MASTER THESIS
INDUSTRIAL DESIGN ENGINEERING


# EXPANDING PSYCHOEDUCATION TOOLS

## Participatory Design for Children with Dyslexia

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Expanding Psychoeducation Tools: Participatory Design for Children with Dyslexia
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This research project was in collaboration with RID (rid.nl).

# Abbreviations

AP = Adult Participant

AT = Attribution Theory

CP = Child Participant

CwD = Child/Children with Dyslexia

DPD = Distributed Participatory Design

EP = Expert Participant

PD = Participatory Design

PE = Psychoeducation

PwD = Person/People with Dyslexia

SDT = Self-Determination Theory

SET = Self-Efficacy Theory

SLD = Specific Learning Disorder

# Preface

As a child, I was diagnosed with dyslexia and struggled a lot with being different and having limitations. When I was a child, psychoeducation was not a part of my dyslexia support, and maybe that could have made a difference. Either way, I ended up experiencing failure anxiety and low self-efficacy when it comes to literacy. This is still something that, even as a university student, I have to deal with every day. That is why I decided to see if I could make a difference for the new generation of children with dyslexia through my IDE Master's graduation assignment.

For my Master's assignment, I am, in a way, designing for the eight-year-old version of me. Once having been part of the user group, the line between designer and user was blurred at certain times, which will be reflected upon at the end of this research. However, dyslexia is only a small part of me, as I am so much more than my struggles. I am a design student, and that is how I approached this research and the design.

## Acknowledgements

I recognise I am privileged to have dyslexia, as one can only have dyslexia if there is no other reason in life for the literacy difficulties. Many people throughout my life have helped me reach this far, and now, there are people who have supported me throughout this thesis.

First and foremost, I am incredibly grateful to my parents. They have been my biggest supporters, helping me with my high school homework, correcting essays and now mentally supporting me with my thesis. In the past few months, my mom was the test subject for all things sent out to parents of children with dyslexia, as she herself, of course, fulfilled these criteria not that long ago.

The next thank you goes to my friends, not just for their love and support, but also for pretending to be children so I could test my session method. Likewise, I want to thank a few of them for joining me in the sessions and being observers so I could focus on being the facilitator.

I want to thank my supervisor, Jodi, for encouraging me, even when I was nervous about whether people would want to participate or even talk to me. Her reminders of who I was doing it all for and my special connection to it all kept me motivated.

I am grateful to everyone at RID, especially those at the Hengelo location, for being open-minded, supportive and enthusiastic about my ideas and requests. Moreover, a special and heartfelt thank you to Sebastián for the same thing, as well as his kindness, enthusiasm, and valuable input throughout our discussions and updates.

Finally, I am thankful for everyone who has participated: the children, their parents, and the employees from RID. Thankful for them being a part of the participatory design session, the distributed participatory design survey, the brainstorming session and/or the final testing. Without their participation, I would not have been able to have done this research.

# Contents

# Introduction

In contemporary societies, literacy is regarded as a highly valued skill often associated with intelligence and academic success[1]. Whereas in primitive or pre-literate societies, prestige was based on other skills such as hunting or storytelling. When the skill in question is valued to be important or meaningful, success or failure can directly affect one's self-esteem.

Dyslexia is a life-long learning disorder marked primarily by difficulties in reading and writing [2]. These challenges arise from issues with the phonological aspect of language, which affects the ability to recognize and manipulate the sound structures of words [3]. Having dyslexia can go beyond challenges related to literacy, impacting self-esteem and experiences of anxiety and embarrassment, as seen in Figure 1 [4].

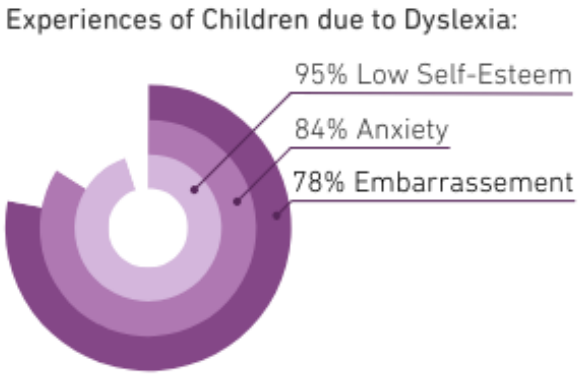



*Figure 1 Prevalence diagram on experiences of children due to dyslexia [4]*

Experiencing low self-esteem for a prolonged period can result in emotional insecurity and low self-efficacy, which can decrease motivation and success, leading to even lower self-efficacy [5]. These secondary effects of dyslexia can be addressed with psychoeducation (PE). Where there is no specified term for PE, for this research, the term is broadly understood as a way to provide insight into a disorder and how to address the primary and secondary effects [6]. PE can help individuals acquire skills to deal with the disorder and lessen social-emotional difficulties. The ultimate goal is for the recipients of PE to manage their disorders and overcome limitations and hindrances when doing activities and participating in society. This goal is achieved through educational/pedagogical tools and interventions that help people take control of their life and disability. PE also emphasizes fostering self-acceptance and self-esteem [7], making it individual-specific and personal. Nevertheless, there appears to be very little research on PE tools designed with the people it is designed for.

# Research question

This thesis aims to answer the overall research question of:

> How can a tool be designed to support children with the secondary effects of dyslexia?

However, this question is reformulated in Chapter 2.1 into a design challenge to narrow down the scope of this thesis.

## Design method

A design thinking framework was implemented to answer the research question and as a guide throughout this thesis. This framework was chosen because it focuses on human-centred design [7], which is seen as essential in this specific research. The framework consists of five stages [7]. Starting with the empathizing stage, this stage helps better understand the target user. The next stage is the define stage, which brings clarity and focus to the research. In the ideate stage, a wide range of solutions are explored. These solutions are narrowed down and redefined in the prototype stage. The final stage is the test stage, where users test the designed solution. Figure 2 illustrates the path of this research through the framework, containing the stages with the corresponding chapters.

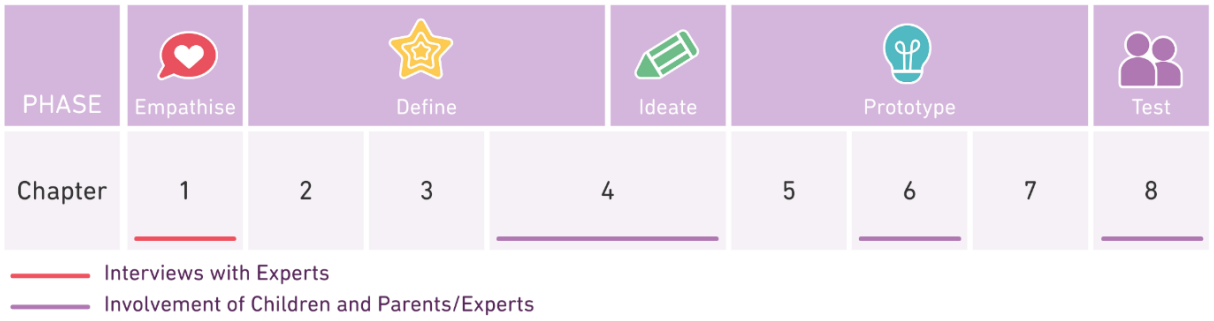



*Figure 2 Overview of the design thinking framework with corresponding chapters, stages adapted from [7]*

# 1. Empathising: Dyslexia and its Effects

This chapter is part of the empathising stage. The focus is on understanding the experiences of the target user. In the following subchapters, dyslexia and its effects experienced by people with dyslexia are outlined, and the use of psychoeducation is explained.

## 1.1 Specific Learning Disorders

Specific learning disorders (SLD) are neurodevelopmental disorders that are characterised by persistent difficulties in learning academic skills [8]. This means that people with a SLD can have difficulties with reading, understanding written texts, spelling, and/or written expression, as well as mastering number sense, number facts, calculations and/or mathematical reasoning. Dyslexia and dyscalculia are terms used to refer to a specific pattern of these difficulties.

There are four diagnostic criteria for diagnosing SLDs. First, the learning disabilities need to be consistent over a minimum of six months, even with the implementation of targeted interventions. Second, the academic skills need to be below the expected standard of the person their age and need to cause interference in (academic/work) life. Third, the difficulties need to begin during a person's academic life. And last, the learning difficulties cannot be accounted for by anything else (e.g. intellect, visual impairment or inadequate educational instruction) [8].

SLDs are known to co-occur with other disorders. For example, with neurodevelopmental disorders (e.g. ADHD, communication disorders, developmental coordination disorder, autistic spectrum disorder) [8], [2] and with mental disorders and psychopathologies (e.g. anxiety, depressive and bipolar disorders) [9]. However, there is a difference in prevalence for the different co-occurring disorders, as seen in Figure 3.

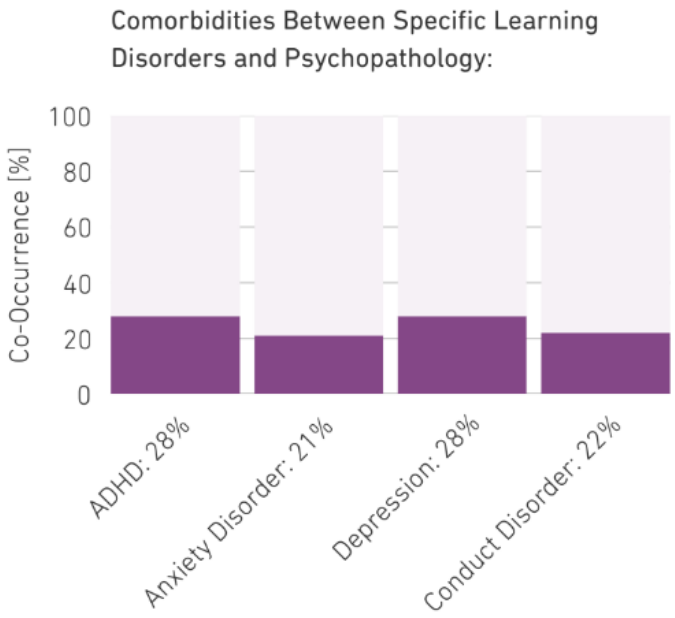



*Figure 3 Bar graph on preference of comorbidities between SLDs and psychopathology [9]*

## 1.2 Primary Effects of Dyslexia

As stated previously, dyslexia refers to a specific pattern of difficulties, primarily marked by difficulties in reading and writing. A key issue in dyslexia is the difficulty with letter-sound mapping or connecting letters (graphemes) to their corresponding sounds (phonemes), a vital skill for decoding words [10], [11]. This struggle can impact the ability to interpret the symbols of written language and is independent of intelligence [2].

In Table 1, an array of difficulties related to reading and writing are further specified. People with dyslexia (PwD) tend to have a combination of these difficulties, including phonological awareness, auditory discrimination, and verbal difficulties[2].

*Table 1 Overview of effects experienced due to specific difficulties faced by people with dyslexia, adapted from [2].*

| Difficulty | Effects |
|---|---|
| Phonological awareness | - Difficulty learning to read<br>- Difficulty identifying or generating rhyming words<br>- Difficulty counting syllables in words |
| Auditory discrimination | - Difficulty with manipulating sounds in words<br>- Difficulty distinguishing different sounds in words |
| Verbal difficulties | - Faulty pronunciation<br>- Difficulty acquiring vocabulary<br>- Difficulty following directions<br>- Confusion with words such as before/after and right/left<br>- Difficulty with word retrieval<br>- Difficulty understanding concepts and relationships of words and sentences |

### 1.2.1 Classification

Dyslexia is understood to be a heterogeneous disorder, making it complicated to classify into subtypes, as there are a wide range of experiences and symptoms [2]. However, there are common ways dyslexia can be differentiated. Specifically into i) visual or auditory dyslexia and ii) phonological or surface dyslexia [12]. While people with visual dyslexia tend to have more difficulty processing visual information, such as recognizing and analysing word shapes, people with auditory dyslexia face challenges processing sounds and phonetic elements. People with phonological dyslexia have difficulties with alphabetic and phonetic decoding, particularly when faced with non-words or unfamiliar terms. Whereas, people with surface dyslexia experience challenges with irregular word recognition and accessing word meanings from visual input. Dyslexia can also be split into i) developmental dyslexia, which is caused by genetics or brain development in utero and ii) acquired dyslexia, which is caused by trauma or disease [8].

Despite these classifications, PwD have their own unique set of characteristics and challenges that can change throughout different developmental stages [2]. Because where dyslexia is a life-long difficulty, the experience of having dyslexia can change as a person matures, learns to adapt and compensate.

### 1.2.2 Language Differences

In addition to the differences in dyslexia characteristics between individuals, variations in prevalence rates across different languages lead to cultural differences in dyslexia. Languages can be classified as having transparent orthography (e.g. Chinese, Japanese) or opaque orthography (e.g. English), describing if the relationship between letters and sounds is, respectively, consistent or inconsistent [2]. The Dutch language has a relatively easy letter-sound correspondence in terms of inconsistency [13], making it a transparent orthography [14]. These language aspects of the Dutch language result in CwD having more difficulties with decoding than their phonological ability [14].

### 1.2.3 Diagnosing in the Netherlands

In the Netherlands, 7.5% of students at the end of primary school have received a dyslexia diagnosis [15]. Dyslexia support is provided to children with severe dyslexia ("Ernstige Dyslexie"); 3.3% of the children diagnosed with dyslexia at the end of primary school also meet the diagnosis criteria for severe dyslexia. Dyslexia support, part of the Dutch Youth Law, is only for children in primary school between the ages of seven and thirteen [16]. These children aged seven to thirteen with severe dyslexia were the target users of the tool designed in this thesis.

## 1.3 Secondary effects of Dyslexia

As briefly discussed in the introduction, there is a close relation between excelling in literacy and being perceived as intelligent in today's society [1]. Most Children with dyslexia (CwD) perceive the relationship between reading ability and intelligence to be stronger than their peers and, therefore, tend to perceive themselves to be less intelligent in comparison [4], [5]. The inability to acquire perfect literacy by CwD can directly affect their self-esteem [17]. Even when CwD do succeed, they are more likely to attribute this to external factors (e.g. good schooling) rather than internal factors (e.g. high intelligence) [4]. This attribution is further explored through attribution theory in Chapter 3.1.2.

Emotional insecurity and low self-efficacy can be the result of experiencing low self-esteem (due to dyslexia) for a prolonged period. This can, in turn, decrease motivation and success, further decreasing self-efficacy [5]. For instance, when a student does not feel capable of writing an essay or feel that they are not intelligent enough, they will be less motivated to put much effort into the essay. This lower effort could lead to a higher chance of receiving a bad grade and making them feel even less capable when they have to do it in the future.

### 1.3.1 Dyslexia as a Label

After being diagnosed or labelled as having dyslexia, there are different ways PwD and their environment react. When children are asked how they felt after being diagnosed with dyslexia, some report a sense of relief from having an explanation and not simply being "stupid" [1], [17]. Others did not react in any way, and some were devastated [17]. This devastation could be partially due to the stress of being split up from their peers in class [5]. Furthermore, experiencing the label as negative can hinder success, so negative feelings toward the label must be reframed [5].

Before being diagnosed with dyslexia, people can be stereotyped and labelled as stupid, lazy, slow learners, etc. After the diagnosis, PwD can have their intellect and work ethic questioned by others (e.g. teachers and parents) [5]. This questioning from others leads to stereotype threat, meaning that an individual is scared to confirm a stereotype about their diagnosis and label [5], [18]. As an example, if someone presumes PwD to be less intelligent, someone with dyslexia might become scared that they would confirm this belief and further stereotype the label. Possibly resulting in the avoidance of specific tasks, counteractively exacerbating the difficulties experienced with the learning disability.

### 1.3.2 Acceptance of Dyslexia

When a person is first diagnosed with dyslexia, multiple factors can determine their self-acceptance and self-efficacy. For example, the amount of information they receive about dyslexia following their diagnosis and the academic and social support provided afterwards [5]. Literacy support, understanding and emotional support from parents at the time of the diagnosis can encourage a CwD to keep trying despite their difficulties[17], as this support positively affects the emotional experience of dyslexia [5].

A positive attitude toward dyslexia from teachers can also greatly impact the self-efficacy of CwD [19]. Some teachers can find it challenging to teach CwD [19]. However, when the teachers have a high self-efficacy in their teaching ability, they embrace innovative learning techniques and better support all students. Self-efficacy in teaching abilities can be fostered through specialized (dyslexia) training [5]. Furthermore, CwD self-efficacy could be increased overall by being better understood within an educational environment [5].

### 1.3.3 Secondary Effects Depending on Age

There is also an important difference in how a PwD reacts to their diagnosis and how the secondary effects develop based on the age at which they receive the diagnosis. When CwD are diagnosed when still in middle school, they have lower self-esteem and self-efficacy than their peers; however, they do not believe themselves to be less intelligent [4]. When diagnosed at a later age, PwD have lower self-esteem and doubt their intelligence more but have the same amount of self-efficacy compared to their peers. This difference could be explained by the ability to create coping mechanisms later in life [5], while having been unaware of why they experience learning difficulties [4]. These secondary effects are also the case for adults in the workplace. At the same time, they may no longer be reminded of their learning difficulties and may still think of themselves as less intelligent than their colleagues [4].

### 1.3.4 Secondary Effects Depending on Gender

Gender also makes a difference in dyslexia prevalence and its secondary effects. Dyslexia is generally diagnosed about three times more often in boys than girls [8]. Despite this difference, cognitive abilities are quite similar between boys and girls with dyslexia [20], [21]. With only minor differences in abilities like memory (e.g. verbal and visual memory). Regarding metacognitive abilities, girls generally outperform boys of similar age, and this difference holds across both students with and without dyslexia [22]. However, metacognitive abilities are slightly lower overall for students with dyslexia. Nevertheless, this is not a problem when starting higher education. A hypothesis for why boys are diagnosed more often than girls is that it might be more physically evident through the behaviour displayed by boys [16].

While failure-related anxiety is generally more common among students with dyslexia, girls experience it more often compared to boys [22]. This gender-based difference in failure anxiety also exists in students without dyslexia. Therefore, gender-based differences in treatment for dyslexia alone are not principally justified. However, general gender differences might still be considered in educational approaches. Therefore, it would also mean that dyslexia PE interventions aimed at addressing these secondary symptoms should not be adjusted based solely on gender.

## 1.4 Psychoeducation

The specific objective of this thesis was to support the secondary effects of dyslexia. The initial idea was to improve general dyslexia support tools because improving success rates and feelings of competence could help mediate these secondary effects. However, extensive research has already been done on improving training tools and methods.

Interviews[1] were held with people with expertise in dyslexia: Tamara Vreeken, founder and CEO of the *HOI foundation* and Pol Ghesquière, professor of Ortho pedagogy at KU Leuven and chairman of the *Wetenschappelijke Adviesraad Dyslexie* [23], [24]. After conducting the interviews, it became apparent that the real gap is in supporting children with the secondary effects of dyslexia through PE (tools). Ghesquière pointed out that when looking at existing research, there was minimal development of PE tools for dyslexia, let alone tools that focused on independent use by children [23].

### 1.4.1 Definition of Psychoeducation

There is no specified term for PE. However, in this research, the term was broadly understood to provide insight into a disorder and how to address the primary and secondary effects [6]. This entails, for dyslexia PE, diminishing possible social-emotional problems, explaining dyslexia and strengthening motivation for receiving dyslexia support [25]. The ultimate goal of PE is that the recipients can handle their disorder to the extent that they are not limited and hindered when doing activities and participating in society [6]. This goal is achieved through educational/pedagogical interventions that help people take control of their life and disability. These interventions consist of three components: the transfer of information, skills training and counselling. PE is an important part of a disorder intervention, not only for the PwD but also for their environment (e.g. family, friends, teachers) [6],[16].

The effectiveness of PE for other disorders (e.g. autism spectrum disorder) has been proven; however, the potential has yet to be extensively researched for dyslexia [16]. There are some guidelines for designing a PE intervention, where the focus should be on knowledge, self-acceptance/self-image, execution, individualizing and finally, the translation to daily impediments [6].

[1] These interviews were conducted with ethical approval from the Natural Sciences and Engineering Sciences Ethics Committee at the University of Twente (application nr. 240922).

Furthermore, the Dutch Association for Dyslexia *(Stichting Dyslexie Nederland)* advises to include the following questions (translated from Dutch) [26]:

- What is dyslexia?
- What effects due to dyslexia do you experience?
    - How do you experience reading and writing?
    - How do you navigate these effects?
- What are your strong and weak points?
- What would you want to achieve/improve?
    - How can you achieve/improve that?
    - What do you need to be able to do this?

### 1.4.2 Current Psychoeducation in the Netherlands

PE is still in development within the Netherlands. Only as of 2021, PE has become a mandatory part of dyslexia support for children with severe dyslexia [25]. PE for dyslexia is primarily available to the public through books or written manuals [27]. Currently, there are multiple method/tool books to provide PE: *Dyslexie, wat is dat?, Wegwijs in Dyslexie, Dyslexiesleutels, Dyslexie de Baas* [27]. These tools can be used to provide training in an individual or a group context and must be carried out by a professional (e.g. a psychologist or remedial teacher). They are used for different age groups and can all be commercially bought. There seems to be no PE tool that is commercially available for children or parents and made to be used independently.

# 2. Defining: The Design Challenge

This chapter is the first one in the defining stage. The research question is further defined as a design challenge. Furthermore, the collaboration with RID and the methods that address the design challenge are introduced.

## 2.1 Design Challenge

As the research question is quite broad, it was translated into a more defined design challenge. This was done after better understanding the different sides of dyslexia, the different aspects of its secondary effects and the shift to focus on PE. Therefore, the question of how a tool can be designed to support children with the secondary effects of dyslexia was now translated to the following design challenge:

> Create a tool that children, aged seven to thirteen, can use independently and that expands RID's current PE program.

However, the goal was not to create a PE intervention and replace any PE provided by a professional but to provide more tools to CwD when they feel the need for it

## 2.2 Collaboration

To ensure that the tool/product created in this research reaches the target user, CwD, a collaboration with the Dutch company RID, was established. RID is specialized in dyslexia and dyscalculia throughout the Netherlands [28]. Supporting children with severe dyslexia and dyscalculia in their primary and secondary difficulties through multiple support levels, see Figure 4 [29].

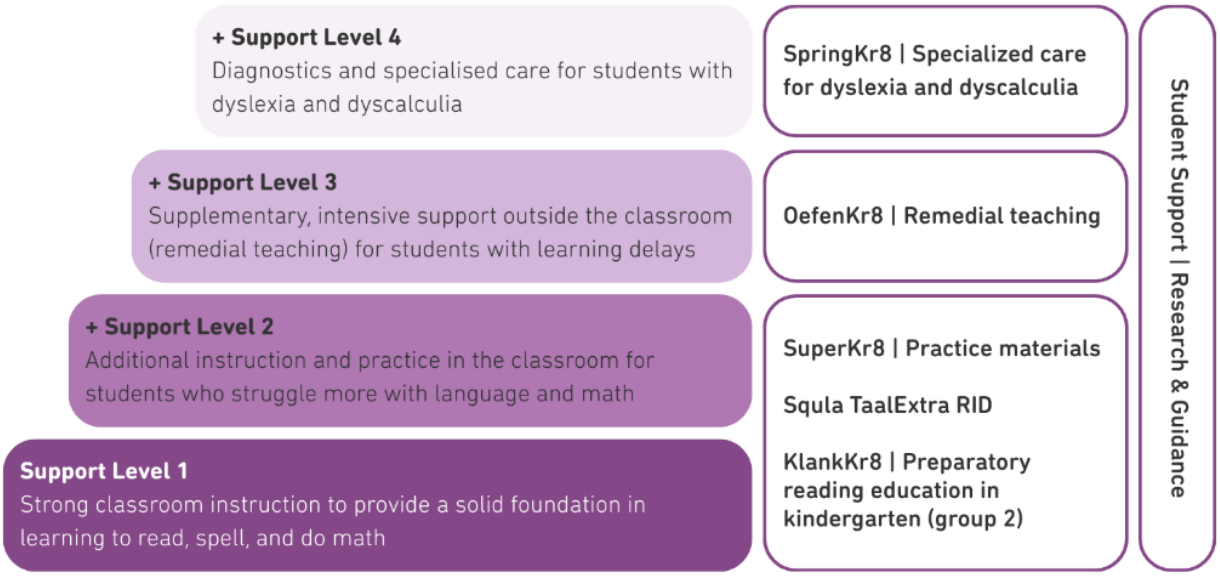



*Figure 4 Support Levels of dyslexia/dyscalculia support provided by RID, adapted from [29]*

As mentioned before, children need to qualify for certain support (Level 4 in Figure 4), and RID supports around 3000 children with severe dyslexia and dyscalculia per year [30]. RID was founded in 1983 and currently has 15 headquarters and more than 300 satellite locations throughout the Netherlands. Furthermore, together with the University of Amsterdam, they have an academic expertise centre for learning difficulties called the Rudolf Berlin Center. They are nationally certified and possess excellence in the fields of practice, policy, education, and science. This field of expertise was why they were requested to collaborate on this thesis.

Currently, RID provides PE for dyslexia through a phone application they have developed for their clients, called GroeiKr8, which is part of their SpringKr8 program [31]. Children can use this application independently on a phone or tablet; however, it is not publicly available.

RID allowed much freedom in the design and function of the tool. RID's focus on children's experience matches the design thinking frameworks and its human-centred design approach[7]. This means that CwD, their needs and experience will lead within the design.

## 2.3 Addressing the Design Challenge

To ensure the needs and experiences of CwD were addressed, children receiving dyslexia support at RID were invited to participate in the design process. Exploring how children would design a tool addressing the design challenge. This exploration together with children, bridges a gap in existing literature, as there appears to be little published work on conducting participatory design with CwD and exploring PE through participatory design. Furthermore, no published work on exploring PE through participatory design with CwD appears to exist.

Two participatory design sessions were conducted with CwD and their parents[2], as well as distributed participatory design with children and remedial teachers from RID. The following chapter explores the importance of participatory design with children. The focus participants of the (distributed) participatory design session[3], were the same as the primary target users, the CwD receiving specialized support from RID. This resulted in the child participants being between seven and thirteen years old.

### 2.3.1 Participatory Design with Children

Participatory design (PD) is a design approach that enables the user to take an active role in creating a new product [32]. This approach can lead to the development of a product that will be more relevant and timeless for its users [33]. Nonetheless, product designs for children are made mainly by adults, with input from parents and teachers, but often not from children directly [34]. Children are considered to be their own user population and have their own culture, norms and complexities [34]. Therefore, designers should not simply view them as little adults and should design for (and with) them accordingly.

[2] The term parents throughout this research will be used as a term to describe parents, legal guardians and caregivers.

[3] These (distributed) participatory design sessions were conducted with ethical approval from the Natural Sciences and Engineering Sciences Ethics Committee at the University of Twente (application nr. 241229).

Conducting PD with children means involving them in the design process and ensuring their needs and points of view on a design are met in all phases of the design process [35]. After all, they are the best experts on currently being a child [36]. Therefore, in this research, the most credible participants for designing a product for children who have dyslexia are CwD.

There are different ways of including children in the design process. Generally, there are four roles a child can fulfil within the design process. The roles range from least to most involved: user, tester, informant, and design partner [34]. These roles can be layered, with the user being only a user and a design partner being all four roles combined, as demonstrated in Figure 5. For this research, children were positioned as informants and played a part in various design stages, but not all of them.

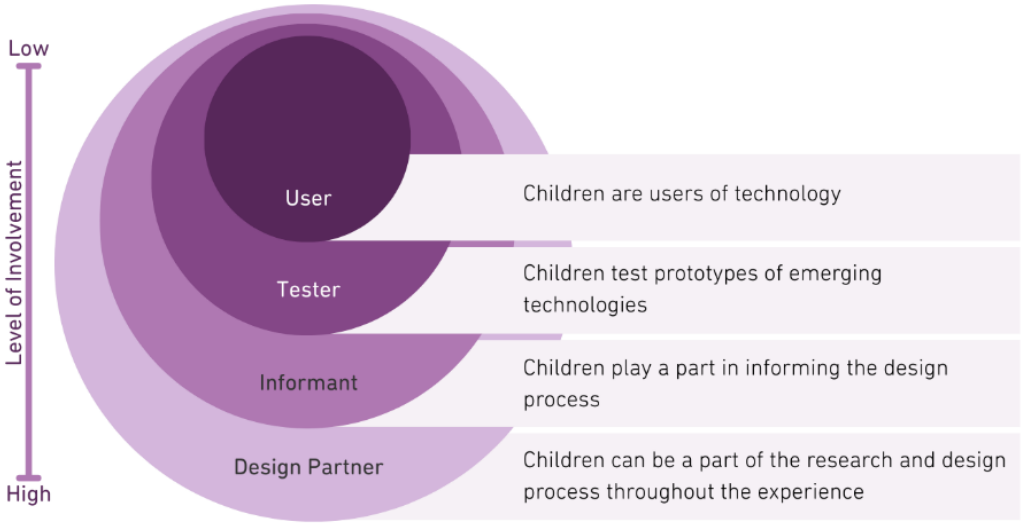



*Figure 5 Levels of child involvement in a design process, adapted from [34]*

Children between the ages of seven and ten are suitable design participants as they have verbal proficiency and can self-reflect [37]. At this age, they are able to discuss their thoughts, feelings, and ideas about prompted subjects. Furthermore, they can understand the idea of designing something without having preconceived notions of how things should be. This allows them to think outside the box and have creative solutions. Most likely, this will result in not directly practical solutions, which can, nevertheless, lead to important product requirements. However it is important that the PD is in line with children's cognitive abilities[36].

### 2.3.2 Distributed Participatory Design

Conducting PD in in-person settings allows for data collection through observation, note-taking, and video recording, capturing the nuances of interaction (e.g. non-verbal cues, spontaneous interactions), reaction, collaboration in real-time and tacit knowledge [38]. However, this setting is resource-intensive, requires logistical planning, and could unintentionally restrict participation to those who are able to attend physically.

One way of making PD more inclusive is by doing it distributed [39], meaning in different locations and/or times. Although most PD methods, techniques and research are in co-located and synchronous sessions, there has been a movement towards Distributed Participatory Design (DPD) due to external factors (e.g. the COVID-19 pandemic and diversification of youth) [40]. DPD can be classified into three categories: synchronous (occurring at the same time), asynchronous (occurring at different times), and hybrid (a mix of synchronous and asynchronous). The benefits of using DPD are that it allows for higher diversity in participants as its location (and time) is not bound [38]. These benefits were utilised in this part of the research to allow for more participants, as RID supports about 3000 children (not all CwD) a week nationwide [30].

# 3. Defining: Requirements from Literature

This chapter is the second chapter in the define stage. The following subchapter defines a theoretical framework connecting behavioural change theories. Furthermore, the framework is interpreted and translated to design requirements.

## 3.1 Behavioural Change Theories

For this thesis, a theoretical framework was created to help guide the design process and establish requirements by linking three theories on motivation and behaviour: self-determination, attribution, and self-efficacy theory. These theories were further expanded upon with one common occurring behaviour: learned helplessness.

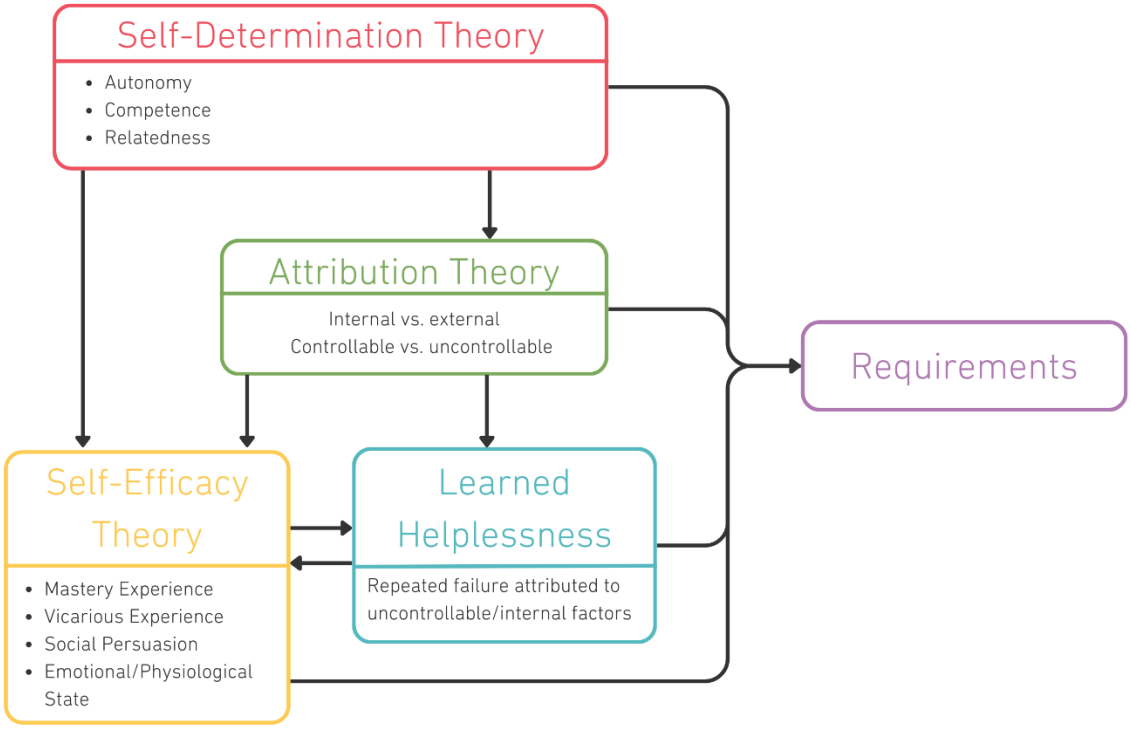



*Figure 6 Overview of the created theoretical framework based on three behavioural change theories and one common occurring behaviour, resulting in requirements*

As seen in Figure 6, self-determination theory is the basis for the framework, connecting attribution theory and self-efficacy theory with the behaviour of learned helplessness. These theories are commonly touched upon in literature regarding SLDs [41], [16] and were linked together to create the framework and establish requirements. This framework addresses motivation, beliefs about abilities, and interpretations of successes/failures.

### 3.1.1 Self-Determination Theory

Self-Determination Theory (SDT), introduced in 1985 [42], is a widely used theory in educational settings to support student motivation, including for children with disabilities [43]. The key components of SDT, used in the framework are reflected in the basic needs theory. Basic needs theory is a sub-theory of SDT that describes the human tendency to fulfil three fundamental psychological needs: autonomy, competence, and relatedness [44].

- Autonomy is the need for control in life and an environment. This control means that people with SLD, for instance, have the freedom to do something in their own way and time, coping better with their limitations.
- Competence is the need to acquire the ability to perform tasks.
- Relatedness is the need to belong, care for and be cared for.

The importance of having these needs fulfilled leads to a self-determined life, which, no matter whether having a disability or not, will lead to better overall life outcomes [43]. When given the opportunity, students with SLDs can acquire and benefit from SDT skills similar to those learned in PE. Self-determined behaviour aligns with the goals of PE [6], as seen in Table 2. SDT focuses on motivation, personality and well-being, stressing the role of intrinsic motivation over extrinsic motivation.

*Table 2 Comparison between the goals of PE [6] and self-determined behaviour [43]*

| Psychoeducation Goals | Self-determined Behaviour |
|---|---|
| - Increasing awareness | - Self-awareness<br>- Self-advocacy |
| - Improving communication and support | - Self-advocacy |
| - Developing coping strategies | - Goal-setting and attainment<br>- Problem-solving |
| - Fostering self-efficacy | |

### 3.1.2 Attribution Theory

Attribution theory (AT) describes how people attribute reasons for success or failure to their experiences [45]. There are different ways people can attribute their experiences, internal or external and controlled or uncontrolled. People with SLDs tend to attribute their failure and success to external uncontrollable circumstances. Their failures are attributed to a lack of ability due to having a SLD, and their successes to external factors (e.g. good teachers, easy circumstances) [4], [46], [47]. Combining AT with SDT allows for a comprehensive understanding of motivation: how psychological needs, found in SDT, interact with individuals and their interpretations of events, found in AT. For students with SLD, this means their motivation to engage in learning activities is heavily influenced by how they attribute outcomes in academic situations.

### 3.1.3 Self-Efficacy Theory

Self-efficacy theory (SET) is introduced to explain the belief in one's ability to persist and succeed. The theory differentiates four ways of improving personal beliefs in their abilities and self-efficacy: mastery of experience, vicarious experience, social persuasion, and physiological/emotional state [48]. SET is used to extend upon SDT on relatedness mainly through social persuasion and vicarious experiences and on the feeling of competence through mastery of experience. However, SET touches more on the internal beliefs of self-efficacy, connecting it to AT through internal attributions. People, especially students with SLD, have a lower self-efficacy than their peers [4], [5], as discussed in Chapter 1.3.

### 3.1.4 Learned Helplessness

Attributing negative experiences with internal (un)controlled factors (e.g. anxiety, nervousness or low effort) can harm one's self-efficacy beliefs [49]. Having low self-efficacy can lead to more internalisation of negative experiences. Students with SLD can contribute academic failure to their disability, giving less incentive to continue working on their difficulties, therefore experiencing these difficulties to a greater extent [47]. This pattern can be described as 'learned helplessness', the behaviour displayed by a person after repeated exposure to uncontrollable negative experiences [16], [50]. This behaviour also helps keep their self-worth intact as they are not simply "dumb" but have a disorder. People, including students, want to keep up their self-worth, which means they are required to either work extra hard to achieve academic success or give up as they feel like they will not be able to, thus handicapping themselves [46]. This negative feedback loop connects to SET, lowering self-efficacy and increasing learned helplessness.

## 3.2 Interpreting and Translating Theories to Design Requirements

These theories, specifically looking at how they pertain to (young) students with a SLD, were interpreted into design requirements, in Chapter 5.1.

*Self-efficacy in Communication*

The tool should develop confidence in expressing their thoughts and feelings. It should help children believe: "I can explain what I need and why I need it."

*Autonomy through Independence*

The tool should contain advocacy methods to teach children to take responsibility for their well-being by actively participating in decision-making. It should empower children through PE programmes so that they feel able to steer or contribute to their treatment.

*Connectedness and Understanding*

The tool should have elements that allow children to feel understood, build up trust between and improve relationships with family, teachers, and peers. The tool should promote mutual care and empathy, and promote the idea of "When I explain something, I am heard and taken care of."

*Empowerment in Attribution*

The tool should instil the belief: "If I get help, it is because I stood up for myself." Ensuring that children attribute their progress to their own efforts, creating a positive feedback loop that builds resilience.

# 4. Defining and Ideating: Participatory Design Sessions with Children and Parents

This is the final chapter in the define stage and the only one in the Ideate stage. In this chapter, children and one of their parents were asked to explore possible designs and generate ideas through participatory design. Resulting in 16 insightful artefacts and some ideation.

## 4.1 The Derived Method

The sessions were conducted using a session method that was specially designed for this thesis. This method, called Inventor-for-the-day, was designed to be specifically engaging and suited for CwD aged seven to thirteen. A detailed explanation of the creation and specific aspects of this method can be found in Appendix A. The method consists of six parts based on common activity patterns found in literature, seen in Figure 7 and more detailed in Table 3. In the session, child participants (CPs) were inventors for the day and had to create a persona they could use to make an invention that supports the secondary effects of dyslexia. Their parent, an adult participant (AP), functioned as a proxy and explored the possible future of the persona concerning dyslexia.

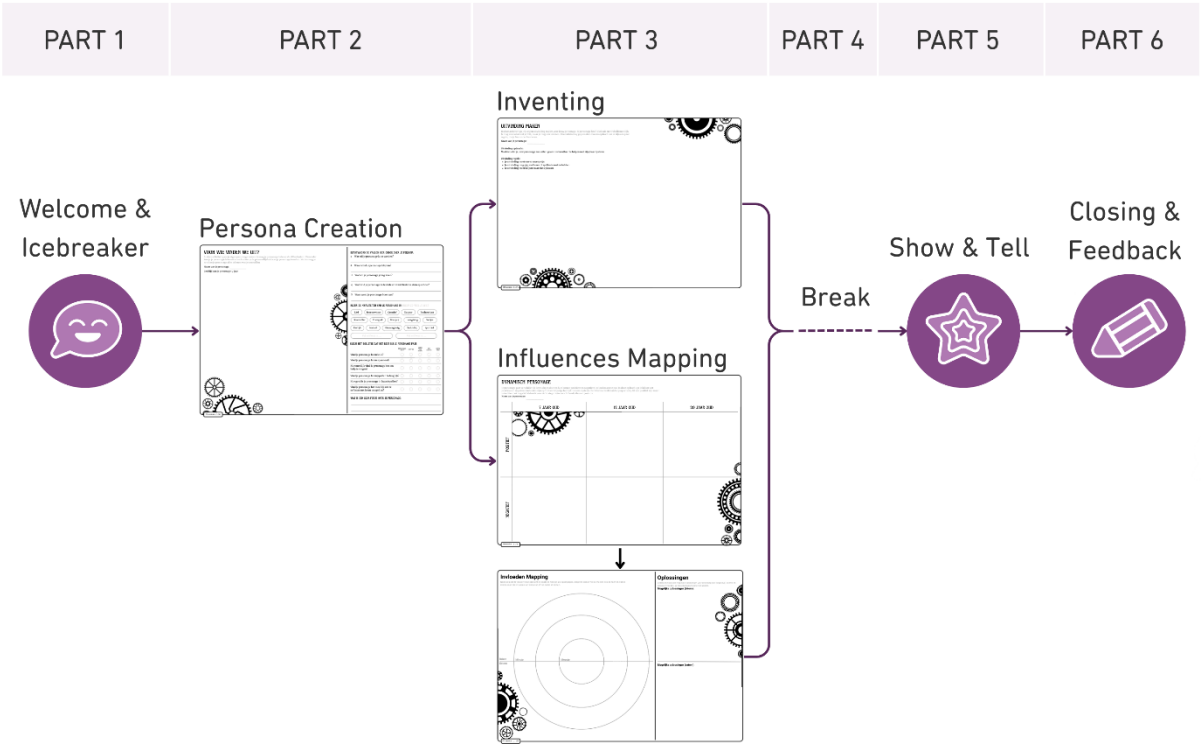



*Figure 7 Overview of the six parts of and four worksheets used in the PD sessions*

*Table 3 The six parts and the goals of the PD session*

| Part | Description | Goal |
|---|---|---|
| PART 1 | Welcome & Icebreaker: Short explanation and introductory game. | Create a welcoming and inclusive environment. |
| | | Help participants get to know each other and feel comfortable. |
| PART 2 | Craft Activity 1: Persona Creation, through drawing, with coloured pencils, the visual attributes of their persona and answering personality questions. | Develop a narrative to explore challenges and strengths. |
| | | Encourage creativity and emotional expression in a non-personal way. |
| PART 3 | Craft Activity 2 Parents: Consider how dyslexia influences the persona at ages seven, twelve and twenty, map these infuneces colaberatively and develop possible solutions. | Reflect on future growth and identify enablers and blockers. |
| | Craft Activity 2 Children: Invent a physical object that helps their persona with dyslexia. | Explore solutions for an PE expansion tool through creativity. |
| PART 4 | Break: Time for a snack an.d chat | Provide a moment to relax and connect informally. |
| | | Reinforce a sense of community. |
| PART 5 | Show & Tell: The children present their invention and explain why they designed it this way. | Celebrate participants' creativity and ideas. |
| | | Facilitate a deeper understanding of the challenges and solutions shared by the group. |
| PART 6 | Closing: closing of the session and collecting feedback. | Reflect on the session's value and gather feedback. |
| | | Provide closure and explain next steps in the research process. |

The session was expected to be one and a half hours, with an extension of half an hour for transitions between activities and unforeseen delays. The session's facilitator created examples for worksheets in parts 2 and 3 to convey expected outcomes. Besides the facilitator, three observers were present; one took notes on the participants' behaviour, and two took notes on verbal interactions. Two sessions were conducted, with the first having four CPs and four APs and the second having two CPs and two APs. The sessions were held at the RID location in Hengelo, in a spacious room with two tables and a seating area.

A few days before the session, the informed consent forms, general information and instructions on how parents should engage in the session were emailed to the participating parents. This email helped to set expectations, pre-assign roles and remind participants about the session.

## 4.2 Analysing Outcomes from the Sessions

The outcomes of the two sessions were analysed to establish requirements. These requirements should then reflect the wants and needs of CwD when it comes to the design of a tool that expands PE for dyslexia. Besides establishing requirements, the participants ideated possible PE tools by creating inventions and possible solutions in part 3 of the sessions.

### 4.2.1 Outcomes Derived from Produced Artefacts

The term "artefact" is used throughout this thesis to describe the things produced by the participants. From an ethnographic perspective, the artefacts are understood not simply as objects but as entities rooted in the context of their creation, reflecting social and cultural norms [51].

#### *Personas*

There were six artefacts created by the CPs together with their parent, APs, in part 2 of the session. To provide an impression of these artefacts, one of them can be seen in Figure 8. All personas were analysed and compared, and prominent findings are reported in the following paragraphs.

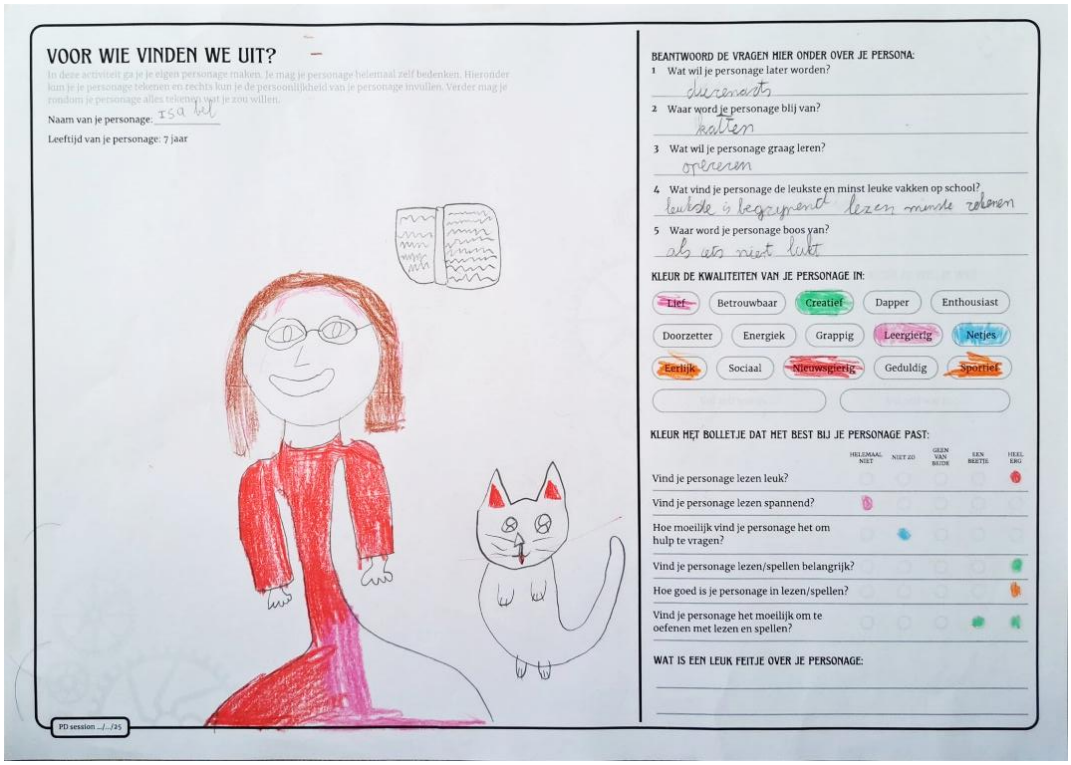



*Figure 8 One of the six artefacts created by CP and AP during part 2: persona creation in the PD sessions*

What was notable about the artefacts created in the first session was that all mentioned animals and half mentioned flowers and books. Unlike the first session, no flowers or books were mentioned in the second session; however, a new pattern emerged combining both sessions: an emphasis on a sport. These patterns are depicted in Table 4.

*Table 4 Patterns of things mentioned on the persona worksheets in the PD sessions*

| Mentioning of: | Personas of Session 1 | Personas of Session 2 | All personas |
|---|---|---|---|
| Animals | 4 / 4 | 2 / 2 | 6 / 6 |
| Flowers | 2 / 4 | 0 / 2 | 2 / 6 |
| Books | 2 / 4 | 0 / 2 | 2 / 6 |
| Sports | 2 / 4 | 2 / 2 | 4 / 6 |

When looking at the written portion of the persona creation, there was, in most answers, not a detectable trend. All personas felt differently about literacy and wanted to become different occupations. However, four of the six personas found literacy the least enjoyable subject at school. The primary trend was found in the traits they could assign to their persona, found in Table 5.

*Table 5 Overview of persona traits chosen by the CPs for their persona in the PD sessions*

| Persona traits | Personas of Session 1 | Personas of Session 2 | All personas |
|---|---|---|---|
| Sweet | 4 / 4 | 2 / 2 | 6 / 6 |
| Creative | 4 / 4 | 2 / 2 | 6 / 6 |
| Honest | 4 / 4 | 1 / 2 | 5 / 6 |
| Go-getter | 3 / 4 | 1 / 2 | 4 / 6 |
| Funny | 3 / 4 | 2 / 2 | 5 / 6 |
| Neat | 3 / 4 | 1 / 2 | 4 / 6 |
| Curious | 3 / 4 | 2 / 2 | 5 / 6 |
| Sporty | 3 / 4 | 1 / 2 | 4 / 6 |
| Trustworthy | 2 / 4 | 1 / 2 | 3 / 6 |
| Social | 1 / 4 | 2 / 2 | 3 / 6 |

### *Inventions and Parental Discussion*

Session 1

Children created four artefacts individually in part 3 of the first session. Two artefacts can be seen in Figure 9 and Figure 10 to give an example of what these inventions looked like. The four inventions are: i) a stuffed animal that encourages literacy, ii) a tablet that distorts words to give someone the experience of having dyslexia, iii) a pencil that makes someone without dyslexia purposefully make spelling mistakes, and iv) a lock which, once opened, explains dyslexia. When looking into specific features of the inventions, one had (emotional) support animals as a primary feature, and two had animals as a secondary feature. Half of the inventions could let others experience dyslexia, and the last one had the primary feature of explaining dyslexia to others.

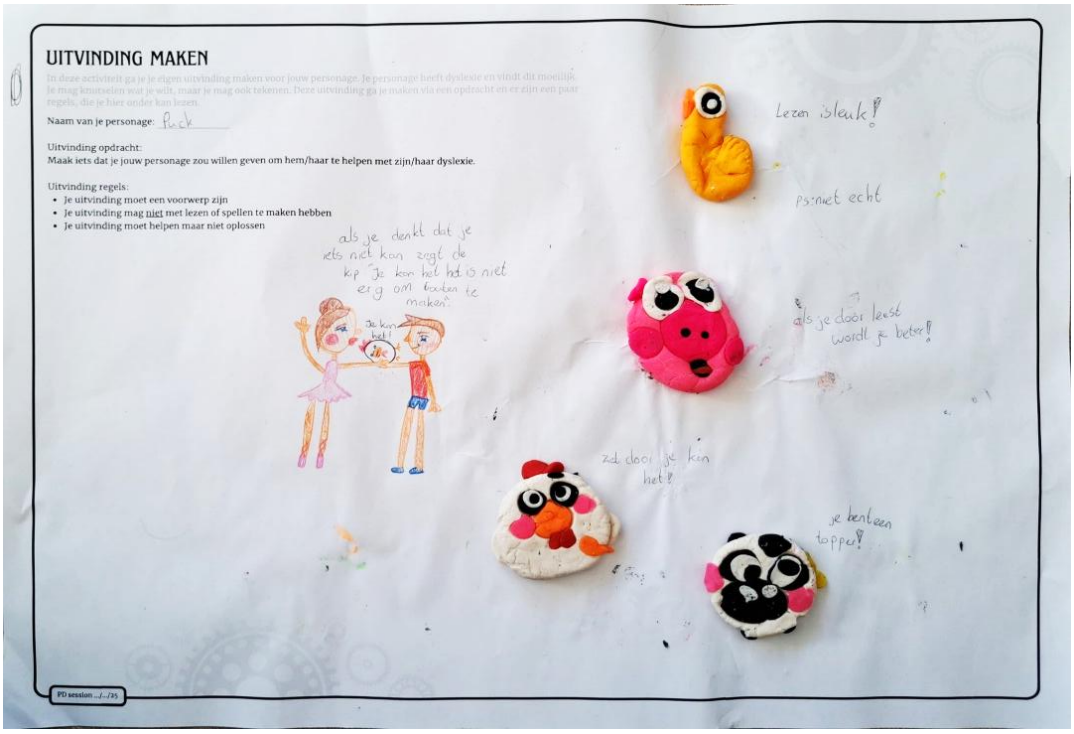



*Figure 9 One of the six artefacts created by a CP during part 3: inventing in the PD sessions*

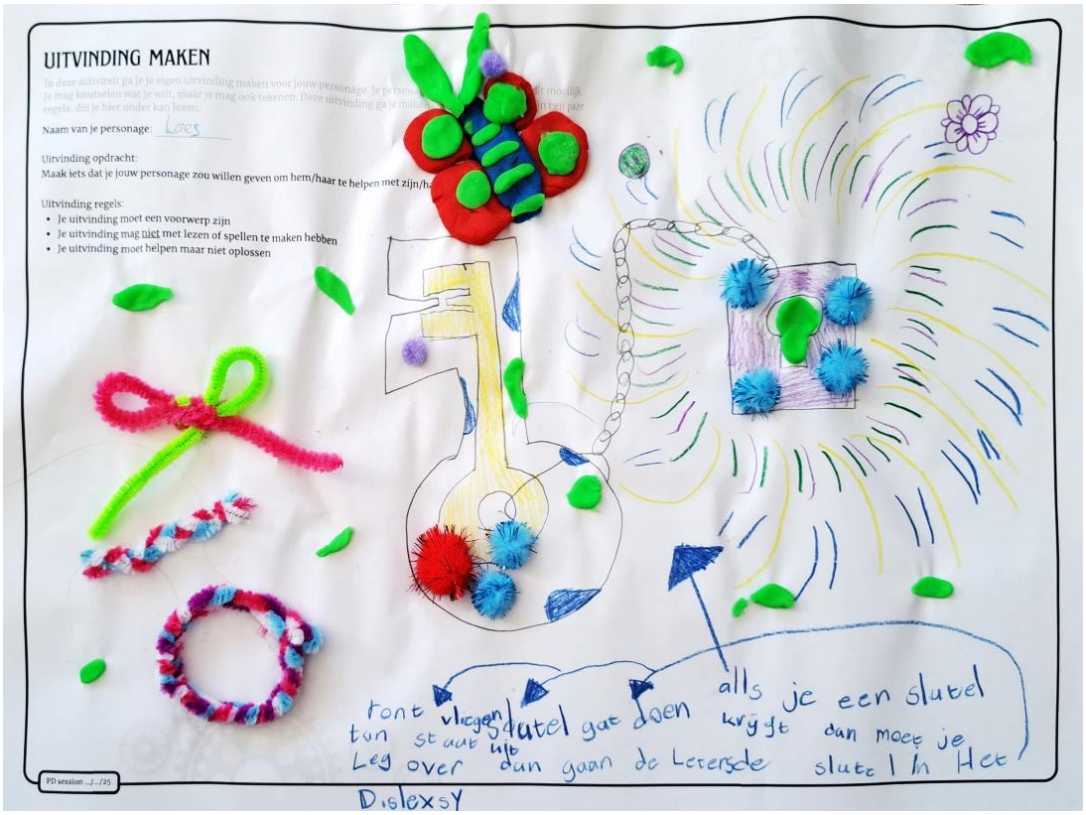



*Figure 10 One of the six artefacts created by a CP during part 3: inventing in the PD sessions*

Looking at the four individually made artefacts by the APs, there was a pattern of personally accepting dyslexia at the age of 20 while still having to deal with the effects of having it. When collaborating, the APs decided that one of the main negative influences of dyslexia was that everything goes slower (e.g. reading, writing) and that more work needs to be put in by a CwD. Next to that, they found that children get labelled with dyslexia and might feel ashamed (e.g. when reading out loud, having to explain dyslexia). However, they found a countering positive influence: that it cannot be physically seen if someone has dyslexia and that the children do not "feel" the label as much yet. Other notable positive influences are getting extra time and excelling at non-literacy skills. They also ranked the positive impacts as more important than the negative impacts and were somewhat inconsistent with what were internal and external influences. The possible solution for the internal influences was to put less societal focus and lower demands on literacy and for external influences, not placing people and disorders in boxes.

### Session 2

The children made two invention artefacts in the second session. Both artefacts focused on how others viewed the intelligence of the persona, with i) one being a bracelet that let others believe the wearer to be very smart (this was also one of the examples given to the children) and the other ii) glasses that made others think the wearer had no difficulty remembering the alphabet. One of the children had created a second, nontangible artefact of a dinosaur that would speak encouragingly within the persona's mind.

The artefacts created by the APs were similar to the ones created in the first session. The negative influences are that everything goes slower and the importance of literacy in school is too high. However, compared to the first session, being different was more prominent within the negative influences. In contrast, in the first session, the APs believed the children did not see themselves as different. The positive influences were also similar, for instance, focusing on other talents and getting more time and help in school. One positive influence that was even more prominent in this session than in the first session was the importance of self-acceptance.

Furthermore, just like in the first session, APs had a difficult time thinking about the future influences on the life of someone with dyslexia. Once again, all positive influences were deemed notably more important than the negative ones. The possible solutions created to counteract the influences were for the internal influences to focus more on other talents, as dyslexia is only a tiny part of someone, and CwD should not compare their literacy skills to those of others (who do not have dyslexia). Moreover, the created possible solution for external influences is to understand dyslexia and its aspects and what kind of help and tools there are to use.

### 4.2.2 Outcomes Derived from Observations

*Conversational Notes*

The following section will discuss and quote things said by participants, with the children denoted with 'CP', Parents with 'AP' and the facilitator with a 'F'. The quotes used to demonstrate occurring themes were translated from Dutch to English. The original Dutch quotes can be found in Appendix B.

The essence of the participants' needs is not always captured in their artefacts and their explanations but also in the talks when they are creating [52]. The following quotes, Table 6, are from the children while making their invention and explaining their creation later on. Displaying the need for others to experience and understand dyslexia and also getting the right encouragement.

*Table 6 Quotes collected during the PD sessions demonstrating CPs' needs*

| | |
|---|---|
| F: | About the magic pencil: "Does it do anything else?" |
| CP1: | "No, I just want people to understand." |
| CP4: | "If you put the key in the keyhole, it explains what dyslexia is. Then that shows to friends and stuff. Then I do not have to explain it myself." |
| CP3: | "I am going to make a chicken that tells others not to be afraid to make mistakes." |
| CP5: | "I am now drawing someone else who now believes that my brother knows the alphabet" |
| CP5: | "My brother thinks of a dino who says you do not have to learn the alphabet." |
| CP6: | "I made Lois. She also has dyslexia, so I made a bracelet and when she wears it everyone says she is smart." |

The following quotes, Table 7, are from the second session, where the facilitator asked more questions and prompted more frequently to help the CP create their inventions.

*Table 7 Quotes collected during the PD sessions demonstrating prompting by the facilitator*

| | |
|---|---|
| F: | "What are you thinking about?" |
| CP6: | "What I can do." |
| F: | "First, think about what you want to help with? What do you have difficulties with yourself?" |
| CP5: | "Learning the alphabet." |
| F: | "What could you do with that?" |
| F: | "Can the dinosaur talk?" |
| CP5: | "I do not know." |
| F: | "Does it not say: you do not have to know the alphabet?" |
| CP5: | *happy* "yes!" |
| F: | "Do you already know what the bracelet will do?" |
| CP6: | "No" |

The parents discussed a variety of topics during part 3. These conversations were about the impact of RID's support, different tools used at school, flaws in society/school system self-esteem, and other talents. An interesting note on the conversation is how it was affected by one of the moms having dyslexia themselves, found to be very valuable by the other moms. All parents seemed to understand that their child currently is better at other non-literary skills, but some did not foresee this for their child's future. Notably, APs struggled to conceptualize the long-term future of CwD, possibly indicating a gap in awareness about the persistent nature of dyslexia-related difficulties. They also found it challenging to think of positive influences. These observations are reflected in the quotes in Table 8

*Table 8 Quotes collected during the PD sessions from the AP during part 3*

| | |
|---|---|
| AP2: | "Positive, a difficult one, on the one hand, nice that it is known, but otherwise not positive itself" |
| AP2: | "In high school, it might be a bigger thing to tell others that you have dyslexia." |
| AP2: | "Later seems easier to me because then you might be less bothered by it." |
| AP1: | "Not quite. Everyone always keeps correcting you." |
| AP3: | "And what is the positive then at a later age?" |
| AP2: | "Acceptance?" |
| AP1: | "Well, not necessarily, but I thought creativity, which is much more common among children with dyslexia, I think." |
| AP3: | "Focus should be internally less on school performance, but more on other qualities and other things." |

The following quotes, Table 9, from the closing part of the session elaborate on the previous findings. APs primarily commented on the creativity displayed by the children and the value of connecting with other parents. One key observation was the children's differentiation between "normal children" and "children with dyslexia," indicating a self-perception of being outside the norm.

*Table 9 Quotes collected during the PD sessions from APs at the closing of the sessions*

| | |
|---|---|
| AP4: | "Nice to observe. What strikes me is that children talk about children with dyslexia and normal children. Everyone just is normal. Somewhere, we are all put in a little box, and it is good that there is research and that they do not have to feel different from anyone else." |
| AP2: | "I hope there will be something to make it easier for the children. That it becomes a bit more normalized." |
| AP3: | "Very nice to talk about it with others. You will continue to work on it throughout your life. I thought when you are young, it is difficult, but when you get older it is all under control, but that is very different from what I thought." |
| AP6: | "Nice to think on it like this, especially about the future. I do not know exactly how it will go, but good to think about what could happen." |
| AP5: | "That you collectively think about what has the most influence and what is the most important. Accepting yourself and that it is normalised for others as well." |

## 4.3 Ideating Possible PE Tools

Besides establishing design requirements, the PD sessions also provide ideation for expanding a dyslexia PE tool. In Table 10 below, all created ideas are listed. Not all ideas are realistic and plausible. However, as found in the next chapter, they could still be used as inspiration when the concepts were created in the prototyping phase.

*Table 10 Overview of ideation created by the participants of the PD sessions*

| | |
|---|---|
| Created by CPs | A stuffed animal that encourages when experiencing literacy difficulties. |
| | A tablet that distorts words to give someone the experience of having dyslexia. |
| | A pencil that makes someone without dyslexia purposefully make spelling mistakes. |
| | A lock which, once opened, explains dyslexia. |
| | A bracelet that lets others believe the wearer to be very smart. |
| | Glasses that made others think the wearer had no difficulty remembering the alphabet. |
| Created by APs | A tool that helps put less societal focus and lower demands on literacy. |
| | A tool that helps with not placing people and disorders in boxes. |
| | A tool that helps with focusing more on other talents and not comparing literacy skills. |
| | A tool that helps with understanding dyslexia and its aspects better, as well as what kind of help and tools there are to use. |

## 4.4 Interpretation and Translation to Design Requirements

It is understood from the outcomes of the session that children struggle with explaining dyslexia to others, feel not fully understood, want encouragement, and want not to be seen as stupid. From this point onwards, these needs will be referred to as the 3Es (Explaining, Experiencing and Encouragement). From the APs' artefacts and quotes, it is understood that they might underestimate the self-image of the children, that they struggle with imagining what life with dyslexia can look like and that they do not like the way dyslexia, as a label, is put into a box by society.

# 5. Prototyping: Creating a Tool

This Chapter is the first one in the prototyping stage. The first subchapter gives an overview of all the requirements found in previous chapters, as well as new ones. Afterwards, possible concepts and the final concept of a card deck are discussed.

## 5.1 The Design Requirements

To ensure the concept reflects the findings from literature and the PD sessions, all prior research was interpreted and translated into design requirements in Chapters 3.2 and 4.4. Table 11 restates these design requirements, and use and implementation requirements are added. These requirements are the answer to the how in the research question.

*Table 11 Overview of the requirements created in the previous chapters and new ones using the MoSCoW method.*

| Function | Requirement | Must/ Should/ Could |
|---|---|---|
| Theories outcome | | |
| The tool … | | |
| Supports self-efficacy in communication. | Must develop confidence in expressing their thoughts and Feelings. | Must |
| Supports autonomy through independence. | Should contain advocacy methods to teach children to take responsibility for their well-being by actively participating in decision-making. | Should |
| | Should give empowerment to children through PE programmes so that children feel able to steer or contribute to their treatment. | Should |
| Supports connectedness and understanding. | Must have elements that allow children to feel understood by, build trust between and improve relationships with family, teachers, and peers. | Must |
| | Must promote mutual care and empathy and promote the idea of "When I explain something, I am heard and taken care of." | Must |
| Support in the empowerment of attribution. | Should instil the belief: "If I get help, it is because I stood up for myself." Ensuring that children attribute their progress to their own efforts, creating a positive feedback loop that builds resilience. | Should |
| PD session outcomes | | |
| The tool …. | | |
| Includes at least one of 3Es. | Must have an element of encouragement, explaining, or experiencing dyslexia. | Must |
| Emotionally connect with children. | Could include at least one animal-related element. | Could |

| | | |
|---|---|---|
| Usability for Children | | |
| The tool …. | | |
| Is suitable for children with dyslexia, aged seven to thirteen years. | Must have minimal use of literacy | Must |
| | Should have dimensions no larger than 15x15x15 cm | Should |
| | Must weigh under 500 grams to ensure easy handling by children. | Must |
| | Could have a feature that allows the child to personalize it in some way (e.g. colour choice, modular parts). | Could |
| Usage is intuitive. | Must be understandable how to use the artefact without written instructions. | Must |
| Is durable. | Must be handled at least 50 times | Must |
| Implementation | | |
| The tool …. | | |
| Expands on the current PE program of RID. | Must not be the same as the current PE on dyslexia (at RID). | Must |
| | Should be implemented after completing the PE phone application app from RID. | Should |
| Can be used independently. | Must have no explicit need for assistance from a professional. | Must |
| Can be produced. | Must be manufactured by RID or easily through outsourcing. | Must |

## 5.2 Creating Tool Concepts

Using the ideation of the inventions of the PD sessions, they were first directly translated into concepts. These concepts ranged from an animal plushie with an audio element with encouraging sentences to an app that kept changing everything typed and a display that explained dyslexia.

In Figure 11, four concepts can be seen. These concepts are i) a teddy bear that also has dyslexia and says encouraging things, ii) a keychain that also says encouraging things with QR code stickers inside that explain dyslexia through a video, iii) two see-through cards that can be put on top of text mimicking dyslexia difficulties and iv) a test with made-up spelling rules that make it harder to read and write for someone without dyslexia. Digital concepts like a phone application or a VR experience were also explored but yielded no suitable results.

Only one or two of the three needs expressed by CwD was addressed per concept. This led to the final concept of a card deck, combining different components from the mentioned concepts and addressing all 3Es.

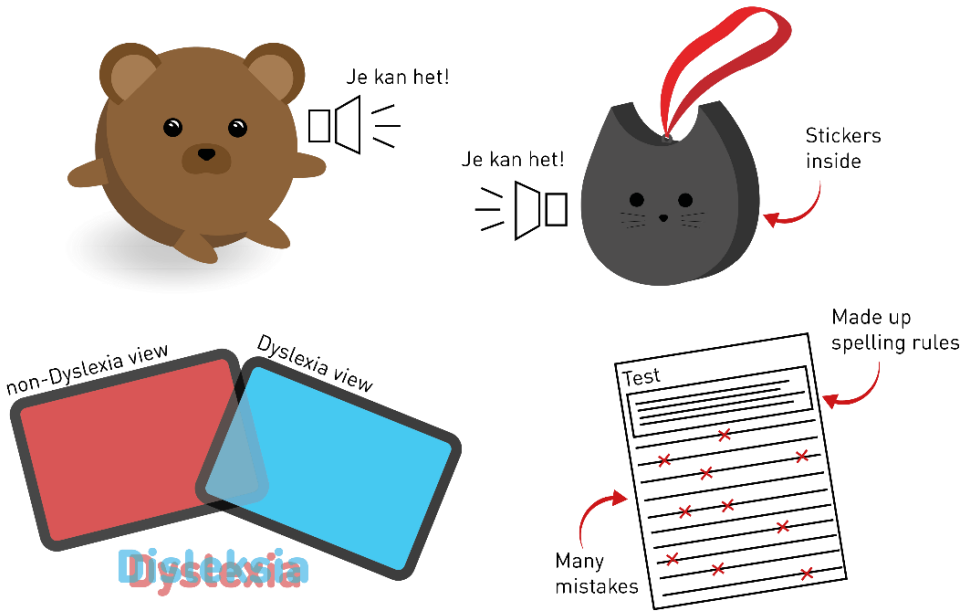



*Figure 11 Four tool concepts created, inspired by the ideation found in chapter 4.3*

# 5.3 The Final Concept

## 5.3.1 Why cards?

### *Requirements and the 3Es*

A card deck facilitates the combining of information and ideas that would typically be hard to combine [54]. It allowed for many different cards and content, resulting in a higher chance for at least one card to resonate with a CwD. Different cards can connect to different dyslexia types and needs, seeing that dyslexia is a heterogeneous disability. CwD can prefer cards over others and decide which they want to use and which to disregard.

Looking at the requirements, a card deck satisfied the set physical properties, making it easy for CwD to bring them with them. This size constraint on the cards also helped with reducing literacy in the cards as space was limited. A card deck should also satisfy the durability requirement as cards are created to be touched and handled whilst staying in usable conditions.

### *Visualization*

When communicating, people need to ground their understanding, which means they must confirm that they are thinking about the same thing [53]. This grounding is more easily established, faster, and more accurate if people share the same visual context or reference than when it is exclusively explained verbally. A visual representation reduces mental and social strain as well as ambiguity. The card deck should help with having conversations about dyslexia for the user and their environment by introducing visual representations.

### *RID*

When looking at products commercially offered by RID, there are multiple card boxes and one card deck [54]. The card boxes and the deck they currently sell are unrelated to PE. Adding a PE card deck would, therefore, add to the diverse support RID offers in the form of cards. It

will also make integrating a new card deck on PE easier, as they have an existing manufacturer and online distributor.

The card deck concept also introduced the opportunity to further explore the design and its possibilities with CPs connected to RID through co-creation. When having people participate in a design process and having to create something themselves, it is easier when they understand the medium they work in [55]. It is assumed that every participant in the co-creation understood what a card deck was and had seen and/or held cards before.

### 5.3.2 The Card Deck

The card deck, similarly sized to regular playing cards (56mm×87mm), is split into four categories. The categories need to be clear through the design of the cards. Therefore, before some example cards were made in the different categories, possible graphical designs were explored, Figure 12. These designs were inspired by the existing RID cards [54], and the left design was chosen as the card template.

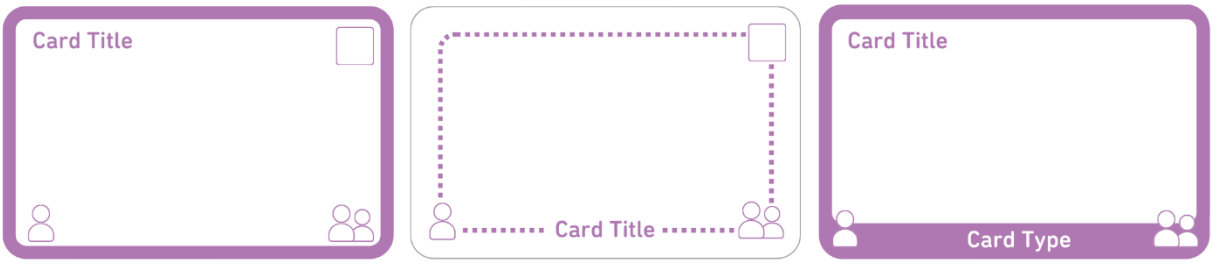



*Figure 12 Possible graphical design for the cards/card categories*

#### *Four Categories*

Explanation Cards

The explanation cards can be used by a child to explain or tell a fact about dyslexia to others or to learn one by themselves. Focusing on the part of PE to provide a better understanding of the disorder and the goal of increasing awareness.

Create Cards

The create cards can be used for children to give their own input into the deck. They have to create or answer something more personal to them than the general cards. They can be used either as reminders for themselves or to show and explain more personal things to others.

Experience Cards

The experience cards can be used by a child to let others experience dyslexia through reading and writing differently. Others experiencing dyslexia can lead to more compassion and understanding for the ones who have it [56]. Focusing on the PE goals of increasing awareness and improving communication and support

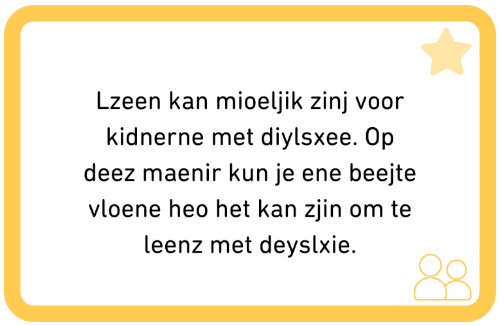
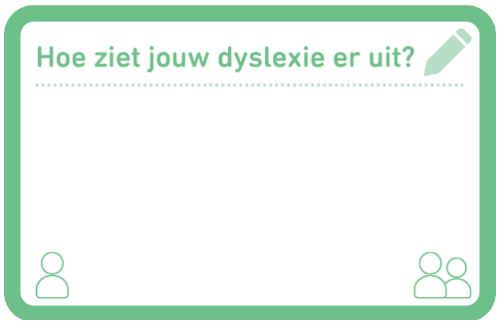
Encouragement Cards

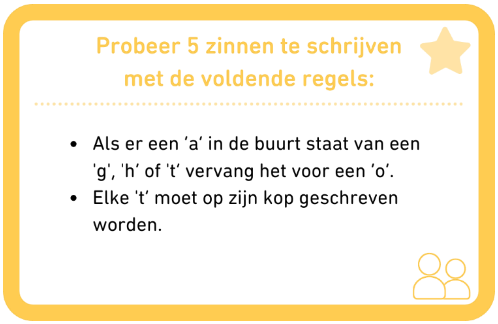
The encouragement cards encourage children to keep going and to persist through the use of motivational statements. The statements are mainly for the child to read themselves or for someone else to read to them but not to share with others. There are also cards containing questions to challenge children's negative thoughts. Focusing on the PE goals of fostering self-efficacy and self-acceptance.

### *The Example Cards*

There were seven example cards created as the final concept, as well as one card explaining the cards and a design for the back of the cards. This final concept represents a complete card deck addressing the 3Es. These cards and their explanation/intent can be seen in Table 12.

*Table 12 Overview of all the cards (not full-sized) created as a final concept and their explanations*

| Card | Explanation/Intent |
|---|---|
|  | The backside of all the cards |
| | The back of the cards is inspired by graphic design from the existing RID cards. Four categories are displayed through colour and a representative icon in the card's corners. |
|  | The card explanation |
| | This purple card explains how the card deck can be used, what the icons mean, and the idea behind the card deck. |
|  | Experience card |
| | This card scrambles letters within words. For some CwD, this is what it could feel like when reading. Inspired by the tablet that would scramble text created by one of the CPs in the PD sessions. |
|  | Create card |
| | This card is a create card where children can draw what dyslexia looks like to them, making it more personal and easier to talk about due to having a visual representation. |




Experience card

This card gives fictitious spelling rules that make it harder to write sentences. This hindrance is how a CwD could experience writing with the standard spelling rules. Inspired by the pen that makes spelling mistakes created by one of the CPs in the PD sessions.


Encouragement card

This card is inspired by the supportive farm animals created by one of the CPs in the PD session.



Explanation cards

These cards are explain cards with facts that are also used in the PE phone application from RID so that children are reminded and can share facts more easily with others. Sharing these facts with others might also help children not feel seen as stupid or different by others, like the creations by two of the CPs in the PD sessions.


Explanation card

This card has a QR code that links to a video about dyslexia created by RID. This way, children do not have to explain everything themselves, but they can let the video do it for them, like the lock created by one of the CPs in the PD sessions.

# 6. Prototyping: Distributed Participatory Design with Children and Experts

This chapter is the second one in the prototyping stage. The following subchapters discuss how the prototyping was done remotely by children and experts. Children and experts connected to RID were asked through a survey to give feedback on the seven prototyped cards and to create cards themselves, resulting in numerous useable card suggestions.

## 6.1 The Survey Worksheet

Once the concept was established, more cards were created through co-creation with children and personnel connected to RID. As stated in Chapter 2.3 it is important to have children be part of the design process. Therefore, it was decided to have them assist in creating the final design of the tool, resulting in co-creating prototypes. This helped with further aligning the card deck with the user's needs. This co-creation was extended to include RID employees, referred to as expert participants (EPs). The co-creation is asynchronous DPD and was done remotely through a printable worksheet and a digital version combined into a survey, which can be found in Appendix C. RID distributed the survey to the participants.

Although DPD has several benefits in terms of convenience and flexibility, some limitations need to be taken into consideration [40]. As discussed before, doing PD with children is different from doing PD with adults, and this is also the case for DPD. Children may need to be assisted in the absence of the facilitator and must be able to use the selected remote platform. Furthermore, asynchronous DPD does not support in-the-moment idea-sharing and collaboration.

When creating a DPD session, researchers tend to fall back on personal preferences due to an overwhelming number of available choices, resulting in suboptimal outcomes [38]. Therefore, when the DPD method was developed, the most difficult aspects of not having the session in person were considered: technological accessibility, engagement, collaboration, tech support, data format, accuracy and authenticity, complexity and richness and security and privacy [38]. As well as using the Participatory Design online tool (PDot) [57]. This tool was developed to create web apps, but the six user requirements can also be applicable in other DPD sessions [39]. These user requirements are interactivity, annotation, creativity, collaboration, access and instructions [57].

### 6.1.2 Important Aspects

*Technological Accessibility*

It is important that the participants can easily participate in the DPD [38], [57]. Therefore, technological accessibility was considered for both CPs and EPs. Just like in part 2 of the PD session, parents were asked to function as proxies for the DPD. The start of the survey was addressed to the parents with the request to give literacy help to their child. The parents had to give informed parental consent for participation and then had to choose to either print or continue online. The EP also had to give informed consent to participate and then could select to either print out the worksheet or continue online. As the survey was directed to adults (i.e. parents of CP and EP), the survey technology available through a link to an online web browser was considered to be accessible.

*The DPD Visualization*

Engaging participants in a DPD session is more difficult than in a PD session [38]. Therefore, prototypes needed to be made interactive instead of static [57]. This interactiveness was challenging as the pre-made and the to-be-created prototypes were flat cards. To make the cards somewhat more realistic, they were scaled to the actual size in the worksheet. It is also important to have clear instructions for the participant without a live facilitator's presence [57]. The instructions in the worksheet were written with the CP comprehension level in mind, using short sentences and easily understandable words.

The participants should have the opportunity to be creative and the ability to annotate [57]. The participants could annotate all cards separately for both parts in both versions. The creativity was incorporated into the card creation part, where participants can draw and/or annotate to create a card. Allowing for creativity was more complicated in the online version, and participants were, therefore, allowed to hand in photos of drawn creations.

*Data Collection*

Data collection differs in DPD from PD; therefore, this was also an important consideration. Starting with data format, as DPD generates fewer data types and data complexity/richness, for instance, no (behavioural) observations can be made [38]. Therefore, besides textual responses, the pictures sent in by participants added to the data richness. The data collected through DPD tends to be more accurate as the participants directly fill it out. However, the authenticity could be lower than in a PD session [38]. This authenticity was especially a concern due to the use of proxies for the CPs. Therefore, the proxies were instructed not to interfere with the CP's answers. This absence of interference could not be validated due to a lack of physical presence.

Collaboration between participants in DPD is harder to facilitate, but it is nevertheless important [38], [57]. Due to how data was collected, participants had no opportunity to collaborate. Collaboration could have been achieved using a different platform for the card creation collaboration. However, this would have made the technology less accessible as these platforms are less commonly used. Furthermore, these platforms also introduce a higher security and privacy risk, as the collaboration board would be publicly accessible to anyone with the survey link. Therefore, it was decided to have the co-creation be done individually by participants.

### 6.1.1 The DPD Survey Method

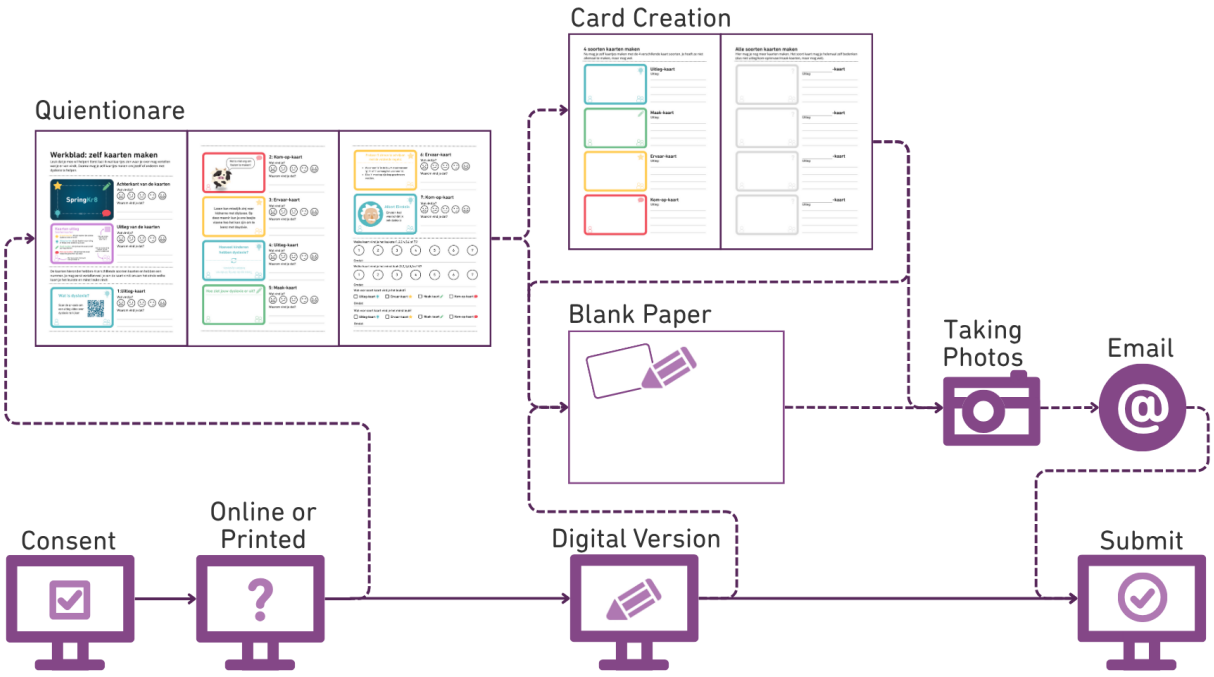



*Figure 13 Overview of the DPD survey method containing the worksheets*

Due to the used survey platform, the steps of the DPD survey are somewhat complex, as can be seen in Figure 13. The survey began with the participants (their parents) signing informed consent to their participation. Participants could choose within the survey to print out the worksheet or continue to a digital version, depending on their ability to print; however, the physical worksheet was recommended. Both versions will be referred to as 'the worksheet' from here on out.

To optimize participation, the worksheet started with a questionnaire on the cards designed to represent the final concept. The cards were ranked one to five (sad to happy smileys for the physical version and stars for the digital version), and the participants could explain why they gave this ranking. The first two cards shown were the back side of all the cards and the information card. Followed up with seven cards representing the four different categories. They were also asked to pick a favoured and least favoured card and card category. Once the questionnaire was completed, they were asked to create one card for every card category.

Finally, the participants could create four cards in either one of the categories and/or four in a new category they created themselves. They could create the eight cards, or how many they wanted to make, by either drawing the card in the template provided in the worksheet, on a blank sheet or by describing the card. The worksheet had, therefore, four pre-colour-coded empty cards and four cards with a grey border and a question mark icon in the corner. When completing the worksheet, participants were asked to send out their survey and pictures of additional drawings through email, when applicable. The survey results were used to develop the card deck further and adjust the pre-designed cards.

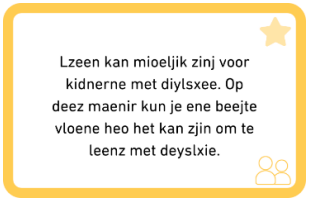
## 6.2 Analysing Outcomes of the Survey

The co-creation survey was available for two weeks and was filled out by six children (three online, three photo submissions) and nine employees from RID (six online submissions, three submissions through the brainstorming session).

### 6.2.1 Questionnaire

The results of the questionnaire part were combined and examined in Table 13. The main overall feedback was that it was unclear what was meant by children using the cards by themselves or with others. Nevertheless, the participants found the cards to be a good conversation starter and that they positively displayed dyslexia. Appendix D contains more information on the most and least liked card and card type by CPs and APs.

*Table 13 Feedback results and average grade (on a scale to 5) per card and card category, from the questionnaire portion of the DPD*

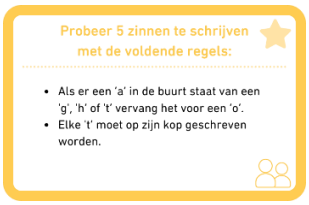
| Card | Feedback | |
|---|---|---|
|  | - Represents the categories and RID well.<br>- Colours well received. | |
| | CP avg grade: 4.0 | EP avg grade: 4.5 |
|  | - Clear.<br>- However, too busy, too small font size and too long sentences. | |
| | CP avg grade: 4.17 | EP avg grade: 4.38 |
|  | - Boring design.<br>- Dyslexia could be explained on other explain cards through pictures.<br>- Good that dyslexia is explained. | |
| | CP avg grade: 3.67 | EP avg grade: 4.0 |
|  | - CP loved the animal, and the message.<br>- Most EP did not like/understand the animal and thought the message should be explained.<br>- The red colour might be received as negative.<br>- Least liked card by APs | |
| | CP avg grade: 4.17 | EP avg grade: 3.63 |
|  | - CP commented that now others could experience what they experience.<br>- EP liked the idea, but some questioned if it was difficult enough.<br>- Most liked card for both CPs and APs | |
| | CP avg grade: 4.67 | EP avg grade: 4.38 |


- It is nice that there is a fact.
- The distribution of 2:30 is complex to imagine.

| CP avg grade: | EP avg grade: |
|---|---|
| 3.33 | 4.25 |


- Too complex and vague.
- Some CPs liked that they could be creative but disliked that the card was for one-time use only.
- Least liked card by CPs

| CP avg grade: | EP avg grade: |
|---|---|
| 3 | 4.38 |




- Unclear to some CPs that this was something to let others do and very much disliked doing this themselves (the ones who did understand liked it).
- EP had suggestions to add example sentences, only have one rule introduced and add a time-constrained.

| CP avg grade: | EP avg grade: |
|---|---|
| 2.83 | 4.25 |


- It is well known (maybe too known).
- More information could be added.
- A good message of becoming whatever you want.

| CP avg grade: | EP avg grade: |
|---|---|
| 4 | 4.25 |

| Card Type | General Feedback |
|---|---|
|  | - Fun to learn more about dyslexia.<br>- Found to be boring by some CP (EP: maybe boring but important). |
|  | - Mixed reactions: The task is too complex and it can only be used once.<br>- Least liked type card by CPs |
|  | - Very well received.<br>- Now people can also experience dyslexia.<br>- Most liked card type for both CPs and APs |
|  | - Received well by CP.<br>- Suggestions from EP:<br>- Good idea, but it could be more positive and challenge negative thoughts.<br>- There is no 'play' element. |

### 6.2.2 Cards Suggestions

The outcome of the creating part of the survey is collected in Table 14 and Table 15. The suggestions are numbered to be cross-referenced with the final design in Appendix E.

*Table 14 Overview of card suggestions made by CPs*

| Type of card | Nr. | CP suggestions for cards |
|---|---|---|
| Explain | 1.1 | Explanation of what dyslexia is |
| | 1.2 | "math is hard, and spelling and language as well for children with dyslexia." |
| Experience | 1.3 | Mixing letters in a text |
| | 1.4 | The font size is tiny, so it is harder to read |
| | 1.5 | "take care of yourself" (misread that the card was on danger, not on encouragement: 'ervaar' -> 'gevaar') |
| Make | 1.6 | "Draw a story in smileys." |
| | 1.7 | "Draw your house/home." |
| | 1.8 | "Draw anything you want." |
| Encourage | 1.9 | "Keep persisting." (said by a pig) |
| | 1.10 | "you can accomplish everything." |
| | 1.11 | "you cannot be good at everything." |
| | 1.12 | "do not listen to people that want something of you." (explained that they might ask you something you do not know the answer to) |
| | 1.13 | "Stand up for yourself and stand tall." |
| | 1.14 | "I am unique and shine in my own way, I can always ask for help, I am proud of myself, I learn something new every day, I listen to my feelings."[4] |

[4] Derived from affirmation cards owned by the CP from Praktijk KIK [58]

*Table 15 Overview of card suggestions made by EPs*

| Type of card | Nr. | EP suggestions for cards |
|---|---|---|
| Explain | 2.1 | "If your mom and dad have dyslexia, do you have a higher chance of having dyslexia?" |
| | 2.2 | A card on what it means to them to have dyslexia, letting children explain |
| | 2.3 | Facts on heredity, intellect, etc. |
| | 2.4 | Dyslexia has nothing to do with intellect |
| | 2.5 | Two lines: one straight, one bent, with the explanation that this is what dyslexia is like in the brain |
| | 2.6 | "You are not stupid." (said by an owl) |
| | 2.7 | Add an existing video made by RID where children talk about reading becoming fun again |
| Experience | 2.8 | Text without spaces |
| | 2.9 | Reading through a perforated hole |
| | 2.10 | Reading non-existing words with a time limit |
| | 2.11 | A dictation in a foreign language |
| | 2.12 | When reading a difficult text, the other person is instructed to interrupt you constantly, e.g. by saying, "You have to read faster." "Have you read that word correctly?", "Read that piece again?", And then ask afterwards what the text was about |
| | 2.13 | Reading a text with swapped b/d/p |
| | 2.14 | Read a text out loud with non-existing pronunciation rules |
| Make | 2.15 | "Create your own word with lots of letters." |
| | 2.16 | "Help me by doing…?" to be filled out or picked from different pre-made options |
| | 2.17 | "Make a mind map about dyslexia." |
| | 2.18 | "Everyone has their talents. What are yours?" |
| | 2.19 | Make the smiley complete (draw the emotion in the face), "How do you feel when…?" |
| | 2.20 | "Draw what you are proud of." |
| | 2.21 | "Draw your best quality." |
| | 2.22 | "Make a list of things you are good at." |
| Encourage | 2.23 | "Name three things you are good at." |
| | 2.24 | Think together with someone on negative things and challenge these |
| | 2.25 | "It is okay not to know something." |
| | 2.26 | "Trying never fails." |
| | 2.27 | List of qualities a child can encircle three to attribute to themselves |
| | 2.28 | "If you practice, you will learn new things." |
| | 2.29 | "I am not stupid." |
| | 2.30 | Ask three people what you are good at |

*Brainstorming Session*

Three EPs, from the survey participants, were part of a physical brainstorming session. This brainstorming session was held at the beginning of the two-week DPD survey period. As the EPs filled out the questionnaire portion individually, the results were added to the overall results in Chapters 6.2.2 above. After the EPs had filled out the worksheet, there was a collective brainstorm to make possible card suggestions in every category. This brainstorming was done by having discussions and making/placing sticky notes. The outcome is summarised in Table 16, found below. Two general comments were on explaining the encouragement cards more in-depth and creating cards that focus more on children's personal talents.

*Table 16 Overview of card suggestions that were created during the brainstorming session*

| Type of Card | Nr. | Suggestions for cards from the brainstorming session |
|---|---|---|
| Explain | 3.1 | Clarify with/use a metaphor |
| | 3.2 | Dyslexia does not mean you are stupid |
| | 3.3 | "Is everyone with dyslexia stupid?" *flip the card* "Intelligence has nothing to do with dyslexia." |
| | 3.4 | Examples of people who are currently famous with dyslexia (e.g. YouTubers) |
| | 3.5 | Drawing of a big circle "me" with a dot in it "dyslexia" (I am much more than just dyslexia) |
| Experience | 3.6 | Nonsense/made up words dictation with time pressure |
| | 3.7 | Swapping b/p/d in text |
| | 3.8 | Use △= 'ie', □= 'au' etc. in a sentence |
| | 3.9 | QR code of distorted audio (vowels) that have to be written down |
| | 3.10 | QR code to video of moving text |
| Make | 3.11 | "What are your superpowers?" |
| | 3.12 | "Dyslexia?" Drawing of a thought bubble |
| | 3.13 | "This is what I am proud of:" with writing lines |
| Encourage | 3.14 | A diagnosis is not your personality |
| | 3.15 | "You cannot do more than your best." |
| | 3.16 | Emphasis on not being stupid |
| | 3.17 | "Ask dad/mom what you are good at/what your qualities and strengths are." |
| | 3.18 | "What happens when you make a mistake?" *flip the card* "nothing!" |

# 7. Prototyping: The Final Design

This chapter is the final one in the prototyping stage. The chapter explains the aspects of the whole card deck of 54 cards prototyped and the four created card categories. Furthermore, the packaging design and the deck's name are explained, as well as some market research.

## 7.1 The Card Deck

In total, 54 cards were created based on the outcomes of the two PD sessions and the DPD. Four purple cards were created to introduce the concept and the use of the deck. All cards with detailed explanations can be found in Appendix E. However, to give an impression, nine of the cards can be seen in Figure 14.


*Figure 14 Depiction of nine of the 54 cards created as the final design*

Besides the four categories, the cards can further be divided into subcategories. Table 17 provides an overview of these subcategories, which will be explained in more depth below.

*Table 17 Overview of the four card categories, their subcategories and the amount of cards.*

| Category | Subcategory | Amount of cards |
|---|---|---|
| Explanation cards | Explaining dyslexia cards | 6 |
| | Questions and answers cards | 6 |
| Create cards | Drawing/writing cards | 7 |
| | Personal Qualities cards | 4 |
| Experience cards | Reading challenge cards | 8 |
| | Rule cards | 6 |
| Encouragement cards | Questions and answers cards | 5 |
| | Ask someone cards | 2 |
| | Animal encouragement cards | 6 |

### 7.1.1 Explanation Cards

The explanation cards are blue and are denoted with a light bulb icon representing ideas and understanding. The cards were split into two categories: cards explaining dyslexia and Q&A cards containing dyslexia facts.

#### *Explaining Dyslexia Cards*

As multiple CPs in the DPD noted that they liked to have dyslexia explained through cards, this category was added. The cards explain in simple terms that the brain of a CwD is somewhat different from that of people without dyslexia. Explaining that some things go slower, that reading and writing can be difficult, and that it has nothing to do with intelligence. The last card explains that dyslexia is only a small part of a person and that they are so much more.

#### *Questions and Answers Cards*

This subcategory contains interesting facts so that CwD and their environment can learn more about dyslexia. The specific facts were chosen to let CwD know they are not alone and can be smart in their own way.

### 7.1.2 Create Cards

A green colour and a pencil icon denote the create cards. The category was also split into two categories: cards that allow for drawing or writing and cards where personal qualities needed to be coloured in.

#### *Drawing/Writing Cards*

The subcategory has the most variety of cards compared to the other subcategories. Some cards were added to make personal dyslexia representations to convey to others. Other cards were added for the CwD to have fun and make the deck their own (e.g. a story written only in smileys, removing literacy). Two cards were added to help focus on positive things (e.g. being proud and having superpowers).

*Personal Qualities Cards*

This subcategory serves as a reminder of the children's good qualities. Based on The RID PE phone application, children can attribute or create positive personality traits. These personality trades were also part of the persona creation in the PD sessions.

### 7.1.3 Experience Cards

A yellow colour and a star icon denote the experience cards. The category was split into: cards containing reading challenge cards and cards containing pronunciation, spelling and time rules.

*Reading Challenge Cards*

This subcategory consists of a variety of visual representations of dyslexia. As dyslexia is not a homogeneous disorder [2], visual representation cannot be represented in one card. Therefore, these cards were created so that CwD could decide for themselves which card represented their dyslexia the best or a combination of cards.

*Rule Cards*

This subcategory lets the CwD environment experience a different side of having dyslexia than the other experience cards. As CwD have difficulties with the phonological aspect of language, which affects the ability to recognize and manipulate the sound structures of words [3], rules were created to imitate these difficulties. These four rule cards attach other letters to letters and sounds making writing something simple or reading aloud increasingly more difficult. A fifth card was added to emulate the stress of time constraints and needing high levels of focus, introducing time constraints and instructions to distract the person doing the experience. The sixth rule card explains how to use the rule cards in four steps.

### 7.1.4 Encouragement cards

The encouragement cards are red and are denoted with a speech bubble icon containing a heart, representing love and kindness. The category was split into three categories: Q&A cards containing questions to challenge children's negative thoughts, cards where the child is instructed to ask loved ones questions, and cards containing depictions of animals saying encouraging things.

*Questions and Answers Cards*

This subcategory contains questions to challenge negative thoughts so that CwD can more actively work towards a positive attitude toward dyslexia. The specific questions were chosen to be positive but also correct negative ideas (e.g. making mistakes, asking for help and being different). This was done because challenging negative thoughts was common feedback from the EP in the DPD.

*Ask Someone Cards*

This subcategory was also added due to occurring notes from EP. With these cards, a CwD needs to ask loved ones what makes them special and what they are very good at.

*Animal Encouragement Cards*

The final subcategory contains depictions of animals paired with encouraging sayings. Four out of the six sayings are directly based on suggestions from CPs. The animals were chosen to be common pets or farm animals, to be familiar to the children.

## 7.2 The Deck's Packaging

The packaging of the card deck is based on the packaging of the existing RID card deck, adjusted to reflect the cards. The packaging can be seen in Figure 15 below.

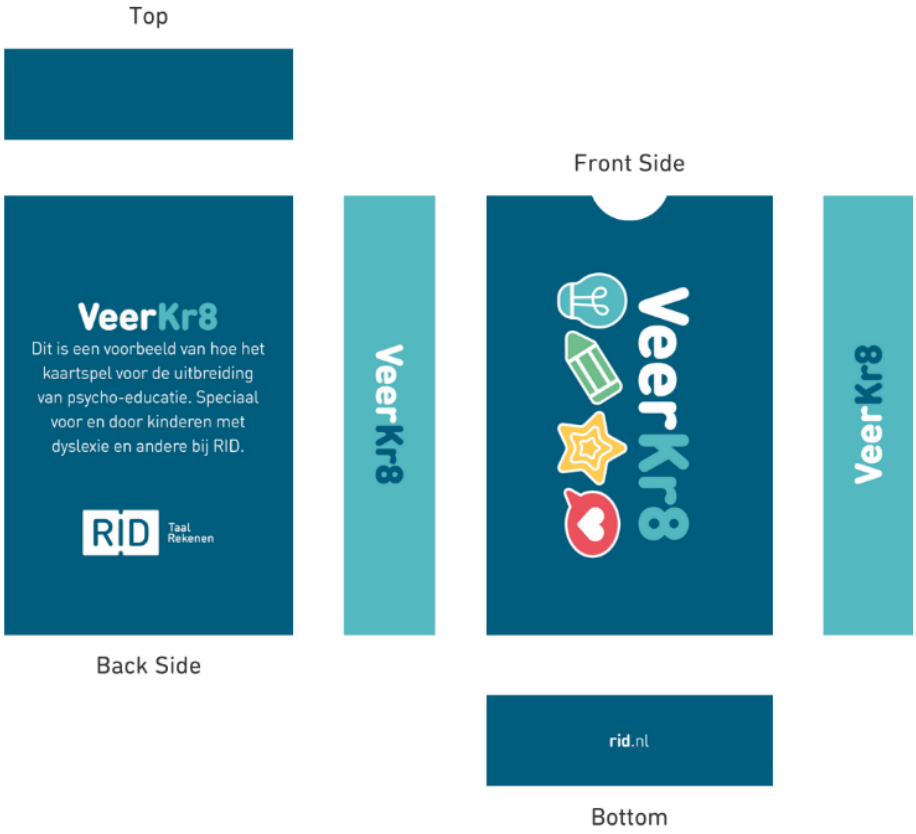



*Figure 15 Depiction of the design of the packaging of the card deck*

### 7.2.1 The Deck's Name

RID has their products/programs names ending in kr8 (translation: "power"). The cards could have been named the same as the PE phone application, namely GroeiKr8, meaning the power to grow. However, a new name was decided upon, VeerKr8, which translates to the power of a spring. This name embodies endurance and the ability to bounce back, which is what children get the support to do with the help of the card deck.

## 7.3 Analysing Market Research

### 7.3.1 Dyslexia Cards

The British dyslexia association has created dyslexia discussion cards [59]. These cards consist of six question cards that aid class discussion about dyslexia. The designed cards somewhat attempt to do the same in aiding the discussion and conversation on dyslexia. However, this was not achieved through open-ended question cards but through collective learning and (visual representations of) a dyslexia experience.

### 7.3.2 Dyslexia Experience

Multiple dyslexia simulations can be experienced, mainly online and even live experiences for teachers. The online simulations are mainly disturbance of text through different means, like removing spaces, scrambling letters, swapping words and restricting view [60], [61], [62]. There is also a Dutch book that allows for a dyslexia simulation, combining the experiences and difficulties of many people who have dyslexia [63]. None of these experiences touches on the writing aspect of the literacy difficulties, besides the live simulations designed for teachers [64], [56]. These live simulations moved the participants towards a more empathetic view of dyslexia, with more patience and encouragement [56]. The downside to these live simulations is that they are not publicly available and are logistically more difficult and expensive.

There seems to be no dyslexia experience in card form. By incorporating experience cards, on both reading and writing, into the deck, the goal was to initiate a move towards more empathy and patience similar to the before-mentioned experiences. The main difference is that CwD can initiate this themselves by using the card deck and that they incorporate writing aspects.

### 7.3.3 Encouragement Cards

Cards with encouraging statements for children seem to be nothing new. Some examples are the Dutch *EigenWijsjes* and *KIK Affirmatiekaarten*, with (animal) pictures and an affirming statement (e.g. I believe in myself, I am strong) [65], [58]. These cards are, however, not tailored towards CwD. The Neurodiversity Education Academy does have Dutch cards that focus on checking in on mental health (specifically for children) and personal strengths question cards tailored towards people who are neurodiverse [66], [67]. The designed cards were similar to the existing cards with animal pictures and affirmation statements, and this was done based on the invention created in one of the PD sessions. In addition to the encouragement cards, create cards focusing on strengths and talents were also added to the deck. Finally, there were also encouragement cards created challenging more negative thoughts through question cards added to the deck which is not in any of the existing card decks.

# 8. Testing: The Implementation of the Design

This chapter is the only one in the testing phase. The following subchapters are on how the card deck was tested. Children were sent a physical card deck to test and give feedback. Resulting in possible improvements and a recommended usage and implementation of the card deck.

## 8.1 The Testing Procedure

To see if the cards could be successful, they needed to be tested by the users. With children functioning as testers of technology, the focus is more on whether it meets the design goals rather than on education and future directions[34]. This focus results in a better understanding of more immediate issues: Whether the technology is understandable, what is liked and disliked if children can learn from the technology, and what is wrong with the design. It is recommended that children understand the testing task at hand and are familiar with the surroundings [68].

Four physical decks were created and distributed to CwD to test the card deck. These children had also been part of the PD session participants. They got two weeks to test and use the cards and were interviewed afterwards. This test setting allowed them to use and test the cards within the intended use environment (e.g. at home or school) and with people they knew. The deck was distributed through a mail parcel and contained instructions on how to test it. The children were asked to test the cards with a family member, a teacher and/or a peer/friend, preferably all three. No further instructions were given as part of the test was the understandably of the standalone deck. The final interviews were held through a video call with one of their parents present.

### 8.1.1 Interviews

All four interviews started with pleasantries and ended by thanking the children and asking them how they felt about having participated throughout the design process. During the interview, the CwD were asked the same questions about the card deck and their experience. They were asked if the cards and their usage were clear, when and with whom they used them the past two weeks, how they reacted, and if they found it difficult to show to others. After these questions, they were asked about their experience with the cards. They were asked whether it was fun to use or felt like homework, what their favourite (type of) card was, their least favourite and if they would have liked to add something to the deck. Finally, they were asked if they wanted to continue using the cards and if they would recommend them to other CwD. Their parent was also asked about their experience with the cards and if they had gotten new insights into dyslexia because of it.

## 8.2 User Evaluations

The children seemed to have found it a fun experience, having been part of the design process and appeared excited to see their ideas and creations incorporated into the final design. The user evaluation per interview question topic is summarized below.

*Usage*

The deck was found to be overall well self-explanatory by all children, and when asked how they used it, it appeared to have been in line with the expected usage. However, two of the children were confused about how to use the five experience rule cards. Two of the children commented positively on the cards' colours and design.

*When/Who*

The children used the deck at home with their parents and other family members (sister, grandmother/grandfather). Some used the cards with a friend, and others showed them to their remedial teacher from RID. The children reported positive and interested responses from the other people. Furthermore, all the children looked at the cards by themselves and started making the create cards.

*Ease of Use*

When asked if it was easy to go up to people and start a conversation with the cards, all the children reported it was. Furthermore, all parents reported that other family members were interested, felt more connected and understood dyslexia difficulties better after using the cards.

*Enjoyment*

As children have weekly homework from RID, they were asked if the cards also felt like homework [30]. All four children said they enjoyed using the cards and did not feel like homework, especially the cards with others and the create cards.

*Liked Cards*

Three of the four children said their favourite type of cards were the create cards, with two mentioning a card where they have to make a story using only smileys specifically. The other child found the experience cards the best out of the deck, finding it funny to see others struggle with literacy. One of the children's favourite cards was directly inspired by their creation from the PD sessions.

*Disliked Cards*

When asked about their least favourite card, they all gave different responses. One of the children had no card (type) that they distinctively did not like. While another distinctively disliked one of the explanation cards but could not specifically give a reason as to why this was the case. The other two disliked a specific range of cards, the experience rules cards and the encouragement Q&A cards. The rules cards were disliked because the child thought they had to follow them instead of someone else. The Q&A cards were disliked because the child knew the answers to all the encouraging questions. Furthermore, the parents said the other Q&A questions were perhaps too similar to the ones in the RID PE phone application.

#### *Additions to the Deck*

None of the children could think of any additions to the card deck, and multiple parents commented on its completeness. When the children were asked if they would have liked to have more cards of a specific type, two answered with create cards, and the other two did not have an outspoken preference.

#### *Continue Usage*

All children reported that they would like to continue using the cards, particularly with their friends, as none had the chance to do so extensively before the interviews. They also seemed excited to bring them to school in the following weeks. Specifically, two of them looked forward to using them with other CwD, which had not been considered before in this research.

#### *Recommendation to Others*

When asked if they would recommend the product to other children with dyslexia, most said yes. Some even named specific CwD they knew would benefit from the cards. However, there was one child who was hesitant in their recommendation but could not address why.

#### *Parents Opinion*

All parents found that the tool helps with generating more empathy towards CwD. They appreciated the positive outlook on dyslexia; however, they thought the usage might be better suited soon after receiving the diagnosis. This way, the children and parents learn together, as the interviewees already knew a lot about dyslexia when they used the product. Two of the parents commented on whether the deck needed to be shuffled or not, and one parent said that the order of the deck provided a framework for better understanding the dyslexia of their child.

## 8.3 Design Recommendations

### 8.3.1 Intended Use

The card deck is intended to be used by CwD, aged between seven and thirteen, next to PE training. The card deck is not PE in itself and should not be used as such. It should be used by the children by themselves as well as with others. The children will encounter new people in their lives, like teachers and peers, leading to parts of the card deck to be used for many years.

When a child first receives the deck, the explanation and create cards are mainly for them to learn more and think about dyslexia. Afterwards, they can carry the deck with them, for instance, in their schoolbag, and take it out when they feel the need for encouragement or explaining dyslexia to others through the explanation and experience cards. If the cards work as designed, however, the user should have less and less need of them over the years, as they experience fewer secondary effects of dyslexia. In the end, the cards are no longer needed to encourage, teach, or as a conversation starter. Nevertheless, the experience cards could still make it easier for CwD to convey their literacy difficulties and could be used indefinitely.

### 8.3.2 Improvements

Three main improvements can be made to the deck. First, clarify the usage of the six experience rule cards or at least the explanation of the rules. This clarification would allow the cards to be used as intended and not cause frustration to the CwD when they try to use them themselves. The second improvement is to establish a clearer order in the cards. As the cards work best in the order they would arrive in, card numbering could be included in the cards' design. This numbering would ensure the cards are experienced in the order they were designed.

Finally, however not, an improvement to this deck is the creation of a standalone experience deck, as this is what the parents still seemed to find valuable to have even in the stage they were in and children wanting to show others. This split-off deck would therefore be applicable not only to CwD between seven and thirteen but also to older children and adults, without having the PE aspects of the other card categories in the deck.

### 8.3.3 Implementation

Although this thesis has come to an end, the research, design and ideas are left with RID. Who are able to do further research and make design changes when or if they are inclined to do so. The following part of is on the implementation of the cards within RID, if they would not make any changes to the deck.

The cards were designed to be in the same (file) format and cohere to the print limitations of the existing RID cards. This format allows for easy implementation, as RID could send the files to the same print company and distribute them similarly (granting that the print paper can be drawn on).

This distribution would preferably be to children after completing the PE phone application and could be gifted to them in one of their support sessions. This makes sure that the deck is available and gets distributed to the intended target user. Besides the children who are currently receiving support at RID, the deck could also be made purchasable through the online RID store where the other cards are bought. This purchasability would allow the PE extension to be commercially available for CwD in the Netherlands, as nothing like it is currently available. However, it needs to be made clear to the customer that the card deck is not PE but an extension of PE.

# Discussion and Conclusion

## Discussion

### Participants

As this thesis aimed to incorporate children's ideas and opinions into the design process, active participation from children was crucial. However, the number of participants was limited: only six children participated in the PD sessions, and six responded to the DPD survey. This small sample size restricted the diversity and range of perspectives included in the design process. The final design was shaped by both the insights of the participating children and findings from literature. Still, the limited number of participants means that the design may not reflect the broader population of CwD.

Despite having less interaction, the DPD provided great insights into the usability of the cards as well as the content of the rest of the cards. It was expected that the DPD would allow for more participants as it was not location and time-bound. This increase in participants did not happen as the same amount of CPs participated in the PD sessions. Nevertheless, the CPs' input was insightful and valuable in making and improving cards for the final card deck. The insights from the EPs also provide interesting ways to develop the deck further. However, besides the EPs participating in the brainstorming session, none of the EPs created drawings, making their textual input more widely interpretable.

The parents of the CPs seemed to have functioned well as proxies, and clarification notes were written where necessary. However, the way in which and to what extent the proxy (unknowingly) influenced the answers remains unknown. All participants seemed to have understood the intended purpose of the worksheet as they all filled it out as expected. Although the worksheet was designed to be used individually, some EPs did fill out one together, collaborating on every answer. This collaboration was unexpected, but it appeared to be still in line with the expected outcome.

Additionally, there was a gender imbalance among participants. Only one of the six children in the PD sessions was male, which does not align with the typical gender distribution of dyslexia in the Netherlands, where the male-to-female ratio is approximately 5:3 [69]. This imbalance was also present during the testing phase of the final design, where four children, three girls and one boy, participated.

The testing phase was limited due to who was included in the testing and interviews. The design was tested with children who had previously participated in the design process. This created a risk of participation bias, as they may have been more familiar with or positively predisposed toward the design. Furthermore, the testing phase involved interviews only with the children and their parent. Input from other individuals in the child's environment, such as teachers or peers, was not gathered, further limiting the scope of the feedback understanding of applicability. Furthermore, the testing was not observed by the researcher but only reported on by the children and parents. This lack of observation limits the more profound understanding of how the children used the tool.

While input from EPs gathered via the DPD was integrated into the final design, the artefacts created by the APs during the PD sessions were minimally used. This was not due to a lack of valuable insights but rather because many artefacts could not be translated into concrete design requirements or concepts for this thesis. As a result, the contribution of the APs to the final design was limited. Nevertheless, these artefacts may hold insights for future research or designs. The PD method itself could be revised to have a higher focus on creating tangible artefacts.

In conclusion, due to the limitation discussed above, the final design might not fully represent the broader group of CwD at RID who may eventually use the product. However, to draw this conclusion fully, further testing needs to be done to see if the design works for enough CwD and their environment.

## Applicability

Besides the limitations surrounding the participants, there are also limitations in the applicability. The card deck was created to be used by CwD connected to RID, with expectations of broader applicability for Dutch CwD. This applicability introduces the first limitation of the product, as it is only created in Dutch. For some cards, it would be as simple as translating to create them in a different language. However, for more than a quarter of the cards, translating is more complicated. For instance, the explain cards have facts that are only true for the Netherlands and some of the experience cards are based on experiences with Dutch literacy.

Another limitation is the number of cards that are in the deck, which has to be 54 cards due to production constraints. This number constraint led to having, for instance, only six cards containing dyslexia facts and a limited number of six animal encouragement cards. The ratio of the subcategories of the cards was initially based on the suggestions provided in the DPD, but in the end, also on having a good distribution of the 54 cards. To better understand if this is the correct ratio and work with the card limitation, the cards do need to be evaluated over a more extended use period.

The final limitation pertains once more to the target user. As stated before, the deck design for the CwD is connected to RID. However, RID also supports children with dyscalculia who cannot make use of the cards for extending their PE. It would be interesting to see how the deck needs to be changed and how easily it could be changed not to have it be limited to dyslexia. The created cards could be used as a framework to create similar cards pertaining to dyscalculia, as the categories would still be suitable for dyscalculia PE. This suitability is partially due to the fact that the secondary effects are similar and that the requirements from literature were based on SLD and, therefore, applicable to both dyslexia and dyscalculia. If the cards could be suited to help with the PE of other non-learning disorders (e.g. ADHD and autism spectrum disorder), it is harder to predict. The inclusiveness of the design will be further discussed in the researcher reflection.

## Future Research

If more PD sessions were conducted using the derived methods in this thesis, some interesting changes could be made. First, it would be interesting to see how different examples could change the created artefacts. For instance, not having a pet in the persona example might lead to children incorporating fewer animals into their personas. Next, the APs' influence mapping could be adjusted to focus on creating tangible artefacts for their children. However, the outcome could also already be used (by RID) to create possible tools for parents to learn more about guiding their children with coming of age with dyslexia.

As previously discussed, the card deck could be redesigned for children with dyscalculia. It would be possible to do the DPD survey with children who have dyscalculia and experts on dyscalculia. The main adjustment that needs to be made is the cards in the questionnaire. To do this, dyscalculia facts and simulations need to be researched and made into example cards. However, before expanding on the deck, the current design needs to be evaluated more. Ensuring its usability, improving the deck for CwD, and possibly adjusting it for children with comorbidities.

# Conclusion

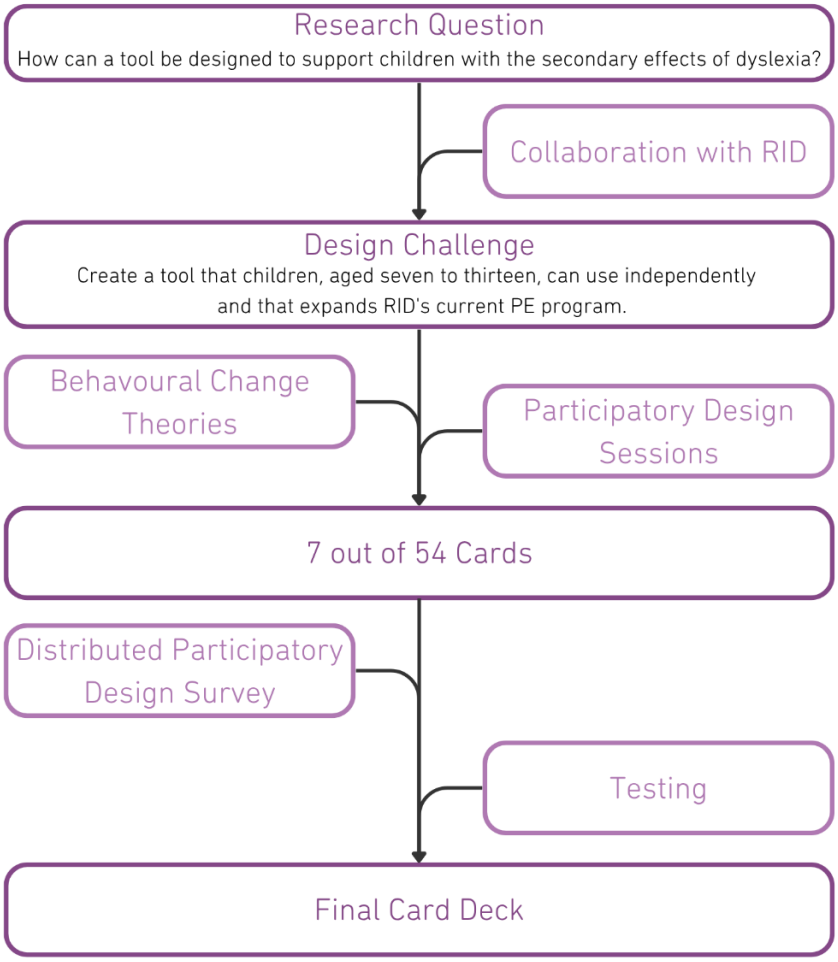



*Figure 16 Concluding overview of main steps taken in this thesis*

As can be seen in Figure 16, this thesis set out to answer the question of how to design to support children with the secondary effects of dyslexia. Combating the secondary effects is important as many children experience low self-esteem, anxiety and embarrassment due to dyslexia. Therefore, literature on dyslexia and its secondary effects was explored, leading to the focus on PE and the collaboration with RID. The how question was answered in the form of the creation requirements resulting in the creation of the card deck. The first segment of the requirements was established through the creation of a behavioural change theory framework. This framework focused on the ability to persist, self-efficacy and self-advocacy.

More requirements were needed to address the design challenge of creating a PE extension for RID for children's independent use. This establishment of requirements was accomplished through PD with CwD and their parents, who are connected to RID. Filling a gap in literature on PD for PE with CwD. This resulted in the CPs' contribution of the 3Es (explanation, experience and encouragement). The 3Es were translated into requirements reflecting the needs and wants of the CPs.

The idea of a card deck and a few cards were created based on the requirements. The card deck was reviewed and further ideated on with the help of CPs and EPs, creating a wide range of card suggestions. These suggestions were compiled into the final design, resulting in 12 explanation cards, 11 create cards, 14 experience cards and 13 encouragement cards. The card deck was tested by four CwD, resulting in feedback and possible improvements. Finally, an implementation of the cards within RID was described.

In conclusion, a tool in the form of a card deck was created for CwD from RID that can be easily distributed and used, expanding on the PE. This tool should help lessen the secondary effects resulting from dyslexia.

# Researcher Reflexion

As declared in the preface, I have dyslexia myself. Having dyslexia made writing and researching this thesis probably a different experience than if I did not have the same disorder as my thesis topic. Therefore, I found it important to reflect on my experience and the (tool) outcome of the thesis process in a more personal way than found in the discussion.

## Having Dyslexia

In the beginning, it was difficult for me to be faced with literature research on a disorder that I have myself, from the research denying the existence of dyslexia to the unpleasant secondary effects. However, the interesting thing was that the further I progressed, the less it felt like I was a PwD. Speaking with the CPs, it became very clear to me that I am no longer a CwD and have learned from and grown with my disability. I expected that to happen, but I also no longer felt like a part of the PwD category altogether, although I am still experiencing the associated difficulties. At the end of my thesis I looked at specific existing tools for PwD and thought how great it was that they existed, not remembering that they also existed for me to use.

As extensively discussed before, PwD has difficulty with literacy. Therefore, filling these pages and reading all the literature was not the most pleasant task for me. However, I do understand the importance of literacy in research, so in the end, it was even a bit enjoyable. Nevertheless, I was glad to have something to keep me going, helping CwD. The idea that I could make the secondary effect less for children like me, who also was an eight-year-old CwD once. Having struggled and still struggling with the secondary effects myself made me very grateful to have gotten the chance to help others, to a small extent, with this thesis.

## Ethics and Bias

### Confirmation Bias

One thing that immediately concerned me was how much the design theories coincided with the creations of the CPs. Did I use the creations to confirm what I was convinced of as important? This is something that I believe I can never fully answer; however, I did my best for the answer to be no. First, I acknowledged that I will have confirmation bias to some extent, and I genuinely believe that it is impossible not to have any bias. Furthermore, I did not try to make assumptions about the outcome of the session, and I deliberately did not reread the chapter on the behavioural change theories beforehand. Therefore, I was genuinely surprised by how good the creations were and how well they fitted with the theories. Finally, when designing the concept, I kept the requirements established through the theories and the PD session detached so that they could influence the design separately.

## Researcher Bias in the PD Setup

### *Influence*

There is a risk of researcher bias influencing the data of an in-person PD session, as researchers are directly involved in facilitating these sessions [38]. I think this could have been the case for the second PD session. The second PD session did not go as smoothly and spontaneously as the first one. There was a higher need for guidance and prompting from my side for the children when they were creating. This focus on the CPs led to almost no interaction with the parents when they were creating and discussing the influences.

Furthermore, having to guide the children also led to children's solutions that were more in line with expectations (e.g. nothing to do with "fixing" literacy problems). However, it is harder than not to introduce researcher bias, especially when I had already experienced the first session and its outcomes. In the end, I might have guided them to incorporate encouraging aspects into their designs. There were moments, however, that went differently compared to the previous session and were left unguided or uncorrected (e.g. parents entirely took on the reading and writing for the children).

The researcher has an ethical responsibility to ensure that all children involved in the PD session have a positive experience [70]. When doing a PD session on the PE of dyslexia, children might not be fully willing to share their experiences. They should not feel pressured or forced to answer or do things that they are not comfortable with, making it more challenging for me to ask them to create something for a negative aspect of dyslexia. At one point, I directly asked them what they struggled with themselves and if their persona might struggle with that as well, which felt objectionable. At no point were they directly pressured or forced, and they appeared to enjoy the session. However, I do not know how they truly felt during and after the session.

### *Provided materials*

There is a bias to be found in the tasks and materials given to the participants [71]. Having control over what is provided is controlling what can be made. When making design concepts from the artefacts made in the PD sessions, I will not experience what the participants experienced when they were making the artefacts.

I tried to have a wide range of materials that were most likely known to the children and materials that I personally like to prototype with (e.g. clay, thick paper). So there, I introduced bias in the needs of children by adding my material preferences. However, ignoring my insights would also not be right, as my preference could stem from having dyslexia. The provided materials seemed to have been suitable for the task, with most children being drawn to the clay and wanting to take home the art supplies. I am, however, not able to say with certainty that there was no material missed by the children.

This bias could also be found in the type of PD session method I created: a primarily art-based method. I think most designers would be more drawn towards art-based methods, whether they have dyslexia or not. I looked into many different methods. However, to get ideation and possible concepts as an outcome, an art-based method seemed the most suited. Nevertheless, I also see how I could have influenced the choice, as I personally prefer art as the base for the method.

*Remoteness*

Because the DPD was not in an in-person setting, no observations could be taken or nuances captured. The only thing that could be used for insights was the direct outcome of the worksheets. This lack of observation meant that I had to interpret the answers to the best of my abilities, leading to possible misinterpretations and hints of my ideas/beliefs. There were some suggestions regarding the outcome of the DPD that did not resonate with me; however, these were still incorporated into the final design. I added all the suggestions to this thesis, and most of them can be directly related to the cards in Appendix E.

# Is it Inclusive Design?

I do not consider this thesis outcome to have been an inclusive design, as the design only focuses on a niche target user. Although I have seen inclusive design often paired with design for disabilities, in this case, it was not. The card deck was not designed to be applicable to as many different people as possible, but just applicable to CwD. As discussed in Chapter 1.1, there is comorbidity with other neurodiverse disorders as well as other psychopathology. This comorbidity introduced a limitation in this thesis, as the cards were not designed also to be applicable to the comorbidities. It would be interesting to see if and how the cards could be adjusted for a CwD and, for instance, ADHD or autism spectrum disorder. Furthermore, the deck was not adjusted to the gender differences found in Chapter 1.3.4.

I think the real question is if the cards are inclusive to most CwD, as dyslexia is already a heterogeneous disorder with a wide variety of symptoms [2]. A researcher should also be careful with their own personal values and beliefs regarding the disability [70]. Having the disability myself could have made me closed-minded towards the struggles that I have, but others do not experience dyslexia and the other way around.

When I started with this thesis, I was afraid that I would create something only applicable to my dyslexia, as I did not really know any other. Therefore, I did a lot of literature exploration on the different types and sides of dyslexia. However, sometimes, I noticed myself dismissing certain ideas or suggestions as they did not fit my experience with dyslexia. That led me to be drawn towards PD and co-creation, to incorporate as many voices of CwD into the process and design as possible, which were not my own. That is why I tried to base and incorporate as many of the suggestions and observations in the final product as possible because my experience did not matter. Of course, some of the cards still resonate more with me than others, but that is precisely the point. Not all cards will resonate with a CwD, but some should. I genuinely believe the cards represent different types of dyslexia and the children I worked with well. However, I am sure that I am still limited in my knowledge of all that a child could experience due to dyslexia. So I would say the outcome is more inclusive due to the participation of CwD than if I only used my literature research, but not per se directly inclusive to all CwD.

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# Appendix

Appendix A

# Inventor-for-the-Day:

## a Participatory Design Session Method for Children with Dyslexia and their Parents

Technology and designs change, creating a need for adaptations in participatory design (PD) methods and techniques [72]. New PD methods/techniques can be created, or existing methods/techniques can be adjusted to better fit the aim of a PD session. This adjustment can be done by changing the materials available when using an existing method (e.g. the Bags of Stuff method).

A method must be suited to the research it is used for [72]. Because this thesis research conducts PD with children with dyslexia (CwD), the method needed to reflect this. Therefore, a new technique was created, and existing methods were adjusted to create a tailored PD session for CwD, named 'Inventor-for-the-day'. The session method was created to conduct PD sessions with children who received dyslexia support from the Dutch company RID. The outcomes of the two sessions that were conducted can be found in Chapter 4.2, which aided in establishing design requirements and ideation for the design of a tool to expand current psychoeducation.

Conducting PD with children means involving them in the design process and ensuring that their needs and points of view on a design are met throughout the design process [35]. There are different ways of including children in the design process. Generally, there are four roles that a child can fulfil within the design process. Ranging from least to most involved roles: user, tester, informant and design partner [34]. Children are considered to function as informants through the created session method.

People with dyslexia, specifically, have not often been participants in PD, let alone CwD [70], [73]. It is important to consider the obstacles and challenges that working with people with a disability brings, as they cannot be asked to do something they are not able to do.

## Designing a Session Method

### Session Guidelines

Much of the literature on conducting PD with children in the last decades ends with advice on the subject. Below are all the pieces of advice found that are relevant to the created method and used as indirect guidelines for the design of the session.

#### *Communication*

There is a preset dynamic between children and adults as they are taught to listen, learn and not challenge adults. However, in PD, their thoughts and ideas should be valued just as much as those of adults [74]. Since they are the experts on being children, they should be treated as experts. Therefore, the researcher should listen, ask 'why' questions, and contribute their thoughts as well. Children will have ideas that are not realistic. Nevertheless, there can still be

functional and specific user needs within their explanation. The focus can be on the insight that the artefact represents and not on the artefact itself [71]

To create a comfortable atmosphere and to connect with the participants, the researcher can eat and chat with them [74]. This helps them feel comfortable and talk more informally. Informal talks are important as the essence of the participants' needs is not always captured in their artefacts and explanations but also in informal talks whilst creating [52]. Another way to achieve a good atmosphere is by laughing and playing together, such as starting the session with an icebreaker game. Furthermore, the researcher should wear casual clothes, use first names and communicate openly with the participants [36].

### *Materials*

The materials that the participants can use must reflect the research [37]. Especially since materials limit what the participants can make and, therefore, influence what can be created and what thoughts can be conveyed [71]. Therefore, the researcher needs to consider what materials are suited for the purpose of the PD session. A good place to start is with low-tech expressive materials that are familiar to children and widely available [55].

### *Parts of the Session*

There are no predefined parts of a PD session or formula on what to do when [34]. However, common activity patterns are found in published literature on designing with children [55]. These were used as inspiration in designing the session and are found in the important aspects chapter below. Nevertheless, each part needs to be clear to the participants so they do not spend their time deciding what the task itself is [32].

### *Roles within the Session*

To have a beneficial PD session, the roles and responsibilities of all involved must be specified [32]. Children, for instance, can be assigned the role of a researcher who will do 'research' within the session [36]. However, These roles should consider the participants' cognitive development [36] and ensure the tasks are suitable to ask of them [34]. Furthermore, having a backup in the form of simpler tasks is also advised [70], [55]. All participants should be embraced as they are, and there should be no preconceived judgements [33].

When participating in a PD session, adults should avoid seeming childlike or intentionally portraying childlike characteristics [36]. They will be viewed as an adult either way, which could come across as patronizing towards the children. It is hard for an adult to step into a child's world and for a child to step into that of an adult [36].

### *Disabilities*

Generally, people with disabilities can experience confusion and/or boredom when involved in design sessions [70]. Nevertheless, PD sessions also have a possible positive impact on the participants. Helping with developing skills like creativity, social and teamwork. Unfortunately, the positive and negative impacts are unclear in terms of their longevity and when and if a participant will experience them.

Possible challenges and obstacles for CwD in a PD session, besides literacy, can be having problems translating an idea into a prototype and having repetitive behaviours (e.g. getting fixated on a specific feature) [73].

## Type of Methods

Knowledge is a social construct and, therefore, dynamic, meaning children can be knowledgeable through 'unconventional ways' (e.g. dance, art, music) [36]. Designers are encouraged to join children in their imaginative, playful, creative world [32]. Using children's natural tendencies for playfulness and role-playing as part of PD methods [32],[35].

PD methods and techniques can be grouped into five methods: observation-based, narrative-based, documentation-based, art-based and game-based [32]. The created method was mainly based on narrative and art-based methods.

### *Narrative-based*

By pretending or roleplaying, children can make sense of the world and others' behaviour and imagine what they could be [35]. They can contribute certain mental states to those around them and themselves. Creating a narrative helps to translate feelings and behaviour into something tangible. A good example of a method that uses this type of method is the "*mission from Mars,*" where children create requirements for technology through the shared narrative of Martians being interested in this technology [75].

### *Art-based*

This method helps make sense of things through one's body with movement and creation. Epistemic actions (e.g. talking with hand gestures) can help facilitate mental work [76], [77]. By creating art/prototypes (epistemic production), design questions get worked through, not just thought through. This results in unexpected realizations and a concrete manifestation of ideas. Having people partake in joint creation and the manipulation of things helps them make sense of experiences and needs [71]. They change what is inside by changing what is outside [77]. Children can materialise their ideas through hands-on activities [32] without being taught how to prototype, which comes naturally to all ages [34]. These art-based methods should be fun and mirror children's playful nature [33]. A good example of an art-based method, which was adjusted as part of the created method, is *Bags of Stuff*. This method uses bags of art supplies or low-tech prototyping supplies that can be used by participants in order to come up with ideas for designing new or enhancing technologies [78].

## Adult Involvement within the Session

Due to the session's location and the target user's age, children had to be brought and picked up by their parents. For this reason and also to explore a different side of dyslexia, parents were asked to partake in the PD session alongside their child. However, having adults and children in the same session changes the whole session.

Many adults find it difficult to relate to children as design partners [37]. Within the PD session, decisions and tasks must be made in collaboration. However, adults assume that art-based methods are for the children and leave those parts to them while they take on the roles of teachers, facilitators and mediators [33]. This affects the session and should be navigated correctly by the researcher, as adults also make important contributions to the session. Adult participants (e.g. parents, teachers, specialists) can attribute psychological and pedagogical insights to the design process [70]. Parents can especially give insights into children's design decisions as they know their child's psyche better than researchers. A good example is when a child says a picture of biking seems scary and their parent knows they like biking so they ask about it; it turns out the picture looked fast, which the child finds scary [52].

#### *Responsibilities*

Adults can be facilitators, motivators, parents or full participants in the PD session [70], [33]. When it comes to designing with children with a disability, adults can also become proxies for the children [70]. This helps to overcome communication barriers; for CwD, they could function as simple proxies for overcoming the possible literacy barrier. However, to ensure adult participants can make valuable contributions to the PD session, they should not solely focus on supporting children. However, they should have clearly defined roles, responsibilities, and activities to undertake.

#### *Facilitator*

The session's facilitator needs to ensure the children's well-being, giving them every opportunity to participate in the session and empowering them by providing support [70]. Furthermore, they must provide an environment for mutual learning and positive experiences. They need to support children who have difficulties with the activities (e.g. drawing, writing, reading, spelling) so that they are not limited when generating their ideas. Additionally, the facilitator should be able to adapt the design activities on the fly to maintain the children's engagement.

#### *Impact*

It is unclear which influence adult participation can have on the outcome of the PD session [55]. Additionally, there are no direct guidelines on how to introduce adults as participants in a child-focused session and what their contributions should be [70]. Having different adult participants with different backgrounds contributing to a session adds complexity and different participatory relationships. Children have their mental world away from the rules and assumptions of their parents, which they might not be able to access when their parents or other adults are around [33].

# The designed session method

## Important aspects

The session method was designed with important considerations in mind. The first and most important consideration is that the session was tailored to the participants [36]. This consideration means the parts designed for the child participants (CPs) were on their comprehension level. They were designed for children aged eight to thirteen who have to spend more effort reading and writing due to their dyslexia. The tailoring was done by limiting the amount of literacy, having more verbal explanations and having parents, adult participants (APs), function as proxies. When having written text, simple words that are age-appropriate and that they were familiar with (from the RID psychoeducation phone application) were used.

The next consideration is not underestimating participants' comprehension of the activity and creative skills [34]. Especially when the CPs are inventing, they are set a complicated task by having a design prompt and rules for them to follow; however, they get the chance to try, and only if that failed was a backup plan implemented. The backup plan is important, as working with children can be unpredictable [70], [55] and consist of more specific instructions. These instructions were about what to make, giving only freedom on how it should look and some design features. Having a backup plan, with the intended plan being less specified, gave the participants more autonomy over the session's outcome, which is important for the participant's enjoyment of the session [55]. Having examples of all templates filled out by the

facilitator in advance can help explain what is expected without adding more information to the activity.

When working with CPs, a key consideration is how to motivate them. This was, in this case, done by having a narrative (inspired by the method *Mission from Mars* [75]), an understandable goal and rewards [55]. By using the narrative of the facilitator being an "inventor in training" needing help from other inventors to design for people like them, the children got to fulfil a role and have a clear goal. Furthermore, all parts of the session transitioned into each other through the narrative and after the session was concluded the children were allowed to take home a part of the art supplies as a gift for participating. The narrative was also shown through the graphic design of the templates, by having a steampunk typeface and faint gears in the background.

Moving away from the participants, the final consideration is in collecting data, what data to collect and who will collect this data. There was chosen to have an observer per table to write down conversations, an observer who walked around and wrote down behavioural observations and insights written down by the facilitator. The session is also captured in the artefacts made by each participant. The persona's name is used throughout the templates to track the artefacts anonymously.

## Six session parts

To fulfil the guidelines, consideration and purpose of the session, the session is divided into different parts. This division resulted in six parts all with their own function and purpose. The created session method consists of: i) welcome and icebreaker, ii) persona creation, iii) for the APs: dynamic persona and for the CPs: inventing, iv) break, v) show & tell and vi) feedback and closing.

The total duration of a session intended to be two hours, with one and a half hours for all the parts and half an hour for transitions between activities and unforeseen delays. Some session materials are needed before the session is conducted; these can be found in Appendix A-Table 1 with their needed quantities.

*Appendix A-Table 1 Overview of needed materials and quantities for all six parts of the PD sessions*

| Part | Needed materials | Quantity |
|---|---|---|
| PART 1 | Stickers with common known pairs | One sticker per participant, one for every observer and one for the facilitator |
| PART 2 | Persona creation worksheets | One for every CP and AP duo |
| | Coloured pencils | One set for every CP and AP duo |
| PART 3 | Dynamic persona worksheets | One for every AP |
| | Small sticky notes in two colours and writing materials | 2 stacks for every AP and at least one pen for every AP |
| | Influence map worksheets | One per 3-5 APs |
| | Invention Worksheets | One for every CP |
| | Craft materials familiar to the CPs | Dependent on the type of material |
| PART 4 | Fruit and snacks | - |
| PART 5 | - | - |
| PART 6 | - | - |

*Part 1: Welcome and Icebreaker (15 minutes)*

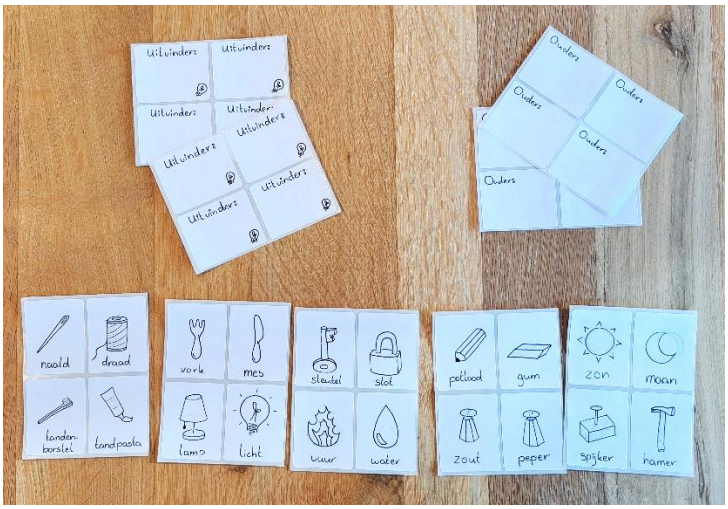
Objective: Establish a comfortable atmosphere and introduce participants to the session.

- Begin with a warm welcome and an overview of the session's purpose.
- Confirm that all consent forms are signed and ensure participants are ready to engage.
- Assign roles and responsibilities (e.g. children → inventors, parents → proxies)
- Icebreaker: Participants play a matching game. Each person receives a sticky note with an icon they cannot see (e.g. a sun). They ask questions to find their "match" with a slightly different but complementary icon (e.g. sun and moon).

Goal:

- Create a welcoming and inclusive environment.
- Help participants get to know each other and feel comfortable.

The session begins with 15 minutes of welcoming the participants and doing an icebreaker together. The facilitator of the session, starts by welcoming the participants, offering drinks and explaining the premise of the research. The research topic is explained, and the narrative of the children being "inventors" for the day is established. The children are also assigned the role of inventors through nametags. Now that the premise is clear, the participants, facilitator and observers engage in an icebreaker game. The game goes as follows: each person gets a sticker on their back with an icon (e.g. sun) and needs to find their matching pair (e.g. moon), the stickers can be seen in Appendix A- Figure 1. They do this by giving and receiving hints to and from each other. This should help participants ease into communicating openly with others. This specific icebreaker was chosen as it has visual icons (therefore minimal reading) and allows for moving around within the room.




*Appendix A- Figure 1 The name and icon stickers used in part 1 of the PD sessions*

*Part 2: Persona Creation (15 minutes)*

Objective: Help children and parents externalize feelings and experiences through creative storytelling.

- In pairs (child and caregiver), create a persona of a 7-year-old child.
    - Appearance: Draw and design the persona.
    - Personality: Answer questions about the persona.
- The exercise encourages participants to express emotions indirectly, making it easier to share personal experiences.

Goal:

- Develop a narrative to explore challenges and strengths.
- Encourage creativity and emotional expression in a non-personal way.

The following 15 minutes are spent making a persona, "for who are we inventing?". Here, the CPs, together with their parents, design a persona. They do this by drawing, with coloured pencils, the visual attributes of their persona and answering personality questions. The narrative explains that an inventor needs a person to invent for and must create this person themselves. The idea was that they subconsciously design their person, persona, as a partial representation of themselves without becoming too personal. Furthermore, the persona is pre-determined to be seven years old, as it can be easier for children to design for someone younger than themselves [55]. The template can be seen in Appendix A- Figure 3.

The questions were designed to require minimal writing, with predetermined answers that can be coloured in. However, there were also open questions, which can be answered with the parent's help if needed. These questions are about dream occupations, their likes and dislikes, and their views on literacy. The predetermined answers can be used to assign positive traits to a persona and were based on the RID psychoeducation phone application. Besides encouraging emotional expression in a non-personal way and persona making commonly being a part of the design process, the activity aims to help warm up everyone's creativity.

*Part 3: Separate Activities for Parents and Children (20 minutes)*

For APs:

- Build on the persona by creating a "dynamic persona."
    - Analyse enablers (positive influences) and blockers (negative influences) in the persona's growth (from part 2).
    - Project the persona their development at ages 12 and 20, considering challenges and achievements.
- Engage in a group discussion to identify common self-image, confidence, and self-acceptance themes.

For CPs:

- Create a prototype of a tangible object to support their persona.
    - Through a design prompt and three constraints

Goal:

- Parents: Reflect on future growth and identify enablers and blockers.
- Children: Explore solutions, a tool expanding psychoeducation through creativity.

Following the creation of a persona, the children and parent participants are divided into separate tables. This activity is the longest part of the session, with it being 20 minutes. All parts should be kept to 20 minutes or less so as not to lose the attention and focus of the participants [55].

The parents analysed the personal growth of the persona from the prior activity. They do this by writing down, on small sticky notes, negative and positive influences on the persona's dyslexia and psyche. This activity is based on an existing dynamic persona design tool, used to ideate on desired futures [79]. The template can be seen in Appendix A - Figure 4. They do this for 5-7 minutes individually, using different coloured notes for positive and negative influences for ages seven, twelve and twenty.

Then, for the remainder of the 20 minutes, they discuss and rank the notes for highest to lowest influence and decide per influence if it is internal or external onto the template seen in Appendix A - Figure 5. This template was inspired by the internal and external mapping of project stakeholders [80]. The experience of having dyslexia can be influenced positively and negatively by, for instance, internal thought patterns and support from teachers [5]. These internal and external influences should represent the contextual factors (e.i. environmental and personal factors) found in the international classification of functioning, which is a tool to describe, but also further than the aspects of a disorder [16]. The mapping of these influences helps with making an overview of current positive and negative influences on the experience of having dyslexia through the eyes of parents. Once the notes are ranked, the APs can write down interventions they think could enhance or diminish the ranked influences. The goal was to see if caretakers foresee specific struggles or opportunities in the life of someone with dyslexia, drawing on their own experience of growing up and the knowledge of their child (their dyslexia).

Simultaneously, at another table, the CPs are instructed to invent something to give to their persona created in part 2. Many art supplies were placed on the table: coloured paper, pompoms, pipe clears, coloured pencils, glue, clay and templates, Appendix A - Figure 2.

*Appendix A - Figure 2 Photograph of the art supplies for the CPs*

The narrative continues with the children learning that their persona, like themselves, was diagnosed with dyslexia. They get a design prompt explained and three constraint rules: i) the object needs to be tangible, ii) it could not help specifically with literacy, and iii) it needs to help and not fix. The design prompt and rules were also written down in the worksheet, Appendix A- Figure 6. The aim was that the children indirectly designed for themselves and their needs when they had just found out about their dyslexia.

*Part 4: Break (10 minutes)*

Objective: Foster informal connections and maintain a relaxed atmosphere.

- Enjoy snacks and casual conversations.
- Participants can share their thoughts on the session so far.

Goal:

- Provide a moment to relax and connect informally.
- Reinforce a sense of community.

The fourth part is a 10-minute break with fruit, snacks, and beverages. This break divides the session into two parts, gives the participants a slight respite, and allows for informal talks between the facilitator and participants. The informal talks aim to obtain informal feedback on the session and talk openly about dyslexia.

*Part 5: Show and Tell (15 minutes)*

Objective: Celebrate creativity and gather insights.

- Children present their prototypes, explaining:
    - What they created.
    - How it helps their persona.
- The group discusses each idea, asking "why" questions (e.g. "Why is it green? What does that represent?").
- This activity highlights the diversity of dyslexia experiences and identifies overlapping themes.

Goal:

- Celebrate participants' creativity and ideas.
- Facilitate a deeper understanding of the challenges and solutions shared by the group.

After the break, the CPs can show everyone what they made and why they made it. After a child explains their invention, others get the opportunity to ask questions or ask for clarifications on specific details. This part should take approximately 15 minutes or as long as the children need to explain their ideas, celebrate the creativity of the CPs, and facilitate a deeper understanding of the solutions created.

*Part 6: Closing and Reflection (15 minutes)*

Objective: Gather feedback and conclude the session.

- Summarize the day's activities and insights.
- Ask participants to share one thing they liked and one they did not and give suggestions for improvements.
- Explain how the research findings will be used.
- Give the participants a way to contact the facilitator if they come up with something.

Goal:

- Reflect on the session's value and gather feedback.
- Provide closure and explain the next steps in the research process.

The final part focuses on closing the session and gathering formal feedback. The facilitator explains what would happen with the day's outcomes and how to stay in touch if desired. Furthermore, the participants get the opportunity to say what they liked, did not like and what they would do differently. Afterwards, all participants were thanked, and the session was closed.

*Appendix A- Figure 3 Depiction of the persona creation worksheet that was printed on a A3 paper*

# VOOR WIE VINDEN WE UIT?

In deze activiteit ga je je eigen personage maken. Je mag je personage helemaal zelf bedenken. Hieronder kun je je personage tekenen en rechts kun je de persoonlijkheid van je personage invullen. Verder mag je rondom je personage alles tekenen wat je zou willen.

Naam van je personage:_____

Leeftijd van je personage: 7 jaar

PD session .../.../25

**BEANTWOORD DE VRAGEN HIER ONDER OVER JE PERSONA:**

1 Wat wil je personage later worden?

2 Waar word je personage blij van?

3 Wat wil je personage graag leren?

4 Wat vind je personage de leukste en minst leuke vakken op school?

5 Waar word je personage boos van?

**KLEUR DE KWALITEITEN VAN JE PERSONAGE IN:** KLEUR ZO VEEL JE WILT

Lief | Betrouwbaar | Creatief | Dapper | Enthousiast

Doorzetter | Energiek | Grappig | Leergierig | Netjes

Eerlijk | Sociaal | Nieuwsgierig | Geduldig | Sportief

Vul zelf wat in..... | Vul zelf wat in.....

**KLEUR HET BOLLETJE DAT HET BEST BIJ JE PERSONAGE PAST:**

| | HELEMAAL NIET | NIET ZO | GEEN VAN BEIDE | EEN BEETJE | HEEL ERG |
|---|---|---|---|---|---|
| Vind je personage lezen leuk? | ○ | ○ | ○ | ○ | ○ |
| Vind je personage lezen spannend? | ○ | ○ | ○ | ○ | ○ |
| Hoe moeilijk vind je personage het om hulp te vragen? | ○ | ○ | ○ | ○ | ○ |
| Vind je personage lezen/spellen belangrijk? | ○ | ○ | ○ | ○ | ○ |
| Hoe goed is je personage in lezen/spellen? | ○ | ○ | ○ | ○ | ○ |
| Vind je personage het moeilijk om te oefenen met lezen en spellen? | ○ | ○ | ○ | ○ | ○ |

**WAT IS EEN LEUK FEITJE OVER JE PERSONAGE:**

*Appendix A - Figure 4 Depiction of the dynamic persona worksheet that was printed on a A3 paper, adapted form [79]*

*Appendix A - Figure 5 Depiction of the influence mapping worksheet that was printed on a A1 paper, inspired by [80]*

*Appendix A - Figure 6 Depiction of the invention worksheet that was printed on a A3*

# UITVINDING MAKEN

In deze activiteit ga je je eigen uitvinding maken voor jouw personage. Je personage heeft dyslexie en vindt dit moeilijk. Je mag knutselen wat je wilt, maar je mag ook tekenen. Deze uitvinding ga je maken via een opdracht en er zijn een paar regels, die je hier onder kan lezen.

Naam van je personage: _____

Uitvinding opdracht:
Maak iets dat je jouw personage zou willen geven om hem/haar te helpen met zijn/haar dyslexie.

Uitvinding regels:

- Je uitvinding moet een voorwerp zijn
- Je uitvinding mag niet met lezen of spellen te maken hebben
- Je uitvinding moet helpen maar niet oplossen

PD session .../.../25

# Piloting the method

## Initial Observations

The following chapter discusses the first observations directly after completing the first and second sessions. Going over each activity, observations on participant engagement, and potential areas for improvement. The session was held on 17-02-2025, took almost two hours and had four CPs (one boy, three girls) and four parent participants (four moms, one with dyslexia).

Although improvements could be made to the session, the agenda and tasks were kept the same to validate the outcomes. This session was held on 11-03-2025 with two children (both girls), one mom, and one adult familiar to the child. It had a duration of about one hour and forty-five minutes.

### *Positive and negatives*

The session was held in the same way as the first one, with the same exercises, explanation script, and examples. The main difference was the number of participants, and one of the children did not have a parent with them but someone they knew well who was functioning as the parent. From this point on, this acquaintance will be referred to as a parent. There was no mention of the outcomes of the first session with the second session to the participants. Appendix A-Table 2 below discusses the initial observations, both positive and negative. Parts 4, 5 and 6 are not separated into the two sessions in the table as these were as good as the same for the sessions.

*Appendix A-Table 2 Overview of positive and negative observations within the two PD sessions*

| Part | Positives | Negatives |
|---|---|---|
| 1 | Session 1: | Session 1: |
| | While the introduction was clear, participants appeared to already understand the session's structure due to using name tags, reducing the necessity for extensive explanation. Participants enjoyed the stickers and continued interacting with them beyond the activity. | After completing the task, the purpose of the activity was lacking, suggesting that a more explicit explanation of its relevance and a better connection with the narrative would possibly have enhanced engagement. |
| | Session 2: | Session 2: |
| | Similar to the first session, however, the stickers were disregarded immediately after use. | There seemed to be less comfort and enthusiasm, possibly due to the CP-to-adult ratio (2:6). |

| | | |
|---|---|---|
| 2 | Session 1: | Session 1: |
| | APs functioned well as proxies, assisting their children.<br>The CPs seemed to have enjoyed the drawing portion of the task. | While the structured persona personality questions provided a foundation, they limited creativity, and some CPs struggled to comprehend the questions fully. |
| | Session 2: | Session 2: |
| | The APs functioned again very well as proxies, this time reading everything to the CPs. | Both CPs decided to design for someone they knew instead of for a fictional persona. This seemed to have made it harder for them to assign difficulty to invent in part 3. |
| 3 CPs | Session 1: | Session 1: |
| | The children responded positively to this task, demonstrating creativity and enthusiasm. The use of clay was particularly effective.<br>The backup plan was unnecessary, so there was no overestimation of CPs comprehension of the activity. | When asked to explore other ideas, the CPs stayed committed to the initial one. |
| | Session 2: | Session 2: |
| | The CPs seemed to have enjoyed creating the inventions. | The CPs needed more time and prompting to start creating.<br>One of the CPs got stuck fixing primary aspects of dyslexia, whilst the other CP copied one of the examples given as inspiration. |
| 3 APs | Session 1: | Session 1: |
| | The parental discussion yielded insights into their view on the experience of a CwD. | The APs steered off-topic occasionally, and CPs sometimes got distracted by the discussion. |
| | Session 2: | Session 2: |
| | The same patterns as observed in the first session arose. | APs had, just like in the first session, a difficult time thinking about what the future of a PwD would look like.<br>The provided example was used slightly more as inspiration, possibly due to not having a parent with dyslexia present. |
| 4 | Participants focused on socializing and relaxation. | It did not generate substantial feedback. |
| 5 | The CPs expressed a desire to showcase their work to their parent, demonstrating a sense of pride in their creations. | CPs were initially disappointed that this segment only involved presenting their work and the creation time was over. Their explanations were somewhat reserved. |
| 6 | Both CPs and APs reported enjoying all aspects of the session. | Almost no feedback on the session's parts. |

*Improvements*

Some changes could be made to improve the session method. These improvements can be seen in Appendix A - Table 3 for the first session and Appendix A - Table 4 for the second session.

*Appendix A - Table 3 Overview of possible improvements after the first session to the PD session method*

| Part | Improvements |
|---|---|
| 1 | - |
| 2 | Implementing other more visual ways of building the persona's personality should be considered.<br>More why questions could be asked so that the children could make up stories about their persona and characteristics. |
| 3 CPs | Placing the invention in a new scenario and asking the CPs how it would function differently would allow the design to be explored further. |
| 3 APs | Moving the APs physically further away from the CPs. However, this would complicate the facilitator's ability to observe both parties well. |
| 4 | Additional prompting could facilitate more meaningful discussions during this break. |
| 5 | It could be more engaging and less overwhelming for the CPs by having them demonstrate or have an invention market. |
| 6 | The different parts of the session could be rated with smileys. |

*Appendix A - Table 4 Overview of possible improvements after the first session to the PD session method*

| Part | Improvements |
|---|---|
| 1 | Fewer observers present |
| 2 | Clear instructions on the persona needing to be fictional |
| 3 CPs | More CPs should be included in the session so that they can inspire one another. |
| 3 APs | Having no examples/prompts or different ones to see if and how much it influences the participants. |
| 4 | - |
| 5 | - |
| 6 | - |

## Materials

In Appendix A-Table 5, the art supplies used by the CPs were analysed. Some materials were more popular for prototyping than others. What is especially interesting to see is how much clay material was used, possibly connected to literature suggesting that PwD excel in visual-spatial and hands-on tasks [81].

*Appendix A-Table 5 Usage of different art supplies by the CPs*

| Art Material | Used in Session 1 | Used in Session 2 | Total Use |
|---|---|---|---|
| Clay | 4 / 4 | 1 / 2 | 5 / 6 |
| Drawing supplies | 3 / 4 | 2 / 2 | 6 / 6 |
| Pipe cleaners | 2 / 4 | 1 / 2 | 3 / 6 |
| Feathers | 2 / 4 | 0 / 2 | 2 / 6 |
| Pompoms | 1 / 4 | 0 / 2 | 1 / 6 |
| Coloured/shiny paper | 1 / 4 | 0 / 2 | 1 / 6 |

## Conversational Notes

The following section will discuss and quote things said by participants, with the children denoted with 'CP', Parents with 'AP', observers with an 'O' and the facilitator with a 'F'.

In part 2, there was a lot of intended interaction between the CPs and their parents. Notable conversations were on asking for (literacy) help and being similar to the persona. The following quotes, Appendix A-Table 6, are about children asking for and receiving help with their literacy difficulties, demonstrating how the parents functioned as proxies.

*Appendix A-Table 6 Quotes collected during the PD sessions demonstrating the APs functioning as proxies*

| |
|---|
| AP2: "Look sweetie, different S", *draws an 'S'.*<br>CP2: "Euhg" (frustration). |
| CP2: "How do you write ....?".<br>AP2: "It is with only one 'r'." |
| CP3: "My character is also very good in ...., but I do not know how to write that."<br>AP3: "Then I will help you." |
| CP1: *Writes something down*, "Correct 'b'?"<br>AP1: "Wrong 'b'." |
| CP1: "Can you read aloud?"<br>AP1: *Reads aloud.* |

The following quotes, Appendix A-Table 7, are of the children asking for help with creating, asking general questions or getting parental approval and encouragement, displaying collaboration between child and parent and how the APs functioned as proxies.

*Appendix A-Table 7 Quotes collected during the PD sessions demonstrating APs encouraging CPs*

| |
|---|
| CP1: "I only miss the arms. The legs are a bit ugly." *Asks their parent,* "Do you want to draw the legs?"<br>AP1: "Straight legs or ..?"<br>CP1: "Just normal." |
| CP2: "I cannot make a circle."<br>AP2: "Try it; you can also use a glass."<br>CP2: "Can you hold the glass?" |
| CP1: "What does inquisitive mean?" "What does social mean?"<br>AP1: "That you would like to learn something." "That you can get along well with others." |
| CP3: "I want something more. An animal!"<br>AP3: "Good idea!" |
| CP2: "First, I will test if it is a good brown." *Looks at their parent*.<br>AP2: "Yes, beautiful." |
| CP5: "I cannot draw a dog."<br>AP5: "Of course, you can! And otherwise, you can just write it down." |

The following quotes, Appendix A-Table 8, are on the connection between the children and their persona. It can be concluded that whilst the persona is not the child themselves, they put in personal characteristics. This idea is cemented further by the personas being named after their second name, their dog and a peer at school. In the second session, however, the CPs's personas were a real CwD they were close with.

*Appendix A-Table 8 Quotes collected during the PD sessions demonstrating CPs designing their personas after themselves or someone they know*

| |
|---|
| AP1: "Seems like you are describing yourself." *laughs.* |
| CP4: "My character wants to be a police officer, because I want that too." |
| AP4: Talking about the persona: "That sweater has [name] as well." |
| F: "Who are you drawing now?"<br>CP5: "My little brother." |
| CP6: Drew her neighbour of similar age: "Yes, because she also has dyslexia." |

When, at the end of the session, asking for feedback the CPs unanimously found all parts of the session fun and none of the parts not to be fun. With small comments on especially enjoying the clay and getting to draw and wanting to have had more time for inventing.

## Behavioural Notes

### *Session 1*

In part 2, most parents gave their child the freedom to independently read and write the persona personality questionnaire in the first session while assisting and intervening when mistakes were made. The children showed excitement for the drawing part, and when drawing, they all seemed quiet and concentrated. One of the children got frustrated and angry when they made faults in the questionnaire and had to be brought back to attention by their parent; once drawing, they appeared peaceful again. Notably, the more the parent participated in the task, the more advice (e.g. on spelling and persona traits) is asked by the child to the parent.

In the part that follows for the children, where they get to invent, they all seemed peaceful and focused when creating. Even when some were writing invention instructions, there was no notable frustration or struggle. They also appeared comfortable as they started to engage in informal talk with each other and with the observer/facilitator (e.g. on nursery rhymes). However, some got distracted by the parents' discussion at the other table. At this parent discussion, there was no notable behaviour to report.

When children got to show and talk about their creation in part 5, they all displayed some nervousness, making no eye contact and stimming with their hands. One child continued to work on their invention throughout the show and tell.

### *Session 2*

In the second session, the CPs seemed more nervous than the CPs in the first session, which could have been due to the distribution of six adults to two children. They also appear more introverted, waiting for another CP or the facilitator to take the lead. When the facilitator and one of the observers started working with clay and pipe cleaners, they soon followed. There were no other notable differences compared to the first session, with similar patterns occurring in parts 3 and 5.

# Discussion

## Impact

There could have been an impact on the participants due to having examples, as having examples might have influenced the artefacts. There appeared to be no published literature on the influence of giving examples. Therefore, it would be interesting to see if doing such sessions again if having different examples for the parts has different outcomes. Comparing the outcomes and seeing if the same pattern emerges. For instance, in part 2, if the children still create a pet and a sport for their persona and in part 3, if the artefacts are about experiencing dyslexia or if that type of invention completely disappears.

A behavioural observer was introduced to see the influence of having APs in the session. However, it is difficult to say what the actual direct impact was of having adults collaborate in the session. It could be observed that the children sought comfort during the break with their parents and help and approval. Nevertheless, no notable difference was observed when the participants were working individually in part 3 and then when working together in part 2 besides being distracted by the other participant group from time to time. This could be explored further by having a session with no parent involvement. It could also influence the amount of nervousness of the CPs with fewer unknown adults around. This was especially the case in the second session, where a CP only knew one out of six adults present and was observed by four. This observation could also have influenced whether or not the CP felt at ease. Furthermore, the APs also seemed to dislike being directly observed.

Moving away from the influence of adults on the CPs, there could have been an influence of participants on participants. In the first session, the APs used the experience of the mother with dyslexia to help fill out the influences in part 3. Furthermore, when comparing the first to the second session, it appeared that when one CP started creating, the others followed more easily. However, it is unknown how much influence that had and if the children started adding animals to their invention because another CP did it first.

The dyslexia of the children did have some influence on the session, and the frustration of reading experienced by the CP was underestimated. The sessions were designed to be low in literacy, with it being replaced with colouring-in and simple questions. However, the children in the first session still displayed some frustration. This frustration was not observed in the second session, and this could have been due to the parents reading aloud and writing as a proxy to the children. This resulted in the children seeming less frustrated. However, there was no frustration or resistance when the request was made to write down prototype explanations in part 3 of the session. Furthermore, the children had difficulty letting go of their initial ideas. This fixation could potentially be connected to earlier research on PD with PwD, which suggested repetitive behaviours [73].

It is hard to draw conclusions from the observed behaviour and patterns. There were only a few participants, and the overall goal of the sessions was not to explore these patterns and behaviours in depth. The goal was to obtain insights into what CwD want in a psychoeducation extension tool and how they would design it.

## Future Improvements

Some improvements could be implemented if the sessions were to be done again through the created session method. These future improvements are discussed for each part in this section.

### *Part 1*

Although successful in setting the mood, it might not have been necessary. The icebreaker exercise could be turned into a more creative warm-up, used to get the AP into more of a creative mood and give the CP more time to create.

### *Part 2*

The second part of the session could be adjusted to have fewer literacy elements, which was frustrating for the CP. Introducing, for instance, instructions that parents can read so that children can draw instead of write. Another way is to instruct the parents to read and write as a proxy, as displayed in the second session. Besides a literacy change, there could be a change in instructions on what a persona is and that it should be fictional. Having a real person as the persona, especially in the second session, seemed to make it harder to assign difficulties and design for.

### *Part 3*

To improve the CP part 3, a focus could be put on the interaction between the facilitator and CPs, with more questions. With questions about their invention (e.g. why specific colours and decisions) and how it would function in different situations. These questions could help further explore the CPs' needs and requirements and help the CP further explore their design.

Part 3 was a good conversation starter for the APs but might have been too complicated to imagine the lifelong experiences of dyslexia. Furthermore, the results did not contribute much to the needed insights for the tool. It could have had a bigger brainstorming component, with APs creating detailed prototypes.

### *Part 4*

The break could have been moved between parts 2 and 3 as that would have been a more naturally occurring moment for a small break. The children were disappointed that they would not continue creating after the break; moving it sooner gives them something to look forward to. Furthermore, as the goal is to help with the atmosphere and open communication, it could be beneficial to have this occur before part 3. Finally, the fifth and sixth parts were shorter than expected, making the move also split the session more evenly timewise.

### *Part 5*

The fifth part can be improved the most, as the show and tell made the CP visibly nervous. To mediate this nervousness the show and tell could have been done more collaboratively. For instance, it could also be set up as a fair so that others can walk by to see, and CP can show and explain to their parent while the interaction can be observed.

### *Part 6*

Finally, part 6 could be improved with pre-defined questions or a small survey. However, the feedback can contribute to the insights into the needs, as the summarising done by the AP was quite valuable for concluding the insights.

Despite possible improvements, the sessions gave good insight into the wants and needs of CwD while also exploring what it means to have a PD session with CwD.

## Concluding Thoughts

Having parents at the session and having them work together with their child had a different dynamic than when they were working separately. It seemed that children appreciated being able to ask their parents for help but had frustrations when being corrected. There are clear advantages to having the parents function as proxies; however, the children seemed to also function great without the parents nearby. They also got distracted by the conversation between the parents when they were creating on their own.

Focusing on designing a session tailored to the comprehension level of CwD, it was clear that the chosen art supplies were well-suited, especially the clay. However, there was still too much reliance on literacy elements (e.g. persona personality questionnaire). What helped were the examples made in advance by the facilitator to convey expectations. Furthermore, the children seemed to get some distress from having to present their invention to the other participants. Nevertheless, the session method yielded useful results and insights for the requirements and ideation of a tool that expands psychoeducation for CwD.

# Appendix B – PD sessions quotes in Dutch

*Appendix B - Table 1 Original quotes said during the PD sessions found in Chapter 4.2.2*

| |
|---|
| F:Waar zit je aan te denken?<br>CP6:Wat ik kan doen. |
| F: Eerst bedenken waar je mee wilt helpen? Waar heb je zelf last van?<br>CP5: Het alfabet leren.<br>F: Wat zou je daarmee kunnen doen? |
| F: Kan de dino praten?<br>CP5: Weet ik niet.<br>F: Zegt die niet: je hoeft het alfabet niet te kennen?<br>CP5: *blij*, ja! |
| F: Weet je al wat de armband gaat doen?<br>CP6: Nee |
| F: *Over het magische potlood:* Moet het nog iets anders doen?<br>CP1: Nee, ik wil gewoon dat mensen het begrijpen. |
| CP4: Als je de sleutel in het sleutelgat doet legt hij uit wat dyslexie is, dan laat het dat zien. Aan de vriendinnen enzo. Dan hoef ik het zelf niet uit te leggen. |
| CP3: Ik ga een kip maken die tegen anderen zegt dat je niet bang moet zijn om fouten te maken. |
| CP5: Ik ben nu iemand anders aan het tekenen die nu gelooft dat mijn broertje het alfabet kent.<br>CP5: Mijn broertje denkt aan een dino die zegt je hoeft niet het alfabet te leren kennen. |
| CP6: Ik heb Lois gemaakt, zij heeft zelf ook dyslexie en ik heb dus een armband gemaakt en als ze die om heeft dan zegt iedereen dat ze slim is. |
| AP2: Positief een lastige, aan de ene kant fijn dat het bekend is, maar verder niet positief zelf. |
| AP2: Op de middelbare school is het misschien meer een dingetje om te vertellen dat je dyslexie hebt.<br>AP2: Later lijkt me beter, want dan heb je er misschien minder last van.<br>AP1: Is niet helemaal zo, iedereen blijft je altijd verbeteren. |
| AP3: En wat is het positieve dan op latere leeftijd?<br>AP2: Acceptatie?<br>AP1: Nou niet per se, maar ik dacht creativiteit, wat veel meer voorkomt onder kinderen met dyslexie, volgens mij. |
| AP3: Focus intern minder op school prestatie, maar meer op andere kwaliteiten en meer op andere dingen. |
| AP4: Leuk om te observeren, wat me opvalt is dat kinderen het hebben over kinderen met dyslexie en normale kinderen, iedereen is gewoon normaal. Ergens worden we in een hokje gestopt en goed dat er een onderzoek naar is, en dat zij zich niet anders hoeven te voelen dan een ander. |
| AP2: Hoop dat er iets komt om het makkelijker te maken voor de kinderen. Dat het wat normaler wordt. |
| AP3: Heel fijn om het er met anderen over te hebben. Je blijft er je hele leven mee bezig. Ik dacht als je jong bent is het lastig, maar als je ouder wordt dan is het allemaal onder controle, maar dat is dus heel anders dan gedacht. |

AP6: leuk om er zo mee bezig te zijn, vooral ook over de toekomst. Om er een keer over na te denken, weet niet precies hoe het gaat, maar wel eens goed om over na te denken wat er zou kunnen gebeuren.

AP5: Dat je samen nadenkt wat heeft nou de meeste invloed en wat is dan het belangrijkste. Jezelf accepteren en dat het dan voor anderen ook normaal is.

*Appendix B - Table 2 Original quotes said during the PD sessions found in Appendix A*

AP2: Kijk eens schatje, andere S, *tekent S voor.*
CP2: Euhg (frustratie).

CP2: Hoe schrijf je ….?
AP2: Is met één r.

CP3: Mijn personage kan ook heel goed …., maar ik weet niet hoe ik dat schrijf.
AP3: Dan help ik je toch even.

CP1: *Schrijft op.* Goede B?
AP1: Verkeerde B.

CP1: Kun jij voorlezen?
AP1: *Leest voor.*

CP1: Ik mis alleen de armen, beetje lelijke benen. Wil jij de benen tekenen?
AP1: Recht of ..?
CP1: Gewoon normaal.

CP2: Ik kan geen rondje maken.
AP2: Probeer maar, je kunt ook een glas gebruiken.
CP2: Kun jij het glas vasthouden?

CP1: Wat betekent leergierig? Wat betekent sociaal?
AP1: Dat je graag iets wilt leren. Dat je goed met anderen om kunt gaan.

CP3: Ik wil er nog wat bij, een dier.
AP3: Goed idee!

CP2: Eerst testen of het goeie bruin is.
CP2: *Kijkt naar moeder*
AP2: Ja, mooi.

CP5: Ik kan geen hond tekenen
AP5: Tuurlijk wel, en anders schrijf je het er gewoon bij.

AP1: Lijkt wel alsof je jezelf beschrijft, *lacht*.

CP4: Mijn personage wil politie worden, want dat wil ik ook.

AP4: *Pratend over de persona:* die trui heeft …. Ook.

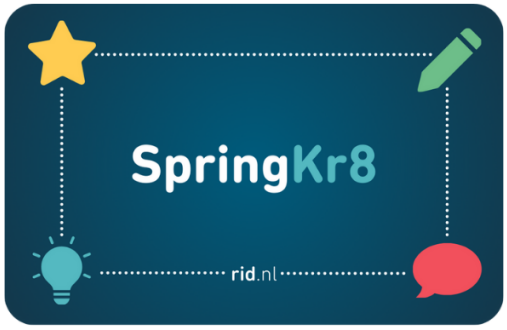
F: Wie ben je nu aan het tekenen?
CP5: mijn broertje.

CP6: Tekent haar buurmeisje van dezelfde leeftijd : 'Ja want zij heeft zelf ook dyslexie'.

# Appendix C – DPD session worksheets

## Werkblad: zelf kaarten maken

Leuk dat je mee wil helpen! Eerst laat ik wat kaartjes zien waar je over mag vertellen wat je er van vindt. Daarna mag je zelf kaartjes maken om jezelf of anderen met dyslexie te helpen.




### Achterkant van de kaarten

Wat vind je?

Waarom vind je dat?


### Uitleg van de kaarten

Wat vind je?

Waarom vind je dat?

De kaarten hieronder hebben 4 verschillende soorten kaarten en hebben een nummer. Je mag eerst vertellen wat je van de kaart vindt en aan het einde welke kaart je het leukste en minst leuke vindt.


### 1:Uitleg-kaart

Wat vind je?

Waarom vind je dat?

*Appendix C- Figure 1 First page of the DPD worksheet, to be printed on A4*


## 2: Kom-op-kaart

Wat vind je?

Waarom vind je dat?

Lzeen kan mioeljik zinj voor kidnerne met diylsxee. Op deez maenir kun je ene beejte vloene heo het kan zjin om te leenz met deyslxie.

## 3: Ervaar-kaart

Wat vind je?

Waarom vind je dat?

Hoeveel kinderen hebben dyslexie?

Twee op de dertig kinderen hebben dyslexie.

## 4: Uitleg-kaart

Wat vind je?

Waarom vind je dat?

Hoe ziet jouw dyslexie er uit?

## 5: Maak-kaart

Wat vind je?

Waarom vind je dat?

*Appendix C- Figure 2 Second page of the DPD worksheet, to be printed on A4*

Probeer 5 zinnen te schrijven met de voldende regels:

- Als er een 'a' in de buurt staat van een 'g', 'h' of 't' vervang het voor een 'o'.
- Elke 't' moet op zijn kop geschreven worden.

## 6: Ervaar-kaart

Wat vind je?

Waarom vind je dat?

**Albert Einstein**

Einstein had waarschijnlijk ook dyslexie

## 7: Kom-op-kaart

Wat vind je?

Waarom vind je dat?

Welke kaart vind je het leukste (1,2,3,4,5,6 of 7)?

1 2 3 4 5 6 7

Omdat:

Welke kaart vind je het minst leuk (1,2,3,4,5,6 of 7)?

1 2 3 4 5 6 7

Omdat:

Wat voor soort kaart vind je het leukst?

☐ Uitleg-kaart ☐ Ervaar-kaart ☐ Maak-kaart ☐ Kom-op-kaart

Omdat:

Wat voor soort kaart vind je het minst leuk?

☐ Uitleg-kaart ☐ Ervaar-kaart ☐ Maak-kaart ☐ Kom-op-kaart

Omdat:

*Appendix C- Figure 3 Third page of the DPD worksheet, to be printed on A4*

## 4 soorten kaarten maken

Nu mag je zelf kaartjes maken met de 4 verschillende kaart soorten. Je hoeft ze niet allemaal te maken, maar mag wel.

### Uitleg-kaart

Uitleg:

### Maak-kaart

Uitleg:



### Ervaar-kaart

Uitleg:

### Kom-op-kaart

Uitleg:

*Appendix C- Figure 4 Fourth page of the DPD worksheet, to be printed on A4*

## Alle soorten kaarten maken

Hier mag je nog meer kaarten maken. Het soort kaart mag je helemaal zelf bedenken (dus niet uitleg/kom-op/ervaar/maak-kaarten, maar mag wel).



_____ -kaart

Uitleg:



_____ -kaart

Uitleg:



_____ -kaart

Uitleg:

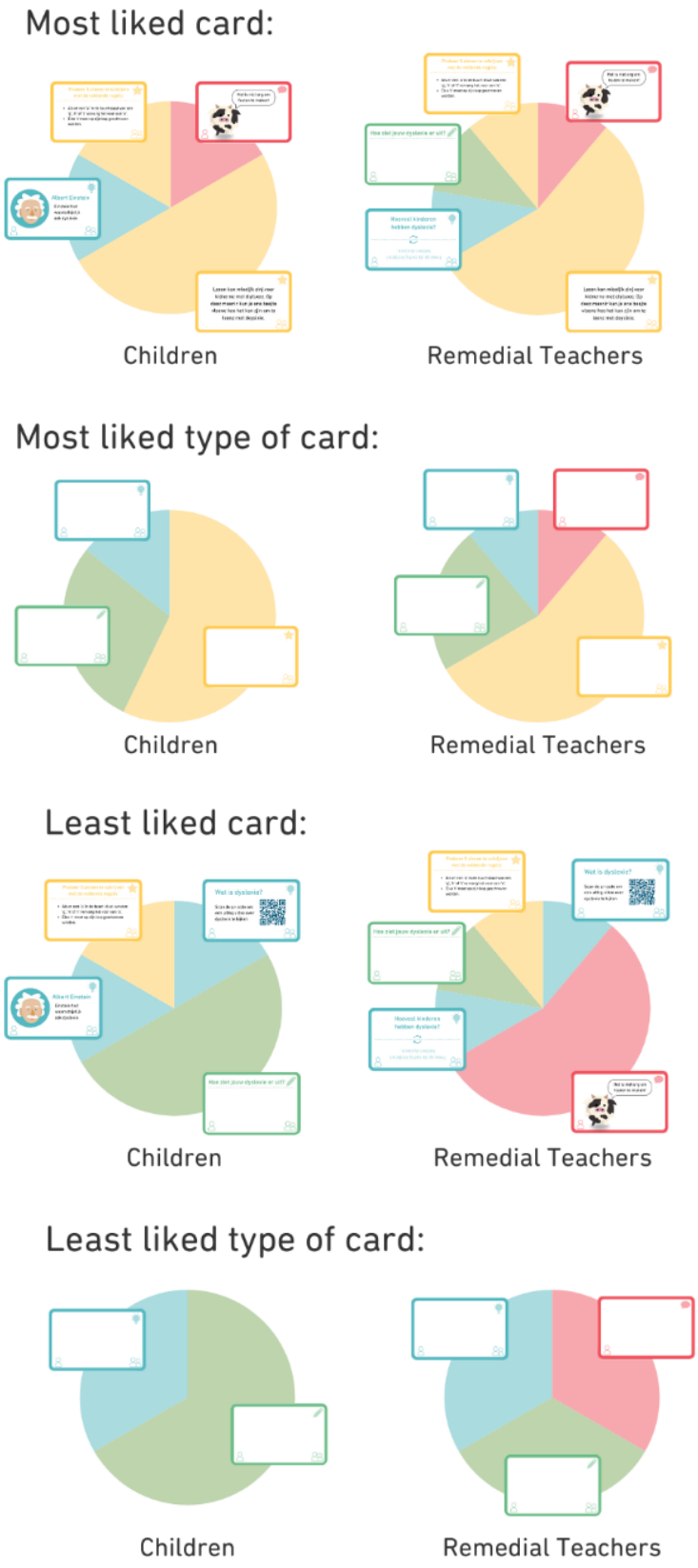


_____ -kaart

Uitleg:

*Appendix C- Figure 5 Final page of the DPD worksheet, to be printed on A4*

# Appendix D – Outcome Questionnaire Part DPD



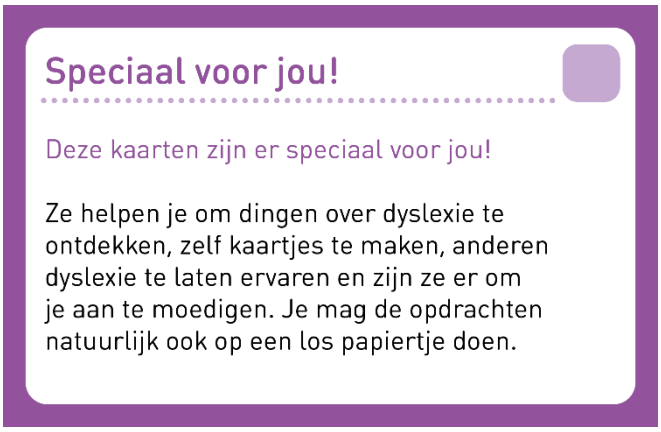

*Appendix D- Figure 1 Pie charts on the outcome of the questionnaire part of the DPD*

# Appendix E – The Cards and their Explanation

FR = Feedback RID main contact person
CF = Feedback on a specific card or card category
PD = Directly or indirectly based on something form the PD sessions
RA = Based on something from the RID PE phone application

All cards and their functions are explained in Appendix E-Table 1. It can also be seen what the card was inspired by, and when a card was directly based on something (e.g. feedback or suggestion) it is highlighted purple.

*Appendix E-Table 1 Overview of all the 54 cards created as the final design and their explinations*

| Cards | Explanation |
|---|---|
|  | Based on:<br>Saying hello and crediting the creator, the CPs, APs, EPs and the University of Twente. |
|  | Based on: FR<br>Used to explain the purpose of the card deck and when to use it. |
|  | Based on: FR CF<br>Used to explain how and when to use the deck with others. |

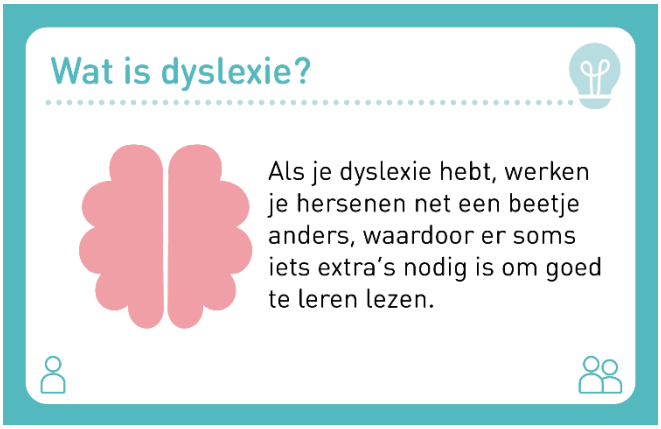

Based on: CF

Used to explain the different card categories and the card layout. With less text than before.


Based on:

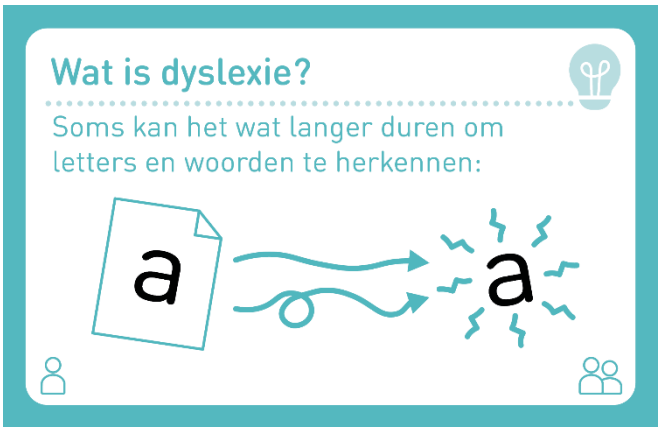
Used to explain dyslexia to the user or to be used to explain to others, so that the user does not have to do so.

However, as the QR can not be updated, it is suggested that it be linked to a page of the RID website that contains the video so that it can be changed when needed.




Based on: 1.1

The need for more cards explaining dyslexia to others was expressed. This card is the first of the explanation cards that does that.

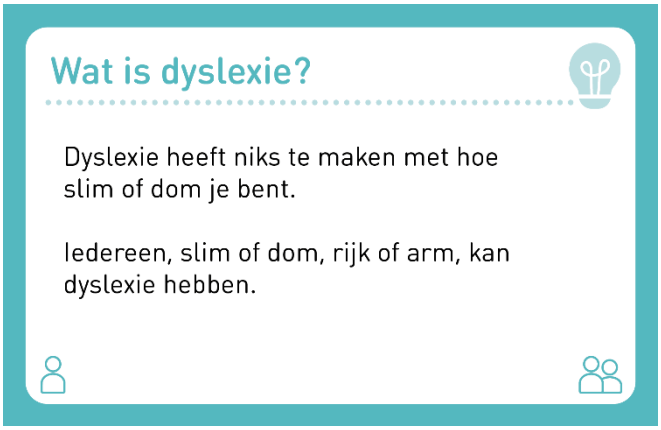



Based on: 1.1 2.5 3.1

As a suggestion, two lines were drawn, conveying that dyslexia might take a little detour in the brain. This card used this idea to convey the seeing of a letter and the registration of said letter, with text explaining that letter/word registration might take longer.

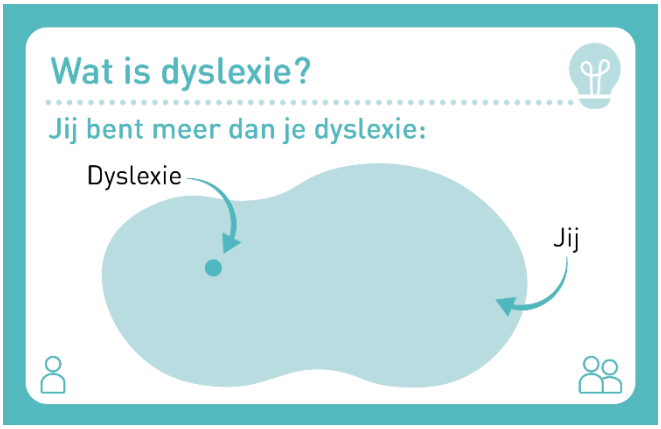

| Based on: | 1.1 | 1.2 |
|---|---|---|

Per the suggestion of a CP, dyslexia makes literacy more difficult. However, a sentence on improving through practice was added.
The scrambled letters represent the literacy difficulties.




| Based on: | 1.1 | 2.3 | 2.4 |
|---|---|---|---|
| | 2.6 | 2.29 | 3.16 |

As one of the most common suggestions was on intelligence having nothing to do with dyslexia, this card was added to the explanations.




| Based on: | 1.1 | 3.5 | 3.14 | PD |
|---|---|---|---|---|

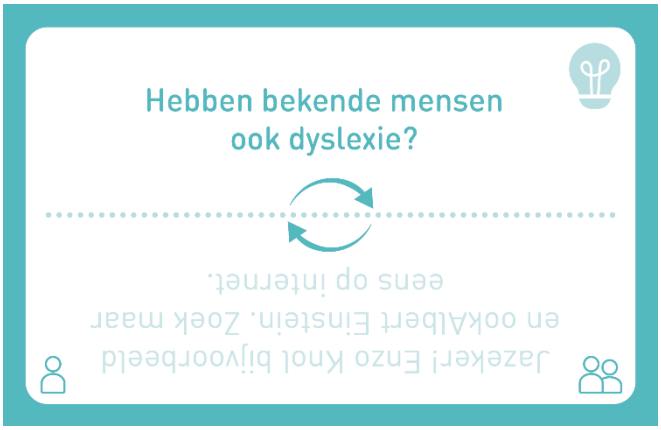
An AP first drew this graphic in the second PD session. As in both PD sessions and in the DPD, a big focus was on having other talents and not only being a CwD, this card was added.


| Based on: | CF |
|---|---|

This card should help the user feel less alone or out of place. After reviewing this specific card in the DPD, the answer was adjusted based on the feedback.


Based on: 2.1 2.3

This card should help the user feel less alone or out of place just like the first Q&A card.



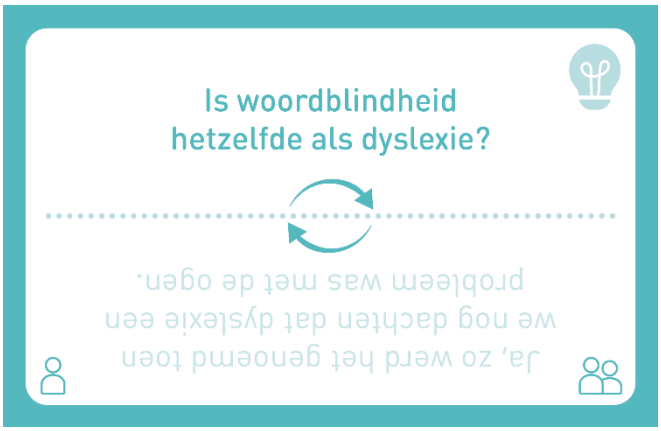

Based on: 3.4 CF

This card should help the user feel less alone or out of place and shows-that dyslexia does not make things unattainable.

After having this specific card reviewed in the DPD, it was apparent that the CP already knew of Einstein's dyslexia, so it was included differently in this card.

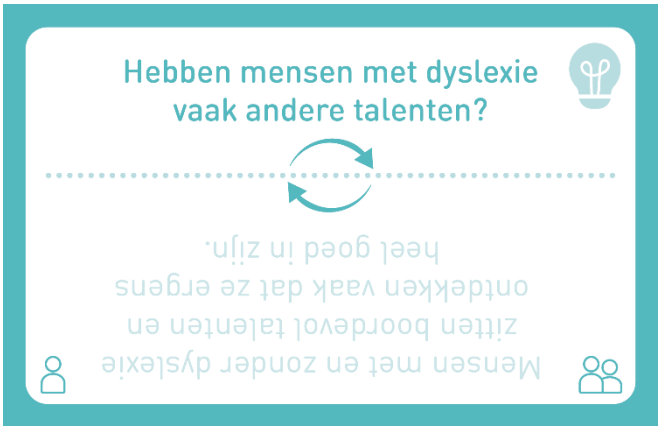

Based on: FR

To also include a less doubled layered card, this card on a dyslexia fact was added. However, it might also help with feeling less alone.




Based on:

To also include a less layered card, this card on the history of dyslexia was added.




Based on: 2.30 3.18 PD

As in both PD sessions, in the DPD and as suggestions, a big focus was on having other talents, so this Q&A card was added.


Based on: 3.12

Directly based on one of the suggestions. This card could help convey to others how the user views dyslexia.


Based on: 2.15

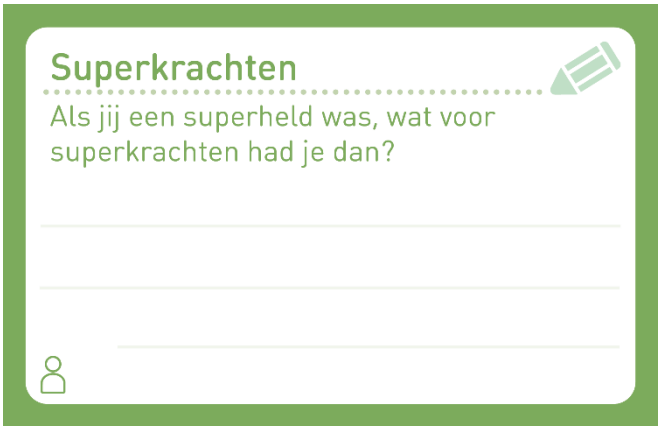
Based on one of the suggestions. This card could help the users have more fun with words and spelling without experiencing limitations. Their environment could, in turn, ask 'why that specific word'.


Based on: 3.13

Moving the focus away from dyslexia and literacy the user can draw/write on this card what they are proud of.


Based on: 1.6 2.19

One of the CPs suggested this card. It is the writing of a story with no literacy. Giving the user a way to convey something without having literacy difficulties.




Based on: 2.18 2.21 2.22 2.23 3.11

Focusing once more on other talents, the users assign themselves superpowers.


Based on: CF

This card does not have anything to do with dyslexia. However, it could make the deck feel more personal and create a closer connection with the product.


Based on: 1.8

This card does not have specific instructions. However, it could make the deck feel more personal and create a closer connection with the product.


| Based on: | 2.22 | 2.23 |
|---|---|---|
| | 2.27 | RA |

This card is based on the character traits used in the RID PE phone application. They can function as reminders of positive personal traits.


| Based on: | 2.22 | 2.23 |
|---|---|---|
| | 2.27 | RA |

This card is based on the character traits used in the RID PE phone application. They can function as reminders of positive personal traits.


| Based on: | 2.22 | 2.23 |
|---|---|---|
| | 2.27 | RA |

This card is based on the character traits used in the RID PE phone application. They can function as reminders of positive personal traits.

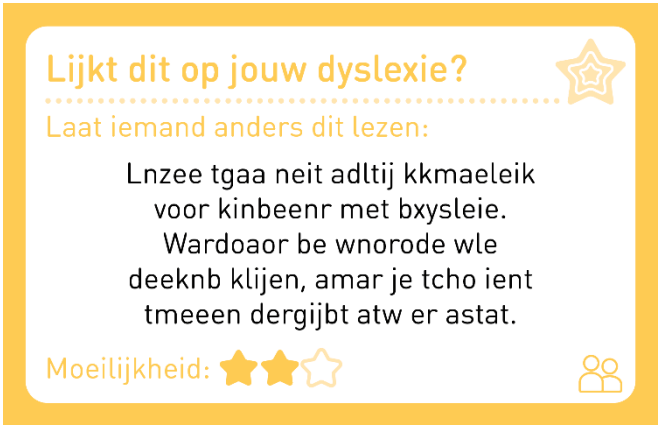

| Based on: | 2.22 | 2.23 |
|---|---|---|
| | 2.27 | RA |

This card is based on the character traits used in the RID PE phone application. They can function as reminders of positive personal traits.


Based on:

This card helps others experience what dyslexia could be like for the user.

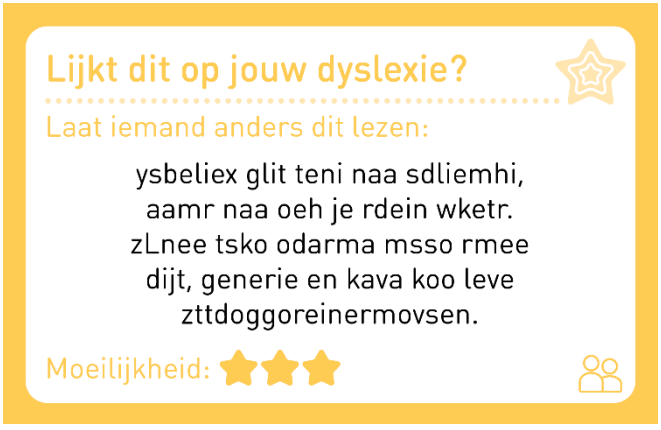
As this card was the most liked card by the CPs, only the design was changed to match the rest of the cards.




Based on: 2.13 3.7 CF

This card helps others experience what dyslexia could be like for the user.

As there was a concern from the EPs that the original was not tricky enough, two more levels of difficulties were added (mixing even more letters and swapping b/d)




Based on: 2.13 3.7 CF

This card helps others experience what dyslexia could be like for the user.

As there was a concern from the EPs that the original was not tricky enough, two more levels of difficulties were added (mixing even more letters, specifically the first letter, and swapping b/d)


Based on: 1.4

Directly suggested by a CP.
Having text that is very small and close to each other can imitate the accidental skipping of words and mixing of letters.

## Lijkt dit op jouw dyslexie?

Laat iemand anders dit lezen:

Vanbaag gingen wij naar het zwempab. We namen plauwe zwemklebing mee en een zwemdanp. Hoobelijk gaan we snel weer met een zwemdanp in het zwempab sbelen.

Based on: 2.13 3.7

Directly suggested by an EP.
This card imitates the swapping of b/d/p that sometimes occurs when CwD are reading/writing.

## Lijkt dit op jouw dyslexie?

Laat iemand anders dit lezen:

Le zenmet dyslexieka nmoe ilijk zijn, om datj ewoo rdenan dersve rwe rkt dan and ere me nsen. Hetv raagt veelins pan ning enfoc us o mdeletters goedtele zenendew oorden tbegrij pen.

Based on: 2.8

This card imitates the struggle with word spacing that sometimes occurs when CwD are reading.

## Lijkt dit op jouw dyslexie?

1. Maak een gaatje in dit kaartje
2. Zoek een blaadje of boek met tekst
3. Leg het kaartje op de tekst
4. Laat iemand anders door het gaatje heen lezen

Hierdoor kunnen ze maar een letter per keer lezen

Based on: 2.9

This card imitates the struggle with reading text letter by letter, sometimes occurring when CwD are reading.

## Laat iemand anders dit verhaal vol onzinwoorden hardop lezen:

Skrenvold klatferde driftig door de gluxpende blortschwaag van de knaustvallei. “Zorg dat de trimbzacht niet klopdwurmt in de plensferk,” zei hij tegen de zwark. Maar nog voor de zwark kon spruivelen, klopdwurmte de trimbzacht met een snerpende plodsch.

Based on: 2.10 3.6

This card imitates what it can be like having to read out loud for CwD.

## Ervaar regels

1. Zoek een blaadje of boek met tekst
2. Kies 1 regel van de gele regel kaarten
3. Laat iemand anders de regel uitvoeren tijdens het overschrijven of lezen
4. Voeg meer regels toe om het moeilijker te maken

Based on: CF

This card explains how to use the rule cards in four steps.

This card was added to clarify the instructions, as the CPs thought they had to use the rules instead of someone in their environment.

## Regelkaart - schrijven

1. Elke 's' aan het einde van een woord wordt een 'z'
2. Elke 'e' moet op zijn kop geschreven worden
3. Elke 'oo' klank in een woord wordt een 'ou'

Moeilijkheid: ★☆☆

Based on: 3.8

This card was added to emulate the experience of having to think of spelling rules while writing. The cards attach other letters to letters and sounds making writing something simple less automatic and increasingly more difficult.

## Regelkaart - schrijven

4. Draai elk woord met 5 of meer letters om
5. Vervang een 'a' vlak voor of na een 'g', 'h' of 't' door een 'o'
6. Vervang elke 'e' voor 'i', 'i' voor 'o', 'o' voor 'u' en 'u' voor 'e'

Moeilijkheid: ★★★

Based on: 3.8

This card was added to emulate the experience of having to think of spelling rules while writing. The cards attach other letters to letters and sounds making writing something simple less automatic and increasingly more difficult.

## Regelkaart - lezen

1. Spreek iedere 'uu' klank wordt uit als 'ui' klank
2. Spreek elke 'j' in een woord korter dan 6 letters wordt uit als 'g'
3. Spreek de 'ng' klank uit als een 'nk' klank

Moeilijkheid: ★★☆

Based on: 3.8 3.9

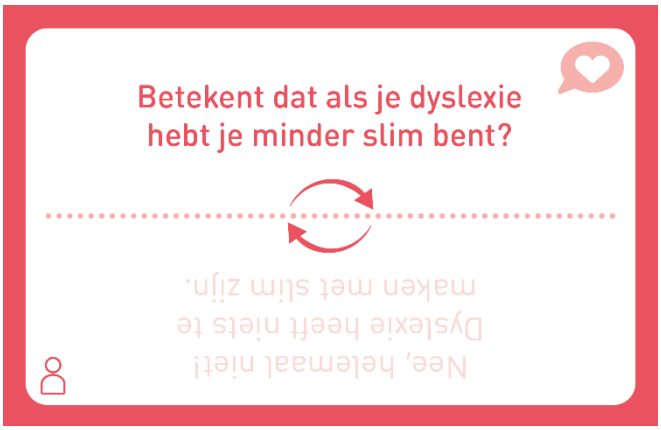
This card was added to emulate the experience of having to think about how to pronounce certain letter combinations. The cards attach other letters to letters and sounds, making reading aloud less automatic and increasingly more difficult.


| Based on: | 3.8 | 3.9 |
|---|---|---|

This card was added to emulate the experience of having to think about how to pronounce certain letter combinations. The cards attach other letters to letters and sounds, making reading aloud less automatic and increasingly more difficult.


| Based on: | 2.10 | 2.12 | 3.6 |
|---|---|---|---|

This card was added to emulate the stress of time constraints and needing high levels of focus CwD might experience. It introduces time constraints and instructions to distract the person doing the experience.




| Based on: | 2.3 | 2.4 | 2.6 |
|---|---|---|---|
| | 2.29 | 3.3 | 3.16 |

One of the most common suggestions was that intelligence has nothing to do with dyslexia, so this card was added to the Q&A cards.


| Based on: | 2.28 | CF |
|---|---|---|

This card was added to encourage children to stick with their practice and give hope for the future.


| Based on: | 3.18 | CF |
|---|---|---|

This card was added to remind the user that making mistakes is not a bad thing.


| Based on: | RA | CF |
|---|---|---|

This card was added to remind and encourage the user to ask for help if and when needed.

This is also a promenent part of the RID PE phone application.


| Based on: | PD | CF |
|---|---|---|

This card was added as one of the CPs spoke of CwD and normal children. It should remind the user that they are more than their dyslexia; they are normal.


| Based on: | 2.30 | 3.17 |
|---|---|---|

The user uses this card to get direct compliments from their loved ones, possibly increasing their self-image.


Based on: 2.30 | 3.17

The user uses this card to get direct compliments from their loved ones, possibly increasing their self-image.


Based on: PD

This card is to encourage and cheer on the user. It conveys the message that it is okay to make mistakes.

The design was slightly changed from the concept to better match the final design.


Based on: 1.12 | 2.25

This card conveys the message that it is okay not to know something.

One of the CPs expressed a concern that they might not know something.


Based on: PD

This card was added to encourage children to stick with their practice and give hope for the future.


Based on: 1.10

This card is based on a direct text suggestion of a CP. Conveying the message that nothing is out of reach despite having dyslexia.


Based on: 1.9

This card was added to encourage the user to stick with their practice and give hope for the future.


Based on: 3.13

The other animal encouragement cards are more about persisting; this card tells them to be proud of how far they have come.


The back side of the cards. Representing the four categories and RID.


op jouw dyslexie?
Ben jij?
Kleur in wat jij bent
of bedenk er zelf wat bij:
Als je blijft proberen, dan word je er beter in!
Hebben mensen in andere landen ook dyslexie?
Regelkaart - schrijven
4. Draai elk woord met 5 of meer letters om
5. Vervang een 'a' vlak voor of
'h' of 't' door een 'o'
6. Vervang elke
Moeilijkh
Superkrachten
Als jij een superheld was, wat voor superkrachten had je dan?
Speciaal voor jou!
Deze kaarten zijn er speciaal voor jou!
Ze helpen je om dingen over dyslexie te
ontdekk
dyslexi
je aan
natuu
Wat is dyslexie?
Jij bent meer dan je dyslexie:
Dyslexie
Laat iemand anders dit
vol onzinwoorden hardo
Skrenvold klatferde driftig
gluxpende blortschwaag va
knaustvallei. "Zorg dat de tr
klopdwurmt in de plensferk
de zwark. Maar nog voor de
spruivelen, klopdwurmte de
met een snerpende plodsch
Smile
Schrijf
maar
bereiken: