Self-concepts and psychological health among children and adolescents with reading disabilities and the influence of assistive technology

Emma Lindeblad
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SELF-CONCEPTS AND PSYCHOLOGICAL HEALTH AMONG CHILDREN AND ADOLESCENTS WITH READING DISABILITIES AND THE INFLUENCE OF ASSISTIVE TECHNOLOGY

EMMA LINDEBLAD

LINNAEUS UNIVERSITY PRESS
Abstract


This thesis includes three empirical studies that have all aimed to increase the understanding of the interactions and connections between self-concepts, reading impairment, psychological health and Assistive Technology (AT). The use of applications in tablets as assistive technology to facilitate reading and compensate for reading impairment and its impact on the participants' self-concepts and psychological health as well as on their reading abilities was also of interest.

The first study included 67 pupils in school years 4-9. They were assessed by the Beck Youth Inventory (BYI) regarding self-image, anxiety and depression. The results showed no deviance from age-equivalent norm group scores.

The second study included 35 pupils in school years 4-6. This study aimed at investigating the transfer effects on decoding and general reading ability after 20 intervention sessions where AT (applications in tablets) were used. Results showed that the decoding ability had progressed at the same rate as that of the norm group. The results also showed that using AT increased motivations to learn, as well as independence and improved family climate.

The third study was a randomized control study (RCT) with 137 participants in school years 4, 8 and high school. The results showed that reading impaired children and adolescents to a great extent, but not completely unanimously, did not depict any different self-image or self-esteem than peers with an expected reading ability of the same age. Self-esteem was investigated by the Cultural Free Self Esteem Inventory (CFSEI-3). The CFSEI-3 scores showed no effect by interventions with AT. The results also showed that there were no signs of depression, assessed by BYI, in the investigated groups, but somewhat inconclusive results regarding anxiety where the school-year 4 group depicted higher levels of anxiety.

The results generally showed a more positive depiction than what previous studies within the field have presented, which was interpreted as being due to the development of efficient pedagogical strategies and supportive attitudes in the school context, as well as among family members or peers.

Keywords: dyslexia, reading impairment, self-image, self-esteem, assistive technology, reading interventions
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Sammanfattning


Denna avhandling innehåller tre empiriska studier som allt har till syfte att öka förståelsen för interaktionerna och kopplingarna mellan självbegrepp, läsförmåga, psykisk hälsa och assisterande teknik (AT). Användningen av applikationer i surfplattor som hjälpmedel för att underlätta läsning och kompensation för lässvårigheter och dess inverkan på deltagarnas självbegrepp och psykiska hälsa samt på deras läsförmåga var också av intresse.


Resultaten visar i allmänhet en mer positiv bild än vad tidigare studier inom fältet har presenterat, vilket tolkades som en följd av utvecklingen av effektiva pedagogiska strategier och stödjande attityder i skolans sammanhang, samt bland familjemedlemmar eller kamrater.
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Den första studien omfattade 67 elever i skolår 4 -9. Frågeformuläret Becks ungdomsskalor (BYI) användes för att skatta självbild, ångest och depression. Resultaten visade ingen avvikelse från åldersekvivalenta normgruppsresultat.

Den andra studien omfattade 35 elever i skolår 4-6. Denna studie syftade till att undersöka överföringseffekterna på avkodning och allmän läsförmåga efter 20 i nterventionssessioner där AT (applikationer i surfplattor) användes. Dessutom undersöktes ATs inverkan på vardagslivet. Resultaten visade att deltagarnas avkodningsförmåga hade utvecklats i samma takt som normgruppens. Resultaten visade också att man med hjälp av AT ökade motivationen att lära sig, såväl som självständighet och förbättrat familjeklimat.

Den tredje studien var en randomiserad kontrollstudie (RCT) med 137 deltagare i skolåren 4, 8 och gymnasiet. Resultaten visade i stor utsträckning, men inte helt enhälligt, att barn och ungdomar med lässvårigheter, inte visade på mer negativ självbild eller självkänsla än jämnåriga kamrater med en förväntad läsförmåga. Självkänslan undersöktes med Cultural Free Self Esteem Inventory (CFSEI-3) och resultaten visade inte på någon effekt av interventioner med AT. Resultaten visade också att det inte fanns några tecken på depression enligt BYI i de undersökta grupperna, men resultaten är något in konklusiva angående ångest där skolår 4 -gruppen visade på en högre ångestnivå.

Resultaten visar i allmänhet en mer positiv bild än vad tidigare studier inom fältet har presenterat, vilket tolkades som en följd av utvecklingen av effektiva pedagogiska strategier och stödjande attityder i skolans sammanhang, samt bland familjemedlemmar eller kamrater.

**Abbreviations**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>ADHD</td>
<td>Attention Deficit Hyperactivity Disorder</td>
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<td>APA</td>
<td>American Psychiatric Association</td>
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<td>AT</td>
<td>Assistive technology</td>
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<td>BYI</td>
<td>Beck Youth Inventory</td>
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<td>CFSEI</td>
<td>Cultural Free Self-esteem Inventory</td>
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<td>DAISY</td>
<td>Digital Accessible Information SYstem</td>
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<td>HAAT</td>
<td>Human Activity Assistive Technology</td>
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<td>M</td>
<td>Mean</td>
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<td>N/n</td>
<td>number</td>
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<tr>
<td>PIRLS</td>
<td>Progress In International Reading Literacy Study</td>
</tr>
<tr>
<td>PTSD</td>
<td>Post Traumatic Stress Disorder</td>
</tr>
<tr>
<td>RCT</td>
<td>Randomized Controlled Trial</td>
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<tr>
<td>SBU</td>
<td>Statens Beredning för social och medicinsk utvärdering</td>
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<tr>
<td>SD</td>
<td>Standard deviation</td>
</tr>
<tr>
<td>SEN</td>
<td>Special Educational Needs</td>
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<td>SVR</td>
<td>Simple View of Reading</td>
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<td>T</td>
<td>Test trial</td>
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<tr>
<td>TSP</td>
<td>Text to speech [program]</td>
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<td>UK</td>
<td>United Kingdom</td>
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ACKNOWLEDGEMENTS

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Great thanks to my fellow PhD students at Linnaeus University; our hours of whining and chit chat made the adrift through a harsh desert landscape somewhat easier.

Thanks to family and friends, who supported and cheered me through the years. Thank you for your consistent encouragement.

LIST OF SCIENTIFIC PAPERS

This thesis is based on the following published or submitted articles:

Study I:
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Study II:
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Study III:

Study I and II are included in the thesis with the kind permission of the publishing journals.
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INTRODUCTION

Today, reading ability has become a fundamental for optimal adaption in our society. To master reading is a necessary skill to succeed in academic settings, while failing to do so may have major implications for an individual. A great deal of information that we attain is delivered in written form, regardless of the medial way of providing it, whether by books, newspapers, the Internet or subtitles on TV. To fully encompass governmental edicts and take active part in the community as well as in the social environment, in real life or digitally, an age-equivalent reading ability is therefore often required. Reading impairment may influence the everyday life of an individual in many ways: the opportunity to acquire education at an equal level with non-impaired individuals; reaching academic goals in higher education and affecting independence, since many societal functions such as governmental information take reading ability for granted. The exclusion from basic communal aspects as well as from social groups, for instance social media or other social activities where reading might be mandatory, such as reading menus, tables or programmes, may generate negative effects on psychological health issues. Repeatedly feeling excluded, embarrassed, inadequate, perhaps even stupid, different or like a hopeless learner, as has been reported in anecdotal and scientific evidence about everyday life as a dyslexic (Glazzard, 2010; McNulty, 2003), may generate negative evaluations about oneself, and subsequently cause psychological ill-health like anxiety and depression. However, new technologies and a new knowledgeable era within the realms of reading and writing disabilities and dyslexia raise the hope of improvement for the reading impaired, both as to equating educational settings via, for instance, the use of assistive technology and increasing knowledge about reading impairment throughout society, and by doing so eliminating the negative effects on psychological health issues.
Structure and aims of the thesis

The target group comprised Swedish children and adolescents with reading impairment and/or dyslexia. The overall aim of the thesis was to create an understanding about the interconnected relationships between the notions of self-concept, reading impairment and assistive technology. Further, the aim was to investigate if Swedish children and adolescents with reading impairment would depict lower self-concepts than their peers, and whether Swedish children and adolescents with reading impairment show a higher level of symptoms of psychological ill health than their peers, as well as to understand contextual factors behind the results. Context, which is presumed to have a prominent explanatory position in this thesis, is defined below. An additional aim was to investigate whether assistive technology may support and compensate the ability to assimilate and create text. This intervention study investigated the impact of using technological accommodations on reading ability and whether it would equate the educational and social environment for the reading impaired individuals and improve aspects of their self-concept.

First, an overview of the concept of reading is presented, including how to understand reading impairment from the Simple View of Reading model (Gough & Tunmer, 1986). Next, there is a discussion about how to define dyslexia and the neurological and hereditable aspects as well as how dyslexia is constituted on a behavioural level (Lyon, Shaywitz, & Shaywitz, 2003). This is followed by a section with a discussion of the importance of an adequate reading ability for optimal adaption to society and of remaining healthy. This section of the thesis is followed by an account of the connections between reading impairment and psychological health, referring to the results of previous international as well as Swedish studies. Next follows a section about self-concepts, which investigates the different levels of abstraction regarding the self, as illustrated by a model for visualizing the notion. The following section explains assistive technology according to the definition formulated by Edyburn (2015) as well as its interconnections with self-concepts and psychological health. In this section, the HAAT model (Cook & Hussey, 2002; Cook & Miller Polgar 2008) is introduced. In the final section, the notion of early detection of reading impairment is discussed.

The results of the studies included are discussed by means of the applications of the HAAT model created by Cook and Hussey (2002) and modified by Giesbrecht (2013), a model which targets the interconnectedness between the human, the activity, the assistive technology and the context and is therefore suitable for being employed in the analysis and the discussion of the results.
Reading and reading difficulties

According to the Simple View of Reading (SVR) model, the act of gaining information via written text is described as a formula where decoding and language comprehension equals reading, \( \text{Reading} = \text{Decoding} \times \text{Language comprehension} \) (Gough & Tunmer, 1986; Gustafson, Samuelsson, Johansson, & Wallmann, 2013; Hoover & Gough, 1990; Kirby & Savage, 2008). Decoding is the ability to connect a symbol with a speech sound and to summarize these symbols into words, sentences and texts (Hoover & Gough, 1990; Lundberg & Austad, 1999; Snowling, 2001). Language comprehension is the complex cognitive process of understanding the meaning of words and larger units of language such as sentences, stories or texts (Gustafson et al., 2013). The language comprehension component could be interpreted as reading comprehension and requires an understanding of context, inference making and an ability to detect implications as well as an act of interpreting the text being decoded (Bishop, 1997). To perform the act of reading, both decoding and language comprehension are necessary, and deficits in either or both of the components will result in reading difficulties, whose severity will depend on the type and the severity of the deficit in any of the components (Gustafson et al., 2013; Hoover & Gough, 1990).

A reading difficulty could be said to occur when a child is not performing the reading activity adequately in comparison with age equivalent peers, and when the educational level or other plausible reasons have been excluded, such as poor schooling, intellectual disabilities of different kinds, or emotional distress that may hinder the learning process (American Psychiatric Association, 2015; Snow, Burns, & Griffin, 1998).

As mentioned above, several factors could contribute to reading difficulties with dyslexia being one. Dyslexia is a complex neurological condition (Lyon, Shaywitz, & Shaywitz, 2003; Singleton, 1999) and a specific reading disability that originates from a cognitive deficit in the phonological processing domain (Hatcher, Snowling, & Griffiths, 2002; Lyon, Shaywitz, & Shaywitz, 2003; Tunmer & Greany, 2010). Within the Simple View of Reading model, dyslexia is specifically associated with decoding deficits, which in turn generate an impediment in reading comprehension skills. For a review of the research regarding the dyslexia definition, see Elliott & Grigorenko (2014).

Since dyslexia constitutes itself as a decoding deficit and, consequently, as a reading difficulty, a dyslexic reader often requires a disproportionate amount of time to perform the same act of reading or writing as a non-impaired reader. Individuals may also display deficits in other cognitive aspects such as organizational skills (Barden, 2014; Elliot & Grigorenko, 2014; Tunmer & Greany, 2010). Dyslexia has shown to have a comorbidity with Attention Deficit Hyperactive Disorder, ADHD, since co-variation has been discovered on attention factors, such as working memory (Elliot & Grigorenko, 2014).
However, the associated problems of deficits in working memory and/or attention problems which subsequently may fulfil the diagnostic criteria for ADHD are not within the scope of this thesis. There are several other psychiatric and/or psychological maladaptations whose relationship to and interconnectedness with reading difficulties would be of interest to investigate, like intellectual disabilities or personality disorders. However, in this thesis the focus is set on documented reading impairment, including dyslexia.

Dyslexia has a scientifically confirmed hereditability (Mascheretti et al., 2017; Wadsworth, Olson, Penning, & DeFries, 2000) and may often be traced in families (McNulty, 2003). The prevalence in the population is estimated at 5-8% (SBU, 2014). This prevalence can be compared to other learning impairing disabilities such as ADHD, which has an estimated prevalence of 5% among children and of 2.5% in adults (American Psychiatric Association, 2014).

A new way to comprehend and define the act of reading is to “assimilate text”, and writing to “generate text” as discussed in studies I and II, which means that gaining information is the main goal of the activity, not to decode letters into meaningful words, sentences and texts. The gaining process could be achieved via listening to a text being read aloud. With new technology, the way information is gained may be of lesser importance in the future (Lindeblad et al., 2016).

In this thesis, the participants had and participants with dyslexia are included. The term “reading impaired” will be used for the reading deficits of the participants in the studies. To include individuals with dyslexia in the reading-impaired group is motivated by the similar circumstances in the school context that they may be assumed to have encountered, and by the fact that all participants took part in the same intervention program, unrelated to documented reading disabilities, when reading is comprehended within the realms of SVR the specific characteristics of their reading difficulties. Due to the age of some of the participants it is plausible to assume that several will attain a dyslexia diagnosis after undergoing assessment later in life.

The importance of reading ability

In the context of a modern, industrialized, technically and information-based society, many aspects of everyday life take reading ability for granted and if this is impaired, an individual may experience substantial limitation and decrease in the quality of life (Novita, 2016; Terzi, 2007). To be able to become an informed and knowledgeable citizen on whom the fundamentals of a democratic state rest, literacy could be seen as a requirement. It may therefore be argued that reading impairment may even give rise to threats to democratic principles (Abascal et al., 2015). It is reasonable to assume that most
Educational systems are based on teaching how to read in order to enable pupils to read to learn. In school, a reading-impaired child will undoubtedly face considerable challenges to become able to learn and may never reach a level equal to that of their peers. Previous studies have mentioned how the hardship of repeated failures in educational settings may have an impact on self-concepts and thus generate a vulnerability to psychological ill health in reading-impaired children (Bandura, Barbaranelli, Caprara, & Pastorelli, 1996; Denhart, 2008). The personal insight into being different than others and the labelling made by the environment are often connected with low self-esteem among reading-impaired individuals (Carroll & Ilse, 2006; McNulty, 2003; Riddick, Sterling, Farmer, & Morgan, 1999; Singer, 2005; Taylor et al., 2010). Furthermore, on an individual level, a great deal of social life takes part within social media today, which may also require swift perception of digital text-based information. Barden (2014) enabled reading-impaired adolescents to take part in social media on an equal level with the support of Assistive Technology. The ability to take part in different social media activities with friends without feeling hindered by reading impairment has been demonstrated in previous studies to have a positive effect on psychological health (Gasparini & Culen, 2012; White & Robertson, 2014). Peers and activities among friends play an increasingly important part in a child’s health and well-being when growing up (Lass, 2011).

**Reading impairment may induce psychological ill-health**

In previous psychology studies within the area, connections have been made between reading impairment and a decline in certain aspects of psychological health, especially levels of anxiety and depression (Alessi, Rappo, & Pepi, 2014; Alexander-Passe, 2015; Carroll & Illes, 2006; Dahle, Knivsberg, & Andreassen, 2013; Ghisi, Bottesi, Re, & Mammarella, 2016; Humphrey, 2002; Mugnaini, Lassi, La Malfa, & Albertini, 2009; Nelson, Lindstrom, & Foels, 2015). Anxiety and/or depression have been defined, construed and therefore assessed in various ways in the above cited studies and within the field, and therefore some caution could be recommended when generalizing about health issues among the reading impaired from these studies. However, the similarity in these studies is the reading impairment and/or dyslexia in the investigated group and the explanations given to the results: individual experiences of repeated failures in school, being bullied or experiencing feelings of exclusion from peers, feeling different, being called stupid, lazy or a hopeless case will with certainty affect the psychological health of any child. Unfortunately, according to anecdotal research this has been the reality for many school-aged children with reading impairment (Alexander- Passe, 2006; Burden, 2008;
Denhart, 2008; Glazzard, 2010; Davis, Nida, Zlomke, & Nebel-Schalm, 2009; McNaulnty, 2003; Singer, 2005). There is hence a need for large and systematic studies within the area to further clarify the relationships between psychological ill-health and reading impairment.

Experiences of the misfortunes described above may influence self-concepts as well as psychological wellbeing. The notion of resilience may contribute to understanding why some children can generate strength against negative incidents, as described above. Resilience is commonly defined as the adaptability to challenging life events and may be applied on an individual as well as on a systematic level (Masten, 2014). Within the research field of developmental psychopathology some focus has been directed to mechanisms that initiate “positive adaptation despite exposure to significant threat (...) that constitutes major assault on the processes underlying biological and psychosocial development” (Cicchetti, 2013, p. 404). In this thesis, it is interesting to incorporate the concept of resilience in order to understand the reciprocal relationships between reading ability and psychological health. However, resilience and psychological health have not been investigated further, due to the scope of this dissertation, though it is assumed that, among reading impaired children and adolescents, a range of different reactions may be provoked toward similar situations, thus creating different influences on psychological health.

**Self-concepts**

Harter (1992) states that self-esteem is important not only for learners’ academic achievement but also for their long-term general wellbeing (in Ntsahngese et al., 2011). Humphrey (2002) claims that most previous research within the area has linked self-esteem to academic achievement, behavioural [mal]adjustment and emotional regulation. Previous studies have connected behaviour problems and/or psychological ill-health with reading difficulties (Bandura, 1986; Bandura et al., 1996; Covington, 1992; Martinez & Semrud-Clikeman, 2004; Palombo, 2002; Humphrey & Mullins, 2002; Burden & Snowling, 2005).

The self is greatly debated within the comprehensiveness of psychological theory. The standpoints range from a psychoanalytic declaration of its importance (Harter, 1992; Kernberg, 1982; Stern in Lichtenberg & Kaplan, 1983) to disregarding its unique existence in the realms of Skinnerian behaviourism (Phelps, 2015). In sociological theory, the self has often been discussed from a pragmatic perspective and “conceived as versions of the internal conversations” (Wiley, 1988, p. 256).
In the realms of reading psychology, the self has a recognized position in the realization that the way developing readers think and feel about themselves makes a substantial contribution to their reading progression and vice versa. However, how the inner cognitive dialogue is described varies considerably, which makes the self into a non-uniform concept.

Humphrey (2002) made a literature review about the self-concepts within the psychology of reading difficulties, stating that the self is “far from a unitary construct” (p. 1). Humphrey (2002) credits Rosenthal (1973) and Thomson and Hartley (1980) as pioneers in the research field of children with reading impairment and/or dyslexia, connecting reading impairment with an impact on the self-concept. Fälth, Svensson, Carlsson and Gustafson (2014) reviewed research literature in their study and concluded that the nature of self-concepts seems to constitute the foundation of different behaviours in school-related situations.

How self-concepts develop is answered differently from different theoretical approaches. In the field of personality psychology, a trait discussion is often initiated (Eysenck in Buzz-Weissmeyer, 2013) and a debate regarding different contributions from biological or social heritage frequently follows. In clinical psychology, there are basically two broad categories of theory that can be said to have emerged. One perspective is rooted in psychoanalysis and the other draws its theoretical standpoints from behaviourism and biological as well as learning psychology. How the self-concepts develop is therefore explained in dissimilar ways and is given different kinds of significance. Theoretical statements that are communal include the suggestion of the importance of context, constituted by close caregivers, family, siblings, peers, teachers, systems, societies and cultures that have an impact on how our inner selves are formed. We may learn through observations of significant others (Bandura, 1986) and gradually internalize societal values and rules through stages of a developmental and maturation process (Freud & Clifford, 1989) or possibly learn behaviours through being reinforced by the environment (Beck, 1992).

As Figure 1 illustrates, the notion of self-concepts includes various terms. The model in Figure 1 aims to illustrate how different concepts in the literature can be arranged to create a better understanding of the different labelling used in the literature within the field of research. The different concepts in the model are assumed to be coexisting, though at different abstraction cognition levels. All positions in the model are assumed to play different roles without rivalry or hierarchy. Self-efficacy is an individual’s belief in possessing the ability to complete a specific task in a given situation and influences the constitution of goals and motivation, in some sense the personality, in an individual’s life (Bandura, 1986; Klassen & Lynch, 2007; Schunck, 1991).
Self-efficacy is learned through the observation of significant models in the close environment and represents a major part in how one embraces tasks, formulates the goals, level of effort and persistence chosen in a given situation as well as evaluating performance. Hence it is important in learning situations (Bandura, 1986; Bandura et al., 1996; Schunck, 1991; Zimmerman, 2000). Close to the concept of self-efficacy is the construct of Locus of Control, which refers to an individual’s unique tendencies to hold circumstances responsible for inner or outer events (Rotter, 1966). Locus of control affects and is affected by self-efficacy and subsequently by other self-concepts. In this thesis, the concept of Locus of Control is not directly investigated.

Thus, self-efficacy could be understood as a situational and concrete concept as depicted in Figure 1. Self-confidence is generally not used in reading psychology, due to the preference of other concepts. However, self-confidence is investigated in other areas of psychology such as sports psychology (Ferliz, 2002) and in health issues such as loneliness (Cheng & Furnham, 2002). In this domain of literature, self-confidence is defined as related to self-efficacy, being an appraisal of one’s own abilities, but perhaps in a slightly more general and abstract manner and not limited to a specific situation or a given task but still referring to certain definable abilities (Judge et al., 2002).

In the field of research on reading development and hence reading difficulties, self-esteem is perhaps the most commonly used concept (Alessi et al., 2014; Fälth et al., 2015; Humphrey, 2002; Humphrey & Mullins, 2002; Glazzard, 2010; Imram, 2013; Nalavany, Crawan, & Sauber, 2013; Ntsangase et al., 2008; Novita, 2016; Riddick et al., 1999). Figure 1 illustrates self-
esteem as a concept positioned on a continuum where it is more abstract than self-efficacy and self-confidence but could be said to have a more concrete meaning than self-image and is thus constructed as a more situational concept. Self-esteem is not necessarily described as uniform within the individual since it is possible to have a strong self-esteem in one area but not in another (Battle, 2002; Fredrickson & Jacobs 2001; Novita, 2013; McArthur, Castles, Kohnen, & Banales, 2016; McNaulty, 2003). Shavelson, Hubner and Stanton (1976) pioneered in their work by subdividing the self hierarchically into three domains where the global self was positioned as superior, whereas the academic, verbal-academic and mathematical selves were situated underneath, indicating that an impact on one of the subdivisions did not necessarily affect the others but, usually, the global self (Shavelson et al., 1976). Following this notion, self-esteem may be subdivided into domains like the four domains of self-esteem described by Battle (2002): Academic, Social, Home and General, plus the Personal domain in adolescents. These domains constitute subscales in the CFSEI-3 test used in the third study in the thesis. Their labels suggest what area of self-esteem is theoretically enclosed by the domain: Academic refers to school-related self-esteem issues, such as evaluating one’s ability to learn in comparison to one’s peers; Social self-esteem refers to aspects of self-evaluation regarding interaction and the child’s own perception of peer acceptance; Home refers to perceived support from family members and to the family climate; General represents a broad sense of self-esteem but not in the sense of being top of the hierarchy of scales as in the Theory of Shavelson (1976). The domains are considered interrelated and mutually affecting one another (Battle, 2002; Shavelson et al., 1976).

The position of self-esteem in the middle of the continuum, as illustrated in Figure 1, makes the concept of great interest to research in reading psychology. The non-generalizing and situation-specific qualities of the concept makes it possible to empirically refer it to a certain domain of interest, in this case reading [dis]ability. On the other hand, the abstract qualities of the concept enable making statements about an individual level of self-esteem, in the sense that it affects the individual’s behaviours across situations. The concept enables concrete and measurable statements in questionnaires as well as providing a global appreciation of the individual’s self-worth (Battle, 2002; Harter, 1999; Humphrey, 2002).

Self-image is even higher on the abstraction level in the model illustrated in Figure 1, in the sense that the concept is generalized and greatly influences most behaviours including emotional states and cognitions. Beck, Beck and Jolly (2001) used the term self-image to describe cognition regarding self-evaluation in an abstract and generalized manner. In this sense, self-image represents a global representation of self-worth, reaching across situations and upcoming tasks. In the context of research on reading impairment, self-image is of interest when it comes to discussing what impact reading difficulties have on an individual. In Study I and III, the concept of self-image was used to
describe the state of self-evaluation in reading impaired children and adolescents. This self-image concept is derived from the Theory of Depression (Beck, 1979), a ground-breaking work that defined almost all psychological ill health as maladaptive patterns of cognitive content (Beck, 1979). This was in sharp contrast to the then prevalent paradigm of the theory of psychoanalysis which described psychological ill health as an inner imbalance of unconscious forces (Freud, 1922). In the Theory of Depression, self-image is described as deriving from past experiences and influencing all cognitions, including thoughts, feelings and motives (Beck, 1979). This description makes it into an abstract concept that exercises influence on the more concrete ones on the Figure 1 continuum.

At the highest level of abstraction, according to the model presented in Figure 1, is identity; a complex psychological concept with numerous definitions without much consensus among researchers. The most common definitions agreed upon is that identity is how we describe ourselves, including elements of self-evaluations on the different levels, as well as emotional factors, and constituting a broader sense of who we are (Baumeister, 1997; Nario-Redmond, Noel, & Fern 2013). To this thesis, the concept of identity is interesting because it integrates “being reading impaired” and the emotional responses to that statement. However, due to the scope of the dissertation and its focus, the concept of identity and how reading impaired children or adolescents encompass their reading impairment in their identity, and what consequences reading impairment may have on identity, are topics beyond the focus of this thesis.

**Reading impairment and/or dyslexia, self-concepts and psychological health**

Several studies have connected reading impairment and/or dyslexia with self-concepts and have concluded that dyslexia has a negative impact on self-concepts (Alexander – Passe, 2006; 2015; Humphrey, 2002; Humphrey and Mullins, 2002; Imran, 2013; Martinez & Semrud –Clikeman, 2004; McNulty, 2003; Nalavany et al., 2013; Palombo, 2001; Zeleke, 2004). In these studies, consentient explanatory reasons for the fact that reading impaired individuals depict lower self-esteem than non-impaired individuals may be discerned: the repetitive experiences of failure in academic settings; the recurring experiences of being misunderstood or regarded as lazy, even stupid and non-dedicated to their learning by peers, family or teachers; the sense of injustice of having to work harder than peers to achieve similar results; the reported bullying and non-accepted attitude in peers; the described sense of being different or unintelligent; as well as the need to undertake strategies to cope with the over-demanding school situation.
Alexander-Passe (2015) conducted a mixed-method study on the effect of having dyslexia and not being supported appropriately. Twenty-two adults with dyslexia that had recently had depressive symptoms participated along with 7 non-depressive adults with dyslexia as controls. The results showed that repeated experiences of failure during school years can be experienced as traumatic and that adults with dyslexia might be suffering from post-traumatic stress disorder, (PTSD), (American Psychiatric Association, 2014). In a reciprocal development of negative events, a spiral may be created leading to psychological problems, even psychiatric diagnosis such as depression, anxiety and/or PTSD, as well as an increased risk for delinquency (Alexander-Passe, 2015). Alexander-Passe (2015) suggested that failing to meet the reading impaired pupils efficiently and empathetically creates frustrations which subsequently influence their self-esteem in a negative way. As adults, participants reported that they were feeling anger and resentment toward school in general, which could create problems when their children started school (Alexander-Passe, 2015). This can generate further problems since children of a parent with dyslexia are also at risk for having dyslexia, as mentioned above (Maschereretti et al., 2017).

Similar experiences can be found in the work of McNulty (2003), whose narrative study described how having dyslexia affected the participants throughout life, not necessarily in reading related activities. McNulty (2003) suggested that negative experiences from school had a profound effect on crucial life choices, such as choosing education or career. Positive aspects of having a reading impairment were also accounted for when several of the participants described developing great skills and talents that were not related to reading, for instance art or industrial design. This “niche” of competence compensated for the devaluing experiences and may have deterred the individual from developing negative self-concepts and psychological ill-health (McNulty, 2003).

Dahle & Knivsberg (2011) targeted a group of children with severe dyslexia (n=70) together with a control group of children matched on age, gender, intellectual abilities and place of residence (urban or rural area). The procedure included teachers and parents assessing the child, as well as the child’s self-assessment, on a questionnaire regarding internalizing – (e.g. social withdrawal, sadness, loneliness) and externalizing (e.g. attention problems, impulsivity and aggression) behaviour problems (Dahle et al., 2011). The results of the study showed: Participants with dyslexia were more withdrawn, had more somatic complaints, social problems and attention problems than controls, (…) [were also] rated with more delinquent and aggressive behaviours, but these problems were less severe (Dahle et al., 2011, p. 167).

Humphrey and Mullins (2002) conducted a study where n=61 children with dyslexia and a control group of n=57 children without learning difficulties were assessed with a questionnaire regarding how the participants
attribute their learning performance: internally or externally. This process is related to the relatively concrete self-concept of self-efficacy (Bandura, et al., 1996), a term which, however, is not used in the study. Instead, the theoretical standpoint was personal construct as formulated by Kelly (1955, in Humphrey, & Mullins, 2002). Kelly (1955 in Humphrey and Mullins) described humans as scientists when opposing Freudian drives and Skinnerian schedules. Instead, Kelly proposed a notion about constructs, which meant that, within every human being, constructs were being created, revised and constantly developed owing to individual characteristics and experiences (Humphrey & Mullins, 2002). In a study by Humphrey and Mullins (2002), the results showed strong connections between low self-concepts and the participants’ perceptions of themselves as learners. Participants with successful school results were significantly more likely to attribute their results to external factors, and thus not connecting success in academics setting with their own ability or efforts (Humphrey & Mullins, 2002). Humphrey and Mullins, (2002), as well as Humphrey (2002), in a frequently cited paper regarding self-concepts in reading impaired children, accentuate “that the problems that children with dyslexia encounter have negative consequences for their self-development” (Humphrey & Mullins 2002, p. 201).

Dăderman, Nilvang and Levander (2014) conducted a study in Sweden investigating n=12 women with dyslexia (mean age 19 years, ranging between 16-30 years) on aspects of self-esteem and psychological health. The instrument used (Jag tycker jag är/ I think I am) measured different subdivisions of self-esteem. The results showed that the participants depicted significantly negative differences in scores in comparison with a norm group on all the self-esteem subscales included, namely Physical characteristics, Talents and gifts, Psychological health, Relationships with others and Total scale with the exception of Relationships with parents and family, which did not indicate any lower scores than the norm group (Dăderman et al., 2014). Nalavany and Carawan (2011) found similar results and concluded that support from family members had a mediating effect on the negative emotional experiences from having dyslexia.

Several studies have presented a somewhat different standpoint than those cited above by introducing results that do not indicate vulnerability to developing negative self-concepts among reading impaired children and adolescents (Jordan, McGladdery, & Dyer, 2014; Lindeblad, Svensson, & Gustafson, 2015; Lockiewicz, Bogdanowicz, & Bogdanowicz, 2013; Taylor, Hume, & Welsh, 2010).
Assistive Technology and its function for reading impaired individuals

Assistive Technology (AT) is defined as devices or means that have the potential to enable people with disabilities to live, learn, and work more independently through the application of specialized technologies that reduce, eliminate, or minimize the impact of a disability (Edyburn, 2015, p.1). This definition has been relied upon throughout the studies included in this thesis.

Dyslexia is considered to be a persistent disability throughout life (Jacobson, 1999; Marino & Beecher, 2008; Tunmer & Greaney, 2010). It has also been concluded that extensive training on reading while having dyslexia may not be enough to improve reading abilities (Siegel, 2013). Instead, reading impaired individuals with dyslexia are in need of assistance and compensation to facilitate and/or enable their reading processes, for instance with text-to-speech programs. Accommodations and/or interventions to strengthen reading impaired individuals do not necessarily have to involve technical devices. Ramirez, Flores-Torres, Perez and Carlson, (2009), conducted, for instance, a successful intervention study where Spanish-speaking American students were using tales to strengthen language abilities including aspects of reading and self-esteem. In this thesis, however, technically based interventions are focused on.

Technology has been used at least since the 1990s to train aspects of reading ability. Wise, Ring and Olson (1997), for instance, used computerized training programs in a pioneering study to strengthen phonological abilities. These early programs usually comprised special education exercises in computer programs. As computer programs and technical devices improved, the possibility of targeting the training of a specific deficiency increased. Fälth et al., (2013), who conducted intervention studies with computerized training programs to enhance different aspects of reading abilities such as phonology, showed positive results. However, the aim of using AT is not to increase an ability, but to equate the circumstances and to erase the effect of a deficit when performing an activity (Cook & Hussey, 2002). In other words, in the context of reading difficulties and dyslexia, the reading impaired individual may assimilate information to create an equated platform of learning without having to perform decoding.

Audiobooks were early examples of AT that enabled reading impaired individuals to gather the same information as non-impaired ones by listening to books without any disproportionate effort (Nuttal, 2015). Text-to-speech (TSP) programs such as Kindle Fire pioneered as AT. Kurzweil® was an early scanning program that could scan texts and read them aloud for the user, which had a profound assisting and accommodating function for the reading impaired (Nuttal, 2015). An important feature of AT is the function it compensates for or assists, and the occurring necessity for individuals with pronounced difficulties to be assisted but avoid training abilities that have
little chance of improving. The process of assimilating text via AT could be compared to moving with the assistance of a wheelchair or looking at something through a spectacle lens to ensure a clear vision. AT may facilitate everyday life for many people, but for some it is even necessary (Edyburn, 2015).

As technology has been used in different ways in previous studies to improve reading ability positive results were found, for instance, with an emphasis on phonological training (Chapman, Tunmer, & Prochnow, 2009; Otaiba & Fuchs, 2015; Vellutino, Fletcher, Snowling, & Scanlon, 2004). Other previous studies have focused on how using technological means may motivate reading impaired pupils to engage in activities involving reading (Gasparini & Culen, 2012; Roberts & Stodden, 2014). White and Robertson (2014) used applications in tablets to support reading ability, which showed an increase in reading skills as well as wider impacts on individual participants such as increased motivation and social ability. Fälth and Svensson (2015) used Prizmo®, a multifunctional application including scanning a text and having it read aloud. Results showed that a majority of the participants increased their word decoding ability after using Prizmo® 4-5 days a week during 5 weeks (Fälth & Svensson, 2015). The Prizmo® application was included in studies II and III.

A Meta analysis was conducted in the field of the effect of AT on reading ability has concluded that using AT generates small but positive results. Still, more studies of higher scientific standards are called for, since many of those conducted so far have included few participants, who were seldom, or never, randomized into trials (Archer, Savage, Sanghera-Sidhu, Wood, Gottardo, & Chen, 2012; Cheung & Slavin, 2013; Roberts & Stodden, 2014). The Swedish Council on Health Technology Assessments, SBU in an international literature overview reported that the majority of studies within the area of using applications in tablets or smartphones as AT for reading impaired involved few participants and non-randomized selection (SBU, 2014).

An important feature of the technical aspects of AT is the differences in size and usability brought about by technological development. Previous studies on the continuous use of AT, including the frequently recurring circumstance of reading impaired individuals abandoning AT, have claimed stigmatization as a reason for not using AT to its full potential (Deibel, 2013; Gasparini & Culen, 2012; White & Robertson, 2014). Leaving the classroom in front of peers or having to use a sizable apparatus among non-impaired pupils may cause unsought attention to the reading impaired child. Stigmatization may make the child vulnerable to psychological health issues and to developing negative self-concepts. Today, AT is portable, user friendlier and much cheaper than just a decade ago. A current tablet or a smartphone may contain applications like scanning texts that can be listened to, which may be a useful aid for a person with a reading impairment (Gasparini & Culen, 2012; Nuttal, 2015; White & Robertson, 2014). The price
is essential in the context of making it available to all reading impaired pupils, which is a largely political ambition (Abasacal et al., 2015).

**Assistive Technology, psychological health and self-concepts in reading impaired individuals illustrated in the HAAT model**

A version of the HAAT model (Cook & Hussey, 2002; Cook & Miller Polgar 2008; Giesbrecht, 2013) may be applicable to describe the interdependent, reciprocal and complex relationships between the investigated phenomena in this thesis. Cook and Hussey developed the model to explain and evaluate occupational therapy interventions, inspired by Bailey’s Human Performance Model (1989 in Giesbrecht, 2013). The HAAT model consists of four core concepts or components: Human, Activity, Assistive Technology and Context (Cook & Miller Polgar, 2008; 2012).

![The Human Activity Assistive Technology (HAAT) model as presented by Giesbrecht (2013).](image)

The four components influence one another reciprocally and, in later versions of the model, the context factor has been given stronger emphasis while influencing all of the other three pervasively. Giesbrecht (2013) suggested a modernized version of the model, which is presented in Figure 2, where the
dynamics in the relationships between the core concepts are illustrated by the eight-shaped curve and the overall influence of context is emphasized visually.

The Human component consists of an individual’s physical, cognitive and emotional aspects, including for example motivation for the activity and physical and/or cognitive prerequisites such as mobility, attention, judgment and problem-solving skills which have to be matched with the AT to obtain use efficiency (Cook & Miller Polgar, 2012).

The Activity component defines the goal of the assistive technology, which is influenced by its perceived meaning., This meaning may in turn affect the choice of AT (Cook & Miller Polgar, 2012; Giesbrecht, 2013).

Assistive Technology (AT) refers to any product that intends to eliminate any kind of hindrance that prevents an individual from performing an activity (Cook & Miller Polgar, 2012). The goal of AT is defined by the activity and the human, in other words what is supposed to be done and by whom, and further in what contextual circumstances (Cook & Miller Polgar, 2012).

Context supposedly involves physical, social, cultural and environmental factors around the other core components (Cook & Miller Polgar 2008). While developing the model, the originators of the HAAT model (Cook & Hussey, 2002; Cook & Miller Polgar, 2008) augmented the importance of the core concept of context. The placing of context at the outer ring of the model illustrates its omnipresence and overall influence. However, context appears to be a complex and ambiguous concept, judging by the imprecise definitions provided by the HAAT model creators. According to the original explanation of the HAAT model (Cook & Hussey 2002; Cook & Miller Polgar, 2008), context encompasses factors like physical context, social, cultural and environmental factors. Every single one of these factors can be seen as multidimensional and composed by several domains of concepts such as family, the school environment, peers or socio-economical group.

The sociological idea of multilevel perspectives implied by Coleman (1986) by introducing a version of using the concepts of Macro and Micro social levels of analysis may be considered as fundaments for a structural approach to social psychology (Lawler, Ridgeway, & Marokovsky, 1993). To summarize, the macro level represents a level of reality that exerts an overall and indirect influence on citizens, such as political systems, societal structures, culture, and general social values. The micro social level is closer to values, norms and structures that are valid only in a small defined group. The smaller the group, the closer to the micro level, e.g. a school football team, family, peers or the special education teacher. The different levels may be said to be represented in the realms of discussing reading impairment, self-concepts, AT and context.

Bronfenbrenner’s classical model is comparable to the HAAT model in the area of analyzing the context (Boyes, Leito, Claessen, Badcock, & Nayton, 2016; Bronfenbrenner, 1979; Johnson & Puplampu, 2008). However, Bronfenbrenner’s model is wide and general, providing ready defined
Bronfenbrenner’s model is wide and general, providing ready defined area of analyzing the and context. represented in the realms of discussing reading impairment, self peers or the group, the closer to the micro level, e.g. a school football team, family, norms and structures that are valid only in a small defined group. The smaller culture, and general social values. The micro social level is closer to values, and indirect influence on citizens, such as political systems, societal str

summarize, the macro level represents a level of reality that exerts an overall approach to social psychology (Lawler, Ridgeway, & Marokovsky, 1993). To social levels of analysis may be considered as (1986) by introducing a version of using the concepts of Macro and Micro...
SUMMARY

According to the Simple View of Reading model, reading impairment may be comprised of a general impediment in either decoding ability or language comprehension, or it could refer to a specific neurological, hereditary deficit in the phonological processing system that generates decoding difficulties and is labelled dyslexia. Being reading impaired faces several challenges in everyday life in society today, the most prominent being the learning situation during childhood and adolescence. Most educational systems today rely on a progression of the reading ability from an early age. When children fall behind in this respect, they become vulnerable to emotional stress, which in turn can lead to the development of negative self-concepts and a decrease in psychological health. Previous research has investigated the connections between self-concepts and reading impairment, and the majority of the relevant studies have concluded that reading impairment may have a negative impact on self-concept and psychological health. However, more recent studies have presented discrepant results where the relationship between reading impairment and negative self-concepts is complex, context dependent and hesitant in nature. In addition, the scientific body of knowledge about psychological health and reading impairment will show some discrepancies; most previously conducted research will argue for a greater incidence in symptoms of psychological ill-health such as depression and/or anxiety, whereas others claim not to have found results that confirm this, but rather show results where symptoms of psychological health do not differ from non-reading impaired groups. The differences in results are claimed to derive from contextual factors, the use of different instruments, small and non-randomized participant groups and an attitude change towards reading impairment in general, which will subsequently change the circumstances for the reading impaired children when teachers become more educated and family members more understanding and supportive. Technical advancement may also have helped the development in a positive direction. The complex interrelationships of the included concepts have been illustrated by the use of the HAAT model as a means to understanding the results.
General aims

The overall aim was to create a greater understanding about the interdependent relationships between self-concepts, individual reading impairment, contextual factors and the individual use of applications in tablets as reading facilitating as well as compensating AT and its impact on individuals and their surroundings.
METHOD

In this thesis, results from two research projects aiming to investigate the notions mentioned above are included, one project generating two pilot studies, studies I and II, which were followed by a randomized controlled trial study, Study III.

Participants

In all included studies, the participants were children and adolescents ranging from 10 – 18 years of age and with documented reading and writing difficulties and/or dyslexia. The inclusion criteria in Study II were 0.5 standard deviation below mean on expected reading ability, assessed by word recognition, non-word reading and word reading tests and compared to a norm group at an equivalent chronological age derived from the test manuals. In studies I and III the inclusion criteria were one standard deviation below mean on reading ability, assessed in a similar way. In Study II the lower cut-off level constituting the including criteria was motivated by an attempt to avoid false negatives, which prevents potential participants from being excluded even though they were in need of intervention due to their reading impairment. However, in Study III the cut-off for the inclusion criteria was raised in order to generate greater homogeneity within the investigated group and to pursue the notion that interventions with AT for supporting and compensating reading difficulties reached pupils in evident need of accommodations.

The participants in all three studies were selected by their teachers, and the participants’ legal care givers gave consent for the children to partake. In Study III, the participants were randomized into the control or intervention group, though a fully blind randomization was not possible to achieve since assessments as well as interventions were performed in the participants’ school context and the group affiliation would thus be impossible to retain unknown. However, the assessor was usually naïve to the participant, meaning that the pedagogue administrating the reading ability tests and CFSEI-3 had not taught the child/adolescent prior to project participation.
The different age groups of the participants in all three studies were motivated by the access of participants with documented reading difficulties, and the categorization of participants into mainly two groups, children and adolescents, was motivated by the circumstance that the different life phases provided more similarities than differences within the contexts of the studies.

**Instruments**

To assess reading ability, test batteries regarding decoding and word recognition “Läskedjor” (reading chains) (Jacobson, 2001) were administrated and to assess non-word reading and word reading “LäSt” (Elwér, Fridolfsson, Wiklund, & Samuelsson, 2011) was administrated to all participants. These tests are highly acclaimed among special education teachers in Sweden and are commonly used in special educational contexts. To create the composite score in Study III and assess the progression of reading ability in Study II, the test battery was expanded to include tests designed to assess reading comprehension, where different tests were used depending on the age of the participants. However, throughout the studies, assessments depended on established tests that the special educators participating as assessors were familiar with and able to handle with proficiency.

To assess self-concepts, the Beck Youth Inventory, BYI, (Beck, Beck, & Jolly, 2001) Self-image subscale was used in studies I and III. This gave the opportunity to try to replicate the results of Study I. BYI is a clinical test meaning that it is commonly used in the context of psychological and psychiatric treatment to assess mental health issues. To increase the sensitivity toward a non-clinical group, the American CFSEI-3 test was added in Study III. This test, which measures domains of self-esteem (Battle, 2002) was previously administered in research addressing participants with reading difficulties (see above). The subscales focusing on school related issues (the Academic subscale) were included, as they were of interest due to the aims of the thesis. The English version of the questionnaires was translated by the author and two native speaking persons in a translate and reverse process, meaning that the translation from English was then translated back into English by a naïve translator and the correspondence was almost one hundred percent congruent.

To assess psychological health, both BYI and CFSEI-3 were used since both instruments claim to address health issues albeit from different perspectives.
Procedure

Study design
The participants in all I and II studies underwent several assessments on reading abilities, as shown in Figure 3. However, only the first assessment was included in Study I, where they were conducted before the start of interventions to establish the reading ability level. In Study II, assessments at all trials were included in the analysis of the results.

<table>
<thead>
<tr>
<th>Time</th>
<th>Week 1</th>
<th>Week 5</th>
<th>Weeks 11-15</th>
<th>Week 16</th>
<th>Week 21</th>
<th>1 year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity</td>
<td>Assessment 1</td>
<td>Assessment 2</td>
<td>Interventions</td>
<td>Assessment 3</td>
<td>Assessment 4</td>
<td>Assessment 5</td>
</tr>
<tr>
<td></td>
<td>Inclusion</td>
<td>Pre test</td>
<td>Post test</td>
<td>Evaluation</td>
<td>Follow-up</td>
<td></td>
</tr>
</tbody>
</table>

Figure 3: Study I and II design: assessments and interventions using applications in smartphones or in tablets as AT assessment in project weeks.

The design of Study III was similar but contained 4 test trials, excluding assessment 4 in Figure 1. This was motivated by avoiding a test recognition effect and assessor and participant fatigue in the assessment process. However, in Study III only the CFSEI-3 and BYI assessment results were used in the data analysis. The reading progression tests will be presented in Svensson et al., (submitted, 2017).

Intervention program
Before commencing assessments and interventions, the participating teachers received a two-day training on how to operate the applications that were included and how to follow the assignments in the intervention program. The applications were not specially designed for this project but could be purchased at the app store and focused on facilitating the process of assimilating and generating texts, such as text-to-speech, scanning, searching the internet through speech to text and translating spoken word to, or from, a foreign language. The intervention program was designed to train the ability to assimilate and generate text through AT and to integrate the use of AT into the everyday school context. The intervention programs in studies II and III were similar, with only minor adjustments before the commencement of Study III.
Follow-up assessments and attrition rate

In Study II, 18 participants out of the initial 35 were tested and questioned at a follow-up assessment one year after the end of the interventions. In Study III, 61% of the participants did not pursue the test design since only 83 out of the original 137 participants pursued the study and were assessed at the one-year follow-up test trial. The attrition rate in the follow-up groups can be explained by pupils changing schools due to the Swedish school system, which consequently involved changing the teachers who were assessors. Besides, many teachers left their original position during the year following the interventions for reasons outside the scope of the research project.

Data analysis

In all studies, statistical analyses were performed in order to establish whether any significant differences could be detected. In Study II a content analysis was performed to capture the wider impact of using AT, which was considered beyond the range of the quantitative test batteries. The explorative approach of the included studies argued for a mixed method design since an efficient method to assess the outcome of using AT has not yet been established but is undergoing development (Edyburn, 2015). The contribution of the studies included is rather that further discussion regarding outcome measurement is needed (see below).
In this study, the Beck Youth Inventory (BYI) (Beck et al., 2001) was used. It is a questionnaire commonly used in clinical settings which is standardized as well as tested to prove high internal consistency and test-retest stability (Bose-Deakins & Floyd, 2004; Thastum et al., 2009). BYI consists of five subscales regarding aspects of psychological health issues. In Study I, three subscales were administered to the participants: Anxiety, Depression and Self-image. Each subscale contains 20 questions with a multiple-choice design where one can choose from never, sometimes, often and always. The questions were read aloud by the administrator to facilitate the procedure, given that the participants had a reading impairment.

A questionnaire regarding self-efficacy and self-image was constructed by the authors. The 36 questions were inspired by the PIRLS material (Rosén, Myrberg, & Gustafsson, 2005). It contained questions about the participants’ own beliefs in being able to master specific tasks to capture aspects of self-concepts regarding their perceived reading ability. The questionnaire contained 23 questions covering self-efficacy with regard to reading ability, for example: I can read a text message from a friend, and 13 questions regarding self-image, for example: I do as well in school as I want to. The questionnaire was read aloud and the answers were given on a five-graded Likert scale ranging from strongly disagree to strongly agree.

The following reading tests were performed to ensure the inclusion criteria: word reading (Läskedjor) (Jacobson, 2001) and non-word reading (Oord) (Svensson & Jacobson, 2006, Unpublished material).

Procedure
BYI and the questionnaire were administered once, see Figure 3 above. The assessments took place in the autumn of 2012 and the spring of 2013 at the schools where the participants were registered.

Data analysis
The BYI scores in Study I were summarized according to the instructions provided by the manual. Participants were analyzed in 6 groups of school years 4-9. The participants’ mean values on BYI were compared to those of the norm group by one-sample t-tests. The questionnaires were summarized and the results presented in frequencies. One-sample t-tests were performed on word reading and non-word reading test scores and compared with norm groups.

SUMMARY OF THE STUDIES

Study I

Aim Study I
Study I had a descriptive aim regarding self-image and psychological health in children and adolescents with reading difficulties. Thus, the aim was to describe the self-image as well as the level of depressive and anxiety symptoms and to compare the descriptions with an age-equivalent norm group.

Participants
In Study I, 67 pupils between the ages of 10-16 were included. The gender distribution was boys n=48 and girls n=19. The participants were concurrently involved in a pilot study regarding using applications in smartphones and tablets as AT to facilitate reading ability and compensate for reading impairment. They were, accordingly, chosen by teachers in a previously conducted study that argued for teacher estimation of reading ability (Wixon & Valencia, 2011). The participants were assessed with reading tests to establish a cut-off level at one standard deviation below the mean of an age-equivalent group provided by norm or comparison data on reading ability as inclusion criteria. Twenty-one of the participants had received a dyslexia diagnosis before taking part in the study.
In this study, the Beck Youth Inventory (BYI) (Beck et al., 2001) was used. It is a questionnaire commonly used in clinical settings which is standardized as well as tested to prove high internal consistency and test-retest stability (Bose-Deakins & Floyd, 2004; Thastum et al., 2009). BYI consists of five subscales regarding aspects of psychological health issues. In Study I, three subscales were administered to the participants: Anxiety, Depression and Self-image. Each subscale contains 20 questions with a multiple-choice design where one can choose from never, sometimes, often and always. The questions were read aloud by the administrator to facilitate the procedure, given that the participants had a reading impairment.

A questionnaire regarding self-efficacy and self-image was constructed by the authors. The 36 questions were inspired by the PIRLS material (Rosén, Myrberg, & Gustafsson, 2005). It contained questions about the participants’ own beliefs in being able to master specific tasks to capture aspects of self-concepts regarding their perceived reading ability. The questionnaire contained 23 questions covering self-efficacy with regard to reading ability, for example: *I can read a text message from a friend*, and 13 questions regarding self-image, for example: *I do as well in school as I want to*. The questionnaire was read aloud and the answers were given on a five-graded Likert scale ranging from strongly disagree to strongly agree.

The following reading tests were performed to ensure the inclusion criteria: word reading (Läskedjor) (Jacobson, 2001) and non-word reading (Oord) (Svensson & Jacobson, 2006, Unpublished material).

**Procedure**

BYI and the questionnaire were administered once, see Figure 3 above. The assessments took place in the autumn of 2012 and the spring of 2013 at the schools where the participants were registered.

**Data analysis**

The BYI scores in Study I were summarized according to the instructions provided by the manual. Participants were analyzed in 6 groups of school years 4-9. The participants’ mean values on BYI were compared to those of the norm group by one-sample t-tests. The questionnaires were summarized and the results presented in frequencies. One-sample t-tests were performed on word reading and non-word reading test scores and compared with norm groups.
Results
The BYI results showed no significant statistical differences in mean values in school years 4, 5 and 9 on any of the BYI scales (Anxiety, Depression, Self-image) in comparison to the norm groups. In year groups 5, 6, and 7, the participant group showed a statistically significant higher mean value on the self-image scale and a lower mean value on the depression scale.

The one-sample t-tests further showed that girls presented a statistically significant higher level of symptoms on the Anxiety subscale, which is consistent with the norm group. The results of the self-efficacy and self-image questionnaires showed that a majority of the participants in all school year groups reported few limitations in their reading ability. This was contrasted with their performance on the reading tests administered as an inclusive criterion. Further, the participants answered that they found reading an easy activity (75%) and felt confident that they would manage their school work.

Since BYI was originally designed to complement a clinical observation, the test may not discriminate between high or low values retrieved during assessment unless the participant reaches a “clinical critical value” where it is alerted that a psychiatric diagnosis may be underpinning the results. Thus, the results of Study I should not be interpreted as if the participants showed greater psychological well-being than the norm group, even though the group mean values were far lower than the clinical critical values presented by the manual (Beck et al., 2001).

Study II

Aim Study II
The second study aimed at investigating the possible transfer effects on reading skills when using AT, and the wider impact of using AT in reading impaired participants who took part in a systematically conducted intervention where applications in smartphones and tablets were used as AT to train, and facilitate reading and compensate for reading impairment.
Participants
Thirty-five (n = 35) pupils participated in Study II, 23 boys and 17 girls. The participants were between 10 and 12 years of age, attending school years 4, 5 and 6 within the Swedish school system. The school where the pupils attended volunteered, as in Study I, and the teachers at each school selected participants. Thereafter they were assessed on word recognition, non-word reading and word reading tests to meet the inclusion criteria of a reading ability of 0.5 standard deviation or lower below the mean of an age equivalent norm group. The cut-off level may seem low and the decrease in comparison to Study I was motivated for by previous studies ethically arguing for avoiding false negatives in interventions studies, to ensure that interventions will favour the pupils in need of support (Parker et al., 2015). Eleven of the participants had been previously diagnosed with dyslexia.

Instruments
In the second study, reading ability was assessed by the following instruments: “Läskedjor”; (Word Chains and Sentence Chains tests) that focus on decoding, word recognition and aspects of semantics and syntactic (Jacobson, 2001); “LäSi”, a non-word and word reading test (Elwer, Fridolfsson, Wiklund, & Samuelsson, 2011); and the “Vilken bild är rätt” (Which picture is correct?) test that targets reading comprehension (Lundberg, 2001).

Questionnaires were administered to the participants, their parents and their teachers. The questions focused on how the participants used AT in reading-related activities and whether AT had an impact on the participants regarding aspects such as motivation and learning independence as well as on the evaluation of the project. The questions were answered by selecting among five response alternatives ranging from strongly agree to strongly disagree.

Procedure
In Study II, all the reading tests mentioned above were distributed in Assessment/Test trials 1, 2, 3, 4 and 5, as shown in Figure 3. Test trial 5 (T5) was conducted one year after the interventions had finished. The questionnaires were administered at Assessment 2 (pre-test), 4 (5-week post-test) and 5 (1-year follow-up).

The intervention leaders, who were special education teachers, worked with a pupil 4 times a week during 5 weeks. The mean time of an intervention was 47 minutes (n = 33, SD 9.74). The average number of sessions was 18 (n = 33, SD 2.55). For a full description of the applications included, their function and the intervention program, see further in Lindeblad et al., 2016.
Data analysis
In the statistical analysis in Study II, raw scores with paired t-tests were used for all variables except Non-word reading and Word reading, where Wilcoxon signed-rank test was used. Longitudinal changes from T2 to T5 were analyzed using stanine values with Wilcoxon signed-rank tests. To facilitate comparison between the initial assessment and the follow-up (one year after the interventions had finished) and to compare scores with norm groups, the raw scores were transformed into stanine values.

The notion of clinical significance was used when the statistical results were interpreted in order to understand the wider impact of the values generated to be able to insert them into a clinical as well as an everyday context for the reading impaired participants.

In the qualitative analysis, content analysis was applied (Graneheim & Lundman, 2003). The answers were initially read three times and then coded from the latent content. The content drawn from the material was categorized from the basis of similar meaning. Each category was labelled appropriately and illustrated with quotations.

Results
The analysis used T2 as baseline in all the comparisons. Results on the tests Word chains and Sentence Chains showed a statistical significant increase of mean scores (p<0.05) between T2 and T3 and T2 and T4. The tests scores on Non-word reading showed overall statistically significant mean differences (p<0.05), which hence entailed an improvement of results. Word reading also showed a statistically significant improvement on all the assessments (p<0.05). The reading comprehension results showed a statistically significant improvement on all test trials but were not administered at T1. Further, the results showed an increase in stanine values from the T2 to the follow-up, where fewer participants scored on the lowest stanine value (st 1) at the follow-up test trial (T5).

Study III
Will be prepared for submission in July 2017.
Aim Study III
The third study aimed at mapping self-concepts in a group of reading impaired children and adolescents and comparing them with a norm group. Study III also aimed at investigating the impact of using AT on these children’s self-image, self-esteem and psychological health after taking part in interventions in comparison with a control group that received education as usual.

Participants
In study III, 137 children and adolescents participated and conducted the pre-test assessments and 79 completed the post tests. The inclusion criteria were documented reading and writing difficulties and scores with at least 1 Standard deviation below the mean on the Word Chains, Word reading and Non-word Reading tests compared to age-equivalent norm groups provided by the respective test manuals (Elwén et al., 2011; Jacobson, 2001). The participants were attending school year 4, 8 or high school. The mean age in school year 4 (n=87) was 123 months (SD= 4.9), in school year 8 (n= 35) 172.6 months (SD = 5.7) and in high school (n= 15) 193.1 months (SD= 28.0) months.

Instruments
The Cultural Free Self-Esteem Inventory, 3rd edition (CFSEI-3) (Battle, 2002) was distributed to the participants in Study III. This is a self-esteem test that subdivides self-esteem into different domains: academic, general, home, social and personal. As CFSEI-3 offers different versions according to age the age equivalent version was distributed to the participants. In the adolescent version administered to participants in school year 8 and high school, an additional subscale, personal, is presented. The questionnaire contains 64 and 67 questions, respectively, and offers the yes/no answer options. BYI was also used to assess Anxiety, Depression and Self-image, similarly as in Study I, to a selected group of participants.

Procedure
The participants in Study III were taking part in a larger study that aimed at investigating the effect of using AT on reading ability after a systematic intervention where the participants used AT several times a week as well as at home (Svensson et al., submitted). The design was similar to the one in studies I and II, as depicted in Figure 3, except that one assessment was removed and that a break during the interventions was inserted to avoid fatigue. In Study III, the participants were assessed twice by the CFSEI-3 and BYI at the pre...
intervention and at the follow-up. Participants were randomly assigned the intervention or the control group. After the randomization, a few participants chose not to continue the study, which unbalanced the matching marginally.

The assessments were conducted from September 2014 to December 2016.

**Data Analysis**

The raw scores on CFSEI-3 were transformed to standard scores according to the CFSEI-3 manual, and these standard scores were compared to the norm mean 10 with the Wilcoxon signed-rank test. The CFSEI-3 scores were compared between pre-test and follow-up with the Wilcoxon signed-rank test. The Mann-Whitney U test was used to compare the change scores between the control and intervention groups.

A composite score was calculated as follows: Seven reading tests were first transformed into z-scores. Two part scores were then created, one for words by averaging the z-scores for Word chains, Non-word Reading, Word Reading, and one for sentences by averaging the z-cores on Sentence reading, What picture is correct and Meaning sequences. Finally, the mean of these two partial scores formed the composite score. The Mann-Whitney U test was used to compare the change scores between the control and intervention groups. The relationship between CFSEI-3 and BYI as well as the composite score was examined using Pearson correlation.

**Results**

In study III, CFSEI-3 did not show completely unitary results in comparison with a norm group. On the Academic subscale, referring to school- and learning-related self-esteem, the adolescent participant group showed lower results than the norm group value. On the Social subscale the school year 4 participant group showed significantly higher results. The results were expected to be analogous with that of the norm group.

The results on the CFSEI-3 pre-test showed no statistically different results in school year 4 on the General and Academic subscales. On the Home and Social subscales, the results showed a statistically significant higher level than the norm group (p=<0.05). In the school year 8 and high school groups of participants, the results on the General subscale showed statistically lower results compared to the norm group, and statistically higher results on the Home and Social subscales. The Personal and Academic subscales showed no statistically significant differences in comparison with the norm group at the pre-test.

The comparison with a composite score of reading ability showed no correlations between reading ability and self-esteem as measured by CFSEI-3.

At the post intervention/follow-up assessment, two statistical differences were found: in school year 4 on the Academic subscale, which showed lower
results than at the pre-intervention assessment, and in school year 8/high school groups on the General subscale, which improved to come into line with the level of the norm group.

The BYI results showed uniform results to the norm group in both groups of participants on all the Depression and Self-Image subscales. However, some deviation from the norm group in school year 4 was depicted on the Anxiety subscale. The material was compared to the clinical critical value provided by the test manual. These results confirmed the results in Study I except on the Anxiety subscale for school year 4, which depicted a higher level of anxiety than the norm group.

**Ethical considerations for all studies**

In all three studies, ethical considerations were taken into account. The studies received permission from the Central Ethical Review Board in Sweden, who before approval gives strict instructions regarding storing research material in archives and maintaining the anonymity of the participants at all times. In designing and conducting the study, the emotional content in the questionnaires was taken into consideration. The participants, their parents and the teachers were informed of the purposes of the studies and that participation was voluntarily. Parents of the participating children and adolescents had to sign an informed consent before the participants could join the studies.

Teachers were informed about the confidentiality of test and assessment results. The researchers evaluated all tests to avoid spreading confidential information. Teachers who assessed pupils with CFSEI-3 had access to supervision from a clinical psychologist when necessary, and detailed instructions about this were given. BYI was administered by the author of the thesis for ethical reasons and due to restrictions given by the test manual. If a participant gave answers that indicated serious psychological problems, teachers were immediately notified to be able to take appropriate action.
SUMMARY OF FINDINGS

An overview of designs and results in the included studies is presented in Figure 4.

As presented in Figure 4, the results of the three studies indicated similar results. The investigated notions of self-concepts and psychological health showed similar results in studies I and III, with the exception regarding anxiety for younger participants. The results of Study II are in line with both Study I and III in that the wider impact of using AT created a positive effect on health issues such as independence, motivation and family relations.
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Self-concepts and psychological health in Swedish pupils with reading impairments

Study I presented unexpected results in comparison with previous studies, involving that the participating pupils neither showed any signs of psychological ill-health, nor a low self-image when assessed with BYI and compared to an age-equivalent norm group. To investigate this further, an additional questionnaire was added in Study III, CFSEI-3. Study III showed similar results to Study I in that there are no statistically significant differences in the reading impaired group in comparison with a norm group regarding aspects of self-concepts or psychological aspects such as depression, anxiety, family problems or social problems. However, some results were incoherent and therefore more difficult to interpret. The group of participants in school year 4 in Study III showed more symptoms of anxiety than the norm group. This could be due to the small sample group \((n=20)\), which may suggest that a few individuals experience anxiety, which perhaps affects the results for other reasons than learning-, school- or reading-related ones. The results contradict those in Study I, which makes interpretation difficult because of the similarity of the contexts in the two studies. The results will be further discussed below.

In the intervention group among adolescents general self-esteem was significantly lower than that of the norm group level. This may derive from difficulties in performing the statistical analysis due to inadequate information regarding group statistics provided in the test manual and will therefore be interpreted with caution.

The third study also showed that interventions using AT to assimilate and create text did not have a direct impact on self-concepts and psychological health, as measured in the study.

Study II showed, however, that children, their parents and teachers, reported increases in motivation, independent learning and family climate, which could all be included in the concept of psychological health.

The impact of using AT on reading ability

Study II focused on reading ability and how the use of AT as applications in smartphones and tablets affected reading skills. The results showed improvement in aspects of reading ability in general after using AT and taking part in the intervention program. At the follow-up assessments one year after the interventions, the reading impaired children were expected to lag behind their peers, in this case the norm group, as a result of a more restrained reading development caused by their deficit, but this was not the case. In this study, the reading impaired group increased their reading development at the same
rate as the norm group. These results were unexpected in comparison with assumptions made from the results in previous studies.

**Impact of using AT on self-concepts**

Study III investigated the impact of using AT on the participants’ self-image, measured with BYI, and on their self-esteem, measured with CFSEI-3. The results showed no statistically significant difference in either self-image or self-esteem between test occasions before and after using AT to compensate for reading impairment and facilitate reading ability. However, as shown in studies I and III, the participants showed almost no depreciation in any of the assessed self-concepts in comparison to equivalent norm groups. This means that an increase would have been unexpected regardless of the intervention.

Study II also investigated the wider impacts of using AT, in other words how the individuals experienced the use of AT in their everyday life and within themselves. In Study II, the qualitative analysis generated categories that may be said to be related to self-concepts such as motivation and independence.
GENERAL DISCUSSION

The ambitions of this thesis were to generate an understanding about the interconnected relationships between self-concepts, reading impairment and assistive technology. A further aim was to investigate if Swedish children and adolescents with reading impairment would depict lower self-concepts than a norm group, and whether those with reading impairment presented a higher level of symptoms of psychological ill-health than a norm group, as well as to understand the contextual factors behind the results. After conducting the three studies, the relationships between reading impairment, AT as accommodations, and self-concepts and psychological health remain complicated and somewhat disparate, due to the interrelated, interdependent and reciprocal nature of the investigated phenomenon.

All the results will be interpreted and discussed using aspects and modifications of the HAAT model.

Assistive Technology, psychological health and self-concepts in reading impaired individuals: results illustrated by the HAAT model

Figure 5 shows a modified version of the HAAT model as presented by Giesbrecht (2013) depicting some alterations made to fit the discussion about reading, reading impairment, AT and self-concepts as well as psychological health.

The HAAT model can be used to develop a greater understanding of the interrelationships in the included components placed in a reading context. The HAAT model was constructed as a “framework for understanding the place of assistive technology in the lives of persons with disabilities, guiding both clinical applications and research investigations (Cook & Miller Polgar, 2012, p. 22).
In this thesis, it has been applied on the usage of AT in the occurrence of reading impairment. The originators of the model did not have the ambition to create an instrument to evaluate certain occupational therapy interventions but rather to provide a description of the intervention (Giesbrecht, 2013). The bearing idea in the model is to show that the four components, Human, Activity, Assistive Technology and Context, constantly interact and reciprocally affect one another as well as emphasizing that “each component plays a unique part in the total system” (Cook & Miller Polgar, 2012, p. 22), as depicted in Figure 2. In Figure 5, self-concepts and psychological health, assistive technology, reading and context could be said to constitute the components of the original HAAT model.

In applying the model in the context of this thesis, reading is to be considered as Activity and the concept of Human will include self-concepts and psychological health. Assistive Technology incorporates the use of applications in smartphones and tablets to facilitate the process of assimilating and generating text-based information.

The Human component in the model includes self-concepts on every theoretical level according to the overview model described above and visualized in Figure 1. This component will incorporate how children think and feel about themselves, which will, both directly and indirectly, influence the effort, the motivation and the emotion in regard to the tasks set before them. Personality factors will also be of importance, as well as resilience toward, for instance, achievement requirements. This will correspond to the self-efficacy level of the self-concept (Bandura et al., 1996; Pajares, 1996; Zimmerman, 2000). Other abstraction levels of self-concepts may be included in the HAAT model, for instance, self-esteem as defined by Battle (2002), who construed the CFSEI-III instrument used in study III, referring to how
children or adolescents value themselves and their performances, globally or domain specifically, which in this framework is interconnected with reading ability/performance, AT and context. The performance is affected by how the factors in the context treat reading disability; whether it is supported, whether resources for efficient AT are available and/or desirable, or whether reading ability is considered important, necessary or treated with indifference.

In the context of a school-aged child trying to follow the ordinary curriculum while using AT, for instance reading-facilitating applications in tablets (e.g. text-to-speech or scanners), the AT component in the HAAT model interrelates between human/self-concepts and psychological health and the activity/reading. Psychological health is also directly and indirectly affected by how the self-concepts are constituted within the child, and is therefore also affected by factors like reading ability, the AT provided and contextual factors, in consequence with the reasoning above.

Cook and Miller Polgar (2012) argued for a systematic perspective when applying the HAAT model. As, in the framework of reading, AT and self-concepts, the system is both contextual- and individually specific, one cannot foresee either of these components when evaluating and understanding the system.

**The components of self-concept, reading and AT**

In the HAAT model as depicted in Figure 5, the different components are considered as being integrated in one human, hence occupying the same position in the model. Self-concepts influence the motivation and emotional capacity to acknowledge and accept reading impairment. Positive but realistic self-concepts on every abstraction level may create effective strategies to handle the struggles that reading impairment and/or dyslexia will induce. On a concrete self-efficacy level, the self-efficacy may have to be modified by being adjusted to the ability to create achievable goals (Bandura et al., 1996; Zimmerman, 2000). This could create a positive impact on psychological health (Bandura, 1986).

As studies I and III showed, the investigated groups did not show more negative self-concepts on any abstraction level in comparison to norm groups. In the adolescent intervention group in Study III, however, some different results were discovered when the *General* subscale showed statistically significant lower results than the norm group. Furthermore, the mean comparison between the control and the intervention groups was non-significant, which could mean that the difference noticed in the adolescent group between pre-test and follow-up was probably induced by other factors than taking part in the intervention. Further, the *Academic* subscale showed similar results, as the norm group and the correlations with the BYI *Self-image* scale indicated strong correlations. The comparison with composite score and the *General* subscale was not significant, in the sense that reading ability did not influence the results on the self-concept test. It can therefore be assumed
that other factors than being reading impaired correspondingly induced the results on the General subscale for the adolescent Group I in Study III and for results on the BYI Anxiety subscale for the school year 4 group.

However, the results in Study I and Study III are not totally consistent, which is in line with earlier research regarding the self-concepts of reading impaired children and adolescents (Frith et al., 2014; Novita, 2013; Glazzard, 2010; Humphrey 2002; Imram, 2013; McArthur et al., 2016). A possible interpretation of the diverse results from self-concept investigations is related to the age of the participants since, as shown in studies I and III, the younger group of participants did not show any signs of negative self-concepts. It could be theorized that they have, because of their age, had the time to experience a general increase in knowledge about reading impairment/dyslexia in their environment, which has led them to experience knowledgeable, efficient and supportive teachers, supportive family surroundings and non-bullying peers, hence avoiding a negative impact on self-concepts. However, for the adolescent group of participants who showed lower scores on the General scale of self-esteem in the CFSEI-3 test battery used in Study III, they may not have been given the chance to experience such advanced, easy to use and non-stigmatizing AT to facilitate and compensate their reading ability. Neither may the adolescent group have had the opportunity to be affected by the presumed increase in awareness of reading impairment and the improvement in attitudes that may have followed. These speculations could constitute one of many reasons for the results. The fact that it was the General scale that showed lower results in Study III, and not the scales that could be related to school achievement and hence to reading difficulties (Academic), could be seen as further support for this reasoning. In Study III, the comparison between the composite score on reading ability and the scores on CFSEI-3 were compared and showed no relation, in other words, participants with greater difficulties in reading did not depict lower self-esteem. Using the HAAT model to discuss this, on the reason could be that self-concepts and reading did not affect one another in negative way.

However, the results on the BYI Anxiety subscale in school year 4 in Study III seem to contradict the above interpretation, as the reading impairment may have contributed to the score on this subscale. To clarify the connection, a larger sample will be recommended in future studies. On the other hand, in Study III, reading ability, as created from a composite score of results on tests measuring different aspects of the activity of reading, showed no association with scores on CFSEI-3. Even though the participants scored below the expected level of their chronological age on reading ability, the self-esteem scores were almost in line with the norm group.

Connected to age is also the notion of the early detection of reading impairment, which has been claimed as important to prevent the often reported negative outcomes for reading impaired children and adolescents (Burden & Snowling, 2005; Edyburn, 2006; Hellendoorn & Ruijssenaars, 2000; McNulty,
2003). Although being different could be seen as a humanely difficult task to accept, it can be assumed that knowing about your reading difficulties at an early age gives you the time and opportunity to incorporate this fact into your self-concepts at a concrete level, which in a developmental sense constitutes the foundation for creating more abstract levels of self-concepts. If a teenager, for instance, was diagnosed ten years previously, the emotional distress about being different, needing assistance or AT may not be as complicated to master as if being diagnosed with reading difficulties/dyslexia as a teenager. In such a case, the self-concepts have to be reconstructed and the internal emotional processes must be regulated to be able to construct efficient and healthy self-concepts (Linehan et al., 2006). When a reading impaired child has constructed healthy and strong self-concepts at every level of abstraction, the use of AT is probably a non-complicated act. A possible interpretation of the positive outcome regarding self-concepts in all of the studies is that the reading impairment was detected before any negative consequences of it were experienced. The younger group of participants could be said to have been detected “early on” in their academic career, which creates a more positive developmental platform than if detected later in life (Edyburn, 2006).

Motivation as a general concept, but in this particular context as motivation to perform the activity of reading, may also be affected by early detection arguments. If the self-concepts include reading impairment without being charged with negative emotional components, the fact of having to struggle with reading may not affect the motivation to learn or to read.

The goal is thus to create self-concepts where reading impairment is both included on all areas in the model of self-concepts as depicted in Figure 1. This means that a child may think of its reading impairment in a given situation, anticipate a certain task and rate its ability realistically without creating negative emotions about it. However, it also means the possibility of thinking of oneself as having dyslexia or reading impairment on an abstract level without charging it with negative emotional components. An early detection, that is when a child is a beginner at reading, will probably help to create this balanced and realistic nature of a child’s self-concepts.

The impact of using AT on self-concepts and health perspectives

In the HAAT model (Figure 5), the AT component is bridged between the other core concepts so that, for instance, AT affects the individual and the individual is affected by using AT. The AT features may be important and, besides, tablets and smartphones used in all three studies are assumed not to create a stigmatizing effect while being used. Even if the need to compensate for one’s deficient reading ability is prominent, the social stigma it may create and/or the risk of being ridiculed by peers will induce greater motivation to avoid AT (Deibel, 2013; Gasparini & Culen, 2012; White & Robertson, 2014). In Study II, the results of the questionnaires indicated a positive attitude among participants toward tablets and smartphones as AT, one characteristic
mentioned being the portability of the device. While using modern AT, a pupil
may not have to leave the classroom or experience other potentially
stigmatizing situations such as using a machine (e.g. a DAISY player®) and
drawing unsolicited attention to oneself (Deibel, 2013; Gasparini & Culen,
2012; White & Robertson, 2014), which could leave self-concepts and
psychological health unaffected by the academic learning situation, as is in
line with the results of the studies included.

In Study III the results showed that using AT to assimilate and create text
had no impact on self-concepts, since the correlations between the composite
score of reading ability and the CFSEI-3 results were low. In both studies I
and III, almost all investigated groups showed similar self-concepts as a norm
group, which would make increases less expected. However, Study II showed
that the impacts on everyday life were stronger among the participants, for
instance with regard to independence, the motivation to learn, and the
discovery of books. This is important for continuous use of AT but also for
how the user feels while receiving the support. According to the HAAT model
(Figure 5), self-concepts are continuously affected by the use of AT and the
activity of reading. Several studies on the reason why AT is not effectively
and continuously used by its operators have concluded that AT should be
individualized, socially adaptable and smooth, as well as technically
manageable by both users and staff (Alsbahi, Khan, & Rahanu, 2014; Dawe,
2013; Deibel, 2013; Gasparini & Culen, 2012; Philips & Zhao, 1993; Reimer-
Reiss & Wacker, 2000; White & Robertson, 2014).

Strong self-concepts may promote higher self-worth and create resilience
toward differences in comparison with peers (Casserly, 2013). This may make
a child more willing to try AT if compensation is needed. In the other
direction of the HAAT model, reading activity may influence self-concepts
and presumably more as negatively if the reading process is not age-
equivalent. If the child has strong resilience to failures in academic activities
such as reading, the negative influences of reading impairment may not be as
distinct with regard to its self-concepts if they are already at a vulnerable
level. If Reading is connected with negative emotional reactions such as
failure, frustration, sense of stupidity and hopelessness, which has been
reported to occur in reading impaired individuals, as mentioned above
(Alexander-Passe, 2015; Burden, 2008; Green, 2015; Humphrey, 2002;
Humphrey & Mullins, 2002; McNulty, 2003; Nalavany & Carawan, 2012), the
motivation to commit oneself to this activity might decrease. This may create
a vicious circle of events where everything surrounding reading will be
connected with negative emotions and therefore avoided. This, in turn, may
serve as one of the explanations why delinquency has been overrepresented in
reading impaired individuals, or reading impairment overrepresented in
delinquents (Alexander-Passe, 2006; Bandura et al., 1996; Svensson, 2011;
Svensson, Lundberg, & Jacobson, 2001). However, in Study I and generally in
Study III, contradictory results in comparison with those mentioned above

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were found. The AT and the Reading did probably not create the negative effect on the self-concepts in our participants. A positive reinforcement when mastering reading ability on the reading impaired child’s possible level could instead create positive self-concepts and psychological health.

The impact of using AT on reading ability

In Study II the effect of using AT on decoding ability was investigated. The results showed transfer effects on decoding ability at the follow-up, one year after the interventions were concluded. An RCT study is being conducted to attempt to replicate these results (Svensson et al., submitted). In Study II the results were interpreted within the notion of text exposure (Cipielewski & Stanovich 1992) in other words, by using AT as applications in smartphones and tablets the participants were exposed to text to a greater extent than before, which made their decoding development increase to the degree that the difference between the reading impaired participants and the norm group was almost eliminated. In the realms of the HAAT model the results may be understood as the reciprocal influences of AT as applications in tablets; the activity of reading stimulated by the intervention program and by self-concepts, including aspects of motivation, collectedly created this positive outcome.

Context: family, school and society

Self-concepts, AT and Reading are concepts in the HAAT model that may be valid in understanding the results of the studies included. However, as Cook & Miller Polgar emphasized (2002), context contributes extensively to the system and should be considered for its encompassing role which thus influences the other components discussed above.

The analysis of the macro and micro levels of context (Coleman, 1986) can be applied in the modified HAAT model. At the macro level, society influences the school systems by political reforms. The declaration of dyslexia as a disability in Sweden is one example of influential events on the macro level. The overall attitude toward reading impairment and/or dyslexia is a cultural factor that could be said to be categorized on the macro level. The individual has little direct impact on events and factors, but may exert influence via elections, for instance, or other societal activities.

Family support has shown to be important in supporting a child with dyslexia in different ways according to previous studies (Bandura et al., 1996; Glazzard, 2010; Nalavany & Carawan, 2012) and composes an important position in the context area of the HAAT model at a micro level. Study III showed statistically significant results on the Home subscale in the CFSEI-3 test material, in both control and intervention groups, before and after interventions and in all age groups in that the participants reported a more
positive and supportive family environment than the norm group. Study II presented results indicating improvement in family climate after using AT in reading and writing activities for one year. This result is important in the realms of how family support affects a child’s development. A worried, low-feeling reading impaired child may not have the extra energy required when reading. Family support could also be crucial when asking for assistance in school (Bandura et al., 1996), e.g. access to AT. Self-concepts are naturally hugely affected by the family environment, the ability of the caregivers to foster a balanced child with strong resilience toward setbacks in everyday life that even the most equipped parents cannot control and protect their child from, such as accidents, poverty and bullying. Since there is a relatively strong hereditary component in dyslexia, there is a risk that parents will recognize themselves in the child’s struggles with reading. This may lead to emotionally guided actions, for instance, if parents are affected by their own traumatizing school years, as was the case in the study of Alexander-Passe (2015). Then the support to the child may not be as efficient as it should be. However, it seems as if the participants in this dissertation experienced strong family support, which may have contributed to the positive reciprocal connections between self-concepts and family support.

In Study II an increase in independence among participants was noted as an indirect result of using AT. In the cultural context where the studies were performed individual independence could be seen as highly valued and desired. Not reaching the expected age-equivalent levels of independence could affect both the child and the family and create social shame feelings of guilt (Nalawany, Carawan, & Shauber, 2014). However, since this turned out not to be the case, the results could mean that the reading impaired child could orientate itself on macro and micro social levels autonomously when using suitable AT. This could create prerequisites for developing sound family relations, as illustrated by examples given in Study II where parents reported relief in the family when they were not being co-dependent regarding homework, because when AT was introduced, the participant child could do this on its own.

The context in which a reading impaired child is situated may both encompass and influence the school where it is enrolled. For a child, the given school has a conducive impact on reading from the child’s debut as a reader, and of course on its self-concepts. The pedagogical strategies chosen, the level of education among teachers, as well as the overall understanding and attitude among teachers toward reading difficulties, have shown to be hugely important for the individual outcome. Several studies have pointed out the importance of a supporting attitude in teachers when educating reading impaired and/or dyslexic children (Burden, 2008; Glazzard, 2010; Humphrey, 2002; Lindeblad et al., 2015) albeit often in a negative sense from a narrative perspective where adults recall feeling being made a fool of by an ignorant teacher (Alexander-Passe, 2015; Dăderman et al., 2014; McNutly, 2003).
The context in which the studies were conducted

All studies were conducted in Sweden and within a Swedish educational context. The school system in Sweden has undergone substantial changes in recent decades due to political reforms that have fundamentally restructured education on both macro and micro societal levels (Skolverket, 2011). However, as a result, the common theme in all studies is a discussion of the increase of knowledge in reading impairment among educators; the need of support to reading impaired pupils; and how this support can be given in the most efficient way.

The context in which these studies have been conducted may be the greatest explanatory factor of the results in comparison with international studies. However, previous studies with a similar approach have shown contradictory results (Dåderman et al., 2013; Fälth et al., 2014; Ingesson, 2003).

Time may be an important factor, since several referred studies were conducted at least a decade ago from today, with several exceptions such as Taylor et al., (2010) and Alexander-Passe (2015). However, some studies focusing on the relationship between dyslexia and self-concepts might now be considered out-dated, especially where adults have been interviewed reminiscing their school experiences, since these may have taken place 20 years earlier than the study was being conducted (McNaulty, 2003; Alexander-Passe, 2015). If that is the case, the results from the similar studies are not completely comparable since changes may have occurred in the school systems that benefit reading impaired pupils, at least in Sweden.

The development in society is hopefully leading to greater understanding and tolerance. In Sweden, the government-initiated campaigns during the 1990s that raised reading impairment to the legal status of a disability, giving individuals with dyslexia the legal right to societal accommodations and support in school and other learning institutions, as well as other reading requiring situations. The Dyslexia Act may be assumed to have been preceded by an increase in knowledge via new findings that contributed to the need of a new attitude toward dyslexic and reading impaired individuals. The new general awareness promoted teacher education programs to include courses about reading difficulties and ultimately contributed to greater knowledge among class and special education teachers and other pedagogical professions and health care professions such as psychologists. Subsequently, a more understanding attitude and hence a more helpful situation for reading impaired pupils have been cultivated in Sweden. It could be assumed that differences in results between studies I, II, III and some previous international works may be related to differences in teachers’ educational level regarding reading difficulties when the studies were conducted, which have subsequently created different attitudes toward the reading impaired individual. However, the goal has not been completely attained. In news reports in 2016 (Sydsvenskan,
February 12, 2016) there was a debate whether a child with dyslexia should be allowed to have the right to use accommodation and/or AT when performing a national test, or if this use of AT should be considered cheating. This child was being misunderstood, since reading was as impossible for him or her as it would be for a peer to read without the prescribed glasses. Edyburn (2015) debates that AT does not involve cheating if you simultaneously equate dyslexia or reading impairment with a disability. Edyburn (2006) would even go as far as stating that this act of refusing AT to dyslexic individuals could be compared to denying a functionally impaired person the use of a wheelchair (Edyburn, 2006).

Taylor et al., (2015) showed in their study that a generic label for reading difficulties, Special Educational Need (SEN), made pupils score low on self-esteem, as tested in the CFSEI-3 material. These results were compared to a group of children diagnosed with dyslexia, referred to as a specific label in the context where this study was conducted (the UK), whose self-esteem was comparable to that of a control group of peers without reading difficulties (Taylor et al., 2010). The conclusions were that specific labelling may generate a more positive context for the child than a generic label. In Sweden, the Swedish Education Act (SFS 2010:800) states that every child should be supported on the basis of individual needs to reach age-relevant academic goals (SFS 2010:800 Ch, 3, sections 1-12). This should mean that a reading impaired child or adolescent would acquire accommodations, for instance AT, emotional support and pedagogical strategies and planning regardless of generic or specific labels, i.e. a diagnosis should not be required to attain support or accommodations.

However, Francis (2013) stated that the psychiatric diagnosis according to American Psychiatric Association, APA, where special learning disorders are included, in this context dyslexia, has been subject to extreme lobbying for creating a medical approach to deviant and maladaptive behaviour. In a Swedish school context, this has developed into an emphasis on assessments by medical professionals rather than the appreciations of needs form the child’s closest teacher. What profession conducts the most efficient assessments of difficulties may not be answered due to the focus of this thesis; however, the focus on diagnosis has obstructed the learning situation for many children while waiting for the assessment process to start. The dyslexic disabilities may be of a pedagogical art, whereas self-concepts and psychological health are rather of a psychological nature. The fusion between the two disciplines may create additional misunderstandings about how to create the optimal learning environment for a child experiencing reading difficulties and/or dyslexia.

The interrelationship between self-concepts and disabilities such as reading impairment is complex, with multiple factors contributing to the scene. Even though the overall climate in Swedish schools may have improved regarding the attitudes toward reading impaired pupils, the individual still has a process
of acceptance to conduct when facing the fact of having a deficiency, which means a deviation from what peers have. And if not supported by family and peers or experiencing internal vulnerability for any other reason, this may be a complicated and stressful process.

In future studies, it would be interesting to investigate the level of diagnosis acceptance, how integrated into self-concepts reading impairment is and how this relates to psychological health and the motivation to use AT.

Methodological concerns: strengths and limitations

All three studies have suffered from individuals not completing their participation in the research. Many reasons have been mentioned before why pupils or their teachers decide not to pursue the project, such as moving, changing schools or work places. One major limitation is the dependence of the researcher on teachers to perform assessment and interventions. Fidelity is one issue entailing whether the participants are following the research program as meticulously as research requires, as well as confounding and perhaps affecting factors such as different test and intervention executors that must be taken into account when making analyses and inferences. The distance between the participant and the researchers is probably one reason for the too low dedication to pursuing all test trials. However, a different design where researchers themselves perform interventions and assessments would increase the cost in time, money and effort to the degree that it would be impossible to conduct. The percentage of participants not pursuing the studies will restrain their generalizability.

To perform research close to its investigated context increases ecological validity and could be seen as a strength in the three studies that were all conducted in the participants’ everyday school context. However, this created the challenge of following a strict RCT design as was the ambition in Study III, since double blind trials were impossible to pursue. It also induced difficulties in controlling fidelity, as mentioned above.

Participation in the studies were based on volunteering for the project, which may create a positive bias in selection. The teachers that chose to participate may not represent Swedish schools nationally with regard to the level of engagement and the resources provided when it comes to time spent on project participation.

The instruments used in this dissertation have an origin in both a clinical and a pedagogical context. This means that research was not the priority of the developers when designing tests or writing manuals. Especially regarding norm groups, some important facts were missing in both the BYI and CFSEI-3 manuals to confidently perform a reliable analysis. However, their clinical association could be seen as a strength, one of the arguments for using these
instruments being their usefulness among practitioners in the everyday context of professionals among the participants.

The design of Study II possibly led to the results being affected by test-re-test effects in that they were too close to one another in time, which made it possible that the participants could remember the test, but it was more likely that they were familiar with the test procedure, which could be seen as an disadvantage in comparison with a naïve test person as was the case in the norm group. However, the test manuals for the test batteries declared that the risk of learning the test was minimal due to the test design. Furthermore, test trial 2 was used in the analysis as the baseline for everyone, thus equating the learning factor for all the participants included.

To measure self-concepts by the use of tests and/or questionnaires can be viewed as a strength as well as a limitation in studies I and III. The strength is that the BYI questionnaire follows a theoretical assumption which states that thoughts represent inner structures and are thus measurable. The limitations can be said to contradict this assumption by stating that in being translated into a language many aspects of self-concepts are lost. and that a questionnaire therefore does not represent the inner structures of a respondent. However, in Study III two self-concepts tests were used to be able to encompass the complex issue of self-concepts.

Using norm groups could induce limitations to the interpretation of the results. BYI and the reading ability tests provided norm groups from Swedish children and adolescents, while CFSEI-3 provided American norms. CFSEI has the ambition to reduce cultural bias in formulating questions, hence the name Cultural Free Self-Esteem Inventory, though it may be discussed if that is possible. In areas like family values, for instance, where the participants in Study III scored significantly higher than the norm groups on the Home subscale, it may be suggested that Swedish and American values differ. This will not, however, amount to the degree that comparisons are made invalid, since Swedish and American cultural contexts are similar in many respects, and the norm group comparisons could be argued for as still being practicable.

To use self-reports is usually regarded as a limitation since there are difficulties in knowing whether respondents are telling the truth, understand questions the way it was intended or that the questionnaire captures the phenomena intended to be investigated. It may also be argued that children are not mature enough to answer self-reports due to their not yet fully developed cognitive abstraction ability, which could be said to be required to grasp psychometric questionnaires. However, in studies I and III the answers are compared to an age-equivalent norm group and thus eliminate age-related issues from limiting the generalizability of results. Both BYI and CFSEI-3 were constructed to fit the age groups assessed, which makes it possible to assume that some of the self-concept content has been illuminated in the assessment.
To study the relationship between AT and reading ability is a challenging task since the research field is lacking outcome measures (Edyburn, 2015). Although in Study II the decoding ability and the wider impact of using AT was focused on, it was concluded that the ability to assimilate and create text by using AT was not captured by the instruments and methods of analysis used in the study. Ways to scientifically study the effect of AT in these respects have yet to be developed.

Several anecdotal facts deriving from people with reading impairments assert that AT has improved their quality of life in many ways. This includes the importance of independence; being able, for instance, to read a time table when travelling or instructions to a newly acquired device, but the results did not confirm this when participants showed such similar self-concepts as the norm group. Maybe different and more sensitive instruments would show a more circumstantial outcome. A more qualitative approach may be suggested, since the complexity of the interrelationships in these conducted studies that have been discussed above may not be easily described in questionnaires.

**Implications**

This thesis has been manoeuvring between education and health care throughout the project. The implications of the studies are directed to both educational and health care instances as well as parents, family and friends to a reading impaired child or adolescent.

Reading difficulties should be seen as a component in a system where all parts in the interconnected system need support to obtain optimal function. To support only one component, i.e. reading, will not be efficient if, for instance, a pupil is not psychologically healthy.

- Introducing AT as supporting and compensating means to reading impaired children and adolescents could reduce the everyday reading hassles for many reading impaired individuals.
- Pupils may improve their reading ability when using applications in tablets so that their reading progression is not left behind in comparison with their peers.
- Using AT to compensate and facilitate reading may contribute to the process of protecting vulnerable children from developing negative self-concepts.
- Educational establishments and governmental health agencies should improve their cooperation to support each other in further improving the life quality to pupils with reading impairment.
- The technological evolution and expansion in learning contexts may henceforth, hopefully, bring even more efficient assistive technology means for reading impaired individuals.
• In the future, the definition of reading may need to be modernized to meet the new technological advancements which bring about societal changes. The notion of assimilating and creating text is suggested to more explicitly define the act of reading, and would subsequently facilitate the reading process for reading impaired individuals.

Conclusions

The overall conclusion from the studies included in this thesis may be that it indicates that Swedish children and adolescents participating in the studies depicted neither any different self-image nor different self-esteem compared to the norm groups provided by the test manuals, which is somewhat contradictory to most previously conducted international research. With regard to psychological health, the issues remain complex, with Study I showing results indicating no difference in psychological well-being among reading impaired pupils, while the results of Study III showed some ambiguity regarding anxiety. Bearing in mind that the sample in Study III was small, the results may not represent the group of reading impaired children in school year 4. However, to conclude: studies with larger samples of participants are suggested to further investigate and clarify the circumstances. The results of psychological health may be said to also show an indication of a standard psychological health among participants in most age groups and on most variables, which could be said to contradict a great deal of previous research within the field.

As this thesis also investigated whether the use of AT had any impact on decoding ability the results showed that the reading impaired participants progressed at a similar rate regarding reading abilities for one year while using AT. Moreover, it was shown that using AT had a positive effect on the motivation to learn, on independence and family climate. The use of AT could not be shown to have an impact on self-concepts, which may partly be due to the participants showing similar self-concepts as the norm groups, which implies that improvement was neither necessary nor expected.

Future studies

It would be interesting to investigate, in a subsequent project, the level of acceptance of diagnosis, how integrated the reading impairment is in self-concepts and how this relates to psychological health and the motivation to use AT.

As sequential studies, it would be interesting to follow up pedagogical strategies, teacher attitudes, school climate and policies in the Swedish school to establish what factors may generate positive school-related self-concepts.
The gender perspective would be interesting to investigate further from a discourse that socialization is creating different gender roles that might make dyslexia appear in different shapes depending on gender category. It has been previously assumed that the frequency of boys with reading impairment and/or dyslexia is higher than that of girls or non-binary gender categories. It would have been interesting to investigate whether these differences exist and what factors may create the different circumstances for different gender groups.
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