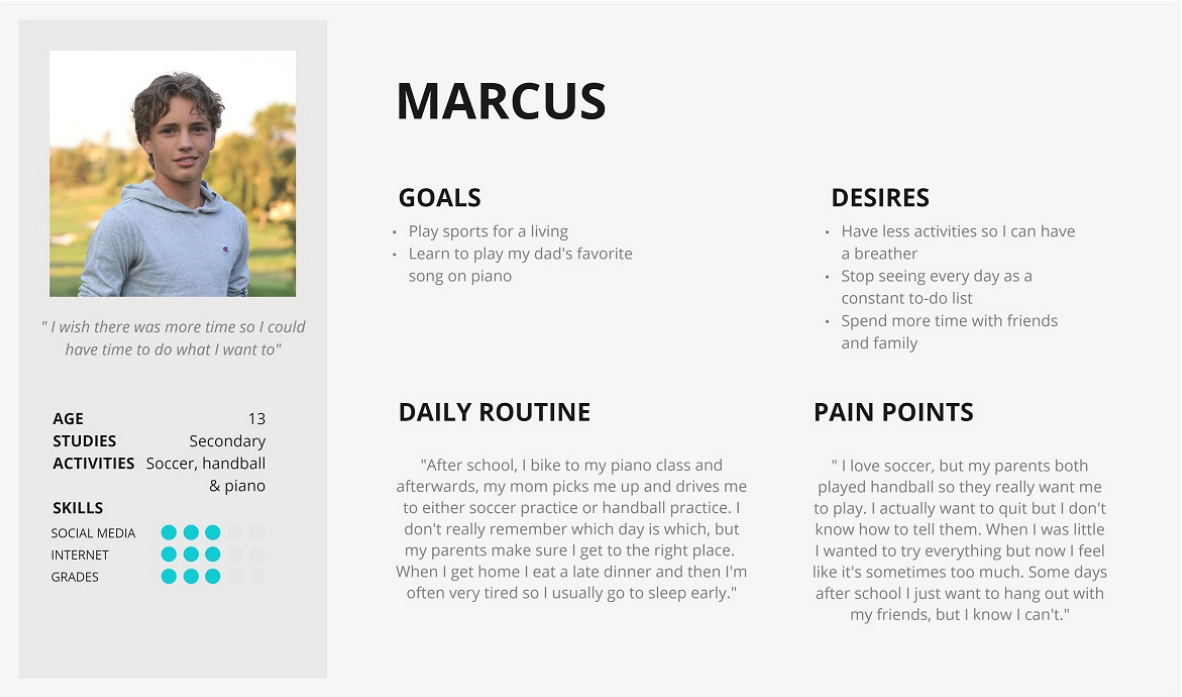


Figure 5.3: Marcus - The Busy One.

5.2 Problem and Goal Definition

When observing these two personas, it was clear that they both had issues relating to *Time management*. When discussing their needs further, it became clear that one need they had in common was the need for increased recovery. Agnes spends basically all of her free time studying and has a hard time ever feeling finished, and Marcus is overwhelmed with the amount of activities he's partaking in and rarely has time for anything else. As such, given the important need for recovery in general and the apparent need for recovery within these two personas, it seems appropriate to focus on this user need going forward. In addition, it was decided that going forward, the thesis would only focus on solutions that could be implemented in a public, open version of Ungdomsportalen. This means that the user would not need an account and no data would be stored.

Within the scope of the previously formulated purpose of the thesis, a final goal definition was decided as the following.

- *Developing and communicating a concept for a digital solution that meets the need of increased recovery in adolescents aged 12-17, which should function in a public version of Ungdomsportalen.*

6. Develop

This chapter presents the Develop phase in the Double Diamond model (figure 6.1). Within the Develop phase, different solutions are developed to solve the defined problem [46]. Solutions are tested and those that doesn't work are disregarded [64]. This chapter presents two iterations of concept generation, each followed by concept evaluation. These concepts are not finished prototypes but rather mock-ups to visualize the concepts.

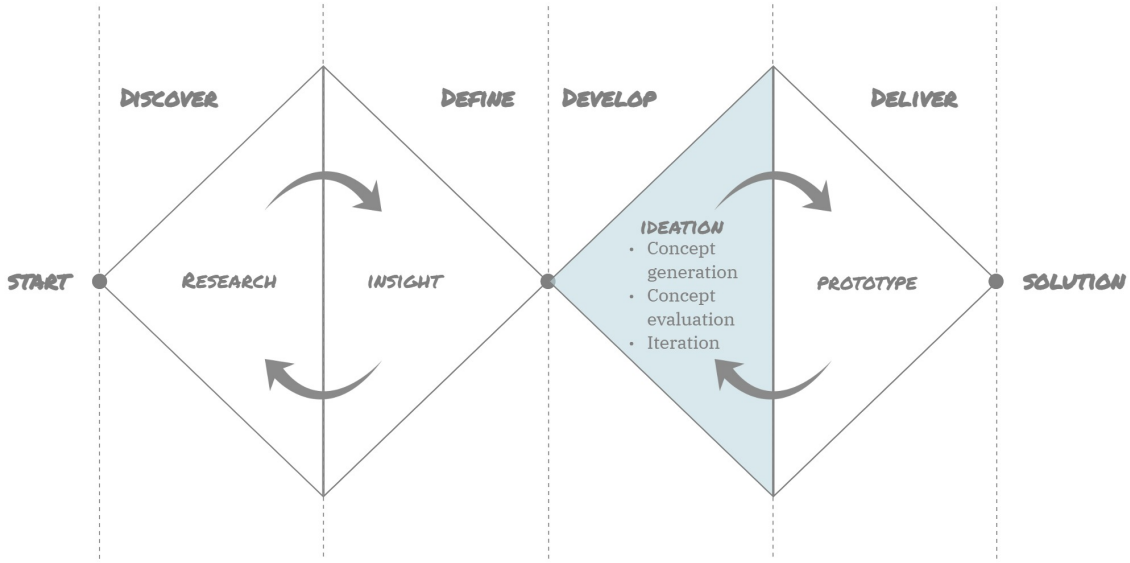


Figure 6.1: Develop phase in the Double Diamond model.

6.1 The First Iteration

The focus in the first iteration was to evaluate ideas on a conceptual level in order to gather more information about the user's wishes and expectations in regards to increasing recovery.

6.1.1 Methods for Generating the First Concepts

A mixed methodology for creative thinking was used during concept generation. This section describes the theory behind the methods used to generate and develop the concepts in the first iteration, as well as how they were used.

6.1.1.1 Market Research

Market research based on the problem definition as well as the goals and needs of the chosen personas, Agnes and Carl, was performed. This included investigating applications or other tools already available on the market that could be used as sources of inspiration. Examples of products that were looked into were various scheduling and planning tools, tools for ranking, quizzes and self-tests, and games for creating positive habits.

6.1.1.2 SCAMPER

A method called SCAMPER was used to innovate on existing products or services. SCAMPER stands for Substitute, Combine, Adapt, Modify, Put to another use, Eliminate and Reverse. These make up the different lenses a product or service could be analyzed through. The general idea behind SCAMPER is to take an existing product or service that could be a suitable starting point for further development. By looking at the product or service through the different lenses, it can be developed. Questions such as "Which other target group could benefit from this product?", "Can I seek inspiration in other products or processes, but in a different context?" are used to develop existing products or coming up with new ones [65].

6.1.1.3 Brainstorming

Brainstorming allows thinking to expand in all directions with the goal to find innovative solutions to design problems. Design problems can be verbalized by using questions of the type "How might we?" [66]. By using brainstorming, multiple potential solutions to the question in mind can be created, which can be developed later on. As brainstorming is carried out in groups, rather than individually, it allows for collective thinking building on each others ideas and leveraging innovation. A common way of describing this is using "and" instead of the more negative "but" to address an idea of another member in the brainstorming group. As keeping notes during brainstorming can help visualize thoughts and drive creativity [66], digital post-its were used in Miro.

In the brainstorming sessions carried out during the first iteration, the design problem was defined as "How might we increase recovery in adolescents aged 12-17 by the use of a digital service?". The participants during the brainstorming sessions were the authors, however concepts were further developed in collaboration with part of the project team for Ungdomsportalen as input was received during meetings. The members of project team that partook consisted of the team leader, a psychologist working in pediatric psychiatry and a web designer.

6.1.2 First Concepts

Using both brainstorming and SCAMPER on existing products resulted in five concepts that potentially could increase recovery among the target group. These are presented in table 6.1.

Table 6.1: The five concepts that were developed during the first concept generation. Concepts marked with a * indicates that they were disregarded from further development as they did not meet the previously defined goals.

Concept name	***Concept description***
*GetStarted**	This concept aims to help the user get started with stress management by pitting stress management strategies against each other and having the user choose the one they find the easiest to start with. A final ranking of the top strategies are then presented.
*SchedulingTool**	This concept aims to help the user increase their recovery by scheduling recovery sessions among their ordinary activities. They would have to include at least one session per day, and would not be able to schedule any schoolwork in the evenings.
RecoveryFinder	This concept aims to help the user find what kind of recovery works best for them by answering a couple of questions.
*Challenges**	This concept aims to help the user increase their recovery by participating in challenges relating to the topic.
*RecoveryTest**	This concept aims to help the user find out if they have a need for increased recovery and how severe the need is.
BalanceGame	This concept aims to help the user understand and navigate the balance of recovery and productivity. This is achieved by completing either productive or recharging tasks and observing the effect on the user's energy levels.

Together with members of the project team, the five concepts presented in table 6.1 were evaluated against the goal definition during discussions. This discussion led to RecoveryFinder and BalanceGame being the concepts chosen to evaluate further. These concepts are more thoroughly explained below and the elminated concepts are further explained in Appendix C.1.

6.1.2.0.1 RecoveryFinder

RecoveryFinder was influenced by the book *Reload - Så blir du återhämtningssmart*, which provides tips and methods for including more time for recovery in day to day life [67]. The book includes a test which allows the user to find out what kind of recovery is the best for them. SCAMPER was used to slightly alter it to better suit the target group, resulting in the concept in figure 6.2.

As can be seen in figure 6.2, the user is asked to answer questions by finishing sentences. The questions indicate how the user acts and thinks in certain situations which could imply the kind of activities that the user could find recharging. As a result, the user is provided with a set of activities that they are recommended to try.

This concept was chosen to proceed with in evaluation because of its potential to work well in a public version of Ungdomsportalen and for its potential to help the user increase their recovery.

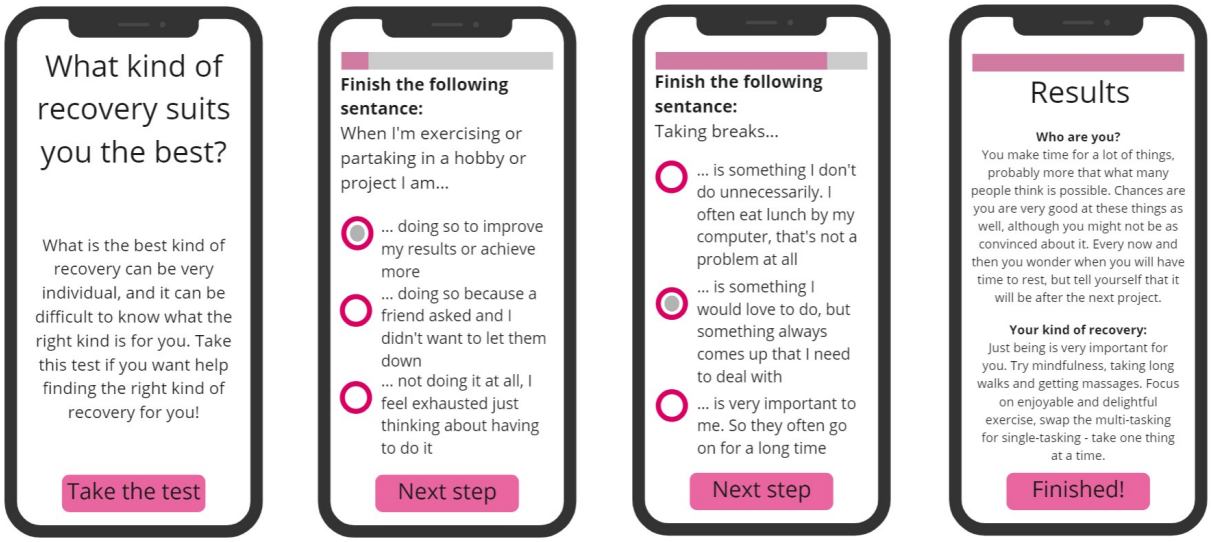


Figure 6.2: RecoveryFinder, a concept aiding the user in finding suitable activities for recovery.

6.1.2.0.2 BalanceGame

BalanceGame, presented in figure 6.3, aims to help the user understand and navigate the balance of recovery and productivity. This is achieved by completing either productive or recharging tasks and observing the effect on the user's energy levels. The productive tasks drain the energy level, which is represented by a battery, and the recharging activities increase the energy level. In order to clear the level the user has to have a battery level of at least 50%. The purpose is to teach the user that in order to be productive and complete tasks, recovery is crucial.

BalanceGame was inspired partly by Habitica, which is a habit and productivity app that uses gamification (the use of game design elements in non-game contexts). In order to increase engagement for mental health and wellbeing technologies, gamification is increasingly being proposed as a strategy to do so [68]. It has also shown some positive effects on improving health behaviors [69].

BalanceGame was selected to be evaluated as it was thought to be able to function properly in the public version of the portal and provided an alternative way of increasing recovery. This concept was also well-received by the project team, as the aspect of a game appeared intriguing and promising.

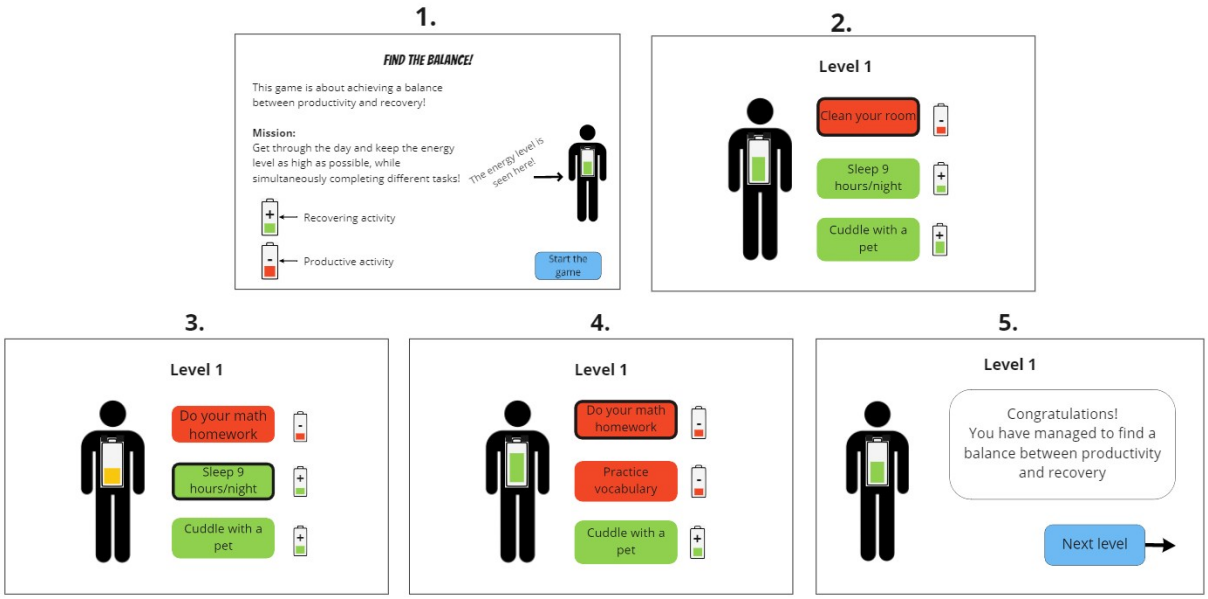


Figure 6.3: BalanceGame, a concept aiding the user in understanding that recovery is crucial in order to be productive.

6.1.3 Methods for evaluating the first concepts

The concepts were evaluated during workshops using focus groups engaging in brainwriting.

6.1.3.1 Focus groups

To ensure a user centered design process when developing Ungdomsportalen, focus groups are used to co-design the content for the digital platform together with adolescents. Focus groups are a qualitative method used to collect opinions about products or services [70], and can be used to evaluate concepts [50]. Focus groups generally consist of 4-12 people led by a moderator who will ask questions, encourage input and feedback from the participants and keeps the discussion on the right track [71].

Focus groups are known to be an excellent approach when conducting research in adolescent health care to include the perspective of the adolescents when designing health programs [71]. The members participating in the focus group should be of similar backgrounds, in order to create adequate discussion and interaction, and be of similar age which is particularly important for adolescents [71]. According to Thabrew et al. [42], using naturally occurring groups (e.g. friends or classmates) when co-designing with adolescents may assist the conversation. However, it may assist less when sensitive topics are discussed [42].

6.1.3.2 Brainwriting

Brainwriting is a method similar to brainstorming, with the exception that participants write down their ideas on post-it notes instead of sharing them out loud. Brainwriting was deemed to be a suitable method, as benefits of using brainwriting is that less communicative participants are given a better opportunity to express themselves and that it allows participation from everyone without inhibition from members that are naturally more vocal [72]. The use of brainwriting

in a digital setting could also provide anonymity, which can be important when discussing sensitive topics such as mental health.

6.1.3.3 Workshop with adolescents

The focus group participated in a workshop, that due to the covid-19 pandemic, had to be held digitally using Miro and Microsoft Teams. However, as the world becomes increasingly digitalized, traditional face-to-face research practices are being adapted to suit this societal change. This might be especially true for adolescent research, as this demographic spends much of their time in the digital world [73].

In total, the focus group consisted of 13 adolescents aged 13-14 and were recruited by the Ungdomsportalen project team to participate in the workshop. The participants were recruited from different schools within the same municipality. When co-designing with children during workshops, using short activities and clearly stating outputs may help to increase motivation, and the use of frequent breaks may also improve productivity [42]. When designing the workshop, it was therefor decided to include 2 breaks during the 90-minute duration.

Using the persona of Agnes, as presented previously in figure 5.2, the participants were introduced to the two chosen concepts and asked to answer some questions from her perspective. These are presented in table 6.3. The use of Agnes in the workshop was to provide some anonymity for the participants, so that they could use a persona to explain their thoughts on a potentially sensitive topics.

The primary goals of the workshop were decided as shown in table 6.2. During the workshop, the questions in table 6.3 were asked for each concept.

Table 6.2: The goals of the workshop.

Goals
Identify which functions are appealing and which could be improved
Identify which non-functional attributes are appealing and which could be improved
Identify which concept or which aspects of a concept that should be further developed

Table 6.3: The questions asked during the brainwriting session in the workshop.

Brainwriting questions
What would Agnes like about using this concept?
What would Agnes dislike about using this concept?
How can the concept be developed?

6.1.4 Results From First Iteration

This section presents the key themes discovered when analyzing the data gathered during the evaluation of the first concepts. To categorize and analyze the data, affinity diagrams were used. To exemplify the kind of answers given during the workshop, the resulting answers from the question "How can the concept be developed?" regarding the RecoveryFinder concept, can be seen in figure 6.4. The key themes are presented in table 6.4.

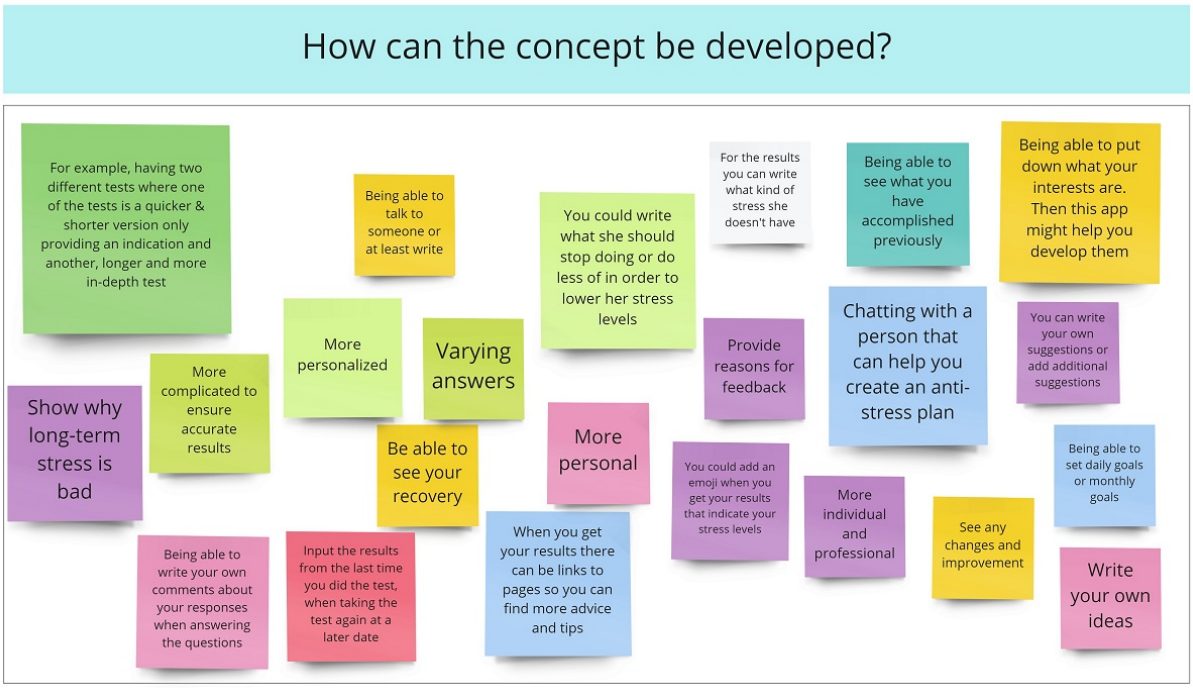


Figure 6.4: One of the questions asked during the workshop brainwriting session, with answers provided for the RecoveryFinder concept.

Table 6.4: Themes, key findings and quotes related to the themes.

Theme	***Key findings***	***Quote***
Providing advice and tips	Some participants stated that they thought that Agnes would like using RecoveryFinder as she would be able to receive tips and advice on concrete methods to reduce her stress levels.	*"She receives tips on how she can reduce her stress"*
Setting goals	Some participants, when asked what aspects of the RecoveryFinder concept that could be further developed, said they would like to be able to set goals.	*"Having the opportunity to set daily goals or monthly goals"*
Creating a plan	Similarly to setting goals, creating a plan for stress management and increased recovery was also pointed out by participants as one way to develop the concepts.	*"Getting help with creating an anti-stress plan"*
Identifying the need for recovery	Another possibility for development, as mentioned by participants, was to include some way of finding out your current level of stress and need for recovery.	*"There could be an emoji or something similar when you receive your results, to show how stressed you are"*
Transparent results	Many participants said that with a test like RecoveryFinder, there needs to be more transparency in the results. They wanted to know more specifically why a certain action was recommended.	*"There is no depth. It only tells you how, not why"*
Achievable recommendations	Regarding the concept RecoveryFinder, some participants felt that the recommendations might not be achievable enough for Agnes. To increase recovery, the recommendations and suggestions must be achievable to user.	*"They [recharging activities] might hinder her goals of getting high grades"*
Opportunity for personalization	Feedback regarding personalization and tailoring was evident in both concepts, and appeared to be one major contributor to whether they believed Agnes would like to use the concepts or not.	*"You could write your own suggestions or add suggestions"*
Credibility	For both concepts, feedback regarding credibility and trustworthiness was expressed. If it does not feel professional and complex enough, it lowers the user's trust in the solution.	*"It [BalanceGame] looks more like a puzzle than a serious health intervention"*
Relaxing user experience	The importance of having a relaxing user experience was brought up by participants as important. As the goal for the solutions is to reduce stress, they cannot be stress-inducing themselves.	*"It feels relaxing, there is no stress in doing the test [RecoveryFinder]"*
Fast to use	As response to what Agnes would like about using the two concepts, many participants say she would like that completing them would take little time. It appeared that having a solution that was relatively fast to use was preferred.	*"You are able to quickly press some buttons and then receive an elaborate answer"*

6.1.5 Conclusion From First Iteration

Some of the themes that were identified are in agreement with the behavior change techniques for digital interventions as suggested by Morrison [32] and Michie et al. [74]. Personalization and goal setting are examples of such techniques, and the results suggest that they are important for the target group of this thesis as well as in general. Based on the goal definition and in discussion with the project team, it was decided to go forward and continue developing the self-test concept. Some of the reasons were that it appeared easier to personalize in the public version, easier to set goals and more relaxing to use. Additionally, in a public version of the site, this concept would be technically easier to implement compared to a game. Hence, for the second iteration, the self-test concept would be further developed.

6.2 The Second Iteration

The goal of the second iteration was to generate a new concept based on the results from the first iteration, and create an updated and more realistic-looking mock-up that could be incorporated into the prototype for Ungdomsportalen for evaluation purposes.

6.2.1 Methods for Generating a Second Concept

To generate the second concept, knowledge and inspiration was gathered during literature review on behavior change, laying the foundation for the development of the concept.

6.2.1.1 Literature Review on Behavior Change Theory

In design, literature review is used as a way of informing the current thesis by capturing the important parts of previous work on the topic. Chosen literature for review should clearly demonstrate a connection to how it informs the design project [70]. In order to gain a deeper understanding of the design problem at hand, literature review on behavior change was conducted as a way of finding inspiration on how to improve the concept by incorporating evidence-based theory.

The behavior change wheel, first introduced by Michie et al. [31], was applied to the concept generation process to promote further development as outlined by Truelove et al. [75]. This was done mainly as a way to include a theoretical behavior change framework in the development process, and also to validate that previously identified themes were suitable for behavior change. It was also used as a method of generating new ideas to improve upon the concepts of the first iteration.

First, the three components of the COM-B model (capability, opportunity and motivation) were used to analyze what change needs to happen in order for the targeted behavior to occur, and whether that change is necessary or not. It was concluded that for the scope if this project, the components psychological capability, social opportunity, reflective motivation and automatic motivation could be targeted. Lastly, appropriate intervention functions were applied to these COM-B components and their respective sub-themes. This was exampled using behavior change techniques as introduced by Michie et al. [74] as well as examples of possible solutions to be incorporated in Ungdomsportalen. These results can be seen in table 6.5.

Table 6.5: Intervention functions and BCTs.

COM-B	***Sub-themes***	***Intervention functions***	***Examples of BCTs***	***Examples of possible solutions in Ungdomsportalen***
Psychological capability	Adolescents have difficulty knowing how to recover, what recovery actually is and how they best recover.	Education, Enablement	4.1 Instruction on how to perform a behavior 5.1 Health consequences	Text and image information about what recovery is supposed to be like and why it is so important. Possibility to test and experiment with different recharging activities and behaviors to find what works best for each individual.
Social opportunity	Adolescents' social networks value performative behavior and thus put constraints on recharging activities.	Enablement	1.8 Behavioral contract	Possibility to invite friends and participate together.
Reflective motivation	Adolescents lack the motivation to make changes as they don't see the long term benefits.	Education, Training, Enablement	2.2 Feedback on behavior 2.3 Self-monitoring of behavior 1.1 Goal setting (behavior) 1.3 Goal setting (outcome) 1.4 Action planning 5.4 Self-assessment of affective consequences	Possibility to set goals in regards to how many times per week to engage in suggested and then chosen recharging activities. Self-tests where the user reflects about their well-being after incorporating recharging activities. Feedback on the outcome of the behavior tracked in self-tests.
Automatic motivation	Adolescents struggle to create routines for recovery and include recharging activities in their daily lives.	Education, Incentivization, Persuasion, Enablement	8.4 Habit reversal 8. 3 Habit formation 1.4 Action planning 15.1 Verbal persuasion to boost self-efficacy 2.3 Self-monitoring of behaviour	Possibility to plan specific, personalized actions to take in order to create new habits. Words of encouragement and motivation to boost the user's confidence.

6.2.2 Second Concept

The second concept is presented below, first giving an overview of the concept linking it to behavior change theory, and second presenting parts of the concept in more detail.

6.2.2.1 Conceptual Model of Self-test Series

The Transtheoretical model was used as a starting point for reinventing the concepts, giving cues about the user's journey towards increased recovery. Combined with the results presented in tables 6.4 and 6.5, a new concept was generated.

This concept is a series of three self-tests which are meant to help the user go from a contemplating stage to a maintenance stage when it comes to increasing time for recovery. This conceptual idea is presented in figure 6.5.

- *Contemplation.* To help the user become aware of their need for increased recovery, a first test called "Do you need more recovery?" asks users to answer some questions about their recovery habits, much similar to "RecoveryTest" from the first iteration. After finishing the test, the user is provided with a recommendation to whether they need to increase their recovery or not.

- *Preparation.* The second test, called "What could recharge your mind?", helps the user discover what activities they could do to increase recovery and supports them in setting goals and creating a plan.

- *Action.* As this stage is about implementing behavior change [35], this is where the user tries out the activities suggested during the previous stage. With the self-test series concept, this stage partly takes place outside of the concept as the user partakes in their chosen recharging activity. After completing an activity, the user is recommended to take the third test "How well is your recharging activity working?", that helps the user reflect on whether it actually recharges their mind or not. The test could also be taken at the end of a trial period, such as after trying the same activity for a week, to help reflect on its recharging abilities. The test "How well is your recharging activity working?" presents the user with feedback and, to a certain extent, allows self-monitoring, which are behavior change techniques that are presented in table 6.5 as a way to improve the reflective and automatic motivation. If the user finds that the activity they have tried is not working, they could also re-do the test "What could recharge your mind?" to help find another activity to try.

- *Maintenance.* By trying out activities and reflecting continuously, the user might be able to find what activity they feel is the most recharging for them, which could then hopefully lead to the maintenance stage where continuation of the new behavior is the goal. At this point, the user could also do the first test again to see if their need for increased recovery has changed.

Although these tests have been generated to be taken in a certain order, the user can choose either one to start with and what order to take them in. For example, if the user already knows they need more recovery they might go straight to the second test, or if they want to reflect on some activity they are already doing they can do the third test right away.

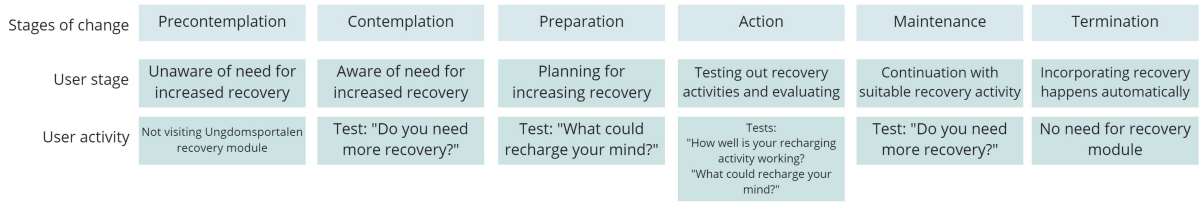


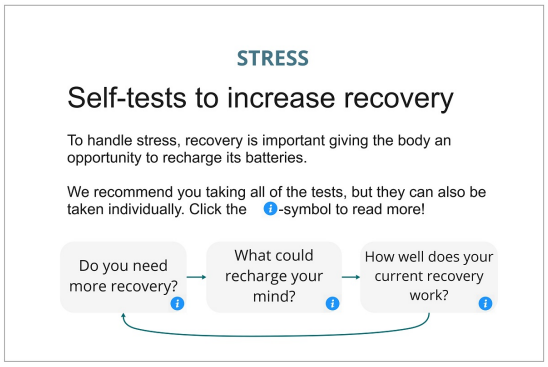
Figure 6.5: The self-test series concept, linked to the stages of the Transtheoretical model.

6.2.2.2 Concept for In-depth Evaluation With the Target Group

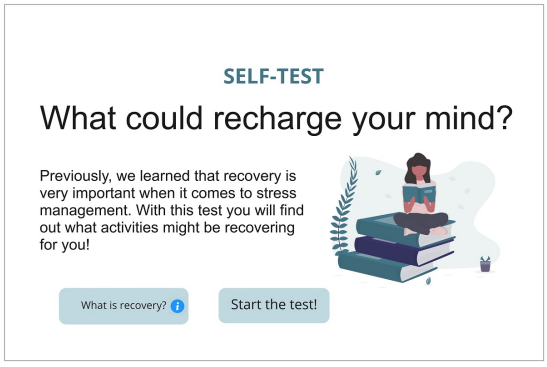
For the second workshop, it was decided that only one of the tests was going to be demonstrated to the target group due to time constraints. Based on the results of the last workshop, the test called "What could recharge your mind?" was chosen. This test has its foundation in concept "RecoveryFinder", which was demonstrated in the first workshop, and thus it had been adapted and updated based on the feedback to better fit the needs of the target group. Hence, it was included to discover whether these changes, such as an increased level of personalization and goal-setting, were satisfactory. The test was added to the prototype for Ungdomsportalen as clickable images showing the intended workflow. The other two tests from the second iteration, which were not demonstrated in the second workshop, are presented in Appendix C.2.

The pages in the test can be seen in figures 6.6a-6.9b, along with a figure text describing the action that the user takes. Further explanation of the choices for the functions and features is given below.

The information provided when clicking the information buttons seen in figure 6.6a and 6.6b aims to educate the user about the importance of recovery and provide advice and tips for managing stress. The information given also provides examples of activities that could be recharging. By adding these educational features, psychological capability according to the COM-B model is attained. The use of information buttons to provide extra information instead of showing the information by default was a design choice based made upon the fact that adolescents prefer little text in DHI's [34].



(a) Starting page of the self-test series, where more information is provided under each information button. The information given is both an explanation of how to use the tests together or individually, as well as explaining the purpose of each test in relation to the importance of recovery.

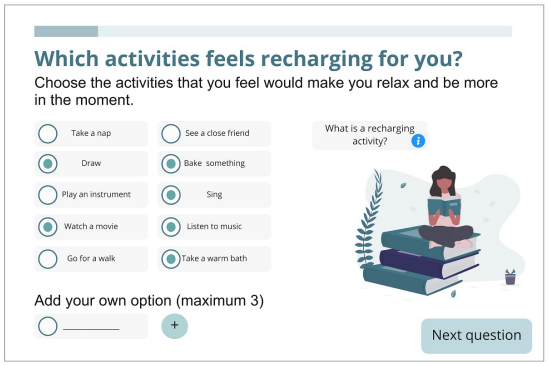


(b) First page of the test, in which the purpose is explained. Information about recovery is provided when pressing the information button.

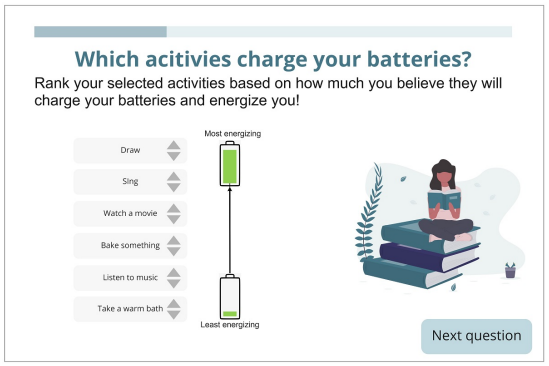
Figure 6.6

In figure 6.7a, the functionality for the user to add its own activity option was to offer personalization and adaptation. The other activities listed are known examples of what could be recharging in general [15], and from this list the user is provided with information about different kinds of recovery.

The ranking functionality in figures 6.7b and 6.8a aims to provide achievable recommendations to the user as well as provide transparency regarding specific results presented to the user. As pointed out by a psychologist in the project team, they might believe something will charge their batteries but even so it is not certain they will begin doing it. Thus, this ranking was added to make the final recommendation be more achievable, as requested in the workshop. By reducing the barriers to start with the activity, the intervention function enablement is incorporated as described in the COM-B model [31].



(a) Second page of the test, in which the user selects the activities they find recharging. The user is also allowed to enter their own activities.

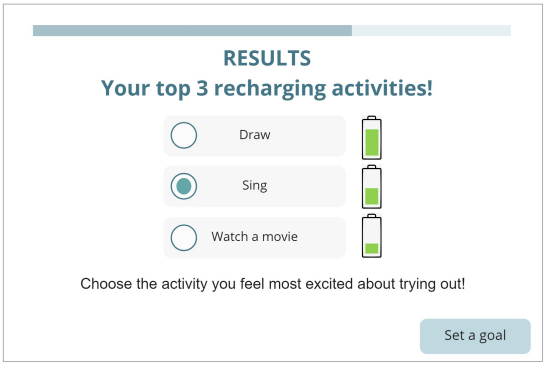


(b) Third page of the test, in which the user gets to rank their selected activities based on how much they charge the user's batteries.

Figure 6.7

In figure 6.8b, the user is presented with a choice to choose one of their top three activities to set a goal for. This functionality was added to increase personalization and offer adaptation, as well as enable the user's autonomous motivation and thus increase likelihood for the behavior to occur. Autonomous motivation can be enhanced by providing choice and flexibility, thus giving the user the impression that the behavior is performed out of a sense of choice rather than external pressure [32].

(a) Fourth page of the test, in which the user gets to rank their selected activities based on how likely it is they will start doing them every day.

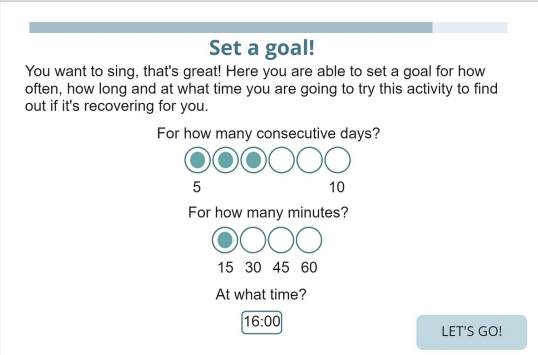


(b) Fifth page of the test, in which the user is presented with their top 3 activities, based on the previous rankings. The user chooses one of these to try out.

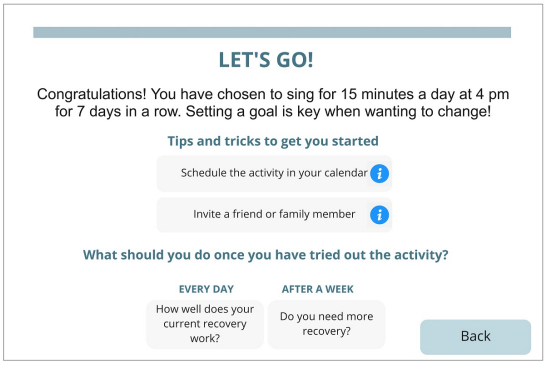
Figure 6.8

To increase reflective and automatic motivation as presented in the COM-B model [31], the BCT's goal setting, habit formation and action planning were incorporated as seen in figure 6.9a. This functionality also ensures that the concept helps the user to set goals for decreasing stress and offer help in creating a plan for decreasing stress, as proposed during the first iteration.

In figure 6.9b, the social opportunity in the COM-B model was achieved by using the BCT called behavioral contract [74]. In this case, this means that the user has the opportunity to invite a friend or a family member to participate alongside them. This is thought to encourage and motivate the user to increase their recovery, and the user is also provided with positive feedback as a response to goal-setting consistent with BCT's for verbal persuasion to boost self efficacy [74].



(a) Sixth page of the test, in which the user is allowed to set goals for when, how often and for how long they will try out the chosen activity.



(b) Last page of the test, in which the user has created a plan and is given tips on how to get started and what to do next. The user is asked to schedule the activity and invite a friend or family member.

Figure 6.9

6.2.3 Methods for Evaluation of the Second Concept

The second concept was evaluated during a workshop with a focus group engaging in brainwriting and discussions. This evaluation was further complemented by using cognitive walk-

throughs with personas and in discussions with the project team.

6.2.3.1 Workshop

The project team had arranged for a second workshop with a new group of adolescents, in which part of the workshop was arranged so that the self-test series could be evaluated. The goals of the workshop are presented in table 6.6. Similarly to the first workshop, the plan was to use Microsoft Teams and Miro in a similar manner to collect feedback from the participants regarding the concept. However, for reasons that are discussed later on, the workshop with the adolescents failed to provide sufficient feedback. For this reason, it was decided to hold another workshop. However, due to time constraints and the covid-19 pandemic, conducting a workshop with the target group was not possible.

Instead, 6 participants ages 24-25 from the authors' social network were recruited for the workshop. As a focus group may consist of as little as 4 participants [71], the number of recruits was deemed as sufficient. The goals for the workshop were, however, chosen to be the same as for the original workshop, presented in table 6.6.

The persona of Agnes was used again, and participants were first introduced to the second self-test, "What could recharge your mind?", as presented in figures 6.6-6.9. Miro was then used as a platform for the participants to perform brainwriting as response to the questions in table 6.7. Following, the entire self-test series concept was introduced and explained, and a discussion regarding the questions in table 6.8 was held.

Table 6.6: The goals of the workshop.

Goals
Identify whether a self-test series would help adolescents increase their recovery
Identify whether adolescents would be interested in using a self-test series to increase recovery
Identify desirable and non-desirable functionality for a solution aimed to increase recovery
Identify desirable and non-desirable behavior change techniques for a solution aimed to increase recovery

Table 6.7: The questions asked during the brainwriting session in the workshop.

Brainwriting questions
What does Agnes like about receiving help in finding and planning recharging activities?
What does Agnes **not** like about receiving help in finding and planning recharging activities?
How could the test be developed so that Agnes would be more motivated to do the activity?

Table 6.8: The questions asked during the discussion in the workshop.

Discussion questions
What does Agnes think about taking one or several of the tests?
What does Agnes think about taking the tests as a series?
What could motivate Agnes to take all three tests?
Would Agnes be able to increase her recovery after taking these tests? Why/ Why not?

6.2.3.2 Cognitive Walkthrough

A cognitive walkthrough, as first proposed by Polson et al. in 1992, is a usability inspection method that links the interface walkthrough to a cognitive model [76]. A cognitive walkthrough focuses on the cognitive activities of the user, especially their goals and knowledge when performing tasks. For each task, the following questions are asked [77].

1. Will the user try and achieve the right outcome?
2. Will the user notice that the correct action is available to them?
3. Will the user associate the correct action with the outcome they expect to achieve?
4. If the correct action is performed; will the user see that progress is being made towards their intended outcome?

For the self-test series, a cognitive walkthrough using the personas of Agnes and Marcus was performed for all three of the tests. This was done to investigate the concept from the perspective of the user, to target usability issues and boosting creativity for feature development by empathizing more with the user.

6.2.3.3 Discussion

For some final feedback, the entire project team of Ungdomsportalen participated in a digital discussion of the concept. Consisting of counselors, psychologists, web designers and team leaders, it was a diverse blend of different professions and perspectives. First, the general concept of the self-test series was explained to the team and afterwards the prototype for each individual test in the self-test series were shown. After being presented with these prototypes a discussion session lasting for 15 minutes was held.

6.2.4 Results From Second Iteration

The results from the evaluation methods of the second iteration are presented in the tables below. Table 6.9 presents the key themes of feedback that were identified in regards to the individual tests and table 6.10 presents the key themes of feedback that were identified in regards to the self-test series in general.

Table 6.9: The identified key themes in regards to the individual tests.

Theme	***Key findings***	***Quote***
Goals should be simple to achieve and not add to the stress	The possibility to set goals is positively received, however concerns are lifted that adding an extra activity can be perceived as stressful. Wishes for the goal-setting functionality to be more flexible in regards to when it is performed was lifted, for example every other day instead of every day.	*"Why should I do more things [when I am stressed]?"* - Workshop participant
Personalize recommendations for activities	Choosing from a list of activities was well received as it was agreed that this is eye-opening to what could be suitable activities. More personalization was wished for, where various suggestions lift the possibility for the system to recommend similar activities to what the user has chosen.	*"Say that I choose to draw, then maybe it [the system] could recommend me to paint?"* - Workshop participant
Provide help prioritizing activities and offer support in where to turn for help	To get started with recovery, adding a feature for prioritizing activities was requested to help the user eliminate things he or she does not need to do. Other ways of inviting friends than over e-mail should be offered. Information of where to get further help was also requested.	*"Agnes only stays in touch with her friends over TikTok, using e-mails is Stone Age technology"* - Workshop participant
Provide information about each individual test	More clarity and information about each individual test was requested as the users are confused to the what they will be asked to do in each test, how long it will take to finish it and how many questions they will be asked to answer.	*"I am confused to how the test works and what I will be asked to do"* - Persona
Provide clear results and recommendations on what to do next	The results pages were perceived as unclear. The results presented to the user must provide clear recommendations on what to do next, with less text.	*"The battery is colored green but my results are bad. What is it trying to tell me?"* - Persona
Negative results needs to be normalized	Seeing negative results were perceived as stressful. Instead, it was suggested to normalize and acknowledge the stress in a soothing way.	*"Maybe it would have felt better for her if it would have been explained to her that stress is natural"* - Workshop participant
Identifying stress levels	Having a way for the user to quickly check their stress levels before and after an acitvity or during a particular day was suggested as a way of developing the tests.	*"The evaluation should be very fast and easy, for example asking the user to rate their stress on a scale of 1-10"* - Workshop participant

Table 6.10: The identified key themes in regards to the self-test series concept as a whole.

Theme	***Key findings***	***Quote***
Feedback and rewards	Receiving positive feedback from the system could be valuable, for example some sort of award if the user manages to perform their activities for a certain number of days. Perhaps a badge or a getting a cookie from a local coffee shop.	*"Provide stars or something similar if she manages to stick to her new routine"* - Workshop participant
Mode of delivery	For many of the steps in the test, there is a lot of text which might not be suitable for some adolescents. Including more images might be beneficial as well as short videos that explain the topic of recovery.	*"There is so much text that I find it hard to understand and take in the information"* - Persona
Battery analogy	The battery as a visual symbol for the user's energy level was generally well-recieved, however there needs to be a clearer explaination on how the energy levels relate to relaxation and how that relates to the user's experience.	*"What exactly does charging my batteries mean, is that the same as relaxing?"* - Persona
Education about recovery	More emphasis needs to be put on educating the user about why recovery is necessary, as well as what recovery is supposed to be like and what that means in a practical sense.	*"Focus needs to be on how you do it [recharging acitivity], not what you do"* - Workshop participant
Returning for evaluation	It needs to be presented more clearly why evaluating is beneficial and make it easier to come back and find the correct test. However, not coming back may not be all negative as this might suggest that the user does not feel the need to go back to Ungdomsportalen.	*"Does the user have to remember to come back after a week? By then they probably will have forgotten"* - Workshop participant
Provide further explanation of the test-series workflow	Clarity about the self-test series as a concept needs to be added as it is unclear to the user how it works and where to start. Once the user has started a test, it is also unclear to the user where in the self-test series they are in relation to the other tests.	*"When you say that it is meant to be taken as a series of self-tests, what do you even mean by that?"* - Workshop participant

6.2.5 Conclusions From Second Iteration

Although feedback could not be received directly from the target group, many of the themes found are consistent with theoretical knowledge about the preferences within the target group regarding DHI's, such as the use of videos and images with limited text [34].

With the self-test in the first iteration receiving positive feedback from the target group

itself for being fast to use and for providing advice on concrete methods to reduce stress levels, it was assumed that the self-test series would be similarly received. As the evaluation during the second iteration also gave positive results, the concept is being further developed in Deliver. The findings during the second iteration gives rise to new features and functionalities implemented in the final concept.

To ensure that the concept as a whole is communicated more clearly, a storyboard explaining different uses of the concept will also be presented in Deliver.

7. Deliver

This chapter presents the Deliver phase in the Double diamond model (figure 7.1). The Deliver phase is where the concept is finalized [78]. The final deliverable of the master's thesis is presented in this chapter, which includes a list of features, a presentation of the final concept as well as storyboards that more clearly communicate the context of use. Finally, a method investigation where insights about the methods used throughout the project are presented.

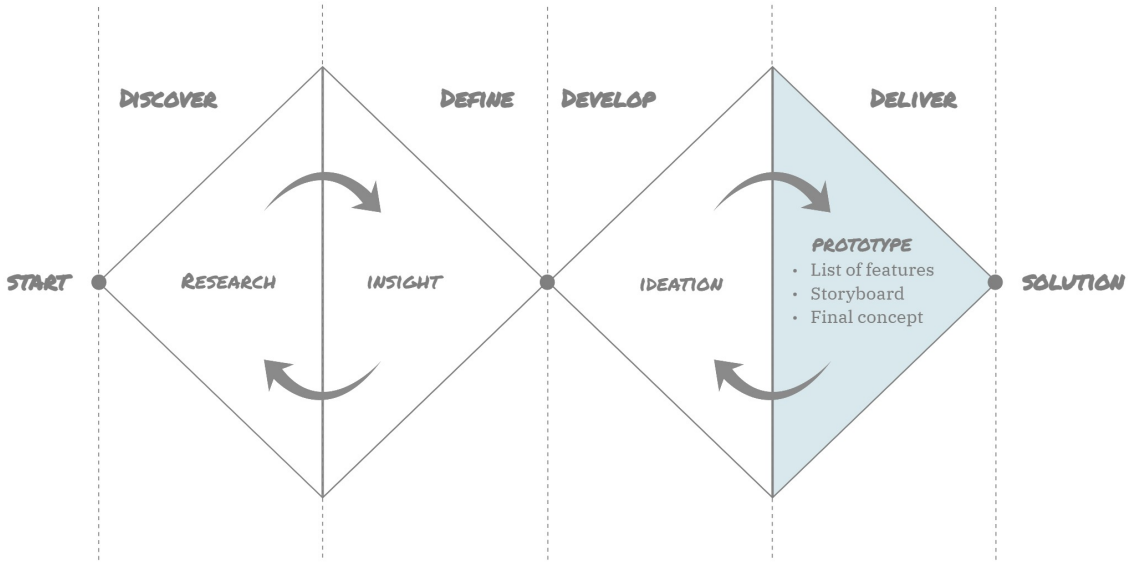


Figure 7.1: Deliver phase in the Double Diamond model.

7.1 List of Features

A final list of main functions for a solution to increase recovery was created, which included all possible features along with what part of the COM-B model they fulfilled. This list is presented in table 7.1.

Table 7.1: Final list of functions and features.

Function	***Feature***	***COM-B component***
Educate the user about recovery	• Short films and text about stress and recovery that are easily accessible. These should focus on what recovery is, why it is important and how it should feel when recovering properly. • Explain the usage of a battery as a metaphor for the user's own energy. • Links to other pages and sites about stress.	Psychological capability
Help the user identify a need for more recovery	• Questions about recovery that the user gets to answer. • Presentation of results in an encouraging way, with emphasis that some stress is normal.	Psychological capability, Reflective motivation
Help the user find recharging activities	• Opportunity to select potentially recharging activities from a list of pre-chosen activities. • Option for the user to add their own activities. • Tailored suggestions of similar activities when selecting one. • Ranking of activities based on what feels most recharging and what is most likely to begin doing every week. • Presentation of the top 3 activities based on the rankings, and option to choose one activity to set a goal for.	Psychological capability, Reflective motivation
Help the user set goals regarding recharging activity	• Opportunity for the user to set goals in regards to how many times a week and for how many weeks the activity will be performed. More advanced options for choosing an exact time or a specific day. • Presentation of a simple summary of their chosen plan. • Option to share with others or invite others via several types of media, both traditional and social. • Other tips of getting started, such as scheduling their activities or getting help in prioritizing. • Links to other pages, sites or contact details to get more help in getting started.	Reflective motivation, Automatic motivation, Social Opportunity
Help the user evaluate and reflect upon recharging activity	• Quick rating of the user's level of stress or level of relaxation before and after performing an activity. • Presentation of results which tell the user whether the recharging activity might be working or not. • Suggestions of what the user might do next based on the results.	Reflective motivation, Automatic motivation

7.2 Final Self-Test Series Concept

The main functions and features as listed above were implemented into a final concept which follows the self-test series idea, seen in figures 7.2-7.11. They are presented in the format of a web browser, as this is currently the layout that is in progress for the general development of Ungdomsportalen.

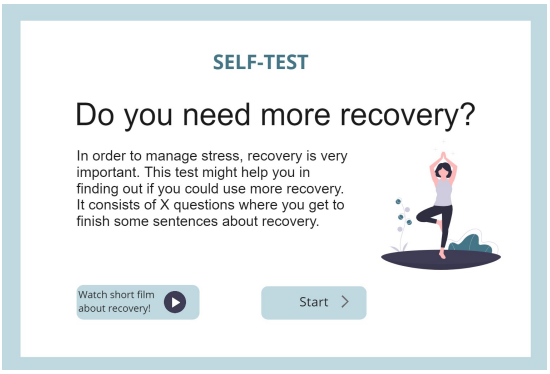
Feedback was given in regards to the amount of text, which might have been too heavy, as well as the information buttons which were perhaps not very accessible to the user. As such, the starting page as seen in figure 7.2 has been updated to include more images as well as short films to present information rather than text. Additionally, the educational aspect of the concept was thought to be somewhat lacking, which also explains the inclusion of more general education about recovery in video format.

Figure 7.2: Starting page of the self-test series, where the user is able to watch some short video clips that explain the topic of stress and recovery, as well as the battery as a metaphor for the user's stress levels. The user is also presented with the three tests along with a short video about each, that further explains their respective purposes.

7.2.1 Do You Need More Recovery?

The steps in the test can be seen in figures 7.3a-7.4, along with a figure text describing the action that the user takes. A further explanation to any changes or updates since the second iteration is described below.

As some feedback pointed out that it was unclear to the user what they would be asked to do in each test, additional information about this was added to each starting page. For the first test, this is shown in figure 7.3a. Additionally, a previously placed information button is once again replaced by an option to watch a short film.



(a) Starting page for the test "Do you need more recovery?", where the test is presented and quickly explained. The user is also able to watch the short film about recovery again if they want.

(b) Example page of a question that the user would answer in this test, in the form of finishing a sentence.

Figure 7.3

The results of the test, as presented in figure 7.4, are presented in a more normalizing way as some feedback stated that results too negative might not motivate the user to increase their recovery but rather add to their stress. Similarly to the previous version of the concept, the user is suggested on what to do next, but using more imagery and less text.

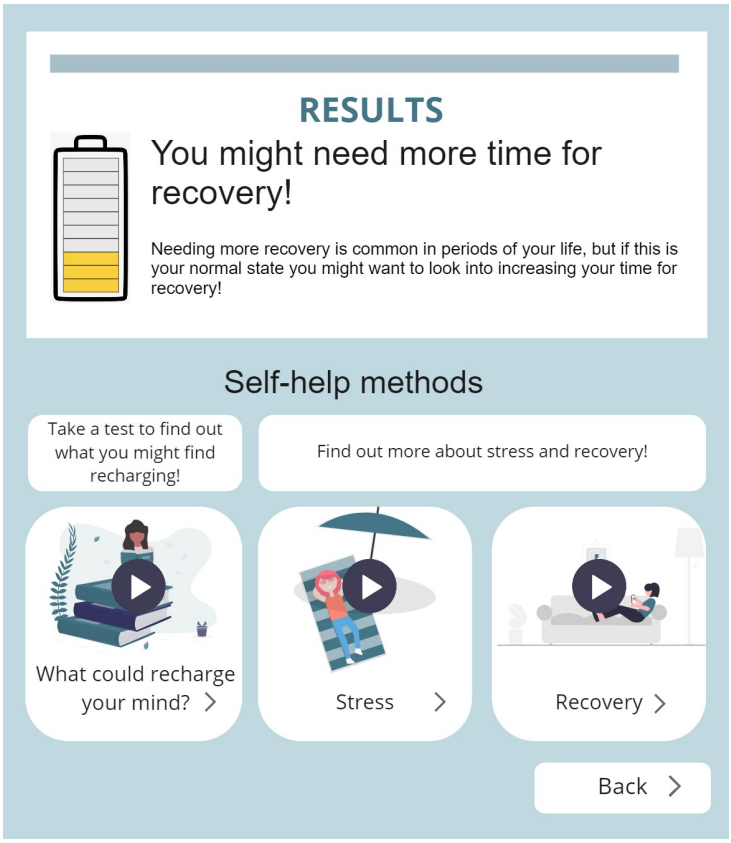
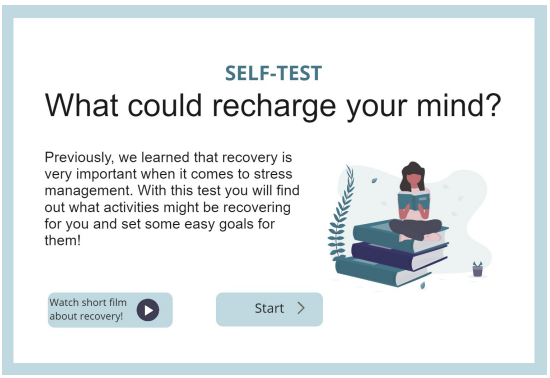


Figure 7.4: Results from the test, in which the user is presented with whether they need more recovery or not. The user is also shown some options for self-help methods, which includes one of the other two tests but also short films about stress and recovery.

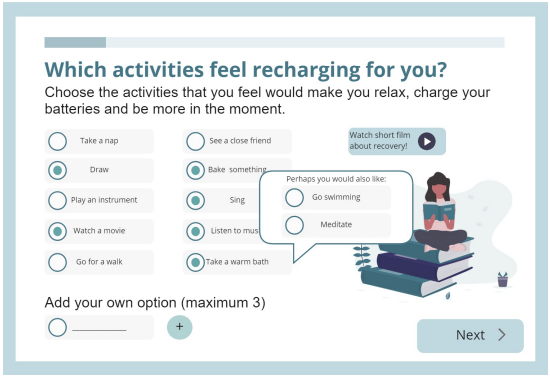
7.2.2 What Could Recharge Your Mind?

The steps in the test can be seen in figures 7.5a-7.8, along with a figure text describing the action that the user takes. A further explanation to any changes or updates since the second iteration is described below.

Similarly to the starting page shown in figure 7.3a, the content of the test shown in figure 7.5a is explained more clearly and a video is presented if the user wants to know more about recovery. In figure 7.5b, some changes were made in regards to how the different recharging activities are selected. The option for the user to add their own activities, in the hopes of including more personalization, was received well. However, one idea that was expressed during the workshop was to include some tailored suggestions for selected activities. As such, when choosing activities, additional options similar to the selected ones are now presented.



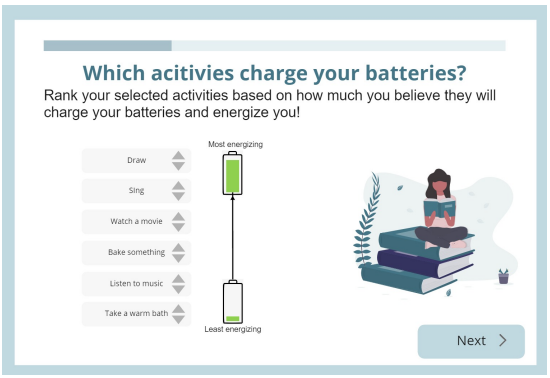
(a) Starting page for the second test, "What could recharge your mind?", in which the user is once again presented the purpose and content of the test.



(b) The first page of the test, where the user gets to select activities they feel could be recharging or add their own suggestions. From here they are also able to watch the video about recovery.

Figure 7.5

The two pages of the test shown in figures 7.6a and 7.6b are very similar to the previous version of the concept, as these were positively received.

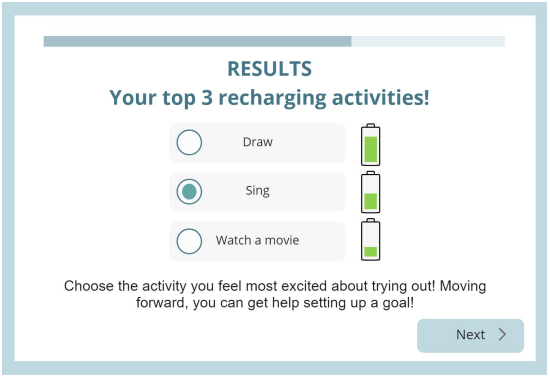


(a) Ranking of the activities based on what the user believes would be the most recharging.

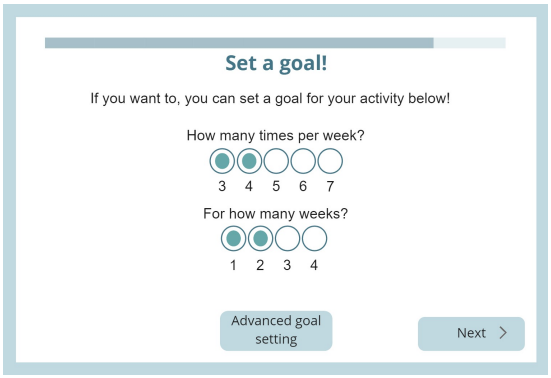
(b) Ranking of the activities based on what the user believes would be most likely to start doing every week.

Figure 7.6

Similarly to the previous version of the concept, a top 3 is presented to the user in figure 7.7a, as this feature was received well during the workshop. However, several changes of the goal setting function were made, as shown in figure 7.7b. During the second iteration, the feature of setting goals was received positively for increasing motivation. However, there was a substantial amount of negative feedback regarding how the goals were set. Thus, the final concept has a goal setting feature in which the user can decide how many days a week they want to do an activity, and for how many weeks. When discussing with clinicians from the project team, this way of setting goals is more similar to how they work clinically with adolescents to increase recovery. It provides more flexibility and consequently, more achievable goals. However, if the user wants to set more specific goals they can do so under "Advanced goal setting".



(a) Presentation of the three activities with the highest average ranking, where the user is able to select one to set a goal for.



(b) The page where the user is allowed to set goals for the activity, more specifically how many times per week and for how many weeks. They can also set more advanced goals if they want, such as which days and at what time.

Figure 7.7

In figure 7.8, results similar to those of the previous version are presented, with suggestions on what the user might do next after they have tried out their activity. The option to invite friends was met positively, however, there was a wish to also be able to share the plan with others. As such, this option was added.

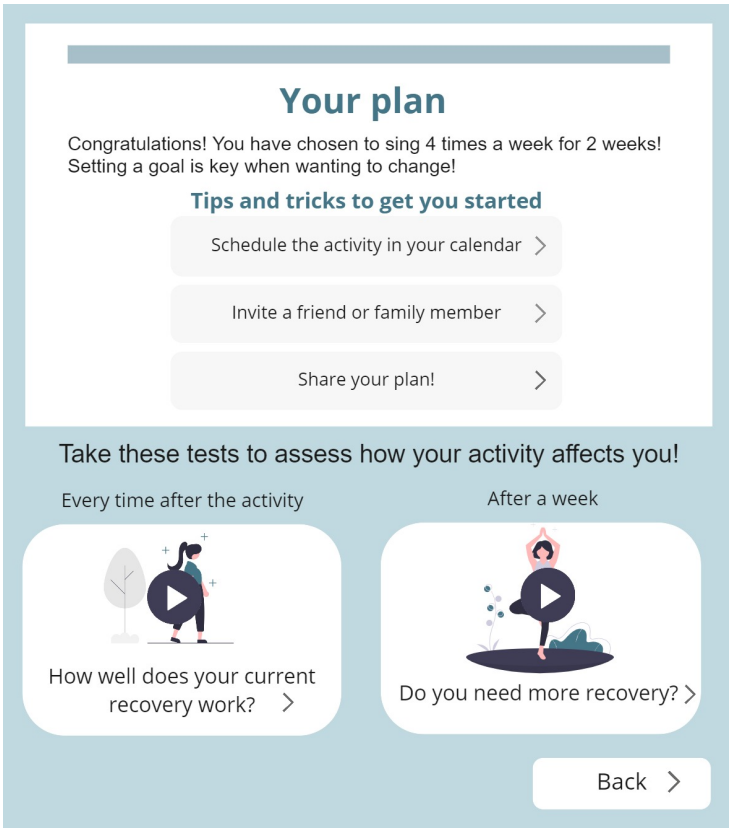
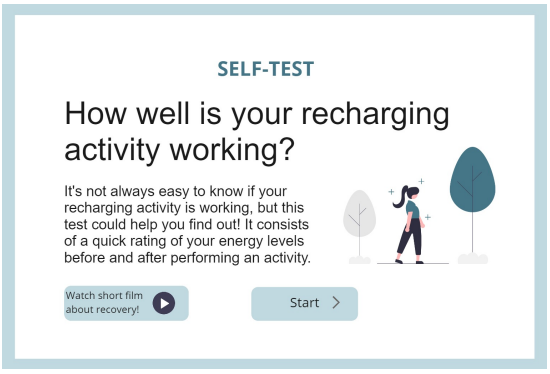


Figure 7.8: Lastly, the user is presented with a summary of their chosen plan as well as some tips on how to get started. They are also shown some suggestions for what tests they could take to find out how their activity might affect them.

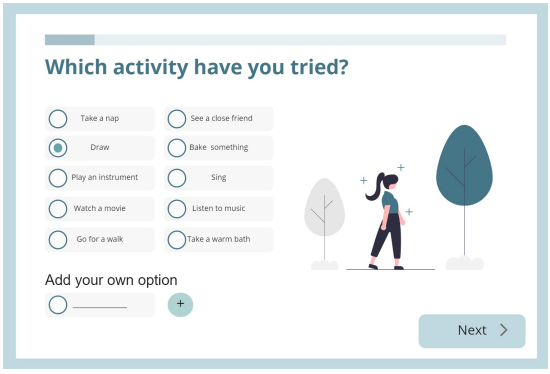
7.2.3 How Well Is Your Recharging Activity Working?

The steps in the test can be seen in figures 7.9a-7.11, along with a figure text describing the action that the user takes. A further explanation to any changes or updates since the second iteration is described below.

The starting page of this test, figure 7.9a has been created similarly to those of the other two tests.



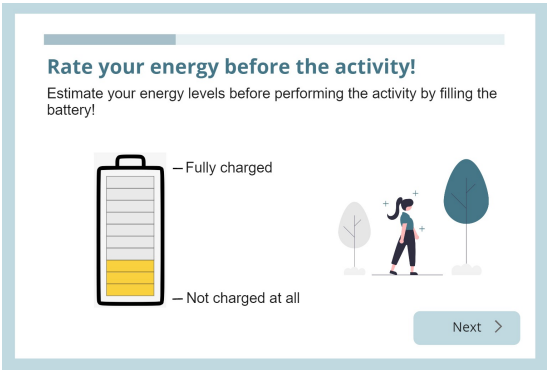
(a) Starting page of the third test, "How well is your recharging activity working?". This has a similar layout to the starting pages of the two other tests.



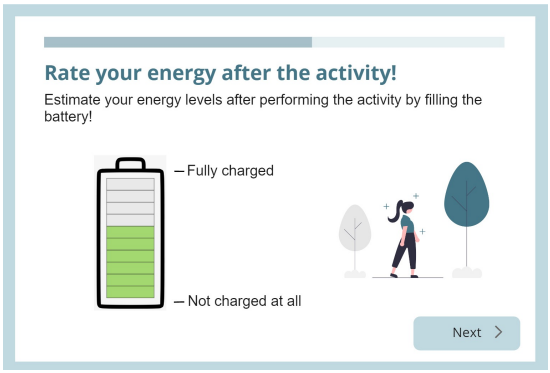
(b) At the first step, the user is asked to select which activity they have tried out and wish to evaluate.

Figure 7.9

As feedback was given regarding a quick and easy method of evaluating, this test features a rating of the user's energy before and after performing an activity, as seen in figures 7.10a and 7.10b.



(a) The user gets to rate their energy level before performing the activity as the amount a battery is charged.



(b) The user gets to rate their energy level after performing the activity as the amount a battery is charged.

Figure 7.10

Similarly to the results of the other two tests, the user is once again provided with clear suggestions on what else they can do, as shown in figure 7.11.

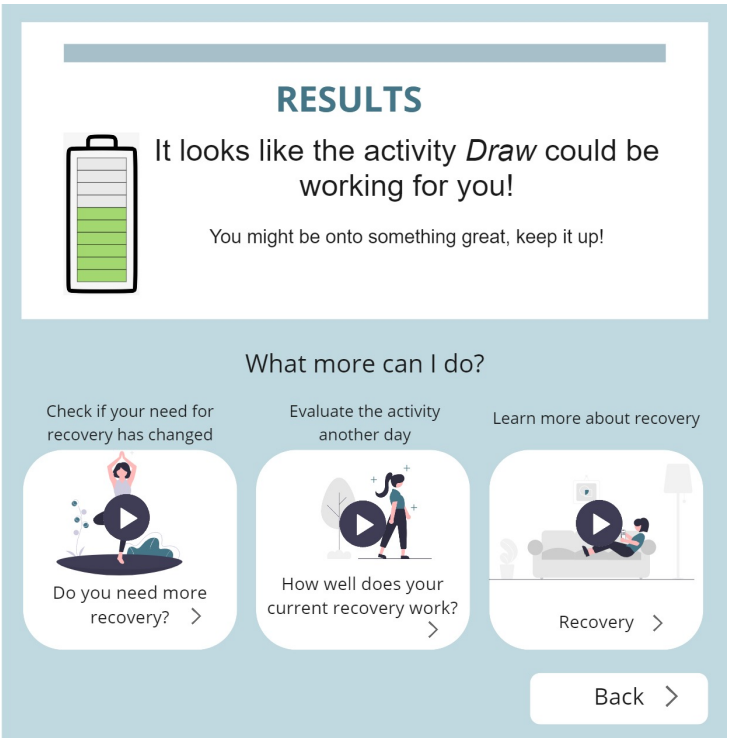


Figure 7.11: Lastly, the user is shown the results of their evaluation. In addition, they are presented with suggestions for what else they can do, such as taking another test or re-taking this test.

7.3 Storyboards

In order to further communicate how the concept might be used, two storyboards were created. According to Krause [79], a storyboard communicates a story through images displayed in a sequence of panels that chronologically maps a story's main events. Storyboards are used to provide context for teams and stakeholders, and using images makes the story quick to understand and easy to remember [79]. The storyboards presented below were created using *Storyboard That*, a digital storytelling service [80].

7.3.1 Storyboard With Agnes

In the first scenario, we get to follow Agnes as she uses the self-test concept to lower her stress over time. This storyboard presents the typical use of the self-tests as a series, where all tests are taken in order (figure 7.12).

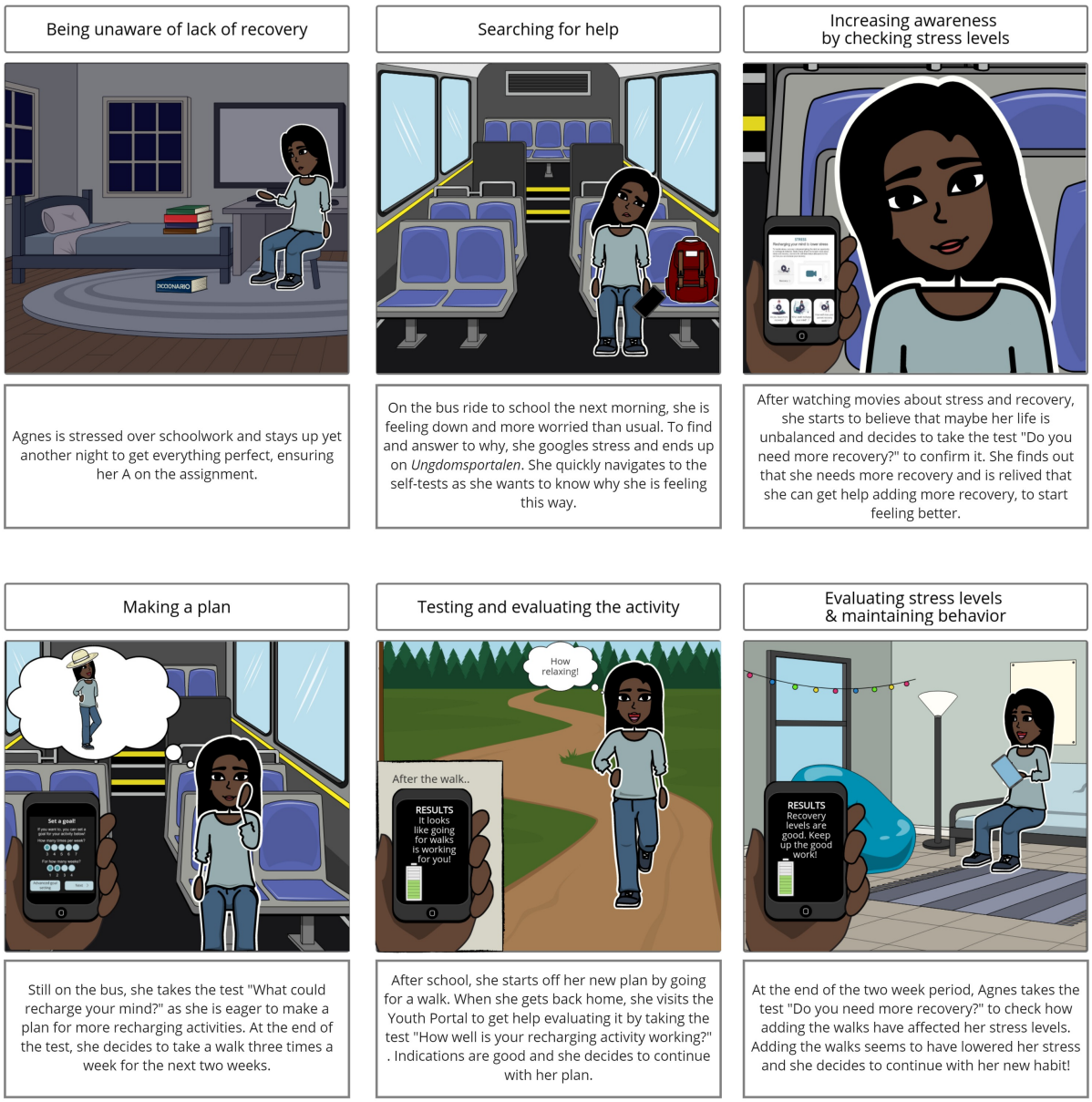


Figure 7.12: Storyboard showing the typical workflow of the self-test series.

7.3.2 Storyboard With Marcus

In the second scenario, we get to follow Marcus as he uses the self-test concept to find out what he can do to lower his stress. This storyboard presents a workflow of the self-tests where not all tests are taken, to show an alternative use of the tests when not taken in a consecutive order (figure 7.13).

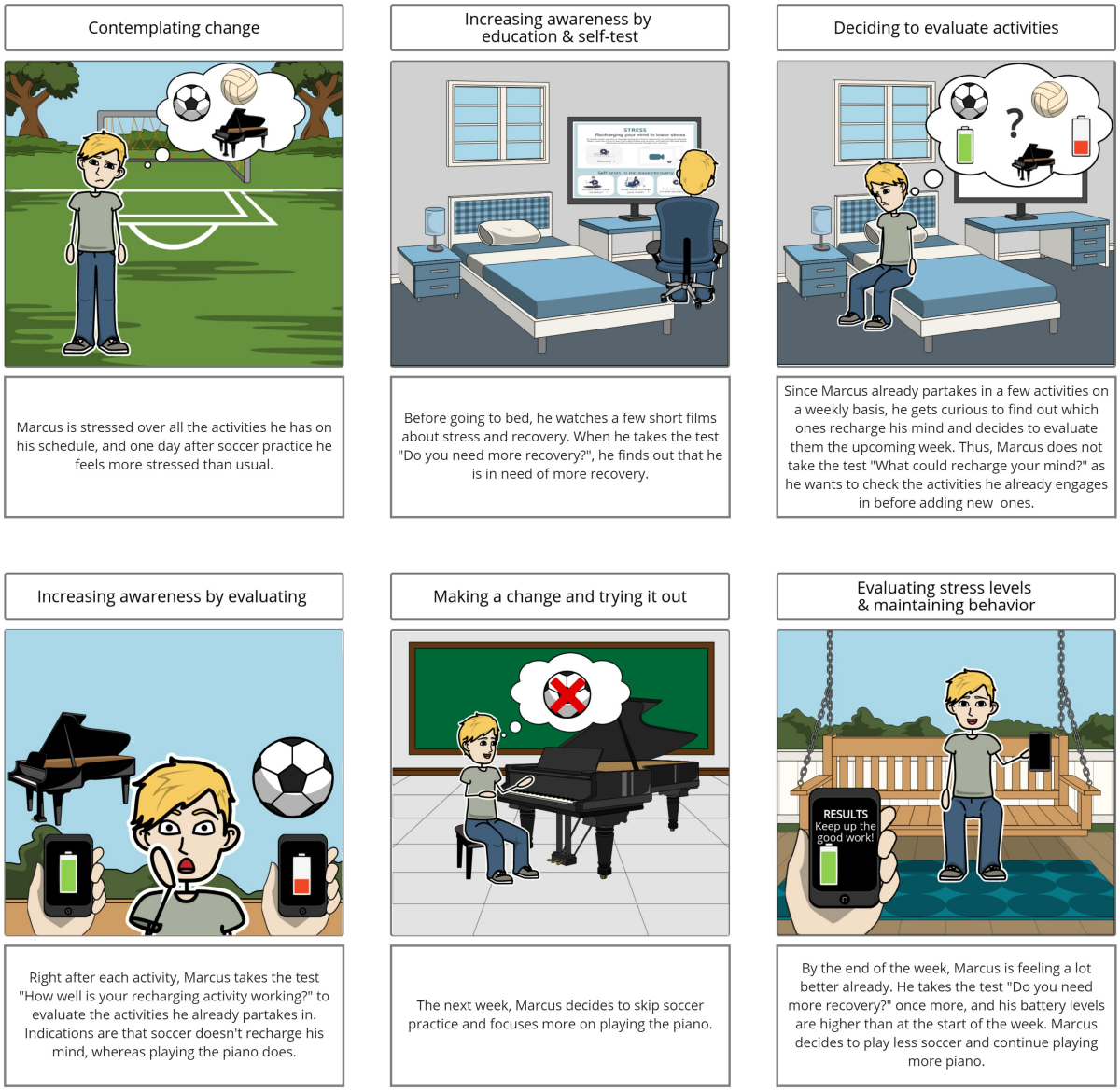


Figure 7.13: Storyboard showing an alternative workflow of the self-test series.

7.4 Method Investigation

Throughout the process, reflections about the choice of methods and how they were conducted were made. Methods where specific insights were gained are presented in figure 7.14 with the aim to provide support for the continuation of the development of Ungdomsportalen. These, and additional, insights are further reflected on in the Discussion.

Discover

Method	Questionnaires to adolescents aged 18-20	Semi-structured Expert Interviews
Advantages	• Good for sensitive subjects resulting in honest, elaborate answers • The survey design using a multi-choice question where answers could be elaborated in an open-ended follow-up question provided valuable insights	• Good way of gaining insight from the people who work with the target group • Good for verifying issues in questionnaires
Disadvantages	• More difficult than expected to recruit participants • Difficulties ensuring diversity among participants • Respondents being older than the target group could produce irrelevant results • Input is solely the users' own opinions, not necessarily actual behavior	• Not the actual target group itself, with risk of a process that is not user centered
Takeaways from phase	Themes of needs that are prevalent among adolescents	

Define

Method	Personas
Advantages	• Facilitate empathizing with the target group • Good for discovering needs that are not explicit
Disadvantages	• Many assumptions had to be made due to lack of data, for example about daily routines • Lack of diversity within group of personas
Takeaways from phase	A well-defined problem definition and goal

Develop

Method	Visual representation of concept	Workshop	Evaluation exercises
Advantages	• Easier to understand the purpose of a concept • Facilitates feedback and input giving rise to new features	• Can result in elaborate concept feedback if participants are provided with anonymity	• Brainwriting provides a greater sense of anonymity • Discussion helps facilitate more elaborate answers
Disadvantages	• If not esthetically appealing to target group, focus is shifted from concept functionality to the graphical design thus limiting relevant feedback	• Difficult to conduct digitally when students are seated together as anonymity is limited • Existing hierarchies within participating group can have negative effect • Failing to communicate expectations on adolescents' participation can have negative impact	• Brainwriting may result in less detailed responses • Discussion might not be suitable for participants who are not very vocal, as they might not voice their opinions
Takeaways from phase	Functions and features wished for by adolescents		

Deliver

Method	Storyboards
Advantages	• Good for providing context of use and for easier communication of the final concept
Disadvantages	• Could have been used in earlier phases to facilitate a better understanding of concepts
Takeaways from phase	A presentation and communication of the final concept

Figure 7.14: Insights regarding various methods used throughout the project.

8. Discussion

This chapter takes off in a discussion regarding the conditions for the thesis along with the project framework. Following, the methodology and outcome in each phase of the Double Diamond model is critically investigated. Lastly, the final concept is discussed as well as recommendations for future development are presented.

This thesis aimed to investigate and identify what needs adolescents 12-17 years old have in regards to preventing stress leading to mental illness, develop and communicate a concept for a digital solution that could solve these needs, as well as investigate suitable methods for co-designing with adolescents.

8.1 Conditions for the Thesis

The original idea behind the thesis was to investigate the desired content for the stress module in Ungdomsportalen. In the startup phase of the thesis, most of the time was put into defining the scope of the project. When conducting research in the Discover phase, the width of the problem was revealed and through discussions with the team, it became clear that delivering a complete module for stress to be included in Ungdomsportalen was out of scope for this project. Instead, it was decided for the project to define a concept for a tool that could be a part of the stress module. However, the final deliverable to the team was not decided upon until the very last phase.

The conditions for the already existing prototype of Ungdomsportalen set some constraints in regards to the development of the concepts. For example, after having developed a range of concepts in the Develop phase, it was communicated that the final concept had to function in a public mode where the user is not required to log in. This led to various concepts being disregarded, as the development could not meet this requirement successfully. During discussions later on in the thesis about developing the chosen concepts further, functionality that required user log-in was frequently wished for by the team. However, as it had been clear that for the current state of Ungdomsportalen, only functionality that was possible in the public version of the portal was taken into account for further development.

8.2 Project Framework

In general, the Double Diamond framework has been helpful during the thesis work as a way to more clearly understand the process and the different phases that should be undergone. It is possible that using a framework consisting of more phases could have been advantageous in guiding the process in more detail, however, the converging and diverging aspect of the Dou-

ble Diamond framework has been very convenient in understanding which direction to go in. On the contrary, using a framework for a design process is also challenging as the process is seldom linear. The Double Diamond consists of four phases that for the report's sake, appear in a linear, chronological order. However, this has not been the case as there has been iterative movement between the phases throughout the entire process. As such, communicating the use of a non-linear framework has been challenging.

As part of the purpose of the thesis, methods used during the process were investigated. Following is a discussion of some of the methods used during the four phases of the Double Diamond.

8.2.1 Discover

The chosen methods for data gathering were questionnaires and semi-structured expert interviews. The techniques chosen influenced what data was gathered and thus the problem definition and concepts developed to meet the identified need.

Gathering enough data to represent everyone in the target group proved to be difficult, partly due to the covid-19 pandemic as this limited data gathering to solely be conducted through digital means. During spring 2021, high schools were mainly teaching digitally due to the pandemic [81]. This affected the thesis work as it was more difficult to recruit high schools to distribute the questionnaires, as many said that both the personnel and students had to fully focus on work related to education. This led to very few schools distributing the survey, with a more narrow variation within the participating group of students as a result. As one of the high schools that distributed the questionnaire was known to have very high performing students coming from families with academic backgrounds, this might have emphasized certain problems that led to the final problem definition. Some students also had a tendency to write more elaborate answers than others, thus impacting the result more.

In regards to the fact that the questionnaire was distributed to students aged 18-20, which is outside the target group age range, it is possible that some particular issues, such as stress relating to the future, were enhanced. However, during the expert interviews with personnel working both with adolescents in high schools and secondary schools, similar issues were brought up. This suggests that the questionnaire data is likely to be relevant for the target group as well.

Regarding the structure of the questions in the questionnaire in the form of multi-choice question with an open-ended follow-up question asking them to explain their answer, this proved successful as most participants elaborated their answers in the follow-up question.

In retrospect, other or complementary methods for data gathering would have been suitable. Ideally, observations of adolescents could have been conducted by visiting secondary- and high schools, and also in the adolescents domestic environment. Compared to questionnaires and interviews, which investigate the users' opinions, observations investigate what the users actually do [57]. Observations could have been a suitable complement as it could validate or possibly contradict the data from the questionnaires and interviews, and thus enable additional methodological triangulation. Another option for data gathering suitable for adolescents particularly would have been videography, where the adolescents themselves films parts of their days [82], like a digital journal. Videography would also have been a possible method for data gathering during the pandemic, in contrast to observations.

8.2.2 Define

Based on the data that emerged from the data gathering, a total of 4 personas were created. There is a suggestion that for most cases, a number of 3-5 personas is sufficient [83]. Having four original personas, each with a slightly different background and problem, was helpful in narrowing the data and establishing the problem definition as it allowed for discovering needs that were not explicitly mentioned. Thus, the number of personas created appeared to be enough for this case.

However, due to the limited data gathering, these personas shared many similarities and there could potentially have been more variation and diversity between them. For example, no information was added about if they had any limitations in reading or writing, or what their native language was. Additionally, also due to the limitation in data collection, most information about each persona had to be assumed based on statements in the interviews and questionnaires. If there had been more direct contact with the target group, it is possible the personas' daily routines, for example, would have been more accurate. Thus, the personas were helpful in both defining the problem and during workshops, but were probably not as developed and nuanced as they could have been to understand and define the problem even more specifically.

Another method that could have been used is empathy mapping, in which the user's actions, words, thoughts and feelings are mapped to increase the understanding of the user [84]. Although this method might have been useful, it would also require several assumptions to be made about the user. With this in mind, empathy mapping probably would not have been a more suitable method to use based on the amount of data available.

8.2.3 Develop

Based on the personas and the problem definition, concepts were created. These were more or less tailored to the personas' specific needs, which meant they probably only catered to a certain part of the target group. Although this had to be done due to time restraints, it also meant that a large part of adolescents would probably not find the concepts appealing as it had not been created with them in mind.

With the scope of the project only being to deliver a concept, the visual representations of the concepts were only created to facilitate the communication of the ideas behind them. However, the graphical design of the concepts received much attention in the workshops. To succeed in receiving more feedback on the concepts itself rather than the design, presenting concepts with a more appealing graphical interface could have had a positive outcome on the feedback given on functionality. Putting more emphasis on the design of the concepts could also have been beneficial for communicating the concept itself. This would have been particularly useful for the concept BalanceGame, that received much negative feedback for its interface. Additionally, surveys could have been sent out to the participants after the workshop for further evaluation of the concepts as well as feedback on the workshop set-up itself, to better tailor the following workshops.

As for the workshops, neither the variation within the participating group of adolescents or the number of participants could be controlled by the authors as the participants were recruited by the project team for Ungdomsportalen. The second workshop, aimed to evaluate the second concept, had a very similar set-up to the first workshop as the arrangement of the first workshop was successful with much feedback as a result. However, the second workshop did not result in nearly any feedback. One possible reason for this could be that it was the first time that this

particular group participated in a workshop within the project for Ungdomsportalen. As many of them had technical troubles both within Miro where the brainwriting session took part, as well as in Microsoft Teams, this made conducting a successful digital workshop difficult.

Another possible reason for the second workshop not being successful could have been due to pre-existing hierarchy within the group. When using focus groups, it it desirable to achieve a peer setting, meaning that participants do not fear being judged by one another [70]. Since all participating adolescents were not only classmates but also seated in the same classroom during the workshop, this hierarchy can be assumed to have affected that some participants had their voices heard less than others due to fear of being judged. When discussing sensitive topics it might not be beneficial for the participants to be classmates [42]. During the discussion, only one or two participants would speak and even so did not provide serious answers but rather tried to be funny for their classmates. Brainwriting was included as a method to combat this potential issue, but since all the participants were in the same room it is possible some participants still did not feel anonymous enough to write down their thoughts. It is possible that another set-up and different exercises could have facilitated another result, however this was difficult to know beforehand since the group was new. In addition, it is possible the adolescents participating did not have a clear understanding of what was expected of them during the workshop as it was their first time.

As a result, an opportunity for interaction with the target group was missed, which meant that the only feedback provided by adolescents was from one group in one municipality. In retrospect, additional opportunities for interaction with the target group should have been arranged. However, due to the pandemic this proved to be very difficult, in addition to adolescents being more challenging to recruit since they are minors. It was also deemed to be sufficient with the two workshops that were scheduled, which was another reason why no other opportunities were arranged. As mentioned previously, another workshop was held in its place. Unfortunately, on such a short notice it was not possible to recruit new adolescents which resulted in participants being above the targeted age. Using a persona in the relevant age range was in this case even more important, so that the participants would view the concept through the eyes of an adolescent from the target group. However, as mentioned previously in the report, the participants were recruited from the authors' social network. This may have created a bias and affected which opinions were voiced.

8.2.4 Deliver

The final deliverables for the project was a list of functions and features, the final concept, storyboards and a method investigation with a summary of insights from the methods used. Storyboards were added to further communicate the concept of the self-test series, as it from the second workshop became clear that it was difficult to grasp the concept. Using storyboards earlier on in the project could have been beneficial, especially in the second workshop and in discussions with the project team to ensure that everyone involved had understood the concept to be able to give more accurate feedback.

It was decided to include a list of functions and features to complement the final concept. This decision was made to open up for alternative solutions other than the self-test series, as the self-test series could not be evaluated with the target group.

8.3 Final Concept

As presented in the background for the thesis, there is potential in developing digital solutions for adolescents. This is partly due to the digitalization of society, but also as this group of people has great technical and digital skills. Digital tools, such as the final concept presented in this report and the platform Ungdomsportalen, are examples of digital solutions that could help improve mental health among adolescents.

The goal, as formulated in the Define phase, was to *"Develop a concept for a service, that should function in a public version of Ungdomsportalen, to help adolescents in the age of 12-17 to increase their recovery"*. The final concept has potential in doing so, as the usage of self-tests has been positively met during concept evaluations. In the final discussion with the project team, the concept was praised as the team members that work as counselors and psychologists said it would be a great way for adolescents to get help in increasing recovery. However, since the second workshop with the adolescents was unsuccessful, this has not yet been confirmed with the target group. As such, it is not completely certain that the goal has been met, although there are indications that the concept at least has potential of meeting them.

The aim of the final concept is to guide the user into habit formation. Due to the restrictions for the concept to be used in the public mode, the implementation of behavior change taking place after completing the test "What could recharge your mind?" relies heavily on the user's own motivation. This is due to the public mode not allowing functionality such as notifications and reminders to boost the user in remembering or finding motivation to perform the activity. According to the clinicians in the project team, they work together with patients to increase their recovery by giving the patient homework to try a specific activity followed by reflection during the next appointment. Comparing this to the self-test series, they both rely on the patients themselves engaging in the recovering activity during their free time. However, the difference is that patients receiving clinical treatment have a behavioral contract with their psychologist or counselor. This could potentially make it more likely that they will succeed in engaging in the activity as they will need to report their progress during their appointments.

In general, getting adolescents to use and engage in DHI's could be challenging, as drop-out rates for these interventions can be high [34]. Hence, the use of behavior change theory, such as the BCW, might be especially important during the development of the digital concepts, to make sure that the user has the capability, opportunity and motivation to engage in the solution. Linking the concept to the Transtheoretical model for behavior change, there is a risk of user drop-out during the Action and Maintenance stages. Despite this, a digital solution might still be the best way of reaching the target group because of their digital skills and competencies. In addition, the chance of creating a DHI with high levels of engagement is higher when co-designing with the adolescents themselves.

8.4 Recommendations for future development

As one of the limitations of the thesis project was that the concept had to work in a public, non-logged-in version of Ungdomsportalen, several desired functions and features had to be dismissed. For example, given that a user were to use this concept while being logged in, they could receive frequent reminders and notifications that could both remind them and help increase motivation. In addition, there could be ways for the user to track their new habits by

recording every time they performed their activity, as well as saving the results from the tests each time they take them. This could help the user track their progress, which was requested as part of the feedback of setting goals and creating a plan in the first workshop. In the second workshop, ideas of providing rewards was also brought up, which could be included in a logged-in mode to induce motivation. Furthermore, social opportunity could be better enabled by inviting other users on the platform to perform activities with. These examples are all possible additions to the concept that could be added in a logged-in version.

As stated during the second workshop, the root cause of the stress might not be solved with this concept, which highlights the fact that there are many different needs in regards to stress that should be looked into. In addition to increasing recovery, a user might need to simultaneously engage in another behavior change intervention to lower their stress levels. In the stress module in Ungdomsportalen, there should be many more tools that can help adolescents reduce stress in different ways.

For further development regarding the results presented in Deliver, more workshops or other forms of evaluation with the target group should be held. It is still not entirely clear whether a concept like a self-test series would be well received by adolescents in the relevant age-range, so this needs to be further examined and confirmed. The different functions and all the individual features also need to be evaluated in future workshops or other user testing opportunities. In a more distant future, the design of the graphical interface must also be developed and tested, as this has not been the focus of this thesis.

9. Conclusion

This chapter aims to answer the questions set out as the purpose of the thesis.

The purpose of the thesis was set to identify the needs of adolescents aged 12-17 in regards to preventing stress leading to mental illness, as well as developing and communicating a concept for a digital solution that could solve these needs while simultaneously investigating suitable methods for co-designing with adolescents. The key points of the report are presented as answers to the questions below.

- *What needs in relation to preventing stress do adolescents aged 12-17 years have?*

  Several reasons cause adolescents to feel stressed in today's society, where needs in relation to *Time management* and *Future* were further investigated. This led to the final problem definition being a need for increased recovery. Findings indicated that adolescents today live a hectic life filled with activities and high expectations on themselves. Incorporating habits for recovery in an early stage of life as a way of keeping stress at healthy levels, can be important for these individuals' future well-being as adults.

- *What functionality should a concept for a digital solution offer that meets this identified need have?*

  To increase recovery with the goal to prevent and manage their stress, adolescents wish for quick and easy-to-use solutions. These solutions should help them make plans to better manage their stress levels, where setting goals is wished for. The solutions should incorporate concrete methods and suggestions to the user on actions to take, as well as guiding the user to increased awareness of their individual need for recovery. To enhance usage, behavior change techniques should be used, such as personalization and tailoring of content.

- *What are suitable methods for co-designing digital health interventions together with adolescents?*

  To gather data, methods such as questionnaires and interviews are well-suited. However, it is important to make sure that there is a variation among respondents to ensure that the whole target group is represented. Complementary methods such as observations or video journals could also be used for additional methodological triangulation. A similar conclusion can be drawn regarding using personas to define a goal definition, as they should showcase diversity among the target group. During the development of concepts, using focus groups in workshop can produce satisfactory results. However, the workshop has to be arranged so that the participants experience anonymity and feel comfortable sharing their opinions.

In an increasingly digitalized world where mental illness among adolescents is on the rise, the use of digital solutions as preventive care methods is more relevant than ever. The project Ungdomsportalen is one example of a digital solution using preventive care measures that could positively impact both the adolescent population and the healthcare system. The concept presented in this report is a potential digital tool that could be one of many more to come that will help adolescents manage their stress and contribute to a more sustainable healthcare. Using the findings of this report, the team for Ungdomsportalen will be able to continue improving the concept and develop additional concepts and tools relating to the theme of stress.

To meet the growing demand on healthcare, and pediatric psychiatry in particular, preventive care solutions such as the concept presented in this report and Ungdomsportalen will likely play a big part. The authors' hopes is that in the future, there will be even more digital solutions for adolescents that will facilitate them in taking care of their own health.

References

[1] Folkhälsomyndigheten (2018). *Skolbarns hälsovanor i Sverige 2017/18* (Report No. 18065). Retrieved 2021-04-22 from https://www.folkhalsomyndigheten.se/contentassets/53d5282892014e0fbfb3144d25b49728/skolbarns-halsovanor-2017-18-18065.pdf.

[2] Folkhälsomyndigheten (2018). *Varför har den psykiska ohälsan ökat bland barn och unga i Sverige?* (Report No. 18023-2). Retrieved 2021-04-22 from https://www.folkhalsomyndigheten.se/contentassets/628f1bfc932b474f9503cc6f8e29fd45/varfor-psykiska-ohalsan-okat-barn-unga-18023-2-webb-rapport.pdf.

[3] Åsberg, M, Grape, T, Krakau, I, Åke Nygren, M R, Wahlberg, A, & Währborg, P (2010). Stress som orsak till psykisk ohälsa. *Läkartidningen*,*107*(19-20). Retrieved 2021-04-21 from https://lakartidningen.se/wp-content/uploads/OldWebArticlePdf/1/14349/LKT1019s1307_1310.pdf.

[4] Folkhälsomyndigheten (2021). Vad är psykisk hälsa? Retrieved 2021-04-16 from https://www.folkhalsomyndigheten.se/livsvillkor-levnadsvanor/psykisk-halsa-och-suicidprevention/vad-ar-psykisk-halsa/.

[5] Alfvén, R G (1997). Psychosomatic pain in children: A psychomuscular tension reaction? *European Journal of Pain*,*1*(1),5–14. https://dx.doi.org/10.1016/s1090-3801(97)90047-1.

[6] Sveriges Kommuner och Regioner (2019). *Psykiatrin i siffror: Barn och ungdomspsykiatri*. Retrieved 2021-04-21 from https://www.uppdragpsykiskhalsa.se/wp-content/uploads/2020/05/Psykiatrin-i-siffror_BUP_2019_200525.pdf.

[7] Socialstyrelsen (2019). *Psykiatrisk vård och behandling till barn och unga* (Report No. 2019-12-6475). Retrieved 2021-04-21 from https://www.socialstyrelsen.se/globalassets/sharepoint-dokument/artikelkatalog/oppna-jamforelser/2019-12-6475.pdf.

[8] Sveriges Kommuner och Regioner (2017). *Hur mår BUP?* Retrieved 2021-04-21 from https://www.uppdragpsykiskhalsa.se/wp-content/uploads/2017/11/Hur-mar-bup.pdf.

[9] Heber, E, Ebert, D, Lehr, D, Cuijpers, P, Berking, M, Nobis, S, et al (2017). The Benefit of Web-and Computer-Based Interventions for Stress: A Systematic Review and Meta-Analysis. *Journal of Medical Internet Research*,*19*(2),e32. https://dx.doi.org/10.2196/jmir.5774.

[10] Hollis, C, Falconer, C, Martin, J, Whittington, C, Stockton, S, Glazebrook, C, et al (2016). Annual Research Review: Digital health interventions for children and young people with mental health problems: a systematic and meta-review. *Journal of Child Psychology and Psychiatry*,*58*,474–503. https://dx.doi.org/10.1111/jcpp.12663.

[11] World Health Organization (2018). Mental health: strengthening our response. Retrieved 2021-04-16 from https://www.who.int/news-room/fact-sheets/detail/mental-health-strengthening-our-response.

[12] Socialstyrelsen (2017). Utvecklingen av psykisk ohälsa bland barn och unga vuxna. Retrieved 2021-04-16 from https://www.socialstyrelsen.se/globalassets/sharepoint-dokument/artikelkatalog/statistik/2017-12-29.pdf.

[13] Bohman, H, Jonsson, U, Päären, A, von Knorring, L, Olsson, G, & von Knorring, A-L (2012). Prognostic significance of functional somatic symptoms in adolescence: a 15-year community-based follow-up study of adolescents with depression compared with healthy peers. *BMC Psychiatry*,*12*(1),90. https://dx.doi.org/10.1186/1471-244X-12-90.

[14] Hjärnfonden (n.d.). Vad händer i kroppen när vi stressar? Retrieved 2021-05-04 from https://www.hjarnfonden.se/stress-vad-ar-det/#.

[15] Stockholms Läns Landsting (n.d.). *Återhämtning*. Retrieved 2021-04-20 from http://dok.slso.sll.se/VC/Gustavsberg/KPO/stress/psykoedukation/om%20%C3%A5terh%C3%A4mtning.pdf.

[16] Stressforskningsinstitutet (2020). *Trötthet och återhämtning*. Retrieved 2021-04-22 from https://www.stressforskning.su.se/polopoly_fs/1.230067.1427290504!/menu/standard/file/trötthet%20återhämtning%20webb.pdf.

[17] Barnombudsmannen (2010). *Upp till 18 – fakta om barn och ungdom*. Retrieved 2021-04-16 from https://www.barnombudsmannen.se/globalassets/systemimporter/publikationer2/upp-till-18-2010.pdf.

[18] Soobiah, C, Cooper, M, Kishimoto, V, Bhatia, R S, Scott, T, Maloney, S, et al (2020). Identifying optimal frameworks to implement or evaluate digital health interventions: a scoping review protocol. *BMJ Open*,*10*(8),e037643. https://dx.doi.org/10.1136/bmjopen-2020-037643.

[19] Yardley, L, Morrison, L, Bradbury, K, & Muller, I (2015). The Person-Based Approach to Intervention Development: Application to Digital Health-Related Behavior Change Interventions. *Journal of Medical Internet Research*,*17*(1),30. https://dx.doi.org/10.2196/jmir.4055.

[20] Hewitt, S, Sephton, R, & Yeowell, G (2020). The Effectiveness of Digital Health Interventions in the Management of Musculoskeletal Conditions: Systematic Literature Review. *Journal of Medical Internet Research*,*22*(6),e15617. https://dx.doi.org10.2196/15617.

[21] Partridge, S, & Redfern, J (2018). Strategies to Engage Adolescents in Digital Health Interventions for Obesity Prevention and Management. *Healthcare*,*6*(3),70. https://dx.doi.org/10.3390/healthcare6030070.

[22] Thulin, E (2018). Always on My Mind: How Smartphones are Transforming Social Contact among Young Swedes. *YOUNG*,*26*(5),465–483. https://dx.doi.org/10.1177/1103308817734512.

[23] Sousa, P, Martinho, R, Reis, C, Dias, S, Gaspar, P, Dixe, M, et al (2019). Controlled trial of an mHealth intervention to promote healthy behaviours in adolescence (TeenPower): Effectiveness analysis. *Journal of Advanced Nursing*,*76*,1057– 1068. https://dx.doi.org/10.1111/jan.14301.

[24] Swedish Ministry of Social Affairs and Health, & Swedish Association of Local Authorities and Regions. *Vision for eHealth 2025*. Retrieved 2021-04-26 from https://www.ehalsomyndigheten.se/globalassets/dokument/vision/vision-for-ehealth-2025.pdf.

[25] World Health Organization (2019). *WHO guideline: Recommendations on digital interventions for health system strengthening*. Retrieved 2021-04-22 from https://apps.who.int/iris/bitstream/handle/10665/311941/9789241550505-eng.pdf?ua=1.

[26] eHälsomyndigheten (2020). Welcome to the Swedish eHealth Agency. Retrieved 2021-04-22 from https://www.ehalsomyndigheten.se/other-languages/english/.

[27] Unicef (n.d.). Barnkonventionen. Retrieved 2021-04-16 from https://unicef.se/barnkonventionen/las-texten#hela-texten.

[28] Region Skåne (2020). *Region Skånes verksamhetsplan och budget 2021 med plan för 2022–2023* (Report No. 2019-POL000107). Retrieved 2021-04-16 from https://www.skane.se/namndshandlingar/2433640/.

[29] Sveriges Kommuner och Regioner (n.d.). Kraftsamling för psykisk hälsa. Retrieved 2021-04-16 from https://skr.se/halsasjukvard/psykiskhalsa/kraftsamlingpsykiskhalsa.28676.html.

[30] Taj, F, Klein, M, & Halteren, A (2019). Digital Health Behavior Change Technology: Bibliometric and Scoping Review of Two Decades of Research. *Journal of Medical Internet Research*,*7*(12),e13311. https://dx.doi.org/10.2196/13311.

[31] Michie, S, van Stralen, M, & West, R (2011). The Behaviour Change Wheel: a new method for characterising and designing behaviour change interventions. *Implementation science : IS*,*6*,42. https://dx.doi.org/10.1186/1748-5908-6-42.

[32] Morrison, L G (2015). Theory-based strategies for enhancing the impact and usage of digital health behaviour change interventions: A review. *Digital Health*,*1*. https://dx.doi.org/10.1177/2055207615595335.

[33] Asbjørnsen, R A, Smedsrød, M, Nes, L S, Wentzel, J, Varsi, C, Hjelmesæth, J, et al (2019). Persuasive System Design Principles and Behavior Change Techniques to Stimulate Motivation and Adherence in Electronic Health Interventions to Support Weight Loss Maintenance: Scoping Review. *Journal of Medical Internet Research*,*21*(6),e14265. https://dx.doi.org/10.2196/14265.

[34] Liverpool, S, Pinheiro Mota, C, Sales, C, Čuš, A, Carletto, S, Hancheva, C, et al (2020). Engaging Children and Young People in Digital Mental Health Interventions: Systematic Review of Modes of Delivery, Facilitators, and Barriers. *Journal of Medical Internet Research*,*22*(6),e16317. https://dx.doi.org/10.2196/16317.

[35] Prochaska, J, & Velicer, W (1997). The Transtheoretical Model of Health Behavior Change. *American journal of health promotion : AJHP*,*12*(1),38–48. https://dx.doi.org/10.4278/0890-1171-12.1.38.

[36] Social Change UK (n.d.). A guide on: The COM-B Model of Behaviour. Retrieved 2021-04-16 from https://social-change.co.uk/files/02.09.19_COM-B_and_changing_behaviour_.pdf.

[37] Abras, C, Maloney-Krichmar, D, & Preece, J (2004). User-Centered Design. (Brainbridge, W S, (Eds.). *Berkshire Encyclopedia of Human-Computer Interaction, Volume 2*). (pp. 763–768). Berkshire.

[38] Kujala, S (2003). User involvement: A review of the benefits and challenges. *Behaviour IT*,*22*(1),1–16. https://dx.doi.org/10.1080/01449290301782.

[39] Interaction Design Foundation (n.d.). User Centered Design. Retrieved 2021-06-02 from https://www.interaction-design.org/literature/topics/user-centered-design.

[40] Friis Dam, R, & Yu Siang, T (2021). Design iteration brings powerful results. So, do it again designer! Retrieved 2021-04-16 from https://www.interaction-design.org/literature/article/design-iteration-brings-powerful-results-so-do-it-again-designer.

[41] Lang, A R, Martin, J L, Sharples, S, Crowe, J A, & Murphy, E (2014). Not a minor problem: involving adolescents in medical device design research. *Theoretical Issues in Ergonomics Science*,*15*(2),181–192. https://dx.doi.org/10.1080/1463922X.2012.678910.

[42] Thabrew, H, Fleming, T, Hetrick, S, & Merry, S (2018). Co-design of eHealth Interventions With Children and Young People. *Frontiers in psychiatry*,*9*,481. https://dx.doi.org/10.3389/fpsyt.2018.00481.

[43] Christie, G I, Shepherd, M, Merry, S N, Hopkins, S, Knightly, S, & Stasiak, K (2019). Gamifying CBT to deliver emotional health treatment to young people on smartphones. *Internet Interventions*,*18*,100286. https://dx.doi.org/10.1016/j.invent.2019.100286.

[44] Hodson, E, Dadashi, N, Delgado, R, Chisholm, C, Sgrignoli, R, & Swaine, R (2019). Co-design in mental health; Mellow: a self-help holistic crisis planning mobile application by youth, for youth. *The Design Journal*,*22*(1),1529–1542. https://dx.doi.org/10.1080/14606925.2019.1594975.

[45] Yip, J, Foss, E, & Guha, M (2012). Co-Designing with Adolescents. (Malmborg, L, & Pederson, T, (Eds.). *Proceedings of the 7th Nordic Conference on Human-Computer Interaction: Making Sense Through Design*). (). Copenhagen, Denmark: Association for Computing Machinery.

[46] Design Council (n.d.). What is the framework for innovation? Design Council's evolved Double Diamond. Retrieved 2021-04-16 from https://www.designcouncil.org.uk/news-opinion/what-framework-innovation-design-councils-evolved-double-diamond.

[47] Friis Dam, R, & Yu Siang, T (2021). 5 Stages in the Design Thinking Process. Retrieved 2021-04-16 from https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process.

[48] Mazzola, J J, Walker, E J, Shockley, K M, & Spector, P E (2011). Examining Stress in Graduate Assistants: Combining Qualitative and Quantitative Survey Methods. *Journal of Mixed Methods Research*,*5*(3),198–211. https://dx.doi.org/10.1177/1558689811402086.

[49] Turner, S, Cardinal, L, & Burton, R (2015). Research Design for Mixed Methods: A Triangulation-based Framework and Roadmap. *Organizational Research Methods*,*20*(2),243–267. https://dx.doi.org/10.1177/1094428115610808.

[50] Preece, J, Rogers, Y, & Sharp, H (2015). *Interaction Design: Beyond Human-Computer Interaction*. 4th ed. Chichester, United Kingdom: John Wiley Sons Ltd.

[51] Bogner, A, Littig, B, & Menz, W (2009). Introduction: Expert Interviews — An Introduction to a New Methodological Debate. (*Interviewing Experts*). (pp. 1–13). London: Palgrave Macmillan UK.https://dx.doi.org10.1057/9780230244276_1.

[52] Skolverket (2020). Leda elevhälsan i skolan. Retrieved 2021-04-16 from https://www.skolverket.se/skolutveckling/leda-och-organisera-skolan/leda-personal/leda-elevhalsan-i-skolan.

[53] 1177 Vårdguiden (2018). Elevhälsan. Retrieved 2021-05-10 from https://www.1177.se/Skane/barn--gravid/vard-och-stod-for-barn/elevhalsan/.

[54] Region Skåne (n.d.). Barn- och ungdomspsykiatrimottagning Första linjen Ystad. Retrieved 2021-04-16 from https://vard.skane.se/psykiatri-skane/mottagningar-och-avdelningar/barn--och-ungdomspsykiatrimottagning-forsta-linjen-ystad/.

[55] DiCicco-Bloom, B, & Crabtree, B F (2006). The qualitative research interview. *Medical Education*,*40*(4),314–321. https://dx.doi.org/10.1111/j.1365-2929.2006.02418.x.

[56] Bazen, A, Barg, F K, & Takeshita, J (2021). Research Techniques Made Simple: An Introduction to Qualitative Research. *Journal of Investigative Dermatology*,*141*(2),241–247. https://dx.doi.org/10.1016/j.jid.2020.11.029.

[57] Daae, J, & Boks, C (2015). A classification of user research methods for design for sustainable behaviour. *Journal of Cleaner Production*,*106*,680–689. https://dx.doi.org/10.1016/j.jclepro.2014.04.056.

[58] Javed, A, Lee, C, Zakaria, H, Buenaventura, R D, Cetkovich-Bakmas, M, Duailibi, K, et al (2021). Reducing the Stigma of Mental Health Disorders with a Focus on Low- and Middle-Income Countries. *Asian Journal of Psychiatry*,*58*,102601. https://dx.doi.org/10.1016/j.ajp.2021.102601.

[59] SCB (2016). *Frågor och svar om frågekonstruktion i enkät- och intervjuundersökningar*. Retrieved 2021-04-22 from https://www.scb.se/contentassets/c6dd18d66ab240e89d674ce728e4145f/ov9999_2016a01_br_x08br1601.pdf.

[60] *Lag om etikprövning av forskning som avser människor* (SFS 2003:460). Riksdagen. Retrieved 2021-04-16 from https://www.riksdagen.se/sv/dokument-lagar/dokument/svensk-forfattningssamling/lag-2003460-om-etikprovning-av-forskning-som_sfs-2003-460.

[61] Socialstyrelsen (2020). *Barns medverkan i Socialstyrelsens arbeten - Ett stödmaterial för att inhämta barns kunskaper och erfarenheter* (Report No. 2020-6-6858). Retrieved 2021-04-21 from https://www.socialstyrelsen.se/globalassets/sharepoint-dokument/artikelkatalog/ovrigt/2020-6-6858.pdf.

[62] Friis Dam, R, & Yu Siang, T (2020). Affinity Diagrams – Learn How to Cluster and Bundle Ideas and Facts. Retrieved 2021-04-16 from https://www.interaction-design.org/literature/article/affinity-diagrams-learn-how-to-cluster-and-bundle-ideas-and-facts.

[63] Friis Dam, R, & Yu Siang, T (2021). Peronas - A Simple Introduction. Retrieved 2021-04-16 from https://www.interaction-design.org/literature/article/personas-why-and-how-you-should-use-them.

[64] Design Council (n.d.). Design Methods Step 3: Develop. Retrieved 2021-05-10 from https://www.designcouncil.org.uk/news-opinion/design-methods-step-3-develop.

[65] Friis Dam, R, & Yu Siang, T (2020). Learn How to Use the Best Ideation Methods: SCAMPER. Retrieved 2021-04-16 from https://www.interaction-design.org/literature/article/learn-how-to-use-the-best-ideation-methods-scamper.

[66] Interaction Design Foundation (n.d.). Brainstorming. Retrieved 2021-04-16 from https://www.interaction-design.org/literature/topics/brainstorming.

[67] Fexeus, H, & Enblad Nordlund, C (2019). *Reload : så blir du återhämtningssmart : boken för dig som inte har tid*. Stockholm: Forum.

[68] Cheng, V W S (2020). Recommendations for Implementing Gamification for Mental Health and Wellbeing. *Frontiers in Psychology*,*11*,3434. https://dx.doi.org/10.3389/fpsyg.2020.586379.

[69] Johnson, D, Deterding, S, Kuhn, K-A, Staneva, A, Stoyanov, S, & Hides, L (2016). Gamification for health and wellbeing: A systematic review of the literature. *Internet Interventions*,*6*,89–106. https://dx.doi.org/10.1016/j.invent.2016.10.002.

[70] Martin, B, & Hanington, B M (2012). *Universal methods of design: 100 ways to research complex problems, develop innovative ideas, and design effective solutions*. Rockport Publishers.

[71] Peterson-Sweeney, K (2005). The use of focus groups in pediatric and adolescent research. *Journal of Pediatric Health Care*,*19*(2),104–110. https://dx.doi.org/10.1016/j.pedhc.2004.08.006.

[72] Litcanu, M, Prostean, O, Oros, C, & Mnerie, A V (2015). Brain-Writing Vs. Brainstorming Case Study For Power Engineering Education. *Procedia - Social and Behavioral Sciences*,*191*,387–390. The Proceedings of 6th World Conference on educational Sciences. https://dx.doi.org/10.1016/j.sbspro.2015.04.452.

[73] Brown, C A, Revette, A C, de Ferranti, S D, Fontenot, H B, & Gooding, H C (2021). Conducting Web-Based Focus Groups With Adolescents and Young Adults. *International Journal of Qualitative Methods*,*20*. https://dx.doi.org/10.1177/1609406921996872.

[74] Michie, S, Richardson, M, Johnston, M, Abraham, C, Francis, J, Hardeman, W, et al (2013). The Behavior Change Technique Taxonomy (v1) of 93 Hierarchically Clustered Techniques: Building an International Consensus for the Reporting of Behavior Change Interventions. *Annals of behavioral medicine*,*46*(1),81–95. https://dx.doi.org/10.1007/s12160-013-9486-6.

[75] Truelove, S, Vanderloo, L M, Tucker, P, Di Sebastiano, K M, & Faulkner, G (2020). The use of the behaviour change wheel in the development of ParticipACTION's physical activity app. *Preventive Medicine Reports*,*20*,101224. https://dx.doi.org/10.1016/j.pmedr.2020.101224.

[76] Mahatody, T, Sagar, M, & Kolski, C (2010). State of the Art on the Cognitive Walkthrough Method, Its Variants and Evolutions. *Int J Hum Comput Interaction*,*26*(8),741–785. https://dx.doi.org/10.1080/10447311003781409.

[77] Interaction Design Foundation (2021). How to Conduct a Cogntive Walkthrough. Retrieved 2021-04-29 from https://www.interaction-design.org/literature/article/how-to-conduct-a-cognitive-walkthrough.

[78] Design Council (n.d.). Design Methods Step 4: Deliver. Retrieved 2021-05-10 from https://www.designcouncil.org.uk/news-opinion/design-methods-step-4-deliver.

[79] Krause, R (2018). Storyboards Help Visualize UX Ideas. Retrieved 2021-05-04 from https://www.nngroup.com/articles/storyboards-visualize-ideas/.

[80] Storyboard That (2021). *Digital berättelse*. Retrieved 2021-05-20 from https://www.storyboardthat.com/sv/.

[81] Folkhälsomyndigheten (2021). *Gradvis återgång till närundervisning på gymnasiet*. Retrieved 2021-04-27 from https://www.folkhalsomyndigheten.se/nyheter-och-press/nyhetsarkiv/2021/januari/gradvis-atergang-till-narundervisning-pa-gymnasiet/.

[82] Poole, E, & Peyton, T (2013). Interaction design research with adolescents: Methodological challenges and best practices. *ACM International Conference Proceeding Series*,211–217. https://dx.doi.org/10.1145/2485760.2485766.

[83] Vedenin, Y (2017). How Many Personas Should You Have? Retrieved 2021-04-27 from https://uxpressia.com/blog/how-many-personas-enough.

[84] Gibbons, S (2018). Empathy Mapping: The First Step in Design Thinking. Retrieved 2021-04-27 from https://www.nngroup.com/articles/empathy-mapping/.

[85] Sorta App. Sorta - Rank Stuff. Retrieved 2021-04-22 from https://sorta.app/.

[86] Västra Götalandsregionen (n.d.). Snabbtest: Behov Av Återhämtning Efter Arbetet. Retrieved 2021-04-22 from https://xn--skattaterhmtning-4nbn.se/.

Appendices

A. Discover

This chapter presents the questionnaire, the form of consent for interviews, an example of an affinity diagram for analyzing qualitative data and additional findings from the data.

A.1 Questionnaire

SURVEY ON STRESS AMONG CHILDREN AND YOUNG PEOPLE

This survey is completely anonymous and consists of three different sections. In total, the survey contains 10 questions and it will take approximately 10-15 minutes to complete.

By answering this survey you are confirming your participation. Each question is voluntary, however, we strongly suggest you answer all the questions.

Thank you for your participation, it is of great value for us!

Jessica & Linnea

I am consenting to participate in this survey *

- Yes

I identify as… *

- Female
- Male
- Other
- Rather not say

How old are you? *

Please do NOT take the survey if you are under 18 years of age, as participating in surveys as a minor requires permission from a guardian. In case a minor were to answer the survey, the answers of this individual will be erased.

- Under 18 years old
- 18-20 years old
- Over 21 years old

Section 1. Reasons for stress

This section will cover what things in life cause stress as well as why they might do so.

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1. What do you think causes your stress?
   Choose one or several options that might contribute to feeling stressed. If the options do not suit you or if there is another reason you want to add, please write this under the option Other.

   - o Expectations on myself
   - o Expectations of others (beside my own or my family's)
   - o My family
   - o My friends
   - o My long-term future
   - o My financial situation
   - o My living situation
   - o My free time activities
   - o My health
   - o My appearance (body, weight, looks)
   - o My current education (school)
   - o My current job
   - o Social media
   - o Other: _____

2. Choose one or several of the options chosen above and explain in further detail why these cause stress for you.
   This question is important as we need to understand why certain things life may cause stress.

   Long answer text: _____

3. At which locations do you experience stress?
   Choose one or several options of where you experience stress. If the options do not suit you or if there is another location you want to add, please write this under the option Other.

   - o At home
   - o At school
   - o At my friends' homes
   - o At relatives' homes
   - o Fitness and exercise facilities
   - o At work
   - o Where I partake in hobbies/activities
   - o Other: _____

4. Choose one or several of the options chosen above and explain in further detail why you might experience stress at this location.

   Long answer text: _____

Section 2. Management of stress

This section of the survey will cover what you might do on your own to feel better, as well as why those things might make you feel better. It will also cover who you might turn to for support and help in regard to stress, and why you chose to turn to those.

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5. What do you do on your own to manage stress?
   Choose one or several options that describe what you do on your own to feel better if you are experiencing stress, i.e., not the people you might turn to. If the options do not suit you or if you like to do something else, please write this under Other.

   - o Use social media/the internet
   - o Exercise
   - o Go for a walk
   - o Watch a movie/tv-show
   - o Engage in mindfulness
   - o Play games
   - o Listen to music
   - o Read
   - o Engage in hobbies/interests
   - o Write lists/plan
   - o Other: _____

6. Choose one or several of the options chosen above and explain in further detail why this activities might make you feel better if you are stressed?

   Long answer text: _____

7. Who do you turn to if you experience stress?
   Choose one or several options that describe who or whom you turn to for support or help regarding stress. If the options do not suit you or if you turn to someone else, please write this under Other.

   - o Parents/guardians
   - o Siblings
   - o Friends
   - o Teachers
   - o Student health team (counselor, school nurse)
   - o Healthcare centre (Vårdcentral)
   - o Youth clinic (Ungdomsmottagningen)
   - o Pediatric psychiatry clinic (BUP)
   - o Other: _____

8. Choose one or several of the options chosen above and explain in further detail why turning to these might make you feel better if you are stressed?

   Long answer text: _____

Section 3. Final section

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9. How would you express the feeling of stress in your own words?
   Describe the feeling of stress using your own words, as if you were to describe the feeling to someone else or thinking about your own experience and how it can make you feel.

   Long answer text: _____

10. Something else you want to add related to stress?

    Long answer text: _____

Thank you for participating! Your anonymous answer is now registered.

A.2 Form of Consent

CONSENT FOR PARTICIPATION IN INTERVIEWS

USED FOR MASTER'S THESIS WITHIN THE PROJECT UNGDOMSPORTALEN

Background and purpose

Innovation Skåne in collaboration with Region Skåne are running the project *Ungdomsportalen*, with the purpose to create a digital portal providing support and advice for preventative mental health care aimed towards adolescents. The master's thesis work carried out within this project aims to identify the needs that adolescents have regarding stress prevention and based on this need develop a concept that can be integrated into Ungdomsportalen. During the master's thesis project, data will be collected using expert interviews with clinicians working in pediatric psychiatry, personnel from school health teams, questionnaires to adolescents and workshops with focus groups. The data gathering will lay the foundation for identifying the need and what kind of solution that best meets this/these need(s).

Voluntary

Participating in this study is completely voluntary and the Participant can at any time discontinue the interview without giving any reason. The Participant also has the right to demand that already gathered information about the Participant is erased.

Results

Recordings of audio, video and notes could be collected for research purpose. The outcomes of the interviews will be made anonymous, be refined and lay the foundation for the development of the technical solution.

Personal data

Personal data (name and contact details) will be treated according to the Data Protection Regulation (GDPR). No personal data will be transferred to any third party and all personal data will be erased by the end of the master's thesis project.

Responsible for the study

Responsible for conducting the study are two students within the MSc Biomedical Engineering program at Lund University, Faculty of Engineering. For more information about the project contact the responsible students:

Linnea Wenäll
li5538we-s@student.lu.se

Jessica Kågeman
je1284ka-s@student.lu.se

Consent

Written consent for participation in interviews, according to what has been specified in this agreement, is given via e-mail.

A.3 Affinity diagram

An example of what an affinity diagram could look like during data analysis can be seen in figure A.1.

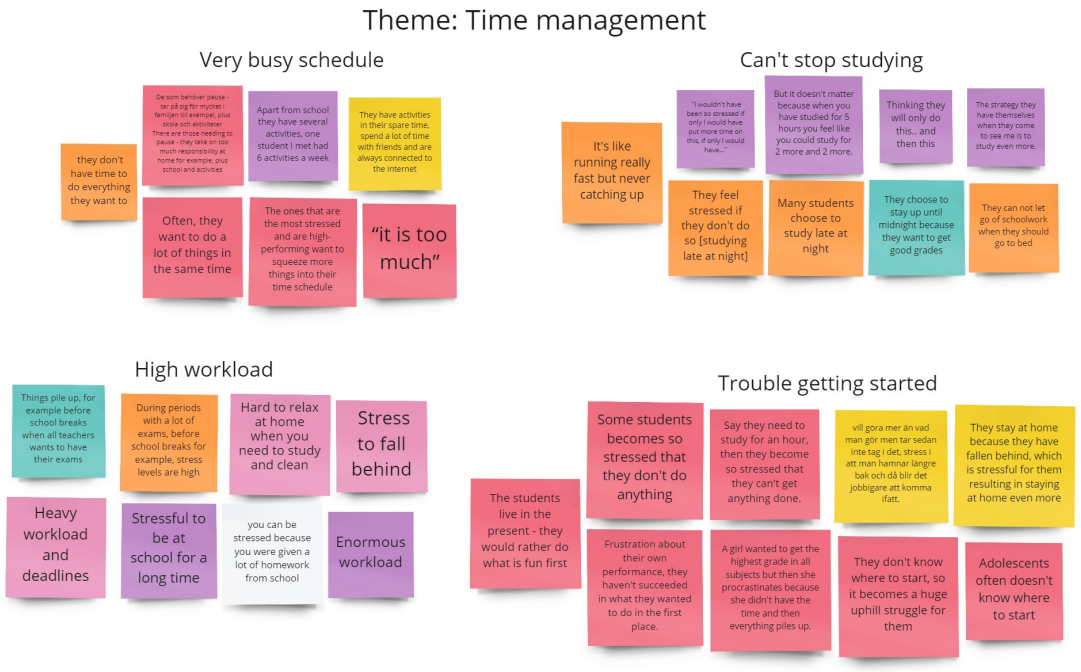


Figure A.1: The affinity diagram for the theme time management, with sub-themes as clusters.

A.4 Additional theme

Additional theme and sub-themes that were not further investigated are presented in table A.1.

Table A.1: Sub-themes, key findings and quotes related to the theme Social Media.

Theme: Social media		
Sub-theme	***Key findings***	***Quote***
Body images	Many young people feel pressure from social media in how they are supposed to look.	*"Social media has a big impact on body stress. Especially girls stress over their bodies"* - School counselor
Skewed idea of normal well-being	Many feel as if other people are always happy, as social media makes them believe that life is supposed to be great all of the time	*"They believe that life is like Instagram"* - School counselor
Status	Many young people feel stress over having to showcase the perfect life on social media, as feelings of success, validation and high status spring from this.	*"Sense that my generation's value has shifted to matter solely online"* - High school student

B. Define

This chapter presents additional personas created during the Define phase.

B.1 Personas

The additional personas of Carl and Elsa are presented in this section.

B.1.1 Carl - The Social Butterfly

Carl (figure B.1) represents the users that tend to always choose to do the things they find the most fun in the moment. This results in schoolwork piling up which makes it difficult to know where to start and in the long run affecting his grades. Carl would be the typical user needing help to break down school work to make it easier getting started. He would also need support to say no to activities with friends and learn how to handle his fear of missing out.

The character of Carl is mostly based on the results presented in table 4.3. He experiences stress because of school work, and more precisely not knowing how to get started with it, and usually opts for hanging out with friends instead.

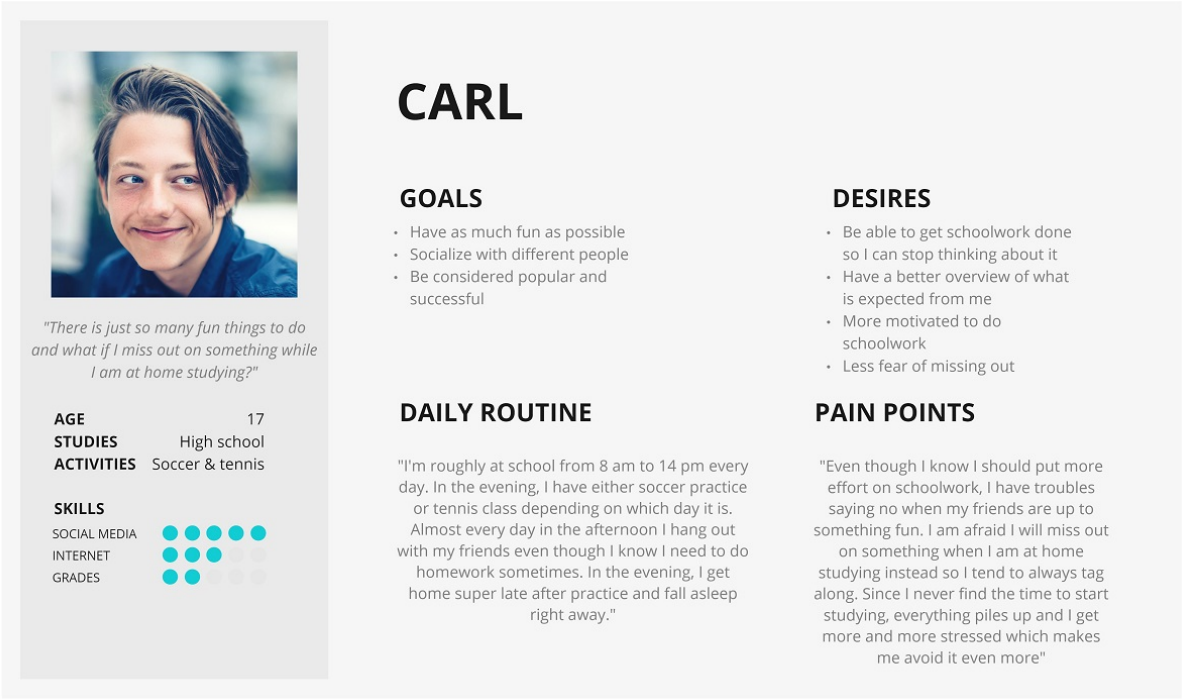


Figure B.1: Carl - the social butterfly driven by fear of missing out.

B.1.2 Elsa - The Social Media Pro

Elsa (figure B.2) represents the users whose body image and perception of their own life is highly influenced by what they see on social media. Elsa experiences a pressure to maintain an image on social media platforms of having a fun and interesting life. She would be the typical user needing help analyzing her social media feed to be able to get a feed affecting her positively as well as learning about the ups and downs in life.

The character of Elsa is mostly based on the results presented in table A.1. She experiences stress as a result of spending many hours a day on social media, both when it comes to her body image but also what kind of lifestyle she is presenting.

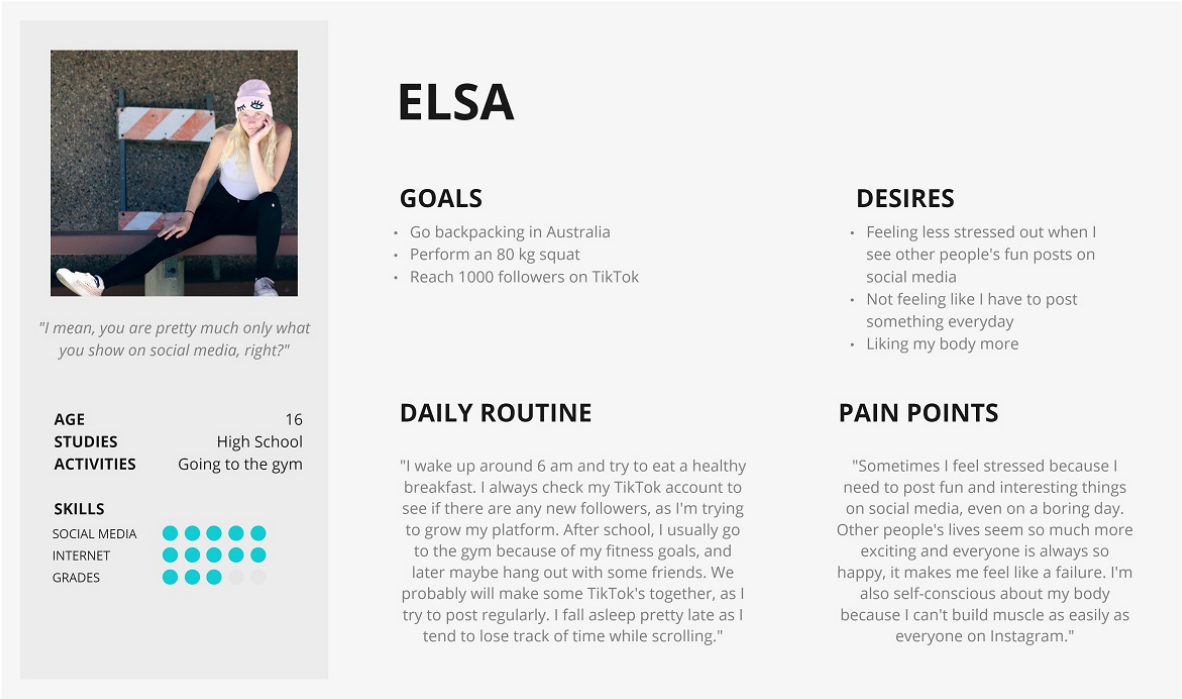


Figure B.2: Elsa - the social media pro.

C. Develop

This chapter presents the additional concepts from first and second iteration during the Develop phase.

C.1 First iteration

The additional concepts from first iteration are presented in this section.

C.1.1 GetStarted

The first concept is a solution that aims to help getting started with stress management techniques. The user will select stress management methods they are already doing, such as not studying on weekends, and the remaining options will be put up against other one by one. Out of two options, the user chooses the one they think would be the easiest to start doing, and when all options have been tested against each other the system will present a top three list. This list will rank the methods the user has voted would be the easiest to start doing. Additionally, the system suggests that the user try these techniques for a week.

This concept was developed using the app Sorta as a starting point for SCAMPER. Sorta is an app used for ranking and offers a wide variety of ranking themes, such as ranking Pixar movies. During the ranking of Pixar movies, the user is asked to answer the question "You can only bring one to watch on a desert island, which?" by choosing one out of two Pixar movies presented to them [85]. The result from the ranking will be a list of the user's prefered Pixar movie. With the overall question being "How can Sorta be modified to increase recovery in adolescents?", GetStarted (figure C.1) was developed.

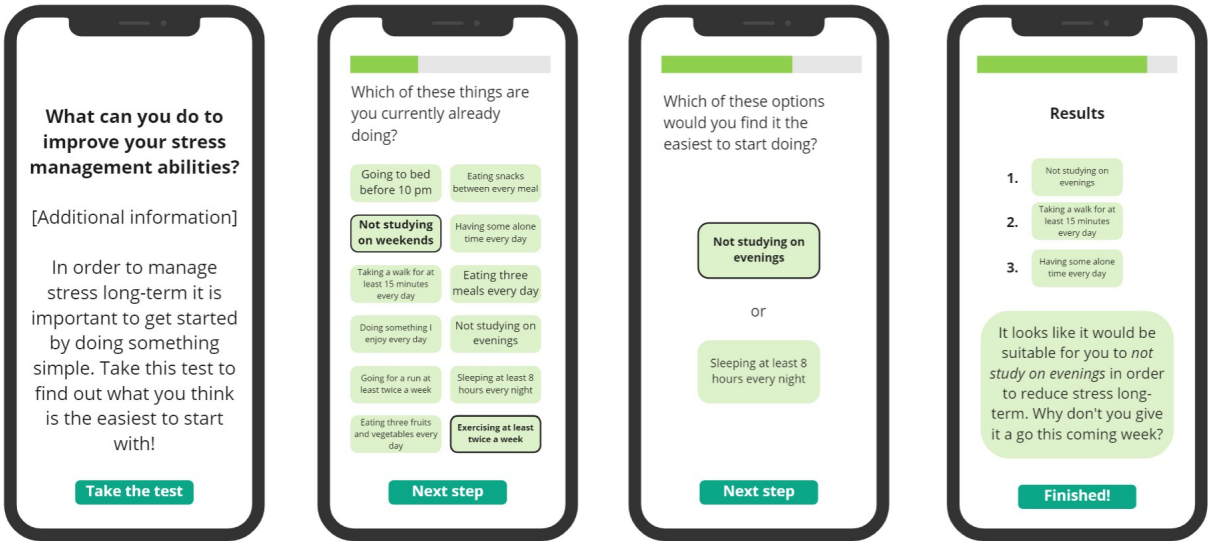


Figure C.1: The concept GetStarted, aiming to help the user get started with stress management.

C.1.2 SchedulingTool

The next concept is a solution that aims to help the user schedule breaks and time for rest in their daily lives (figure C.2). First, the user is asked to schedule any recurring activities they may partake in, such as sports activities, and then they are asked to schedule time for recovery. In order to go to the next step the user has to schedule one session of recovery each day. Next, the user is allowed to schedule sessions of studying, but cannot do so after a certain hour in the evening as this might affect recovery negatively. Finally, the user is able to export this schedule to any other calendar or scheduling app they may use.

This concept was generated during brainstorming, in which the idea of scheduling breaks was brought up as a way to increase recovery.

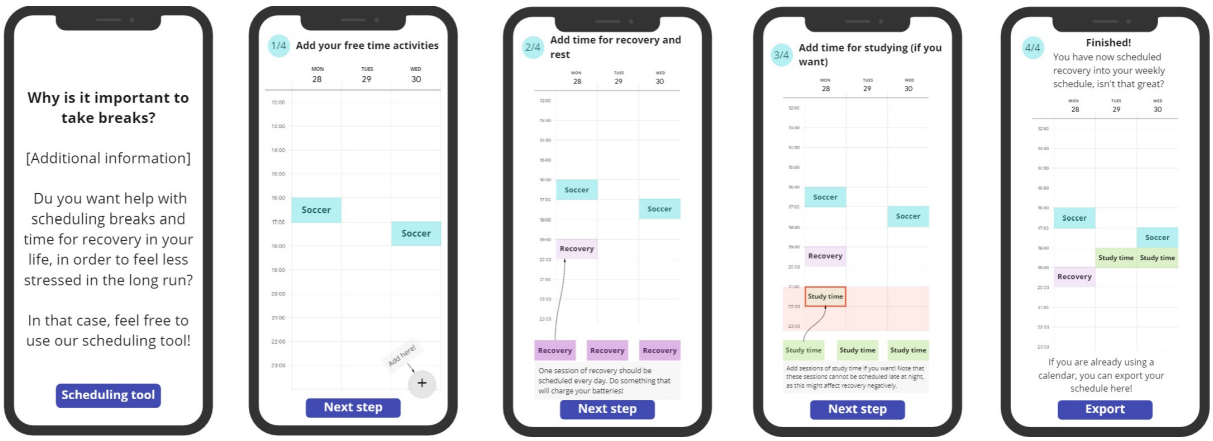


Figure C.2: The concept called SchedulingTool, aiming to help the user schedule breaks and time for recovery.

C.1.3 Challenges

The concept aims to encourage the user to increase their time for recovery by presenting a number or challenges they are able to participate in (figure C.3). Depending on the challenge, they will receive specific instructions and are then asked to take notes and reflect on the outcome of the challenge.

This concept was also generated during brainstorming.

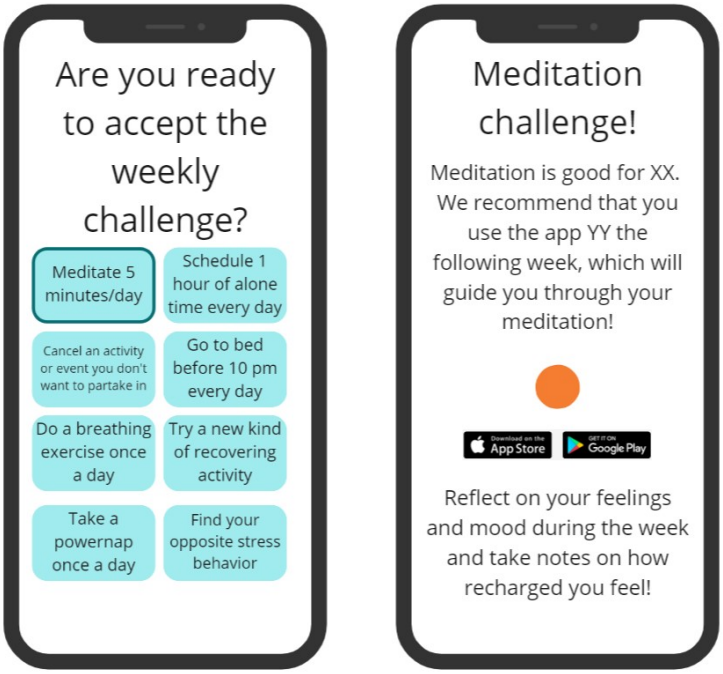


Figure C.3: The concept called Challenges, aiming to motivate the user to start behavior change.

C.1.4 RecoveryTest

The concept presented in figure C.4 is another type of test, where the user gets to find out if they are getting enough recovery or if they need more. By answering some questions about their current resting habits, they are presented a result which tells them whether they need more recovery or not. If that is the case, they are given recommendations on where to find out more about how they might increase recovery periods.

This concept was developed with inspiration from the test *Need for recovery after working* (Swe. Behov av återhämtning efter arbetet), provided by Region Västra Götaland [86]. The purpose of the original test is to give the user an overview over their need in regards to recovery after working as well as advice on how to proceed.

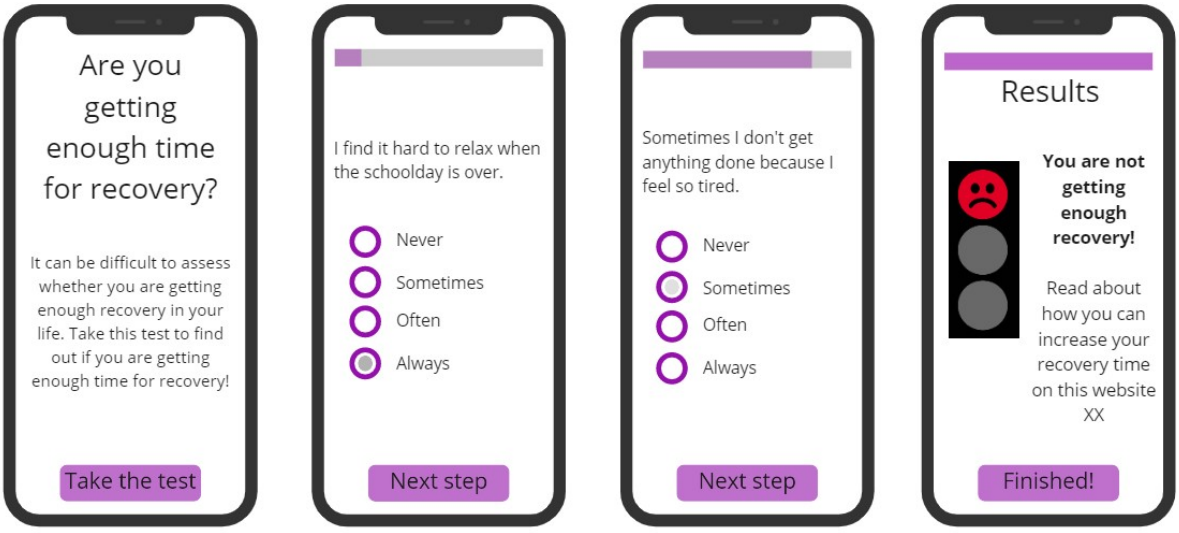


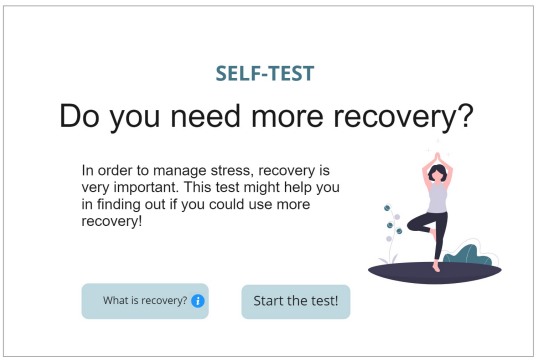
Figure C.4: The concept called RecoveryTest, aiming to help the user identify their need for more recovery.

C.2 Second iteration

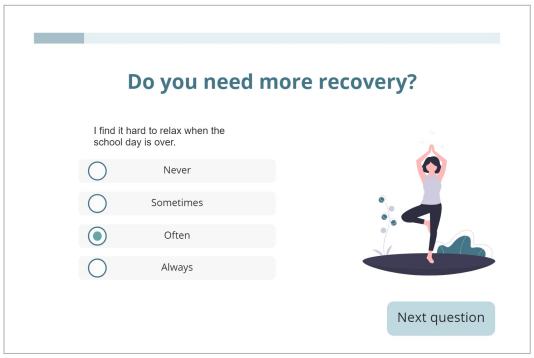
This section presents additional tests from second iteration.

C.2.1 Do you need more recovery?

In figures C.5a-C.6b, the first self-test in the self-test series from the second iteration can be seen. The user is asked to answer a few questions to find out whether they need more recovery.

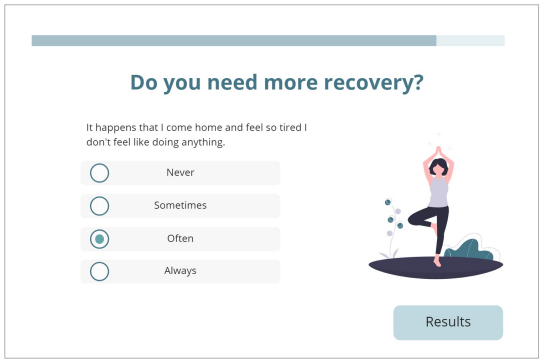


(a) Start page, where the user can read more about recovery under the information button and choose to proceed with the test.

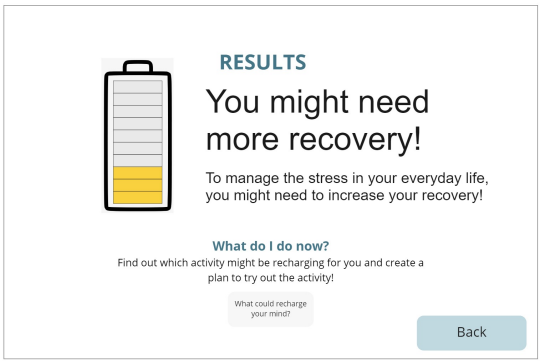


(b) Example questions where user is asked to answer statements.

Figure C.5



(a) Example questions where user is asked to answer statements.

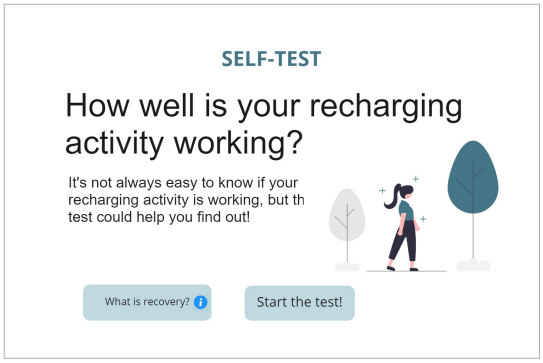


(b) Based on the answers given, the user is presented with a result and a recommendation on what to do next.

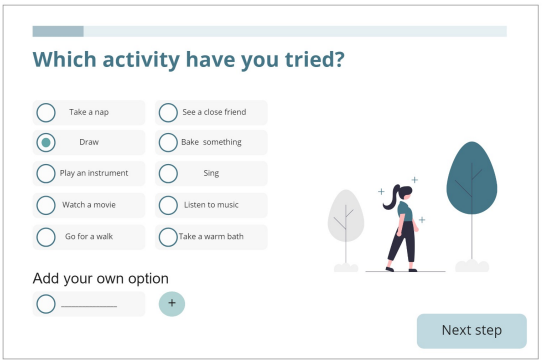
Figure C.6

C.2.2 How well is your recharging activity working?

In figures 6.6-C.9b, the third test in the self-test series from the second iteration can be seen. The user is asked to rank their energy levels before and after the activity to evaluate whether the activity seems to provide mental recharge.

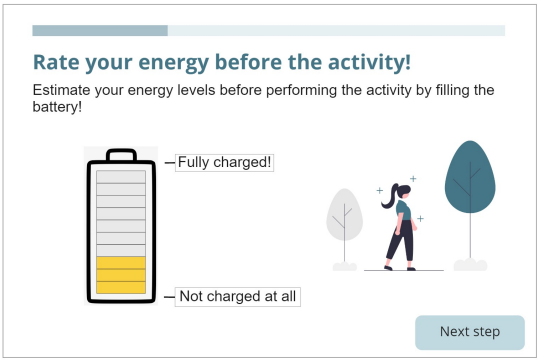


(a) Start page for the third test in the self-test series, where the user can read about recovery under the information button and choose to proceed with taking the test.

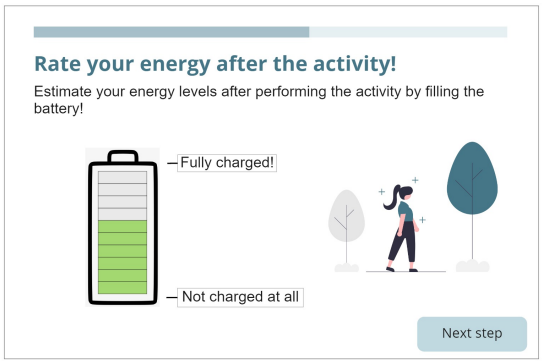


(b) The user is asked to choose which activity to evaluate.

Figure C.7

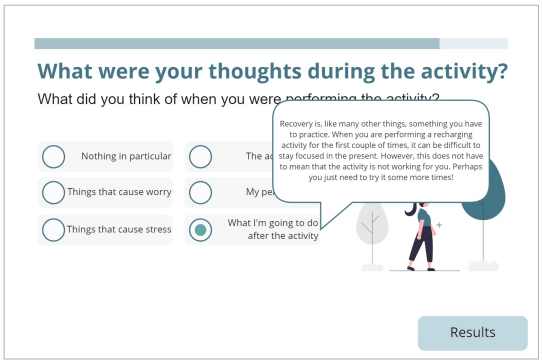


(a) The user is asked to rate their energy level before the activity, by filling in the battery.

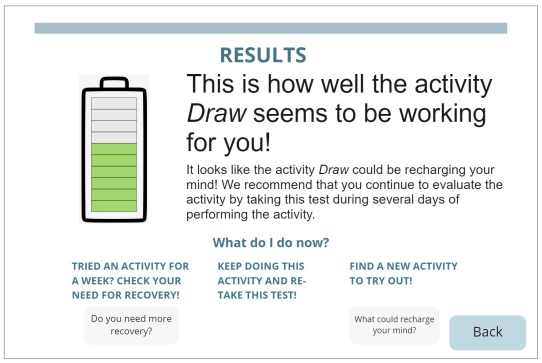


(b) The user is asked to rate their energy level after the activity, by filling in the battery.

Figure C.8



(a) The user is asked what they thought of during the activity, as recovery means being in the moment. The system provides the user with direct words of encouragement according to BCT's.



(b) The results are presented to the user with recommendations on how to proceed.

Figure C.9