



Accessible sleep support

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Abstract

This Graduation Project describes the process of creating the support of a data visualization of sleep. This tool should improve the sleep experience and knowledge of low literate individuals. Low literacy is a major problem within The Netherlands and healthcare. Their needs are not appropriately met within the communication of health-related information. By conducting a literature research, the main requirements for proper and accessible communication were analyzed as well as different possibilities and technologies to support them. The final multi-media prototype is communicating through storytelling more complex information. New technologies enable new developments to support this target group in their engagement with complex information. The different possibilities for the support of data visualizations about sleep were investigated using existing materials and a focus group. Based upon these findings, a prototype was designed for a supportive tool. Digital media could stimulate more accessible communication to understand more about sleep and its influences.

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Chapter 1 Introduction

Low literacy is a serious condition in which individuals are not able to read, write and interpret text on the level that is needed to interact with information from governments or healthcare providers. This means these people are not met in their needs to interact appropriately with government and healthcare environments in an empowering way.

1.1 Current situation

The health sector is seen as an important part of our modern society. Health has been considered a human right since 1948 [3] [4]. The declaration of Alma Ata from 1978 states that: "Attainment of the highest possible level of health is a most important world-wide social goal whose realization requires the action of many other social and economic sectors in the attrition to the health sector...". The Alma Ata declaration of the World Health Conference of 1978 reflects the ideal that healthcare is a fundamental human right [4]. However, healthcare has some difficulties which result in serious consequences for vulnerable groups in society.

When looking at public healthcare services, effective communication is essential to ensure patient safety and compliance, accurate diagnosis and health promotion [5]. The level of health literacy is very important for the appropriate health communication [6]. Literacy refers to the ability to read and write. However, it also has indirect consequences to application-oriented basic knowledge that develops during a whole person's lifetime [7]. Health literacy can be defined as the degree to which individuals obtain, process, and understand basic health information and services needed to make appropriate health decisions [8].

According to reports in Europe, low health literacy is common even in economically advanced countries [6]. Vulnerable groups have much higher proportions of limited health literacy than the general population [6]. Specific vulnerable groups include those with low income, low education, worse health status, and relatively old age [6]. In that case, the existing available data could be "too extensive, too complex, and too confusing" to understand and thus useless to people making their hospital or regional healthcare choice [6]. Communication towards low literate groups of society is challenging. They do not have sufficient health related knowledge and sometimes even have problems with literacy in general. However, it is very important to provide everyone with proper health care and the proper information to help them with medical decision.

The healthcare field regarding sleep medicine is growing rapidly, which results in a continuing need to educate patients. The general population has not traditionally thought of sleep as an important component for staying healthy [9]. They need to understand the role of sleep and the impact it has on their health. This is particularly hard because sleep is experienced unconsciously [1]. Sleep is multi-dimensional and could be characterized by many metrics, such as the time it takes to fall asleep, length of sleep, and how refreshed one feels after waking up. The quality of sleep is influenced by a number of contextual factors: psychological and physiological states like mood and stress, lifestyle factors like exercise, and environmental factors like room temperature and exposure to digital devices [1]. This makes it difficult to explore and communicate possible relationships between the quality of sleep and contextual factors. These relationships are very important for the ability of patients to understand the information necessary to make appropriate healthcare choices [1].

1.2 Problem statement

Due to the lack of awareness of professionals and designers, important information is not offered appropriately to the target group. This results in inadequate interaction of low literate individuals with important information like healthcare brochures or government websites. The limited ways that low literate individuals can interpret and process the given information often puts them at the mercy of others around them.

1.3 Research objective

Low literate individuals experience communicative problems when engaging with healthcare information. Background information and context are also important features to integrate into the communication. Hence, the main objective of this thesis is to examine how sleep related information and data can be communicated towards individuals with lower literacy. The research question stated in this research is:

How can a visualization through story telling support a low literate individual to improve their sleep experience?

1.4 Research outline

By looking at existing literature about low literacy and practical cases involving creating awareness, possible supporting materials will be investigated. These materials will then be tested and iterated upon throughout the design process of a technical solution. The outline of the thesis can be seen in figure 1 below.



Figure 1 Thesis overview

Chapter 2 State of the art

This chapter discusses the state of the art in low literacy and sleep applications. Literature documents related to low and health literacy will be discussed in the first section of this chapter. However, more practical insights could be very beneficial for the appropriate specification of the requirements of sleep visualizations. Through researching existing documents more information can be found. This information will be used to make the academic findings more concrete.

Dutch foundations have contributed in making accessible information guidelines for designers regarding digital applications. The needs of low literate groups regarding written media will be explored and their ability to interact with different kinds of data. More insights can be gathered from these guidelines to determine requirements for visualizations and their accompanying explanations. These existing documents will be introduced during this chapter.

Thereafter, sleep applications and research into these applications will be examined. This will entail analyzing four different sleep applications. Their differences in the use of data and sleep recommendations will be reviewed.

In the figure below, the thesis outline can be seen. The state of the art is highlighted to show how this chapter is related to the rest of the outline of this thesis.



Figure 2 Thesis overview

2.1 Concepts related to literacy

This first part of the state-of-the-art focusses on research into definitions considering low and health literacy.

2.1.1 General literacy and digital literacy

Literacy generally implies “the ability to read and write”. However, it is more complicated than that. According to the study of Rintaningrum, literacy is “an integrated complex of language and thought, processes and skills, incorporating a range of habits, attitudes, interests and knowledge, serving a range of purposes in different contexts” [10]. Rintaningrum says that composing the boundaries of literacy are very difficult and changes in time and context. However, this study also states that there is a range in the definitions of literacy. This range goes from “skills-based conceptions” to “broad definitions” [10].

Literacy once consisted of little more than being able to sign for example documents [11]. Veenhof states that literacy skills are nowadays very important for the ability to comprehend society. His research also depicts the ascendance of the digital world as the start for the development of skills that enable the use of information and communication technologies (ICTs). These skills enable individuals to engage with the digital world, just like literacy skills enables individuals to engage in everyday life. Due to the changing context of society, literacy gets intertwined again and again with new emerging concepts and skills [11].

2.1.2 Health literacy

Health literacy generally describes the collection of knowledge and skills from patients that enables them to make appropriate and adequate health care choices [9]. Watkins & Xie have an extensive definition of health literacy which describe it as “the degree to which individuals can obtain, process, and understand basic health information and services needed to make appropriate health decisions” [12]. Norman & Skinner state that limiting skills affect the quantity of acquired medical knowledge in a negative way [13]. Tackling these communicative problems in health services are of great value.

Sasaki, Groenewoud, Kunisawa, Westert and Imanaka indicates that studies from Europe show that levels of low health literacy are also problematic in economically advanced countries [6]. Furthermore, the authors describe groups with low income and education, worse health status, and old age as vulnerable groups. These groups would not be capable of understanding and make use of the current available data to make appropriate healthcare choices for themselves.

Health care is increasingly using electronic tools to support health care systems [12]. However, this study also argues that these tools have little value if users are not capable of engaging with them. Thus, developments should be monitored closely to ensure that health literacy levels are not decreasing because of the newly integrated tools.

2.1.3 EHealth literacy

Choi & Dinitto use the following definition for eHealth literacy; “the ability to seek, find, understand and appraise health information from electronic sources and apply knowledge gained to addressing or solving a health problem” [14]. Furthermore, they state that eHealth literacy is a combination of six different literacies. These literacies are basic literacy, health literacy, scientific literacy, media literacy and computer literacy. The study of Watkins & Xie supports this claim [13].

The ability of literacy to change over time and context was mentioned before. EHealth literacy is no exception and is not static [13]. Thus, Norman & Skinner says that this process-oriented skill develops with every new introduced technology. However, this is not the only factor that plays a role in the development of new iterations of the skills that are required to engage in eHealth. Environmental contexts, personal and social changes all have their influences on eHealth literacy [13]. This results in the need for people to keep learning and develop their skills [12]. Norman and Skinner state that the proper environment and proficiency of the public to use eHealth is lacking [13]. Thus, the results of the full potential of these resources are still something that need to be reviewed.

2.2 Dutch foundations

Low literacy and the accompanying barriers are not unknown to the Dutch society. Four Dutch foundations are putting already a lot of effort in creating awareness and tools for this group of individuals. These foundations are therefore very important to involved during this study. These foundations are Pharos Expertise centrum Gezondheidsverschillen¹, Stichting Lezen & Schrijven², ABC-ambassadeurs³ and the local foundation Taalpunt Enschede⁴. These foundations will now be introduced.

¹ <https://www.pharos.nl/thema/laaggeletterdheid-gezondheidsvaardigheden/>

² <https://www.lezenenschrijven.nl/over-stichting-lezen-en-schrijven>

³ <http://www.a-b-c.nu/node/23/76>

⁴ <http://www.taalpuntenschede.nl/>

Foundation Pharos develops methodologies, publications, fact sheets and accessible information materials based on scientific research, knowledge syntheses and practical knowledge. They disseminate their knowledge and experiences through training courses in which professionals such as general practitioners, pharmacists (assistants), nurses and midwives learn to communicate effectively and deal with illiterate people and people with limited health skills. They have developed various methods and tools for health centers and pharmacies. The 'Step-by-step plan for low literacy in practice' is an example of this. In the development of all these products and services, they try to involve the people concerned.

Stichting Lezen & Schrijven, together with its partners, ensures that as many people as possible in the Netherlands can read, write, do arithmetic and are digitally proficient. They support hundreds of organizations with education, research, (lesson) materials, advice, and campaigns. In the past 14 years of its existence, the foundation has managed to unleash a broad social movement. Part of this is breaking the taboo on low literacy and creating awareness throughout society that the ability to read and write lies at the basis of a socially and economically powerful, healthy and sustainable society. Innovation also had a major impact on developments. Princess Laurentien der Nederlanden played a crucial role in this by proposing an approach that was very successful outside the Netherlands. This innovation led to the creation of the Language for Life program, as a result of which some 50,000 adults have now taken the big step to attend a language course. The foundation now works together with about 1000 partners.

ABC is a foundation of and for illiterate people throughout the Netherlands. There are already departments of ABC in several provinces, but they aim for national coverage. ABC has 3 goals which are promote, stimulate, and meet interests. Foundation ABC involves ex-low literates in a training course to present themselves and provide information about the problems of low literacy. The test panel assesses texts for clarity of language. They help to adapt each text so that it can be understood by people who have difficulty reading it.

The final foundation is **Taalpunt Enschede**. This foundation wants to serve the inhabitants of Enschede, a city in the East of the Netherlands, who want to learn how to read, write and speak better. They want to create one point of contact for all questions about language in Enschede. This way they want to ensure that everyone can participate in the language related courses that they provide.

2.3 Accessible information

Health tools have manifested themselves in the past years in the digital world which are entitled to be eHealth tools. However, the knowledge of the use of such applications is developing slower than the rise of health applications on mobile phones and the internet. Multiple foundations are raising awareness about this gap between the knowledge of users and the required skills to use them. Different checklists have been developed to support developers to make health applications more accessible to low literate individuals.

Two established checklists regarding the accessibility of information have been found. These checklists are validated and used by various researchers. Unfortunately, no checklist regarding data visualizations were found. However, the two guidelines from the foundations Pharos and Stichting Lezen & Schrijven both offer insights into which aspects of health applications are important to support low literate individuals and thus will be reviewed. This review will include the extent of their applicability to data visualizations.

Pharos checklist: This checklist⁵ is a project of Pharos partly based on Patient Education Materials Assessment Tool (PEMAT). It was created to offer support in the development of tools with more accessible information. The version of the checklist is unknown, but the date of retrieval was April 2020. Two different sections have been made with a different focus. The first one supports the creation of information materials like flyers and movies. The second focuses on eHealth applications. The second checklist will be reviewed because it supports the creation of health apps and patient portals which is exactly the scope of this research. This checklist was

This accessible information in the eHealth checklist has 78 tips drawn up that focus on the collaboration with the users, text, images and eHealth. However, some sections are not required because it is not the focus of this research. For example, questionnaires are not a necessary section to consider for the review of the sleep visualization. No in-depth information is present in this guideline on how to communicate data. There is a tip that warns the designer of integrating formula's and data into the design. However, this research is about the communication of sleep data to low literates. This tip shows again that it is challenging to explain and convey data in a sensible way to this target group which emphasizes the importance of new ways to communicate with about data.

Stiching Lezen & Schrijven Checklist: The foundation Stichting Lezen & Schrijven developed the checklist that can be used to analyze texts for accessibility in digital applications for low literate individuals [17]. The checklist 1F is analyzed, which consists of the dimension's layout & text, structure, sentence structure, vocabulary, and text content. The fourth version of the checklist was drawn up in January of 2014. This checklist is compact and focusses mainly on text and layout. This is more applicable for the focus of this research. However, some very interesting aspects are not present in this checklist. There is no tip or guideline that is regarding the communication of data visualizations. This shows that there is a serious gap when it comes to communicating data from users to this target group.

2.3 Sleep applications

Millions of sleep monitoring applications are being downloaded and used [15]. A lot of sleep applications report measured data which could include sleep efficiency, sleep quality and the metrics that they exist of [2]. The study of Kay indicates that these measurements do not give proper guidance for improvements on the sleep experience of users. Liang et. al. supports this with the information that only few applications focus on supporting their users with sensemaking of the provided sleep data [1]. Daskalova, Metaxa-Kakavouli, Tran, Nugent, Boergers, McGeary and Huang indicate that handling raw data is very challenging for users [15]. Furthermore, a lack of sensemaking applications was established in this study. Meanwhile people have indicated to be interested in improving their sleep experience [15]. Moreover, giving more information about the relations of contextual factors and sleep data could help people understand their sleep habits better. Users are dependent on applications that interpret and view their data [15].

Now a range of sleep applications will be investigated who all have their own way of supporting their users to understand more about sleep and contextual factors. These applications were chosen based on their different ways of communicating with users. These different ways of communicating the sleep data will be the focus of this part of the academic research. After the review of the research sleep applications, an overview will be shown which summarizes the communicative ways of these research sleep applications.

⁵ <https://checklisttoegankelijkinfo.pharos.nl/checklist>

2.3.1. SleepExplorer

The first research application that will be reviewed is SleepExplorer. The goal of the research from Liang et. al. was to investigate how technology supports sense-making of personal sleep data [1]. The bridging of the gap between sleep tracking and sense-making was investigated through this application.

The following metrics are used in this application to determine the sleep quality of the user; minutes asleep, minutes awake, number of awakenings, minutes to fall asleep and sleep efficiency [1]. Liang et. al. states that representing sleep quality as sleep efficiency, which would be minutes asleep divided by total time in bed, would not be adequate because important metrics would be missing in the calculation of sleep quality. However, this simple definition is what most sleep trackers use [1].

Liang et. al. argues that sleep is affected by activities that also take place during the day [1]. A list of 16 contextual factors, that could influence someone's sleep was composed. This list was identified with the help of previous studies that were reviewed by Liang et. al. and function as a starting point for his research. This list can be found in Appendix A. A correlation visualization can be seen in figure 3, above. This shows the importance of the incorporation of contextual factors. Previous studies have also been examined to identify the following design requirements for SleepExplorer; show insights into correlations between sleep data and contextual factors, guide users in ways to track factors that may affect their sleep, help users understand their own sleep structure and redefine good sleep for themselves.

Owning a Fitbit was one of the requirements for the recruitment of participants for this study because the application is able to retrieve data from Fitbit public API [1] Seven participants with good perceived sleep quality were recruited, four with average perceived sleep quality and one with bad perceived sleep quality. Unfortunately, the level of education from the participant was not mentioned extensively which would be of interest in the context of this graduation project.

Liang et. Al. reports results are positive; the majority of participants had a very good experience using SleepExplorer [1]. Ten out of 12 participants showed interest in using the application in the future. The study results present that participants understood afterwards more about different sleep metrics which contribute to their defining of sleep quality. Participants picked different sleep metrics as qualification for their sleep quality which seem to be a result of their different sleep experiences and key data metrics [1]. This suggests that the most important sleep metrics could differ from person to person.

2.3.2. ShutEye

Awareness is very important. Research has shown that people with proper sleep hygiene knowledge but a lack of applying these hygiene's to their awareness still have poor sleep practices [16]. Thus, Bauer has made a sleep application to promote awareness about activities that influence sleep habits.

This application, Shuteye, uses wallpapers of mobile phone's to display sleep hygiene recommendations[16]. These recommendations include real-time common activities. Common activities are identified by this study as the intake of caffeine, napping, exercise, meals, alcohol, nicotine and relaxation. Shuteye was not designed to interrupt the users main task but to provide

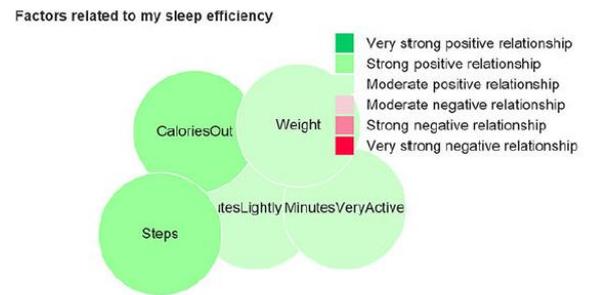


Figure 3 Correlations of sleep metrics and contextual factors tracked by a user. Green bubbles represent positively correlated factors, and red bubbles show negative correlations. The shade of a bubble indicated the strength of correlation. [1]

regularly minimal cognitive load [16]. This means that the information would always be present without distracting the user.

In figure 4 a representation of the wallpaper can be seen. This wallpaper shows a 24-hour window with the different activities represented in horizontal bars. This timeline is spread over five screens which are always available to the user. This always enables the user to know which activities will have a positive effect on the sleep experience, and which should be avoided.

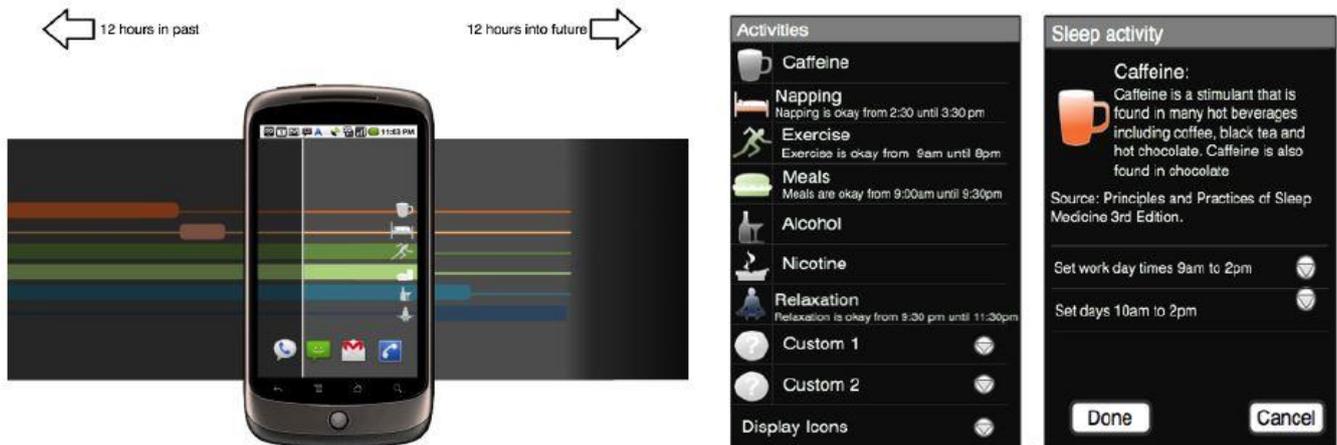


Figure 4 Application Shuteye wallpaper, activities and sleep activity screens. [16]

Figure 5 Shuteye wallpaper (left) has a timeline with horizontal bars that represent activities that would impact sleep. When an activity is unlikely to impact your sleep, the bar will be thick. A thin line indicates that an activity is not recommended and has negative results on sleep. In the application (right) more information and recommendations can be found per activity [16].

Twelve people participated during the experiment which took four weeks [16]. The level of education was mentioned per participant in this study. However, there was no recruitment that depicted the level of education. Thus, this application is not designed especially for users with lower educational level.

The goal of the study of Bauer was to identify if the application was able to create awareness about sleep recommendations [16]. The participants on this study reported that the application was understandable and aesthetically pleasing. Personalization of the display was reported as a missing feature. Another missing feature was the ability to log related sleep data like sleep duration. A majority of the participants reported that the application succeeded in the stated goal. The participants were more aware of sleep and what contributed to the quality of their sleep.

The study of Daskalova et. al. has some critique on the key idea of ShutEye [15]. Daskalova et. al. expresses concerns about the effectiveness of this technology because it weighs heavily on the idea that there are general recommendations that would be useful for everyone. However, the results of the application indicate that some awareness was created in the duration of the study [16]. The level of awareness that participant acquired has not been investigated further during this study. Thus, the level of awareness is unknown.

2.3.3. Lullaby

This sleep application was developed with the idea to enable users to identify why and when their sleep gets interrupted [2]. This study states that with the use of ubiquitous computing technology sleep habits and environmental factors can be tracked. Gathered data from the user gets displayed to the user which enables them to look for trends [15]. This display can be seen in figure 3. Figure 4 shows the setup of the sensors of the application and the touch screen device which presents the users data. One component is not mentioned in this setup which is a personal Fitbit in possession of the user.

Kay states that the design requirements for Lullaby are classified with the help of previous studies and sleep collaborators [2]. Thus, the design requirements from previous literature helped to identify the starting point of the application. Four of these design requirements are about the data that should

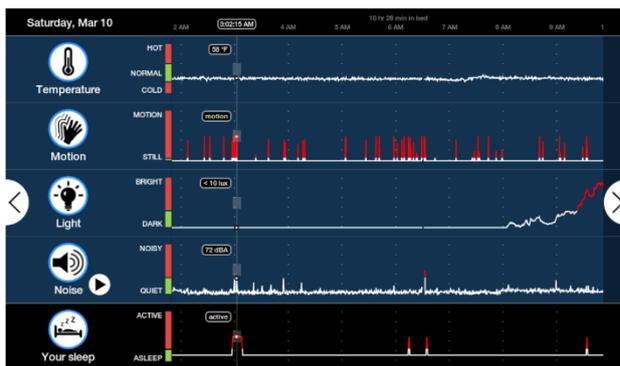


Figure 5 This is the history screen of the application that displays data from an entire night. [2]

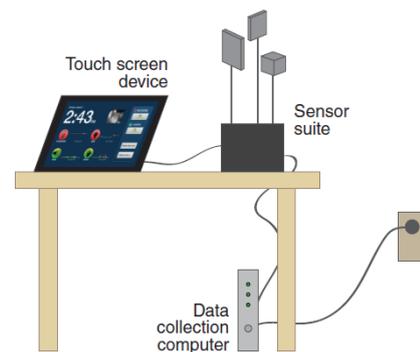


Figure 6 Setup of Lullaby [2]

tracked. The first conditions are identified as light, sounds, temperature and air quality. The requirement regarding movement indicated multiple sources like roommates, family members or pets. Two requirements focus on the support of the user's identification of relationships between the different data types. The final requirements entailed more directives for the hardware and privacy protections of the application. With these requirements as a starting point, the application got designed with the goal to gather personal data from the user with no or little interventions.

In this study of Kay four participants have tested the application [2]. The only requirement for the recruitment of these participants were the desire to improve their sleep and having an internet connection at home. Educational level was not mentioned and thus nothing can be said about this.

The application was continuously used by the participants [2]. This could be a result of the recruitment requirement that made sure that the participants showed interest in improving their sleep. However, the results of the study of Kay showed that more summary data is needed for the full understanding of the correlations from the different data metrics [2]. Participants did indicate that studying their own data was experienced as useful because they could actually see when they would get out of bed or how often they would cough during their sleep [2]. Kay mentioned that more guidance with reviewing data is necessary because aside from some activities that took place during their sleep, the participants had little or no knowledge of what they should be looking for. Thus, future research should be focusing on investigating different interferences that indicate and help identify relationships [2].

2.3.4. SleepCoacher

The study of Daskalova et. al. proposes to turn correlations measured on key metrics into recommendations [15]. These recommendations should enable users to determine which action is necessary to improve their sleep experience.

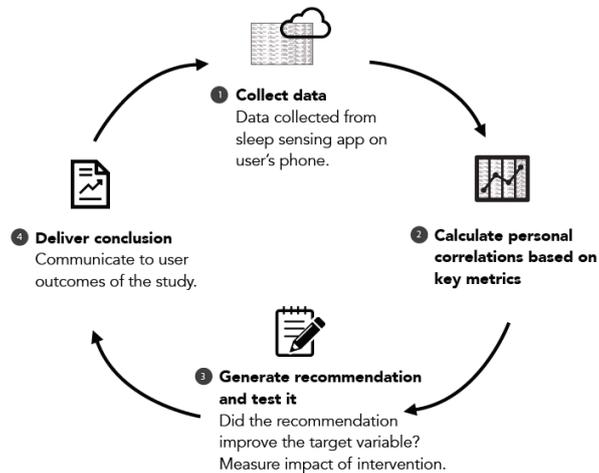


Figure 7 Feedback loop of the data that is being processed [15]

SleepCoacher makes use of a closed feedback loop which is investigated in previous studies [15]. This closed feedback loop can be seen in figure 7. This feedback loop exists of four different steps. The first step of this cycle is that the user's data is uploaded to the cloud, clinicians review the data in charts and correlation tables. Next, the clinicians draw up recommendations that are presented to the user by the application. The users are through these recommendations enabled to improve their sleep habits [15]. The effects of the provided personal recommendations are the focus of the study of Daskalova et. al. which they want to investigate over time.

The participants recruited for the research of Daskalova et. al. were undergraduate students whose age was above 18 and used an Android smartphone [15]. Participants would have been rejected if they had diagnosed sleep problems that could interfere with the ability to carry out the recommendations from the application. The educational level of all the participants is undergraduate students, this indicates that the application is not designed specifically for participants with lower levels of education.

The study of Daskalova et. al. states that creating a baseline was crucial for their research. This baseline was created by gathering data from the participants for 20 days prior to the second phase of the research. After these 20 days the interventions started with recommendations [15]. The effects of the intervention's recommendations were measured over a course of five measurements which entailed five nights. The study of Daskalova et. al. results support the claim that recommendations must be tailormade to personal data. Different correlations were identified per participant by the study. However, in future work Daskalova et. al. states that an alternative for the baseline could be general recommendations.

The participants from this study classified three points of attention: 1) flexible recommendations; 2) When others are affected by a recommendation take this into consideration; 3) Justify the recommendations through explanations or scientific references [15]. Thus, for future work of the study of this study, more specific and personalized recommendations were advised. Overall, the participants had the idea that SleepCoacher had a positive influence on their sleep habits.

2.3.5 Table of Comparison

The table below shows a comparison between the discussed research applications. Different requirements were drawn up on the basis of communicative features. Sleep data and contextual data were chosen to indicate the gathered data by the applications. The amount of sensemaking by the application was represented by the features use of recommendations and reflection of recommendations. This overview shows which applications focusses on which aspects.

Table 1 Comparison of characteristics of the researched applications

	SleepExplorer [1]	Shuteye [16]	Lullaby [2]	SleepCoacher [15]
Main features	Re-commendations on sleep metrics and contextual factors	Provide real-time sleep hygiene re-commendations	Displays sleep data to users so they can look for trends	Turning correlations into actionable, personalized recommendations
Gathering of sleep data	Yes	No	Yes	Yes
Gathering of contextual data	Yes	No	Yes	Yes
Use of recommendations	Yes	Yes	No	Yes
Reflection of recommendations	No	No	No	Yes

From this table of comparison, the focus of the applications become very clear. It becomes clear that each application has its own method to work towards its set goal. Shuteye, SleepCoacher and SleepExplorer are actively supporting its user through the process of making sense of factors that influence sleep. However, Lullaby is giving its users a way to interact with their own sleep data which could also give the user the opportunity to make sense of their data on their own. Unfortunately, it is not clear yet which method is most appropriate to communicate about sleep.

2.4 Summary state of the art

In this chapter, concepts related to literacy have been reviewed, which showed that low levels of literacy compose serious barriers to proper healthcare communication. Literacy enables people to actively participate and contribute to society. However, literacy has many different facets. The different literacies like health and eHealth bring their own critical improvement points. For health literacy, an improvement of the overall health knowledge is important. This will have influence on the communication of healthcare which will reflect in healthier people. EHealth is composed by six core skills which also entail health literacy, this makes the provision of healthcare insights through applications very difficult. Other important facets of eHealth literacy are information and computer literacy will be a focus point in the rest of this graduation project. These core skills of eHealth literacy are becoming more important with the change of communication medium. In conclusion, multiple barriers can be identified in the healthcare communication due to a lack of literacy. To make the literature even more concrete, existing documents were found that included checklists to make information more accessible to low literates. These existing documents show solutions that have been incorporated into drawn up materials from Dutch foundations.

A literature review of sleep applications, relevant for this thesis, has been conducted. More research was done into data visualizations and research applications that try to improve the sleep experience in different ways. Becoming aware of the effects of contextual factors on sleep experience is a focus of all the applications. However, their approach is very different from one another. ShutEye is the only application that is not gathering data from the user to integrate this into recommendations from the application. In contrast, Lullaby is gathering contextual and sleep related data but is not presenting recommendations to the user. The user of Lullaby can sift through the data to look for correlations on its own which they find interesting probably because they were interested into some issues that they experienced during their sleep. However, their four participants were chosen on the fact that they had the desire to improve their sleep. SleepExplorer and SleepCoacher both made sleep recommendations based on contextual factors in correlation with sleep metrics. Both applications were positively received but had some recommendations that could be developed further. To get a better overview of the different applications a table of comparison was made.

The target group for this research are low literate individuals. Their low levels of literacy compose barriers for the use of healthcare tools and the communication of healthcare professionals. The study objective of this graduation project is to eliciting recommendations to create understanding and actionable visualizations for people with low literacy. The focus will lie on sleep visualizations that will be spread through eHealth applications. The starting point for this project will be the current research of sleep applications. The State of the Art has shown that there is not yet an application appropriate for the use by lower literate individuals. However, features from the current sleep applications could be adjusted to make them more appropriate for this target group. Therefore, the aim of this research is to develop a visualization supported by storytelling that makes sleep recommendations accessible and actionable for low literate individuals.

Research Question: How can a visualization through story telling support a low literate individual to improve their sleep experience?

Sub-questions:

- Which important features need to be considered when designing visualization for low literate individuals?
- What are the requirements for the communication of such a visualization?

- What are most suitable design patterns for sleep visualization that would be actionable for low literate individuals?

Chapter 3 Method

In order to solve the study objective, how low literate individuals should be supported in understanding a sleep visualization, and come up with a suitable prototype, more research is needed. This chapter will elaborate on the methods that were used during this research that was conducted during the COVID-19 pandemic that took place in 2020. No face to face contact was permitted during the execution of any of the conducted methods of the research. This has influenced the used methods greatly. In figure 8 below, the thesis outline can be seen. The method is highlighted to show how this chapter is related to the rest of the process of this thesis.



Figure 8 Thesis overview

Low literate individuals and their knowledge of health and eHealth applications have been discussed in the state of the art. However, more practical insights could be very beneficial for the appropriate design of the requirements of sleep visualizations. Through researching existing guidelines for accessible information regarding digital applications more insights can be gathered to determine requirements for the context of visualizations and their accompanying explanations. How these requirements should be met through visualization, design patterns are another subject of attentions. In this section, the methods used to answer the research questions are explained.

The research conducted in this thesis can be divided into different sections:

- Gaining insights of low literate individuals will help to answer which features are of importance for low literates to understand visualizations.
- Analyzing eHealth guidelines for low literacy will help to define the important features that experts have drawn up for designers of digital tools.

Based on the results of the practical insights and eHealth guidelines appropriate requirements for the prototype could be drawn up.

3.1 Insights of low literate individuals

The book of Hennie Boeije from 2016 has been used to explore methods of qualitative research. Data collection amongst other research methods are discussed in her book 'Analyseren in kwalitatief onderzoek'. The following methods have been conveyed in her work and will be used during this research [18].

These options were:

1. Interviews
2. Focus group
3. Content analysis of existing documents

Interviews are a good option to gather personal points of views of the target group. However, due to the COVID-19 restrictions different medias must be explored to conduct the interviews with the participants. The use of an online medium is challenging for most of the participants which makes it important to prepare the use of such a medium more extensively. An inappropriate medium could

compose serious issues for some of the participants which could influence the outcomes of the interview. A focus group is a group interview with a specific topic that will be discussed. Thus, a focus group has some resemblance with doing interviews. This option also entails the preparation of questions. However, the biggest plus point of this option is that multiple people at the same time could be present and discuss the questions together. The last option is content analysis of existing documents. Some existing documents have been introduced in the state of the art. For example, the foundation Pharos has checklists that support designers to make materials more accessible. Moreover, this foundation has also published in May 2016 a series of 15 videos⁶ on YouTube in which ex low literate individuals tell their stories. These materials could contain useful information about new communicative approaches to the target group and for the preparation of a focus group or interview.

3.1.1. Content analysis of existing Pharos videos

The foundation Pharos has published in May 2016 a series of 15 videos on YouTube⁷ in which ex low literate individuals tell their stories. The discussed subjects vary from health-related experiences like going to the doctors to child related problems like parent evenings at schools. The participants of these interviews are official language ambassadors from the foundation ABC. These language ambassadors do not only tell their story to companies and communities. They test materials like government websites and health materials. These opportunities create possibilities for designers to involve a more diverse set of test groups. Through communicating the disabilities that low literates have to deal with, the problem is becoming more concrete. This is done in these videos. Very concrete solutions and examples are discussed which make it more insightful. The findings from the literature research are strengthened with these interviews.

The main aim of this part of the analysis is to understand more of the concessions that are needed to include this group of people. The communicative materials need to be more supportive for this target group. However, which requirements are of great importance for the communication are not entirely clear or differ per communicative medium and subject. Through the inclusion of these existing videos more knowledge could be included in this thesis.

3.1.1.1 Procedure & format

Content analysis is a method for analyzing written, verbal or visual communicative messages [18]. This method can be carried out quantitatively which enables the researcher to test hypotheses derived from theory. Content analysis can also be qualitative, using sources to arrive at explorative categories and assumptions. These existing videos will be analyzed to explore categories and assumptions of the target group regarding health-related subjects. The content analysis of the videos from Pharos will be analyzed following the approach of Hennie Boeije for qualitative research [18]. This includes the use of mind maps, codes and themes.

The first step of the qualitative analysis of the videos will be to open code the material [18]. This was done by listening to the videos and transcribing them. These transcripts can be found in Appendix B. Through open coding a first list of codes was drawn up. These codes were partially from some used wording in the materials. This first step was to explore the gathered materials. The result from this step was an extensive list of codes and a mind map.

The second stage is axial coding [18]. Grouping the codes into themes is the next important aspect. Organizing the codes in relation to each other could result in dropping codes. The results from this step

⁶ <https://www.pharos.nl/thema/laaggeletterdheid-gezondheidsvaardigheden/>

⁷ https://www.youtube.com/watch?list=PLIZqSxp-WkO5SDk6kE9BhmNv9qDPi6l-q&time_continue=1&v=3kkjN2Tvq1q&feature=emb_title

is a mind map that shows the connectivity of codes. From this mind map a list with codes and themes that have more of an order and perspective relative to each other can be drawn up.

The final stage selective coding, the most important categories are determined [18]. The most important codes and themes will be explained into a coherent explanation.

These insights will be used to design the protocol and format of the focus group that will be discussed next. However, more insights about new communicative approaches could be gained from this material which will also be used to determine requirements for the prototype concept.

3.1.2 Focus group

The focus group was conducted to gain insights in more practical struggles that low literate individuals face in their daily life. These practical experiences with the target group could be beneficial for the designer to emphasize with the target group. This important because the researcher must translate the experienced difficulties into features that are of importance for low literates to understand visualizations about sleep.

To find as many participants as possible, different foundations were contacted to get in touch with the target group. Contacts were made with the foundations Pharos, Stichting Lezen & Schrijven and Taalpunt Enschede. Through these foundations the researcher received the recommendation to contact ABC Ambassadeurs. This foundation has a test panel consisting of low literates. Voluntary lesson groups are also organized via this foundation.

Ideally a physical meeting would have been set up. However, the set measures from the University of Twente and the Dutch government restricted the possibilities to online contact. Through consulting with voluntary teachers enlisted at the foundations, the method online focus group was determined to be most appropriate. This resulted into the adjustment of the focus group to an online focus group. Disadvantages like the familiarity of participants with digital applications like Skype became prominent. Thus, it was very important to collaborate with the participants to create an appropriate setting for the online focus group both emotionally and practically. Luckily, the volunteer was able to set up digital lessons in which the online focus group could be conducted. The set up and use of technology was familiar because of its use for the replacement lessons during the COVID-19 period. Eventually by adjusting procedures and online platforms, it was made possible to meet the target group online which gave insightful practical knowledge to the researcher.

3.1.2.1 Participants

There are different categories of participants that have lower levels of traditional writing and reading literacy. These categories can be defined as:

- Dutch as first language (NT1)
- Dutch as second language (NT2)

The online focus group was open to both groups, no distinction was made within the focus group questions. Participants were recruited via different channels; Pharos, Stichting Lezen & Schrijven, ABC-Ambassadeurs and Taalpunt Enschede.

3.1.2 Procedure & format

Through a voluntary Dutch teacher at ABC Ambassadeurs, an online meeting with a NT2 (Dutch as second language) lesson group was arranged. The focus group approach was most applicable for this lesson group because it could be conducted during one of the lessons. This lesson group was able to

adjust to a new online medium since the measures from COVID-19 made it impossible to meet in person. The solution to continue their normal lesson program became to use the mobile application WhatsApp. Most of the participants knew how to use it appropriately. Hence, this application was used during the focus group. The maximum participants of a video call in the application was one of the conditions that the application needed to be equipped with because of the size of the lesson group. Other applications like Skype have been considered but were inappropriate for the participants.

This lesson group consisted of 6 foreign women. The descent of three participants was Asia and the other three were Arabic. The age of the participants ranged from around 35 to 60 years old. Most of these women were housewives or unemployed.

When agreed to cooperate, the researcher proceeded with setting up a WhatsApp group for which the participants and the volunteer were invited. The focus group contained 6 participants. After starting the video call in the application, the participants were asked for their permission to audio record the conversation. When the audio recording would have been approved and started the participants were informed about the goal of the research and the fact that he or she could stop and leave the focus group at any moment. The informed consent was conducted after the explanation of the research. The focus group lasted around 40 minutes and was conducted in Dutch. After the focus group was conducted the WhatsApp group was deleted along with the numbers of the participants.

Through Taalpunt Enschede participants were found that have confirmed levels of low literacy and limited digital skills. Unfortunately, the planned focus group with the NT1 lesson groups was not possible because of the COVID-19 safety measures, which prohibited in-person meetings with this group of 5 participants. No digital replacement was possible at that time because of the little time to prepare. Luckily, other options were found to include this group of participants in the process with user testing.

3.1.3 Questions

The goal of the online focus group was to gain practical insights about the present sleep knowledge. This goal was chosen because it was not possible to find this information in literature. The questions were developed with this goal in mind. There were in total 9 questions divided over 2 different sections. Both sections had its own theme which was daily activities and health management & sleep. All the questions were open questions.

The first theme was focusing on **general information about the participants**. The goal of this sections was to get an idea of the daily activities of the participants. The role of new technologies like the internet and mobile phones was also touched upon because of the active role these technologies are playing nowadays.

1. How long do you already follow this NT2 course?
2. Could you describe a normal day with your daily activities?
3. Which digital applications do you daily use?
4. How big of a role does technology play in your daily activities?

This research is focusing on **health management and sleep**. The goal of this section was to gather insights into the daily health routines and which role sleep plays in this.

5. How much do your daily activities influence your sleep?
6. If you have a bad night rest, which negative effects do you experience during the day?
7. Are you in need to receive support for health-related issues?
8. What have you already tried to improve your sleep?
9. Have you even found useful tips on a digital media like the internet?

3.1.4 Analysis of focus group

The analysis of the online focus group was done by the same qualitative research method as described in 3.1.1.1 Procedure & format. The following steps were taken [18]:

1. Open coding
2. Axial coding
3. Selective coding

The results of the online focus group will be used to determine which sleep knowledge is present in this target group. This will help to determine which requirements and information need to be present for the prototype requirements.

3.2 Accessible information checklist

The aim is to use the accessible information checklists from Pharos and Stitching Lezen & Schrijven to analyze sleep applications. Two established checklists regarding the accessibility of information have been found and were introduced in chapter 2 state of the art. These guidelines both offer insights into which aspects of health applications are important to support low literate individuals.

A combination of the two checklists was be drawn up because this research focusses on the visualizations and relevant information for the visualizations in mobile sleep applications. Some aspects that are included into the checklists are not of interest for this project. Guidelines for the requirements of data visualizations and their applicable explanations will be derived from these checklists regarding eHealth applications.

The applications that were envisioned to be reviewed namely Shuteye, Lullaby, SleepCoacher and SleepExplorer are not all available on the market. This makes it impossible to analyze these research applications. However, it is important to look at the current offer and representation of sleep applications. Thus, it was chosen to choose five new sleep applications that are all currently on the market.

2.3.1 sleep applications on the market

The current mobile sleep applications production is booming. However, some are more popular than others. To review whether the current market of sleep applications satisfies any of the drawn-up requirements in the checklist from the previous paragraph, it is necessary to make a good selection of the current market of sleep applications that could be acquired by users.

Two different application stores have been used to search for the top 5 sleep monitoring applications. The first application store is the Android Play Store⁸ and the second is the AppStore⁹ from Apple. The used search term is 'Sleep monitoring'. This term was chosen because this describes most accurately the process of collecting sleep data. The selected applications were found in March 2020.

Both application stores work with a star system to rate their applications. These stars are the average rating of users of the application. Only applications with more than 4 stars were considered. This was chosen because this shows that the application is high in its ranking. Only the Play Store showed the number of downloads per application thus this could not be taken into consideration. Costs of the

⁸ https://play.google.com/store?hl=en_US

⁹ <https://www.apple.com/ios/app-store/>

applications were another consideration factor. The chosen applications are free of charge. However, most offer paid premium accounts with more statistical features.

The following five applications were chosen and can be seen in figure 9:

- Sleep as android
- SleepCoacher
- SleepCycle
- Sleep Time
- Sleep Monitor



Figure 9 The following applications are represented from left to right. Sleep as Android [19], SleepCoacher [19], SleepCycle [19], Sleep Time [20] and Sleep Monitor [19]

These applications are reviewed with the drawn-up checklist that will be discussed in chapter 4. There will be a rating used consisting of a scale. This will show in which sections the most development of new information needs to happen.

3.3 Ethical approval

The ethical approval checklist from the University of Twente was used as a guideline for the design of the focus group. However, the ethical committee EEMCS from the University of Twente was not further involved with the approval for conducting the focus group. The filled in checklist can be found in Appendix C.

Chapter 4 Results

The results of the executed procedure mentioned in the previous chapter will be presented and discussed in the following paragraphs. In the overview below, the results are highlighted to show how this chapter is related to the rest of the outline of this thesis.



Figure 10 Thesis overview

4.1 Content analysis of existing Pharos videos

The transcript of the existing Pharos videos can be found in appendix B. After the transcription, a mind map was drawn up to create an overview of the relevant subjects. This mind map can be seen in figure 11.

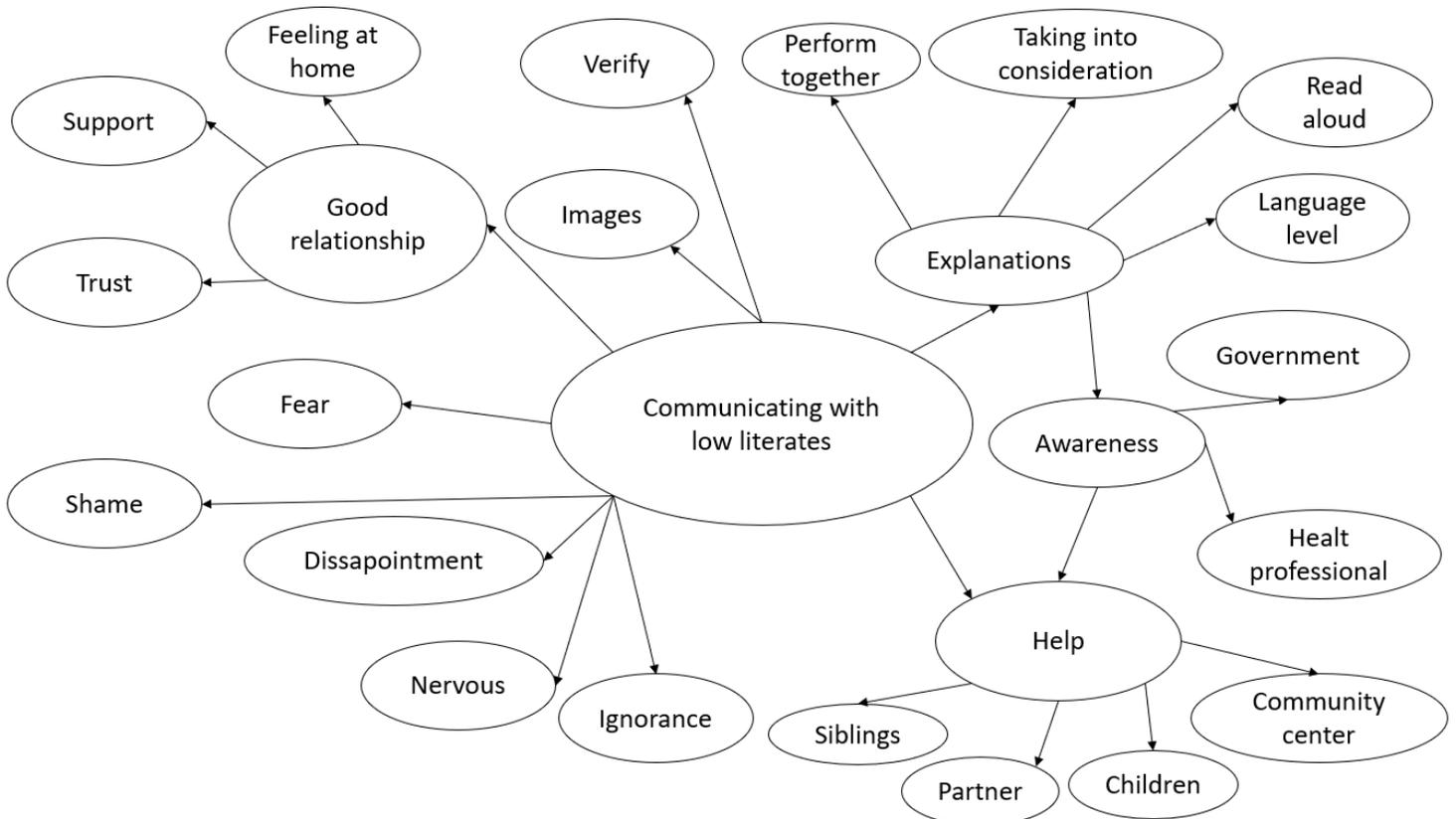


Figure 11 Mind map of discussed subjects in the existing Pharos video's

The next step was to axial code the materials. Three main themes have been identified based upon the analysis of the materials. These themes are strategic approach, help and feelings. The theme “Feelings” has been divided into two categories namely negative and positive. The themes and their accompanying codes can be seen in table 2. In the following paragraphs, the themes will be described in more detail.

Table 2 Overview of the drawn-up codes and themes from the existing Pharos video's

Theme	Sub- theme	Emergent codes
Strategic approach		Language level Explanation Taking into consideration Perform together Read aloud Verify Images
Help		Health professionals Children Partner Brothers and sisters Government Community center
Feelings	Negative	Shame Ignorance Awareness Fear Disappointment Nervous
	Positive	Support Good relationship Feeling at home Trust

Strategic approach: One of the main subjects from the online interviews was that how the individuals are approach is very important. A lot of the language ambassadors experienced a gap in the approach that they need to interact properly with lots of organizations. Different solutions to create more appropriate approaches came about. The codes in this theme describe solutions that have helped the participants. These results communicate one very clear signal which is in line with the recommendations from the checklists. The appropriate level of language is very important to this target group because of their language disadvantages. However, when for example it is not possible to use a more understandable word from their scope, it is possible to explain more of the context of the word which helps them to understand this new and unfamiliar word. Another interesting code that was identified, the wish to validate if the given information was also understood by the individual. When information is given to them, it helps them if they are asked about this information and so that they can repeat it in their own words. By using this method, the information provider can see whether the information has come across. Moreover, the participants also noticed that this helps them to remember the information better.

Help: The participants classified help as very important. Health professionals were classified as very important if there is the awareness of the patient's low literacy. When a doctor or dietitian is unaware of the disadvantages of the patient, they most of the time do not feel the benefits that this professional could provide. Children are also mentioned as fundamental helpers mostly because of their more extensive experience with technologies. The bottom line is that when awareness about low literacy is not present and thus people are not communicating openly about language disadvantages, they miss

a lot of helping hands. When the doctor, dietitian and government are not aware of individuals with low literacy a lot of fundamental help cannot be offered.

Feelings: There are a lot of negative feelings that the ambassadors have explained about. In the beginning the feeling of shame is the biggest feeling that they described. These negative feelings were all described when care givers or government staff were not aware of the low literacy level of the individual. The second part of this theme shows something very positive. When there is clear communication about the lower levels of literacy of an individual a lot of support is generated which gives the patient very positive and happy feelings.

From these codes and themes a lot of helpful aspects can be used when communicating with the target group. The emotions are very important to take into consideration during the conversations that will take place with the participants. By paying attention to the use of appropriate language a better understanding can be formed with the participants. Explanations into the subject and discussion topics are another focus point which will be taken into consideration. These three tips will be taken into account during the focus group and later during the user tests.

The first theme strategic approach is very interesting to take into consideration for the final requirements of the prototype concept. Keeping in mind that explanations through for example images or text that is read aloud could be very beneficial to communicate information through multiple mediums.

4.2 Focus group results

The focus group was conducted with 6 participants. These participants were from the NT2 category. Initially only four participants would join the focus group. However, right before the focus group started more participants were able to join. The use of the application WhatsApp complicated the conversation. Due to the restriction of this application participants had to take turn speaking which did not encourage a discussion. The next paragraph will give a general summary about the focus group which will be supported by a mind map. After this the table with themes will be discussed.

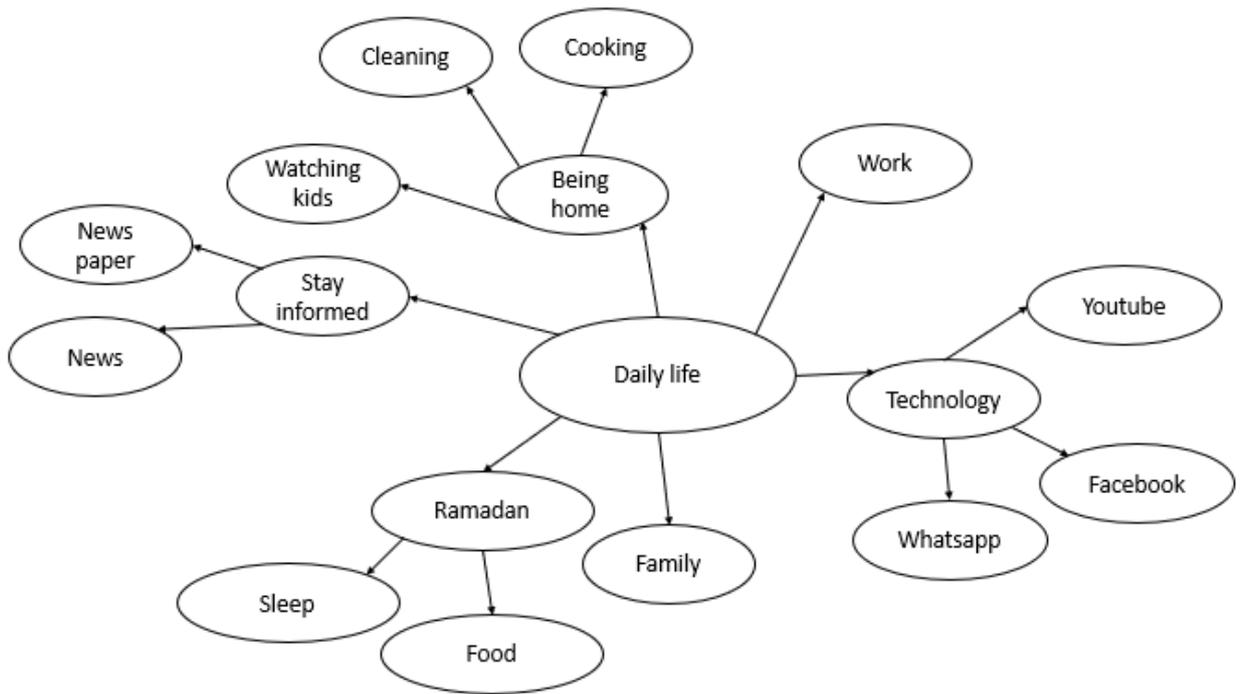


Figure 12 Mind map of discussed subject about daily life in the focus group

During the focus group, the emphasis was put upon daily life and frequent activities. Some general information was gathered about their daily routine. The focus group was transcribed of which the transcript can be found in appendix D. The COVID-19 measures had influence on the explained routines of the participants. A mind map can be seen about this first section in figure 12.

The rest of the questions focused on sleep experiences and routines. Other health related activities were also discussed like taking a stroll or other sports activities. A mind map was composed to create a general idea of the content of the second section. The composed mind map can be seen below in figure 13.

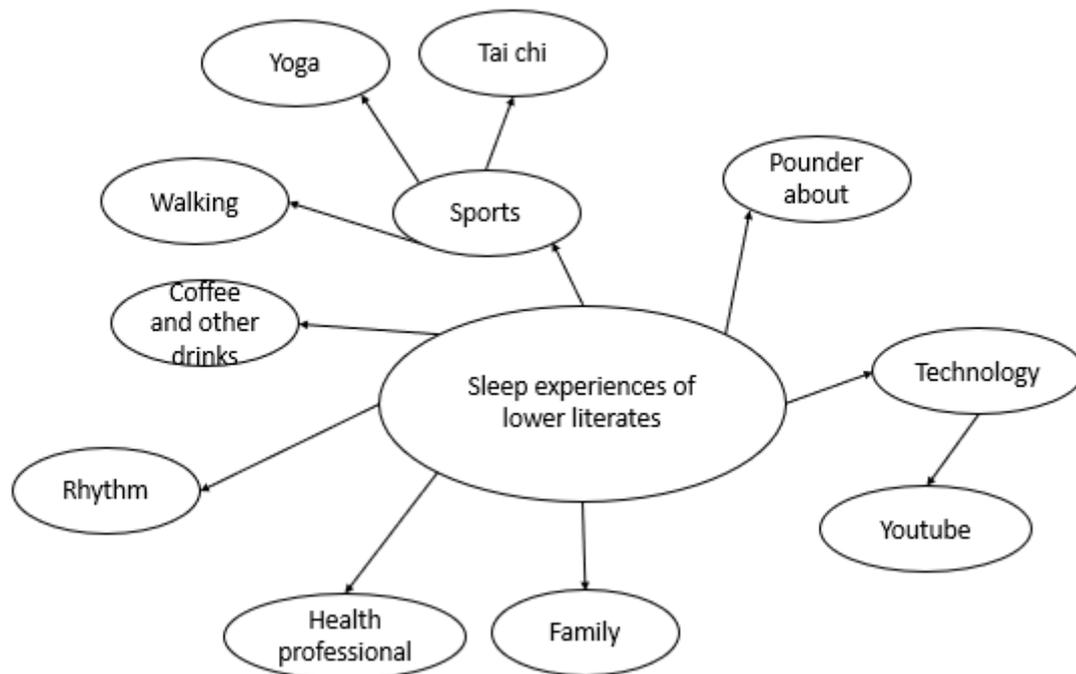


Figure 13 Mind map of discussed subjects about sleep experiences in the focus group

Most of the participants did not have employment or regular work. Only one participant declared to work once every two weeks. Cooking and cleaning were often mentioned as daily activities. Watching the news or reading some paper headlines was often mentioned as daily routines. Due to the COVID-19 measures walking and doing sports activities is also part of the daily routine which are permitted activities. When discussing sleep and their related experiences it became clear that three participants were now fasting because of the Ramadan and that their sleep was also influenced. Some explained that normally they try to keep a good rhythm with going to bed and waking up. However, due to this celebration of their religion this was not possible because they had to wake up very early for breakfast. Solutions for a bad night's rest were discussed and included activities like yoga, drinking coffee in the morning or going back to bed. It was also mentioned that coffee was an influence that multiple tries to avoid during the evening hours. Another important aspect that rose during the conversation was that they like to talk about their sleep problem with each other to explore new solutions. Family members and friends were also mentioned as source for new ideas to sleep better. The internet was only used by one participant to look for solutions to some bad sleep experiences. This was also done by the participant in their mother language and not Dutch.

Table 3 Overview of the drawn-up codes and themes from the focus group

Theme	Sub- theme	Emergent codes
Influences on sleep	Negative	Rhythm Coffee and other drinks Ruminating
	Positive	Sports Technology Rhythm Coffee and other drinks
Who do I ask for help		Family Technology Doctor

Two main themes were identified which were influences on sleep and who to ask for help regarding their sleep experiences. The first theme influences on sleep can be divided into two sections, positive and negative influences. Their daily rhythm for going to bed and waking up at the same time was classified as very important. It has both positive and negative effects on their sleep. When a steady rhythm was sustained a better night's rest was experienced. However, it could also work adversely when you would go to bed very late but still wake up early in the morning. Coffee and other drinks were also mentioned as negative effect on their sleep. A lot of the participants chose to limit themselves with their consumption of coffee. Some positive influences on sleep were also mentioned like talking strolls or watching the news before going to bed. The last theme was where the participants get help from. Family was the most mentioned.

From this focus group more practical knowledge about the target group was experienced by the researcher. This enabled the researcher to show and feel more empathy for the problems and barriers that the target group face. This is very valuable because the researcher has to use and understand the needs of the target group to shape the requirements of the prototype. The gathered sleep related information was useful to determine which information is already present in the target group. This helps to determine where to start with explanations for the topic at hand.

4.3 Application review

The following paragraph outlines the review of the applications using the adapted and combined checklist for data visualizations and accompanying explanations and texts. The original checklists can be seen in Appendix E.

4.2.1 Checklist Data Visualization and Explanation

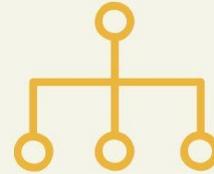
The checklists from Pharos and Stichting Lezen & Schrijven share several common recommendations, such as use language level between A2-B1. However, several aspects focus on the creation of questionnaires or other materials which are not relevant for the research question of this thesis. Thus, a selection has been made to combine these two checklists into one review list for the chosen mobile sleep applications. A new list has been compiled of the overlapping and applicable points of the checklists to this research focus point. This list can be seen in figure 14 below.

ACCESIBLE DATA VISUALIZATIONS



CONTENT

- Do not offer more than 3 new information subjects at once
- Make short but clear sentences
- Emphasise actions and the importance of doing them
- Use language level of A2-B1
- Avoid passive sentences
- Avoid loanwords
- Avoid plier's constructions



STRUCTURE

- Make the information specific and point by point
- Order information recognizable
- Build up information in chronological order
- Choose headings with clear connection to the content
- Emphasize important new information
- Repeat important information in summaries



WORLD OF EXPERIENCE

- Choose specific topics which are recognizable to the reader
- Use words that are appropriate in the context of the text
- Use words that fit in the world of experience of the reader



VISUAL MATERIAL & LAYOUT

- The image and content of the text support each other
- The content of the text and visual materials represent the same information
- The visual materials affiliate to the experiences of the reader
- Avoid distracting details
- choose clear font and font size
- Have enough white spaces and headings
- Align sentences to the left
- Start sentences where possible on a new line

Figure 14 Checklist for accessible data visualizations

The checklist shows that extra material is necessary for the target group to understand more complex subjects like sleep and its influencing factors. It is necessary to explain complex subjects in multiple steps because the target group is capable of receive a limited amount of information. Thus, the explanation of a data visualization should be accompanied by more context of the subject that is discussed in the visualization.

4.2.2 Application analysis

The above drawn up checklist has been put in the table below. For each selected sleep application, the drawn-up requirements have been analyzed in the application. Every requirement was assigned with a score. These scores are between 1 and 5. A score of 1 represents that the applications does not contains the requirement in a satisfactory way. A score of 5 represents that the applications does contain the requirement in a satisfactory way. The results can be seen in the table below.

Table 4 Review of the chosen sleep applications

		Sleep as Android	Sleep Coacher	Sleep Time	Sleep Cycle	Sleep Monitor
Text content						
	New information offer	2	3	2	4	2
	Importance of actions	3	4	2	4	2
	Short and specific sentences from level A2 or B1	3	4	3	4	3
	Avoid passive sentences	1	4	2	3	2
	Avoid loan words	1	1	2	3	3
	Avoid pliers' constructions	1	3	2	3	3
Structure						
	Point by point information	3	3	3	4	3
	Order information recognizable	2	4	1	3	2
	Chronological order	2	3	3	3	3
	Recognizable headings that connect to the content of the text	2	4	4	4	4
	Emphasize important and new information	1	4	2	4	2
	Repeat important information in summaries	1	3	1	3	2

Experiences and context						
	Choose specific topics that are recognizable	3	4	3	3	3
	Appropriate in the context	2	4	4	3	3
	Fit in the world of experience	1	4	3	3	3
Layout						
	Clear font and size	3	3	2	4	2
	White spaces	3	3	2	3	2
	Align sentences to the left	2	4	2	4	3
	Start sentences on a new line	2	3	2	2	2
Visual Materials						
	Image and content of text support each other	2	3	2	3	2
	The content of the text and the visual materials represent the same information	2	2	2	3	1
	The visual materials associate to the experience of the user	1	2	1	4	2
Total		2	3	2	3	2

The first section text content has overall a negative score. Most of the applications do not really explain the application and the presented information. However, it is remarkable that two applications do show better results. Sleep Cycle shows the best results, but Sleep Coacher also shows some promising results.

Most of the applications offer point by point information which makes it easier and more structured. However, the order of the information is not very logical sometimes. Sleep Coacher and Sleep Cycle are again the two applications that score best in this category of structure. Features that all the applications fail in is the resume of the information to recap this information to the user.

The third section is about the world of experience and context of the information from the application. Sleep as Android seems to be doing the worst in this section. This is because the information that it presents is incoherent and does not seem to connect to a lot of known context of daily life. The other applications have more features that connect to the daily life because they also take contextual factors into account for example.

The layout of the applications is designed very differently from the guidelines that have been drawn up. This could of course be the result of the different targeted group which are not in need of such clear structure and layout of the text. However, this is a requirement for the chosen target group. Thus, the results of this section are all quite negative.

The last section is about the visual materials of the application. These visual materials are overall not supported by any explanations or recommendations from the applications. Sleep Cycle is the only application that integrated some comments that were presented together with the data from the sleep of that night. Sleep Coacher tries to communicate recommendations in a different way. Overall, the visualizations are complicated without any elaboration.

The reviewed applications all score neutral at best. It can be concluded that the current sleep applications are in no way accessible to the target group of this thesis. Some sections score a little bit better than others. Sleep Cycle and Sleep Coacher score overall the best in this review. There is overall little explanation present in the applications to support the visualizations and graphics. Another noteworthy aspect of the applications is that there is overall little explanation whatsoever about the subject and the wished health knowledge to start with the application.

4.4 Summary

Now that all the results have been shown and discussed. A small summary will be given of each discussed result. This will include the points of attention for the ideation process.

The existing Pharos interviews were analyzed, and multiple themes were identified. The emotions are very important to take into consideration during conversations with the target group. The next important aspect is to use the appropriate language to create a better understanding. Explanations into the subject are another focus point which could be taken into consideration. The first theme strategic approach is very interesting to take into consideration for the final requirements of the prototype concept. Keeping in mind that explanations through for example images or text that is read aloud could be very beneficial to communicate information through multiple mediums.

During the focus group more sleep related information was gathered. From these results the information from the target group about sleep and related influences was gathered. This helps to determine where to start with explanations about the topic at hand.

The checklist shows that more explanatory material is necessary to understand more complex subjects like sleep and its influencing factors. It is necessary to explain complex subjects in multiple steps because the target group is only capable of receive a limited amount of information. Thus, a data visualization should be accompanied by more context of the subject before the visualization is shown with related data.

The reviewed applications all score in total not higher than neutral. It can be concluded that the current sleep applications are not accessible to the target group of this thesis. Some sections score a little bit better than others. Sleep Cycle and Sleep Coacher score overall the best in this review. There is overall little explanation present in the applications to support the topic of sleep and its visualizations.

From these results it can be concluded that the current sleep applications are not appropriate, and the present information is not accessible for the target group. However, useful information was gathered in this results section which will be used in the ideation to set up requirements for the final product concepts.

Chapter 5 Ideation

In the ideation phase, a final concept idea is outlined. The ideation is highlighted in figure 15 to show how this chapter relates to the rest of this thesis.



Figure 15 Thesis overview

5.1 Specification

The results of the conducted research will be of key interests in coming up with the requirements of the final concept and prototype. The specification will also be processed withing this chapter in subsection 5.2.2 requirements.

5.1.1 Possibilities according to the research

Important aspects were discussed in the results. The most important features to ensure the appropriate transfer of information to the target group should be defined. Multiple requirements were mentioned in different sections of the results. The following three features are specified as important requirements because of the indications given in the previous chapter. These features were mentioned in the checklists, focus group and existing Pharos interviews. These features are:

- Usage of A1 or B2 language
 - o When more complicated words need to be used, explain them to a level that the user can understand them
- Give more user focused information that fits in the world of experience of the user
- Make use of supportive video and image material in combination with texts

One very important aspect that was identified was the appropriate usage of words that are on a certain **language level**. There are major differences between higher educated and their language (namely around C1 or C2) level and low literate individuals. This results in miscommunication because there is no possibility for low literate individuals to understand such language. It is possible to adjust the language and make use of more appropriate language for this target group. However, when new words need to be introduced it is very important to explain these words to the user. This explanation is key for the user to understand the rest of the information that will be provided. This target group finds it harder to understand words outside of their context. This makes it very important to explain more difficult language or new words that are outside of their normal scope.

The **world of experience** is also very important for the target group. When the language and information associates with the user's life and living situations, it becomes easier for the user to get involved with the information. An important aspect of the world of experience of this user is that more steps need to be taken before they are ready to understand the actual information that the whole story will be about. Thus, it is important that the context and situation sketch is done properly and extensively.

Supportive video or picture materials could be very beneficial for this target group. Different senses could be indulged with the information at the same time which could sketch a more complete picture to the user. However, it is very important that the different material convey the same story and in similar ways. Multiple explanations are not very beneficial to the user because it could cause confusion. Thus, technologies make it possible to provide the user with video's and pictures. These could be very beneficial for the target group to understand the information.

5.2 Concept

5.2.1 Concept idea

Based upon the State of the art and the outcomes from the research, a concept idea was drawn up. The final concept idea is based on the following aspects:

- Appropriate use of language
- Supportive video and picture materials
- Affiliate with the user's world of experience

Within the research, the importance of accessibility for low literate individuals was the focus. There is reason to think that when the end user is enabled to associate with the information about sleep the message could be conveyed in a more effective way. The downside is that the process of exchanging information will be prolonged. It will take more time from the user to receive all the information that could be provided. This means that the attention of the user needs to be held for a longer period. It will take more time from the user.

Appropriate use of language

The research that included the analyzation of existing documents and accessibility checklists both stretch the importance of appropriate use of language. Unfamiliar words will miss their intentions because the user will not be able to understand their meaning.

Supportive video and picture materials

The new rise of technology makes it possible to convey a message via different mediums like text, read out loud text, pictures and even a combination of these in a video. The checklist supports that extra materials help to convey the message to the user via different media. This is thus an important aspect that needs to be integrated in the final prototype.

Associate with the world of experience

It is important to make the information subsequently to the knowledge level that the user has about sleep. When the information associates with the user's life and living situations, it becomes easier for the user to get involved with the information.

5.2.2 Requirements

The most important aspects have been presented above which are results from the research. These aspects need to be taken into consideration for the prototype to be made. These requirements are prioritized using the MoSCoW method. This method entails which requirements are a must have, should have, could have and finally won't have [21]. This method shows which initiatives could be released when. A more extensive list of requirements for an accessible and understandable sleep application were drawn up and divided in the categories of this MoSCoW method. This list can be seen

in table 5. The requirements that will be integrated into the prototype are also present in the requirements overview. The prototype for this thesis will not include the creation of an entire sleep application but only a visualization through story telling of related sleep data. Two requirements from the must have and should have categories will be integrated into the prototype. These requirements were chosen because of their connection to the focus of this thesis.

Table 5 Concept requirements

Must	<i>The prototype will not work without these features</i>	Included in user test
	Must have the appropriate language and context	✓
	Must contain supportive video and picture materials	✓
	Mobile application to integrate new materials in	
	Must be able to collect sleep data	
Should	<i>Important aspect but not vital</i>	
	Should provide users with possible actions to improve their sleep	✓
	Should have a clear and non-distracting look and feel	✓
Could	<i>'Nice to have' features</i>	
	Provide the user with pop-up reminders of actions that could improve sleep experience	
Won't	<i>Aspects that can be left out</i>	
	Able to work in different languages	

5.3 Target group

During the design process of the concept for the prototype, it is very important to keep the specific users in focus. Personas and scenarios are a very helpful tool to keep users in focus during this process [22]. In the following paragraphs examples and a day-in-the-life of the end users will be provided.

5.3.1 Personas

A persona is “a fictional individuals created to describe the typical user” [22]. Personas enable the designer to represent a group of end users during design discussions and keeps the focus on the same end goal. When creating personas, it is important to think of all the different types of users. This will protect the designers from building a product around one single user. These user types have been identified in 3.1.2.1 Participants.

In a persona there are several components that could be added and elaborated on. These components are [22]:

1. Identity and photo
2. Status
3. Goals and tasks
4. Skill set
5. Requirements and expectations
6. Relationships

The gathered insights from the focus group and interviews from Pharos were used during the creation of personas. Personas can give a better understanding and insight into the chosen target group. This section portrays two personas: Hans Steenbeek and Sifra Fua.

The first persona portrays the category who has not Dutch as first language. Both personas show the demographics, goals, motivations, and stories of frustration.

Sifra Fua

<p>Age 42</p> <p>Profession Housewife</p> <p>Status Married</p> <p>Residence Enschede</p> <p>Language level NT2</p>	<p style="text-align: center;">Goals</p> <ul style="list-style-type: none"> ✓ Look up information online ✓ Being able to have fun conversations with local residents ✓ Being able to deal with mobile phone and whatsapp 	<p style="text-align: center;">Motivations</p> <ul style="list-style-type: none"> ➤ Join society ➤ Understanding medicine leaflets ➤ Attending and understanding my children's parents' night ➤ No more feeling shame for my language level
--	--	--



Frustrations

Ask for help from bystanders and family. I've always said, I don't want to be embarrassed about anything. I'll never say I'm a computer expert when I know I can't do it right. If I looked at a keypad, I'd get tired of it. It had so many buttons and I didn't know what to do with it. I also didn't feel like someone was helping me with it. But nowadays I often ask my children to explain something to me.

Nervous about going to a doctor or dentist. Making the appointment was already difficult for me. I lost my way on the internet more often when I tried to make an appointment. But now that my doctor knows that I am low literate, they help me with that. Now I am much less nervous because they know much better how to get out of it together.

Figure 16 Persona Sifra Fua [23]

The second persona portrays the second category that have Dutch as first language.

Hans Steenbeek

<p>Age 52</p> <p>Profession Factory worker</p> <p>Status Married</p> <p>Residence Enschede</p> <p>Language level NT1</p>	<h3>Goals</h3> <ul style="list-style-type: none">✓ Reaching NT1 Dutch level✓ Being able to read machine manuals at work	<h3>Motivations</h3> <ul style="list-style-type: none">➤ Be able to read machine manuals at work➤ Being able to read traffic signs on the road➤ Being able to support my family
	<h3>Frustrations</h3> <p>Not understanding government affairs. They say that this is very easy to do digitally. But I don't have a computer at all and my digital skills are not that good. I'd like to find out with help then. Then I get the feeling that I will be appreciated while otherwise I will be put on hold. Because of that disappointment I don't need it anymore.</p> <p>At first, I didn't even know I was low literate. I wasn't very good at reading and writing. But I usually managed to do it in a different way or my wife filled in the forms. Until at some point I had a problem and I didn't know where to go to solve it. Who could help me and who should I tell this to? But my doctor could help me and refer me. Translated with www.DeepL.com/Translator (free version)</p>	

Figure 17 Persona Hans Steenbeek [24]

5.3.2 User Scenario

User scenarios can give a better insight into the main purpose and usage of the tool. A scenario be an explicit representation of a hypothetical use situation [22].

Scenarios can be written based upon 5 aspects:

- The individual's user (i.e., the persona)
- The task or situation
- The user's desired goal
- Procedure and task flow information
- Time interval

Two scenarios have been written, one for each persona. The situation of the personas differs from one another but the task at hand is the same. The desired goal is to understand more about their sleep and how to improve their sleep experience.

Scenario number 1: Sifra is having trouble sleeping. However, she finds it hard to understand information about sleep on the internet. This is when her Dutch teacher introduced her to the mobile application Sleep Explainer. The application gives her the option to choose between sleep influences like stress, pain and more. Sifra would like to know more of the influence that rhythm has on her sleep. Because of her young children she is disturbed a lot during the night. When the theme was set to the influence rhythm, a series of videos could be watched that will each focus on explaining the chosen influence and how to act upon this information. Sifra chooses to watch the first video of the series. This video gives her an introduction on the chosen influence and its importance. The video is three minutes long, so she needs some time to watch it. The information from the introduction video is somewhat known to her and thus very recognizable. The information is read aloud with the support of some accompanying text and pictures. She got distracted once during the video because of her kid. She paused the video to check what was wrong. After this distribution she recognized the pictures on the video which made it easier to remember what the video was about. After she has watched the rest

of the video. She can choose to watch the video again or go back to the rest of the videos. This video was easier to understand than any of the information that she found on the internet. Now she can listen to the video's whenever she has time to learn about ways to get a better night's rest. The next video introduces actions that are important to take to have a good rhythm. She will watch that movie the next time to learn more about her sleep. This way she understands the information which she can re-watch whenever she has time.

Scenario number 2: Hans is having trouble sleeping because he has a sore back at the end of the day. However, he finds it hard not to think of his pain when he goes to sleep. This is when his doctor introduced the mobile application Sleep Explainer to him. The application gives him the option to choose between sleep influences like stress, pain and more. Hans would like to know more of the influence that pain has on his sleep. When the theme was set to the influence pain, a series of videos could be watched that will each focus on explaining the chosen influence and how to act upon this information. Hans chooses to watch the first video of the series. This video gives him an introduction on the chosen influence and its importance. The video is three minutes long, so he needs some time to watch it. The information from the introduction video is somewhat known to him and thus very recognizable. The information is read aloud with the support of some accompanying text and pictures. He got distracted once during the video because his wife asked if he wanted some coffee. He paused the video to answer her about the coffee. After this distribution he recognized the pictures on the video which made it easier to remember what the video was about and he watched the rest of the video. He can choose to watch the video again or go back to the rest of the videos. This video was easier to understand than any of the information that he found on the internet. Now he can listen to the video's whenever he has time to learn about ways to get a better night's rest. The next video introduces actions that are important to take so that he can learn to deal with the pain and have a better night's rest. He will watch that movie the next time to learn more about his sleep. This way he understands the information which he can re-watch whenever he has time.

Chapter 6 Prototype realization

This chapter will show the process of the prototype realization. The process flow can be seen in the figure below. This also gives perspective how this chapter fits into the whole thesis.



Figure 18 Thesis overview

To develop a suitable prototype, design options need to be investigated that could be useful to support the drawn-up requirements. The first design option that needs to be explored is in which way do we want to tell the story to the end users. Thus, some research into story telling was done. Previously stories typically were told and put on paper. This was done by writing or typing at a typewriter or computer. However, the new technologies have enabled new methods to tell stories in a different way. These modern media are applications like Twitter or YouTube. Nowadays storytellers can craft tales in ways that was not possible two decades ago.

Different story telling techniques were investigated. However, it is important to create a realistic picture of the possibilities that could be useful to support a sleep visualization and its elaborations. The following options were explored and found by doing internet research:

- Comics/strips
- Video
 - o Animations
 - o Life action
 - o Vines

The first option comics or strips make use of pictures that are accompanied by text. The target group will via this option have two different inputs. The written word is most of the time challenging. However, pictures have the possibility to support the written word.

The second option is to use videos to convey the story. Different video styles are possible. However, vines which are short movies would not be the most appropriate for the intended purposes of this video. The video should communicate a larger story. This can be done properly via a life action or animation movie.

6.1 programs and applications

In order to produce a video or so-called supportive tool for sleep visualizations the program Canva¹⁰ was used. Canva is a program that enables its users to design anything and publish anywhere. The tool provides its user with drag-and-drop features to create professional layouts to design graphics. Canva provides free media for commercial and noncommercial use. The provided media can be edited in any way possible that the program can support. Canva makes use of the following features¹¹:

¹⁰ <https://www.canva.com>

¹¹ Only the features used for the prototype are explained

- Templates: this function offers the user multiple different prefabricated options to use as basis. Most of the templates are wrapped around one theme but these themes are open to deviations that the user might want to adjust.
- Uploads: it is possible to upload your own set of materials. This can range from picture and video materials to voice recordings.
- Elements: in this feature it is possible to search for prefabricated elements like animations.
- Text: text adjustment was offered in this function.

See figure 19 below: this is an example of an intent to start a new video using a prefabricated template.

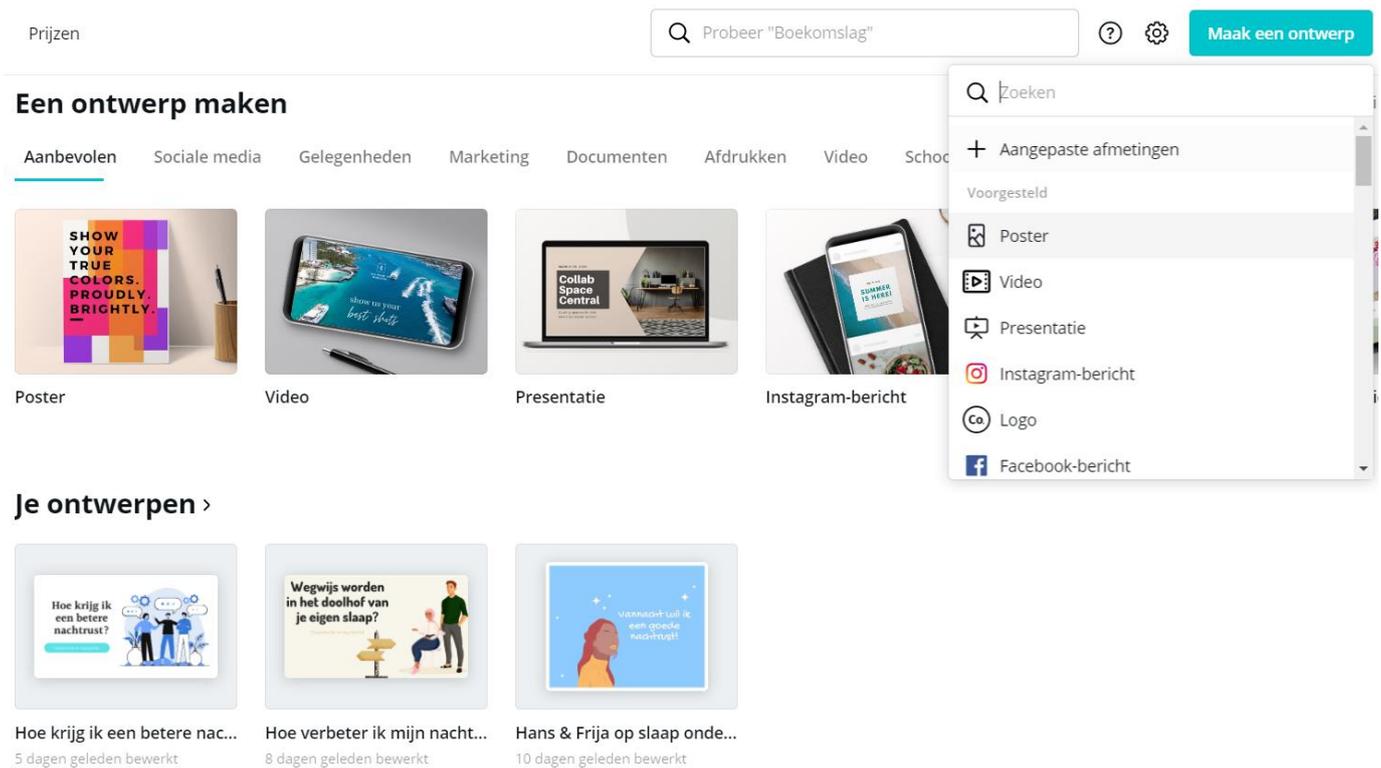


Figure 19 Example: start a new project in Canva

Figure 20 shows the layout when the new project was started. This is when the designing of the video begins. Existing images and templates can be used as basis to create your own new video. Figure 21 shows all the mentioned features. These features were used to create the video.

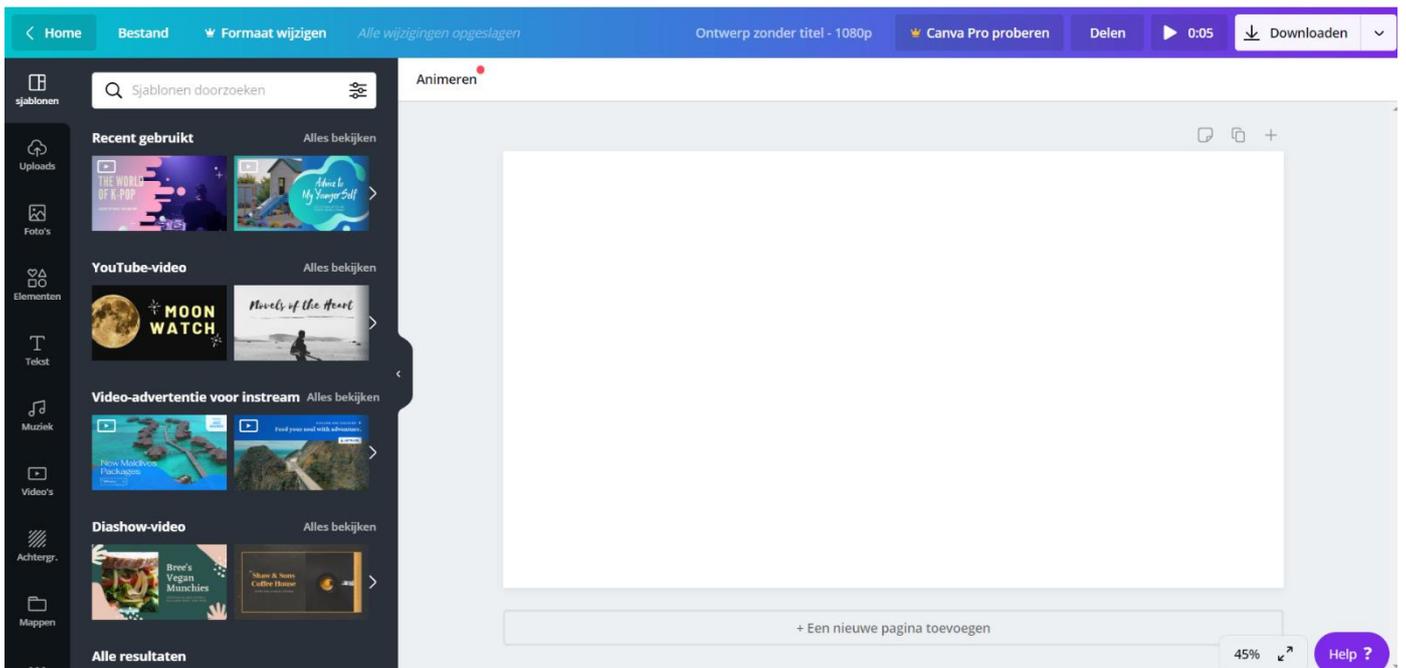


Figure 21 Example: the layout of a new project in Canva

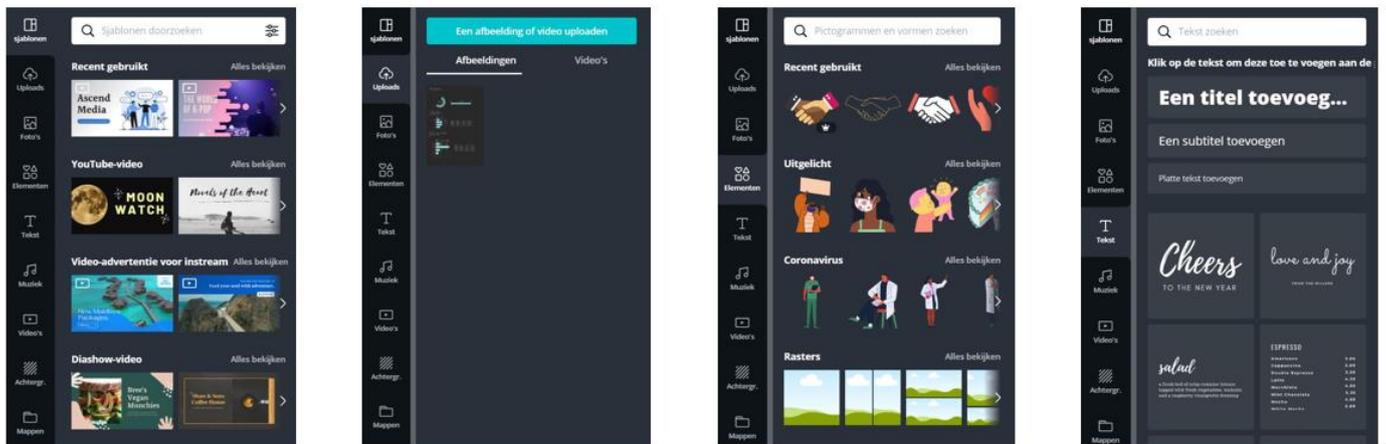


Figure 20 Example: used features - templates - uploads - elements - text

6.1.1 Video flow

The video flow is very important because this should contain explanations about the subject and visualization. This is crucial to enable the target group to understand the visualization. The following sections were determined to support the flow of the video.

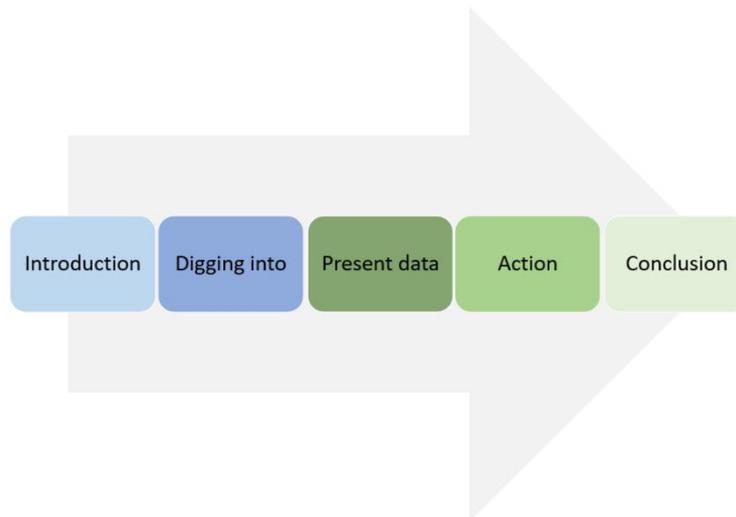


Figure 22 Video flow

The introduction should introduce the subject that will be discussed during the rest of the video. In this case; why 8 hours of sleep is beneficial. The health benefits are also mentioned during this section to create the correct expectations for the next section. The second section, digging into, will talk about the health benefits that a person experiences when the proper amount is slept per night. These health benefits were connected to three big systems in the body. These systems were the brain, heart and vessels and the immune system. This information was gathered from the book 'Why we sleep' from Matthew Walker [25].

The second part of the video talked about data that is connected to rhythm. This data is the time that a person wakes up and the time a person falls asleep. This is also the section where the data visualization will be brought into the video. The visualization will be analyzed to explain how this data can help us to draw conclusions about sleep. This analysis is also a small heads up to the action that is introduced in the next part. An action will be introduced that connects to the data that is discussed before. In this case, the suggestion is made to support your rhythm by watching your bedtime and waking up time. Two options are given to create more flexible recommendations for the user. The video concludes with a short recap in which it questions the user to think about their own sleep and physical state during the day because if not the video offers to go on a journey to search for a better night rest.

6.2 Development

The drawn-up requirements from chapter 5 for the concept of the prototype should be integrated. The following paragraphs will highlight how these requirements were implemented into the prototype.

6.2.1 Video topic

Based upon the different possibilities of topics and actions for the target group, a prototype can be built. However, it became quite clear that sleep and its influences are very broad and complicated to explain and understand. With the help and knowledge of the book 'Why we sleep' from Matthew Walker more information could be explained in a sensible way [25].

The sub-topic of the video is very important to determine. This topic will be a factor that influences sleep. This topic should connect to the world of experience of the target group which was stated as a requirement in chapter 5. Multiple options were explored like rhythm or coffee intake.

6.2.2 Video Language

The video must be in Dutch to be understandable for the target group. The language level should also be appropriate which results in language that has to be in between the level of A1 and B1.

Language level A1 means that the language is very simple. The sentences are often separated by breaks. The speaker speaks carefully, slowly and in clearly articulated standard language. Texts should be short and very simple. The topics should be very familiar.

Language level B1 means that the language has sufficient vocabulary to express oneself. Most topics related to the daily life of a person life such as family, leisure, work and travel are familiar. The meaning from unfamiliar words can be understood partially from the context of the words. The speaking rate is normal. However, the speaker still needs to articulate clearly.

6.2.3 Visual materials

Different media are relating and supporting each other at different parts of the video. Extra visual materials to support spoken and written language will be used when possible. This is very important to help the viewer understand as much as possible from the information of the video. When for example parts of the body are discussed, this could be supported by showing this body part with an animation or picture. The visual representation often communicates very clearly the subject of the current information. This could be helpful for individuals who are often or fast distracted by their surroundings.

However, not all visual materials could be conceived as very supportive. For example, data visualizations could be conceived as complicated to comprehend. Thus, it is of great that such visual materials are being supported in a proper way. Accompanying text could highlight important features like the axis of the visualization. Spoken explanations could also help the user to comprehend a visualization in a better way. It is also important to guide the viewer towards a conclusion that is supported by the visualization. Individuals might have difficulty with drawing conclusions from data representations which should be supported. This could be done by involving them and explaining the conclusion.

The data visualization that is used within this prototype was designed by Laura Maškanceva during her graduation project named “Developing understandable and actionable sleep tracked visualizations”. The original design of the data visualization can be seen in figure 23.

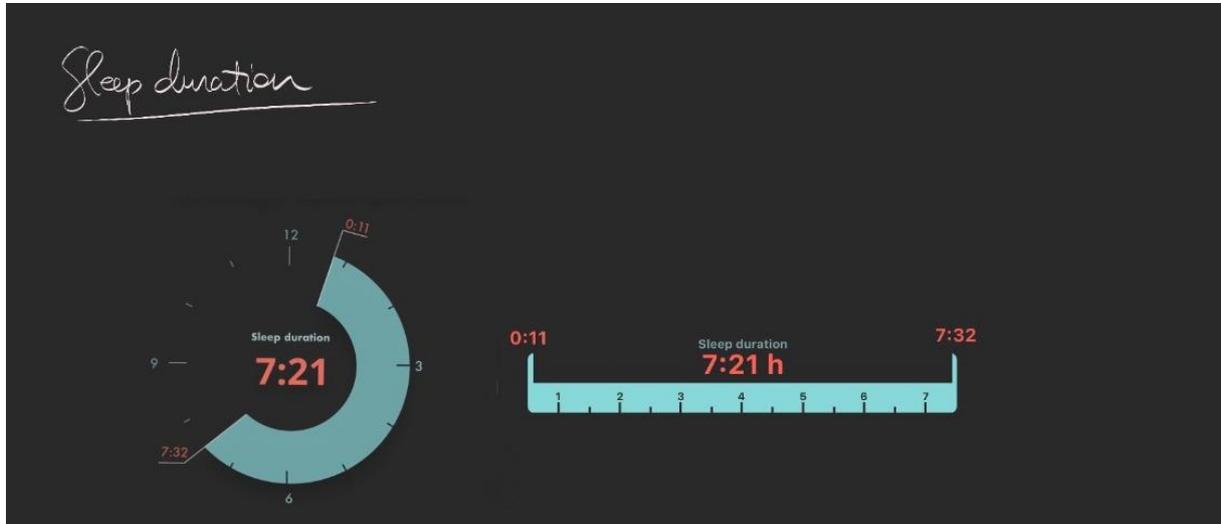


Figure 23 Sleep data visualization by Laura Maškanceva.

Some small modifications were done with the granted permission of Laura Maškanceva.

6.3 The final prototype

The final prototype is a supportive video that gives the user more information about sleep and factors that cohere and influence it. The following storyboard in figure 24 shows the different sections of the video.

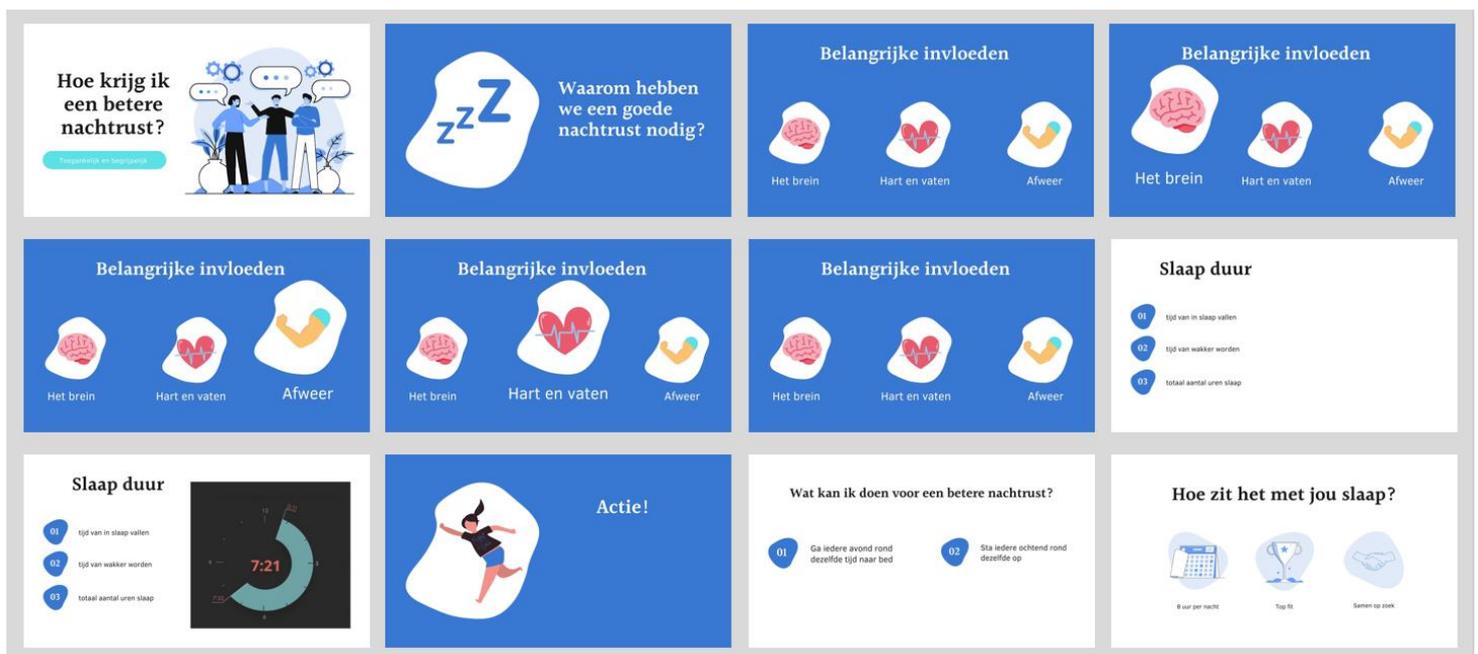


Figure 24 Story board final prototype. Top left is screen number one and bottom right is screen number twelve

As was discussed during the video flow, different sections are present in the video. Screen number one and two represent the introduction in the subject sleep. Then, the important influences are explained in screen three to screen seven. The explanation of the visualizations is done in screen eight and nine which then connects to the action that is explained in screen nine and ten. The video ends with the reflection to the user and a small summary which can be seen in screen twelve. The complete text of the video can be found in Appendix F.

Chapter 7 Evaluation

This chapter will discuss the testing of the prototype with the target group. Due to the COVID-19 measures, it was more difficult to find participants who were able to join the user test. Due to the restrictions the whole user test had to be rearranged to a digital user test. This was for some of the participants to complicated and were not able to participant or finish the user test. Therefore, secondary users namely experts were used to enlarge the user test group and to get more result about the prototype.

In the figure below, the ideation is highlighted to show how this chapter is related to the rest of the outline of this thesis.



Figure 25 Thesis overview

7.1 User testing

To see whether low literate individuals would be able to understand the information and explanations in the video, an assessment was done in a lesson group from Taalpunt Enschede. The video was sent to the participants by email. This email included a basic introduction of the research and how to download and watch the movie. The interview focused on the ability of the participants to understand the information that the video contained.

7.1.1 Participants

In chapter 3 method it was mentioned that a contact was established whit the foundation Taalpunt Enschede. This contact was very useful during the final testing of the prototype. Three participants from this lesson group were interested in participating in this research.

Two of the three participant were male. The estimated age of the participants ranged from 45 to 55 years old. All of the participants had Dutch as a first language and thus are from the category of NT1.

7.1.2 Procedure & format

Before any of the participants could be contacted, the volunteer who is leading this digital skills course was contacted. The research and user test were discussed and explained during multiple email exchanges. To speed up the process, the details of the user test were discussed over the phone. The volunteer still had contact with the participants during the COVID-19 period. However, this communication was lacking the intimacy that was present during the face to face lessons. Luckily, some locations started to open again with new COVID-19 measures. This enabled the volunteer to introduce my research to his lesson group.

The volunteer provided the researcher with contact details to start up the one-on-one contact between the participant and the researcher. Through a first contact moment the researcher discussed whether the participants thought that they would be able to participate. The digital medium was also discussed that could be used during the user test.

Through the discussed medium, which was email, the researcher sends the participant the user test video. Instructions were present about how to download and open the video so that the participant could watch the video on their own. Another safety net was set up to make sure the participants were able to watch the video. This was done by asking the volunteer to discuss during his lesson group if everyone was able to watch the video. The video was not discussed further.

7.1.3 Questions

There were in total 15 questions divided over 6 different sections. Each section had its own theme. All the questions were open questions.

The goal of the questions was to check whether the information from this section was picked up by the participants. The alignment of the speech, images and text was another focus point which is discussed in question 13. With question 14 the researcher tried to test whether the participant could connect the information from the video to their own experiences with sleep. The complete set of questions can be seen here:

Introduction

- What was the subject of the video?
- What was the goal of the video?
- How long is a good night's sleep according to the video?
- Did you hear anything new in the video?
 - o Follow up: what was this?

Health benefits

- What health benefits did you understand from the video about your brain?
- What health benefits did you understand from the video about your heart and vessels?
- What health benefits did you understand from the video about your immune systems?

Action

- Not related to the video: do you know how long you sleep?
 - o Follow up: how do you know how long you sleep?
- Did the video show you any new methods to know how long you sleep?
 - o Follow up: which new method did it show you?
- Which conclusion was drawn from the clock image?
- How could you improve your sleep according to the video?

Layout

- Did you find elements of the video distracting?
- Did the images, speech and text convey the same message to you?

Personal

- What did you think of the video?
- What did you find best from the video?

7.1.4 Results

The first section of questions checked if the goal and main subject of the video was communicated to the viewer. The results from this section can be seen in the form of a transcript in Appendix H. The results indicated that the participants knew 8 hours of sleep is recommended for a good night's sleep. The fourth question asked about their awareness of the information from the whole video. It was surprising to hear that most of the given information was known to the participants. This could indicate that this is the correct level to start explanations in this subject.

The second section focused on the explanation of the health benefits. The participants mention that they were aware of the health benefits when the proper amount of sleep is reached. However, the participant found it hard to give back the details about the explanations of these benefits. This could indicate that all this information was much to remember for them. One participant also mentioned at this section that some of the information was new to him which he did not mention in the beginning of the interview.

The next section focused on the offered action in combination with the clock visualization. The offered method was to know what the duration of the sleep per night is. This method was not new to both participants. Both participants explained that keeping a good rhythm would not improve their sleep because that was not their experienced issue that negatively influences sleep. The mentioned influences of the participants were pain and preferred sleeping time. Through the results of this section it became clear that these factors were leading in their opinion of usefulness of the video. Another important part of this section was about the clock visualization and the conclusions that was drawn from it. One participant mentioned that he had difficulty with analog clocks in general. However, because of the accompanying text and explanations he was able to understand the information that was communicated. Both participants remembered that this part of the video drew conclusions about the duration of the sleep.

The combination of speech, text and images was experienced as very beneficial for the communication of the information. The participants were mostly not distracted by the different mediums. They also thought that the same messages were communicated through the different media. One of the participants did mention that for him the clock is not a very useful addition because he is not able to read them correctly. One other detail was mentioned at the end namely the moving little clouds around some of the images. The first time that the participant watched the movie he did not find it distracting. However, it is easy to watch at this detail instead of the given information from the video.

In the last section there was room to discuss the personal opinions of the participants. Both participants emphasized on the fact that the video was very short. The fact that not much new information was given was experienced as a small disappointment to the participants. However, both participants were glad that the video was very clear to them and expressed the idea that this would be more accessible to people with less language and health knowledge.

From the three participating individuals, one participant was not able to download the video with the sent explanations. A safety net was put in place before hand by the researcher together with the volunteer leading the digital skills course. However, it did not become known to the voluntary teacher that the participant had not seen the video. Otherwise he would have helped to complete the download before the planned appointment between the participant and the researcher. During the planned appointment with the participant, the steps to download the video were still not understood which apprehended the occurrence of the user test.

7.2 Expert review

Due to the COVID-19 measures it was more difficult to encounter the end users. However, a bigger pool that represents more of the end users is beneficial to the testing process. Thus, an analysis was done to see whether proxy users or secondary users could be involved in this study. Proxy users were soon discarded because of the empathize level that they would need to establish. Secondary users were therefore considered and invited to participate in a user test designed for them. These user tests were designed to focus more on general aspects of the video. This entails that the check of information transfer was not integrated into their user test. The expert's reviews were designed to get more information about the requirements that were integrated into the video and if these were met in an acceptable way.

7.2.1 Participants

The participants were found by contacting Pharos and Stitching Lezen & Schrijven again. Two participants came forward who have more experience working with the intended end user. Eline Heemskerk had experience with working on digital tools for the target group. Jolanda Beernink had significant experience with communicating with the target group.

Both participants were female. The estimated age is around 35 years old.

7.2.2 Procedure & format

Through contacts from Pharos the researcher received contact details of Eline Heemskerk. She indicated to have interest in participating in the user test. Through Stitching Lezen & Schrijven the contact details of Jolanda Beernink were received who also showed interest in participating. Both experts received via email the Information Brochure and consent form. These documents can be found in Appendix I. Next the one-on-one interview was planned and discussed which medium to use. The test video was sent to both participants via email.

7.2.3 Questions

There were in total 8 questions and were open questions. The goal of the questions was to discuss the different aspects of the video.

1. Which aspects of the video could, in your opinion, be less suitable for the target group?
2. In your opinion, do the subjects of the video fit into the perception of the target group?
3. Do you find the level of information in the video adequate for the target group?
4. Does it connect to the world of experience?
5. Is the information accessible?
6. Is the explanation accessible enough?
7. Can you say something about the clarity of the image, speech and text of the video?
8. Do you have any improvements to the video?
9. In terms of content
10. In terms of layout
11. Did you find the length of the video appropriate to the user group?
12. Do you have any last additions you would like to suggest for this video?

7.2.4 Results

The results of the interviews can be found in Appendix H. Unfortunately, no complete transcript could be made from these expert reviews.

The questions to the experts did not have clear sections. However, the results will be discussed based on the different aspects that were important from the video. These aspects are mentioned as requirements of the prototype, associate with the world of experience, appropriate use of language and supportive video and image materials. The last section will include more comments of the experts that are not related to these specified sections.

The first category is if the information would associate with the world of experience of the end user. The health benefits were discussed most in this section. It was mentioned that these topics are not inappropriate to the end user. However, it was not completely clear from this video that there could be follow ups that would discuss different factors that influence sleep. Topics like stress or pain were mentioned to be maybe closer to the end users. However, this is very personal and to determine these factors, more focus groups could be conducted.

The use of language was the next aspect that was discussed. It was clear to both experts that effort was put into this element of the video. The speech was one factor that was mentioned by both experts. The pacing was very appropriate. The extra pauses that were integrated into the video were also seen as good benefits because it gives the user time to process the given information. One of the experts mentioned that some synonyms were used. It was recommended to choose between the options and to be more consistent.

Overall, the combination of the three different media was reviewed as very useful and complementary. The use of images was strengthening to the communication of the subjects. The moving clouds were discussed by Eline Heemskerk because they could be distracting. However, Jolanda thought that they did fit in the layout of the rest of the video and make it more playful and interesting to watch. Thus, the opinions clashed regarding this point. The clock visualization was also a point of attention. The explanation of the times that were indicated in this image were appropriate in the opinion of both experts. However, both experts doubted if the end users could link these two times to the conclusion about the duration of sleep. They thought that this was one step too far. They did find that the viewer was included in drawing the conclusions of the video.

Other remarks that were made about the video were that the length seems very appropriate because of the attention span of the end users. Eline Heemskerk did think that there were a lot of discussed topics which makes it hard for the end user to switch from one topic to the other. In her opinion it was more appropriate to divide the video even further so that one video only has one topic that is discussed.

7.3 Requirements evaluation

In chapter 5 ideation, a list of requirements for the prototype was set up. Considering the outcome from the prototype user testing and expert review, the initial requirements will be reviewed.

Table 6 Evaluation concept requirements

Must	<i>The prototype will not work without these features</i>	Included in user test	Outcome
	Must have the appropriate language and context	✓	½
→	<i>The user test and expert review indicated that the information was more accessible and understandable because of the lower language level. The context and topics that were discussed did not were as personal as intended. Thus, the personalization is very important to look into and improve upon.</i>		
	Must contain supportive video and picture materials	✓	✓
→	<i>The extra picture and video materials added to the prototype were reviewed as supportive and beneficial.</i>		
	Mobile application to integrate new materials in		
	Must be able to collect sleep data		
Should	<i>Important aspect but not vital</i>		
	Should provide users with possible actions to improve their sleep	✓	✓
→	<i>The provided actions in the video were understood during the user test.</i>		
	Should have a clear and non-distracting look and feel	✓	✓
→	<i>The user test participants and experts both were positive about the whole looks and feels from the prototype video.</i>		
Could	<i>'Nice to have' features</i>		
	Provide the user with pop-up reminders of actions that could improve sleep experience		

Able to work in different languages

7.4 Discussion

The goal of this project was to investigate new media to communicate more appropriately with low literate individuals about sleep visualizations. This has been conducted in a step-by-step approach, which led to a final prototype and design requirements. The project had some implications which need to be discussed.

The State-of-the-Art research and literature review led to the insights that the information offer of existing sleep applications is not accessible to the target group low literate individuals. Research was needed into the experiences of the target group with complex health information. Existing materials provided guidance. This gave the researcher a better understanding of the support that is necessary in the communication with low literate individuals. Then an online focus group was conducted with 6 participants from the NT2 category and a voluntary teacher. Only the NT2 category of the target group was represented in the focus group. Follow-up research could be conducted to get more input from the other category, NT1. This part of the research provided information for the first sub-question: Which important features need to be considered when designing better visualization for low literate individuals? With this information a new accessible information checklist was developed which formed the basis of requirements for the prototype.

The results of the analysis of existing materials and focus group were used as a base for the Ideation and Realization phase. Most of the gathered materials already existed and are not the result of newly conducted research. For more up to date research, more interviews and focus groups would be ideal. The three final requirements that were drawn-up for the concept were, world of experience, appropriate language and supportive images or video material. These requirements needed to be considered during the design explorations of storytelling methods. The integration of these requirements set the boundaries for the design explorations which is the conclusion of the second sub-question: What are the requirements for the communication of such a visualization?

The requirements that were determined for the prototype set the boundaries for the design options. However, some options were explored with the third sub-question in mind. To help understand the challenges of the target group, personas and scenarios were introduced which led to the final prototype scenario. The construction of the video was conducted with the prototype scenario in mind. The topic and information of the video were chosen based upon the information from Matthew Walker and the requirements and level of the target group were taken into account [25]. This could mean that some relevant information about sleep was not considered. In a second version of the prototype, a bigger variety of topics should be available to choose from by the user, thus creating more personalization.

The researched conclusions supported that more accessible communication approaches are needed to improve the transfer of information to low literate individuals. The end user assessment and expert review gave a good understanding of the current status of the prototype. However, the pool of participants was very limited in this study. Understanding the information is of great importance and the main focus of this thesis. Having more supportive materials, offering more information during communications was perceived as very interesting and beneficial. Whether someone would use the more accessible sleep application really depended on the usefulness of the information for them. The factors that influence sleep differ a lot per person which means that the sleep application should be

able to adapt to more personal settings. Next to that, a series of movies could be more appropriate to the target group such that each movie focusses on one topic instead upon the whole process of improving their sleep. Possibly the application could suggest a sleep factor to start with, but in the end the user's choice is leading.

Overall, the results from the user tests were positive, indicating that the requirements were met to at least a certain extent. The requirement "world of experience" was not met to the level that was intended. Next to this, a few small detailed comments were given during the expert review on the other two requirements. However, the set requirements for the prototype we identified as appropriate to the target group.

7.5 Limitations within the studies

There have been a few constraints within the research, target group and prototype. The number of participants engaged in the research was uneven distributed over the target group categories. The participation in the focus group and user tests were not evenly divided between the NT1 and NT2 categories. In the focus group only participants from the NT2 category were present. This was because at this time only participants from the NT2 category were willing to participate. This may have caused a biased result because the normal distribution of the target was not met. During the preparation of the user test of the prototype only the NT1 category could be recruited to participate. This led to the enlarging of the search for participants for the review of the prototype. Expert reviews were chosen as the extension of the intended user test to enlarge the testing pool.

The reason for the low participants number could partially be caused by the obstacles that were created by the COVID-19 measures from the government and University of Twente. The target group of low literate individuals experience difficulties with the use of digital tools like email or skype. In fact, all the contact that was conducted with the participants of this research was through digital applications. This might have resulted in a lower participant number and less accessible user tests. The less digitally skilled individuals that are present in this target group were not able to participate due to the measures. The exclusion of this part of the target group could mean that the target group was not completely represented during this study.

During the final prototype user test, no digital environment from a sleep application was present. The users had to download the video themselves and imagine that this video would be presented to them in a digital sleep application. This is a lot to ask from this target group. The use of an applications digital environment could possibly stimulate more understanding of the intended purpose of the video. Presenting the video prototype in unrelated digital environment may have had an impact. Another limitation that was caused by the lack of an existing sleep application was that no real data from the user could be gathered as feedback. The prototype uses proxy data which are not real data obtained from the user during the user test. This video could hold more individualized information that would be more motivational and insightful to the user.

Chapter 8 Conclusion

This is the final chapter of this thesis, as indicated by figure 27. In this chapter the research question will be answered. Sub conclusions will be presented based upon the most important results.



Figure 26 Thesis overview

The goal of this project was to improve the communication towards low literate individuals about sleep and its accompanying data. The stated research question and sub-questions at the start of this thesis were:

How can a visualization through story telling support a low literate individual to improve their sleep experience?

- *Which important features need to be considered when designing visualization for low literate individuals?*
- *What are the requirements for the communication of such a visualization?*
- *What are most suitable design patterns for sleep visualization that would be actionable for low literate individuals?*

8.1 Research questions

The first sub question enabled the researcher to create an overview of all the important features. These features are faced by low literate individuals in their daily life when they must interact with complex information. This led to the second sub-question in which a set of requirements were determined and would be further investigated in the user test. These requirements are necessary for the target group to understand the given information by a digital application. These three requirements are world of experience, use of appropriate language and supportive video and picture materials. With the answers to the first two sub-questions, it was possible to answer the last sub-question. An animation video was then created. This option was the most appropriate design option for the final prototype because of the combined media speech, text and picture materials.

The testing pool was limited however, and points of improvements were agreed upon in the user test and expert review. The main point of improvement was about the personalization and individualization of the prototype. The main research question was about the support that visualization could receive from accompanying explanations through storytelling and whether the understanding could lead to improved sleep experiences. The support of visualizations through storytelling was investigated through a user test with the first video concept. The results show that supportive materials are necessary for the target group. Application of these materials improves the transfer of information. However, the second part of the main question could not be investigated. The improvement of sleep was unfortunately not confirmed by the user test and expert review because the sleep of the users could not be investigated. The results confirm that a visualization through story telling does support a low literate individual to understand the given sleep information.

8.2 Recommendations for future work

Based upon this study, several recommendations for future research can be made. These recommendations will be discussed in the following paragraphs.

As mentioned in the discussion during both contact moments with the target group, no normal distribution of participants was acquired. There was an opportunity to get a proper set of participants through the test panel from ABC Ambassadeurs. However, no funds were present during this research which made it impossible to make use of this opportunity. Future studies should consider the use of this test panel to create a proper set of participants for a user test.

A lot of existing research advises against the use of graphs, tables or diagrams with this target group. However, more insightful and accessible visualizations with accompanying explanations should be investigated because it could enable the target group to understand new information. Data types that would be more appropriate to this target group are still unknown. Research into data types that are more appropriate to this target group could stimulate better communication.

Personalization was the main point of improvement resulting from both the user testing and expert reviews. Personalization and individualization could be developed in multiple ways that dive into different study areas. One main aspect is that there would be a need for input from the user. This could take shape in different ways. It is very important to give the user more control over the topics of sleep that are discussed in the video. Sleep and its influencing factors form a very broad topic, which makes it important to focus.

Personalization could also be achieved in a non-active way. Meaning that the user is not choosing the topics consciously. Data from the user could be collected so that sleep recommendations could be developed. To take this a step further, contextual factors could be used as input of the video. During this study no real-life data gathering was done which could be explored in following studies.

The design of an accompanying sleep application could be very beneficial for the integrated use of the now stand-alone video. The gathered materials in this thesis already present a lot of information about digital applications and suggest that they are not very accessible for low literate individuals. Thus, more research into health applications and their accessibility is of great importance to support this target group.

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Appendices

Appendix A: List of contextual factors

Factor list:

- Coffee
- Alcohol
- Mood
- Stress
- Tiredness
- Digital Devices
- Light
- Nap
- Social Activities
- Body Temperature
- Hormone cycle
- Ambient Temperature
- Ambient Humidity
- Exercise Time
- Dinner Time
- Dreams

Appendix B: Transcript Pharos video's

Video 1: bij de huisarts: laaggeletterdheid en gezondheid: ex-laaggeletterden vertellen hun verhaal

interviewer	Janssen kun jij iets vertellen over je ervaring bij de huis arts?
janssen	Ik maak meestal dubbele afspraken en ik neem goed de tijd. Een goede band met je dokter is heel belangrijk. Dus die band opbouwen probeer ik te doen. Dat is het belangrijkste wat je kan doen. Hij moet jou overal naar doorverwijzen. Hij kan voor jou de weg sturen.
interviewer	Ben je nog zenuwachtig als je nog naar een specialist gaat?
janssen	Nee niet meer.
interviewer	Vroeger wel?
janssen	Ja vroeger wel omdat ik dingen moest vertellen. Maar nu maakt de dokter een hele mooie brief op. En daarin verteld hij dat ik laaggeletterd ben en dan weten ze dat. Dat zou iedere huisarts met zijn patiënten moeten doen.

Video 2: laaggeletterdheid en schaamte | ex-laaggeletterden vertellen hun verhaal

Deelnemer 1	En dat stuk schaamte. Dat is zo enorm groot en heel veel mensen beseffen ook niet hoe beperkt ze zijn. En zo lang ze het besef zelf niet hebben.
Deelnemer 2	Nee ik schaam me er natuurlijk nooit voor. Ik heb er nooit geen problemen mee gehad. Maar als ik iets soms moet invullen en niemand mij wil helpen. Dan schaam ik mij daar wel voor. Maar ik vind het ook niet erg als iemand me erop aanspreekt dat ik laaggeletterd ben en niet goed kan schrijven. Mijn dokter zegt ook dat het belangrijk is om het mensen te vertellen.
Deelnemer 3	Bijvoorbeeld 20 jaar terug en nu is er een heel verschil. Want als toen iemand zei ben jij laaggeletterd dan reageerde ik extreem met ik kan echt wel lezen hoor. Maar ik kan dus niet goed begrijpend lezen. Woorden lezen lukt nog wel. Maar het begrijpend lezen van teksten heb ik nog steeds moeite mee. Maar vroeger schaamde me ik er echt voor. Vroeger had je dat niet bij mij er door kunnen prikken. Tenzij het een goeie huisarts dat zou doen als die ik nu heb bijvoorbeeld.

Video 3: taalgebruik aanpassen | laaggeletterdheid en gezondheid: ex-laaggeletterden vertellen hun verhaal

interviewer	Jij bent laaggeletterden, ik weet dat. Je bent een moeder en komt naar mij toe en zegt mijn kind slaapt niet goed of eet niet goed. Hoe moet ik dat dan aanpakken?
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Deelnemer 1	Als je weet dat zij laaggeletterd is kan je manier veranderen. In een simpele vorm communiceren. Niet zoals tegen een kind maar gebruik simpele woorden. Zodat je denkt dat zij dat begrijpt. Als je praat met een hoogopgeleid iemand en jijzelf niet dan pas je je woorden aan elkaar aan. Je kan je woorden naar beneden brengen. Op het hoge niveau blijven praten begrijpen wij niet.
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Video 4: medicatie gebruik | laaggeletterdheid en gezondheid: ex-laaggeletterden vertellen hun verhaal

deelnemer1	Als jij bijvoorbeeld ziet dat de zalf die je aan mij gegeven hebt niet werkt. Als het zo erg wordt dat ik het maanden lang even opzij zet en het daarna pas weer gebruik. Als ik dan terugkom met dezelfde klachten, dan moet je even aan mij vragen of ik de crème wel goed gelezen hebt. Als je geen goed resultaat ziet dan moet je niet meteen denken dat het niet werkt. Want het lezen en begrijpen van de bijsluiter lukt dat wel goed. Dan kom je erachter of iemand laaggeletterd is.
interviewer	Vind je dat dan niet vervelend als ik dat aan je vraag?
deelnemer1	Nee want er wordt niet gekeken of je laaggeletterd bent maar naar het probleem. Terwijl als ik laaggeletterd ben snap ik niet altijd hoe die medicijnen moet gebruiken. En dan werken ze helemaal niet. Je moet samen kijken dat je samen werkt. Jij moet goede medicijnen geven maar ik moet ook begrijpen hoe het aanbrengen hoort. Want als ik laaggeletterd ben lukt het niet om dat zelf te snappen.

Video 5: terug vraagmethode | laaggeletterdheid en gezondheid: ex-laaggeletterden vertellen hun verhaal

Deelnemer 1	Vertel nou eens na wat ik heb gezegt. Wat is er bij je binnengekomen? Als je dit mij niet vraagt en ik loop dan naar buiten kan ik het zijn vergeten. Maar als je vraagt om het in hun eigen woorden te vertellen wat heb ik nou verteld. Vertel dit nou eens na. Dan kom je meer met elkaar overeen. Want als ik het dan vertel kan jij altijd zeggen of ik nog iets vergeten ben terwijl je dat dan misschien wel gezegd hebt. Dit kan helpen om met elkaar in contact te komen. Want als je dat niet doet en je geeft dan een papiertje mee of een iets anders wat ik toch niet kan lezen. Dan komt het in de prullenbak of een laatje. Maar als je het in je eigen woorden laat vertellen weet je beter of het goed is overgekomen. Dan weet je beter wat er gebeurd is.
Interviewer	Heb je dan niet het gevoel dat ik je aan het overhoren ben?
Deelnemer 1	Nee nee. Je kan denken dat wij denken dat we overhoord worden. Maar het probleem is toch dat ik laaggeletterd ben en dat ik op dat moment wat er verteld is toch moet zeggen. Want anders kan mijn kind er de dupe van worden. Mijn kind kan ik niet verder opleiden omdat wat niet aangekomen is kan ik niet doorgeven. Want dan komt toch dat laaggeletterd van je kind afnemen. Of ondersteunen die jij niet ontvangen hebt als kind.

Video 6: het internet | laaggeletterdheid en gezondheid: ex-laaggeletterden vertellen hun verhaal

deelnemer1	Ik heb het altijd eerlijk gezegt want ik wil niet ergens voor schut staan. Want ik ga niet tegen jou zeggen dat ik computerdeskundige ben als ik dat niet weet. Ik kan dat ook niet goed. Van dat toetsenbord wordt ik vreselijk nerveus van en daarom ben ik aangewezen op mijn kinderen. En als ik er niet helemaal uit kom dan vraag ik dat aan mijn kinderen.
Deelnemer 2	Zou u me kunnen helpen om me wegwijs te maken waar ik naartoe kan of naar welke bepaalde instantie ik naartoe kan gaan. Om een rekening te betalen of geef me bijvoorbeeld om een formulier in te vullen. Dan wordt er gelijk gezegd dat is ook een pluspunt en een minpunt want er wordt dan gewoon gezegd dat kunt u digitaal of via uw computer vinden. Maar als ik geen computer heb. En meeste gaan er ook vanuit dat je een computer hebt. En vooral de ouderen mensen hebben geen computer hoe kan je die mensen dan vertellen dat ze dat via de computer moeten doen. Het samen doen vind ik veel leuker. Meneer maakt u geen zorgen. Kom maar naar me toe dan maken we een afspraak. En dan zal een van de collega's je helpen. En dan heb ik ook het gevoel dat ik gewaardeerd wordt. Terwijl nu wordt je soms in de ijskast geduwd of teleurgesteld. En dan heb ik er ook geen behoefte meer aan.
Deelnemer 3	Heel hoop mensen willen tegenwoordig wel geholpen worden. Kijk want dat laaggeletterden want dat zeg ik ook he. Want vroeger kon je elkaar helpen. Maar tegenwoordig zie je dat je bij diëtisten alles gaat niet meer met de brief. Alles moet je van de computer afhaken. Computer dit computer dat. Alles wat je moet lezen moet van de computer. Je moet voor alles nu naar websites toe. Iedere doctor, diëtisten, fysio. Je hebt geen folders meer want die zijn duur. Alles moet je van de computer halen. Dus wat ga je krijgen? Mensen die nu laaggeletterd zijn. Zij krijgen nog een stapje erbij. Want ze zijn ook laaggeletterd op de computer. Dus wat je toen geleerd hebt moet je overnieuw gaan leren. Dus krijgen wij er nu weer bij.
Deelnemer 4	Ik heb nou wel een ipad. Ik heb ook een iphone. Ik wist er eerst niet mee om te gaan. Mijn zus heeft het een beetje uitgelegd. Mijn kinderen legden heel veel uit. Hoe ik het moet gebruiken en noem maar op. Maar heb er soms nog steeds heel veel moeite mee om iets op te zoeken.
deelnemer3	Dat zie je bij sommige want dat zie je bij het ziekenhuis dat je een spraak. Iemand die meeleeft en dat je zelf ook mee kan lezen. Maar dat iemand het voorleest voor jou. Dan komt het toch beter binnen dan als je het zelf gaat lezen. Want als er zo veel moeilijke woorden in staan ben je het helemaal kwijt. Dus als er iemand met jou meeleeft, het voorleest. Dan komt het beter bij je binnen. Dan weet je toch he ik moet daar op letten of daarop. Dat is belangrijk. Zodat het toch binnenkomt.

Video 7: laaggeletterdheid verbergen | laaggeletterdheid en gezondheid: ex-laaggeletterden vertellen hun verhaal

Deelnemer 1	Je hebt ook heel veel schaamte gevoel. Dat is dus ook een punt. Dat is dus niet zomaar hoppakee en dat we gaan naar de huisarts en vertellen dat we laaggeletterd zijn. Dat
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	doen we niet. Dus het is toch wel echt zeer het vertrouwen. En er moet natuurlijk wel een goede assistent zitten. Wat haar betreft en voor mij en ook voor meer mensen. Er hoort gewoon een goede assistente zitten zodat je op je gemak bent. Zodat je het veel meer kan tonen. Ik kan lekker babbelen en ze kwamen er niet achter. Maar er zijn een hoop die niet goed kunnen babbelen. En daar moeten ze naar kijken. Hoe de mensen worden aangesproken. Proberen ze moeilijk ewoorden te gebruiken en proberen ze die te snappen. Kijk of ze daar ook op reageren. En zo kom je erachter. En ga die mensen zeker niet voor schut zetten want dan kom ik niet meer. Of heel veel laaggeletterden mensen komen dan niet meer terug
Deelnemer 2	Want er zijn een hele hoop mensen die dat niet durven. En krijg daar dan maar uit. He ik ben laaggeletterd maar dan kan ik ook niks doen. Want Als ik niet weet dat die persoon laaggeletterd is en die persoon komt daar ook niet voor uit. Dan staat het boek gewoon stil.
Deelnemer 3	We vergeten een ding. De mensen weten zelf vaak niet eens dat ze laaggeletterd zijn. Oh ja ik schrijf en lees niet. Ze hebben geen probleem. Zolang je zelf niet beseft dat je een probleem hebt. Oh ja mijn man vult het formulier wel in. maar zolang die man er is of die vrouw er is. Dan gaat dat goed. Maar als een van de twee wegvalt, dan loop je tegen een muur aan. En dan beseffen ze pas, ja ik heb een probleem. Maar waar moet ik naartoe? Tegen wie vertel je het? Er zijn zoveel mensen van wie hun partner het niet eens weten. Ah nee doe jij het maar. Jij kan dat veel sneller.
Deelnemer 4	Dus het is super belangrijk om een goede band met je dokter te hebben omdat die degene is die je kan verwijzen naar een diëtiste. Naar een cardioloog of wat dan ook . er die kunnen erbij zetten. En dan weten de mensen het en dan kunnen ze er rekening mee houden. Dat is zo ontzettend belangrijk. Je dokter is heel erg belangrijk in dit geval.

Video 8: ouderbetrokkenheid op school | laaggeletterdheid en gezondheid: ex-laaggeletterden vertellen hun verhaal

Deelnemer 1	Ik denk dat het hartstikke lastig is want mijn ouders kwamen al niet naar een ouderavond. Omdat ze zelf laaggeletterd waren. Dus dan krijg je ze al niet naar school voor de voorlichting van je kinderen. Hoe krijg je die ouders van naar voortgezet onderwijs? Dat krijg je niet. Maar we komen weer tegen het stuk schaamte aan. En dat stuk schaamte is zo enorm groot. En vele mensen beseffen ook niet hoe beperkt ze zijn. Zolang ze het zelf niet beseffen.
interviewer	Als ik nou docent ben en er zit iemand tegenover me in tien minuten gesprek en ik weet dat die persoon laaggeletterd is. Wat moet ik dan doen. Hoe moet ik dan anders doen?
Deelnemer 2	Nee, ik denk dat je ook gewoon normaal met elkaar moet doen. Je kan andere dingen verwoorden. Beter verwoorden. Want als je dat niet doet dan moet je bedenken wat heb ik allemaal gehoord. Dus dat zul je op een andere manier moeten vertellen. Je zult toch krijgen dat als je met moeilijke woorden gaat gooien. Wat heb ik daar aan.

	Dus je zult met andere woorden, makkelijke zinnen vertellen. Hoe het met je kind gaat. Dus dat zul je toch op een andere manier moeten formuleren.
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Video 9: consultatie bureau | laaggeletterdheid en gezondheid: ex-laaggeletterden vertellen hun verhaal

Deelnemer 1	Vroeger had je zo'n heel klein boekje. En daar kon je van een heel klein beetje in lezen. Dat kon ik wel. Je kon er geen informatie inschrijven van je kind. Maar bij mijn dochter kon ik een groot boek waar ik heel veel in kon schrijven maar dat deed ik niet. Maar niemand controleerde dat. Dus misschien is dat een tip. Dat je in ieder geval controleert van. Wat zijn er ontwikkelingen. Heb je dat opgeschreven. Kan ik het teruglezen? En dan maak je in ieder geval contact.
Deelnemer 2	Bij mij was duidelijk: ik ben laaggeletterd in deze taal. Ik heb twee kinderen die hier in nederland geboren zijn. En die eerste ja. Mensen weten dat ik de taal niet ken. Maar er worden toch in de nederlandse taal dingen verteld. Over borstvoeding. En ik kreeg ook flyers over hoe moet ik dit doen. En je krijgt ook je babyboeken. Die zijn alleen maar in het nederlandse taal. Dus dan denk je voor mijn situatie hebben ze dat expres gedaan. En achteraf niet denken: nou die mevrouw die komt uit een ander kant. Ze geven me automatisch nederlandse taal boeken en instructies over hoe je moet borstvoeden. Voor mij. Ik heb gedaan wat ik kon. Maar hoe je het echt moet doen, heb ik niet gekregen. Ik had de informatie, maar daar heb ik ook niks aan. Dus borstvoeding heb ik niet geven of opletten op de tijd waarop hij moet eten of wanneer hij moet slapen of niet slapen. En ik krijg dat boek over opvoeding waarin je moet schrijven elke dag wat hij heeft gedaan. Nee ik kon alleen maar zijn naam schrijven. Voor de rest kon ik niks. Dus ijn heeft zijn babytijd, tot een jaar, geen informatie in zijn boek. Dat is gewoon leeg. Ja ik had een nederlandse kraamzorg maar die deed er niks mee. En ik denk dat de oplossing is dat als jij been allochtoon komt dan moet je er direct rekening mee houden dat het wel kan zijn dat iemand de taal niet begrijpt. En niet automatisch moet zeggen. Hij zijn je flyers hier zijn je boeken. Nee je moet echt iemand gaan zitten. Ik denk dat dat wel goed zou zijn.

Video 10: buurthuis | laaggeletterdheid en gezondheid: ex-laaggeletterden vertellen hun verhaal

Deelnemer 1	In mijn vorige woning in amsterdam. Daar hadden wij een buurthuis en die had iedere donderdag een activiteit. Dat was heel breedshalig van handlezen tot knutselen bloemschikken. En dan had je ook in ieder geval opvang voor je kinderen die nog niet naar school waren of peuterspeelzaal. Dat ging niet via folders maar via een buurvrouw hoorde ik dat. Op een gegeven moment is het zo gezellig dat je er iedere week bent. Toen werkte dat nog niet met flyers. In almere is sinds kort een verkapt klein buurthuisje begonnen. Ze hebben ontzettend veel activiteiten voor kinderen. Nu kreeg ik een flyer in de bus voor het sinterklaasfeest. Met een prachtig mooie foto van sinterklaas dus dat was duidelijk dat het over dat feest ging.
Deelnemer 2	Het gaat je vaak krijgen dat mensen ook thuis blijven die in een situatie komen waarin zij alles moeten vragen. Dat is het probleem ook dat ze het gemeente moeten. Het hele buurthuis is niet meer zoals het vroeger was. Ze gaan vaak weg door bezuinigingen. Laat die er juist zijn zodat mensen daar vaak komen. Laat ze bestaan

	zoals ze bestaan. Daar komen juist mensen terecht en in aanraking met andere mensen die kunnen helpen. Dan kom je toch een stuk verder.
interviewer	En dan zegt de gemeente vaak, vijf jaar weet je we hebben geen geld meer. Maar wat de mensen uit de buurt moeten meer gaan samenwerken. Maar dat ga je toch niet altijd krijgen. Want dat doen mensen natuurlijk niet altijd. In een buurthuis zie je elkaar toch want andere mensen weten wel de weg.

Video 11: hulp van de gemeente | laaggeletterdheid en gezondheid: ex-laaggeletterden vertellen hun verhaal

Deelnemer 1	Voor de jeugd, hangjongeren. Wij geven een keer per jaar een feestdag. Dan gaan we naar de gemeente toe. Ik zorg voor de muziek en we zorgen voor leuke spulletjes. En dan vragen wij voor een prijs van 5 tot 600 euro en ik heb het eerlijk zeggen dat als je het gewoon heel goed met de gemeente dan vind ik het ook een heel groot compliment voor de gemeente dat ze je daar dan ook in steunen. En dat mag ook gezegd worden. Want dan zie je dus ook voor de kinderen en de marokkaanse en turkse kinderen zie je met hun plezier deelnemen. Dat is toch een feest. Ik kan rustig zeggen dat ze je helpen op alle fronten.
interviewer	Jij kan goed de weg vinden bij de gemeente maar iemand anders vindt het misschien moeilijk. Hoe kan ik het makkelijker maken?
Deelnemer 1	Zo moet je het niet zien. Je moet het gewoon simpel zien zoals dat ik daar ook met knikkende knieën bij het loket ziet. En dat ik met die vrouw moet gaan praten en boen moet zoeken welk loket het is. Ze vertellen het wel maar als je niet goed kan lezen loop je gewoon te zoeken. Maar als je ziet dat je dus boven komt en dan opeens ga je vragen stellen maar mijn angst is omdat ik niet kan lezen en schrijven. Wat moet ik gaan tekenen. Snap je? Wat moet ik tekenen. Als die vrouw zegt je moet goed luisteren geef mij de bonnen wat je uitgegeven hebt en dan ben je gewoon klaar.

Video 12: bij de gemeente | laaggeletterdheid en gezondheid: ex-laaggeletterden vertellen hun verhaal

Deelnemer 1	Want zelf geweest dat soms dingen heel makkelijk of heel moeilijk is. Maar tegenwoordig in huis in een almere hebben ze een nieuw apparaat. Als je binnenkomt moet je een nummer trekken. Maar dit apparaat is heel moeilijk als je moeite hebt met lezen en schrijven. Of als ze met een ander land komt. Is het een heel moeilijk om dit apparaat te gebruiken om een nummer te trekken. En als er iemand bij staat krijg je er misschien helpt bij. Maar zonder hulp vind ik het echt heel moeilijk om het apparaat te gebruiken.
Deelnemer 2	Wat ze zegt is echt waar. Soms ben je gewoon in een doolhof aan het zoeken. En hoe met je dat invullen dan.

Deelnemer 1	Wij in de gemeente krijg je een brief als je weer nieuw komt of veranderd. Maar ze gebruiken heel moeilijk woorden voor mijzelf. Ik begrijp er niks van. Ik moet iemand om hulp vragen voor mij gaat voorlezen en uitleggen. Of moet ik naar bali gaan. Maar als je naar bali en gemeente gaan maar ze willen graag helpen. Maar sommigen hebben er geen tijd voor. Dan zijn er heel veel mensen in de rij. Ze willen graag zo snel mogelijk andere klanten helpen. Ze hebben niet altijd de tijd om ons te helpen.
Deelnemer 3	Ik ben altijd eerlijk over dat het moeilijk is. Ik heb zeg maar een heel bewust zeggen dat ik laaggeletterd ben. Het is gewoon iets wat heel moeilijk gaat. Als mensen het niet in jip en janneke maar in gewone taal uit. En dat vraag ik dan, wilt u geen dure woorden gebruiken. Want ik zit toch met dat ik niet goed kan lezen en schrijven. Ik ben altijd heel netjes geholpen.
Deelnemer 1	Ik vind het heel belangrijk dat we vrijwillig regelen voor de minste moeite hebben met lezen en schrijven. Wij hebben krijgen papieren en emails. En soms krijg ik zulke brieven en dan zeg ik laat maar op de tafel. Maar dan krijgen we er problemen mee. Andere blijven thuis en geven niet toe. Maar die krijgen probleem thuis. Maar als die mensen zelf naar gemeente gaan en vragen om hulp voor lezen en schrijven. Dan kunnen ze misschien iemand regelen om langer thuis te komen. Maar die mensen zeggen het niet. Dat is heel moeilijk.

Video 13: hulp van diëtisten bij laaggeletterdheid : laaggeletterdheid en gezondheid: ex-laaggeletterden vertellen hun verhaal

deelnemer1	Maar die diëtisten zegt wat we in praktijk kunnen doen dat kunnen we ook een keer in een winkel gaan doen. Dus zijn we naar een supermarkt toe gegaan die dag. En voor laaggeletterde zijn de calorieën en waar moet ik op letten of naar kijken. En moet ik vertellen wat ik eet en dan ging zij het uitleggen. Ze ging vertellen dit is product is wel goed. Hier kun je naar calorieën kijken. Want ik kijk en denk dat het wel een goed product is maar je weet niet hoeveel calorieën er in zitten. Want heel veel mensen die laaggeletterd zijn weten niet welke producten ze nodig hebben. En je ziet ook dat ze te zwaar zijn met overgewicht of diabetes. Dus dan heb je toch profijt ervan dat je het kan leren en niet alleen maar binnen zit om het te leren. Dat was perfect en dat ze dat met mij en andere mensen ging doen. Kijk er zijn een hele hoop mensen die niet laaggeletterd zijn die het ook moet leren. Wegens bezuinigingen zit ze er niet meer. En nu zit ze er niet meer, dat is doodzonde. Er zijn nu weer nieuwe mensen die hulp en uitleg nodig hebben. Degene die ik nu heb neemt het wel ook snel op.
Deelnemer 2	Bij de dokter zit ook een diëtiste en via kristel weet ze dat ik laaggeletterd ben. En die nam ons ook mee naar een natuurwinkel. Iedere week hadden we een ander ontwerp. Daar hebben we geleerd waar je op moet letten. Dat je gezonde voeding binnen moet krijgen. Wat je beter niet kan eten.
Deelnemer 3	Ik heb een beetje slechte ervaring omdat ze nog niet wist dat ik laaggeletterd was. Ik wist het al wel maar vertelde het nog niet. Ze zeiden gewoon dat ik op de weegschaal moest staan. Dat deed ik dan ook. En ik nam het eigenlijk mee en ik ging niet afvallen

	<p>maar werd alleen maar dikker in plaats van afvallen. Vond ik wel heel erg jammer. Nu kijk ik er heel anders naar. Nu heb ik er wel suikerziekte aan overgehouden. Dus moet wel veel meer bewegen. Ik kan het weg krijgen maar ik weet het nog niet zeker. Want het is medisch geworden. En dat vind ik wel jammer. Want ik had eigenlijk ook echt gehoopt dat het net als hun beetje goed begeleid zou worden met voedsel en noem maar op. En dan heb ik nog heel weinig inkomen en het scheelt ook na ik hoor wel dat je kan letten. Maar voor mij is het gewoon ontzettend zwaar. En ik snap het ook niet met de schijf van vijf. En de dingetjes die ze dan uitleggen. Toen der tijd. Nu zou ik het wel beter begrijpen maar toen niks. En ik kreeg niet echt de goede hulp wat ik wel toen heel erg nodig had. Ik kan wel koken maar heel weinig budget. Koop je veel meer vette dingen dan bij een natuurwinkel kan halen. Folders die sla me over want dat vinden wij niet interessant genoeg. Ze zijn veel te veel tekst. Ze zijn niet duidelijk. Daarop zitten wij ook in het testpanel want veel dingen zijn niet duidelijk voor laaggeletterden. Fotos, kleine begrip, grote letters. Veel fotos en ook zien dat het niet zo van lekker hapje. Wat is de bedoeling ervan is.</p>
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Video 14: apotheek | laaggeletterdheid en gezondheid: ex-laaggeletterden vertellen hun verhaal

Deelnemer 1	<p>Als je dus naar de apotheek gaat en je geeft een briefje af. De apotheker zou je dan toch een beetje kunnen begeleiden of je de medicijnen begrijpt. Zo niet kunnen we je erbij helpen. Maar als je daar aankomt en je krijgt ze mee maar je moet het zelf maar uitzoeken met het papiertje. Misschien in de toekomst dat we kunnen zeggen dat medicijnen uitgelegd kunnen worden. Want als ze dat niet doen dan blijf je maar papieren en medicijnen ophalen zonder te weten waar je ze voor slikt.</p>
Deelnemer 2	<p>De apotheek zoals van de week ben ik ook geweest. Dan krijg ik een zalf voor die dingetjes die nu beginnen te jeuken. En dan krijg ik netjes uitleg dat ik het twee keer moet smeren en daarna dun. Dus er wordt gewoon uitleg gegeven maar bij sommige kunnen ze vragen of je nog vragen hebt. Maar je moet zelf ook vragen stellen. Want het verandert steeds bij de apotheek.</p>
Deelnemer 1	<p>Want ik vind het wel fantastisch wat die mensen doen. Maar het moet wel normaal worden.</p>

Video 15: medicijnen gebruik bij laaggeletterden | laaggeletterdheid en gezondheid: ex-laaggeletterden vertellen hun verhaal

Deelnemer 1	<p>Mijn zoon die had een zeldzaam eczeem. En het was best te doen met medicijnen. Maar ik kon niet lezen of schrijven. Ik kan die taal niet lezen. En het werkt met hormonen heb ik overal op zijn lichaam ingesmeerd. Ik heb het precies andersom gedaan. En mijn zoon kon niet meer naar school en had pijn die hele avond. Hij kon niet slapen. Dat duurt jaren tot een keer dat ik niet in staat was dat ik die medicijnen kon halen. En toen heeft die mevrouw uitgelegd wat hij moest doen. Toen was hij in twee weken beter. En nu kan hij weer lopen en speelt weer voetbal. Maar stel je voor nou dat iemand het in een simpele vorm had uitgelegd. Dan denk ik dat al die ellende die ik had niet nodig was geweest. Dus als je ziet dat iemand laaggeletterd is. Kom naar een lager niveau met die persoon praten. Simpele woorden.</p>
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Appendix C: Ethical checklist focus group

Checklist for submitting a research proposal to the Ethics Committee
(See Chapter 3)

Checklist for the principal researcher when submitting a request to the EC or the EC member for an assessment of the ethical permissibility of a research proposal

1. General

1. Title of the project:
Designing understandable and actionable sleep visualizations for low literate individuals
2. In which context will this research be conducted (BSc/MSc/PhD thesis, part of a larger project, ...):
BSc thesis
3. Researcher(s):
Miriam Cabrita
4. Supervisor (for PhD, MSc, BSc):
BSc
5. Name all other people involved and their roles (i.e. Project leader/Principal investigator, research assistants, etc):
Critical observer: Alma Schaafstal, Supervisor external: Christiane Grunloh
6. Department responsible for the research:
BSS
7. Location where research will be conducted:
At home, online through the mobile application WhatsApp
8. Short description of the project (about 100 words):
For this project the input from low educated/low literate individuals is used to identify requirements for data visualizations of sleep information. A focus group will give insights into the daily challenges. With this information useful visualizations that meet the requirements of the target group could be designed. These sleep visualizations will be tested again with the target group low educated/low literate individuals. From this a conclusion will be drawn about the used requirements in the visualization.
9. Expected duration of the project and research period:
The duration of the project is till 5th of July 2020, the research period will be from the 12th of May till the end of June.
10. Number of experimental participants:
As many as are willing but at least 4
11. EC member of the department (if available):
Jan Buitenweg

2. Questions about fulfilled general requirements and conditions

1. Has this research or similar research by the department been previously submitted to the EC?
 No
2. Is the research proposal to be considered as medical research (Also see Appendix 4)
 No
3. Are adult, competent participants selected? (§3.2)
 Yes, indicate in which of the ways named in the general requirements and conditions this is so
Explanatory notes: *Through organisations and associations contacts are made to contact NT1 and NT2 course students. For example, through voluntary classes that are organised by ABC Ambassadors.*

4. Name all characteristics participants must possess in order to be included in the research, such as gender, age, membership of a specific organization, etc:

Low literacy level/low education level

5. Are the participants completely free to participate in the research, and to withdraw from participation whenever they wish and for whatever reason? (§3.2)

Yes

6. Is there a risk for adverse effects of the research for certain participants?

No

Explanatory notes: *there will be no long-term effects from this research*

7. Does the method used allow for the possibility of making an accidental diagnostic finding which the experimental participant should be informed about? (§3.6 and Appendix 4)

No, the method does not allow for this possibility

8. Are participants briefed before participation and do they sign an informed consent beforehand in accordance with the general conditions? (§3.2, §3.3, §3.7, §3.8)

No, explain why not

Explanatory notes: *Subjects will be briefed before participating but they do not sign a consent form since the consent form adds complicated steps for the participants which they are not equipped for. For this study it is important that participating is as easy as possible. Adding a consent form would make it for the participants more troublesome, without improving their situation. The consent will be asked verbally, this statement will be recorded after permission to record the interview.*

9. Are the requirements with regard to anonymity and privacy satisfied as stipulated in (§3.8)?

NB. Make sure to also comply to the General Data Protection Regulation (GDPR), and register the processing of personal data through: <https://www.utwente.nl/privacy/>.

Yes

Explanatory notes: *no personal data will be saved, only the suggestions and answers from the participants.*

10. If any deception should take place, does the procedure comply with the general terms and conditions (no deception regarding risks, accurate debriefing) (§3.10)?

No deception takes place

11. Is it possible that after the recruitment of experimental participants, a substantial number will withdraw from participating because, for one reason or another, the research is unpleasant? (§3.5)

No

3. Questions regarding specific types of standard research

Answer the following questions based on the department to which the research belongs.

12. Does the research fall **entirely** under one of the descriptions of standard research as set out in the described standard research of the department? (Chapter 4)

Yes, go to question 12

Explanatory notes:

13. If yes, what type of research is it? Give a more detailed specification of parts of the research which are not mentioned by name in this description (for example: What precisely are the stimuli? Or: What precisely is the task? OR: What is the nature of the measurement/interview questions?)
The department of Biomedical signals and systems applies. The task is to answer and discuss the following kind of questions which will give insights into the target groups opinions and move of thought.
What are your daily routines to maintain your health?
Do you search for more health-related information?
What kind of consequences has your sleep experience during your day?
14. If no, or if uncertain, give as complete a description as possible of the research. Refer where appropriate to the standard descriptions and indicate the differences with your research. In any case, all possible relevant data for an ethical consideration should be provided.

ADDENDUM

4. Why is your work COVID-19 proof?

Note: choice with * requires explanation

15. Do you add additional face-to-face contact?
 No, I only work in distributed fashion over phone, survey, or telco (Skype, Zoom, Teams, etc)
16. * Do you add indirect physical contact? For instance, sharing a tangible device, please explain why and what actions will be done with the device.
 * No
 Explanatory notes:
17. * Do you put additional burden on people from the care sector that are under pressure?
 * No, I work people from another field, explain; *low literate individuals can be found in all the ages of society. Elderly are not the specific target group.*
18. * Give a thorough explanation, why you consider your research can be considered COVID-19 proof include any considerations you discussed with your supervisor to address contingency of any additional risks you identified.
 Explanatory notes: The research will not include any face to face contact. The focus group will be done through WhatsApp.

Appendix D: Transcript focus group

Researcher	<p>Met de opname van dit gesprek kan ik het interview beter verwerken achteraf. Ik wil jullie bedanken voor de tijd en jullie deelname. Zijn jullie allemaal op de hoogte van dat uw nummers hierna verwijderd zullen worden en er geen namen vermeld zullen worden. Het is een anoniem interview. Alleen jullie antwoorden zullen gebruikt worden om mijn onderzoek verder te helpen.</p> <p>Vinden jullie dat allemaal goed.</p>
Hanneke	Researcher die doet dit ook om het gaat om mensen die nederlands niet volledige of heel goed beheersen.
p1	Wat ik hoorde is dat het gaat over slaap. Wat bedoel jij met slaap?
Researcher Vraag 1	<p>Hiermee bedoel ik dat we gaan praten over de lengte van slaap, hoe diep je slaapt. Daar zijn veel verschillende factoren, sporten, koffie, beeldscherm die invloed hebben op je slaap. Hier wordt nog onderzoek over gedaan. We zijn benieuwd naar wat jullie al weten en hoe dit misschien beter uitgelegd zou kunnen worden. Omdat dit nu nog niet zo goed gedaan wordt. Verder iemand anders nog een vraag over het onderwerp? Ik ken jullie natuurlijk ook allemaal niet. Dus ik wil graag weten hoelang je al taal les volgt. En wat u in uw dagelijkse leven normaal doet. Wat voor werk, een korte introductie. Dit helpt mij om u te begrijpen. Dus als jullie het leuk vinden om iets over jezelf te vertellen dan vind ik dat leuk om te horen.</p>
hanneke	Oke dan gaan we gewoon het rijtje af.
p2	Slaap heel goed.
Hanneke	Je hoeft nog niet over je slaap te vertellen. Alleen heb jij taal les en wat doe jij overdag?
p2	Ik doe slapen tot half 10. Dan opstaan en ontbijt. Ik ga iedere dag wandelen en donderdag heb ik les. Vandaag lukte dat niet. Soms ook werken. Om de week.
hanneke	Een keer in de veertien dagen doet ze werken.
p3	Ik slaap niet goed. Soms wel soms 6 uur. Maar soms maar 2 of 3 uur, heel kort. Dan als ik wakker wordt. Ik ben huisvrouw
p1	Ik heb taallessen gehad lang geleden. En vroeger kregen wij 600 uurtje voor taallessen. Maar ik pas op voor vrouwen met kinderen kan ik soms meedoen omdat ik thuis zit. Ik

	lees kranten en kijk s ochtends naar het journaal. Maar mijn taal is nog steeds niet helemaal goed.
p4	Ik slaap niet lekker. Twee dagen slecht een dag lekker. Ik wandel iedere dag een uurtje.
hanneke	Maar p4 is heel goed in tai chi. Geeft altijd les in de pauze. Nu komt p5.
p5	Ik heb het koud he. Ik slaap niet goed. Ik slaap deze maand helemaal slecht door ramadan. Ik slaap tot half 5. Maar overdag moet ik schoonmaken en zorgen voor eten, koken. Maar na ramadan komt het weer goed.
p6	Ik ben p6, ik doe ook ramadan. Les vind ik heel mooi, we lachen en leren samen. Maar gelukkig kunnen we nu zelfs nog lessen doen. Als wij praten over slapen is dat anders door corona natuurlijk. Want we gaan niet naar buiten en dingen doen. Door corona zijn veel dingen veranderd ook voor slapen. Het is nu ramadan en daardoor is slaap helemaal anders.
hanneke	Oke dat waren ze alle zes.
Researcher Vraag 2	Heel erg fijn om zo het rijtje langs te gaan zodat het gestructureerd is. Zo te horen heeft iedereen over slaap nagedacht. De ramadan en corona doen veel. Het zijn gekke tijden. Hebben jullie het idee dat deze tijden jullie slaap beïnvloeden.
Hanneke	Is corona een reden om slecht te slapen?
p2	Nee, nee ik slaap heel goed. Heel lekker.
p3	Nee het is hetzelfde
p1	Nee, ik ben heel veel bezig met slaap. Ik probeer heel goed vroeg op te staan en altijd om 12 uur naar bed te gaan. Met corona maakt niet uit. Maar de ramadan heeft veel invloed. Om half 5 staan we vaak op.
p4	Is hetzelfde als daarvoor.
hanneke	Corona maakt het niet erger
p5	Corona maakt niet uit. Maar ramadan wel. Maar om in slaap te komen moet ik altijd s avonds wat maken. Maar ik slaap normaal om 1 uur en s ochtends om 7 uur weer wakker.

p6	Voor corona altijd oke maar ik heb een lichte slaap. En ik val langzaam en slecht in slaap. Maar heeft niets met de ramadan te maken.
Researcher Vraag 3	Jullie hebben dus allemaal wel eens last van slechte slaap of nachtrust. Hoe merk je dat dan door de dag heen? Heeft dat echt invloed op jullie
Hanneke	p2 als je slecht slaapt ben je dan moe overdag?
p2	Ja als ik slecht slaap ben je hele dag moe. Ja is een probleem maar heb ik niet veel. Heel soms maar.
p3	Ik slaap vaker slecht. Hele dag moe dan ja. Geen energie. Ik doe iedere dag wandelen.
p1	Soms blijf je op bed denken voordat je kan slapen. Soms kon ik pas om kwart voor 5 naar bed en om 11 uur wakker al weer. Dus als ik iets aan mijn hoofd heb en blijf denken slaap ik slecht. Maar als je moe blijft en blijft denken.
p4	Wandelen of lopen doe ik gewoon als ik slecht slaap.
p5	Soms is het niet goed. Soms ben ik heel erg moe en dan ga ik terug naar bed. Maar soms voel ik me goed.
p6	Als ik slecht slaap dan ben ik wel moe en heb ik hoofdpijn. Als ik vroeg wakker wordt dan is de dag meestal goed. Dan ben ik fit en goed.
Researcher	Soms heb je dat inderdaad dat je vaker slecht slaapt. Probeer je daar dan ook iets aan te doen zoals minder koffie drinken of andere maniertjes zodat je beter slaapt
p4	Ik drink s ochtends koffie, om 8 of 9 uur moet ik een beter koffie drinken.
p1	Ze vraagt als je slecht geslapen hebt wat kan je dan doen. Als ik naar bed ga moeten alle dingen uit mijn hoofd zijn. Dus geen koffie drinken want dat maakt je extra wakker. Als ik savonds koffie drink wordt het erger. Mijn hoofd moet leeg maken.
p6	Ze vraagt of ze mag spelen op de playstation.
p3	Ik drink nooit koffie. Wel thee. Dit drink ik wanneer ik wakker wordt. Beter bewegen dat helpt.

p1	Als iemand zich niet goed slaapt en dan moet hij een boekje mee nemen naar bed en lezen. Anderen zijn het hier niet mee eens
Researcher Vraag 4	Hebben jullie wel eens hulp gezocht, op internet gezocht of met familie erover gehad?
p1	Ik heb bijna 6 jaar geleden heel slecht geslapen en toen ben ik naar de dokter gegaan en tabletten gekregen. Maar dit doe ik nu niet meer.
Researcher Vraag 5	Heeft u nu dan het op een andere manier opgelost door op het internet iets op te zoeken of in boeken?
p1	Nee niet oplossen met medicijn of via internet. Gewoon niet denken, dat is de oplossing.
p4	Ja ik heb wel eens op internet gezocht.
hanneke	Doe je dat dan in het chinees of nederlands?
p4	Ja in het chinees
Researcher	En heb je toen iets nuttigs gevonden?
p4	Soms kijken naar het nieuws.
p3	Ik heb wel eens gevonden dat je moet bewegen. Maar het helpt niet.
Researcher Vraag 6	Oke dat waren de vragen die ik over slaap had. Ik vind het heel erg om te zien dat jullie elkaar nog zo veel spreken via whatsapp. Hoe is het voor jullie om nu zoveel met mobieltjes en online te moeten doen.
p4	Heel fijn om te praten met familie.
hanneke	Er zijn nog 4 andere vrouwen. Die hebben bij de andere vrijwilliger les. Maar die doen allemaal individueel. En die zien wij nu niet dus daar willen wij ook nog iets voor vinden. We missen ze erg.

Researcher Vraag 7	Gebruiken jullie naast whatsapp ook nog andere applicaties zoals facebook of de albert heijn app?
p6	Ja ik ken wel facebook. Maar ik heb geen facebook.
p4	Ik heb wel facebook.
p1	Ik heb facebook daar kijk ik naar het nieuws van vrienden en familie. Maar ik hou niet van facebook.
hanneke	Maar p2 wel he
p2	Jaaa ik wel. Ik kijk vaak bijna iedere dag op whatsapp en facebook.
Researcher Vraag 8	Gebruiken jullie je mobiel ook nog voor iets anders of niet?
p4	Ja radio luisteren
p5	Ja ik kijk tv op mobiel. En praten met familie. Maar geen facebook. Alleen tv en whatsapp.
Hanneke.	Maar dat is toch wel heel top want p2 en p3 praten op deze manier met hongkong. En p1 en de rest kan zo ook over de hele wereld praten.
p1	Ik heb een maand terug mijn mobiel en online geleerd. Ik heb zelfde mobiel naar televisie gebracht om te kijken. En ook serie gekeken.
Researcher	Dus je hebt wel eens extra filmpjes voor bewegen opgezocht op je mobiel
p1	Nu kunnen we niet naar de sportschool gaan maar wel thuis dingen doen.
hanneke	p2 doet ook yoga nu thuis.
p2	Jaa
p1	Ik heb zelfs een crosstrainer nu.

Researcher Vraag 9	Lukt het iedereen een beetje om in beweging te blijven. Dat is goed om te horen. Want stilzitten is natuurlijk ook niet fijn. Heel erg leuk om van jullie te horen. Zouden jullie nog even om terug te komen op slaap. Zouden jullie beter willen slapen en daar iets voor willen doen?
hanneke	Researcher vraag zou je voor beter slapen iets willen doen.
p2	Ik slaap al goed dus geen probleem. Maar ik slaap al heerlijk.
hanneke	Is er nog iets nodig voor haar onderzoek voor haar onderzoek om beter te kunnen slapen
p2	Melk drinken voor het slapen. Na 3 uur thee en koffie niet drinken.
p3	Als je tv kijkt helpt dat soms wel.
hanneke	Maar zou je willen dat er iets was waardoor je beter kon slapen?
p3	Nee, nee. Ik heb al heel veel probeert maar het helpt niet. Alleen tabletten die helpen wel
p1	Ik denk dat als je op tijd naar bed gaat het beter is dan laat slapen. Het is beter om regelmatig te slapen.
p4	Lauwe melk drink ik. Helpt niet altijd
p5	Soms probeer ik wel te slapen maar is het heel moeilijk
p6	Ja ik wil wel maar we hebben alles geprobeerd. Ik heb zelf gemerkt dat op tijd naar bed gaan helpt. Maar slecht routine voor slapen is niet goed. Maar soms lukt het en soms niet. Je hoofds is soms een machine en wil niet stil zetten. Medicijnen heb ik nooit geprobeerd maar dat vind ik niet een goed idee.
Researcher	Dat waren al mijn vragen. Hopelijk vonden jullie het ook leuk.
p1	Het is altijd leuk om te leren van elkaar.
Researcher	Elkaar helpen is erg fijn ja. Dan wil ik jullie heel erg bedanken en dan was dit het.

hanneke	Bedankt allemaal!
p5	Ik ga terug slapen!

Appendix E: Accessible checklists Pharos and Stichting Lezen & Schrijven

Stichting Lezen & Schrijven checklist

Lay-out en tekststructuur

- Informatie herkenbaar ordenen: werk met een titel en tussenkoppen.
- Kies voor korte tussenkoppen: maximaal 3 woorden.
- Kies voor tussenkoppen met een duidelijke verwijzing naar de inhoud.
- Alinea's bestaan uit 2-10 zinnen.
- Maximaal 5 alinea's.
- Zinnen onder elkaar.
- Zinnen links uitlijnen.
- Lettertype: groot en met ruimte, bijvoorbeeld Tahoma, Verdana.
- Lettergrootte: minimaal 12.
- Regelaafstand: minimaal 1,5.
- Afbeeldingen gebruiken ter ondersteuning van de inhoud, gebruik bijvoorbeeld picto's.

Zinsbouw

- Maak altijd zinnen met een onderwerp en persoonsvorm.
- Gebruik zoveel mogelijk de 'vaste' woordvolgorde van het Nederlands, onderwerp-persoonsvorm-lijdend voorwerp.
- Maak je zinnen kort en krachtig, met onderwerp met gezegde dicht bij elkaar.
- Voorkom passieve zinnen.
- Houd de werkwoorden zoveel mogelijk bij elkaar en dicht bij het onderwerp.
- Probeer samengestelde zinnen te voorkomen, maak er twee losse zinnen van.
- Aantal woorden per zin: maximaal 10, liever korter.

Woordenschat

- Gebruik alleen veel voorkomende woorden die ook in het leerwoordenboek staan.
- Staat een woord niet in het leerwoordenboek? Leg het dan uit.
- Gebruik woorden die goed passen binnen de context van de tekst en de leefwereld van de lezer.
- Gebruik zoveel mogelijk inhoudswoorden in plaats van functiewoorden.
- Gebruik bij functiewoorden alleen de (zeer) vaak gebruikte functiewoorden, zoals: maar, want, of, en. Niet: daarentegen, immers, mits.
- Voorkom het gebruik van synoniemen.
- Gebruik woorden met een eenduidige betekenis.
- Voorkom leenwoorden met een niet-Nederlands fonetische opbouw, zoals cadeau.
- Check of alle woorden nodig en duidelijk zijn.
- Voorkom figuurlijk taalgebruik.

Tekstinhoud

- Bied niet te veel nieuwe informatie in één keer aan.
- Herhaal belangrijke informatie.
- Benadruk belangrijke en/of nieuwe informatie door het vet te drukken.
- Kies een concreet onderwerp dat herkenbaar is voor de lezer.

Pharos eHealth checklist

Behoeftepeiling

1. Bepaal wie de gebruikers zijn
2. Vraag de gebruikers naar hun behoefte van de informatie
3. Vraag de gebruikers welke vorm van informatie ze willen

Ontwikkeleing

4. Vraag de gebruikers welke vragen en informatie zij belangrijk vinden
5. Betrek de gebruikers bij de verdere uitwerking van de vorm
6. Test informatie na ontwikkeling met gebruikers
7. Test de conceptversie van het materiaal met gebruikers

Tekst

8. Gebruik korte zinnen en eenvoudige woorden op A2-B1 niveau
 9. Gebruik actieve zinnen
 10. Vermijd tangconstructies
 11. Vermijd dubbele ontkenningen
 12. Vermijd moeilijke vaktermen of medisch jargon of leg ze uit
 13. Vermijd Engelse en Latijnse woorden
 14. Vermijd percentages, formules, etc
- ### Opmaak
15. Kies duidelijk leesbaar lettertype en -grootte
 16. Zorg voor voldoende contrast tussen de tekst en de achtergrond
 17. Zorg voor voldoende witregels en kopjes om de tekst om te delen
 18. Lijn zinnen links uit
 19. Begin een zin zoveel mogelijk op een nieuwe regel
 20. Houd het overzichtelijk: gebruik eenvoudige en overzichtelijke vormgeving

Verhaalvorm

21. Maak de informatie waar mogelijk verhalend
22. Maak het verhaal 'spannend', dat werkt nieuwsgierigheid op
23. Sluit aan bij de belevingswereld van de gebruiker

Concreetheid

24. Maak de informatie concreet en puntsgewijs
25. Vermijd beeldspraak, spreekwoorden of gezegden
26. Leg dezelfde boodschap niet op twee manieren uit

Dosering

27. Beperkt het aantal kernboodschappen: maximaal drie per keer
28. Geef alleen het belangrijkste van de boodschap weer
29. Meld de belangrijkste boodschap in het begin en herhaal die

Structuur

30. Bouw de informatie stapsgewijs en chronologisch op
31. Maak geen uitstapjes in het verhaal
32. De kopjes zeggen hetzelfde als de tekst eronder
33. Elk stukje tekst sluit af met een samenvatting of actie

Vragenlijst

34. Stel niet meerdere vragen in één keer
35. Vraag de gebruiker hoe lang de lijst met vragen kan zijn
36. Geef géén antwoordopties die teveel op elkaar lijken
37. Zorg voor een tussenantwoord tussen Ja en Nee
38. Gebruik geen stellingen. Dat nemen mensen aan als waarheid
39. Spreek mensen persoonlijk aan

Actiegerichtheid

40. Maak duidelijk welke actie de gebruiker kan ondernemen
41. Maak duidelijk wie de gebruiker kan helpen
42. Maak duidelijk waarom het ondernemen van een actie belangrijk is

Beeld

Eenvoudig

43. Zorg dat het beeldmateriaal eenduidig is
44. Het beeldmateriaal bevat heldere lijnen en een helder contrast
45. Maak gebruik van waarheidsgetrouwe kleuren
46. Vermijd afleidende details
47. Vermijd grafieken, tabellen en diagrammen

Leefwereld

48. Het beeldmateriaal sluit aan bij de leefwereld van de gebruiker en er is herkenning in de gebruikte personages/illustraties
49. Het beeldmateriaal is niet betuttelend of kinderlijk

Samenhang tekst/beeld

50. De tekst en beelden geven hetzelfde weer

Ehealth

Vormgeving

51. Verdeel de informatie in korte stukjes
52. Maak het keuzemenu eenvoudig
53. Maak het makkelijk om terug te keren naar de startpagina
54. Maak het makkelijk terug te keren naar eerdere pagina's
55. Vermijd dropdown menu's
56. Plaats het menu (links) bovenaan de pagina
57. Maak duidelijk wat de gebruiker met de toepassing kan doen en hoe
58. De pictogrammen of icoontjes voldoen aan de gestelde eisen voor beeldmateriaal
59. Het is duidelijk wat reclame is en wat niet
60. Gebruik kaders en plaats de knoppen op een zichtbare plek

Gebruiksgemak

61. De tekst kan in een groter lettertype worden gelezen
62. Maak de knoppen in de toepassing makkelijk te gebruiken
63. Ondersteun bij het inloggen
64. De gebruiker hoeft zelf geen berekeningen te maken of interpretaties te geven
65. De eHealth-toepassing is ook offline te gebruiken
66. Antwoorden kunnen tussendoor worden opgeslagen
67. Ondersteun bij het aanmaken van een nieuw account
68. De gebruiksvoorwaarden en het privacystatement zijn geschreven op taalniveau B1

Zoekfunctie

69. Geef de zoekfunctie een centrale plek
70. Pas de zoektermen aan aan de woorden die de gebruiker gebruikt
71. In het zoekveld worden automatisch aanvulsuggesties gedaan
72. De aanvulsuggesties staan op basis van relevantie
73. Het maximaal aantal zoekresultaten is 10

Gesproken tekst

74. Er is een voorleesfunctie
 75. Er is een inspreekfunctie
- ### meertaligheid
76. Er kunnen verschillende talen worden gekozen
 77. Er zijn vertaalmogelijkheden via google translate

Hulp

78. Er is een introductie/instructie(filmpje)

Appendix F: Video text

Pagina 1/2 (12 sec)

Het onderwerp van deze video zal zijn waarom 8 uur slaap goed is voor je gezondheid.

Het doel van deze video is om samen op zoek te gaan naar manieren om beter te kunnen slapen.

Pagina 3/4/5/6 (25 sec)

Voordat we verder gaan is het belangrijk om uit te zoeken waarom slaap belangrijk is.

Wat voor voordelen halen we uit een goede nachtrust in ons dagelijks leven.

Maar hoelang is een goede nachtrust eigenlijk?

Onderzoek heeft ons geleerd dat gemiddeld 8 uur slaap per nacht een goede nachtrust oplevert.

Hier kunnen wij wat mee!

Nu gaan we kijken wat voor positieve gevolgen een nachtrust van 8 uur heeft.

Pagina 7/8 (10 sec)

Het brein, hart en vaten en je afweer zijn belangrijke lichaamsdelen.

We gaan bespreken wat slaap voor invloed heeft op je brein, hart en vaten en je afweer.

Pagina 9/10(10 sec)

Slaap is heel belangrijk voor je vermogen om te leren en onthouden.

Een goede nachtrust zorgt ervoor dat je hersenen goed hun taken kunnen uitvoeren.

Pagina 11 (6 sec)

Een goede nachtrust verlaagt de kans om last te krijgen van hart en vaatziekten.

Pagina 12/13 (13 sec)

Wanneer je slaapt is je immuunsysteem heel hard aan het werk.

Want tijdens de nacht is je lichaam hard bezig met herstellen.

Hierdoor is je lichaam weer in staat om ziekten en infecties te kunnen verslaan.

Pagina 14/15 (10 sec)

Het brein, hart en vaten en je afweer hebben je slaap hard nodig.

Een goede nachtrust is dus voor de algemene gezondheid erg belangrijk.

Pagina 16/17/18(16 sec)

Maar hoe kunnen we erachter komen of je lang genoeg slaapt.

Het tijdstip dat je in slaap valt en het tijdstip dat je wakker wordt zijn belangrijk.

Het tijdsverschil tussen het moment van in slaap vallen en moment van wakker worden kan ons iets vertellen.

Pagina 19/20/21/22 (30 sec)

U ziet hier nu een klok.

Het moment van in slaap vallen is hierin aangegeven.

Dit moment is 11 minuten na middernacht.

Ook het moment van wakker worden is aangegeven in deze klok.

Dit moment was ongeveer half acht s ochtends.

In het midden van de klok staat aangegeven hoelang er in totaal geslapen is.

In dit geval is dat zeven uur en eenentwintig minuten.

Dit is minder dan de algemene aangeraden 8 uur slaap per nacht.

Pagina 23 (7 sec)

Ervaar je gevolge van een slechte nachtrust?

Samen kunnen wij op zoek gaan naar manieren om beter te slapen.

Pagina 24 (5 sec)

Laten we kijken naar een aantal acties die je zouden kunnen helpen.

Pagina 25/26/27 (22 sec)

Een ritme kan heel erg helpen.

Dit kun je op twee manieren mogelijk maken.

Nummer 1 is dat je iedere avond rond dezelfde tijd probeert te gaan slapen.

Nummer 2 is dat je iedere ochtend rond dezelfde tijd opstaat.

Door een of beide van deze acties te kiezen kan je meer op je ritme letten.

Hierdoor zou je beter kunnen gaan slapen.

Pagina 28

Dus heb jij het gevoel dat je niet genoeg slaapt?

En voel je je niet topfit?

Samen kunnen wij op zoek gaan naar een betere nachtrust voor jou.

Appendix G: Transcript user test

Totale duur interview 15.15

De deelnemer zal weergegeven worden met D1 en de interviewer met een I.

I	Natuurlijk heel erg fijn dat u mee wilt doen aan dit onderzoek. Daar wil ik ook heel graag nog een keer uw toestemming voor krijgen. We moeten voldoen aan de regels van de universiteit. Graag hoor ik of u instemt met het volgende; u doet vrijwillig mee met dit onderzoek en u kunt ieder moment stoppen met dit interview. Dit is u ook duidelijk?
D1	Ja.
I	Je hebt de video al zelf bekeken via de email. De eerste vraag die ik je graag wil stellen is; wat was het onderwerp van de video?
D1	Het onderwerp was slaap.
I	Inderdaad, zeker wel. Kwamen er nog meer deelonderwerpen naar voren die je wel als belangrijk zou kunnen zien?
D1	Nou ik zal eerlijk zeggen wat ik ervan vond. Ik vond de video vrij kort. En met dingen die ik eigenlijk al wel wist. Dus ik heb zoiets van is het dit?
I	Dus het mocht wel iets meer van u zijn?
D1	Ja.
I	Het is natuurlijk een eerste video maar dat is natuurlijk helemaal niet erg. Alle tips van jullie zijn super fijn. Maar ik moet erachter komen of alle informatie ik in de video heb gestopt ook is overgebracht. Dus daar ga ik nu eerst een paar vragen over stellen. Dus heeft u het doel van de video ook begrepen?
D1	Ja nou wat ik eruit begrepen heb is wat ik al wist. Dat is dat het fijn is als je voldoende slaap krijgt. En goed oke, als je op tijd naar bed gaat. Maarja dat wil natuurlijk nog niet zeggen dat je dan ook slaapt. In die zin denk ik van ja. Leuke video maar er zit meer achter slaap om je prettig en fit te voelen.
I	Maar u heeft dus wel eruit gehaald hoelang bijvoorbeeld een goede nachtrust is?
D1	Ja 8 uur maar dat wist ik al.

I	Dat is al meer dan sommige anderen. Want anderen zijn daar soms helemaal niet van bewust. Maar u heeft dus niet zo veel nieuws gehoord.
D1	nee.
I	Over de gezondheidsvoordelen, welke gezondheidsvoordelen heeft u uit de video kunnen halen over het brein?
D1	Dat het brein na zijn 8 uur rust beter werkt.
I	Werden daar nog taken bij genoemd?
D1	Taken genoemd?
I	Nee oke. Dan werden natuurlijk ook de hart en vaten genoemd. Wat weet u daar nog over?
D1	Ja nou ja dat ze beter functioneren als je aan je slaap komt. Maar dat geldt voor je hele lichaam. Het is gewoon een geheel. Als je goed slaapt functioneren je hersenen en bloedsomloop allemaal beter. Dat is wel ingewikkelder in de praktijk.
I	Ja inderdaad, ook je afweer bijvoorbeeld. Heel interessant dat het er allemaal mee samenhangt.
D1	Maar ja goed. De hele manier van zijn hangt ervan af. Slaap hangt ook weer van andere factoren af.
I	Ja om dan even naar u te gaan. Weet jij een beetje hoelang je slaapt of probeer je dat bij te houden?
D1	Oh god. Ja dat is heel wisselend. Ik zit in een moeilijke situatie dat ik ook veel met pijn zit.
I	Dat heeft er veel invloed op ja.
D1	Dus dat is al een ding
I	Daar zul je zeker negatieve gevolgen aan ervaren
D1	En dat kan je niet zo veel beïnvloeden.

I	Heeft u het idee dat de video u een nieuwe manier gegeven heeft om te weten te komen hoelang u slaapt?
D1	Nee
I	Dus u was al op de hoogte van dat het belangrijk is om te kijken wanneer je gaat slapen en wanneer je opstaat?
D1	ja.
I	Vervolgens werd er natuurlijk ook je slaap duur geanalyseerd aan de hand van de klok. Weet u nog welke conclusie daaruit getrokken werd?
D1	Dat kan ik niet zo een twee drie terug halen.
I	Vond u dat dan ook niet een interessant deel?
D1	Nou volgens mij ging het over dat je de conclusie kon trekken dat als je minder slaapt dan die 8 uur. Dat je dan niet zo fit bent in vergelijking met als je wel 8 uur slaapt. Weet het niet helemaal zeker meer.
I	Heb jij het idee dat aan de hand van de video je jou slaap zou kunnen verbeteren?
D1	nee
I	Daar zou jij meer voor nodig hebben?
D1	Ja
I	Heeft u een idee over wat u meer zou willen zien?
D1	Meer factoren die belangrijk zijn voor mij die invloed hebben op mijn slaap. Dat is pijn. Dan kan je wel zeggen pijnstillers. Maar ik probeer heel veel met meditatie en yoga te doen.
I	Ja daarmee kan je je gedachten en lichaam rust geven inderdaad.
D1	Ja dat vind ik erg fijn om te doen.

I	Dan om een beetje naar de stijl van de video te kijken. Vond je elementen van de video afleidend?
D1	Nee, vond hem vrij kort dus.
I	Had u het idee dat het beeld, plaatjes, spraak en text dezelfde boodschap communiceerde
D1	ja
I	Wat u van de video vond was duidelijk. U had er meer van verwacht
D1	Ja ik ging er van uit dat je onderzoek doet en dus meer erop in probeert te spelen.
I	Wat had u meer verwacht?
D1	Wat ik net al aanhaalde. Dat je 8 uur slaap nodig hebt maar dat dit iets te simpel is. Sommige hebben minder nodig. Maar er zijn veel meer factoren die je kunnen belemmeren. En als je je slaap wilt verbeteren moet je echt die factoren pakken. Dus dan kan je dus veel meer op yoga en chi gaan zitten zodat je de rust in het lichaam kan krijgen.
I	Ja dat is zo. Deze video zou deel uitmaken van een serie. En dat je iedere video naar een nieuw aspect gaat kijken.
D1	Ja daar ging ik al ongeveer van uit.
I	Het lukt inderdaad niet om met een video van 3 minuten opeens al je problemen opgelost zijn.
D1	Dat zou mooi zijn.
I	En slaap is daar nog veel te complex voor. Wat ik je nog wil vragen is of je iets van de video het meeste aansprak of het beste vond.
D1	Ja dat is moeilijk te zeggen. Het was voor mij al duidelijk. Wat kan ik zeggen dna. Daar kan ik dus niet iets op zeggen.
I	U vond het niet te onduidelijk of te snel gaan.
D1	Nee voor mensen die er niks van afweten is het wel goed denk ik.

I	Zou u verder nog iets over de video kwijt willen?
D1	Nee hoor. Ik heb alles al wel gezegd. Ik zou het niet meer weten.
I	Dan hebben we de vragen besproken.
D1	Ja want alles wat je nu gezegd hebt is al zo lang bekend. Dus wat moet ik daar dan nu mee.

Totale duur interview 15.31

De deelnemer zal weergegeven worden met D2 en de interviewer met een I.

I	De opname is nu gestart. Natuurlijk heel erg fijn dat u mee wilt doen aan dit onderzoek. Daar wil ik ook heel graag nog een keer uw toestemming voor krijgen. We moeten voldoen aan de regels van de universiteit. Graag hoor ik of u instemt met het volgende; u doet vrijwillig mee met dit onderzoek en u kunt ieder moment stoppen met dit interview. Dit is u ook duidelijk?
D2	ja
I	Dan kunnen we beginnen met de vragen. De eerste vraag die ik je graag wil stellen is; wat was het onderwerp van de video?
D2	Slapen, slaap ritme. Gezond slaap ritme.
I	Ook werd het doel vd video genoemd? Weet je die nog
D2	Hoe tot een fatsoenlijke analyse te komen. Om aan een goede nachtrust toe te komen. Ik heb je van de week natuurlijk ook gemaaild dat ik hem gekeken heb maar daarna ook niet meer.
I	Dus hij is vandaag tijdens de les niet meer door bertil gedraaid?
D2	Nee. het lukte niet om hem op de grote tv af te spelen.
I	In de video werd ook genoemd hoelang een goede nachtrust was. Kan je daar iets over vertellen
D2	Ja 8 uur inderdaad.

I	Heb je dat uit de video kunnen halen of wist je dat al?
D2	Nee dat wist ik al.
I	Heb je dan in de gehele video wel iets nieuws gehoord.
D2	Nee was voor mij allemaal bekend. Wel lagere school kennis.
I	Het volgende onderwerp is dan de gezondheidsvoordelen. Wat heeft u gehoord over het brein?
D2	Dat je brein ook tot rust komt. Dat het alles verwerkt.
I	Bijvoorbeeld voor hart en vaten
D2	Ja daar blijkt het ook gezond voor te zijn. En dat wist ik trouwens nog niet!
I	En de afweer werd als derde genoemd.
D2	Ja dat was me wel al bekend. Als je niet genoeg rust krijgt dan ervaar ik dat zelf ook dat mijn afweer minder wordt.
I	Maar fijn dat er toch nog wat nieuws in zat.
D2	Ja toen je het zij bedacht ik het me inderdaad.
I	Vervolgens ging de video door naar uitleg over het ritme. Heeft de video jou een nieuwe manier gegeven om te weten te komen hoelang je slaapt?
D2	Nee. maar daar is bij mij geen pijn op te trekken. Zoals ik laatst al zij, ik ben een nachtmens. Dat is voor een jaar of 4, 5 jaar geleden terug erkent dat dit een ding is. Bij een ochtend dienst slaap slaap ik 3,4 uur per nacht. Bij middag dienst gaa tmijn hele ritme naar de kloten. Maar bij de nachtdienst leef ik helemaal op. Dan ben ik hard aan het werk. Ik kom thuis en eet wat en heb dan nog tijd om iets te doen. Dat is mijn ritme.
I	Dat is dan inderdaad eigenlijk het goede ritme. Maar zou je daar dus bijvoorbeeld een video over willen zien. Zovan dat was toen je dat hoorde wel even een opluchting toen dat erkent werd.

D2	Ja was wel fijn dat er erkenning voor was.
I	Ik heb het inderdaad ook gelezen. Het kan wel helpen om jezelf die ruimte te geven.
D2	Maar in de maatschappij kan het niet
I	De manier dat je kon letten op je tijd dat je naar bed gaat en de tijd dat je opstond was geen nieuwe manier voor jou om te weten hoelang je slaapt.
D2	Nee. ik val in slaap als ik moe ben of helemaal uitgeput doordat ik niet goed geslapen heb.
I	Want dat werd natuurlijk wel geanalyseerd in een klok afbeelding.
D2	Ja die was irritant
I	Oh wat was er precies irritant?
D2	Ja die was voor mij irritant. Niet duidelijk zeg maar.
I	Wat was er niet duidelijk aan?
D2	Ja ik heb er zo geen afbeelding van maar ik heb sws al moeite met een analoge klok. Ik kan al ongeveer weten hoelaat het is maar als ik die klok probeer af te lezen kan ik er nog naast zitten. Ik ben geen analfabeet maar analfaklok.
I	Dus je ziet liever de letterlijke cijfers.
D2	Inderdaad ik heb geen probleem met digitale klokken. Maar als er geen tekst bij had gestaan had ik hem niet gesnapt.
I	Dus de extra tekst heeft je wel echt geholpen dat is fijn om te horen. Maar wat zou je er zelf uitgehaald hebben?
D2	De half 8 haal ik er nog wel uit. Maar die tweede tijd leek voor mij meer rond 1 uur te zijn.
I	Er werd ook een conclusie getrokken uit de afbeelding. Weet je die nog?
D2	De hoeveelheid uur die geslapen was.

I	Weet je die ook nog?
D2	Weet ik niet meer zeker. Volgens mij wel.
I	Aan de hand van de video wordt er dan gezegd dat door op je ritme te letten kan je op je slaap letten. Bij jou geldt dat niet helemaal.
D2	Ja het is nog wel groter dan dat want het is niet puur en alleen je slaap ritme.
I	Het was nu niet helemaal duidelijk dat dit maar een video uit een reeks zouden kunnen gaan zijn.
D2	Oke. dat was voor mij en de rest ook niet duidelijk nee.
I	Vond je elementen van de video afleidend.
D2	Nee niet heel erg. De klok afbeelding heb ik dus moeite mee. Zolang de tekst ernaast staat kijk ik daarnaar. De bewegende wolken om de afbeeldingen heen kunnen afleidend worden ervaren. Voor mij persoonlijk kan het nog net tot ik erop ga letten. Dan zie ik alleen die beweging maar dit komt waarschijnlijk omdat ik autisme/adhd heb.
I	Vond u dat de verschillende mediums dezelfde boodschap overbrachten?
D2	Ja dat vond ik wel.
I	Wat vond je persoonlijk van de video? Leuk of beste?
D2	Ja interessant is een groot wordt maar het was wel gewoon duidelijk ook al wist ik het al. en ook begrijpbaar.
I	Zou je nog toevoegingen graag zien aan zo'n soort video? uitbreiding
D2	Ja nou ja de klok zou dus misschien anders kunnen. Het is moeilijk om te zetten naar een digitale klok. Maar ja voor mij is dat net niet handig.
I	Maar dan hebben we alles besproken.

Appendix H: Results expert review

Eline heemskerk 20:20

Vragenlijst gebruikerstest experts

Vragen	Antwoorden Eline Heemskerk	Antwoorden Jolanda Beernink
Welke aspecten van de video vindt u het geschiktst voor de doelgroep?	Langzaam en duidelijk spreken Laten vallen van stiltes zodat het even kan bezinken Duidelijke plaatsje Goede ondersteuning dmv spraak en plaatjes	Langzame spraak in combinatie met versterkende visuele elementen.
Welke aspecten van de video kunnen naar uw mening minder geschikt zijn voor de doelgroep?	Verschillend woordgebruik: Brein vs hersenen Slaap vs nachtrust Details die afleiden: De bewegende wolken zijn wel het element dat het meest zou kunnen afleiden in de video.	De klok afbeelding zag er wat ingewikkeld uit voor de doelgroep. Vraag me af of ze dat begrijpen. Ben benieuwd of het de doelgroep lukt om de conclusie goed te begrijpen uit de twee genoemde tijden.
Passen de onderwerpen van de video naar uw mening in de belevingswereld van de doelgroep?	Dit zou nog iets beter kunnen door bijvoorbeeld daar een uitgebreide focusgroep te houden. De gezondheidsvoordelen staan niet perse heel dicht bij de doelgroep. Iets van stress zou misschien beter passen.	Ja ze zijn niet heel erg ingewikkeld maar hier zou je nog meer betrokkenheid bij kunnen creëren.
Vind u het niveau van de informatie uit de video toereikend voor de doelgroep? Sluit het aan bij de belevingswereld? Is de informatie toegankelijk?	Het aansluiten aan de belevingswereld van de doelgroep kan dus iets beter maar daar is een uitgebreidere studie voor nodig. De informatie is in zekere zin veel toegankelijker gemaakt door de combinatie van de verschillende communicatie medium. Sommige moeilijke woorden zijn niet volledig uitgelegd en simpeler gemaakt tot het	Het heeft een aantal erg toegankelijke aspecten. De ondersteuning van de drie mediums versterken de boodschap.

	<p>juiste taalniveau A1-B1. Hier kan je dmv online tools checks voor uitvoeren.</p> <p>De uitleg is rustig en een stuk simpeler gemaakt waardoor het al toegankelijker is. Maar kan nog meer door eenduidiger woordgebruik.</p>	
<p>Kunt u iets zeggen over de eenduidigheid van het beeld, spraak en de tekst van de video?</p>	<p>Lijkt vrij eenduidig.</p>	<p>Er is duidelijk over nagedacht hoe dit zo toegankelijk mogelijk te kunnen maken. Op een aantal punten is dit gelukt. Maar er wordt bijvoorbeeld gevraagd naar het tijdsverschil tussen de tijd van opstaan en tijd van naar bed gaan, dit lijkt me te ingewikkeld.</p> <p>Deze ondersteunen elkaar erg goed.</p>
<p>Heeft u aan de hand van de video enige verbeteringen? Op het gebied van inhoud, op het gebied van layout?</p>	<p>Taalgebruik dat volledig overeenkomt dus geen dubbele woorden die verwijzen naar hetzelfde.</p> <p>Misschien het opsplitsen van de verschillende onderdelen van de video zodat je niet hoeft te switchen tussen onderwerpen.</p>	<p>Ik vind het een erg goed initiatief. Wel is het belangrijk om te kijken naar de implementatie. Want heel veel van de doelgroep zal het niet eens zien als het echt verwerkt zit in een digitaal middel. Het is belangrijk om dit ook echt met de doelgroep te testen want dat is altijd moeilijk inschatten.</p> <p>Het is een erg rustig thema. Dat ziet er erg goed uit. Weinig echte afleidende details.</p>
<p>Was de lengte van de video gepast?</p>	<p>De lengte hangt heel erg af van het onderwerp maar</p>	<p>Ja die lijkt me goed. Videos van 3-5 minuten houden</p>

	tussen de 3-5 minuten lijkt het beste voor deze context.	vaak nog wel de aandacht van de doelgroep.
Heeft u nog laatste toevoegingen die u zou willen voorstellen voor deze video?	Nee alles is genoemd.	Nee.

Appendix I: Information brochure and consent forms

Informatie brochure expert review

Beste heer/mevrouw,

Wij vragen je om mee te doen met een gebruikers test. Dit onderzoek wordt uitgevoerd om informatie te verzamelen over de doelgroep laaggeletterden. Door deel te nemen, help je mee met de ontwikkeling van een mobiele applicatie. Deze applicatie wordt gemaakt om extra ondersteuning te bieden voor het begrijpen/snappen van slaap data. Mocht je na het lezen van de informatie brief nog vragen hebben? Dan kun je terecht bij de onderzoekers: Maartje Aalders of Miriam Cabrita.

1. Wat is het doel van het onderzoek?

In dit onderzoek zijn wij op zoek naar hoe we een slaap data visualizatie kunnen ontwerpen die beter te begrijpen zijn. Dit houdt in dat de gebruiker de boodschap uit de informatie kan halen. Hierdoor kan de gebruiker te weten komen welke acties moeten gebeuren om beter te slapen. Dit is samen te vatten in de volgende (vertaalde) onderzoeksvraag:

“Hoe ontwerpen we een begrijpelijke en toegankelijke slaap data visualizatie in een mobiele applicatie voor laaggeletterden?”

2. Wat wordt er van je verwacht?

Deze gebruikerstest kost ongeveer 45 minuten van jouw tijd. Hierin bekijk jij een eerste versie van een video. In deze video wordt een nieuwe uitgebreidere visualizatie getoond. Deze uitbreiding bestaat uit extra informatie en uitleg over het onderwerp slaap en de visualizatie.

Dit moment plant Maartje (een van de onderzoekers) samen met jou. Je mag aangeven wanneer dit jou het beste uitkomt. Voor de gebruikers test zal er in overleg worden besproken door middel van welke digitale media de video opgestuurd zal worden. Ook het medium voor het gesprek dat hierop volgt zal in overleg gekozen worden. Na de gebruikerstest zijn er geen verwachtingen van je. Maartje zorgt dat de video tijdig wordt verstuurd.

3. Hoe ziet de gebruikerstest eruit?

Tijdens de gebruikerstest zal Maartje je vragen om een video te bekijken. Vervolgens zal er een vragenlijst besproken worden. Aan de hand van deze vragenlijst kijken wij of de video de informatie volgens u toegankelijk genoeg wordt gecommuniceerd voor de doelgroep. Ook zal er door Maartje naar jouw ervaringen met de video gevraagd worden.

4. Wat gebeurt er met mijn gegevens als ik deelneem?

Tijdens dit onderzoek wordt uw professionele mening verzameld. Alleen de onderzoeker die de gebruikerstest afneemt weet welke gegevens bij jou horen. Alle informatie die verzameld wordt, wordt gecodeerd (voorbeeld: ‘persoon 1’ en ‘persoon 2’) en is niet te herleiden naar jou als persoon. De verzamelde informatie wordt 5 jaar bewaard. Dit is om mogelijk verder onderzoek te kunnen doen, hierover te publiceren door onderzoekers van GGNet en de Universiteit van Twente of om de uitkomsten van het onderzoek te controleren.

5. Zijn er extra kosten/is er een vergoeding wanneer u besluit aan dit onderzoek mee te doen?

Er zijn geen extra kosten. Je krijgt aan de andere kant ook niet betaald voor deelname.

10. Welke ethische toetsingscommissie heeft dit onderzoek goedgekeurd?

Dit onderzoek is voorgelegd aan de ethische commissie van de Universiteit Twente (faculteit BSS). Deze commissie heeft bepaald dat dit onderzoek uitgevoerd mag worden.

11. Meer informatie?

Mocht u meer informatie willen over dit onderzoek, dan kunt u contact opnemen met een van de volgende drie onderzoekers:

- Maartje Aalders, bachelorstudent Creative Technology aan de Universiteit van Twente
 - E-mail: m.w.c.aalders@student.utwente.nl
- Miriam Cabrita, onderzoeker bij de Biomedical signals and systems-groep aan de Universiteit Twente.
 - E-mail: m.cabrita@utwente.nl

Toestemmings formulier

'Communicatie met laaggeletterden over slaap visualizaties'

'Ik verklaar hierbij dat ik op een voor mij duidelijke wijze ben geïnformeerd over de aard van de zaak en methode van het onderzoek zoals beschreven in de eerder genoemde informatiebrochure. Mijn vragen zijn naar mijn tevredenheid beantwoord. Ik ga akkoord uit mijn eigen vrije wil om deel te nemen aan dit onderzoek. Ik behoud het recht deze toestemming in te trekken zonder opgave van redenen en ik ben ervan op de hoogte dat ik me op elk moment uit de gebruikerstest kan terugtrekken. Mijn persoonlijke gegevens worden niet openbaar gemaakt aan derden zonder mijn uitdrukkelijke toestemming. Als ik meer informatie vraag over het onderzoek, nu of in de toekomst, mag ik contact opnemen met Maartje Aalders.

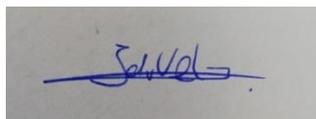
Vink het vakje aan als u het eens bent met het volgende:

- Ik heb de informatiebrochure en het geïnformeerde toestemmingsformulier gelezen en begrepen, ik hebben geen verdere vragen, en ik wil deelnemen aan het interview.
- Ik geef de interviewer toestemming om mijn naam als bron in het verslag te vermelden.

Als u klachten heeft over dit onderzoek, kunt u deze doorverwijzen naar de secretaris van de Commissie Ethiek van de Faculteit Elektrotechniek, Biomedical Signals and Systems aan de Universiteit Twente, postbus 217, 7500 AE Enschede (NL), e-mail: ethiek-comm-ewi@utwente.nl).

Getekend in tweevoud:

Jolanda Beernink
Naam deelnemer



Handtekening

'Ik heb een toelichting gegeven op het onderzoek. Ik verklaar mezelf bereid ten alle tijden antwoorden te willen verschaffen naar mijn beste vermogen die kunnen opkomen over mijn onderzoek'.



Maartje Aalders
Naam onderzoeker

Handtekening

Toestemmings formulier

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- Ik wil anoniem aan deze gebruikers test deelnemen.

Als u klachten heeft over dit onderzoek, kunt u deze doorverwijzen naar de secretaris van de Commissie Ethiek van de Faculteit Elektrotechniek, Biomedical Signals and Systems aan de Universiteit Twente, postbus 217, 7500 AE Enschede (NL), e-mail: ethiek-comm-ewi@utwente.nl.

Getekend in tweevoud:

Eline Heemskerk

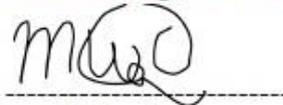
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Maartje Aalders
Naam onderzoeker



Handtekening