

Inclusive library for adolescents with dyslexia, ADHD, and/or autism

A study of the interaction between the digital and
physical library environments

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Abstract

Schools and libraries in Sweden strive to be inclusive of all groups in society, particularly people with disabilities. Both actors are responsible for making knowledge available to all, as knowledge is a necessary precondition for a democratic society that is both inclusive and well-functional.

This study was carried out on behalf of the Svane and Hedda schools in Lund, which will be co-located in the autumn of 2023 and will have a completely new joint school. The thesis thus sought to investigate how Svane-Hedda's school library could be made more accessible and inclusive for the target group of adolescents with dyslexia, ADHD, and/or autism; a target group that is enrolled in the schools but was not considered in the construction planning before the start of this study.

To understand the target group's needs and how the target group is excluded from school libraries, the degree project used multiple iterative design methodologies, with a focus on user-centered and universal design. The findings were then used to create a concept for how to make the Svane-Hedda library more inclusive and accessible to the target group. User tests have also been used to test and evaluate the concept.

The final proposal includes audio files that can be accessed by scanning QR codes on the backs of books and library shelves. The idea is to make it less irritating, stressful, and time-consuming for the target group to navigate and find what they need in the library on their own. A proposal for a web application for librarians with the goal of creating and managing audio and QR code files has also been developed, tested, and evaluated.

The developed concept has the potential to make the school library more accessible and inclusive for the target group, and it addresses several of the expressed needs of the target group. To guide further development of the presented concept, improvement suggestions for the developed concept are included at the end of the study.

Keywords: Universal design, Library, Adolescents, Dyslexia, ADHD, Autism, QR-codes

Sammanfattning

Sveriges skolor och bibliotek strävar efter att vara inkluderande för alla grupper i samhället, speciellt för personer med funktionsnedsättning. Vidare ingår det i båda aktörers roller att tillgängliggöra kunskap för alla, eftersom kunskap är en nödvändig förutsättning för ett inkluderande och välfungerande demokratiskt samhälle.

Denna studie har genomförts på uppdrag av Svane- och Hedda skolorna i Lund, som ska samlokaliseras under hösten 2023, och få en helt nybyggd gemensam skola. Examensarbetet ämnade därför att undersöka hur Svane-Heddans nya skolbibliotek kan göras mer tillgängligt och inkluderande för målgruppen unga med dyslexi, ADHD och/eller autism; en målgrupp som studerar vid skolorna men som inte hade fångats upp i byggplaneringen innan studiens start.

Examensarbetet har använt sig av olika iterativa design metoder, med fokus på användarcentrerad- och universell design, för att förstå målgruppens behov och hur målgruppen exkluderas från skolbibliotek. Insikterna har sedan använts för att ta fram ett koncept för hur Svane-Hedda biblioteket kan göras mer inkluderande och tillgängligt för målgruppen. Konceptet har även testats och utvärderats genom flertalet användartest.

Det slutliga konceptet nyttjar ljudfiler som nås genom skannandet av QR koder på baksidan av böcker och på bibliotekshyllor. Konceptet ämnar göra det mindre frustrerande, stressigt och tidskrävande för målgruppen att navigera och hitta det de behöver i biblioteket på egen hand. Vidare har ett förslag till webbapplikation för bibliotekarier tagits fram, testats och utvärderats, vars syfte är att skapa och hantera ljud- och QR-kodfiler.

Det utvecklade konceptet har potential att göra skolbiblioteket mer tillgängligt och inkluderande för målgruppen och möter flera av målgruppens uttryckta behov. Mot slutet av studien presenteras även flertalet förbättringsförslag, inför en vidareutveckling av det utvecklade konceptet.

Nyckelord: Universell utformning, Bibliotek, Unga, Dyslexi, ADHD, Autism, QR-koder

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In addition, I would like to give thanks to all the special pedagogues, librarians, and colleagues, who also belonged to the target group, and who have provided me with valuable insights about the thesis target group and libraries.

Furthermore, I'd like to express my gratitude to all the students from Svane- and Hedda schools who took part in my research, shared their stories, and helped evaluate the developed concept. Without their perspectives and knowledge, the study would not have been possible.

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1 Introduction

The context for the thesis is shortly presented and described in this chapter, followed by the set objectives and delimitations. Finally, an overview of the disposition of the report is presented.

Lund municipality decided to co-locate the primary school, Svaneskolan, and the high school Hedda Anderssongymnasiet, in 2019 [1]. A briefing given by principles from Svane- and Hedda schools, revealed that the new school is currently being built where Svaneskolan was previously located. Most of the construction work is now done, and there is currently dialogue between Svaneskolan and Hedda Anderssongymnasiet about how to furnish the joint surfaces; one of them being a common library. An important challenge that is currently being considered by the school is how joint surfaces should be designed to promote inclusive, social, and learning environments. The new school is therefore interested in exploring ways in which these joint surfaces and everything they will contain could be made more accessible. Both schools currently have some students with dyslexia, ADHD, and/or autism. Hedda Anderssongymnasiet is additionally considering developing a program for students with special needs in the future. This is a further motivation for the schools to explore new ways of making the common school more inclusive and accessible.

The schools are currently using separate temporary buildings. The schools' individual names will hence be used throughout this report when the schools are addressed separately. The joint school being built for the two separate schools will be called the Svane-Hedda school in this thesis.

1.1 Objectives

The following objectives will be addressed and explored in this thesis:

- Investigating and understanding the needs of different youth groups that will be using the library, with a special focus on adolescents with dyslexia, ADHD, and/or autism.

- Developing a concept for a more inclusive and accessible library to especially include adolescents with dyslexia, ADHD, and/or autism.
- Communicating and evaluating the created concept through the development of prototypes.
- Exploring the intersection between the digital and physical environments as a tool for increased inclusivity and accessibility in indoor environments.
- Identifying which methods are useful and relevant to consider when applying universal design principles to develop more inclusive and accessible indoor environments.

1.2 Delimitations

This thesis is limited to focusing on developing a concept for creating a more inclusive library for adolescents; more precisely, for students of upper elementary and high school age in Sweden (i.e., age 13 – 19). Further considerations will be made to specifically target and include certain youth groups with impairments throughout the design process. However, only youth with dyslexia, ADHD, and/or autism will be addressed. The decision to limit the number of different youth groups with impairments considered, was to set a reasonable scope for the thesis. The three selected diagnoses were based on a request made by the Svane-Hedda school, where they wished for the thesis to especially address these three diagnoses, as they currently have many students that fall within these groups. The thesis will further be limited to only considering all steps up until and including the concept and prototype development phases of the design process. The final technical implementations will not be addressed through this study.

1.3 Disposition

Some additional and relevant background information is presented after this introductory chapter. The thesis methodology is then presented, followed by four chapters, in which each chapter is dedicated to one of the design phases: Empathize, Ideate, Define, and Prototype. The report ends with a discussion of the study's findings and a conclusion.

2 Background

Further motivations for this thesis project are presented in this chapter, as well as some background information on cognitive processes and the psychological disabilities dyslexia, ADHD, and autism. Finally, the social model of disability is described, and its implications explored.

2.1 Motivation

This section presents some brief background information about the mission of libraries and schools, to elaborate on why the thesis topic is relevant for both stakeholders.

2.1.1 The Library's Mission

The Swedish Library Association [2] provides a report on The Library Act (2013:801), which came into force in 2014, and set the legal framework for all libraries in Sweden financed by public funds. The law emphasizes the importance of libraries for the development of a democratic society. It is stated that libraries have a significant and fundamental role in ensuring knowledge is accessible to everyone, as well as enabling people to freely formulate and have their own opinions (2 § 1). Moreover, libraries are obligated to pay special attention to people with disabilities (4 § 1). Prioritizing societal groups that face bigger obstacles in accessing knowledge is a prerequisite for an inclusive and well-functioning democratic system. Libraries are therefore expected to support people with disabilities by understanding their different needs to offer both literature and technical aids that make knowledge more accessible. [2]

2.1.2 The School's Mission

Similar to the libraries, the schools lean on democratic values and aim to provide knowledge for all students on equal terms [3]. The Swedish Nation Agency for Education (in Swedish: Skolverket) [3] explains that schools should work for ensuring the participation and involvement of students, while also contributing to

accessible learning environments and working against discrimination. With these values in mind, it shows the importance of ensuring that the school library offers inclusive and accessible environments that promote knowledge and learning.

2.2 Human Cognition

Background information about human cognition is presented in this section, as the thesis's target group has some limitations in one or more of the different cognitive categories.

Cognition is defined by Cambridge Cognition [4] as “the mental action or process of acquiring knowledge and understanding through thought, experience, and the senses”. It further entails storage, manipulation, and retrieval of information. The different cognitive processes can be grouped into five main categories: Social cognition, Executive function, Memory, Attention, and Psychomotor speed. Social cognition is concerned with how a person responds to and processes emotional stimuli, while Executive function relates to problem-solving and decision making. Memory involves how and for how long information is stored, while Attention includes how well a person attends to some information whilst overlooking others. Finally, Psychomotor speed deals with how accurately a person identifies and reacts to a stimulus. [4]

Cognitive processes rarely happen independently of each other and are often occurring simultaneously in any given activity [5]. A simple example of this is reading, in which sustained attention is needed to concentrate on the letters and words in a text. The words are simultaneously processed in the working memory and several parts of the memory are further engaged to provide the relevant context for understanding the meaning of the text.

Understanding how cognition functions, its strengths, and limitations, is important, not only for understanding what healthy cognitive development is, but also to understand how a person's cognitive abilities are affected by different psychological impairments [4]. A deep understanding of human cognition is further important when designing interactive solutions, as it supports the designer in making well-founded design choices by understanding the design implications of each cognitive process [5].

2.3 Psychological Disability

Psychology teacher Alston [6] defines psychological disability as “a spectrum of mental disorders or conditions that influence our emotions, cognitions, and/or

behaviors”. The psychological disabilities considered in this thesis are dyslexia, ADHD, and autism. Some background information about the disabilities is therefore presented in the subsections below, to give a better understanding of the diagnoses’ characteristics.

2.3.1 Dyslexia

Dyslexia is defined by the International Dyslexia Association [7] as:

“...a specific learning disability that is neurobiological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language...”.

In simpler terms, people with dyslexia struggle in mapping letters’ shapes with their corresponding sounds, which consequently makes the task of reading and writing challenging. Dyslexia does however not directly affect a person’s intelligence, but the person’s mindset can influence how well they attain success [8].

Statistics presented by The Swedish Brain Foundation (in Swedish: Hjärnfonden) [9] indicate that around 4 – 8 percent of the Swedish population have dyslexia and that the diagnosis is more common among males than females. Moreover, a child with either dyslexia or Attention-Deficit/Hyperactivity Disorder (ADHD), runs a greater risk of having both diagnoses [10].

2.3.2 Attention-Deficit/Hyperactivity Disorder (ADHD)

ADHD is a quite prevalent neurobehavioral disorder in the world [11]. The National Board of Health and Welfare (in Swedish: Socialstyrelsen) [12] estimated that, around 4.5 percent of the girls and nearly 9 percent of the boys, between the ages of 10 and 17 years old had been diagnosed with ADHD in 2020, in Sweden.

Centers for Disease Control and Prevention [13] explains that persistent inattention, hyperactivity, and impulsivity are the three most common traits associated with ADHD. Common symptoms of inattention include becoming easily distracted and forgetful, finding it difficult to listen to instructions, and maintaining attention throughout tasks. The latter especially holds for tasks requiring attention and mental effort for an extended amount of time. Hyperactivity and impulsivity are characterized by habitual fidgeting; a persistent need to move around, even in situations when it is not suitable; excessive talking; and repeatedly interrupting others, for example, during conversations. [13]

2.3.3 Autism

Around one percent of children and roughly the same proportion of adults have been diagnosed with autism in Sweden [14]. Boys are more commonly diagnosed than girls, which makes one believe that it is mainly boys that are affected by autism; however, girls are often wrongly diagnosed, not diagnosed at all [14], or get diagnosed much later than boys [15]. A licensed psychologist, Maria Bühler [16], clarifies that there is a lack of knowledge about girls with autism, which explains why many are misunderstood and diagnosed late.

The Swedish Autism & Asperger Association [15] explains that the two key characteristics of autism are: continual limited social interaction and communication; and restricted, repetitive behaviors. The first involves a limited understanding of social cues, where people with autism often come across as insensitive or socially awkward. This is not limited to speech but also includes facial expressions, eye contact, and body language. Restricted and repetitive behavior is described to take many different forms and can appear in motoric movements, interests, and activities that people with autism decide to engage in. Furthermore, many people with autism appreciate structure and routine. They avoid changes even if the changes are small, as any change can be a source of anxiety. [15]

Sensitivity to sensory impressions is another common symptom of autism and includes increased or reduced sensitivity to e.g., light, sound, and tactile [15]. Autism is moreover described as a spectrum, as there is a large variation in the intellectual function and language skills among people diagnosed with autism [15].

2.3.4 Similarities between ADHD and Autism

Zeliadt [17] presents and discusses a study by Karalunas et al. from 2018, which suggested that children with ADHD or autism, shared some common cognitive challenges. The study demonstrated that the test results on short-term memory, mental-processing speed, and impulse control tests were lower for children with one of the two diagnoses, in comparison with the controls. A test of reaction time did however reveal a difference between children with ADHD and children with autism. The latter sacrificed speed for accuracy, while children with ADHD balanced both, just like the controls did. [17]

Zeliadt [17] further quotes an emeritus professor of cognitive development from the University College London, Uta Frith, who made an interesting point based on the study by Karalunas et al.: “The autism group needs more evidence before they make their decision, so they are more cautious”. The professor did however mention that it could be a question of communication, where people with autism might not have understood that they had to be both quick and careful while performing the given task [17].

Both potential reasons behind why children with autism tend to sacrifice speed for accuracy are interesting and relevant for this thesis, as both could lead to very different project outcomes. The requirements placed on the final developed concept might differ significantly depending on if children with autism struggle with communication and understanding instructions, or if it is a question of needing more time and evidence before making a decision. Both reasons will therefore be kept in mind in the user research phase.

2.4 The Social Model of Disability

Many legal and political measures have been taken throughout the years to improve accessibility and reduce the exclusion of people with disabilities, such as the UN Convention on the rights of persons with disabilities [18], and the EU's strategy for the rights of persons with disabilities 2021-2030 [19]. However, many disabled still face obstacles in their daily lives [20] and there is therefore still a lot more that can be done to increase accessibility and limit the exclusion of disabled people.

Buder et al. [20] explain that how we think and talk about disability can explain why the disabled face many obstacles daily. Two models used when talking about disability is the medical and social models of disability. The main difference between the two models is that the first attributes a person's inability to participate fully in society to their impairments, while the latter suggests that a person's disability is a result of the attitudes and physical constructions of society. The social model makes an important distinction between impairment and disability, where impairment is explained as individual limitations in physical or cognitive abilities, and disability as the disadvantaged position a person is put in as a consequence of societies being developed with the average human in mind. [20]

Svensk [21] starts one of the chapters in the book *Human-centered Design* (in Swedish: *Människonära Design*) with the question "In the realm of the blind, the one-eyed is king?", which provides an interesting perspective that can help concretize and further support the social model. What Svensk suggests is that the one-eyed would not be a king in the realm of the blind because the realm of the blind would not be built for someone who can see; hence, the one-eyed would not have any apparent benefit from his sight. [21]

Svensk further emphasizes that it is important to not only focus on teaching a person with a cognitive impairment about the common understanding of the world. The designer should rather attempt to make what is common strange, i.e., to dare to question assumptions about the world and common traditional constructions. This shift of mindset allows for improved identification of needs and problems, while also enabling more creative and norm-critical solutions to be developed. [21]

3 Methodology

In this chapter the theoretical framework for relevant design methodologies is first presented, followed by an overview of the developed and used thesis methodology.

3.1 Design Thinking & Interaction Design

Design Thinking is described by the Interaction Design Foundation [22] as a “non-linear, iterative process that teams use to understand users, challenge assumptions, redefine problems and create innovative solutions to prototype and test”. The process is further explained to consist of five phases, Empathize, Define, Ideate, Prototype, and Test. These phases are captured in one of the most known visual models: the Double Diamond [23], which the British Design Council developed in 2004. The model consists of four phases: Discover, Define, Develop and Deliver [23]; each seemingly corresponding to Empathize, Define, Ideate and Prototype respectively, while Test can be thought to occur throughout the design process and be part of the iterative and evaluative nature of the process.

The Double Diamond will be used as an umbrella for the thesis methodology, as it could provide a base structure to lean on throughout the design process, which is illustrated in Figure 3.1 in section 3.4. Using the Double Diamond further involves moving from a divergent to convergent thinking twice, once per diamond; allowing room for exploring several ideas before selecting which to further pursue [23].

The interaction between the users and the final developed concept is an important part of the project, as an improved interaction could facilitate and increase the target group’s use of the library. Interaction design and its key characteristics will therefore further guide the design process adopted in this thesis.

Interaction design is defined by the Interaction Design Foundation [24] as “... the design of the interaction between users and products”. The main aim of interaction design is further explained as developing interactive products that support people in accomplishing their goals successfully and satisfactorily. The interaction design process consists of four main activities, quite similar to the four phases of the Double Diamond, and additionally has three key characteristics: user involvement, agreeing upon usability and user experience goals early in the project and continual iteration throughout the design process [5].

The next section is dedicated to explaining user-centered design, which will be adopted in the thesis method. This, as the core of interaction design, is based on adopting a user-centered approach throughout the design process [5]. Usability and user experience (UX) goals will not be set for the thesis, as the thesis work will be in the early design stages. Deciding upon usability and UX goals could hence limit the explorative nature necessary in the early stages of design.

3.2 User-Centered Design

The Interaction Design Foundation [25] defines User-centered Design (UCD) as “... an iterative design process in which designers focus on the users and their needs in each phase of the design process”. Preece et al. [5] explain that one of the aspects of UCD is to gather insights about users and their tasks, to let these insights guide the design. Involving users in the actual development process was also mentioned to be another important aspect of UCD. It was further explained that the degree to which users are involved could vary, but the involvement of users in the design process did increase the user acceptance of the final product. Finally, expectation management and ownership were mentioned to be two additional aspects that affect the degree of use of the final product [5].

3.3 Universal Design

The founder and program director of The Center for Universal Design, Ronald L. Mace [26], defined Universal Design (UD) as “... designing all products and the built environment to be aesthetic and usable to the greatest extent possible by everyone, regardless of their age, ability, or status in life”. Burgstahler [27] explains that UD products or environments are developed with the aim to be usable, inclusive, and accessible. Seven principles have been developed to guide the design of UD products or environments: equitable use; flexibility in use; simple and intuitive; perceptible information; tolerance for error; low physical effort; size, and space for approach and use [27].

A model for guiding an inclusive design process was developed by the Engineering Design Centre at the University of Cambridge [28], where the model is part of an Inclusive Design Toolkit. The developed model consists of four phases: Manage, Explore, Create and Evaluate. Manage helps keep track of the design process and with planning the next design steps. Explore aims to investigate and formulate *Clearer needs*, Create helps develop *Better solutions*, while Evaluate gives *Stronger Evidence* to support the final developed concepts.

The suggested UD model is rooted in empathy and questioning assumptions, which promotes a norm-critical design that embraces peoples' varying ability levels. The users' needs could hence be better understood, and solutions more creatively and accurately developed for each completed design cycle [28].

The UD design process will be incorporated into the overall design methodology used in this thesis; mainly because the thesis's target users have some type of psychological impairment, which emphasizes the need for a design process influenced by UD principles.

3.4 Thesis Methodology

The thesis methodology will use the Double Diamond, presented in a previous section, as a base structure for the design process. Furthermore, a user-centered approach will be adopted throughout the design process, in which users will be involved at several stages of the process, mainly in the phases Empathize and Prototype shown in Figure 3.1 below.

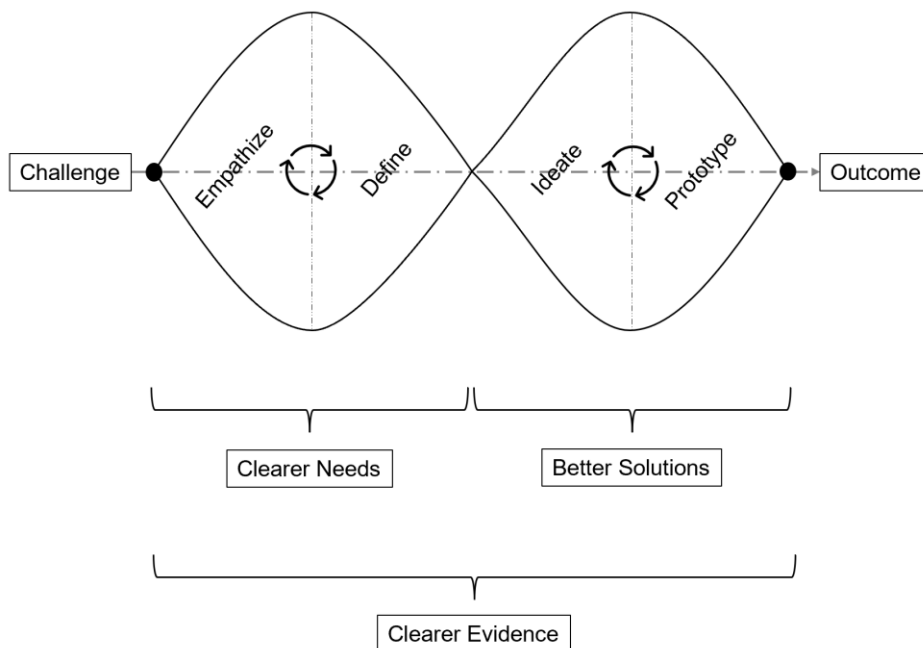


Figure 3.1 Illustration of the thesis methodology

The UD model and principles, presented in the previous section, will be incorporated, and used as checkpoints throughout the thesis design process. This is to ensure that the final concept and prototype are developed to meet the aim of being usable, inclusive, and accessible, especially for users with the psychological

impairments: dyslexia, ADHD, and/or autism. The first two phases of the Double Diamond – Empathize and Define – allow for a clearer understanding of the users’ needs, while the second two phases – Ideate and Prototype – allow for better solutions to be developed. Continual testing and iteration throughout the design process will be used to provide clearer evidence; supporting the final solution presented at the end of this thesis.

Each of the design phases will be explored, detailed, and explained in the coming sections of the report.

3.5 Designing with Adolescents

There are many challenges associated with co-designing with adolescents. The main challenges related to the recruitment of adolescents to participate are captured and presented in an article by Bassett et al. [29]. The study showed that teens were limited in their voluntary participation as their involvement depended on how their relationship was with their parents. Some teens could be given a choice, while others could be forced to participate or abstain from participation in a study [29].

The primary challenges in the interview process were also summarized by Bassett et al. [29] and included the use of technology, opening statement, and location. Teens became less talkative during an interview as soon as the recorder was activated. Furthermore, using a classical opening statement commonly used with adults, where the participant is informed about the interview’s confidentiality and judgment-free nature, made the interview feel more formal and put the interviewer in an authoritarian position. It was additionally challenging to find a location that balanced privacy, so teens could feel comfortable in talking freely, and public visibility that would make them feel safe [29]. The issue of location was also highlighted by Knudtzon et al. and Davis, who raised the importance of selecting a good location for the interviews with adolescents, aiming for a place that was perceived as inviting, non-threatening, and easy to transport to [30][31].

The final challenges presented by Bassett et al. [29] related to engaging adolescents and included four main points; having access to prior information about the interviewee, interviewer disclosing information about self, identifying and using cultural references, and cultural similarities between interviewer and interviewee. The main takes from these four points are the importance of building a relationship with the interviewees by understanding their interests and preferences, while also letting them get to know the interviewer. Additionally, cultural references can help make the abstract more concrete through the use of examples [29].

Davis's [31] research describes factors that motivate teens to participate in a co-designing team and issues that limit participation. The motivational factors were divided into intrinsic and extrinsic factors. The intrinsic factors outweighed the

extrinsic factors, and mainly involved: a frustration that adults did not get it right, and a desire to have a role in developing solutions that would have a real impact on the world. The challenges to participating included: skepticism of the commitment of other adolescent participants, having a busy schedule, and an unwavering demand of being treated as equals throughout the design process [31].

A final important challenge is that adolescents, contrary to younger children, can be more concerned with and limited by thinking in terms of “what is not possible” and “the right answer” [30]. This was still the case even when the adolescents in the study by Knudtzon et al. [30], were reminded that they should think exploratively, which suggested that school thinking was deeply installed in them.

The challenges and motivations associated with co-designing with adolescents will be addressed and considered throughout the thesis design process, especially in the Empathize phase. This is to better reach out to and engage the target group: adolescents with dyslexia, ADHD, and/or autism.

4 Empathize

This chapter presents the work done under the Empathize phase of the design process, which includes the developed user research methodology and the insights obtained from the user study.

4.1 Purpose

The main purpose of the Empathize phase is to obtain a deeper understanding of the target users by understanding their needs and emotions, as well as understanding how they think and what motivates them [32]. It is essentially a research phase, but one that emphasizes the importance of questioning assumptions, stepping into the users' shoes, and embracing a beginner's mindset [33].

Increased reliability and validity of the research insights can be obtained through the method of triangulation, which in simple terms means that insights about the users and the user context are attained using several methods and sources [34]. Different triangulation types exist, but the main two types used in this thesis project were data and methodological triangulation [34]. In the thesis context, it meant talking to different people and using several different methods to gather user insights. The details on how the Empathize phase was designed and conducted is presented in the next section.

4.2 User Research Methods

Adolescents with dyslexia, ADHD, and/or autism are the main target users of this thesis project; especially youth from the target group who are enrolled in Svane or Hedda Andersson schools. Adolescents from the schools were therefore naturally involved in the Empathize phase. The thesis project was presented during class visits or by directly contacting students through a special pedagogue or teacher. The students then had the option to decide if they liked to participate in the study or not.

At first, the classical user research methods interviews and questionnaires were considered, but these were quite early criticized and rejected. A study by Nakarada-Kordic et al. [35] highlights that traditional research methods are usually not

effective in revealing key insights about youth. Research methods have been developed and used for empathizing with adults and children, but there seems to be a gap when it comes to researching youth. According to the study, traditional methods designed for adults were perceived as dull and intimidating by young people, while methods developed for children were seen as belittling and condescending. Nakarada-Kordic et al. co-designed with youth experiencing psychosis and suggested that the issues associated with using the traditional user research methods, designed for adults or children, were likely to be magnified if the participating youth were also struggling with their mental health [35].

Preconceptions and assumptions about the target users were therefore identified and considered, before deciding upon which research methods to use when meeting the thesis target group. These assumptions can roughly be split into two classes: assumptions about youth; and assumptions about the diagnoses of dyslexia, ADHD, and autism. There seemed to be limited research on co-designing with or for several different user groups simultaneously, especially studies about dyslexia, ADHD, and autism, which further stressed the importance of early identifying assumptions and addressing these. Some research existed on co-designing with adolescents, which was presented in the previous chapter, section 3.5. The insights from the presented research were used to guide the design of the Empathize phase.

The second group of assumptions was explored by conducting semi-structured interviews with librarians and pedagogues, who had an experience working with youth with dyslexia, ADHD, and/or autism. Furthermore, three youths, who the author knew before the thesis study, and who were close in age to the students to be interviewed at Svane-Hedda school, were interviewed using semi-structured interviews. More sensitive and direct questions could be asked to these three youths, which helped provide a deeper understanding of the target group. The latter group was named “heroes”, as they could be described as role models; youth who had dyslexia, ADHD, and/or autism, understood their diagnosis/diagnoses and who could help the author better reach out to the students at Svane- and Hedda schools. Details about the semi-structured interviews are given in the following subsection.

4.2.1 Semi-structured Interviews

Preece et al. [5] explain that there are many different interview types, where semi-structured interviews is one of them. Semi-structured interviews consist of predetermined questions that guide the actual interview. The interviewer can however ask follow-up questions when needed during the interview, to deepen the conversation by asking for more details [5].

The interview guides, for interviewing pedagogues and the heroes, were developed by first identifying which topics were important to cover during the interviews. A set of questions were then developed for each topic. Both semi-structured interviews were pilot tested, as pilot testing helps identify any unclear questions, which could

then be modified before the actual interviews [5]. The purpose and set themes of the developed interview guides are described below.

4.2.1.1 Interviewing pedagogues and librarians

The purpose of the interviews was to mainly understand how the experts viewed the library, as well as understanding how dyslexia, ADHD, and autism affected the youths' cognitive abilities and their attitude toward the library. The interviews also aimed to capture some general advice about what was important to consider when meeting the target users.

The identified themes that guided the design of the interview guide were the following:

- Background information about the interviewee
- The mission of the library
- Target users' cognitive abilities and attitudes
- Inclusive and exclusive factors
- General advice
- Digital literacy

The theme "Inclusive and exclusive factors" was added to identify what factors could make the target users feel included or excluded from the school and library environments. A question about digital literacy was included to investigate how well the thesis target group could handle digital tools.

The detailed interview guide can be found in appendix B.1.

4.2.1.2 Interviewing heroes

The purpose of interviewing the heroes was to mainly understand how the diagnosis/diagnoses had affected their lives, the role of the library in their lives, and what factors could make them feel excluded. Moreover, the interviews provided an opportunity to ask for advice in preparation for meeting the main target group: students at Svane-Hedda school with one or more of the three diagnoses.

The identified themes that guided the design of the interview guide were the following:

- Background information about the interviewee
- The role of the library
- Deeper questions about diagnosis/diagnoses
- Inclusive and exclusive factors
- General advice

The detailed interview guide can be found in appendix B.2.

4.2.2 Structured conversation with the target users

The insights gathered from the semi-structured interviews, provided a better understanding of the diagnoses and of what was important to keep in mind throughout the design of, but also during the actual user research sessions with the target users. The key insights, that were considered when setting the structure of the research sessions with Svane-Hedda students, are given below. The remaining insights are presented in section 4.4.2, which mainly relate to the actual interview process.

- It is important to have a clear structure throughout the session
- Attempt to build a personal relationship with the students
- Let them feel seen for who they are and not for their diagnosis (s)
- Make the abstract concrete, by breaking down big and explorative questions into digestible sub-questions
- Avoid making youths with dyslexia read, especially out loud
- Do not make them feel dumb, especially by unnecessarily repeating information to them that they did not ask you for
- Avoid dumping too much information at them at the same time, break it down

The overall set structure, for the research sessions with the target users, can be described as a structured conversation, which essentially is a semi-structured interview, but without the dull and intimidating tone associating it. The content of the structured conversations was mainly inspired by a developed workshop methodology in the study by Nakarada-Kordic et al. [35], where ice breaker, relatable persona, brainstorming activity to capture ideas, and a card sorting activity of pre-identified high-level information topics were used. The developed methodology was however developed for a workshop session, while the target users in this thesis project were talked to individually. The choice of opting for individual sessions was to eliminate the risk of having participants decline to participate, or become less talkative, due to not being comfortable with talking openly about their diagnosis/diagnoses in front of other class or schoolmates. The different parts of the designed structured conversation guide are presented and motivated in the following subsections; all of which were also pilot tested and updated based on feedback. The detailed guideline description of the structured conversation can be found in appendix B.3.

4.2.2.1 Ice breaker

Ice breakers are quite useful and important to make participants feel comfortable; engaged; and further help remove communication, authoritative, and hierarchical barriers [36]. It was therefore quite natural to include an ice breaker at the start of the structured conversations. A simple ice breaker was chosen, in which both the interviewer and the participant had to disclose three fun facts about each other. This

also provided an opportunity to access prior information about the interviewee and let the interviewee get to know the interviewer better, which could further increase the engagement of adolescents according to Bassett et al. [29].

4.2.2.2 Relatable persona

The method of using a relatable persona was used in a similar way as in the study by Nakarada-Kordic et al. [35]. The method of generating a relatable persona, enabled participants to bring up their deeper worries, challenges, and experiences. Projecting their thoughts and feelings onto an imaginary character; redirecting attention and pressure away from the participant and onto the character.

Two personas were created, Adam and Jasmine, to account for possible gender differences. Each character was described as a person who was young and had dyslexia, ADHD, and/or autism. Each participating adolescent was then tasked with presenting the given persona, by answering a couple of questions, to get to know the persona better. The participant was encouraged to make use of their own experiences when presenting Adam or Jasmine.

4.2.2.1 Dream library

The brainstorming activity to capture ideas used by Nakarada-Kordic et al. [35] was modified slightly to an activity in which participants describe their dream library. Describing a dream library is a broad question and could be perceived as too abstract by some. This especially applied to participants with autism, as revealed by one of the heroes. Therefore, the exercise also included a set of questions to help break down the task for the participants. These questions were only to be used once a participant felt he or she had run out of ideas. The questions helped capture different aspects of the future dream library, such as how information should be presented, navigation, seating, lighting, and coloring; allowing the participant to describe his or her future library from numerous different perspectives.

Svane-Hedda school provided the author with the construction drawings of the new school building. A simplified sketch of the library could be drawn based on the construction drawing, which was presented to each young participant when presenting the dream library exercise. This was done to help further guide the youths' ideas by setting some type of ideation framework. The physical design of the library was already set and so any suggested ideas, that went against the predetermined library structure, could thus not be met through the thesis work.

4.2.2.2 Pre-identified factors by other stakeholders

Nakarada-Kordic et al. [35] collected high-level information topics from other stakeholders and presented these to the participants; asking them to sort them in order based on their relative importance. The participants could also add more topics if they felt anything was missing. The same approach was adopted in this thesis, but the participants were also allowed to remove topics if they felt that any of the topics were irrelevant to them. This addition was due to two main reasons: allowing the

participant to feel more in control of the exercise; and because the included topics captured high-level aspects for three different diagnoses, which meant that some of the topics could be irrelevant for some participants.

The included high-level topics were identified through a brief analysis, by creating an affinity diagram, of the semi-structured interviews with pedagogues, librarians, and the heroes. Affinity diagrams will be explained more in detail in a separate section later in this chapter, as it will be used again to analyze all user research data. Affinity diagrams can however shortly be described as an effective method to understand gathered information by clustering similar insights together and letting themes emerge from the data [37]. The created affinity diagram is found in Appendix C.

The identified themes were sound level, clear instructions, sensory impressions, as well as acceptance and acknowledgment. Six topics were then formulated based on these themes; using the sub-topics in each overarching theme as a guide. Topics from the theme acceptance and acknowledgment were not included among the final presented topics to the participants, as it was seen as an umbrella term that encompassed the rest of the themes. The presented topics to the participants were the following:

- Peace and quiet
- Talking zone
- Find what you are looking for in the library on your own
- Help instructions in the library that are not just in text
- Cozy seating
- Isolated seating

Cozy and isolated seating may be believed to be quite similar, but there is a distinct difference. It was interesting to explore if the participants would still opt for an isolated spot if it was uncomfortable, or if it was more important that the seating was comfortable.

4.2.2.3 Library visit

An additional exercise was added before the end of the structured conversations, namely a visit to the current school library. The library visits allowed for an informal observation of how the target users interacted with the library. Observing and talking to the users in a real context, could help with further understanding their needs [5]. The participants were not asked to walk around and pretend to do what they usually did in the library, as there was a perceived risk of it feeling childish or making them feel uncomfortable, by being put at the center of attention. They were instead tasked with explaining what they saw and thought about the library, while also answering a couple of follow-up questions. These questions were based on what had been revealed during the other exercises. Examples of questions asked were:

“You just walked in, what would you do next?”

“What would you do if you wanted to find a book?”

The library visit was rounded off with a final question that helped highlight what topic was most important for the participating adolescent:

“What is one thing you believe is important for me to keep in mind from our conversation today?”

4.3 Methods for Data Analysis

This section presents the different methods used for analyzing the data gathered from the user research.

4.3.1 Affinity Diagram

Affinity diagrams are useful for analyzing qualitative data [38] and they were hence used to analyze the data gathered from the interviews with pedagogues, librarians, the heroes, and the youth with dyslexia, ADHD, and/or autism.

The process of affinity diagramming is explained by Martin et al. [38] as “a process used to externalize and meaningfully cluster observations and insights from research”. It is furthermore explained as a bottom-up data analysis approach, wherein small details are identified and clustered into groups, which then allows for central themes to emerge inductively. The process can be described by the following three steps:

- The analyzer extracts observations from the gathered research about the users.
- Each observation is then noted down on post-it notes and attached to a large blank canvas.
- Overarching themes emerge by moving around the post-its; grouping them based on affinity [38].

4.3.2 Behavioral Mapping

Observable characteristics obtained during observations can be documented using behavioral mapping [38]. Modified place-centered mapping was used to analyze and document the observational information obtained from the library visits. Martin et al. [38] explain that place-centered maps capture observational insights of people at a specific location and focus on how a given space is utilized. It is further explained that the observed movements, activities, descriptions of the environmental context,

and time spent at different spots at a specific location, are usually noted down and presented on a place-centered map [38].

The behavioral map, documenting the library visits, will instead present the descriptions of, and what the observed interviewees pointed at during the library visit. Detailed information about how long the observed would have spent on different activities in the library, was not captured. This as the observations were more relaxed, informal, and more of a dialogue between the observer and the observed. Regardless, the modified place-centered map provided a visual illustration of how the observed students would have interacted with the library and it further helped confirm many of the themes that were raised by the interviewees during the earlier parts of the interviews.

4.4 User Insights

This section presents the insights obtained from the analysis of the user research.

4.4.1 Overview of Participants

Table 4.1 shows what diagnoses the interviewed heroes and Svane-Hedda students had. In total, four pedagogues, three heroes – one male and two females, and ten students – three boys and seven girls from Svane- and Hedda Andersson schools, were interviewed. The heroes were between the ages of 17 – 24 years and knew the author before the interview day. The students were between the ages of 13 – 17 years old. One of the interviewed students had none of the diagnoses and was used as a reference, called RU1. The gender of the interviewees will not be explicitly presented; mainly to help further ensure the anonymity of the students, but also because it was reasoned that the gender would not have a decisive role in this thesis. This as the aim of the thesis is to explore how libraries could be made more inclusive for adolescents with dyslexia, ADHD, and/or autism; regardless of gender.

Table 4.1: Overview of participants' diagnoses

<i>Hero (H), User (U)</i>	<i>Dyslexia</i>	<i>ADHD/ADD</i>	<i>Autism</i>
H1	x		
H2		x	x
H3		x	
U1	x		x

<i>Hero (H), User (U)</i>	<i>Dyslexia</i>	<i>ADHD/ADD</i>	<i>Autism</i>
U2	x		
U3	x		
U4	x		
U5		x	
U6		x	
U7		x	
U8	x		
U9	x	x	

The pedagogues are referred to as P1, P2, P3, and P4 each time quotes from their interviews are presented.

4.4.2 Further Advice from Pedagogues and Heroes

Some of the advice given by the interviewed pedagogues and heroes were presented in section 4.2.2. This section presents the remaining offered advice; mainly related to the actual interviewing process.

- It is important to be present during the entire conversation; listening and acknowledging.
- Adopt a happy, calm, and welcoming attitude throughout.
- Being mad could make the thesis target group feel left out or shut down.
- Be attentive to the youths' reactions during the conversations. Their reaction to different questions says a lot about how comfortable they are with opening up.
- Sharing some personal information helps show the adolescents that the interviewer understands their struggle.
- Do not put a label on them; making them feel that they are only in the room because of their diagnosis/diagnoses.
- Be equals in the room; they are the ones teaching and helping the interviewer.
- Some with autism may be uncomfortable with maintaining eye contact and some may keep it too much. Observe how they do and do the same.
- Young people with ADHD like eye contact, they want to feel that the interviewer cares and is there for them.
- Too much fidgeting or doodling does not necessarily mean that they are not listening; some need to do something else simultaneously.
- The meeting environment is just as important as the meeting itself, especially for people with autism. A very big and light room can feel

overwhelming, but it can be quite individual. It is therefore best to ask the person about what feels okay.

- A completely new meeting place can be quite stressful, especially for people with autism. It is better to opt for a place they are familiar with.
- Avoid using too many metaphors as they require energy to translate, especially for people with autism.
- They may be afraid of the interviewer's reaction, assuming that the interviewer will be negative and judgmental. Young people with ADHD can; for example, sometimes hear "you are too much ADHD".

The offered advice showed that it was important to ensure the interviewed youth felt seen, equal, and appreciated throughout the conversations. Furthermore, it seemed to be good to avoid directly speaking to them about their diagnosis/diagnoses and instead allow them to share their experiences without putting a label on them. This motivated the use of the relatable persona presented in section 4.2.2.2 above. Finally, maintaining a flexible approach, during the conversations with adolescents, appeared to be important to better adapt to their different needs. Some could prefer eye contact, while other youth might not. Some could be very open and aware of their diagnoses, and others not at all.

4.4.3 Sorted Pre-identified Themes & Highlighted Themes

The results from the user research exercise, pre-identified factors by other stakeholders, were analyzed by creating a simple scoring system. The users were tasked with ranking the factors according to their importance. The factors then received a score between one and six in descending order and was based on each factor's ranked position. The factor that was ranked as the most important by the interviewee, received a score of six, while the factor that was placed last in the sorted list of factors, received a score of one. The mean score was then calculated for each pre-identified factor.

The bar chart below, Figure 4.1, shows the mean score of the sorted pre-identified themes. The reference, RU1, was not included in the chart.

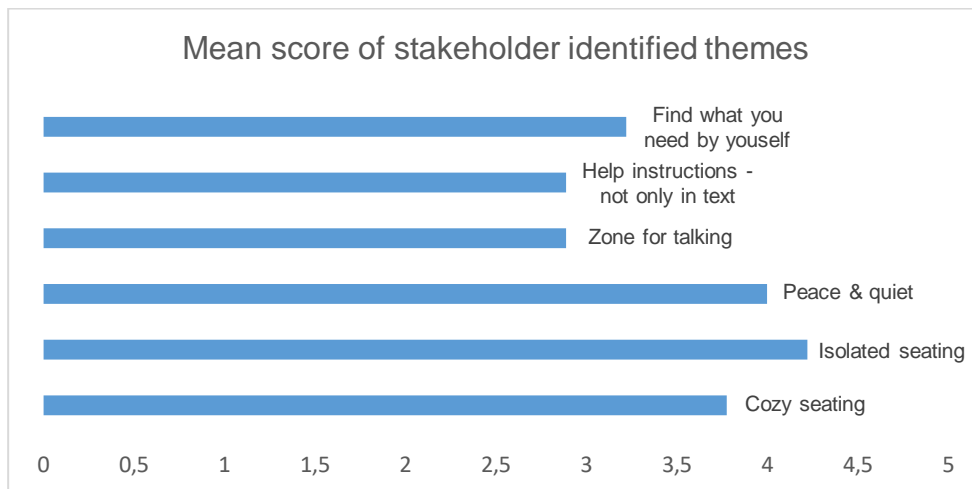


Figure 4.1: Shows the mean score of the six pre-identified themes by other stakeholders

Peace & quiet, Isolated seating, and Cozy seating appear to have had a higher mean score than the rest of the topics. The overall standard deviation was however calculated to be 1.72, which shows that the variance in the data was quite high. There are several factors to note from this chart. Firstly, the sample size was nine, which is a quite small sample and there are technically three different target groups represented in the data: youth with dyslexia, ADHD, and autism; with some of the youth belonging to more than one target group simultaneously. It could therefore be rather difficult to interpret the bar chart, especially without the input from the qualitative portion of the user research.

During the sorting exercise, some respondents expressed that they found it difficult to sort and that they wanted to put most topics at the top. An interesting note is that the variance in the responses would still have been quite high, even if the scoring of the pre-identified topics would have been separated based on each diagnosis. Interviewees U2 and U3, both had dyslexia, but ranked “Zone for talking” completely differently: one and five respectively. Interviewees U5 and U7 both had ADHD/ADD and ranked “Isolated seating” as one and six respectively. There was however a gender difference between the interviewees in both pairs, which could also explain the variation. This would however need further investigation to confirm.

The aim is however for the library to be a place for all students, regardless of gender, and so what can be deduced from the graph is that the needs of the target group; youth with dyslexia, ADHD, and/or autism; vary quite a lot. The qualitative data presented using affinity diagramming and the insights from the library visits are therefore needed to understand the users behind the numbers.

4.4.3.1 Highlighted themes

The highlighted themes by the students at the end of each library visit were peace & quiet, isolated seating (mentioned twice), cozy corner, and finding what you need; all are themes that had already been pre-identified by other stakeholders. Additionally, physical layout, lighting (mentioned twice), and the library feeling; were three highlighted themes that had not been pre-identified by other stakeholders. All these themes also emerged during the affinity diagramming, which will be presented in the following section.

4.4.4 Recurring Themes

The affinity diagram was created based on the insights obtained from the interviews with the pedagogues, librarians, and heroes, as well as the two first sections of the structured conversation with the students: relatable persona and dream library. Findings from the library visits with the users, were used to complement, deepen, and confirm emerging themes.

The themes that emerged from the created affinity diagram are presented in this section. The main challenge with presenting the results from the data analysis was that there were connections between themes that were also important to highlight. Each of the following sub-sections, therefore, begins with an illustrative mind map that captures how other themes related to the overarching theme presented in each sub-section; Figure 4.2, Figure 4.3, Figure 4.4, and Figure 4.6. A straight arrow shows that the sub-themes are part of the main theme, while a dashed line shows a connection.

Presented quotes from the interviewees were translated from Swedish to English, and hence slightly modified to account for the differences in sentence structure between the two languages. The sounds “Ehh”, “Ehm”, and “Um”, were removed from the quotes as well. Some presented quotes include a reference to “he” or “she”, which means that the respondent referred to the relatable persona.

4.4.4.1 Diagnoses

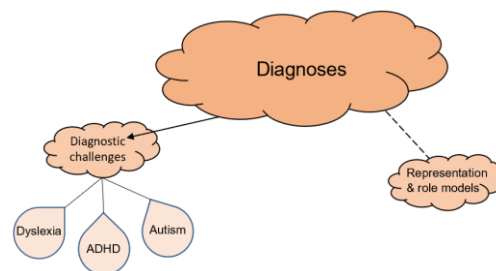


Figure 4.2 An overview of the theme “Diagnoses” with its main subthemes

Table 4.2: Presents the sub-themes, key insights, and examples of the diagnostic challenges

<i>Diagnosis</i>	<i>Sub-theme</i>	<i>Key insights</i>	<i>Example</i>
Dyslexia	Reading & writing	Struggles with spelling, reading, and reading comprehension	“... struggle to extract [relevant information] from a text...” – P1
Dyslexia	Contrast	Text, background, and pictures could be helpful in seeing contrast, reading, and accessing information	“... textbooks with less amount of text, textbooks that are more simply laid out and more structured...” – P1
ADHD	Concentration	Struggles with concentration and attention	“... the cognitive [abilities] suffers because their concentration runs short... but it’s also of varying degree...” – P2
Dyslexia, ADHD	Books – an annoying reminder	Books were an annoying reminder for students with dyslexia as they struggled with reading. Books were also an annoying reminder for students with ADHD because they struggled with concentrating on the text.	“... most with dyslexia come in [to the library] with the mindset that ‘there’s nothing for me here’...” – P4 “... if you have ADHD and dyslexia then books are the worst thing one knows...” – P2
ADHD, autism	Structure and planning	Youth with ADHD, and autism struggled with planning and structure, but of varying degrees. Youth with ADHD needed structure but could struggle with planning and setting the structure themselves. Adolescents with autism could struggle with getting started on tasks and with routine tasks. For someone with both ADHD and autism, it could be a constant trade-off between how much routines to keep and how flexible to be.	“My autism loves routines; my ADHD can’t follow a routine. It’s a constant struggle between that I want routines, but I can’t create them by myself, and I can’t follow them by myself.” – H2

<i>Diagnosis</i>	<i>Sub-theme</i>	<i>Key insights</i>	<i>Example</i>
Dyslexia, ADHD	Quiet	The need for a quiet environment varied both for youth with dyslexia, and ADHD. Some preferred a quiet environment, while others could not stand it. Some learned better through talking, and so a quiet environment caused feelings of exclusion.	<p>“There was a constant thought that if you talk, you’ll disturb the others around you... and you’re directly shh-ed, and that basically makes you get that feeling of that you don’t want to go there [the library]” – U5</p> <p>“... to appear as rebels when we talk in libraries, it made – that was a concrete feeling of exclusion. We talked about our work [school assignment], but it could not be told.” – H1</p> <p>“... as it’s quiet [in the library], then it’s a lot easier to concentrate and there’re a lot less distractions.” – U6</p>
ADHD	Move around	Youth with ADHD could struggle with sitting still, needing to move around, or fidgeting.	“... children with ADHD struggle to sit still and they struggle to concentrate for longer time periods...” – P1
ADHD	Medication	Medication made a huge difference for users with ADHD. They could easily be annoyed by something small such as a ticking clock if not medicated.	<p>“... if they aren’t medicated and haven’t received a diagnosis then it’s very difficult especially for them themselves, because they don’t understand why it isn’t working...” – P2</p> <p>“People who haven’t received [medication] yet still have small things that [annoys them] – one thing, when I sat and read when I was younger, then there was nothing that annoyed me and made me angry – even if there was nothing to be angry about – when you sit there and you hear someone flip the page, and you see that they read faster [than you]...” – U5</p>

<i>Diagnosis</i>	<i>Sub-theme</i>	<i>Key insights</i>	<i>Example</i>
ADHD	Forgetful	Struggles with memory but of varying degrees.	<p>“... sometimes when I listen, I hear most but I forget [some]...” – U5</p> <p>“Always an obstacle to get started [on their own] ... they forget their passwords...” – P2</p>
Autism	Connecting with others	Could be very screened off and difficult to reach. Students with autism struggled with understanding others and understanding social codes.	<p>“... sometimes teachers find students with autism very screened off, difficult to reach, don’t always listen.” – P1</p> <p>“... people with autism maybe may not be very good at being social...” - U1</p>
Autism, (ADHD)	Need information beforehand	<p>Youths with autism needed information beforehand to help prepare them for what is to come.</p> <p>Some with ADHD expressed that if they were in a messy environment they could shut down and then they could not listen or concentrate.</p>	<p>“... a boy in eighth grade... he’s really Aic and then- he, he struggles when things change... he needs information beforehand...” – P2</p> <p>“... sometimes when it becomes too much [noise], then I shut down and then I can neither concentrate or listen, so then, it gets quite hard, and that’s something that’s distracting.” – U6</p>

Table 4.3: Presents the sub-themes, key insights, and examples of the theme representation & role models

Theme: Representation & role models

<i>Sub-theme</i>	<i>Key insights</i>	<i>Example</i>
Inspiration	<p>There was an expressed frustration that it was not shown how common the diagnoses were. Role models were important to help youth feel less ashamed and accept their diagnosis.</p> <p>Representation among the role models was deemed important. The role model should have a similar background to the youth, making it easier to relate.</p>	<p>“Hearing someone like him [philosopher Per Anders], who in some way was a role model, idol or mentor [for me], tell me that I had to read, then it was like a push and I think many need that push” – H1</p> <p>“... someone with ADHD should stand up in front of everyone and say ‘I have ADHD and no one should be ashamed of it’. One should get up and motivate those with ADHD...” – H3</p> <p>“Something that I have noticed is that people with autism usually don’t appear in things... you don’t see them.” – U1</p>
Increase knowledge about diagnoses	<p>It was also quite apparent from the interviews, and even expressed by one of the heroes, that librarians didn’t necessarily fully understand how the different diagnoses affected the students.</p>	<p>“I also feel that one should increase the knowledge among the personnel [in the library] about dyslexia, then it could also be just the libraries that I have been in that they haven’t been very knowledgeable about it...” – H1</p>

4.4.4.2 Library atmosphere

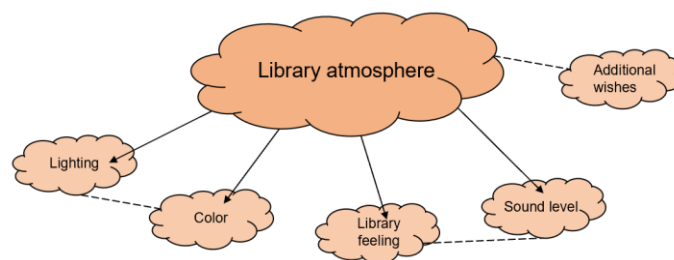


Figure 4.3 An overview of the theme "Library atmosphere" with its main subthemes

Table 4.4: Presents the sub-themes, key insights, and examples of the theme library atmosphere

Theme: Library atmosphere

<i>Sub-theme</i>	<i>Key insights</i>	<i>Example</i>
Cozy and homely	Could for many be the determining factor. The library should not be lifeless. It should be warm, homely, and aesthetically pleasing. Seating, color, and lighting were a few of the words used to describe what was captured by the word cozy.	<p>“[Library] is cozier [than group rooms] – I’ve said cozy many times but it’s kind of that.” – U9</p> <p>“[The library] feels like hospital corridors, they are like pretty lifeless, like only books and chairs. You like don’t want to be there...” – U3</p> <p>“... the environment is almost the most important [factor]...” – P1</p>
Welcoming	The library should feel welcoming, safe, and filled with positive energy, but not all felt it was welcoming.	<p>“... [Included if] they’re welcomed... a library that’s for all students...” – P4</p> <p>“...you don’t feel, like, welcomed, I think it feels like very not nice... [The library] should be like cozy, welcoming, and generally a nice place to like be at, it should be safe...” – U3</p> <p>“... I want the library to be for those who are positive... the one who goes in negative [to the library] will, I hope, walk out positive...” - H3</p>
Helps concentration	The cozy and calm atmosphere at the library helped students concentrate better.	<p>“[Dislikes that the library] has to be the calm environment, that you have to like focus a bit more, that you have to take [things] more seriously... [It helps concentration] like if it’s cozy, cozy places you can sit on, cozy tables, something like that, so it’s something a bit different than a school desk, if you get what I mean.” – U9</p> <p>“...the environment around affects her concentration.” – U8</p>

Theme: Library atmosphere

<i>Sub-theme</i>	<i>Key insights</i>	<i>Example</i>
Transparency	<p>There was an expressed wish to be able to see into the library before entering, it made the library feel more welcoming, especially for someone with autism as it could be stressful to be around too many people, but also because they felt reassured by receiving some information beforehand.</p> <p>The reference mentioned that it helped if the library was central, it made students aware of the library.</p>	<p>“... many move around in [the library] and it’s good if one can see into [the library] and feel welcomed in... so glass doors are good” – U1</p> <p>“I remember in the old building, then the library was on the first floor, and then it was very central and everyone hung out there, which they don’t do today. Very few go to [our current] library and it’s mostly because we don’t see it...” – RU1</p>

Table 4.5: Presents the sub-themes, key insights, and examples of the theme lighting

Theme: Lighting

<i>Sub-theme</i>	<i>Key insights</i>	<i>Example</i>
Bright light	<p>Bright and white light was disliked by many. Bright light reflected more, which made it difficult to read, especially for adolescents with dyslexia. Bright light further affected concentration negatively, both for students with dyslexia and someone with ADHD.</p> <p>The reference also mentioned that white and bright light made one unfocused.</p>	<p>“[White] light is like prickly... I just like find it really annoying... If I get annoyed by it, then I think of it and then it’s more difficult to think about what I should be thinking about.” – U9</p> <p>“But I just like get annoyed by [the light], I focus more on the light than on the books. Then if you have a book, then it lights up too, it like shines on the book” – U3</p> <p>“If it’s not like a nice environment, like a good lamp – once there was a really strong lamp and really good food [at a restaurant] but one got annoyed by the lamp all the time, and it’s the same in libraries I think...” – U5</p>

Theme: Lighting

<i>Sub-theme</i>	<i>Key insights</i>	<i>Example</i>
Warmer light	<p>Warmer light colors seemed to be preferred, especially yellow light.</p> <p>The reference also preferred warmer light but mentioned that yellow light should not be too strong either.</p>	<p>“Like quite warm lamps...yeah [more yellow]” – U9</p> <p>“It’s better if [the light] is yellow, because white, it can be a bit like, it becomes difficult to read.” – U4</p> <p>“Yellow [light] gives one both energy and you see more clearly” – U1</p>
Darker light	<p>Darker lighting seemed to help students concentrate better, mainly for youths with dyslexia.</p> <p>The reference also appeared to prefer darker light.</p>	<p>“... I like to sit a bit darker. It makes it easier to focus because sometimes it can become way too strong light and it takes away my focus.” – U2</p> <p>“... I myself like dark [lighting], I don’t like light so much.” – U3</p>
Colored light	<p>Colored light was mentioned to help with reading by some students with dyslexia. This sub-theme relates to the next theme, color, which will be presented in Table 4.6.</p>	<p>“... that [the light] is colored too [for reading]” – U4</p>
Window light	<p>There were varied opinions about window lighting. Curtains and blinds to regulate the light intensity were however appreciated.</p> <p>Reference mentioned that window light was natural lighting and so it was good.</p>	<p>“...when I work in a group then you become more active in the group [by a window] ...” – U2</p> <p>“I find [window lighting] very disturbing, because it’s so bright.” – U3</p> <p>“...what can annoy me is if the sun comes in, like, if the sun is directed at the window and [the light] comes in, maybe it could be nice to have blinds or something that block the light...” – U6</p> <p>“[Window light is] cozy but it depends a bit on the position of the light, but it’s always cozy. But also cozy with like curtains, that take up a bit of light.” – U9</p>

Theme: Lighting

<i>Sub-theme</i>	<i>Key insights</i>	<i>Example</i>
Flexible light solution	<p>There seemed to be a frustration that lighting could not be individually regulated, especially expressed by some students who had dyslexia.</p> <p>A raised issue was however that varying patches of light and dark could make students with autism feel overwhelmed.</p> <p>The reference also expressed a liking for adjustable lights.</p>	<p>“It can be very bright occasionally... you can’t control [the light], it’s either on or off.” – U2</p> <p>“... sometimes it can be challenging to have too bright light. In that case it’s better to have several lights on several places so you can turn on and off [the light] yourself.” – U4</p> <p>“... lamps with bright light and like dark [light] every other spot. It’s like too, too much sensory impressions, which one becomes very easily overwhelmed by” – H2</p>

Table 4.6: Presents the sub-themes, key insights, and examples of the theme color

Theme: Color

<i>Sub-theme</i>	<i>Key insights</i>	<i>Example</i>
Color associated with feelings	Color was believed to affect feelings, but only youths with autism were very specific with colors.	<p>“... color can affect how you feel quite a lot and feel. So a room that’s too colorful can feel overwhelming...” – U8</p> <p>“Color is important, each color has a feeling” – U1</p>
Specific but varied color preferences	The color preferences varied, but it was mainly adolescents with autism who were very specific with color choices. The rest of the users mainly expressed a preference for calmer colors.	<p>“For me it’s also good if it isn’t too strong colors in the library, because it’s both distracting and a bit overwhelming...” – H2</p> <p>“... but specifically that [colors] should be a bit clearer...” – U1</p> <p>“... some blue color, or green, something like that that’s a bit more calming... or like gray, it’s also like kind off neutral and calming.” – U6</p>

Theme: Color

<i>Sub-theme</i>	<i>Key insights</i>	<i>Example</i>
Color makes library lively	There was generally an interest in introducing more color into the library to make it more lively and less boring, mainly expressed by students with dyslexia.	<p>“... it’s always nicer to go into a room that looks welcoming, like if there’re colors or if there’re things on the walls like paintings or something...” – U8</p> <p>“Like if it had been more color, then it wouldn’t feel like hospital corridors anymore.” – U3</p> <p>“Themes maybe on the walls... a bit more color because now it’s only white...” – U2</p>
Color and reading	Youths with dyslexia expressed that color could help with reading.	<p>“... [students with dyslexia] have specifically a bit difficult to see differences between colors, for example, so gray, white, and black, they can’t be close to each other. They can be base colors as background in walls or something, but [otherwise] one doesn’t see the difference between that and that... I need a colorful paper to feel that I actually see the gray color of the pen” – U1</p> <p>“... that like, rulers that you can hold against the books in different colors...” – U4</p> <p>“... it should be a bit colored background [behind text] ...” – P2</p>

Table 4.7: Presents the sub-themes, key insights, and examples of the theme library feeling

Theme: Library feeling

<i>Sub-theme</i>	<i>Key insights</i>	<i>Example</i>
Calm & Peaceful	Calm & peaceful were commonly used to describe libraries and how the users wanted to feel at the new library.	<p>“[Look for] calmness... quite easy to find where it’s calm, you don’t always see the others, but you can still hear them...” – U1</p> <p>“[Want library to feel] calm and reduce the stress” – U7</p> <p>“...[appreciate] that [the library] is quite calm, even if they’re not very calm. It’s, it’s some kind of safe environment that they have...” – P3</p> <p>“... have like a calm place to be at.” – U3</p>
Rest and get a break from people	Libraries were also commonly described as a good place to retreat to; a place to get a break from being around too many people.	<p>“... when I’m tired, extremely tired, or I’m really angry then I want to go in [to the library] ... – H3</p> <p>“[Go there] because it’s peaceful and because one can be there in peace... that feeling of now I don’t have the energy for that noise [in the school environment], just getting a feeling of needing to go [to the library]” – U1</p> <p>“For me, I think that the most important thing is that you can get away a bit... somewhere where there, like, isn’t a lot of people... for me [the library] was like a place to rest” – H2</p>

Theme: Library feeling

<i>Sub-theme</i>	<i>Key insights</i>	<i>Example</i>
Overwhelmed	Being in the library could be overwhelming if too much was happening at the same time.	<p>“[Feels stressed] when it’s too many people and you’re sitting like in the open, and you must- you can’t focus on your own thing... because a lot is happening around that you notice around you, takes away focus.” – U2</p> <p>“... it like feels too much, like, in the actual library, that there maybe is too much text and stuff like that, that there’re like too many things sitting [close] together...” – U6</p>
Quiet environment	<p>Some expressed that they liked that the library was quiet, because it helped them think for themselves and concentrate.</p> <p>This theme was also captured in Table 4.2 and showed that the need for a quiet environment varied a lot. The theme was still included in this table because it was a feeling associated with the library and appreciated by some.</p>	<p>“... that it’s like quite calm and quiet, she likes that with the library, you can think a bit for yourself instead.” – U9</p> <p>“She goes to the library because it’s calm there, it’s quiet, easier to focus.” – U7</p>
Being silent	Youth with ADHD also appreciated the peaceful nature of libraries, but some struggled with the feeling of knowing they had to be silent.	<p>“A feeling that you have to be silent and I know I can be silent, but I also know that I’m not always silent.” – U5</p> <p>“... if someone sits and points out all the time that ‘you have to be quiet, you have to be quiet, it’s- you become forced to do it on purpose, to not be quiet.” – H3</p>

Table 4.8: Presents the sub-themes, key insights, and examples of the theme sound level

Theme: Sound level

<i>Sub-theme</i>	<i>Key insights</i>	<i>Example</i>
Study places	Many found the library a good place to study. Some looked for a quiet place, while others wanted to sit with friends. There was an expressed wish that it should work to come both alone and in a group to the library.	<p>“Places to sit and study, both for larger groups and individually so one can choose, and that these places aren’t in the same place, so you don’t have to sit right beside a group if you want to be alone” – H2</p> <p>“I want to both read and be at a quiet place, at the same time I want to be able to study without being disturbed.” – U4</p> <p>“... If four of my friends say ‘we’re going to the library’ then it becomes a lot easier [to go there] than if I would go on my own...” – H1</p>
Sound – area of conflict	<p>There was a pronounced conflict over the sound level in the library. There was a consensus that the library should be peaceful, but not everyone agreed that it necessitated a completely quiet environment.</p> <p>The sound level affected the students’ concentration level, where some concentrated better with sound and others needed complete silence.</p> <p>Some students wanted to be able to regulate the sound level alone or have different “sound regions” in the library. An issue raised by a pedagogue was that a major area of conflict in other libraries had been when the room itself had been intended for several different uses simultaneously.</p>	<p>“... if it’s too quiet then I can’t handle it...” – U3</p> <p>“... In my old school, we had it like split up so that those who liked to work with sound could sit in one place and those who wanted it to be quiet could sit in a different place, so that you in some way can split it up. It can help quite many.” – U8</p> <p>“I can’t study without sound, but I like when I’m controlling the sound so to say, so if I’m sitting in the library, I always have headphones with music [on]” – H2</p>
Mumbling	Hearing mumbling or whispering was generally seen as fine, as long as no one was too loud or shouting.	<p>“There can be a bit mumble if one talks quietly...” – U1</p> <p>“In one way [mumbling and whispering] can be disturbing if it’s like, say the person has had a bad day, then, like, anything small can make it impossible to concentrate, but in most cases it can be okay...” – U8</p>

Theme: Sound level

<i>Sub-theme</i>	<i>Key insights</i>	<i>Example</i>
Music	Music was seen as a good way of shutting out a messy environment, but also a good way of making the library feel less quiet for those who needed more background sound to concentrate. Borrowable headphones were also appreciated.	“... In the classroom it can be messy and a lot of noise and stuff, and then I usually want to shut it out. So, either I have headphones during the lesson, or I go sit somewhere else.” – U2

Table 4.9: Presents the sub-themes, key insights, and examples of the theme additional wishes

Theme: Additional wishes

<i>Sub-theme</i>	<i>Key insights</i>
Sockets close to seating	An expressed request was to have sockets close to seating, as there was always something you needed to charge.
Whiteboards	Whiteboards for writing and drawing in the library if needed.
Plants	Plants were mentioned several times and were believed to add a coziness factor to the library. This was also noted during the library visits, as most pointed it out.
Water	Some explained that it would be nice with a water dispenser because they often got thirsty.
Paper & pencils	Some could forget their stuff and so some expressed that it would be nice if the library had scrap paper and pencils to lend.

4.4.4.3 Physical layout

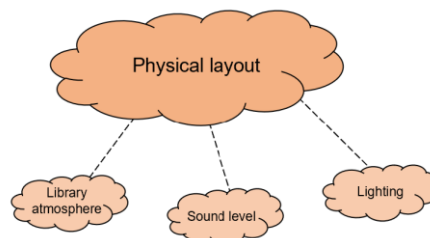


Figure 4.4 An overview of the theme "Physical layout" with its related themes

Table 4.10: Presents the sub-themes, key insights, and examples of the theme physical layout

Theme: Physical layout

<i>Sub-theme</i>	<i>Key insights</i>	<i>Example</i>
Degree of openness	It was important for the library to feel welcoming, as presented in Table 4.4 in the previous section. Larger areas were important but at the same time, there was an expressed need that the library should not feel too open even if it was big. This was especially true for the interviewees with autism.	“[Went to library] a lot in high school... I liked it, so I sat there a lot... It didn’t feel so open despite it being big” – H2
Maze	<p>Building on the previous sub-theme, youths with autism preferred libraries that had some type of maze structure. They wanted to move in between shelves.</p> <p>Moving in between shelves and having seating groups there were not unique for adolescents with autism, which is captured by the next sub-theme.</p>	<p>“... it should almost be a bit like a maze between the shelves and that it should feel like there’re some rooms between the shelves...” – U1</p> <p>“I love libraries, but I like when they look a bit like a maze. A bit like, you shouldn’t need go through everything to find a book, but that there’re a lot of shelves that you can walk between and that it isn’t too open.” – H2</p>

Theme: Physical layout

<i>Sub-theme</i>	<i>Key insights</i>	<i>Example</i>
Corners	<p>Corners were mentioned in all interviews with the users. They were perceived as cozier and more confined.</p> <p>A corner was not necessarily a wall corner but could also be created in between shelves or in the way the furniture was placed.</p> <p>Corners were deemed important for several different reasons. They reduced distraction possibilities, they were peaceful and calm, did not attract too much attention, and ensured people could not look at you from different sides. The latter being mainly important for students with autism.</p>	<p>“I think sofas by a wall or in like a corner, because if I now want to sit and study then it’s more like confined and cozier, but also if I’m sitting and talking because then like, it’s not as open so that others around can’t listen as much, or that you don’t disturb as much.” – U8</p> <p>“... a corner is not specifically the corner itself, but it can be a corner between shelves, or a corner with couches. It can almost be anything, so one can’t look at you from all edges. Specifically not- something that if a person sits and can look [at you] from behind.” – U1</p> <p>“... maybe you could have like books around [seating by entrance] so it separates a bit.” – U9</p> <p>“[Less distracting], that there’re places that are like more shut off in the library, like, maybe a table or a sofa that’s in a corner with screens or something like that...” – U2</p>
Shelves	<p>Using shelves to create corners was already explained in the previous sub-theme. It is however still highlighted here as its own sub-theme as many pointed out that shelves create more screening and hence make more seating in the library usable for the user group.</p>	<p>“I like that there’re bookshelves, like that it’s like, quite isolated, not so open.” – U7</p> <p>“...if you read, it’s quite nice if you can read without thinking of people, one always – you see everything around yourself...” – U5</p>

Theme: Physical layout

<i>Sub-theme</i>	<i>Key insights</i>	<i>Example</i>
Comfortable seating	Seating in the library should be comfortable. Even the reference expressed this, but the main difference was that uncomfortable seating could be distracting for the rest, while the reference could adapt.	<p>“... because if you’ve been sitting on hard chairs the entire day in school, then you feel like, that you want to study the last time [of the day] in something more comfortable, an armchair or so.” – U8</p> <p>“A bit [vital], because, or at least I, become distracted by the smallest thing so if I think that [the seating] is uncomfortable or something like that then I can’t focus.” – U7</p> <p>“... not like, during a short time, I don’t think [hard seating] affects but during a longer time period, then it can affect [concentration]” – U2</p>
Isolated seating	Many looked for more isolated seating places that were more screened off.	<p>“... would have wanted like a sofa somewhere screened off.” – U2</p> <p>“[Stressing], probably that it’s so open tables, that it’s so open for everyone to like- that the tables are also so close to each other...” – U7</p>
Central seating places	<p>There were mixed feelings about central seating places. More isolated seating was generally preferred but some preferred chairs and tables for group work to be placed more at the center.</p> <p>Youths with autism disliked central seating places, in the sense that they were too open, but as explained in the previous sub-themes, working with the shelves and creating corners were believed to create more viable seating options.</p>	<p>“...but also if you have like a long table [at the center], so maybe if, if you are allowed to sit with your friend and study [there] a bit...” – U6</p> <p>“Preferably in a corner, I find it cozier...” – U9</p> <p>“... sofas at the center makes it more like- like in one way [the library] becomes more welcoming but at the same time it can make it more like a hangout place more than a place to study... which can result in that it can become loud and disturbing for those who are actually trying to study...” – U8</p>

Theme: Physical layout

<i>Sub-theme</i>	<i>Key insights</i>	<i>Example</i>
Seating by entrance	<p>Seating places close to the entrance were mostly disliked. It was mentioned that entrance seating helps make the library feel more welcoming for bypassers, but at the same time, many expressed that they felt looked upon and that seating by the entrance could make it messy and loud.</p> <p>Screening was believed to help create some isolation at the entrance.</p>	<p>“[Seating by entrance are] like both good and bad because it can make it more welcoming for those who walk outside [the library] to want to come in or talk or hangout, but in one way it ruins this calmness...” – U8</p> <p>“... no, because it gets messy because people who come and go and stuff...” – U9</p> <p>“... if you have like, you know, one of those [screens] in between [seating places], so you don’t see or become distracted by surrounding, but you may be a bit distracted as people come and go [by entrance], but it’s probably fine if you’re only reading a few pages.” – U6</p> <p>“... if you have a sofa [by entrance] then people come in and they may see someone they know and then you have that they maybe start talking you know, and then... it creates a gathering there... if, just when you enter, you have like ‘this week’s shelf’...” – U5</p>
Tactile solutions	Tactile solutions could help students with ADHD, and dyslexia.	<p>“... both for dyslexic and children with ADHD, we have something called tactile devices... can squeeze things, hourglasses... some students feel they work better if they have something they can touch, though not everyone.” – P1</p> <p>“... a thing to hold in hand so you can touch something... some type of stress ball or something to not remain completely still.” – U4</p>

Theme: Physical layout

<i>Sub-theme</i>	<i>Key insights</i>	<i>Example</i>
Exclusive furniture	<p>The furniture itself could be excluding for the user group. Many students with one or more of the three diagnoses could get specialized furniture and tools from special pedagogues but these were not believed to work in the library, as it made these students stand out.</p> <p>Some with dyslexia, and ADHD appreciate something tactile, but this was perceived as difficult to have in the library. Many, including students with autism, often also wanted to feel shielded.</p>	<p>“...[the specialized pedagogues] have like, for students that struggle to sit still, that you have like special furniture or something, but that doesn’t work in a library... because we have teenagers here and if they see that you have like a chair or a sit-ball that’s a bit different then [other students] can like [comment]...” – P3</p> <p>“The [weighted] vest, they [students with ADHD] don’t want to wear it out in the classroom...” – P2</p> <p>“One should at least have something around oneself that shields one from the rest [around one].” – U1</p>
Movement	<p>Some students needed to move around a bit on their seats to concentrate, while others could get distracted by movement.</p>	<p>“... I know quite many who-some can’t handle sitting in a swivel chair because it’s the only thing they think about, while others can’t handle sitting on a normal chair because they have to move around a bit to be able to concentrate...” – U8</p>

4.4.4.3.1 Library visits

The library visits helped provide a deeper understanding of the desired physical layout of the new library. It showed which type of seating places were preferred and why they were desired, which helped with interpreting the emerging themes in the affinity diagram and made the findings more concrete.

Two different library visits were made, as Svane- and Hedda schools had one library each in their respective temporary buildings. The libraries were very small and temporary, so they might not be very representative of a common school library. It was however not possible to visit other libraries with the users during the study due to time constraints and logistic challenges. The visits to the Svane and Hedda school libraries did regardless help emphasize the bad aspects of libraries for the target group, as most had something negative to say during the library visits.

Six of the interviewees were from Svane and the remaining four were from Hedda. The illustrative sketches below show a simplified drawing of the two visited

libraries, Figure 4.5. The orange rectangles show bookshelves, the dark gray rectangles and circle show seating places, the light blue rectangles are windows, while the light gray rectangles show where the librarians' desks are.

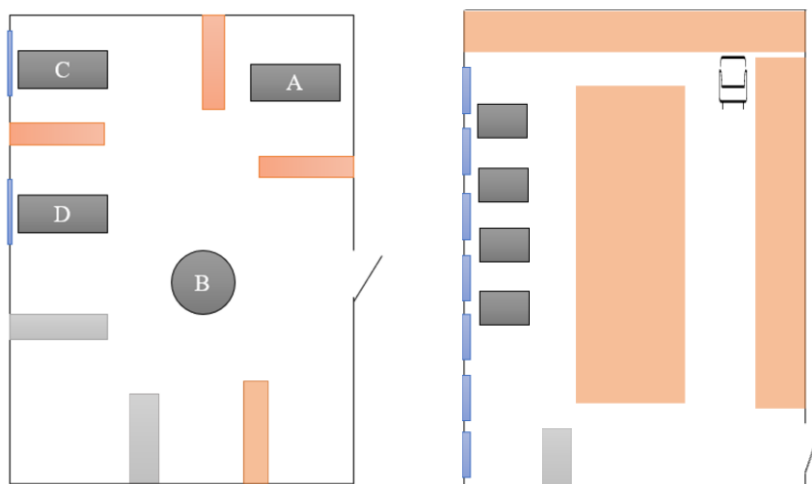


Figure 4.5: Sketches of the physical layout of the temporary Svane (left) and Hedda (right) libraries

The library visits at Svane school helped describe different seating regions, coded with A – D. The recurring descriptions of the different seating regions are presented in the table below.

Table 4.11: Presents four different possible physical layouts of seating places with descriptions

<i>Region</i>	<i>Description</i>
A	<p>Half of the interviewees described this seating region as the best and would choose it first if it was available. These interviewees had dyslexia or/and autism. The seating place was described as isolated, which made it easier to concentrate, while also avoiding having too many people looking at you from the sides. Some students with dyslexia also mentioned that the spot had darker lighting, as just enough light from the windows seeped in through the gaps in the bookshelf to the left.</p> <p>The reference saw the seating region as more like a cozy corner and not so much for studying; mainly due to that there were many books around the spot.</p>
B	<p>This seating region was described as the worst by everyone because it was deemed too central. It was placed too close to the library entrance, everyone passed by it, and people could look in at you from different sides, which all affected concentration negatively. Some also mentioned that even if they would sit there with friends, they would feel like they could not talk because everyone in the library would hear them.</p> <p>The reference said that she could sit there with friends because the table was round, which was appreciated for group work.</p>

Region Description

C	<p>There were split views about this region. Some found it calm and a nice place to sit, especially with the window lighting and because there was a plant pot by the window; making the seating place feel cozy. The ones who did not like the seating place explained that the lighting was the main issue. The spot was too bright, especially with added lighting from outside. This made it particularly difficult for some youths with dyslexia to concentrate, because the light reflected too much on the table.</p> <p>The reference explained that she found this place the best, because it was not too isolated or too open.</p>
D	<p>This spot was seen as the second-worst spot to sit on. The seating region was quite like C, but it was less isolated due to it being closer to the librarian's desk and library entrance. On top of the problems raised with region C, there was the added issue of region D being more open.</p> <p>The reference found this spot the worst because it was too central. The difference between this region and region B was the table shape, rectangular tables were deemed better for individual work, and in that case, region D was too central for that.</p>

The library at Hedda school was not divided into seating regions in the same way, but the visits still helped highlight other relevant aspects related to the seating. The seating places at the library in Hedda were all lined up right after each other by the windows, except for an armchair in the upper right corner. Most found the window seating nice, especially with lighting from outside. A note here is that three out of four of the interviewed students from Hedda had an ADHD/ADD diagnosis, and so the issue that some students with dyslexia experienced with window lighting and reading, captured from the interviews at Svane school, is important to keep in mind. One issue raised at Hedda was that the seating places were too close to each other, and that it would have been better to increase the distance between the tables as that would have created more isolation. The armchair was seen as a cozy and more isolated corner, which the dimmer light in the corner also helped create. The passage by the armchair was very narrow, which was pointed out by the interviewees.

4.4.4.4 Navigation & information access

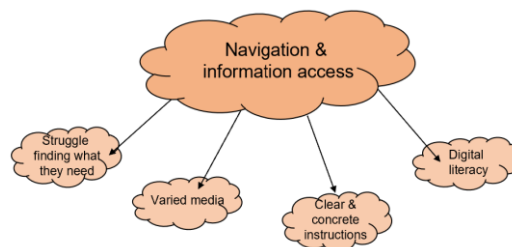


Figure 4.6 An overview of the theme "Navigation & information access" with its main subthemes

Table 4.12: Presents the sub-themes, key insights, and examples of the theme struggle finding what they need

Theme: Struggle finding what they need

<i>Sub-theme</i>	<i>Key insights</i>	<i>Example</i>
Sorting	<p>One of the most frequent issues raised was that the youth did not understand how books were sorted in the library. They preferred the books to be sorted based on genre first and then alphabetically.</p> <p>Only two understood the book sorting in the library, one was a frequent reader, and the other one knew what book she wanted before going to the library, which made it easier to find the book or ask for help.</p>	<p>“... but I know that it like doesn’t really work to change [the alphabetical sorting system], but it – like I find it extremely difficult because I really don’t understand it, where books should be or anything.” – U9</p> <p>“I don’t know the name of any other author, it just gets like really messy in my head.” – U9</p> <p>“... [book sorting should] first be based on theme and then it can be alphabetically within the theme.” – U1</p>
Easily distracted	<p>Looking for a book to read and reading itself was deemed too time-consuming, boring, and tiresome for youth with ADHD.</p> <p>They would hence often struggle to find a book they found interesting and struggled with finishing the book, especially if they found the book boring.</p>	<p>“She goes [to the library] to borrow a book. She likes to read but she still never reads the book... because she doesn’t have the energy for it, it gets like too difficult to read the book. She finds other things [to do] because she gets bored [from reading] after like the third page.” – U9</p> <p>“... reason behind maybe why he doesn’t go there is because he doesn’t have the energy to read...” – U6</p>
Need to read a lot to find books	<p>Building on the previous sub-theme, several interviewees with dyslexia expressed that an obstacle for them was that they needed to read a lot to find a book that they wanted to read. It made it time-consuming, boring, and stressful to find something that interested them.</p>	<p>“[Stressed] more when you don’t find any books that you think are interesting. Also, because you need to read the backside [of a book] to get started... one must read” – U4</p> <p>“It is – it works [to read backside of book] but it’s a lot harder to take in than watching a video...it’s also that that makes it take so much time to choose a book.” – U9</p>

Theme: Struggle finding what they need

<i>Sub-theme</i>	<i>Key insights</i>	<i>Example</i>
<p>Asking for help</p>	<p>The interviewees expressed that, if they did not find what they wanted, they would either leave it for another day, look in another library or ask the librarian for help.</p> <p>Asking the librarian for help was however not liked by all. It felt inconvenient and awkward, and it was mentioned that the librarian might not always be available to help.</p> <p>The reference expressed that if you were shy then you would not have the courage to ask for help.</p>	<p>“She must go ask the librarian to read up [the backside of the book] ... [Feels] difficult [to ask librarian], because sometimes you also have to stand and wait until the other [students] have borrowed their books.” – U4</p> <p>“... there’re quite many who don’t want to ask [for help], because just like I was before, I felt awkward to talk with people. It can be extremely difficult for some to dare to ask for help, dare to like ask where things are...” – U8</p> <p>“... [students] don’t understand the rules, what applies, you don’t understand the systems and there’s no one close by that you can ask for help, instead [the librarians] are standing far away behind a counter...” – P4</p>
<p>Signage</p>	<p>Several of the interviewees expressed that they believed that a better usage of signs could help them navigate.</p> <p>The reference also expressed the same.</p> <p>An interviewed librarian did however express that, according to his/her experiences, most people did not see the signs even if they were up, which will be elaborated on in section 4.5.4.</p>	<p>“That it was something in the ceiling maybe something above the shelves that showed that ‘here’re action, here’re ghost stories, here’re fact books’...” – U1</p> <p>“... I don’t know how high [the library ceiling] is, but one could have, you know at ICA [supermarket], there hangs, you know [signs]...” – U5</p> <p>“... my years in public libraries have even so given me the feeling that 75 – 80 percent of people don’t even see the signs at all...” – P4</p>

Table 4.13: Presents the sub-themes, key insights, and examples of the theme varied media

Theme: Varied media

<i>Sub-theme</i>	<i>Key insights</i>	<i>Example</i>
Library is only for readers	Youth who did not often read felt that they did not belong in the library. The library was a place for nerds and readers. Some interviewees expressed that they had never read an entire book, but they mentioned that they enjoyed the cozy environment in the library and that they wished that libraries had more than only books.	<p>“It also feels like that it’s only a certain type of people at the library.” – U3</p> <p>“When you’re older and you socialize in circles where you talk about ‘ah which book is your favorite’ and you feel so fucking dumb because I have never read a book...” – H1</p> <p>“[Stressed by] the library feeling, as I said before, it’s probably that, just the feeling of that you’re in a library...I’ve always thought about it, if you could call [libraries] something else...” – U5</p> <p>“I remember in elementary school, then I used to always take a book, then I used to – when the teacher came like – I hadn’t read anything, so when the teacher came then I had turned a like four pages [in the book] so she would think I had read anything...” – U9</p>
Listening to books	Many preferred to listen to books as it made it easier to take in information.	<p>“... listen to the teaching material or watch videos, things like that are easy and that they think are okay, similarly [they like] to listen on Legimus*...” – P2</p> <p>“... I read quite a lot online books, I try either Storytel** - or I prefer to listen [to the books] ...” – U8</p> <p>“... otherwise I listen to books, follow along, makes it a bit easier.” – U6</p>
Watching videos	Accessing information through videos was considered a lot easier than reading a book.	<p>“I don’t think we’re allowed to, but I still do [watch videos] ... They work really great, it’s like the only way I learn.” – U9</p>

Theme: Varied media

<i>Sub-theme</i>	<i>Key insights</i>	<i>Example</i>
Acceptance level of diagnosis	Many students with one or more of the diagnoses did not want to stand out, and denied diagnosis and help, while others had accepted their challenges and sought supportive tools adapted for them. Some were comfortable with others knowing about their diagnosis/diagnoses, while others were not.	<p>“I notice that some [students] don’t want to admit that they have challenges with reading and writing and stuff. I’ve had students who don’t want- who don’t have an account to Legimus and don’t want to use it... but it varies a lot.” – P3</p> <p>“That [students with one of the diagnoses] want to feel like they’re like everyone else, it should be so smooth that it isn’t like noticed maybe. At the same time supportive tools should be in the open so they don’t need to ask for them...” – P2</p> <p>“... in the beginning it was straight off denial. No I don’t have it, I don’t want it...” – H1</p>
Navigation	Supportive tools in the form of video or audio recordings could help with navigation and speed up the navigation process in the library.	“... video snippets that show how- where one finds all the books...” – P2
Supportive tools	Supportive tools were available for youth with one or more of the diagnoses, but not all knew they could use these even before they received their diagnosis/diagnoses. Even after receiving a diagnosis, some might not appreciate or accept the help, which was captured in a previous sub-theme.	“... but to access [Inläsningstjänsten – digital tool to make reading & learning easier] often the school was like, you needed to have a difficulty, and not everyone knows that they have difficulties and everyone maybe don’t have the energy to explain their difficulties to access it...” – U5
Cost	It was mentioned that e-books and audiobooks are available, but that the municipality could not afford them.	“The goal is that everyone that come in [to the library] and wants help with finding something should receive help. So there must be media for everyone, but then it’s also a cost question...” – P4

* Legimus is a digital library with audio and braille books

** Storytel offers e- and audiobooks on subscription

Table 4.14: Presents the sub-themes, key insights, and examples of the theme clear & concrete instructions

Clear & concrete instructions

<i>Sub-theme</i>	<i>Key insights</i>	<i>Example</i>
Uncertainty	Students with autism could be very literal and hence become very uncertain if things are unclear. Metaphors could be difficult to understand. They also preferably need to receive feedback, which helps them feel less uncertain.	“To be very concrete in what you say, to not use too many metaphors and things like that because even if I can understand them, because I have learnt them, it doesn’t go into my brain in the same way. They don’t tell me anything more than that I need to translate them and then it just takes more energy” – H2
Break down information & instructions	Information and instructions should preferably be broken down into smaller pieces to help, mainly youth with autism, with understanding and remembrance. Youth with ADHD could struggle with memory and so this sub-theme might also help them with the remembrance of information and instructions.	“... if there’re more things [multiple lines of instructions] then there’s no chance that I’ll remember it” – H2 “... often one needs to give feedback to [students with autism] quite fast if one has an introduction [in class], preferably both written and orally, short steps ‘yeah it says here exactly what I...’, so [the information] is like split up, so you can’t like be given everything at once...” – P2

Table 4.15: Presents the sub-themes, key insights, and examples of the theme digital literacy

Theme: Digital literacy

<i>Sub-theme</i>	<i>Key insights</i>	<i>Example</i>
Technical vs. digital competence	Librarians believed that youth, diagnosis or not, had technical competence but lacked digital competence. It was believed that youth thought they were better than they were at handling digital tools. Technical competence had to do with basic but fast manipulation, while digital competence had to do with knowing when and how they should use what to access what they needed.	“... those students who use internet a lot, they are really good at what they use but other than that they don’t know how to find the encyclopedia on the internet...” – P3

Theme: Digital literacy

<i>Sub-theme</i>	<i>Key insights</i>	<i>Example</i>
Appified	Youth understand application logic but not programs. Mobile applications are limited in their functions, while programs are broader.	<p>“...an app has very limited function, while a program is always a lot larger, and youth are completely useless at searching in menus after commandos and stuff... it’s seven more steps than the youth have the energy for...” – P4</p> <p>“... a bit challenging to get started with [youth]... teens want least possible resistance...” – P2</p>
Reading online vs. physical book	Many youths preferred reading from a screen, but physical books were argued to be better in that they activated tactile memory and were less distracting from e.g., notifications.	<p>“... I often [read] on the internet... like not in book format, but he reads texts... a feeling that makes [reading online] nicer, maybe like because it doesn’t feel like it’s as much, because you don’t see as much [text] on each page.” – U6</p> <p>“... many [youth] choose to read from a screen... youth that are grown up with screens, for them it’s a more natural way in [to reading]... with physical books it’s a lot harder to become distracted by the tablet you’re reading from... some research shows that when you read a book then your tactile memory is activated...” – P4</p>

Table 4.16: Presents the sub-themes, key insights, and examples of the theme remaining smaller themes

Remaining smaller themes

<i>Sub-theme</i>	<i>Key insights</i>	<i>Example</i>
Inspiration - influencers	Influencers or hearing about a book online helped with giving a book a chance. This was also true for the reference.	“... like, to be honest, TikTok, yeah, I know but there’re usually like book tips and stuff like that sometimes on TikTok, and there you get a lot of inspiration. I always do it – if I want to read a book then I like, look at TikTok [to see] if there’s any book that people say should be good, because it makes me like want to read it more.” – U9
Opening hours	Students usually went to the library if they had time during lunch, if they had a canceled class, or if they were allowed to go during some classes. The library was usually closed once they finish school so those who did want to study in the library would sometimes go to a city library. Same for reference.	“... you usually have lessons and stuff so you don’t have that much time to go [to the library] a lot.” – U6
Borrowing & returning books	The majority did know how to borrow and return books. Returning books was however generally easier as it was clear where to place the books.	“Yeah quite clear [how to borrow and return a book]” – U4
Sources of inspiration	A few libraries were mentioned as good examples – KRUT at Malmo City Library, Staffanstorps Library, Malmo Borgarschool, and Lund City Library.	
Play games	Several expressed that they would like to play games in the library and a craft station was also mentioned.	“It would be fun if... there was some type of small game [in the library] ... cards, it can be some memory games or... wordplay... or maybe just chess” – U1 “Like a place where you can sit and draw and like do something more fun.” – U9

Remaining smaller themes

<i>Sub-theme</i>	<i>Key insights</i>	<i>Example</i>
Computers	There was a wish to have a couple of computers in the library and to have digital supportive tools on these computers. If someone needed the tools but had not been fully diagnosed yet, then they could use the computers in the library.	<p>“[Childhood library], in that library they always had computers, so we, I and my friends used to always go there when we were younger, day in and day out, and I had completely forgotten about that. Sometimes I would take a book and read while waiting for my friends, not read but mainly look [in the books] ... Computers, so you don’t only go [to library] just to read...” – U5</p> <p>“I don’t like [my personal computer] ... I always forget [to bring my computer] and mine is never charged. And then I also find it easier with a screen and mouse...” – U3</p> <p>“What could have included me [in the library] ... yeah maybe having accessible computers with audiobooks...” – H1</p>

4.4.4.4.1 Library visits

It was rather clear that the students struggled with knowing where to start looking for books in the library, especially the younger students. Most looked around in a circle, laughed, and said that they did not know where to start. They would pick a shelf based on how many books it had or exclude some shelves if they could see the book coverings of some of the books on those shelves; guessing what genre the books had. There were no signs on the shelves or walls to help with navigation; no method to filter between the books. They would need to go to all bookshelves or ask for help, which everyone was not comfortable with doing.

Two of the interviewed students had a better idea of how to navigate in the library. One of them already read frequently and would start looking for a book on shelves where she had found books to read before. The second interviewee had asked a teacher about the book coding system and so had an idea of how to decode the system.

4.5 Discussion and Conclusion

A summary of the main insights obtained from the user research will be presented and discussed in this section, followed by the main over-arching conclusions drawn from the user study.

4.5.1 The Three Diagnoses

The needs of youth with dyslexia, ADHD, and/or autism have been considered and incorporated into the analysis and presentation of the recurring themes. The Venn diagram in Figure 4.7 below attempts to capture and give an overview of the youths' expressed challenges and needs. The Venn diagram is based on insights obtained during the user research phase, but also based on the secondary research acquired about the diagnoses presented in section 2.3. The overlapping areas in the Venn diagram do not necessarily represent youth with multiple diagnoses, but rather common needs and challenges expressed by more than one of the user groups. Take the area at the center of the Venn diagram as an example; it contains the keywords "To rest" and "Calmness", which shows that the need for a place that is calm and good for resting was important for youth with one or more of the three diagnoses, and these keywords were therefore placed at the center of the Venn diagram. The overlapping area for youth with dyslexia and/or autism was left empty; primarily because there were no commonly expressed challenges or needs in this user study. Only "To rest" and "Calmness" were common for both, but these themes were also important for someone with ADHD and so were placed at the center of the Venn diagram.

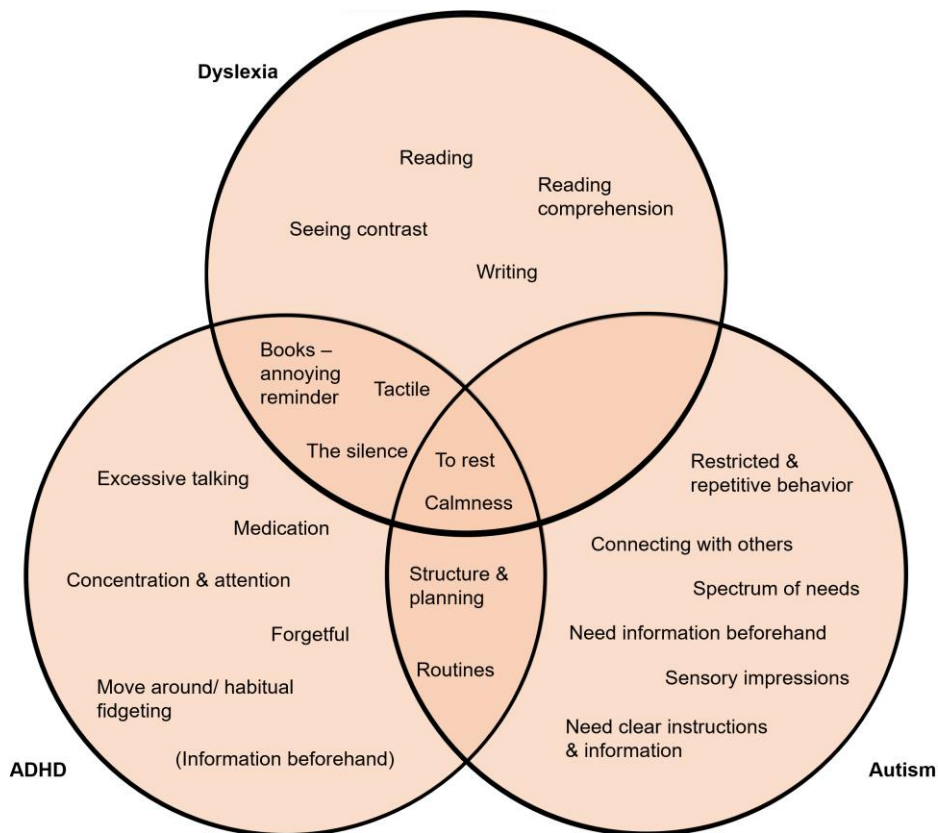


Figure 4.7: Venn diagram giving an overview of the target group’s challenges and needs, where overlaps represent commonly expressed needs

4.5.2 The Library Atmosphere

The library atmosphere was believed to be very important for the target group. It should feel cozy, homely, and welcoming to be at the library. Lighting, color, and the sound level also contributed to the overall library atmosphere. A cozy and calm atmosphere would help students concentrate better.

Several issues were raised about the lighting. Too bright and white light was disliked by many, especially for some students with dyslexia, as the lighting reflected more against surfaces, which could make it difficult to read. A bright light could further affect concentration negatively; both for youths with dyslexia, and ADHD. There were varied opinions about window lighting, some found it cozy, while some found the light too bright. Blinds and curtains were appreciated to be able to regulate the light intensity coming in from outside. Warmer light was generally preferred, and it made it easier to read for students with dyslexia. Darker lighting also seemed to help some students with dyslexia to concentrate better, and colored lighting was

mentioned to help some adolescents with dyslexia with reading. This all summed up to a need for a more flexible light solution and an understanding of how light interferes and spreads in a room. A final note is that it could be overwhelming for someone with autism if the library had too many apparent light and dark patches of light, which would also need to be considered when developing a light solution for the library.

More color in the library was appreciated as it would make the library livelier. The color preferences varied, but only youths with autism were very specific with their color preferences. However, calmer colors were generally preferred. The color was not only important for the atmosphere, but could also help students with dyslexia with reading, as explained in the previous paragraph.

The library was associated with certain feelings, some appreciated and others not so much. The library was commonly described as being calm and peaceful, which was one of the main reasons why the thesis target group would want to go there. It was seen as a place where they could retreat to, rest, and get a break from being around too many people and noise. It could therefore feel a bit overwhelming if too much was happening at the same time in the library, for example, if there were too many people at once in the library. The example relates to the physical layout of the library and will be elaborated on in section 4.5.3. The quiet environment in the library was appreciated by many, as it helped them relax and think more for themselves. Some did however struggle with the silence itself, even though they appreciated the peaceful environment. This was especially true for some youth with ADHD, who felt the need to talk and therefore felt that they did not belong in the library.

The sound level in the library was therefore an area of conflict. Some students needed the silence, while others hated it. It was mainly youth with ADHD or/and dyslexia who expressed that the silence was a negative feeling they associated with the library. Students with dyslexia benefit from oral information, and so for some it was important to be able to talk and discuss topics or assignments with friends. Some with ADHD could struggle with excessive talking, and so knowing they had to be quiet, made it more difficult to do so; making them reluctant to go to the library. Mumbling and quiet talking were generally fine for most if it was not loud. Music was used by some to either shut out messy surroundings or unmute the silence.

4.5.3 Physical Layout

The physical layout is concerned with the positioning of the furniture in the library, and influences the perceived library atmosphere, while also having the potential to influence the lighting and sound level in the library. The library should feel welcoming, but it was also important that the library did not feel too open. This was especially true for adolescents with autism. The interviewed students with autism preferred the library to have a maze-like structure, so they could walk in between

shelves; feeling a bit anonymous. More isolated seating was preferred by most, especially seating in corners. A corner was not necessarily a wall corner but could be created in between shelves or in the way the furniture was placed. Seating in corners was deemed important for several different reasons. They reduced distraction possibilities, they were peaceful and calm, did not attract too much attention, and ensured people could not look at you from different angles. The latter being mainly important for students with autism.

The seating places in the library should be comfortable to sit at, as uncomfortable seating could be distracting for the target users. Central seats and seating places by entrances were less popular. Some preferred chairs and tables for group work to be placed more at the center. Youths with autism disliked central seating places because they were perceived as too open. Entrance seating was mentioned to help make the library feel more welcoming for bypassers, but at the same time, many expressed that they felt looked upon and that seating by the entrance could make it messy and loud. Working with creating corners, using shelves, and increasing screening possibilities around seating places could help create more viable seating options for the target group. Some specialized furniture existed for the user group, but these were not believed to work in the library, as they would make the youth stand out.

4.5.4 Navigation & Information access

Most interviewed youth expressed that they struggled with finding what they needed in the library. They found it difficult to know on which shelf to start looking for a book and some also expressed that they could easily get distracted by other things while searching for a book; the latter was especially true for youth with ADHD. The book sorting system in the library was a frequently raised issue. Most youths did not understand the book sorting system, and most mentioned that they preferred the books to be sorted based on genre first and then alphabetically. Another issue raised was that one had to read a lot just to find a book. This issue was mainly raised by youths who had dyslexia. Reading was already an obstacle as it was; consequently, needing to read in order to find a book, made the task of reading even harder. The user needed to read the backside of books to know what the books were about. The task of choosing a book could therefore be very time-consuming, boring, and stressful. Additionally, younger students did not always know what they wanted to read, which made it even harder to know where to start looking for a book.

Struggling to understand how the books were organized in the library might not be unique for youth with one or more of the diagnoses, but their diagnoses added another level to the struggle. For example, if a student with dyslexia struggled to read the backside of a book or someone with ADHD struggled to concentrate on the text, then they would be forced to ask someone to read it out loud for them. Not

everyone would be comfortable with asking for help, especially not if it could make them feel inconvenient and awkward, as expressed by one of the interviewees.

Better signage in the library was brought up during the interviews. Many students explained that there were no signs in their current school library, and they believed that better signage would help them navigate around better. Several said that signs above shelves could help, and one of the interviewees mentioned that signs should be hanging over shelves, just like they did in supermarkets. One of the librarians did however share that around 75 – 80 % of people did not see the signs, and this estimate was based on his/her experiences of working in public libraries. He/she explained that people walked around clueless, then noticed a book of the genre they were interested in, and that was when they realized that they had found the bookshelf they had been looking for. If people did not find what they wanted after their clueless wandering, then they tended to ask a librarian for help. Around 20 % walked around and then walked out; thinking the library was bad, because they could not find what they wanted in it. He/she finally mentioned that the issues with the signs might only be amplified for youth with a diagnosis.

The library was believed to only be a place for readers and so some of the interviewees expressed that they felt they did not belong there. Varied media was therefore a theme that emerged from the affinity diagramming. Many preferred to listen to books or watch movies over reading. One of the interviewed students, who had ADHD and dyslexia, explained that watching videos was the only way she learned anything, because even if she could become a bit distracted while watching videos, she would still keep up with a fair amount of the video content. She would also remember names of movies but forget the names of books; believing that the visual trait of videos helped make them easier to remember. Several expressed that they would benefit from being able to navigate faster and access information in different ways in the library.

Supportive tools were available for youth with one or more of the diagnoses, but one of the interviewed students thought one's diagnosis must have been finalized before the youth could get access to these tools. The contrary was revealed during a discussion with a specialized pedagogue, but then again, a documentary by Dahlström et al. produced in 2021, through SVT [39], showed that four out of five parents felt that their children did not receive the help they needed before their diagnosis/diagnoses had been finalized. This indicated that even though the students should get the extra help they needed before their diagnosis/diagnoses had been finalized, they either did not get it or did not know that they were entitled to it.

The process of getting a diagnosis could take a lot of time, and so apart from the interviewed youth in this user study, there might be undiagnosed youth who are yet to receive their diagnosis. One of the interviewed youths received his diagnosis in ninth grade, and another student, currently enrolled in seventh grade, was in the process of being examined for a second diagnosis. The youths' acceptance level of their diagnosis/diagnoses also had an impact on how willing they were to receive

the offered supportive tools. Pedagogues and heroes explained that some did not want others to know about their diagnosis, feared standing out, and hence denied their diagnosis/diagnoses and help.

Clear and concrete instructions were important for students with autism, as unclear instructions and lacking feedback could create uncertainty. Abstract terms and metaphors were disliked, as they also created ambiguity around the given instructions. It was also important that given instructions were broken down into smaller pieces, as too much information at the same time could be difficult to take in.

Finally, the perceived digital literacy of youth, by the specialized pedagogues and librarians, was that youth thought they were better than they were. The youths had technical competence, meaning that they knew how to manipulate digital tools and were quite fast at it. However, most lacked digital competence; knowing how and when to use what to access the information they needed. The youths understood application but not program logic. The digital literacy of youth was believed to be the same, regardless of if the youths had one of the three diagnoses or not.

4.5.5 Exclusion

Exclusion factors have been incorporated throughout the presentation of the emerged themes from the user research, as these were a consequence of many of the expressed challenges. This section is however dedicated to highlighting the main exclusion points and what factors are important to keep in mind to create inclusive and more universal solutions.

The interviewed heroes were more directly asked about exclusion factors, which provided a deeper understanding of how exclusion made them feel and how it had affected their lives. One of the heroes expressed that "... it was awkward, embarrassing, uncomfortable, to have to read out loud, to stand out, to not fit in...", another hero expressed that "... [youth with ADHD] are afraid, afraid that someone will find out [about their diagnosis]... they are actually afraid to open up... they keep quiet instead...", and the final hero expressed that "... do I appear weird for other people and stuff, it's like difficult to see oneself from the outside...".

The interviewed students also expressed exclusion points, but more indirectly through explaining certain interactions they have had with the library and how it made them feel. One of the students explained that she would always stay for a very long time in the library, when she was younger and was forced to go there with her class to choose a book to read. She would take the first best book she found and end up not liking or finishing it. Now, being older, she mentioned that "... you feel very ignorant, when you don't find a book or when you don't really know where to look [for a book], and you're like walking around in the wrong aisle". Another student explained that he thought it was difficult to make someone like him go to the library

and that he had never read an entire book. He only realized his school had a library during the actual interview, further explaining that libraries for him were associated with a built-up negative pressure on the inside, from having been told to be quiet at the library when he was younger. The student also explained that he believed that the will to go to the library had to be built up gradually and that he wished the library did not feel like a library; a place that was only for reading: "...I've always thought about it, if you could call [libraries] something else...". What these two examples show is that exclusion starts early, creating a negative library experience, and limiting library interactions in the future.

Many of the students wanted to go to the library because it was a peaceful and cozy environment, but still, many did not go there very often. One student mentioned that "when I go to the library; it feels that it's only those that like, driven people who sit and study and do nothing else. I think, after all, that the library should be a place for everyone". Another student explained that "... there are no supportive tools that help her [in the library]", which both strengthened the feelings of exclusion.

As explained in the previous section on navigation and information access, youths' acceptance level of their diagnosis/diagnoses varied a lot. Students with a lower acceptance level could deny offered supportive tools, especially if these tools made them stand out more from the rest of the students. The interviewed pedagogues' experiences from working with the target group helped back this up; "...I've had students who don't want- who don't have an account to Legimus and don't want to use it...", and "... they [students with ADHD] don't want to wear [the weighted vest] out in the classroom...".

This section will be wrapped up with a final quote by one of the heroes, that helps put the topic of exclusionary solutions in perspective and sheds some light on the importance of thinking universally when designing solutions for the target group:

"... It's like saying that vegetarians should sit in a different canteen, it was really like that, that's how I felt, and that frustration still remains, because I was so fucking excluded. That exclusion didn't make it easier to accept my problem, it became more denial... so I think that how the environment [around the student is] makes the student him-/herself feel very belittled."

4.5.6 Conclusion

Three main over-arching conclusions can be drawn from the user research phase, which are the following:

- The interactions between the emerged themes are just as important as the themes themselves
- Students with one or more of the diagnoses are less flexible and adaptive to deficient solutions

- Incorporating flexibility into design solutions is important for designing universally

The first conclusion emphasizes that the themes that emerged during the data analysis should not be treated separately and in isolation from the other themes, because the interactions between the themes help connect the themes, which is central for an all-encompassing solution development process. An example is an interaction between the themes: physical layout and lighting. Isolated seating was one of the sub-themes in physical layout. Many needed more isolated seating to concentrate better. Some adolescents with dyslexia did however express that too bright light made it difficult to read, and so creating isolated seating options in the library, but using bright lights, would not be of any use to someone with dyslexia, whose reading struggles could increase if the light was too bright.

The second conclusion, points to the vulnerability of the target group. Students with one or more of the three diagnoses, seemed to be less flexible and adaptive if solutions were lacking, in comparison with the norm. Some examples include the following: “a bit [vital], because, or at least I, become distracted by the smallest thing so if I think that [the seating] is uncomfortable or something like that then I can’t focus”, “... sometimes when it becomes too much [noise], then I shut down and then I can neither concentrate or listen, so then, it gets quite hard, and that’s something that’s distracting”, and “... without the help, [youth with dyslexia] don’t get their knowledge out, which can be extremely frustrating...”.

The third conclusion stresses the importance of incorporating flexibility into designed solutions, for a more universal usage of developed solutions. This is especially important in the thesis context, as youths’ acceptance level of their diagnosis/diagnoses varied a lot, and so many did not want to constantly be reminded that they were different and stood out. Incorporating flexibility into designed solutions could help create more viable and inclusive usage options for the target group, such as working with creating adjustable seating and lighting options or creating several ways of interacting with and accessing information in the library. One concrete example from the user study is that, opting for seats that can be fixed or released, to allow for some movement, could help meet the following expressed needs:

“... I know quite many who- some can’t handle sitting in a swivel chair because it’s the only thing they think about, while others can’t handle sitting on a normal chair because they need to move around a bit to be able to concentrate...”

Many also preferred more screened-off seating places, hence; innovating to develop flexible and easy-to-use screens, could be an interesting approach to meet that expressed need.

A final note is that there are more groups that need to be included when designing universally. This thesis focuses on three groups, youth with dyslexia, ADHD, and/or autism, but the commonly used Universal Design principles will be used to capture

more perspectives when moving into the ideation phase. One example is that creating corners and seating groups in between shelves could meet the needs of this thesis's target group but might create obstacles for someone sitting in a wheelchair. This does not mean that the idea of creating corners should be abandoned, rather it means that the awareness of this added target group, ensures its needs are taken into consideration, when setting the final physical layout of the library. This could be by ensuring passages are wide enough, despite introducing more seating groups between shelves, and by introducing clear navigational cues on the library floors.

5 Define

This chapter presented three developed personas based on the findings from the Empathize phase. The chapter ends with a section specifying the goals going forward.

5.1 User Personas

This section presents developed personas based on the user insights presented in the previous chapter.

5.1.1 Personas

LUMA Institute [40] defines personas as “fictional characterizations drawn from real research data. They are not preconceived stereotypes; they are archetypes borne of careful study”. Personas are further explained to be useful in user-centered design, because they are helpful in putting the users at the center once it is time to make design decisions; reducing the risk of the designer’s own assumptions getting in the way. Personas also help humanize the research insights by giving the outcomes a face, which also makes the findings more memorable. Finally, personas help sum up the needs, goals, and mindsets of the typical users [40].


5.1.2 The Three Personas

The personas are based on the insights captured by the affinity diagram, created in the previous chapter. The needs, goals, and mindsets of the users were extracted from the affinity diagram and were then used as a basis for developing personas. A persona profile template provided by LUMA Institute was used [40]. A total of three personas were developed and are shown in Figure 5.1, Figure 5.2, and Figure 5.3.

5.1.2.1 Jasmine Geelen – the motivated but insecure one

Persona Profile

NAME:
Jasmine Geelen

PORTRAIT:


GENERAL DESCRIPTION:
Jasmine is a 13-year-old female with dyslexia. She's aware of the challenges that her diagnosis entails, but she doesn't want to talk openly about her diagnosis. She feels inconvenient and awkward when she must ask someone for help, especially when everyone else can manage the same task on their own. Jasmine wants to read, but she finds it difficult and boring. She enjoys music a lot and likes to draw during her free time.

ATTITUDES:

- Feels that she won't find anything she likes in the library
- Very insecure about needing to ask for help
- Wants to feel independent

GOALS:

- Find books in the library that interests her
- Navigate around the library by herself

Innovating for People | Activity Templates | Persona Profile

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Figure 5.1: Jasmine Geelen – the motivated but insecure one

5.1.2.2 Mayan Lindgren – the withdrawn one

Persona Profile

NAME:
Mayan Lindgren

PORTRAIT:



ATTITUDES:

- Can become unsure if information and feedback aren't communicated clearly
- Overwhelmed if too much is happening around her

GENERAL DESCRIPTION:

Mayan is a 14-year-old girl with autism. She's very open about her diagnosis and her needs. She wants a calm, peaceful, and screened-off place to rest in the library. Mayan wants to feel a bit anonymous in the library and so she wants to be able to navigate around on her own, with minimal interactions with others around her, as that can feel overwhelming. She enjoys listening to music and specifically enjoys reading books about the human mind.

GOALS:

- Wants to know into what environment she's entering beforehand
- Wants to find a calm place to sit, where she can rest or read

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Figure 5.2: Mayan Lindgren – the withdrawn one

5.1.2.3 Adam Ayad – the distracted one

Persona Profile

NAME:
Adam Ayad

PORTRAIT:


GENERAL DESCRIPTION:
Adam is a 16-year-old boy with ADHD. He can be quite forgetful sometimes. He doesn't read a lot because he finds it boring and a too energy-demanding task. Adam prefers to watch movies or listen to books, and if he reads then he finds it easier to read online than from a physical book. He used to go to the library when he was younger, not primarily to read but to use the computers there with his friends. Just like other youths in his age, Adam enjoys playing games and spends a lot of time on TikTok.

ATTITUDES:

- Easily distracted and bored
- Shuts off in a messy environment
- Very curious

GOALS:

- Wants to learn something new

QUOTES:

"I want to learn something new, but the library only has thick books. I wish the library was more accessible."

"It's so much easier for me to remember things I've seen and heard."

Innovating for People | Activity Templates | Persona Profile
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Figure 5.3: Adam Ayad – the distracted one

5.2 Goal Specification

All developed personas relate to navigation and information access – one of the main identified themes from the data analysis phase. A lot more personas could be developed, targeting more of the emerged themes from the user research. However, only the three presented personas above were decided to be used going forward. This limitation was to ensure the thesis remained within a manageable and reasonable scope, but also because this theme was seen as the most relevant for answering one of the initially formulated objectives of the thesis: exploring the intersection between the digital and physical environments as a tool for increased inclusivity and accessibility in indoor environments. The following and more specific goal was therefore set going forward:

- The interaction between the digital and physical environments shall be explored, as a tool to facilitate the navigation and information access, in the Svane-Hedda library, for adolescents between the ages of 13-19 with dyslexia, ADHD, and/or autism.

All insights from the user research will be shared with the Svane-Hedda school, who will continue to build on the research and incorporate the findings into the final interior design of the library.

6 Ideate

This chapter presents the ideation work done during the Ideate phase of the design process. It included a description of the methods used, and a list of the developed concepts; followed by an evaluation and selection of the final concepts proceeded with. The chapter ends with a couple of storyboards conveying the final concepts.

6.1 Methods for Ideation

This section presents the ideation methods used during the ideate phase of the project.

6.1.1 Alternative Worlds

The method of alternative worlds was used, and is described by LUMA Institute [41] as a method that encourages one to explore successful organizations outside the field one wants to innovate in. The exploration should be done with the aim of understanding how other organizations would tackle a similar issue as the one the thinker aims to solve [41].

Preece et al. [5] explain that innovations rarely emerge from one source but are rather the result of “cross-fertilization of ideas from different applications, the evolution of an existing product through use and observation, or straightforward copying of other, similar products”. The method of alternative worlds could hence help with providing valuable inspirational sources; allowing for the development of innovative ideas.

Observations and short interviews with workers were used to gather insights from the physical alternative worlds. Questions asked during the short interviews related to navigation: how often did customers need help and how did the “world” work with facilitating navigation. Mappedin, Supermarkets, Netflix, IKEA, and bookstores were explored as alternative worlds.

6.1.2 The Lotus Blossom

The insights obtained from the tool Alternative worlds, presented above, were kept in mind when moving on to ideate more using the ideation tool Lotus Blossom. According to Riley [42], the method Lotus Blossom allows for a structured brainstorming session, in which a larger quantity of ideas could be created quite fast. The method further builds on placing a central theme or problem at the center, which is then surrounded by eight related concepts. Each related concept is then taken and ideated around to generate eight more ideas building on each related concept, which gives a total of 64 ideas [42].

6.1.3 Four Categories Method

The Four Categories method was used to help select which of the generated 64 ideas to move on with and into the next ideation step. Dam et al. [43] present the method as a framework for splitting up generated ideas into four categories: Most rational, Most delightful, Darling, and Long shot. The abstractness level increases for each category, where the Long shot covered the most abstract ideas [43]. Around two to three ideas from the Lotus blossom were selected and placed under each category. This is to follow best practice and also to ensure that at least one idea from each group of eight ideas, surrounding each related concept in the Lotus Blossom, was included to the next ideation step.

6.1.4 The Disney Method

The Disney Method was used to further think through and improve on the ideas selected using the Four categories method. Williams [44] explains that The Disney Method is an ideation process that forces the thinker to adopt three different perspectives, using them one at a time. The first perspective was the dreamer, who allowed for crazy and fantasized ideas to be created. The dreamer's ideas were then analyzed using the perspective of the realist, resulting in refined and more practical ideas. Finally, the critic's perspective was used to criticize the ideas, elaborating on the ideas' shortcomings. Breaking down the ideation session into the different perspectives ensured that practical restrictions, set on the project, did not directly limit wild ideation, which allowed for outside-the-box ideas to also be considered [44].

6.2 Insights from Alternative Worlds

The observations of and interactions with the alternative worlds helped deepen the understanding of how signs were used and their limitations. Only the insights that were especially important for the remaining ideation phase are presented in this section. The gained insights were used as input for the remaining ideation phase, involving the use of the Lotus Blossom and the Disney Method.

All visited supermarkets struggled with that many of their customers did not seem to understand the sorting system or notice the hung-up signs. The customers could ask about a product and not notice that they were standing right beside it. The sorting system and hung-up signs seemed to be clear for the workers. One of the interviewed workers did express that the system was simple and clear once you learned it, but at the time of the interview the store had just recently been re-organized and so the worker expressed that navigation was not only a challenge for the customers, but for the workers as well. This seemed to suggest that the sorting system and hung-up signs, that were intended to support customer navigation, were only useful if the customers had been introduced to and understood the system before the actual interaction.

The navigation challenges in supermarkets were similar at IKEA, even though IKEA had navigation maps placed around the store. It did however seem easier for customers to navigate around the take-by-yourself-stock, as an interviewed worker mentioned that she received fewer questions in the take-by-yourself-stock than out in the store. One reason for this could be that the customers had already been introduced to how the take-by-yourself-stock was organized through an interaction with the workers in the store, which meant that they understood the sorting system and how to navigate around before they got there.

The main conclusion from the visits to IKEA and supermarkets was that many customers struggled with the navigation even though signs and other supportive navigation tools were used by the businesses. Many customers did not seem to see the signs, which could be attributed to that they did not know where to look to find the information they needed or in what order information was presented. It is like when one starts to take driving lessons: you only notice the signs once you begin learning the sign system.

6.3 Developed Concepts

A total of nine concepts remained at the end of the Disney Method. The nine concepts are presented in the following section.

6.3.1 QR Codes for Backside Texts

This developed concept involved the use of QR codes on the backside of books. The users would use their phones to scan the QR codes, which would lead the users to an audio recording or an animated talking figure, allowing the users easier and faster access to book descriptions. This would speed up and make the process of choosing a book less stressful and more enjoyable for the users. The solution would also help the target users interact with the library in a similar way as the norm user would, which could promote more universal access to books.

This concept assumed that the users would have a phone and headphones with them to the library, which they then could use to scan the books' QR codes.

6.3.2 Book Video Reviews and Summaries

This concept first mainly intended to present book reviews in a different and more fun way for the target group, using platforms that the users already used, such as TikTok; aiming to inspire and motivate users to read.

The concept was then critiqued by the critic perspective in the Disney Method, which argued that the concept aimed to inspire the target group to adapt to the world of the average person, i.e., to access information and knowledge through reading, which went against what Svensk [21] emphasized: the importance of questioning assumptions about the world and common traditional constructions, i.e., to not only make the target group understand and adapt to the average world, but to also understand theirs.

Some of the users understood and got less distracted by watching videos, and so this concept developed to also include making visual book summaries available for the users, which would not exclude them from book contents if they did not have the energy or concentration to read.

6.3.3 Scenarios of Interactions

This concept aimed to provide illustrative and visual scenarios of how library visitors should interact with the library, which could help users feel more independent in the library, as guiding instructions on library interactions would not only be provided in written text.

The illustrative and visual scenarios were first thought to hang around in the library in places where the users could experience interaction issues, e.g., borrowing a book. The critique criticized this, arguing that the scenarios were likely to face the same challenges normal hung-up signs in libraries faced: people would not notice them. The scenarios were suggested to be incorporated into reminder notifications

in a developed navigation app, as their pop-up function better ensured the users would see them.

6.3.4 Book Collection Points

Two of the raised challenges, through the presented personas, were forgetfulness and that messy environments could be stressful; Figure 5.3 and Figure 5.2 respectively. Book collection points could help meet both needs and built on the idea of having dedicated spots around the library where users could place their used books; instead of leaving them on a table or putting their books on the closest shelf they found. In this way, users who forgot which shelves they had fetched their books from, would still have dedicated spots in which they could leave their books; reducing the perceived messiness in the library from having abandoned books lying around in the wrong places. This could also help any other library visitor who is stressed on their way out and does not have the time to return their used books to their right place.

A scanning function could further be added to the book collection points, where the thrown in books are scanned, just like recycled bottles are scanned in a recycling machine. Scanning the books would help identify which books were in the book collection points, which could be linked to a library book search engine to update the position of the books in the library. This could help both users and librarians find displaced books in the library faster, as a quick search in the updated library book search engine, would help reveal the position of books.

The book collection points would also need an added function enabling users to, by themselves, take out a book they were looking for and have the status of the book's position be updated.

The critic critiqued that, students who were stressed or who struggled with routine tasks, might not bother with finding out where the book collection points in the library were. Finding optimal positions for these points would therefore need further investigation.

6.3.5 Book Trailers

This concept attempted to make it more fun for the users to read, hence motivating them to read by providing a more visual and exciting book description. This idea could be combined with ideas 6.3.1 or 6.3.2. The idea could however be problematic as the critic raised that it could be costly and time-consuming to create trailers. Another issue was that trailers risked raising the users' expectations of the books, which could lead to even more dissatisfaction once the users started reading and were again reminded of how difficult they found reading to be.

6.3.6 Tool for Navigation and Media Search

This concept started as an idea to develop an app for library visitors, that would facilitate navigation in the library and support the users to find what they needed and wanted in the library. The idea was then developed to instead be an application-inspired website, as that would help integrate the concept into Svane-Hedda's school website; in case developing a mobile application was too costly. Another reason for this choice was to eliminate the need for downloading a library application; mainly because it could be assumed that it would primarily be frequent library visitors who would want to download the application, and because downloading an application necessitated that the users had enough free storage space on their phones.

The digital navigation and media search platform would provide a map of the library. The media search function would allow the users to look up books or other available media in the library, either by searching by author, category, or title. Once a user selects a book or other media in the application, an updated navigation route is shown with details on how and where to find the book or other media in the library.

6.3.7 Displaying Human Clusters

This concept would mainly help meet the needs of Mayan, the second developed persona, Figure 5.2, who wanted to be more in control of how much she needed to interact with people and navigate around places with a lot of people. Several options were explored for estimating and showing the clustering of people in different areas of the library but were critiqued by the critic to be inaccurate or accompanied by integrity issues.

The final concept was to display an estimation of the number of people in the library on a screen by the library entrance or integrated into a library application. The estimate could either be based on the average hourly visitor numbers, or more accurately calculated by placing a camera with a face recognition function by the entrance. Another option could be to use a sensor that senses and counts the number of passing people. The presentation of the number of people should also consider the library size, for a more representative estimation.

6.3.8 Pokémon Go Inspired Navigation

This concept aimed to facilitate the navigation in the library for the users, while also promoting a more fun and memorable interaction along the way. Just like in Pokémon Go, the real world, in this case, the library, would be the "playground". The user would use their phone to discover things in the library. The user could, for example, be looking for stories about dragons, and so a search in the Pokémon Go

inspired application, would display and portray the correct navigation route in front of the user; showing anything the library had to offer about dragons, while also adopting a dragon theme throughout the navigation. The critic critiqued that the application risked not being used all too often, even if it was likely to make the navigation and interaction with the library more fun.

6.3.9 Search Screens on Shelves

This final concept was built on the idea of making search screens available directly on shelves, where users could directly type in and look up books they wanted. This idea was however heavily critiqued by the critic. For this concept to work, the users would need to find the right shelf by themselves first. The search screens would hence not be helpful if the users could not find the right shelf on their own. The search screens would display false information if books had been displaced by someone else, and everyone passing by a search screen could see what users were typing, which could feel stressing and intruding. The idea also assumed that the users knew what they wanted and that they were comfortable with typing on a screen in the open.

6.4 Evaluation and Selection of Final Concepts

The nine concepts presented in the previous section were evaluated using the seven UD principles: equitable use, flexibility in use, simple and intuitive use, perceptible information, tolerance for error, low physical effort, as well as size and space for approach and use. The UD principles were used to, early in the design process, evaluate the potential each developed concept had in living up to the UD principles. It also helped broaden the perspective from who the target users were to who the user also could be, e.g., how would the concepts be affected if a user was short, sitting in a wheelchair, or blind. The UD principles with broken down criteria, developed by Story et al. [45], were used during this part of the evaluation.

A second evaluation was also done to help complement the UD evaluation of the concepts. The nine concepts were presented to the author's co-supervisor from the Svane-Hedda school, who could evaluate the developed concepts based on her experiences and knowledge about the target group.

6.4.1 Evaluation Results

The two concepts that were evaluated to be the most promising and doable for the Svane-Hedda school were "QR codes for backside texts" and "Tool for navigation and media search", presented in 6.3.1 and 6.3.6 respectively.

The first concept was evaluated to make the users' interactions with the library more equitable, as the users and anyone else visiting the library could simply choose how they preferred to access the information given on the backside of books. Broadening the target group to also include the blind showed that the concept could be excluding for this added target group, which hence made the concept less universal. However, it was questionable if this concept would even be of any benefit for someone who was blind, as they would either need to listen to a book or read braille either way. It would be interesting to explore this target group further, maybe as another thesis subject. The concept was further evaluated and was believed to provide flexibility in use to a large degree, but one noted issue was that a user who struggled with gripping objects could struggle to grab a book from a shelf to scan the backside of the book, which was another aspect that could be interesting to consider. It was also reasoned that the concept had good potential to provide sufficient perceptible information, be simple and intuitive, and be tolerant of errors. These principles should however be further considered when prototyping and further developing the concept, for example, how could the purpose of the QR codes be made intuitive and how should feedback be given when a user wrongly interacts with the concept. The concept was believed to require low physical effort. Size and space for approach and use was deemed less relevant for this concept. An interesting parallel would however be to consider shelf height and how that could exclude users who were short or using wheelchairs from fully accessing and using the proposed concept.

The second concept, "tool for navigation and media search", was evaluated to potentially be both equitable and flexible in use. This, as the concept, with its digital platform, could potentially be developed to include more users; for example, someone who is blind could still navigate around the library using an installed reading service, and different language settings could be included. How simple and intuitive, perceptible informative, and tolerant of error the concept was, was deemed difficult to determine at this stage of the design process, as it heavily depended on how the platform and interface would be designed. The concept would therefore need to be further developed before it could be re-evaluated based on the mentioned UD principles. The concept was evaluated to require low physical effort to use. Size and space for approach and use was considered difficult to directly apply to the concept.

The evaluation with the author's co-supervisor also confirmed that these two were the most interesting for the Svane-Hedda school to further explore. Some of the other concepts were interesting but more challenging for the school to implement by themselves; for example, "book video reviews and summaries" and "book collection points", presented in 6.3.2 and 6.3.4 respectively. The disadvantages of some of the remaining ideas outweighed their advantages and they were hence also excluded; for example, "Pokémon Go inspired navigation" and "Search screens on shelves", 6.3.8 and 6.3.9. Pokémon Go had, for example, the potential of making it fun to be in the library, but it risked having youth running around in the library too

much. The UD evaluation of the remaining concepts is included in a simplified table in Appendix D.

6.5 Storyboards

Storyboards were created for the two chosen concepts. This was done to better illustrate and explain the concepts and how they helped meet the expressed needs and goals of the presented personas in section 5.1.2.

6.5.1 Why Storyboards

Storyboarding can be used to convey a developed concept to users through the creation of stories and can even be thought of as low-fidelity (Lo-Fi) prototyping [5]. Drawing stories, through a series of sketched-up images of how the users are thought to interact with new concepts, helps contextualize ideas and helps people visualize and imagine how the future might look like [46].

6.5.2 Modifications of the Two Final Concepts

Some modifications were made to the final two concepts before moving into the prototyping phase. It was at first unclear if Svane-Hedda school would be able to further develop and implement the “tool for navigation and media search” after the end of this thesis project. The school would not be able to integrate the concept into their current website, as they were no longer allowed to use a public domain. An application would also be difficult for the school to develop, as they would, among other things, need to get the application GDPR controller. It was however possible for the school to work with web applications. It was therefore decided that the concept “tool for navigation and media search” would be based on a web application format.

The concept of “QR codes for backside texts” was further explored and developed. This was done as it at first was somewhat unclear if the school would be able to work with the concept “tool for navigation and media search”, but also because it was believed that the QR code concept would be easier for Svane-Hedda school to implement after the end of the thesis project. The QR code concept was further explored with the following question in mind: “how could QR codes be used to facilitate navigation in and increase interaction with the library?”.

The application “Be Here, Then” was used as inspiration to explore the question above. The application allows the user to follow a navigation map around a city and view how buildings looked like in the past or how they would look like in the future;

allowing users to step in and out of history and the future [47]. The idea of using QR codes to allow users to step in and out of shelves, exploring and listening to books through a simple scan, evolved. QR codes could be placed on shelves to complement bookshelf signs. Library visitors could scan a QR code on one of the bookshelves and have the backside of one of the books on the shelf be read; followed by a short review and information on what books were stored on the specific shelf. Even though this idea would benefit from being integrated into a navigation app, it could still, through the use of QR codes, make it more enjoyable for adolescents to walk around in the library, which could increase their interaction with the library. The concept of “QR codes for backside texts” was therefore renamed to “nudging QR codes” and included QR codes on library shelves and books.

6.5.3 Two Concepts, Four Scenarios

Four main scenarios were established for the two selected concepts – two per concept. The scenarios are described below and provide the basis for the created storyboards.

Concept 1: Nudging QR codes

The first scenario is built on the idea of having QR codes on library shelves. The user would, by scanning one of these QR codes, access an audio recording or animated talking figure. The audio file would present one of the stored books on the bookshelf on which the QR code was attached. The backside text of the presented book would be read; followed by some quick book review. The book title and author would also be given; ending the audio with telling the listener what books were stored on the shelf. This scenario could also, in the long run, be integrated with concept 2 so that all audio recordings are stored in the web application.

The second scenario is built on the idea of having QR codes on the backside of books. A user could listen to books’ backside texts by scanning the codes, and hence get an idea about what books he/she was interested in faster; making it more enjoyable and less stressful to find and choose a, for the user, interesting book to read.

The two scenarios, presented above, can shortly be described and associated with the phrases below.

- 1st scenario – QR codes on shelves
 - “What’s new?”
 - “Inspire me”
 - “Give me a quick insight”
 - “Something new every week”
- 2nd scenario – QR codes for backside texts
 - “Get insights into books faster”
 - “More enjoyable book search”

Concept 2: Web application for navigation and media search

The first scenario is built on the idea of making a navigation map of the library accessible for the user through a library web application. A navigation map would give the user an overview of the library, its physical layout, and its offerings before the user entered the library.

A physical navigation map would be placed by the entrance of the library. The users would be able to look at the physical navigation map before entering the library. They could also scan a QR code at the bottom of the physical navigation map, to bring the navigation map with them on the go in the library. The QR code would lead the users to the library web application, which would also make it possible for the users to access the media search function; illustrated in the next scenario and is explained in the next paragraph.

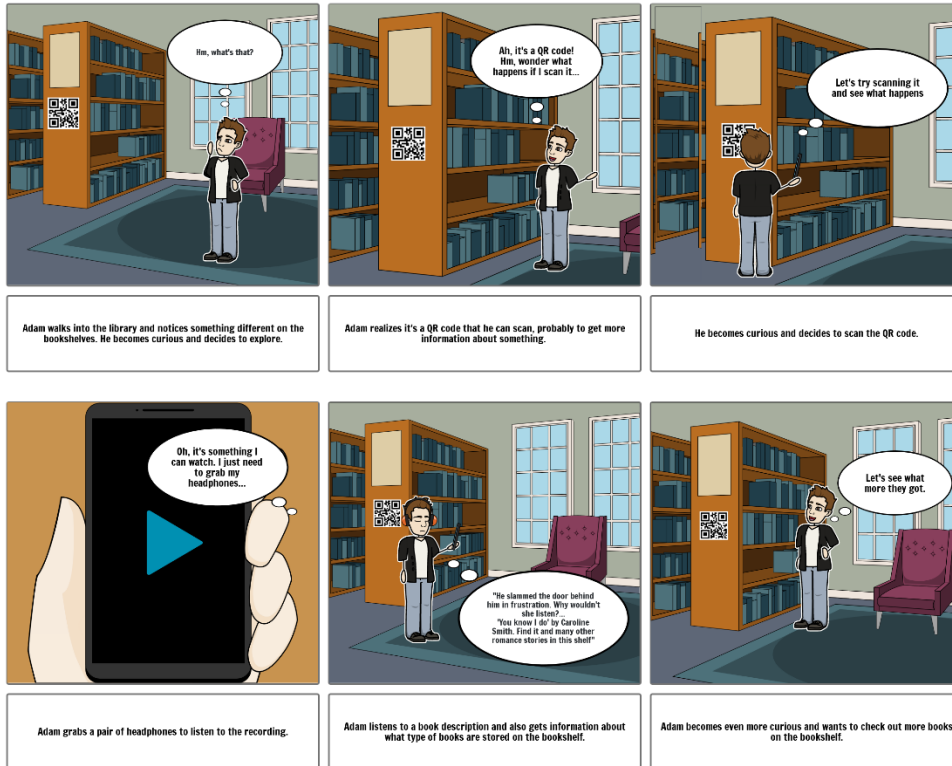
The second scenario is built on the idea of making it possible for the user to look up what media the library offered and where in the library to find these. The user would be able to search after books or other media by author, category, or title; accessing information about the looked-up object, such as status (is it in the library now or borrowed), description of the object, and its location in the library. The user would further be able to ask for help with navigating to the selected object's location, which would invoke the navigation map function; explained in the first scenario.

The two scenarios presented above can shortly be described and associated with the phrases below.

- 1st scenario – Location search
 - “Find me where...”
 - Seating regions
 - A certain media section
 - “Show me how to get there”
- 2nd scenario – Media search
 - “Search by category or author”
 - “Recommend me”
 - “Surprise me”
 - “Show me where to find it”

6.5.4 Created Storyboards

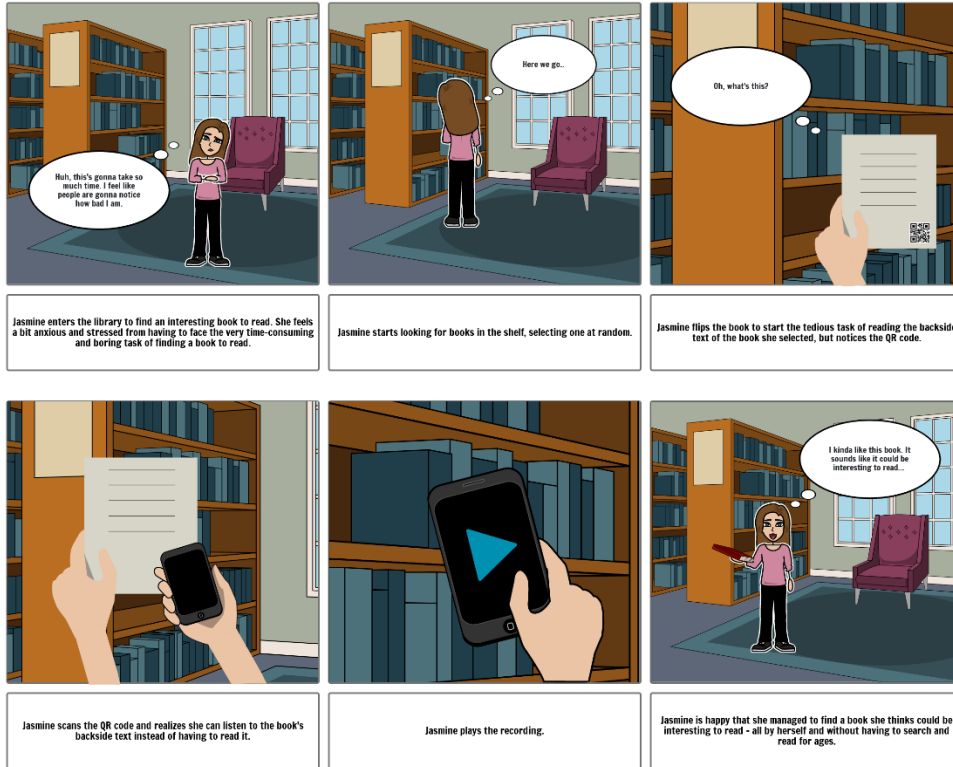
6.5.4.1 QR codes on shelves



Create your own at Storyboard That

Figure 6.1 Shows how Adam interacts with the concept “Nudging QR codes”, specifically focusing on the function “QR codes on shelves”

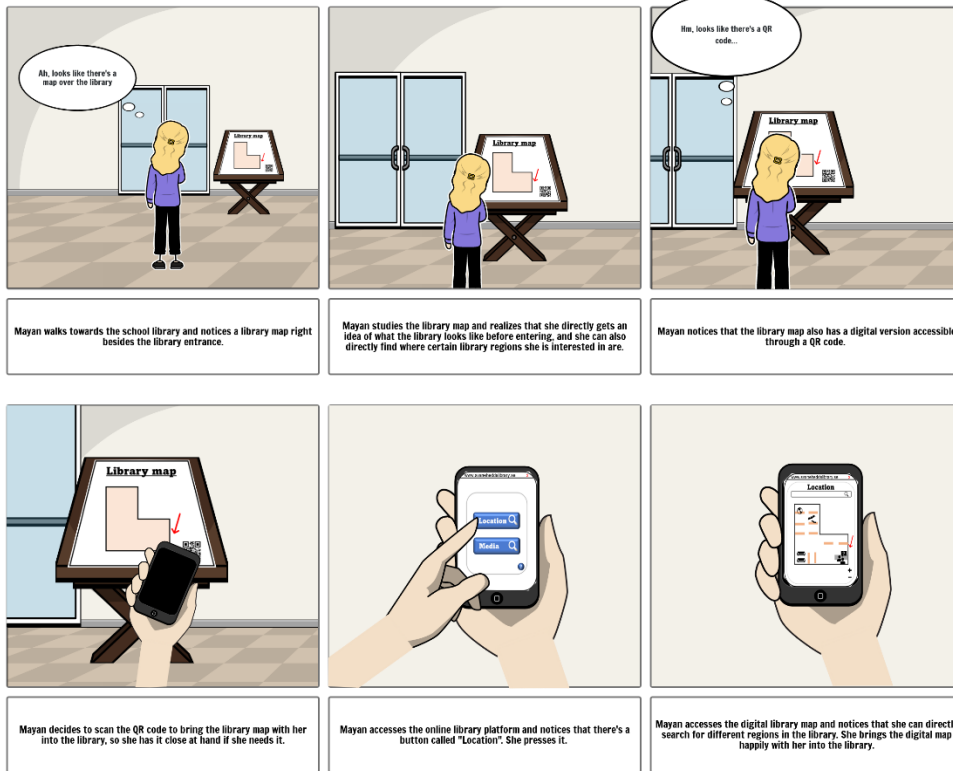
6.5.4.2 QR codes for backside texts



Skapa din egen på Storyboard That

Figure 6.2 Shows how Jasmine interacts with the concept “Nudging QR codes”, specifically focusing on the function “QR codes for backside texts”

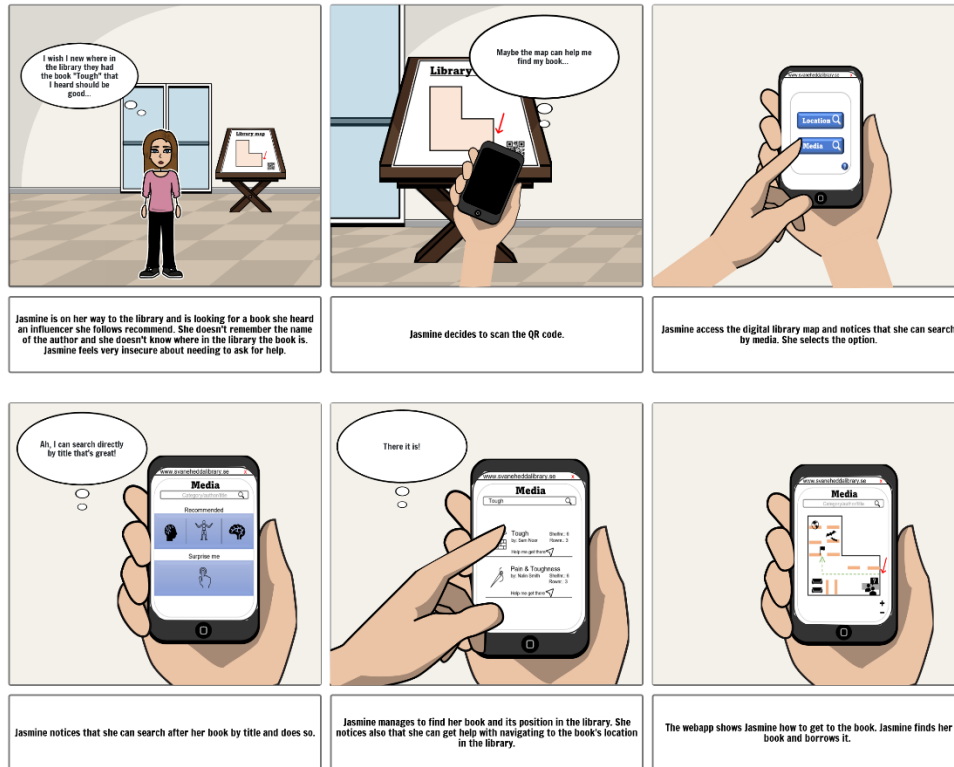
6.5.4.3 Location search



Skapa din egen på Storyboard That

Figure 6.3 Shows how Mayan interacts with the concept “Webapp for navigation and media search”, specifically focusing on the function “Location search”

6.5.4.4 Media search



Skapa din egen egen på Storyboard That

Figure 6.4 Shows how Jasmine interacts with the concept “Webapp for navigation and media search”, specifically focusing on the function “Media search”

6.6 Narrowing Scope of Project

The thesis’s scope was further narrowed before moving on to prototyping. This was done to ensure enough time could be dedicated to the selected concepts so that the quality of the prototyped concepts would not suffer from a lack of time. Moving on, only the “nudging QR codes” would be prototyped. Both QR code scenarios presented through storyboards in Figure 6.1 and Figure 6.2 will be prototyped and evaluated in the next chapter. The second concept of creating a web application for navigation and media search, was not selected as it was reasoned that the concept would be more time-consuming and costly for Svane-Hedda to further develop and implement following the end of the thesis. The second concept would however be interesting to further explore and test e.g., through another thesis project.

7 Prototype

This chapter presents the work completed during the Prototype phase of the design process. It includes descriptions, evaluations, and modifications made to the developed prototypes of the nudging QR codes concept.

7.1 Lo-Fi Prototyping

Developing low-fidelity (Lo-Fi) prototypes are according to Preece et al. [5] intended to be a quick, easy, and cheap way to test different ideas and different designs. The prototypes are created using any available or cheap material. The cheap nature of the Lo-Fi prototypes allows the designer to explore different designs and do several modifications before the final and more expensive prototype is developed. [5]

Two Lo-Fi prototypes were created and tested, where the feedback obtained from the testing of the first Lo-Fi prototype was used as input for the creation of the second prototype.

7.1.1 First Iteration

7.1.1.1 Description of first Lo-Fi prototype

The first Lo-Fi prototype was created using PowerPoint, an audio recording function on phones, Google Drive, and a QR code generator. The prototype consisted of two parts: one per described storyboard, Figure 6.1 and Figure 6.2 in the previous chapter. The created Lo-Fi prototypes were created with mid-level detail, to avoid unnecessarily confusing the target group. This was especially due to that test participants with autism could become uncertain if things were too unclear and ambiguous, which could reduce the amount of valuable feedback obtained from the user tests.

The first part of the prototype can be seen below in Figure 7.1.

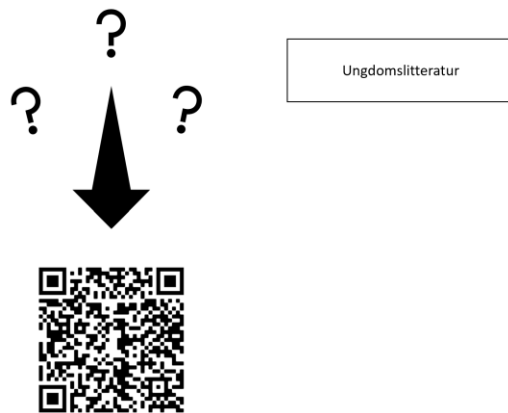


Figure 7.1 First iteration of QR codes on shelves

The Lo-Fi prototype was intended to be fastened on the side of a library shelf and it consisted of a QR code that, if scanned, lead to an audio recording. The audio file informed the listener what type of books were stored on the specific bookshelf and read an extract from one of the stored books there as inspiration. The question marks were added to create a sense of curiosity, which would nudge users to scan the QR code and find out more about what was hidden behind it. A sign saying “Youth literature” was added at the top right corner to allow the users who preferred to read the option to do so. The quicker and more frequent library visitor could hence skip the QR code and still directly get an idea of what kind of books were stored on the specific shelf.

Figure 7.2 depicts the second part of the Lo-Fi prototype.



Figure 7.2 First iteration of QR codes for backside texts

The second part of the prototype was fastened on the backside of a book; consisting of a QR code that would lead the user to an audio file of the book’s backside text, title, and author; allowing the user to listen to the backside text instead of reading it. A descriptive blue label was also added to the QR code, with the aim of clarifying the purpose of the QR code and to encourage the user to use headphones while listening to the audio file.

7.1.1.2 Test procedure

The first Lo-Fi prototype was tested with two previously interviewed students, both of whom had dyslexia, and one of whom also had autism. The test participants were given two test scenarios to follow. The first scenario aimed to test the first part of the Lo-Fi prototype with QR codes on bookshelves, while the second scenario tested the QR codes for books' backside texts. The following were the two scenarios:

- You are in the library and want to find a book to read. You do not exactly know where to start, but you have a bit of time to walk around and explore. What do you do?
- You have found a bookshelf that you think could have books that would interest you. You select a book from the shelf and want to know more about what the book is about. What do you do?

In the second scenario, a book had already been pre-selected for the sake of the test. This was done so that a QR code could be prepared in advance.

The test participants were asked to think aloud during the prototype testing. Think aloud is an evaluation method in which the testers are asked to share their thoughts out loud throughout the prototype test; allowing the test facilitator to understand how the user thinks when interacting with the prototype [48]. The testing session ended with having the test participants answering five evaluating questions. These are presented in the next section.

7.1.1.3 Feedback from tests

The feedback and insights obtained from the tests are presented in the sub-sections below. The first sub-section presents the insights obtained from the think-aloud evaluation, while the second sub-section presents the users' answers to the asked evaluation questions at the end of the prototype testing session.

7.1.1.3.1 Think aloud evaluation

The first tested scenario caused some confusion for both testers. They did not directly notice the hung up QR code on one of the bookshelves and began looking for books the way they usually did; for example, looking at some of the visible book coverings on some of the shelves and based on that guess which type of books were in the specific shelf. Both testers also mentioned that they would have preferred signs hanging down from the ceiling. The users noticed the hung-up QR code once they were given a hint by the author. The user who only had dyslexia, immediately understood that one should scan the QR code and did so successfully.

The second user, who had both dyslexia and autism, felt a bit confused. She noticed the sign saying, "Youth literature". She liked the sign and she understood that there was a QR code one could scan. She did, however, feel unsure about having to scan the code; expressing that she did not know where the QR code would lead her and therefore did not trust it; mentioning that there were a lot of bad things one could

access using digital tools. The tester did however seem to appreciate the question marks and the leading arrow to the QR code; explaining that the question marks signaled that the surrounding was unclear, and the leading arrow showed where the answer and solution was. The problem lay in having to scan the QR code as she did not feel she had enough information about the QR code destination. She also mentioned that she was not very technical and was not entirely sure of how to scan the QR code.

The first user pointed out that it would have been better if it said on the QR code sign that one should scan it and an explanation of what the QR code was leading to. She further mentioned that it would have been better if one could also have the option to read what was being read up in the audio file. The second user explained that she thought it was good that the QR code sign stood out on the side of the bookshelf and mentioned that it should not be a lot of things around the sign that could make it less visible.




The second scenario felt quite clear for both users. The first user who only had dyslexia directly noticed the QR code on the backside of the book when she turned it; exclaiming that she found that good and that she would never have had the energy to read all the backside text. She then proceeded to scan the QR code and did so successfully. The first user pointed out that she liked the size of the QR code and label; explaining that she found the size to also be an important aspect of the final solution.

The second user also noticed the QR code on the backside of the book and liked it. She did however mention that it was important that the QR code did not cover any important information through its positioning. The tester did not feel as unsure of having to scan the QR code on the backside of the book, explaining that she would have scanned the code because it said, “Listen instead?” below the QR code; indicating where the QR code would lead her.

7.1.1.3.2 Answered evaluation questions

The five asked questions are presented below in italic, followed by the users’ answers. The first three questions were an emoji scale, presented below in Table 7.1. The last two questions were discussion questions.

Table 7.1 Shows the emoji scale with descriptions used for questions 1, 2, and 3

<i>Emoji</i>	<i>Description</i>
	Good
	Not different from before QR code solution was introduced
	Bad

- 1. Do you believe that the QR codes make it easier for you to find a book you want to read?*

Two happy faces were given here. One of the users commented on her happy face, noting that it was important that it was clear for which book a QR code was intended.

- 2. Does it feel enjoyable to use the QR codes to find your way around the library?*

One happy and one sad face were given on this question. The sad face was given because one of the users found the navigation process more time-consuming with the QR codes; mentioning that she found it more effective to just hang up signs.

- 3. Do you believe that you can better access more information from the library without needing to ask for help (i.e., find the correct bookshelf, know what books are about, etc.)?*

One happy and one indifferent face were given on this question. No user commented on their choices.

- 4. Was there something particular you liked with the QR code solution? If yes, what and why?*

One of the testers explained that she found it good that one did not need to read, which made the process of selecting a book go faster. The other tester agreed but mentioned that the QR codes could be problematic for a user who was deaf.

- 5. Is there anything you wished would have been made differently? If yes, what and why?*

Both users commented on the QR code on the side of the bookshelf. The first user explained that it should have said on the side of the shelf what the audio file was about. The second user pointed out that she did not believe the QR code sign was important and that she found it enough to only have QR codes on the backside of books. She further explained that she would have preferred a website that presented information about the books, where the books were sorted based on category; an idea quite similar to the concept presented in Figure 6.4. The tester explained that one could listen to the backside of the books using the website. One could listen and select a book at home before coming to the library to grab the book one wanted,

instead of rushing with the task in between classes. The first user commented on this idea explaining that she thought it would take more time to look up a book using the website and believed it was faster to scan the QR codes.

7.1.1.4 Reflections

Some reflections from the insights obtained from the first Lo-Fi prototype testing are presented below. These will be kept in mind and used as input for the modifications done to the second Lo-Fi prototype.

- The suggested QR code solution does seem to make it easier to find a book.
- The first scenario with the QR code on bookshelves created some uncertainty and was not perceived as very clear.
- There was too much information presented in one audio file (QR code on shelf). The information needs to be broken down more, as it could create some uncertainty for the users.
- More clarifications and evidence need to be provided about the QR code destination.
- Size of the QR codes on the backside of books is important. The prototyped size was appreciated and was around 6 x 6 cm.
- A QR code should not through its positioning cover anything that could be perceived by the user as important to see.
- The users were fine with reading short sentences.
- Headphones were not used by the users during the test.

7.1.2 Second Iteration

7.1.2.1 Description of second Lo-Fi prototype

The second iteration of “QR code on bookshelf” can be seen in Figure 7.3 and Figure 7.4. The second iteration includes a sign saying, “Youth literature”, which was hanging down from the library ceiling, as seen in Figure 7.3. The sign was added to test and see if users would notice it or not, especially as it was expressed during the first Lo-Fi testing that users wanted signs hanging down from the ceiling, which was also revealed during the user research phase. The second iteration of “QR codes on bookshelves” also consisted of a QR code sign attached to the side of a bookshelf; a close-up view can be seen in Figure 7.4. The QR code did still lead to a description and review of a book stored on the specific bookshelf, but the sign itself was changed; attempting to better clarify the purpose of the QR code. An illustrative image was created so that the users could see how the QR code related to the bookshelf. A label was also added to the QR code saying “Curious?”, to nudge the user to scan the QR code out of curiosity about what was hidden behind it, while still providing enough information to not create uncertainty as to where the QR code would take the user.



Figure 7.3 Shows the second iteration of "QR code on bookshelf"

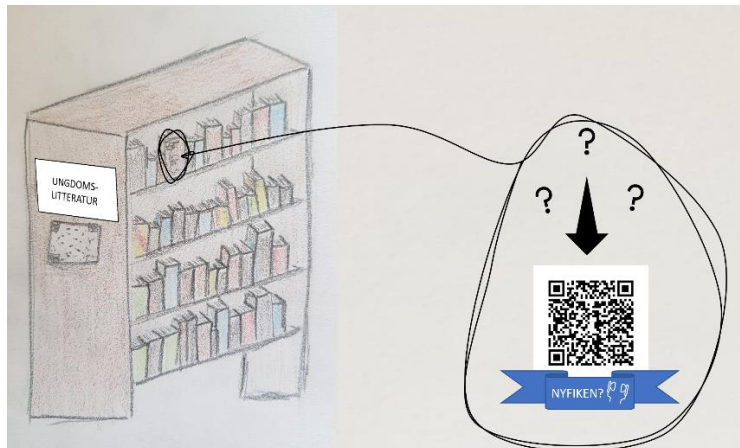
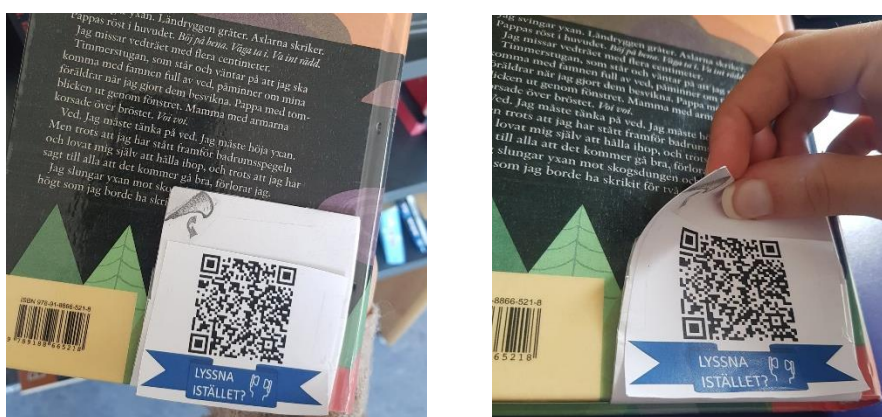


Figure 7.4 Close-up of the second iteration of "QR code on bookshelf"

The second part of the prototype can be seen in Figure 7.5; showing the second iteration of "QR code for backside texts". The main adjustment made to this prototype was to incorporate more flexibility into the "QR code sticker", so that its

large size could be maintained without concealing anything important from the backside of books. An icon was added to the upper left corner of the QR code, indicating to the user that they could flip the QR code sticker open to show what was behind it; as seen in Figure 7.5 (b). The icon was inspired by how the beauty industry manages to include a lot of information on their products, by simply layering pages of information on the backside of products; using a “flip-the-page icon” to show users that there is more information to read. The size of the QR code sticker was made a bit larger in this prototype. This was done only to conceal some of the backside text of the selected book, in order to test the change made to the prototype.



a) Front image of “QR code for backside text”

b) Image showing the flipping function of solution

Figure 7.5 Second iteration of "QR code for backside text"

7.1.2.2 Test procedure

The same test procedure used for the first iteration of the Lo-Fi prototype was used for the second iteration as well; see section 7.1.1.2 for details. The prototype was tested by three users. All three users had dyslexia, and one also had ADHD.

7.1.2.3 Feedback from tests

The feedback and insights obtained from the test are presented in the sub-sections below.

7.1.2.3.1 Think-aloud evaluation

The first tested scenario seemed to be perceived as clearer when compared with the feedback obtained from the testing of the first iteration of the Lo-Fi prototype. The first scenario did however still cause some confusion, but less than before. The first user, who had both dyslexia and ADHD, did notice the put-up QR code on the side of the bookshelf. She read that it said “Youth literature” on the paper sign and guessed that she should scan the QR code; she did however not understand why she should scan the code. She could not access the audio file through the QR code;

receiving an error message when trying to open the file in Google Drive where the audio file was stored. The tester expressed that she found the solution slightly complicated; mainly due to that she could not access the audio file and because she found the audio file to be too long (the QR code was scanned using the author's phone). She did however mention that she thought it was good with having an audio file, so that one could listen instead of reading.

The rest of the users also noticed the QR code on the bookshelf but moved away from it and then back again once asked about it. "Youth literature" was read and they realized they should scan the QR code, but they were a bit unsure of why. One did however think that she would get a summary of a book that was standing behind the paper sign. It did not work to scan the QR code using the users' phones; the author's phone was used instead. Both users liked the concept and found it smooth to use (once they had understood its purpose). They understood that they received a sneak peek into a book after having listened to the audio file and they found the solution to be smart.

None of the users noticed the sign "Youth literature" which hung down from the ceiling.

The second scenario was clear for all three users. They flipped the book and realized that they could scan the QR code to find out more about the book. All three liked the concept and thought it was good to be able to listen to the backside text. One explained that she disliked the whole process of having to walk around the library and read everything, which made her appreciate the QR code solution. Another tester explained that she would never have had the energy to read the backside text of the book and that the QR code solution made the process of choosing a book easier.

No user noticed that they could flip the QR code sticker open to see the entire backside of the book.

7.1.2.3.2 Answered evaluation questions

1. *Do you believe that the QR codes make it easier for you to find a book you want to read?*

All three gave a happy face.

2. *Does it feel enjoyable to use the QR codes to find your way around the library?*

All three gave a happy face.

3. *Do you believe that you better can access more information from the library without needing to ask for help (i.e., find the correct bookshelf, know what books are about, etc.)?*

All three gave a happy face.

4. *Was there something particular you liked with the QR code solution? If yes, what and why?*

All three testers appreciated that they could get an insight into books faster and smoother by using the QR codes.

5. *Is there anything you wished would have been made differently? If yes, what and why?*

One user found the QR code on the bookshelf unnecessary in that too much information was given and because it was not clear why the QR code should be scanned. The user did however still think the QR code was good and should be kept, but that it should be introduced and displayed better. The remaining users also wanted to keep the QR code on the bookshelf, as it helped give an idea of what most books on the shelf were about. The idea was also considered fun to use.

One user preferred the QR code on the backside of the book to be smaller, and another one mentioned that the QR code covered some text.

7.1.2.4 Reflections

Reflections from the second iteration are presented below and will be used as input for the High-Fidelity (Hi-Fi) prototype.

- The improvements made to the “QR codes on shelves” helped clarify the concept but not enough. Information accessed through the QR code should be broken down more. The book presented should preferably also be displayed, to avoid causing confusion as to which book is being presented.
- The hung-up sign on the ceiling was not noticed. It does not necessarily mean that signage is bad, but it does indicate that signs should not only be relied on for navigational support.
- The “flip-the-page icon” on the QR code sticker was not noticed. One reason could be that the testers were more dependent on the audio file than on the backside text; the QR code was therefore never really in the way, even though some noticed that the QR code sticker covered some text. It could hence be interesting to test the “flip-the-page icon” on library visitors who do not belong to the thesis target group.
- Headphones were not used.

7.2 Lo-Fi Prototyping – Personnel

The Lo-Fi prototype testing with the target group helped validate the need for the concept of nudging QR codes and helped guide the final design of the solution. It is however also important to consider how personnel best could manage and

implement the concept. The concept was therefore further developed, where a platform for managing all audio and QR code files was developed and tested.

The thesis target users needed help with accessing information and library content. The concept of nudging QR codes meant that the users had to perform three main tasks: finding a QR code, scanning the code, and listening to an audio file. The needs and tasks of personnel, managing the concept of nudging QR codes, differ from that of the users, and include the following basic requirements:

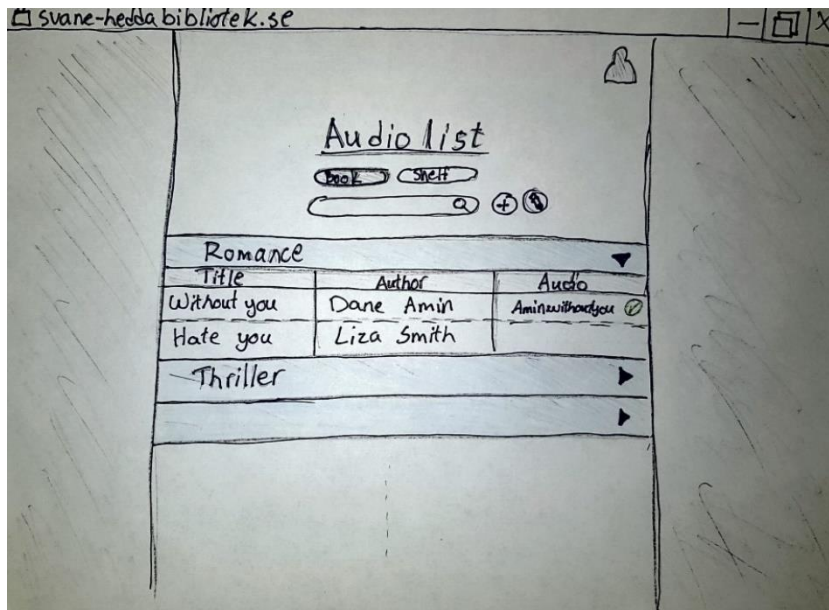
- Creating audio files
- Generating QR codes
- Name-system for the QR codes
- Edit/replace an audio file without needing to re-generate the file's unique QR code
- Print QR codes in the correct format
- Organized sorting and storing system of audio files
- Look up information about which books have/have not received a QR code

Furthermore, it was important that the developed solution for personnel was simple to use and feasible for Svane-Hedda school to implement. A web application was therefore developed. It was believed to help meet and support the needs and tasks of the personnel, while also being possible for the school to further develop and implement after the end of the thesis project.

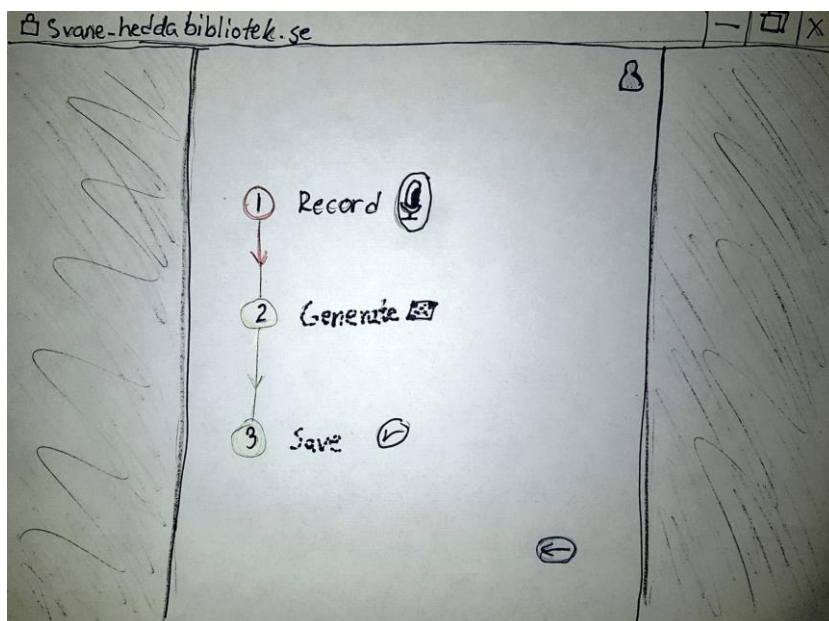
An initial sketch-up of “a QR code managing platform” was first created. It was then presented to and modified based on feedback received from the author's co-supervisor and the Svane-Hedda librarian. The librarian provided valuable information and input on the library system, what solutions had been tried before and which issues had arisen then. A question that arose during the sketch-up of the platform was if the library had information about all library books stored on a digital platform, or if the librarian would need to manually insert all books into the QR code platform. It was revealed that the library indeed had a system they used: Book-IT. This meant that it could be possible to directly transfer the relevant information about all books to the QR code web application, instead of manually inserting everything. The librarian also mentioned that the system possibly offered the possibility to download an excel sheet with information about all books, which could be a second option. The librarian did however mention that it would still be manageable to manually insert all books into the QR code platform if no other option existed.

7.2.1 Description of Lo-Fi Prototype

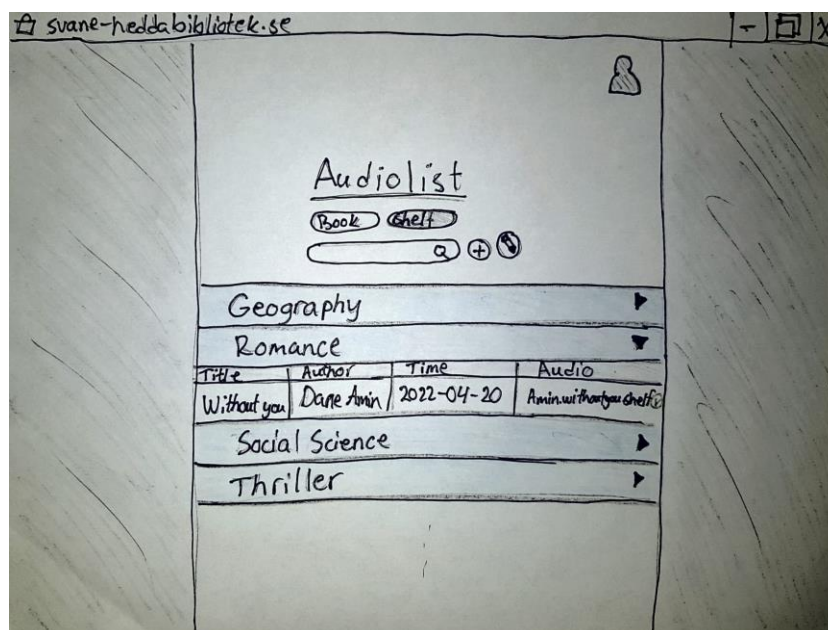
Screenshots of the three main views of the created prototype are shown in Figure 7.6 below. The prototype was created using paper and pens.



(a) Book view: for managing audio- and QR code files for books' backside texts



(b) View for recording audio files and generating corresponding QR codes



(c) Shelf view: for managing audio- and QR code files for books displayed on shelves

Figure 7.6 Shows three screenshots of the main views in the created Lo-Fi prototype for personnel

The user (personnel) is first asked to log in to the web application, as only personnel, responsible for managing the audio-QR code system, will be allowed access to the platform. The created web application allows for two main page views: the book view and the shelf view, Figure 7.6 (a) and (c) respectively. The book view contains a list of all books in the library, organized into different book categories. The categories are intended to be based on the same book sorting system commonly used in Swedish libraries: Dewey's Decimal Classification for fact books, and the Swedish Library Classification System (SAB) for everything else. The categories used in the prototype were however not entirely following the correct sorting system; mainly because the prototype testers would not be librarians and so book category themes were used to adapt the language used in the prototype to the testers. Each book category contained a list of books, sorted in alphabetic order based on authors' last names. The list also contained a column showing which books had received an audio file. If a book had received an audio file, it also meant that it had a corresponding QR code, as the audio and QR code files are generated at the same time; as seen in Figure 7.6 (b). Users could add an audio file to books missing one by pressing the books' empty audio file field.

The shelf view has the same base structure as the book view: categories and lists. The categories do however not represent different book categories, but rather different shelves. Books inside the categories are books displayed *on* the corresponding bookshelves and not the books stored *in* the bookshelves. The list

used in each shelf category has an additional *time* column, which is intended to show the date of when books were displayed on the shelves. The time column was added so the library personnel could get an overview of how long different books have been displayed on different bookshelves.

A profile icon was added in the top right corner; once pressed, a menu for changing general settings and logging out would appear. Finally, a search bar, an add and editing button were added on both the book and shelf views. The search bar was intended to make it easier to search based on book category, shelf, author, or title. The add button was added to the book view so that personnel could add books manually to the audio-QR code system. This was done to show where an add button could be positioned, in case the book system used by the Svane-Hedda library, containing a list of the library's books, could not be synchronized with the audio-QR code system. The edit button was added so that the personnel could change the names of the categories if needed. The add and edit buttons in the shelf view were added for similar reasons as with the book view.

7.2.2 Test Procedure

The prototype was tested by four test volunteers individually. The testers were not from Svane-Hedda school or from the thesis target group. An introduction to the concept of nudging QR codes was first given, followed by an explanation of the purpose of the web application being tested. This information was given as it could be assumed that anyone using the completed web application would have received information on what the purpose of the platform was.

The testers were given a few tasks to complete using the prototype and they were asked to think aloud throughout the interaction. These tasks were:

- Login
- Find a book in the category romance:
 - that has an audio file
 - lacks an audio file
 - Create and save an audio file
- Go to the shelf section of the platform
 - Is any book currently being displayed on the shelf with romance literature? If so, which one?
 - Change which book is displayed on the romance shelf

7.2.3 Feedback from Tests

- The search function was unclear. Some testers thought they could search for and add books to the platform. Others believed they could look up both books and shelves with the search function.

- It was unclear where one should press to edit or add an audio file to a book or shelf. Some thought they could add an audio file by pressing the (+) button to the right of the search bar. Someone wanted to press the “shelf” button first, then (+) and then on the empty box in the audio column.
- The “Record – Generate – Create” view: one commented that he did not understand why one had to record one’s voice, as he wanted the recording to be of good quality. Another one thought “Generate” meant that the audio file would be generated, instead of a QR code. Someone else was unsure if the view was only an “instruction page” or the page in which one created an audio file.
- It was quite clear for everyone that they should press the “shelf” button below the search bar to switch to the “shelf” view. It was however unclear for all what the added “time” column was. Most thought the “time” column showed when a book was borrowed or should be returned.
- Finding which book was displayed on the Romance shelf was quite easy for most. However, one mentioned that it said in the system that the book “Without you” was displayed, but he mentioned that he was not sure if the book was physically on the shelf.
- The shelf names seemed to be a bit confusing, as most would start thinking in terms of category and not specific library shelves.
- The task of changing which book was displayed in the romance section seemed unclear. One thought he had to press the option “Geography” to switch to that option. Others thought they should press the “pen” option, to the right of the search bar.

7.2.4 Reflections

Some reflections and insights obtained from the feedback given by the Lo-Fi prototype testers are presented in this section. These reflections and insights will guide the design of the Hi-Fi prototype, which is presented in the next section.

The name “Audiolist” chosen for the platform could itself have been misleading, which could explain why most testers struggled with correctly adding an audio file for a book’s backside text or for books displayed on shelves. The name of the platform will therefore be changed to “QR Manager” in the Hi-Fi prototype. The name could be changed and decided upon at a later stage, if/when the web application is implemented. It could also have been unclear that one could press the books’ empty audio file fields to add an audio file; an icon indicating “add” could therefore be added to the empty fields. The (+) add icon close to the search bar might have stood out more than the empty fields; explaining why some testers thought they could add an audio file by pressing the (+) icon.

The (+) and “pen” icons close to the search bar will be removed in the Hi-Fi prototype. The (+) icon will be removed as it could be possible for Svane-Hedda to

synchronize their existing book systems with the web application, and in that case, the (+) icon would not be needed. It could however be added again if the school would need to add all library books manually; with the assumption that the design of the “add audio file” will be clearer after the next prototype round. The “pen” icon will completely be removed from the book view, as the library will use the same book categories used to group physical books. The book categories could hence be pre-created into the book view so no user could add or remove a category. The “pen” function would however still be necessary for the shelf view and will be included in the Hi-Fi prototype, but its position moved.

Another reflection was that it could be good to add a sorting function to the web application; allowing the users to navigate around quicker. The sorting function will briefly be tested in the Hi-Fi prototype.

7.3 Hi-Fi Prototyping

Hi-Fi prototypes look more like the final product, are more interactive, and are easier to test as compared with Lo-Fi prototypes [48]. The developed Hi-Fi prototypes, as well as the conducted user tests and evaluation will be presented in this section.

7.3.1 Hi-Fi Prototype – Student Group

This section presents the developed Hi-Fi prototype for the thesis target group, followed by the user tests and evaluation.

7.3.1.1 Description of prototype

The Lo-Fi prototypes were presented to a librarian from Svane-Hedda school before the final Hi-Fi prototype was created. This was done to check if the Lo-Fi prototypes had any other shortcomings important to consider from a librarian’s perspective. The most important point to highlight is the size of the QR codes on the backside of books, as the “flip-the-page” function would not be needed if the size of the QR code stickers did not cover any text. The stickers would further be more sensitive and easier to remove with the “flip-the-page” function. The librarian explained that Axiell labels were used on the backside of all books in the library. Designing the QR code stickers to be of the same height as the labels, would therefore almost guarantee that the QR codes would fit on the backside of books, without needing the “flip-the-page” function. The height of an Axiell label was estimated by the librarian to be around 3.5 cm. The Hi-Fi prototype of the QR code sticker was thus prototyped with a height of 3 cm, to stay a bit below the set limit by the librarian.

Two versions of the QR code sticker were prototyped, as seen in Figure 7.7 below.



Figure 7.7 Shows the two Hi-Fi prototypes of the QR code stickers

The QR code sticker to the left in Figure 7.7, is identical to the Lo-Fi version but of a smaller size. The QR code to the right in Figure 7.7, attempted to clarify the “scan and listen” concept and was presented as an alternative design.

Two versions of the “QR codes on shelves” were also prototyped, seen in Figure 7.8 below.

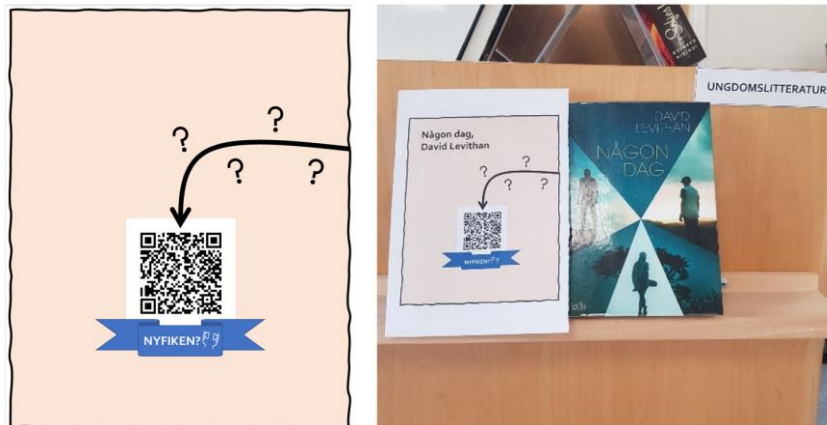


Figure 7.8 Shows the two Hi-Fi prototypes of the concept with QR codes on shelves

The only difference between the two versions is that one included the displayed book’s title and author in the QR code sign, while the other version did not. The added title and author would help clarify which book the QR code leads to. This could help eliminate uncertainty, especially if the book would be moved from the shelf by a library visitor. The version without the title and author could create a bit more uncertainty, but the QR code sign would not need to be re-printed every time a new book is to be displayed on the shelf.

7.3.1.2 Test procedure

Four testers tested and evaluated the prototypes. All four testers had previously tested and given feedback on the Lo-Fi prototypes. The test mainly revolved around evaluating the different design alternatives by discussing the pros and cons of the different designs.

The testers were first asked to briefly go through the two test scenarios used during the Lo-Fi testing, see section 7.1.1.2. This was done to refresh their memories and also so that the different design alternatives could be presented in different orders during each conducted test; reducing the influence the order in which different designs were presented could have on the given feedback.

7.3.1.3 Feedback from tests

The feedback given by the four testers was quite similar. All testers preferred the black headphone QR code sticker, seen to the right in Figure 7.7. They found it clearer and more fun. One tester mentioned that the black headphones helped make it clearer and that the design helped the QR code sticker appear larger. Two testers first expressed a worry about the small size of the QR code, but they were fine with it once they realized that they could still scan it. One tester, only diagnosed with dyslexia, did however generally feel that both versions of the QR code stickers were too small and wanted them to be a bit larger. Another tester mentioned that she liked that the second version of the QR code sticker was more appealing and stood out more with its blue color, but the tester still opted for the black headphones version when deciding between the two versions.

Three out of four of the testers preferred the QR code sign on the bookshelf with the book title and author. One tester explained that it made the sign feel more connected to the book it presented and hence made it easier to understand its purpose. The same tester also wanted it to say “listen”, somewhere on the sign so it would be clearer that the QR code would not lead to more text or an image. One tester found the version without the book title and author better, arguing that it was unnecessary information as the book was standing right next to the QR code sign.

7.3.2 Hi-Fi Prototype – Personnel

This section presents the developed Hi-Fi prototype of the web application for the personnel who will be managing the audio-QR system. The Hi-Fi prototype was developed using Figma. This section also includes the conducted user tests and evaluations.

7.3.2.1 Description of prototype

The central Hi-Fi prototyped pages are presented in Figure 7.9 below and will be used to describe the main aspects of the designed prototype. The platform is accessible through a login page, and the idea is that only personnel, who will be tasked with managing the audio-QR concept, will have an account. The user (personnel) is hence not by him-/herself able to create an account through the login page and is instead assigned an account by an IT personnel. Once logged in, the user accesses the “book view”, seen in Figure 7.9 (a). The book view contains a list of all books in the library, grouped into different categories, and will be based on book

classification systems used by libraries, as explained in section 7.2.1. The category names used in the prototype were again not based on the commonly used classification system. This was primarily because many of the prototype testers would not be librarians. It would additionally have been too time-consuming to understand and implement the classification system at this stage of the design process.

Each category in the book view contains a book list showing books' titles, authors, and if they have received an audio file of their backside texts. If a book is missing an audio file, an add button is shown in the book's audio file field. A pop-up box, called Audio & QR code Generator, appears once the user presses the add button and allows the user to directly add an audio file to the book(s) missing one, Figure 7.9 (b). The user is step-by-step walked through the process of recording an audio file and generating a QR code. The audio and QR code files are saved after previewing, Figure 7.9 (c), and the book's audio file field is updated. The QR code cannot be changed once it has been generated, and it, therefore, does not have an edit icon in Figure 7.9 (c). The QR code would hence not need to be re-printed each time the audio file would be updated. The QR code could directly be printed by pressing the button "Print QR code" in (c).

Two buttons, "Book" and "Shelf", are placed at the top of all pages in the web application. These buttons are used by the user to easily switch in-between the two main pages. The user accesses the page managing the second part of the nudging QR codes concept by pressing the "Shelf" button, Figure 7.9 (d). The shelf page has the same basic category and list structure as the book page, but with a few differences. Each category bar represents a shelf in the library and not a book category. A simple naming system for the library shelves was chosen for the sake of the test, but the idea is that the same naming system used by the library should be used in the web application. The list of books on each library shelf has the same structure as the book view, but additionally has the column "Displayed since", previously called "Time" in the Lo-Fi prototype. The user can press the add button inside each bookshelf category to display a new book on the selected shelf, Figure 7.9 (e). The bottom of the shelf page has a bar with an arrow pointing upwards (d); once pressed, the bar opens and allows the user to add or edit a library shelf.

Finally, a sorting function was also included in the prototype to make the platform easier to use and navigate, Figure 7.9 (f). The sorting function was added at the top of the lists, both in the book and shelf views, so that entire lists could be sorted all at once. Only the sorting function for the shelf view was implemented in the prototype and included sorting based on authors' last names and display time. A search bar was added at the top of all pages to further simplify and speed up navigation. The search function was however not further implemented in the prototype, as it was deemed a less significant feature to test at this design stage. The same applied to the deleting row in the book lists, Figure 7.9 (a) and (d).

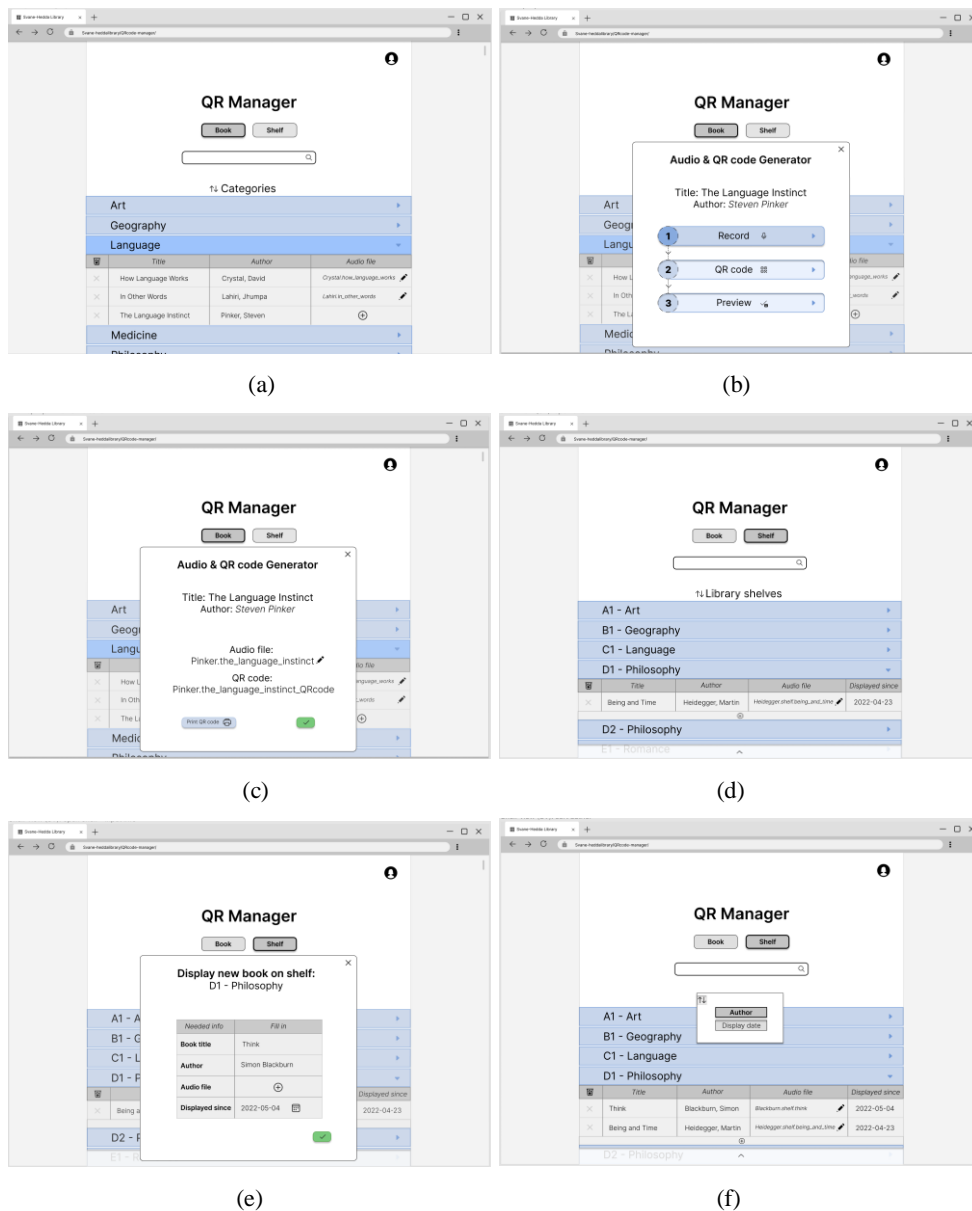


Figure 7.9 Shows some of the main pages in the developed Hi-Fi prototype of the web application

7.3.2.2 Test procedure

Five testers tested and evaluated the Hi-Fi prototype of the developed web application, out of which one of the testers was a librarian and another one was a librarian student. The testers were given a couple of tasks to complete using the prototype and were asked to think aloud throughout the test, see Appendix E.

The testers were then asked to evaluate the prototypes' usability and UX using two tests: System Usability Scale (SUS) and Measuring User Experience. SUS is a "quick and dirty" evaluation method used for evaluating a system's usability, where the testers receive a SUS score by answering a couple of questions designed using a Likert scale [49]. The testers' individual SUS scores were then summed and averaged. The UX was measured by presenting a list of words to the testers and asking them to mark all the words they associated with the usage of the prototype [48].

The testers were also asked two questions at the end of the test to capture what they found especially good with the solution and what they would like to change. These are presented in section 7.3.2.3.3 below.

7.3.2.3 Feedback from test

7.3.2.3.1 Observations & think aloud

Test person 1: Succeeded with all tasks, except adding a new bookshelf to the shelf collection and finding the sorting function. Mentioned that she would expect the sorting function to be by the author column or an arrow on the side. Once logged in, she assumed she was at the main page, but did not specifically mention the purpose of the page (managing audio and QR codes for backside texts).

Test person 2: Succeeded with all tasks except the task of adding a new bookshelf to the shelf collection. An observation made was however that the tester did move the cursor towards the bottom of the page. The test person found the sorting task a bit hard but managed to solve it in the end.

Test person 3: Succeeded with all tasks except with the two tasks of adding a new bookshelf to the shelf collection and the sorting function. The tester did move the cursor towards the bottom of the page when attempting to add a new bookshelf and mentioned that he would want to scroll down. Mentioned that it was a bit unclear that the book page contained audio files for books' backside texts; assumed the audio files were audio versions of books. The test person also mentioned that it would be clearer if the tab for displaying a new book in D1-Philosophy was of the same size as the row already showing a displayed book. The test person still managed to display a new book regardless.

Test person 4: Succeeded with all tasks except the sorting function. Thought it would be possible to drag around rows to change their orders or press the heading "author" in the table as that was what the tester was used to seeing on different websites. The tester struggled with finding where one would add a new bookshelf to the shelf collection but managed to complete the task in the end. The tester expected a (+) sign to the side of the heading "Library shelf". The tester explained that it was a bit unclear how one would add a new bookshelf as all other functions in the web application were at the top of or on the side of the main tabs.

The tester also mentioned during login that there was no method to create an account and assumed the user would already have been given one before usage.

Test person 5: Succeeded with all tasks except with the two tasks of adding a new bookshelf to the shelf collection and the sorting function. The test person did not directly spot the “add” audio file button in the pop-up view for displaying a new book on a bookshelf, explaining that she expected that the audio file would be created and added by a colleague tasked with the recording job.

The test person expressed that some could struggle with social anxiety and not want to record their voice during the recording step. She would appreciate it if the program showed a count down until the start of the recording so the user would know when the recording started.

The test person found the task of generating a QR code unclear but assumed correctly that the QR code had automatically been generated, and she wanted it to be clearly stated to avoid confusion. She also mentioned that it would be good to include the generated QR code in the preview view.

The test person wanted to scroll down to the bottom of the shelf page to check what was at the bottom and see if she could add a new bookshelf there.

When asked to check how long the book “Being and Time” had been displayed on the D1-Philosophy shelf, the test person mentioned that she wanted to use the search bar because librarians were lazy and wanted to search after everything. She did however understand that she could check the display date by opening the D1-Philosophy tab. The test person mentioned that she wanted all text in the table rows to be of the same size (the audio file name was of a smaller size). She also wanted to be able to edit book titles, author names, and display dates. The tester explained that the programs commonly used by librarians usually allowed the users to simply double click on the text they wanted to edit and then get a pop-up window: “Are you sure you want to edit?”, before proceeding. The tester also found the titles “Needed info” and “Fill in” unnecessary. She also wanted to add type, format, and location to the tables. The test person mentioned that it would be better to change “book” to “media collection” (Swedish: *bestånd*), as libraries had more than only books and the presented concept could be relevant for more media collections. She finally shared that it would be nice to also include, in the tables, if books were part of a series and their number, as that was missing in the current library systems used.

The test person mentioned that she wanted to press the heading “Author” in the bookshelf table to sort the table after the authors.

7.3.2.3.2 SUS & UX

Table 7.2 Shows the individual and average SUS score

<i>Test person</i>	<i>SUS score</i>
1	95
2	100
3	92.5
4	87.5
5	57.5
<i>Average SUS score</i>	86.5

Research presented by Sauro [50] suggested that a SUS score can be considered above the mean if its value is above 68. The average SUS score was 86.5, which indicates that the usability of the developed web application was quite high. The average score was even above 80.3, which according to the SUS scoring guidelines [50], indicates that users enjoyed the proposed design and could potentially also recommend it to others.

The proposed web application layout is still in the initial stages of design and is hence likely to be modified before finally being implemented. The important take from the SUS score is therefore that the core structure of the web application is quite functional and appears promising, as details in the web application could be subjected to changes.



Figure 7.10 Word cloud capturing the users' experience using the Hi-Fi prototype

Figure 7.10 above presents the words (in Swedish) used to describe the users' experience interacting with the developed Hi-Fi prototype. The larger the word, the

more frequently chosen it was. The five most common words were: “System-oriented”, “practical”, “uncomplicated”, simple”, and “relevant”.

7.3.2.3.3 Evaluation questions

1. *Was there something particular you liked with the QR code solution? If yes, what and why?*

Test person 1: Found the web application very clean, limited, and only showed what one needed to know and do; described as easily oriented.

Test person 2: Liked that the web application was very simple and minimalistic. Easy to use for most and specifically mentioned older people.

Test person 3: Liked that the web application was very simple.

Test person 4: Liked that the web application was not complicated to use. Found the application to fulfill its purpose without needing to be “flashy”.

Test person 5: Liked that the web application was simple and that it was clear what one should do using the application. Found the application to be organized with categories after each other. The test person also mentioned that she liked the QR code concept.

2. *Is there anything you wished would have been made differently? If yes, what and why?*

Test person 1: Struggled to give any concrete improvement suggestions. The test person did however mention that she was generally critical of books’ backside texts as their main purpose was to sell the book. The test person, therefore, found it beneficial that the web application allowed the librarian to record his/her voice, allowing more flexibility in choosing the content of the audio files.

Test person 2: Explained that she would appreciate it if the web application was more appealing and fun to look at. The test person specifically mentioned that one could use a bit more color.

Test person 3: Explained that he would appreciate more color as he found the web application to be too white.

Test person 4: Wanted the sorting function to be improved to make sorting easier and clearer for the user. The test person also explained that it was a bit unclear how one should add a new bookshelf to the shelf collection, which he would want to be improved. The (^) icon used at the bottom of the page could easily be misunderstood to indicate that the user could scroll downwards instead of the intended purpose of the (^) icon: press to add a new bookshelf. The test person mentioned that he would appreciate it if he could listen to the audio recording once previewing both the audio and QR code files.

Test person 5: The test person wanted the author to be placed first in all tables. She wanted to add more functions to the web application, mainly more information

about the books, such as format and type. She found the name “audio and QR code Generator” to be a bit misleading, as she would expect the audio files to also be automatically generated and not recorded by the user. The tester also wanted the web application to be more advanced; mentioning that she found the application to be too simple and that it could cause confusion. Elaborating on what advanced meant, the test person explained that she did not want all functions to be in the same page and that some parts of the application should be more difficult to reach. The test person clarified that librarians type very fast and that it was not uncommon that librarians typed or pressed on the wrong thing. Critical functions should therefore be more hidden. Another precaution could be to use more pop-ups and warning windows for critical functions, such as removing a book from a list.

7.4 Final Concept and Modifications

This section presents the final concept of nudging QR codes by describing the final changes that will be made to the tested Hi-Fi prototypes, presented in the previous section.

7.4.1 Nudging QR Codes – Thesis Target Group

The final concept of nudging QR codes consists of two parts: QR codes for backside texts, also called QR code stickers, and QR codes on library shelves, also called QR code signs. The final design of the QR code stickers will, based on the user tests, be the version with larger black headphones; the right image in Figure 7.7 above. The final size of the QR code stickers was 3 x 3.5 cm.

The QR code signs will, based on the user tests, include the title and author of the book being displayed; the right image in Figure 7.8 above. This does however mean that a new QR code sign would need to be printed, with an updated author and title, each time a new book is displayed. Including the title and author in the QR code sign could nevertheless be beneficial for the users, if the book being displayed is moved or borrowed by a library visitor.

The text on the QR code labels, in the QR code signs, will be changed from “Curious?” to “Scan and Listen”, in the final version of the QR code sign on shelves. This will be done to clarify that the QR code will lead to an audio file. The QR code, with its label, will not be changed to the same format as the final QR code sticker. Using different formats for the QR codes could help distinguish the two parts of the nudging QR codes concept. This, as the QR code stickers, will contain an audio version of books’ backside texts, including author and title, while the QR code signs will present what type of books are stored on a given library shelf, and also present one book as inspiration.

7.4.2 Nudging QR Codes – Personnel

The two main changes, based on the user tests, that will be made to the developed web application are the sorting function, as well as the addition and editing of library shelves.

The sorting function was not fully explored and implemented in the final Hi-Fi prototype, but some aspects of it were investigated as the sorting function was deemed important to include in the final and implemented web application. The user tests showed that the positioning of the sorting icon was misleading and unintuitive, especially when the testers were asked to sort books within a category/shelf. The testers wanted to directly sort inside a category/shelf. The feedback given by one of the testers, who was also a librarian student, was mainly used to influence the new design of the sorting function. The tester had given the sorting system in the Journal Citations Report (JCR) as an example; explaining that a list would be sorted after, for example, authors' last names if the heading "author" was pressed. The same sorting function will be introduced in the final version of the web application, as seen in Figure 7.11 below. The sorting icon at the top of the lists, seen in Figure 7.9 (a) and (f), will still be maintained in the final version of the prototype. This is to allow experienced users a quicker way to sort all sub-lists under all categories and shelves. The sorting function will however need to be explored and tested during further development of the web application.

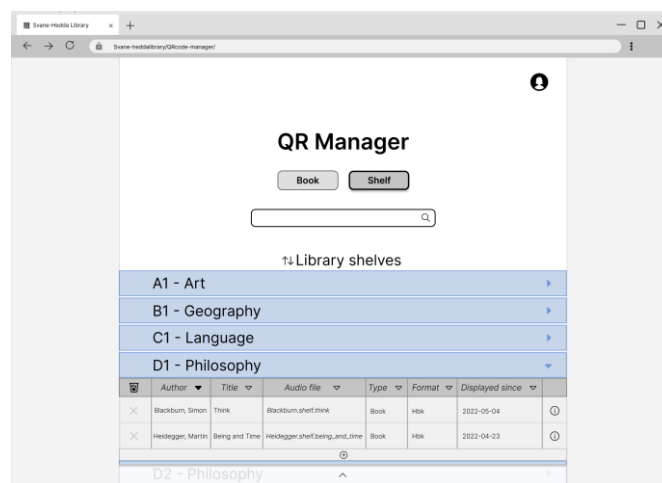


Figure 7.11 Updated sorting function and list structure

The addition and editing of library shelves seemed to be too hidden, as only one tester managed to access it. The idea from the start, was for the function to be slightly more hidden than the rest of the functions in the prototype. It was reasoned that new shelves would not be added often to the library, and the same applied to editing shelf names. An observation made from the tests was that four out of five

testers did either move their cursor toward the bottom of the page or mentioned that they wanted to scroll down towards the bottom of the page. This suggested that the testers intuitively expected the add and edit button to be at the bottom of the page, but that the icon used to open the add and edit bar could have been too small or unclear. It could therefore be valuable to change the icon used, seen in Figure 7.9 (d), and re-test the Hi-Fi prototype, before any major changes are made to the add and edit bar of library shelves. Another reflection is that the open icon was close to the bottom boundary of the prototype, which caused the prototype boundary frame to sometimes appear during the tests, if the testers moved the cursor too close to the boundary. This was a limitation with the prototype that could have been the reason for the testers failing to add a new bookshelf, which further motivates a smaller modification of the add and edit bar before large changes are considered.

Apart from the two main changes, there were also a couple of minor but important changes that were made to the final web application. Some changes were made to the book lists, seen in Figure 7.11 above. The author column was placed first and three new columns were added: type, format, and information. Type and format were added based on the user feedback. One of the testers wanted more information about the different books to be included in the lists. The audio-QR system does however have a very simple and limited purpose: creating and keeping track of audio files and their corresponding QR codes. Some information about the books was therefore deemed less relevant and unnecessary to include. This would however need further exploration and confirmation when further developing the suggested web application. The information column replaces the “pen” icon in the list and was added for two main reasons: more fields could need editing and double-clicking on the fields could be a more convenient editing method. Once a book’s information icon is pressed, all available information about the book appears in a pop-up box and can also be directly changed there.

The line “QR code generated:” was added to the QR code generator page. This was done to clarify that the user only needed to check the name of the QR code file before moving on to the Preview page. The name “Audio & QR code Generator”, Figure 7.9 (b), was changed to “Audio & QR code Maker”. The name was changed to not cause any confusion around “Record”. The recording function was kept, even though some of the user testers were reluctant to use the record function and would prefer to have an audio file automatically generated. This decision was mainly due to that it was believed to be more feasible for the school to implement a recording function than having audio files automatically generated. It is however still recommended for Svane-Hedda to look over the possibility to include a function in the web application where audio files are generated from text, as this is a more inclusive option for the personnel who feel insecure recording their voices.

8 Discussion

This chapter presents a discussion and evaluation of the thesis project, delimitations made, and design framework used; followed by an evaluation of the outcomes of each design phase. An evaluation of the design methods used throughout the thesis is also presented; focusing on the methods that were valuable from a UD perspective. Finally, the final developed concept is presented, including a section with further recommendations.

8.1 Project Scope and Delimitations

The thesis started with the broad and explorative task of investigating how libraries could be made more inclusive for adolescents with different disabilities, with a special focus on youth with dyslexia, ADHD, and/or autism. Furthermore, there was a focus on exploring how the interplay between the digital and physical library environments could contribute to making the Svane-Hedda library more inclusive. Designing more inclusive solutions required an understanding of what caused the target group to feel excluded from the library environment as this was not known at the start of the project. A lot of emphasis and time was therefore put on the Empathize phase, which was deemed crucial for better understanding the overall library environment and what caused exclusion.

The width of the problem and the amount of work needed to make the thesis target group feel more included in the library environment became very apparent in the Empathize phase. The scope of the project has therefore been redefined and refocused several times during the design process to ensure the thesis remained within a reasonable scope. The delimitations made were based on what needs felt more urgent to address, how the different needs related to each other, and how feasible it was for the school to continue working with the identified needs. The feasibility and technical complexity, of the suggested concepts in Ideate were, for example, very determining when selecting the final concept to prototype.

8.2 Project Framework

The Double Diamond was utilized to structure the design process used in this thesis. It proved to be very valuable, guiding with what and when different delimitations should be made; ensuring the design process did not spiral out of scope. The Double Diamond is a non-linear process, which made it challenging to explain the process linearly in the thesis report. Jumping back and forth between the different design phases was inevitable, especially since the project was in the earliest stages of design and numerous determining insights were gained throughout all design stages. The design process was nevertheless explained linearly. Any new insights or delimitations made were explained in the design phase in which they were made. This was done to make it easier for the reader to follow the design process.

Apart from the Double Diamond, the perspectives of UCD and UD were used and incorporated into the overall design process. This helped maintain a focus on user involvement and exploring methods to design more inclusively.

8.2.1 Empathize

A lot of work was put into the Empathize phase. This was, as mentioned before, because it was not completely known at the start of the thesis work, how and what made the target group feel excluded from the library environment. It was therefore deemed necessary to thoroughly explore the size of the problem before setting the final thesis direction.

Data triangulation [34] was achieved by interviewing: pedagogues with experience about the thesis target users; librarians; older youth with one or more of the three diagnoses, also called heroes throughout the report; and adolescents from Svane-Hedda school belonging to the target group.

The interviewed heroes were former or current colleagues of the author, which could generally be considered to have given some bias to the research. It was however believed that it was beneficial to reach out to some interviewees who had one or more of the diagnoses, had come to terms with their diagnosis/diagnoses, and were comfortable with opening up about their stories and feelings of exclusion. These interviews were beneficial and provided a valuable perspective that helped with planning the interviews with the main thesis target group – students from the Svane- and Hedda schools. The interviews with the pedagogues, librarians, and heroes were semi-structured and helped the author gain some initial insights about the target group, which also helped with guiding and setting the focus of the structured conversations with the thesis target group.

Several different methods were used to gather data during the structured conversations with the adolescents from the Svane- and Hedda schools; contributing to methodological triangulation [34]. The method of both data and methodological

triangulation helped increase the reliability and validity [34] of the findings from the Empathize phase.

The structured conversations with the target group consisted of several smaller exercises: ice breaker, relatable persona, dream library, sorting of pre-identified factors, and library visit. The ice breaker helped create a more relaxed environment, as it allowed both the interviewer and interviewee to get to know each other better, which was recommended by Bassett et al. [29] to increase adolescent engagement.

Both the relatable persona and dream library exercises helped uncover a lot about the users' needs. Just as for Nakarada-Kordic et al. [35], the relatable persona proved very valuable, especially to capture the UD perspective during the Empathize phase. The exercise made it easier for the target group to talk about sensitive topics, as they could portray difficult thoughts and feelings onto the imaginary character. It helped provide a better understanding of the needs of the target group; without them feeling stigmatized or put under the spotlight when sharing their thoughts and experiences.

The dream library exercise, allowed the participants to think freely about what they wanted their dream library to look like, which together with the library visits, helped identify both problems and opportunities with current libraries. Both the relatable persona and dream library exercises included help questions. These were at first mainly included to help break down abstract and big questions for adolescents with autism. The help questions did however prove to be valuable, not only for the youths with autism, but for everyone else who needed help to develop their thoughts and ideas. It also helped ensure that the same themes were explored with all the interviewed youth.

There has been a large emphasis on gathering qualitative data during the Empathize phase, as it helps capture the users' lived experiences [51], which was judged to be very valuable and important from a UD perspective. The exercise of sorting the pre-identified factors was included to attempt to quantify some of the research findings. It did however not add much depth to the Empathize phase. There were large variations between the respondents' answers, even within the same diagnosis group. None of the interviewees removed any of the factors, suggesting that all were relevant for all three diagnosis groups. Only nine users (excluding the reference) were interviewed, which could also have accounted for the low variation in the respondents' answers.

Further notes about some of the limitations of the user research are that only one control user was interviewed and only two youths with autism participated in the study. One of the interviewees did not belong to the target group but was interviewed and included as a reference. Only one control user was interviewed due to lack of time, but also because the interviewed reference had expressed a desire to partake in the study. The input given by the control was mainly used to give an indication of what challenges were shared among adolescents and what was unique for the thesis target group. The study would however have benefited from including more control users for a better comparison. Only two youths with autism were

interested in participating in the study, one of which was a hero, which means that youths with autism were less represented in the user research than youth with dyslexia or/and ADHD. The interviews with the pedagogues helped provide insights about adolescents with autism, but the study would have benefited from involving more students with autism. Generally, the sample size was quite small, and it would therefore be beneficial to work with a larger sample size in future studies about the thesis target group.

Finally, the presented interviewee quotes in chapter 4, with the insights from the Empathize phase, have been translated to English and slightly reformulated to account for the difference between the Swedish and English sentence structure. There is hence a risk of having lost some of the meaning in the translated quotes. More than one quote was therefore included, whenever possible, when presenting evidence for the gained user insights.

8.2.2 Define

The Define phase was very helpful with extremely narrowing the scope of the thesis after the very explorative and large Empathize phase. One main theme was selected from the themes that had emerged from the affinity diagramming done in the Empathize phase. The choice was mainly based on what the Svane-Hedda school needed the most help with and on the set objectives at the start of the thesis work. Three personas were created to re-center and maintain the focus on the users within the theme: navigation and information access. The created personas helped concretize the users' needs and formulate user goals.

The insights used to create the personas were limited by the size of the interviewed thesis target group. Drawing on the insights obtained from the interviewed pedagogues, some of which had a long experience of working with the thesis target users, helped give more input about the group, which can be seen as having increased the reliability of the created personas.

The thesis target group consisted of three main subgroups: youth with dyslexia, ADHD, and autism. All three subgroups had to be captured in the created personas, which resulted in that one persona was dedicated to each diagnosis. This limited the depth in which each diagnosis could be presented using personas, as the Empathize phase showed that there were variations within the same diagnosis group. Around three to eight personas are commonly considered enough, but it depends on the project goals and how different the potential users' needs and goals are [52]. Only three personas were created during the Define phase as too many could have risked causing a loss of focus in the Ideate phase, especially with the limited timeframe of the thesis project. The most commonly expressed needs, within the theme navigation and information access, were used to create the personas; in an attempt of making the personas as representative as possible.

8.2.3 Ideate

The focus at the start of the Ideate phase was to look for inspirational sources and to use ideation methods that would help create a large quantity of ideas. Fudd's first law of creativity, as explained by Preece et al. [5], says: "To get a good idea, get lots of ideas". Multidisciplinary teams are usually used as they, among other things, help generate a lot of ideas [5]. Working in a multidisciplinary team was not possible during the thesis project, and so the method Lotus Blossom, which allows for 64 ideas to be generated in a short amount of time, was used as a form of compensation. The study could have benefited from involving users in one or more ideation workshops, but this was not possible due to time constraints. The dream library exercise, used in the Empathize phase, helped compensate for the lack of user involvement in the Ideate phase, as the users gave several ideas on improvements they wanted to introduce to libraries. These suggestions were kept in mind during the ideation phase. The Disney method used helped develop and evaluate different ideas, which helped develop the quality of the selected ideas from the Lotus Blossom.

Different methods were used to evaluate and select ideas throughout the Ideation phase. A more qualitative approach was used to ensure ideas were evaluated based on UD principles and users' needs; ensuring the design process re-focused on the users before the final concepts were selected. Using UD principles as a part of the evaluation of ideas, proved to be valuable from a UD perspective, as it made it possible to evaluate how well the developed ideas would manage if more user groups were included, i.e., users who were not already included in the thesis target group.

The main determining factor, when selecting which concept to move on with to the Prototype phase, was feasibility and cost for the Svane-Hedda school. Some ideas were excluded because they were evaluated to be complicated and costly for the school to implement. Storyboarding was used at the end of the Ideate phase to help concretize and visualize the selected concepts, which helped convey the potential and key aspects of the concepts. Storyboarding also helped with narrowing the project scope before moving on to prototyping.

8.2.4 Prototype

Two Lo-Fi and one Hi-Fi prototype of the nudging QR codes concept were created. The created Lo-Fi testing helped develop the concept further and confirm that the solution met the thesis target users' needs, while the Hi-Fi tests focused on evaluating different design alternatives for the two parts of the nudging QR codes. A limitation of the tests was that the same users that tested the Hi-Fi prototypes, had also tested the Lo-Fi prototypes. This meant that the testers already had an idea of what to expect to see during the Hi-Fi test, which meant that the intuitiveness of the

concepts could not fully be re-tested again. The second part of the nudging QR codes, QR codes on shelves, would especially benefit from a test that focuses on evaluating how intuitive and visible it is for library visitors. This, as it was critiqued the most during the Lo-Fi testing.

Additionally, some of the Lo-Fi and Hi-Fi tests were tested and evaluated by participants in pairs, while others tested individually. The testing method would have been more consistent if all testers evaluated the prototype only in pairs or individually. This was however not possible due to the author having to adapt to the thesis target users' school schedules. It did however prove valuable to use two different testing methods, as these helped complement each other. All testers were also asked in advance if they were comfortable with pair testing. This was done to reduce the influence fear of doing something wrong in front of a classmate, could have on the test results. The same testing tasks and evaluation questions were used for all tests. The only difference was that the tests done in pairs allowed the thesis target users to build on and comment on each other's inputs; giving more depth to the evaluation, as focus groups help capture diverse topics that are otherwise easily overlooked [5].

Think aloud was used as one of the evaluation methods during the Lo-Fi testing of the nudging QR codes. The method did not prove very successful all by itself, as the adolescents would forget to think aloud sometimes and had to be reminded of it.

One Lo-Fi and one Hi-Fi prototype of the web application for managing the nudging QR code concept, were also created. A limitation with the tests was that not all test participants were librarians, who were meant to be the main users of the web application. Librarians became a new user group in the thesis, as the concept of nudging QR codes required someone who could create and manage the audio and QR code files. This group was never the intended user group at the start of the thesis, and so only a few were involved due to time constraints. The concept of the web application was presented to a Svane-Hedda school librarian before the Lo-Fi prototype was created. This helped capture some valuable input about librarians and their needs when it came to managing the suggested web application. One librarian and one librarian student were involved in the Hi-Fi test, which further helped with capturing a librarian's perspective.

The prototyping of the nudging QR code concept and the web application occurred somewhat in parallel. The Lo-Fi version of the web application was designed and tested before the Hi-Fi prototype of the nudging QR codes was prototyped. This proved to be beneficial as both designs could be evaluated and modified in parallel, ensuring both the needs of the main thesis target group and the librarians' needs could be met.

8.3 Universal Design Methods

One of the goals set at the start of the thesis work, was to identify which methods were useful and relevant to consider, when applying universal design principles to develop more inclusive and accessible indoor environments. Several methods have been used throughout the four main design phases, and these have been evaluated with the aim of exploring which methods were particularly valuable to use from a universal design perspective. The consecutive figures below, Figure 8.1 and Figure 8.2, present the methods that proved to be valuable from a UD perspective during the thesis process.

METHOD	UD VALUE
Interviews with pedagogues	<ul style="list-style-type: none"> Allowed the author to directly ask questions about the different diagnoses, how they affected the students and what to consider when meeting the thesis target group. The interviews helped uncover assumptions about the target group, which is important when adopting a UD approach.
Interviews with heroes	<ul style="list-style-type: none"> Same benefits as given above, but they also helped capture some factors that could make the target group feel excluded or included in the given school and library environments. More direct and sensitive questions could be asked to the heroes as most were older than the thesis target group and also trusted the author.
Structured conversation with thesis target group	<ul style="list-style-type: none"> Several participants found the entire method more fun and different from traditional user research methods used.
<i>Relatable Persona</i>	<ul style="list-style-type: none"> One of the most successful exercises used as part of the structured conversations. It allowed the respondents to jump back and forth between "I" and "he/she", depending on the perceived sensitivity of asked questions.
<i>Dream Library</i>	<ul style="list-style-type: none"> Allowed the adolescents to describe a library they would want to go to. Their descriptions helped provide an understanding of what common libraries lacked.
<i>Library visit</i>	<ul style="list-style-type: none"> Helped concretize the challenges the target group faced in the school's library. Made it easier for the participants to point at and explain what they were limited by and unhappy with. Allowed the author to see the typical library from the eyes of the target group.
<i>Flexibility</i>	<ul style="list-style-type: none"> Flexibility was not a method used but rather a perspective that was incorporated throughout the thesis work. Included in the Empathize phase to highlight the importance of also adopting a flexible approach throughout the research phase, e.g., some participants wanted to draw and write while explaining their thoughts, while others did not. Including exercises that allowed for flexibility was therefore very valuable during the structured conversations.

EMPATHIZE

Figure 8.1 Shows methods used throughout the Empathize phase that were valuable from a UD perspective

METHOD	UD VALUE	
User Personas	<ul style="list-style-type: none"> • Documented user needs and helped formulate goals. • Helped maintain a user-centric approach throughout the consecutive design phases, which helped ensure a continual focus on developing more universal solutions. 	DEFINE
Alternative worlds	<ul style="list-style-type: none"> • A UD perspective was adopted when analyzing the alternative worlds, which helped with developing ideas that could create more inclusive libraries. 	
The Disney Method	<ul style="list-style-type: none"> • The critique perspective allowed developed ideas to be critiqued from a UD perspective, which helped uncover some of the ideas' limitations. 	IDEATE
Evaluation & Selection	<ul style="list-style-type: none"> • Two methods were used to let the evaluation and selection of ideas be guided by the UD principles and the target group's needs. 	
<i>UD principles</i>	<ul style="list-style-type: none"> • Helped with broadening the perspective and exploring how flexible different ideas were to potentially include more user groups than the ones addressed in this thesis. 	
<i>User group expert</i>	<ul style="list-style-type: none"> • Aided with maintaining a focus on the thesis target group when evaluating and selecting the final concept. 	PROTOTYPE
Parallel prototyping	<ul style="list-style-type: none"> • The Lo-Fi version of the web application was prototyped and tested before the Hi-Fi version of the nudging QR codes was finalized and tested. This helped evaluate and modify designs to meet both user groups simultaneously. 	
Explorative evaluating questions	<ul style="list-style-type: none"> • Captured what the suggested solution succeeded with and what it still lacked. • Helped with the continual empathizing and learning needed when designing more universal solutions. 	

Figure 8.2 Shows methods used throughout the Define, Ideate, and Prototype phases that were valuable from a UD perspective

8.4 Final Concept

The developed concept consisted of two elements: nudging QR codes on books and shelves, and a web application for creating and managing audio and QR code files. Nudging QR codes on books, also called QR code stickers, allowed the users to listen to books' backside texts, titles, and authors. QR codes on shelves, also called QR code signs, helped the users understand what type of books different library shelves had and also acted as an inspirational source, by providing a review of one of the books stored on the specific shelf.

The feedback received from the several user tests with the students from the Svane-Hedda school, showed that the concept of nudging QR codes was very promising and helped meet some of the expressed needs of the thesis target group. The

feedback obtained from the user testing of the developed web application, with personnel and external adult testers, also suggested that the concept would be manageable for the librarians to manage. The proposed design of the web application received a quite high SUS score, 86.5, suggesting that the base structure for the web application was functional. The testers' user experience, using the Hi-Fi prototype of the web application, was also generally good.

The proposed concept was developed to be incorporated into the library, not as an add-on, but rather as a natural digital component in libraries. A component that could promote a more universal usage of the library. In this way, the thesis target group, would not feel disabled when being in the library, despite having their impairments, which the social model of disability [20] promoted.

8.4.1 Further Recommendations

The proposed concept of nudging QR codes has been explored and tested using developed prototypes. Improvements have been suggested in section 7.4, but there is still more that needs to be explored, tested, and elaborated on before the concept could be ready for implementation. Some further recommendations will therefore be presented in this section and include the following main points:

- Content and structure of audio files
- Flexibility in the QR code signs
- Printing function
- Error prevention and handling
- Terminology used in web application
- Sorting function
- Add and edit new library shelves
- Record function
- New user group: librarians

Each of the points above will be elaborated on in the paragraphs below.

Guidelines on how information should be presented in the created audio files need to be decided upon and detailed during further development of the nudging QR code concept. It is also important to decide upon the length of the audio files and what information should be prioritized and included. A clear and structured naming system in the web application is additionally needed for the created audio and QR code files.

The QR codes on shelves concept has developed a lot throughout the Prototype and Test phases. The final version, seen to the right in Figure 7.8, included the displayed book's title and author. Opting for this version means that the QR code sign would need to be edited and re-printed every time a new book is displayed on a shelf, which defeats the purpose of having one QR code per display area on shelves and is not an

environmentally attractive solution. It could therefore be interesting to explore if the written information about displayed books could be attached separately to QR code signs or by using digital display screens. Generating QR codes for shelves was not fully implemented and tested in the final prototype, instead the testers were told that it would be the same process as with generating QR codes for the QR code stickers. If an option for separately attaching a displayed book's title and the author is developed, then the function of generating a QR code for library shelves needs to be further explored, as one unique QR code can be generated per display area on a shelf. The same also applies if digital display screens are used.

QR code stickers and signs will need to be printed once they have been generated and assigned to audio files. The printing function needs to be further explored during the further development of the concept of nudging QR codes. Printing one QR code sticker at a time is, for example, not effective, economical, or environmentally friendly if a typical A4 printer is used. If more than one QR code sticker or sign is printed at the same time, then a coding system needs to be developed and introduced to help distinguish the QR codes from each other.

Preventing and handling errors have not been explored a lot during the design and testing of the developed web application. It has been kept in mind throughout the design, but it has not been fully explored due to lack of time and due to the concept still being in the earlier stages of design.

An attempt was made to adapt the terminology used in the developed web application to the terminology commonly used by librarians. This will however need to be further examined and correctly incorporated into the final web application. A more effective and precise wording in the web application could also help reduce uncertainty and make the web application more intuitive and easier to use. One important word to add to the current version of the prototype is "media collection" (Swedish: *bestånd*), as it allows for more media to be included in the concept of nudging QR codes.

The sorting function introduced into the web application, as well as the function for adding or editing bookshelves, need to be further explored, tested, and evaluated. These two functions are important to work on as almost all testers failed on the test tasks involving these functions. Some suggestions and alterations have been presented in the thesis and can be used to guide the further developmental work.

The recording function has been commented on in the previous section and is also included here. Allowing personnel, the option to generate an audio file from text is important for a more inclusive usage.

Finally, it is extremely important to note that a new target group developed and was somewhat considered once the idea of nudging QR codes emerged: librarians. Librarians are needed to manage the developed web application, which is important for the concept of nudging QR codes to be realized. Meeting the librarians' needs would in turn help meet the needs of the thesis's main target group: adolescents with

dyslexia, ADHD, and/or autism. From a UCD perspective, it is therefore important that librarians are involved throughout the further design of the web application.

9 Conclusion

This chapter presents the main conclusions of the thesis.

Both libraries and schools are expected to work to make knowledge accessible to all [2][3]. With the Svane-Hedda school currently being built, it provided a great opportunity to explore how the indoor environments could be made more inclusive for adolescents with dyslexia, ADHD, and/or autism. After discussion with the school, it was decided that the thesis should focus on the new school library being built. The Empathize phase of the adopted design process, provided a deep understanding of the thesis group's needs. The needs were grouped into four main categories: diagnostic challenges, library atmosphere, physical layout, as well as navigation and information access. The diagnostic challenges included both similarities and differences between the three diagnoses. The library atmosphere was split into four sub-themes: lighting, color, library feeling, and sound level. Physical layout related to how the library furniture could be excluding by their positioning. Finally, the theme navigation and information access, was further split into four sub-themes: struggle finding what they need, varied media, clear and concrete instructions, as well as digital literacy.

Once the needs of the thesis group were better understood, the scope of the thesis was better specified; investigating how the interaction between the digital and physical environments in the library could facilitate the navigation and information access in Svane-Hedda library for adolescents between the ages 13-19 with dyslexia, ADHD, and/or autism. This resulted in a developed concept called nudging QR codes. Students from the thesis target group, who struggled with reading or concentration, could scan QR codes on books and shelves to access audio files. The QR codes on books would allow users to easier and faster understand what books were about, which would make it easier for them to find books that interested them. The QR codes on shelves would make navigation easier and more fun for the users.

The suggested concept was developed and tested through the development of prototypes. The user feedback, given by the involved adolescent testers from Svane-Hedda, indicated that the concept of nudging QR codes had a large potential of meeting some of the thesis target users' needs. Furthermore, a web application for creating and managing the audio and QR code files was suggested, prototyped, and tested. The ser tests, with personnel and external adult testers, also gave positive

feedback about the web application. Improvements to both the nudging QR codes and the web application were also given as a deliverable of the thesis work.

Finally, the design methods used throughout the thesis work, were evaluated from a UD perspective. This was done with the aim of exploring which methods had been valuable to use when developing more inclusive and accessible indoor environments. The findings were presented in Figure 8.1 and Figure 8.2.

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Appendix A Informed Consent Form

Presents the informed consent form used to get consent from the interviewed students' parents.



Samtycke för medverkan i ett examensarbete

Härmed samtycker jag till att medverka i en intervju inom projekt "Tillgängligt bibliotek för unga med dyslexi, ADHD och/eller autism" som ska undersöka hur det gemensamma biblioteket som byggs på Svane- och Hedda Andersson skolorna kan göras mer tillgängligt för målgrupperna unga med dyslexi, ADHD och/eller autism.

Jag är fullt införstådd med att

- Medverkan är frivillig och att jag när som helst kan avbryta min medverkan närhelst jag finner detta önskvärt och utan att ange orsak.
- Jag ger mitt tillstånd till behandling av personuppgifter som är nödvändiga att samla in för examensarbetet.
- Aktiviteten dokumenteras och förvaras säkert med projektets kontaktperson.
- Resultatet inte kan knytas till min person.
- Denna blankett upprättas i två exemplar, där jag som medverkar behåller den ena och den andra förvaras tryggt hos projektets kontaktperson.

Kontaktperson för projektet är:
Diana Barazi
Telefon: (Blinded)
E-post: di2380ba-s@student.lu.se

Ort, Datum

Elevens namn

Vårdnadshavarens signatur

Vårdnadshavarens namnförtydligande

Figure A.1 Informed consent for student participation

Appendix B Interview Guides

Presents the developed and used interview guides in the Empathize phase.

B.1 Interview guide: pedagogues & librarians

Målsättning

- Ta reda på hur pedagogen ser på bibliotekets roll och utbud
- Förstå hur de 3 diagnoserna påverkar elevers beteende och kognitiva förmågor, samt elevers inställning mot bibliotek
- Allmänna råd vid dialog med elever med en eller flera av diagnoserna

Intervjufrågor

- **Bakgrundsinfo**
 - Vilken utbildning har du?
 - Hur länge har du jobbat med unga som har dyslexi, ADHD och/eller autism?
 - Kan du berätta lite om dig själv samt vilken erfarenhet och kunskap du har om unga med dyslexi, ADHD och/eller autism
- **Biblioteksuppdraget**
 - Vad ska biblioteket innehålla och erbjuda enligt din uppfattning?
 - Hur skiljer det sig mot hur biblioteket tidigare varit?
- **Dyslexi/ADHD/Autism**
 - Hur upplever du att diagnosen påverkar elevers beteenden?
 - Följdfråga: specificera även för biblioteksmiljön
 - Följdfråga: hur upplever du att beteendet påverkas av elevens ålder?
 - Hur upplever du att diagnosen påverkar elevens kognitiva förmågor?
 - Minne?
 - Planering?
 - Uppmärksamhet?
 - Vad upplever du att elever med dyslexi/ADHD/autism:

- Uppskattar med bibliotek?
 - Tycker är utmanande med att vara på bibliotek?
- **Kombination av diagnoser**
 - På vilket sätt upplever du att ovan svar (dvs. för de individuella diagnoserna) förändras om en elev har mer än en diagnos samtidigt?
 - Följdfråga: Hur upplever du att de olika diagnoserna samspelar?
- **Påverkansfaktorer**
 - Vilka faktorer har du lagt märke till ligger bakom att unga med dyslexi, ADHD och/eller autism känner sig:
 - Inkluderade:
 - I skolmiljön?
 - På bibliotek?
 - Exkluderade:
 - I skolmiljön?
 - På bibliotek?
 - Vad tror du är nyckeln till att få unga med dyslexi, ADHD och/eller autism att känna sig:
 - Inkluderade på bibliotek?
 - Vistas på och använda sig av det biblioteket erbjuder?
- **Allmänna råd**
 - Vad är viktigt att tänka på vid ett första möte med en elev som har:
 - Dyslexi?
 - Autism?
 - ADHD?
 - Mer än en av diagnoserna?
 - Vad kan trigga i gång dem?
 - Vad ska jag undvika?
- **Digital kompetens**
 - Hur upplever du den digitala kompetensen hos unga med en eller flera av diagnoserna?
- **Något jag missat som du vill dela med dig av?**

B.2 Interview guide: heroes

Målsättning

Förstå hur diagnosen påverkat hens liv, skolgång och om hen brukade besöka bibliotek, samt vad som påverkade det beslutet. UD tillägg: vad som får hen att känna sig utanför

Få råd inför dialog med unga med samma diagnos

Intervjufrågor

- **Demografisk information**
 - Hur gammal är du?
 - Vad identifierar du dig som? (man, kvinna, annat)
 - Vad har du för diagnos(er)?
 - Vad tror du att ett barn med diagnosen(er) i högstadie-/gymnasieåldern är orolig och rädd för?
- **Bibliotek**
 - Vad ska man kunna göra på ett bibliotek enligt dig?
 - Brukade du vara på skolbiblioteket i högstadiet och gymnasiet?
 - Om ja?
 - Vad var det du uppskattade med biblioteket?
 - Var det något som du upplevde som utmanande när du var på biblioteket?
 - Om nej?
 - Varför inte?
 - Beskriv ditt drömbibliotek
- **Fördjupning i diagnos(er)**
 - Vilken påverkan upplever du att din diagnos(er) har haft på dig?
 - Hur upplever du att det påverkat din skolgång?
 - Vad upplever du som extra utmanande med din diagnos(er)?
 - Vad kan få dig att känna dig utanför?
 - När kan du känna dig utpekad eller satt i ett fack?
- **Påverkansfaktorer**
 - Vilka faktorer har du lagt märke till ligger bakom att unga med dyslexi/ADHD/autism känner sig:
 - Inkluderade på bibliotek?
 - Exkluderade på bibliotek?
 - Vad tror du är nyckeln till att få unga med ADHD och autism att känna sig:
 - Inkluderade på bibliotek?

- Vistas på och använda sig av det biblioteket erbjuder?
- **Allmänna råd**
 - Vad är viktigt att tänka på vid ett första möte med en elev med (dyslexi/autism/ADHD)?
 - Vad kan trigga i gång dem?
 - Vad ska jag undvika?
- Något du upplever att jag inte fångat och som du gärna vill ta upp?

B.3 Interview guide: students

Att tänka på

- Klä dig informellt och ordna sittplatser informellt
- Informell introduktion
- Bygg en relation i början
- Jämlikt bemötande

(0) Introduction

- Presentera syftet med dagens träff samt vad de bidrar med genom sitt deltagande
- Betona vem som är experten (dvs. dem)
- Betona att det inte finns något rätt eller fel svar, utan att det är deras erfarenhet och åsikter som är viktigast

(1) Ice breaker

- Lär känna eleven lite mer, förstå deras intressen och preferenser, samt dela med mig av mina
- Kör följande ice breaker med eleven: – “Share 3 fun facts about each other”

Guidelines:

Guidelines till frågorna i (2) och (3): fånga “mental flexibility”, “working memory”, “planning”, “memory” och “attention”. Speciellt i frågorna markerade med CA.

Unika guidelines för de 3 diagnoserna:

Dyslexi: Erfarenhet av att biblioteket är ett textbaserat system

ADHD: Distraction, minne - glömska, svårt att lyssna på instruktioner, svårt att sitta stilla och behov av att “fidget”, “excessive talking”

Autism: När blir det för mycket stimulans av sinnestryck (främst syn, hörsel, känsel). Uppskattar struktur och rutiner, undviker förändringar

(2) Relatable Persona

Jasmine och Adam som har samma kön och diagnos(er) som deltagaren

Frågor att ställa om personan:

- Varför går hen dit/inte dit?
- När brukar hen gå till biblioteket?
- Vad tror du hen gillar?
- Vad tror du hen ogillar?
- Vad kan göra att hen känner sig orolig eller stressad på biblioteket? (CA)
 - *Hjälpfråga:* kan inte du berätta om en gång då du kände dig orolig eller stressad på biblioteket?
- Vad kan göra att hen känner sig lugn på biblioteket?
 - *Hjälpfråga:* kan inte du berätta om en gång då du kände dig orolig eller stressad på biblioteket?

(extra frågor om det finns tid över)

- Vad tycker hen är jobbigt med att vara på biblioteket? (CA)
- Vad kan göra att hen känner sig utanför?

(3) Brainstorming aktivitet om drömbiblioteket

Beskriv ditt drömbibliotek

(hjälpfrågor när eleven behöver hjälp att komma vidare i sin beskrivning)

- Vad vill du kunna göra där?
- Hur vill du att sittplatserna ska vara?
- Vad behöver du för stöd för att hitta rätt i biblioteket? (CA)
 - Steg-för-steg instruktioner?
- Vad är viktigt att tänka på när det gäller belysningen?
- Vad tänker du kring ljudnivån och isoleringen?
 - Vad tycker du om att det är tyst på bibliotek?

(extra frågor om det finns tid över)

- Vad föredrar du för färger?
- Vad föredrar du för material?
- Känsla när du är där?

(4) Identifierade faktorer av andra aktörer

Presentera faktorerna för deltagaren och låt de sortera dessa i ordning, där det viktigaste ska vara högst upp.

Identifierade faktorer:

- Lugn & ro
- Prat-zon
- Att hitta det du söker i biblioteket på egen hand
- Hjälpinstruktioner i biblioteket som inte bara är text
- Mysiga sittplatser
- Isolerade sittplatser

Deltagaren kan även lägga till eller stryka faktorer.

OBS! Gör kort som du skriver ut, en per faktor. Varje kort ska ha både text och bild. Deltagaren ska kunna skriva eller rita på ett tomt kort om hen vill lägga till en faktor. Deltagaren ska även kunna välja att berätta vad hen vill lägga till och att jag skriver ner det på ett tomt kort.

(5) Biblioteksbesök

- Besök biblioteket med deltagaren
- Låt de beskriva sina tankar och vad de gör där

(6) Avslutning

- Något du känner att jag missat som du gärna vill ta upp?
- Vad är en sak jag absolut inte får glömma efter vårt samtal idag?

Appendix C Affinity Diagrams

Presents the created affinity diagrams in the Empathize phase.

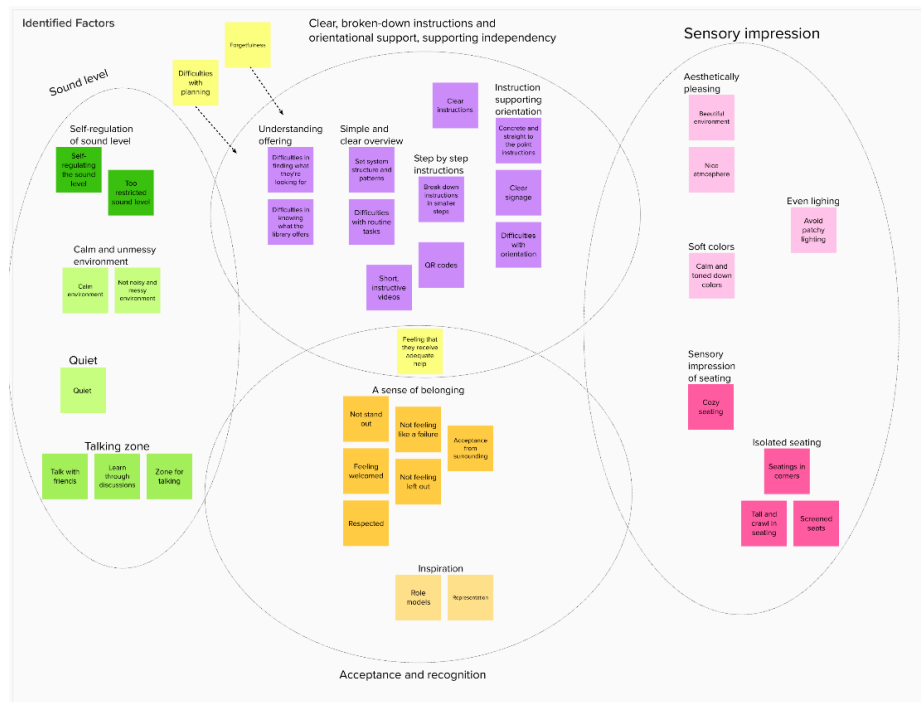


Figure C.1.2 Shows the created affinity diagram of the obtained insights from the interviewed pedagogues, which was then used in the sorting exercise used with the interviewed students

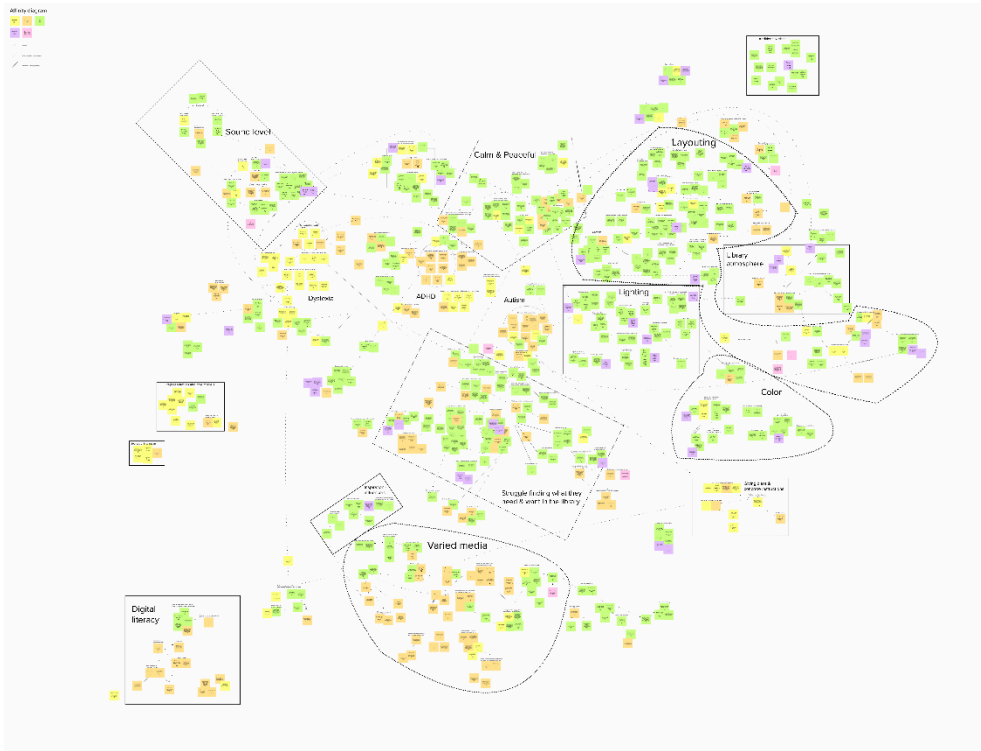


Figure C.2 Shows the created affinity diagram for analyzing the obtained user research obtained during the Empathize phase of the design process

Appendix D Evaluation of Concepts

Presents the UD evaluation of the nine developed concepts during Ideate

UD criteria / Concept	Equitable Use	Flexibility in Use	Simple and Intuitive Use	Perceptible Information	Tolerance for Error	Low Physical Effort	Size and Space for Approach and Use
QR codes on backside text x (blind?)		x (but can be difficult for someone with grip-difficulties to grab and hold book still)	Difficult to determine at this point	x (but important that the user is somehow introduced to the purpose of the QR code - make it intuitive, which relates to the previous point but also issues with signs)	x - (user can scan again, but need to consider how feedback will be given)		N/A (but can be interesting to mention shelf height and student length or wheelchair)
Book video reviews and summaries x		x	Difficult to determine at this point	Difficult to determine at this point, depends on platform and interface design	Difficult to determine at this point	x	N/A
Scenarios of interactions x (no audio for blind?)		Depends, yes to some degree - can read or decipher scenarios but artist can struggle with abstract drawings and if they also have dyslexia - can be a challenge	Difficult to determine at this point, but even if scenarios were in drawings - they will need to be concrete for artists	Difficult to determine at this point, but still an issue for blind as there's no audio or tactile	Difficult to determine at this point	Depends on where they are hung up, but generally yes low	Depends on where they are hung up
Book collection points x		x (but needs to be explored and confirmed more during design)	Difficult to determine at this point	Difficult to determine at this point	Difficult to determine at this point, but it is moving in the right direction	Difficult to determine at this point, but it's moving in the right direction	Difficult to say at this point, but it is moving in the right direction
Book trailers x		x	Difficult to determine at this point, but moving in the right direction	x	x	x	N/A
Tool for navigation & media search x		x	Difficult to determine at this point, but moving in the right direction	x (but will need to be explored more)	Difficult to determine at this point, but moving in the right direction	x	N/A
Displaying human clusters x	Difficult to say, but it can intrude on people's privacy and also the findings are mainly presented visually - artist need information to be super concrete and it also provides an issue for the blind	N/A	Difficult to determine at this point	No	N/A - but what if the user misinterprets the reading?	x	Depends on where the information will be displayed
Pokemon Go inspired navigation x	x (but could maybe be uncomfortable to use for artists. It is more fantasy - inspired, but could add a setting that regulates that, + very visual (blind))	x (but needs to be explored more)	Difficult to determine at this point	Difficult to determine at this point, but leaning towards a no however it works for the target group (keeping the note about artists made above)	Difficult to determine at this point, but moving in the right direction	x	N/A
Search screens on shelves x	Limited privacy, but could work for target group - though user expected to type search so that is a limitation	To some degree, but only one way of using it. Difficult to add e.g. audio or speak in function as the screens are in the open	Difficult to determine at this point	No, mainly reading and the rest of the points are difficult to determine at this point	Difficult to determine at this point	x	Depends on how high up the screens are hung up, but could add a screen height adjuster on all screens

Figure D.1 Shows the UD evaluation of the nine developed concepts during the Ideate phase

Appendix E Hi-Fi prototype test

Presents the test questions used during the testing of the Hi-Fi prototype of the web application developed for managing the audio-QR system.

E.1 Test questions

Book view:

- Can you log in to the web application?
- Which page have you accessed?
- Can you check if all books in the language category have received an audio file (of books' backside texts)?
- If not, can you add the audio file(s) to the book(s) missing one?
- How would you directly print the audio file's corresponding QR code? (view showing the print button)

Shelf view:

- Can you switch to viewing the page containing information on books displayed on shelves?
- How would you add a new bookshelf to your shelf collection?
 - Can you hide it again?
- Since when has the book "Being and Time" been displayed on the D1-Philosophy shelf?
- Can you display the book "Think" by Simon Blackburn on the shelf D1 – Philosophy?
 - Once the tester tried to add the audio file and successfully gets to the "Audio & QR code Generator" pop-up, tell the tester to go back to the previous page and assume that he/she successfully added the audio file (as it's the same procedure done for adding an audio file for books' backside text).
- Can you sort the displayed books in the D1-Philosophy tab based on the authors' last name?
- Can you sort the displayed books in the D1-Philosophy tab based on display time?
- We are done sorting; can you close the sorting box?