Effects of the dyslexic version of the typewriting course TypeTopia on reading skills of dyslexic children

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Summary

This research describes an experiment on the question whether dyslexic children can improve their reading skills by participating in the dyslexia version of the typewriting course TypeTopia. The literature shows that there is only little knowledge about the relation between reading and writing, of which Graham and Hebert (2010) indicate that writing is an often-overlooked tool to enhance reading. Even though Francken (2013) and Hopman (2014) are convinced that especially handwriting has a positive influence on reading, because of the special motor program that will be stored in the memory, typewriting has potential (Van Daal, Van der Leij, & Geervliet-Van der Hart, 1989).

In the first chapter of this report the theoretical framework will be described. The phases a child goes through during reading education, the disorder dyslexia and the different reading deficits are defined. After this, the possibilities for reading remediation and the link between reading remediation and typewriting will be explained. Furthermore, the description of the relevance of the research will be elaborated, ending with the research question.

After the theoretical framework the second chapter contains a description of the intervention; the dyslexia version of the typewriting course TypeTopia. The curriculum of the typewriting course will be elaborated and the time span of this study will be shown.

The method section explains the methodological choices of the research. The study follows an experimental design with two groups: an experimental and a control group. The dyslexic participants (N=49), randomly assigned to one of the conditions, will be tested both on cognitive achievement and the attitude towards reading. The cognitive achievement will be measured by two pre- and posttests, the CB&WL and the Klepel, which measured the reading achievement and the attitude measures which have been studied with a questionnaire.

In chapter 4 the results section of the outcomes of both the pre- and posttests and the questionnaire are shown. The sampling characteristics are listed and the effects on the pre- and posttests are displayed. The results show that four out of the eight outcomes show significant differences in favor of the experimental group, of which the caveat has to be made that this is without the Bonferroni correction of multiple testing. No significant differences could be found with the questionnaires.

Finally, the conclusions are drawn and the outcomes are discussed. First of all, it must be stressed that the present study fails to provide compelling evidence for an effect on any of the cognitive tests included in this research. On the other hand, the chance to find this many significant results (without the Bonferroni correction) is less than 0.04% .This suggest that the dyslexia version of typewriting course TypeTopia, could be a remediation tool for dyslexic children, but definite conclusions would require further research (on a larger scale). The attitude towards reading did not change due to the intervention, also an improvement of the reading achievement was not perceived. The children might probably need more time to experience better reading performance. For both cognitive achievement and the attitude towards reading, further research is necessary to confirm or refute the current theories.

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1. Introduction

Reading is one of the most important skills in our society and one of the key information processing skills (Buisman & Houtkoop, 2014). These key information processing skills are essential to understand, analyze and use information provided in our daily life (Buisman & Houtkoop, 2014). This is necessary because in our society almost all information we use in daily life is presented through text (Bryant, Bryant, & Ok, 2014), which requires that you can read what is written (Lovio, Halttunen, Lyytinen, Näätänen, & Kujala, 2012). If reading is a serious challenge it is highly possible some important information will be missed, for example the risk of combinations of medicines or the location of an appointment. Besides this, people with low developed reading skills often have a lower income, poorer health and are less active in the society (Buisman & Houtkoop, 2014).

The learning process of the reading ability does not come naturally; reading skill needs to be taught (Banes & Seale, 2002; Bloemendaal, 2006). Nevertheless, even with good reading education the acquiring of decent reading skills cannot be taken for granted. A small group of children have big problems in acquiring technical reading skills, they have dyslexia. Children with dyslexia find that decoding of written text continues to be a time consuming and a laborious activity (Bloemendaal, 2006), they need a lot more effort to develop their reading skills (Nicolson, Fawcett, & Dean, 2001).

With appropriate remediation, the reading problems of dyslexic children can be reduced (Dwyer, n.d.; Hoenderken, 2010; Hoenderken et al., 2012), which is essential to prevent them to get further behind. This is very important, because low reading skills in childhood are a predictor of low literacy in adulthood (Matute et al., 2012). The Netherlands is one of the richest countries in the world, but still counts one out of nine adults as low literate at this moment. This results in almost 1,3 million people between the age of 15 until 65 (Buisman & Houtkoop, 2014). This number is disappointingly high; therefore, the search for good remediation has to go on.

1.1 The development of reading skills

Gille, Loijens, Noijons, and Zwitser (2010) defined reading skills as understanding, using and reflecting on and interest in written language to accomplish your goals, expand your knowledge and potential, and participate in the society (Gille et al., 2010). The development of these skills begins at home. At home children become familiar with the spoken language (Leij, 2003) and (picture)books (Wentink & Verhoeven, 2004).

In school the learning process of the reading skills start with teaching children to decrypt and understand written language. This concerns explicit education in reading techniques, which is also called decoding (Wentink & Verhoeven, 2004). Decoding is defined as the skill to convert written text (graphemes) into sound (phonemes). The goal of the technical reading education is to create a clear understanding of the text by performing reading skills accurately and smoothly (Leij, 2003). Consequently, after mastering the reading technique, reading can be used for reading comprehension (Leij, 2003). Meaning can be given to what is written (Kuhn & Stahl, 2003), which means reading can be used to learn subject matter knowledge by using written words as an instrument (Mayer, 2003).

Leij (2003) divides the development of the technical reading process into three stages: (1) pre-reading phase, (2) beginning reading phase and (3) continuing reading phase (Leij, 2003). After these stages, the children master the technical reading process and theoretically should have the knowledge to read. Ehri (2005) agrees with these phases, but names them (1) pre-alphabetic, (2) partial alphabetic and (3) full alphabetic phase. After mastering these phases, Ehri (2005) names a fourth phase, the consolidated alphabetic phase. In the first phase children learn that spoken words have meaning, structure and some might have little experiences with alphabetic representations, for example for writing their own name (Leij, 2003). Nevertheless, they have little knowledge of the alphabet because of their lack of knowledge and experience (Ehri, 2005). In the second phase, children are starting to read. Children learn to split words into small building blocks, by visual analyses, and by visual discrimination they do recognise these building blocks as the different graphemes (letters). The graphemes can be linked to their phonemes using auditory discrimination after which these links can be pasted together by auditory synthesis and the first words can be read. This starts with some grapheme combinations, after which small monosyllable words, two syllable words and finally multiple syllable words can be read (Leij, 2003). Within this phase the focus is placed on accuracy. In the third and last phase reading accuracy and reading speed are becoming more important. The reading

level rises which makes the sentences getting longer and the complexity of the words increase (Leij, 2003).

After mastering the technical reading process there is a huge enlargement of familiar words which are stored in the long term memory as sight words; a link in the memory which creates direct word recognition the next time it is read. Besides these sight-words also familiar letter patterns that recur in different words become fixed in larger units in the long term memory. These larger units make it easier to read unfamiliar but similar words because fewer connections have to be made. Therefore, more space in the short term memory will be available to perform the reading task (Ehri, 2005).

Direct word recognition makes it possible that the reading process itself runs automatically; without full attention words will be recognized, even if there are no intentions to read. Automatized readers perform their reading performances fast, effortless, autonomous and unconscious (Logan, 1997) and cannot easily suppress, ignore or influence their reading process (Gersons-Wolfensberger & Ruijssenaars, 1997). In contrast to the automatized readers novices and dyslexic readers are painfully aware of the steps, executing them slowly with considerable effort. After a lot of practice automaticity can be produced, resulting mostly in faster reaction time and higher accuracy (Logan, 1997).

1.2 Dyslexia

Even though the reading process of regular children follows all the steps of automaticity, the progressive development of reading and writing skills cannot be taken for granted. During the learning process children can get significantly behind on classmates because of reading, writing and spelling problems. These children might have dyslexia (Gersons-Wolfensberger & Ruijssenaars, 1997).

Dyslexia, also called 'developmental dyslexia' or 'specific reading disability' (Leij & Daal, 1999), can be explained as a persistent problem in acquiring reading, writing and spelling skills (Drigas & Dourou, 2013). There is a lot of variety in definitions of the term dyslexia, which means there is no single definition (Gersons-Wolfensberger & Ruijssenaars, 1997). Stichting Dyslexie Nederland (2008) [SDN, Dutch foundation for Dyslexia] defines dyslexia as a disorder characterized by a persistent problem in acquiring and/or fluently applying reading and spelling skills on word level (SDN, 2008). In addition to this, the reading scores of a dyslexic is significantly lower than expected based on the intelligence, received schooling (Shaywitz, 1998) or other extraneous factors; such as sensory acuity deficits, socioeconomic disadvantages or personal preferences (Vellutino, Fletcher, Snowling, & Scanlon, 2004). This all is taken together in the definition of Lyon, Shaywitz, and Shaywitz (2003):

> *"Dyslexia is a specific learning disability that is neurobiological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language. That is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge."* (Lyon, Shaywitz & Shaywitz, 2003, P. 2-9)

In this thesis the working definition of the committee on Dyslexia of the Health Council of the Netherlands will be used: "*Dyslexia is present when the automatization of word identification (reading) and/or word spelling does not develop or does so very incompletely or with great difficulty*" (Gersons-Wolfensberger & Ruijssenaars, 1997, P. 209). In this definition the term automatization refers to the establishment of the automatic reading process, which is characterized by a high level of the speed and accuracy of word reading, as earlier mentioned by Logan (1997).

As the definition already suggests, the main problems of dyslexics are automaticity problems (Leij & Daal, 1999), which occur at word level and by comprehension difficulties (Blomert, 2005). Children without reading problems will follow all the reading phases mentioned above during their education. Nevertheless, dyslexics will not be able to become consolidated alphabetic readers in most cases (Ehri, 2005). Short and simple words are often accurately decoded by dyslexic children, indicating dyslexic children do possess the essential grapheme-phoneme knowledge, but they lack in applying the necessary knowledge fast and efficiently (Bosch, Bon, & Schreuder, 1995). This makes that dyslexic children lack the ability of simultaneously decoding words and comprehending text. The

decoding of words costs too much attention of dyslexic children, which makes it impossible to focus on understanding the meaning of the text at the same time (LaBerge & Samuels, 1974).

Besides the direct problems of dyslexia, there is also a number of indirect problems dyslexic children face. Reading skills are not only necessary for special reading tasks; they are also required during other courses in school (Demetriou, 2009). Because of failures by all courses due to the reading skills, children experience a chain of disappointments during the whole school day, which reduces their courage and self-confidence (Demetriou, 2009). Not only for themselves, the children are also ashamed and worried about the criticism of their peers, for example because of the choice of books they read (MacEwen, 2013). Not surprisingly many dyslexics are extremely reluctant learners (Dwyer, n.d.).

In practice the problems of dyslexia become visible as two main deficits: the phonological deficit (Morken & Helland, 2013) and the semantic deficit (Greene, 2013), which are described by Wolf and Bowers (1999) in the Double Deficit Hypothesis. In this hypothesis they recognize three categories of dyslexics; (1) dyslexics with a phonological deficit, (2) dyslexics with a semantic deficit and (3) dyslexics with a combination of both deficits (Wolf & Bowers, 1999). In this, it is proposed that readers with the double deficit have the most severe reading impairment (Vukovic & Siegel, 2006).

The preliminary deficit is the phonological deficit (Leeuw, 2010; Morken & Helland, 2013; Yap & Leij, 1993), which means troubles with pronouncing words, especially words that do not exist or words that are never seen before. Consequently, this deficit is characterized by poor reading of words that demands decoding (Yap & Leij, 1993), which Leeuw (2010) explains by difficulties with phonological awareness and complications with phonological processing (Leeuw, 2010). In this explanation the phonological awareness refers to the knowledge that spoken words consists of different phonemes and the phonological processing to the skill to apply this knowledge (Leeuw, 2010). The technical reading skills of the phonological deficit can be measured by measuring the reading speed in word reading, in which nonsense word reading has an extra possibility of assessment; the ability of decoding words they have never seen before (Snowling, 1998).

Besides the phonological deficit, Greene (2013) and Wolf and Bowers (1999) mentioned a semantic deficit also called the naming speed deficit (Vukovic & Siegel, 2006), which means troubles with the speed that information is retrieved from the memory. This deficit addresses problems in naming speed tasks, timed reading and fluency measures, and reading comprehension (Wolf & Bowers, 1999). The naming speed tasks are also called Rapid Automatic Naming (RAN) tasks, which involves *"timed naming of familiar stimuli presented repeatedly in random order*" (Norton & Wolf, 2012, p. 434). These RAN tasks requires not only the knowledge of the graphemes and phonemes, the speed of retrieving the names of the stimuli from the memory has a huge influence on the measurements (Bos & Lutje Spelberg, 2010). In the development of RAN tasks the retrieving speed is getting shorter with age, but the differences between children in early age shall probably stay for live (Bos & Lutje Spelberg, 2010).

Both word reading and RAN measurements are measured in time and accuracy. While both constructs are good predictors of reading achievement, at a given time the accuracy is not or hardly differentiated anymore between people. This is not the case for the speed because of the differences between people of processing speed, which will probably be a permanently difference for life (Bos & Lutje Spelberg, 2010). Although Bos and Lutje Spelberg (2010) state that the speed score is probably the best predictor of reading skills, these scores have to take into account the reading experience (age) and the reading 'ability'. Younger children often make more mistakes and probably belong always to the group of readers with the longest processing time. Older 'normal' readers make hardly any mistakes, which makes the reading time a better scale for individual achievement scores (Bos & Lutje Spelberg, 2010).

1.3 Remediation

The above mentioned deficits of dyslexia cannot be cured, even after specialized and intensive assistance dyslexics will always experience some problems (Druenen, Gijsel, Scheltinga, & Verhoeven, 2012). Nevertheless, it is possible to help children in their daily activities (Leeuw, 2010). However, to achieve the same degree of mastery content as children without reading difficulties, this requires a larger amount of structured practice (Dwyer, n.d.). This is not easy because practice requires

time and dyslexic children do often not find reading very exciting, they even find it very exhausting most of the time (Aziz & Husni, 2012).

To address these problems, a lot of compensatory and supporting materials are available, either with or without technology (Hoenderken, 2010). The materials with technology are also called assistive technologies and are designed to fill the 'access gap' of information between the children and their normal school materials. If the assistive technology is sufficient, the learning materials do not need to change and the achievement of the children will maintain or even improve (Banes & Seale, 2002). The use of assistive technology for remediation has increased exponentially (Bryant et al., 2014) and these resources cannot only reduce the barriers of the dyslexia (Hoenderken et al., 2012), they can also address the secondary problems (Dwyer, n.d.). Dwyer (n.d.) claims assistive technology enhances self-confidence, independency and a better personal wellbeing of the children (Dwyer, n.d.).

One of the most common assistive technologies for dyslexic children is the computer (Stichting Taalhulp, n.d.). The use of computers at schools has increased sharply during the last decades and not only at schools, but also at work and for social networking the production and consumption of text is huge. All these applications require reading and writing skills, so promoting their development is extremely important (Takala, 2013). Interestingly, many pupils who have problems in learning to read and write seem to benefit substantially from using computers (Loo, Bamiou, Campbell, & Luxon, 2010). Callebaut (2006) mentioned that the computer also has special features to help dyslexic students. The first and basic feature is the word processor. The most important advantage of the word processor is that the written texts can be modified, corrected and adjusted at any time, without making the result unreadable or disorderly. The second feature is the spellchecker, which helps to screen the mistakes from self-written text. Thirdly, there is extra auditory support, for example read out loud software which reads out loud books or own written text. The fourth feature is the homophone displays, which will show words that sound the same, but are written differently. The different meanings are displayed and the right word can be placed. Finally, there are also word prediction programs. After the first letter is typed the program starts to guess what word you probably want to type and shows a list of options (Callebaut, 2006). In addition, it needs to be mentioned that the computer will be particularly effective for drilling exercises and to practice learning material (Dwyer, n.d.). This is because computers are endlessly patient and the programs are often highly motivating (Takala, 2013). Computer are also highly flexible, which makes it possible to make use of a wide range of adaptations to customize the computer to the needs of the user (Banes & Seale, 2002). However, to use the computer as an assistive tool, first the basic computer skills needs to be taught (Callebaut, 2006).

1.4 Typewriting

One of the essential computer skills that should be taught is typewriting (Kennisnet, 2013; Stichting Taalhulp, n.d.). This is because the earlier mentioned assistive technology of word processor and spellchecker depends on typed text (Stichting Taalhulp, n.d.) and in further education it is expected to hand in most work in printed form (Banes & Seale, 2002). Callebaut (2006) states that dyslexic children will probably never reach fully automated "blind" typewriting, because of their automatization problems. Nevertheless, Callebaut (2006) find it necessary that these children explore the computer keyboard as soon as possible, so dyslexic children can benefit the most from the possibilities of the computer (Callebaut, 2006).

Typewriting is a psychomotor skill, of which mental representations will be transformed into movements of the fingers in time and space (Leyden, 1993). Finally, after a lot of practice, these movements are supposed to be automated, which is also called blind typewriting. This means the typists do not have to look at the keyboard to find the location of the keys. The learning process of the typewriting skill requires a lot of time and practice to succeed. Leyden (1993) states it takes at least three years of practice to reach the ceiling of typing speed and accuracy (Leyden, 1993). Learning how to type can be done by using a typewriting course (Suárez-Orozco & Qin-Hilliard, 2004), which mainly involves key control and the mastering of ten-finger typewriting (Stichting Taalhulp, n.d.). In such typewriting courses children need to learn which key corresponds to a specific letter to type words (Yamaguchi, Crump, & Logan, 2013) and they need to feel comfortable with the computer keyboard (Suárez-Orozco & Qin-Hilliard, 2004).

To become a skilled typist, three stages need to be followed; (1) using keyboarding instruction in identifying the letters and its location, (2) developing progress on motor performance and (3) developing automatic fluency (Stevenson & Just, 2012). Besides these stages, according to Salthouse (1984) each key press passes four components phases; (1) an input phase, (2) a parsing phase, (3) a translation phase and (4) an execution phase. In the input phase, the to-be-typed material enters the processing system, for example as words or phrases. These to-be-typed words must eventually be exactly copied in the out-put. In the parsing phase, the words must be split into keyboard characters. In the translation phase the characters will be linked to finger-movement patterns, after which the execution phase could carry out the exact typewriting movement (Salthouse, 1984). These different phases run in sequence for one individual letter, but can be performed simultaneously for different letters (Rieger, 2004). In automaticity of the typewriting process the translation phase is the process component that can be automated. If the translation phase is automated, while typing, the activation of key presses will occur automatically when letters are read (Rieger, 2004).

1.5 Typewriting as reading remediation

To date, there seems to be no research conducted that deals with the question whether typewriting courses can function as reading remediation. However, some research has been conducted regarding the question whether writing can act as reading remediation (Fitzgerald & Shanahan, 2000; Francken, 2013; Graham & Hebert, 2010).

Graham and Hebert (2010) indicate that writing is an often-overlooked tool to enhance reading. They state that both reading and writing appeal to the same knowledge and cognitive processes. Consequently improving writing skills of the children should also result in improved reading skills (Graham & Hebert, 2010). Fitzgerald and Shanahan (2000) do agree with Graham and Hebert (2010). They claim that the use of both reading and writing at the same time will gain most insights (Fitzgerald & Shanahan, 2000). If children read a received letter and also have to send another one back, both concepts need to be addressed and the same graphemes, phonemes, grammar rules and spelling need to be used. Consequently, writers may use their own written texts to gain insights about reading.

Also Francken (2013) is convinced that reading and handwriting have a positive connection if taught at the same time, but is not certain this is also the case with typewriting. The start of handwriting together with basic reading seems to be essential according to Francken (2013). Children who learn how to read and write by hand at the same time, build a motor program of each letter they write which makes them memorize the unique letter characteristics. This makes it easier to recognize the different letters when reading. Unfortunately, this is not the case with typewriting, because the type-action has no inner relationship with the shape of the letters. However, she mentioned that there is no scientific proof that children really need the motor program to learn how to read (Francken, 2013). Moreover Hopman (2014) indicates the same advantages of handwriting over typewriting. The lack of the connection between the shape of the letter and the movement involved writing it in typewriting is a huge loss. This is because the motor program that is built by acquiring handwriting has significantly more influence on letter recognition than the movements of typewriting. Nevertheless, the letter memorisation will still be there, but will mostly be remembered by the location on the keyboard (Hopman, 2014). Perhaps this connection could complement the motor program of handwriting and expand the possibilities of typewriting.

Apart from the lack of the motor program in typewriting, Hopman (2014) mentions also the potential opportunities of typewriting. ICT is part of the life of children and therefore it will be good if typewriting is a part of their development. Furthermore, typewriting is commonly considered easier to perform than handwriting, faster in execution and it is easier to read for both writer as reader. Also the choice of font makes it easier to create an own style and the backspace makes it possible to make neat deletions and improvements (Hopman, 2014).

In earlier research, of Daal et al. (1989), typewriting was used in exercises regarding reading education for elementary school children with serious reading problems. This was done with a typewriter instead of a computer keyboard and with a pre-selected set of words that needed to be practiced. In this research, three conditions were used; words to (1) read, (2) retype with visual examples and (3) retype without examples. The results of this research has shown that the intervention of all three conditions improved the achievement of the children; the children spelled better, read

faster and read with more accuracy (Daal et al., 1989). This implicates the possibility to improve reading skills by typewriting.

1.6 TypeTopia

The opportunities that the literature show and the results on their typewriting course made the company Computype request for an explorative study. Computype was established in 1986, and designed the typewriting course TypeTopia, which was launched in 2007. From experiences over the years, the company has realized that dyslexics have a lot of trouble with learning typewriting. This resulted in the launching of the special dyslexia version of the typewriting course TypeTopia in 2008 (Computype, 2013). In the light of this special version, Computype became highly interested to explore if the improvement in typewriting also influences the reading skills of the dyslexic children. This made them want to explore the opportunities to remediate the problems in reading.

The dyslexia version of typewriting TypeTopia is also very suitable as an intervention, because of its special adaptations to the needs of dyslexic children. The adaptations can be found in three different aspects which compensate the primary constraint of the dyslexic children; the reading difficulty (Computype, 2013). The first adaptation is the addition of extra audio support, so the letters and words that need to be typed are shown on screen and at the same time read aloud. The second addition is extra visual support by making a ruler that shows the text to be typed. The last adaption is the option to use the more accessible font 'Dyslexia Regular' (Computype, 2013). The font 'Dyslexia Regular' is specially designed to make reading more pleasant, by creating more uniqueness to the different letters to produce better letter recognition (Dyslexie Font B.V., 2014). These adaptations reduce the barriers for dyslexic children to start typewriting and help to continue and complete the typewriting course.

1.7 Research question

To explore the effects of the dyslexia version of typewriting course TypeTopia on the reading skills of dyslexic children, this study aims to answer the following research question:

To what extent does the dyslexia version of the typewriting course TypeTopia affect the reading skills of dyslexic children?

It is expected that the typewriting course TypeTopia will improve the reading skills of dyslexic children, because reading and writing skills are both part of the same cognitive skills (Graham & Hebert, 2010). Consequently, the amount of practice in typewriting should also provide extra practice in reading. In addition, the reflexes in typewriting influence the retrieving speed from the brains, which will also speed up the recognition speed for letters (Bos & Lutje Spelberg, 2010). Furthermore, Daal et al. (1989) showed that children read faster and with more accuracy after their typing intervention, which shows its potential.

Based on the expectations of the literature, the following hypothesis will be tested:

1. Both phonological deficit scores (word reading) and the semantic deficit scores (RAN) will improve after following the dyslexia version of typewriting course TypeTopia;
2. The decoding level of nonsense word reading will improve after following the dyslexia version of typewriting course TypeTopia and
3. The attitude towards reading will improve after following the dyslexia version of typewriting course TypeTopia.

To test all hypotheses a comparison was made between an experimental group and a control group, of which the experimental group followed the dyslexia version of typewriting course TypeTopia and the control group did not take any typewriting course. The first hypothesis was tested by two tests; the test 'Continue Benoemen en Woord Lezen' [Continued Naming and Word Reading; CB&WL] (Bos & Lutje Spelberg, 2010) and the Klepel [nonword reading test] (Bos, Lutje Spelberg, Scheepstra, & Vries, 1994). Another characteristic of 'De Klepel' is used to test the second hypothesis. Both tests will be explained in the method section. The third hypothesis was tested with a questionnaire.

2. Intervention

In this chapter an explanation is given of the used intervention: the dyslexia version of the typewriting course TypeTopia. Additional explanation can also be found in appendix I.

2.1 The dyslexia version of typewriting course TypeTopia

To answer the research question, the already existing dyslexia version of the typewriting course TypeTopia will be used as the intervention. The structure of the typewriting course consists of 20 modules, each consisting of five lessons, which makes a total of 100 lessons. These lessons can be divided into two phases. In the first eight modules, the characters and their location on the keyboard will be trained to be automated. After this first phase, the last 12 modules will contain skill training and personal exercises (CompuType, n.d.). The exact curriculum is shown in Table 1.

The intervention itself will only consist of a part of the typewriting course, due to time limits. As can be seen in table 1 the first 12 modules of the typewriting course will be used, which comes down to 60 lessons. These first 60 lessons will be completed within 20 weeks, so the students have to finish three assignments a week. As described in the training schedule (appendix II; present actually used document in Dutch language), there will be 22 weeks' time available to complete the intervention, because of two weeks of school holiday that are included (week 18 and 19 of the year 2014). In these two weeks of holiday, there will be an opportunity for the students to catch up with the schedule.

Table 1
Curriculum for each module of the typewriting course

Module	Curriculum	
1	Letters j, f, k, i, e, l, s	
2	Letters a, h, g, u, r	
3	Letters o, w, p, q, t	
4	Letters y, m, v, n, b	
5	Letters c, x, z, comma, point	Intervention
6	Capital letters	
7	Special characters ; and : and ? and ! and ‘ and “	
8	Numbers	
9	Skill training + personal exercises	
10	Skill training + personal exercises	
11	Skill training + personal exercises	
12	Skill training + personal exercises	
13	Skill training + personal exercises	
14	Skill training + personal exercises	
15	Skill training + personal exercises	
16	Skill training + personal exercises	
17	Skill training + personal exercises	
18	Skill training + personal exercises + practice exams 1-3	
19	Skill training + personal exercises	
20	Skill training + personal exercises + TypeTopia typewriting exams	

Each lesson of the typewriting course will contain the same types of exercises and a couple of extra games to keep up the motivation. The exercises are divided into three categories; (1) reflex exercises, (2) audio training exercises and (3) text training exercises.

To show the experimental group is a representative group of dyslexic children and can be used for generalization, the experimental group of this study is compared to 222 other children who already fully completed the dyslexia version of typewriting course TypeTopia. This group is further called the TypeTopia group. The mean scores of both the experimental group of this research and the above mentioned TypeTopia group are compared of which the results show that both groups are quite similar. An overview of these results can be found in appendix I.

3. Research method

This chapter presents the research methodology of the study. The first paragraph gives an overview of the research design (paragraph 3.1) and the next paragraph shows the participants (paragraph 3.2). In paragraph 3.3 the procedure of the research is presented, after which the instruments and the data-analysis are discussed (paragraph 3.4).

3.1 Research design

Effects of the dyslexia version of typewriting TypeTopia are measured by an experiment. The study follows an experimental design. The children and their parents applied for the study and therefore the sample was not randomly selected. However, the assignment to experimental and control group was at random. The children who had applied were divided into two similar groups; the experimental group and the control group. The children in the experimental group received the intervention and the children in the control group participated without doing the intervention.

3.2 Participants

For this research children from the upper grades of primary school (in the Netherlands between 8 and 12, if doubling a school year 13 years old) were selected. Besides this, the children needed to be officially diagnosed dyslexic without having an extra (co morbid) disturbance, such as autism, ADHD, ADD or a motor impairment. Finally, the children should not have any earlier experience with a typewriting course. However, it should be taken into account that the exclusion criterion for participation is the lacking of a signed approval of participation by their parents or guardians. These inclusion and exclusion criteria were determined by the application form, as shown in the appendix III. Besides the children also their parents and teachers participated in parts of the research. The parents' permission was also based on the same form of signed approval of participation as the child. The permission of the teachers was given by the school management.

The experiment started with 58 participants from 11 different schools in the region of Alkmaar, but 11 children dropped out because of several reasons. Two participants withdrew their application because of the assignment to the control group instead of the experimental group. The parents of these children were unpleased with this choice, which made them quit the research. The other nine children dropped out from the experimental group. A given reason to drop out was difficulty of the typewriting course. The typewriting course took an unexpected large amount of time and the difficulty level of the exercises was too high.

3.3 Procedure of the research

After approval of the ethical committee (of the department Educational Science and Technology [EST] of the University of Twente) to perform the research activities, the research started with the recruitment procedure of the schools and children in the preparation phase (shown as phase zero in table 2). After the schools agreed to participate, information packages were distributed, in which the children and their parents could read all the information about the research procedure and its activities. This information packages can be found in appendix III. It included an information letter, an information folder and application form, which allowed them to choose to participate. This application form also contained a consent, which made it clear they could withdraw their participation whenever they pleased (appendix III).

After the preparation, the research included four phases; (1) before the intervention, (2) the intervention and (3) after the intervention, also shown in table 2. The first phase measured the prior knowledge of the children by the pre-test and their attitude towards reading by the questionnaire. In the second phase the intervention was carried out by the experimental group; meanwhile the control group was not allowed to follow any typewriting course. The third phase established the attainment level with the posttest and their change in attitude with a questionnaire. After completing the research phases the collected data were analyzed, after which conclusions were drawn.

Table 2
Research phases with their research activities

Phases	Phase description	Activities
Phase 0	Preparation	- Recruiting schools and children
Phase 1	Before the intervention	- First questionnaire
		- Pre-test
Phase 2	The intervention	- Intervention
Phase 3	After the intervention	- Second questionnaire
		- Posttest

3.4 Instruments

The used research instruments will be discussed below in combination with the different groups of respondents as shown in table 3. In the explanation of the instruments, there will be a separation between the tests of the cognitive achievement (pre-and posttest) and the measurements of the attitudes of the participants (the questionnaire).

Table 3
Research activities for each group of respondents

	Experimental group			Control group		
	Students	Parents	Teachers	Students	Parents	Teachers
First questionnaire	X	X	X	X	X	X
Pre-test	X	-	-	X	-	-
Intervention	X	-	-	-	-	-
Second questionnaire	X	X	X	X	X	X
Posttest	X	-	-	X	-	-

Pre- and posttest

The primary aim of the pre- and posttest is to measure the improvement of the reading performance, of naming speed and word reading, during the intervention period. To measure the performance of the children before and after the intervention, two tests will be used: the CB&WL (Bos & Lutje Spelberg, 2010) and De Klepel (Bos et al., 1994). These tests will study the first two hypotheses, as shown in table 4. Both the CB&WL (Boom Test Uitgever, n.d.; Cito, 2014b) and De Klepel (Cito, 2014a) have positive ratings of the Dutch committee of test affairs (COTAN), which means the tests are valid for research purposes (Egberink, Janssen, & Vermeulen, n.d.). The two tests were combined, because the combination will not only display the improvement scores in word reading and RAN as measured in the CB&WL, De Klepel also shows if the problems are due to decoding deficits or not (Bos et al., 1994).

Table 4
Research activities for each hypothesis

	Tests		Questionnaire
	CB&WL	De Klepel	
1. Effect of different deficits (phonological and semantic)	X	X	-
2. Effect of the decoding level of nonsense word reading	-	X	-
3. Effect of the attitude towards reading	-	-	X

CB&WL

The CB&WL measures the effect of both phonological and semantic tasks, as referred to in the first hypothesis (shown in table 4). This will be done by four different RAN tasks (color naming, number naming, image naming and letter naming) and two word reading tasks (Monosyllabic word reading and a one minute reading test EMT-B (T-50 determination). Every task, accept the EMT-B, consists of a test card with 50 items that need to be read as quick as possible by which the reading speed is tracked. All four RAN tasks provide five different stimuli shown ten times in random order. This will be presented in five columns of each ten stimuli, which need to be read out loud from top to bottom,

from left to right. For example with the letter naming task; the used letters are d, o, a, s and p, and each letter is presented ten times in the test card. The naming speed, in seconds, will be the tracked on this task. The monosyllabic word reading task is quite similar to the RAN tasks and presents 50 different monosyllabic words, of which the reading speed is tracked. The EMT-B (T-50 determination) test card consists of 116 words but, because the test is adjusted to the CB&WL, only the first 50 words needed to be read. As with the other tests, the reading speed of these words is tracked. The Execution of these tests took a total of 15 minutes per child and were conducted as specified in the user manual (Bos & Lutje Spelberg, 2010).

De Klepel

De Klepel (Bos et al., 1994) will also be executed during the pre- and posttest, which will study both the first and the second hypothesis. The first hypothesis is addressed by De Klepel on terms of word reading. In only two minutes time, the children needed to correctly read as much nonsense words as possible, from a test card with a total of 116 nonsense words. This test card starts with easy nonsense words and proceeds gradually towards the most difficult ones to read. At the end of the test the correctly read number of nonsense words shows how well the children performed on the word reading task. This test was conducted as specified in the user manual (Bos et al., 1994).

The second hypothesis, whether there is any effect on the decoding level of the children, was measured by the same test, but used another output. During the test, the mistakes were tracked as well, after which the fault percentage could be calculated. With the fault percentage the level of decoding or the technical reading skills could be identified (Bos et al., 1994).

Questionnaires

The third hypothesis was measured with the questionnaire, by the improvement in attitude (shown in table 4). As can be seen in table 3, all the respondents filled in a questionnaire two times; one before and one after the intervention. This is because it was expected that the children who perform better in reading also have a more positive perception of reading (Demetriou, 2009). To measure this effect, three different kinds of questionnaires were used both before and after the intervention; one for the children, one for the parents and one for the teachers. The reason to use all three sources is to create higher reliability by means of triangulation. The results of the questionnaires do not immediately show the progress of the reading abilities, but underpin the results of the pre- and posttest by their perceptions on the reading progression of the children. All three questionnaires addressed the perceptions of the reading improvement of the child and can be found in appendix IV. The perceptions of each respondent group are split into three sets of questions, representing the statements whether the child (1) likes to read, (2) performs reading activities well and (3) finds it important to be able to read. The fulfillment of these statements will be based on a set of both positive and negative questions, combined to one score for each set mentioned above. The teacher questionnaires contains two parts, one part for general classroom information (which only needs to be filled in once) and one part that needs to be filled in for each participating child.

The questions of the questionnaires are based on the student questionnaire of the international comparison research 'Progress in International Reading Literacy Study' [PIRLS] (International Association for the Evaluation of Educational Achievement [IEA], 2011). PIRLS compares the reading comprehension skills of primary school students, of which the data consists of reading achievement scores of students, the school curriculum and background information on the students, parents, teachers and the school director (Mullis, Martin, Foy, & Drucker, 2012). The PIRLS questionnaire consists of two kinds of questions: (1) general background questions and (2) reading attitude questions (IEA, 2011). To keep the reliability and validity of the questionnaire as high as possible, the already existing questionnaires is only slightly changed. Consequently, the result of the questionnaire consists of all the reading attitude questions and only the relevant general background questions. The same reading attitude questions were adapted to ask parents about their children and teachers about their students.

3.5 Data-analysis

With the data-analysis the same distinction is used between the research activities; the tests of the cognitive achievement (pre-and posttest) and the non-cognitive measurements of the attitudes of the

participants (the questionnaire). With all the data combined a lot of tests were performed, which means that the significance level of the tests officially had to be adapted by a Bonferroni correction (Field, 2009), and had to be divided by the number of tests. With the cognitive tests the significance level had to be divided by eight (resulting in a significance level of $p<0.0063$, if we start out from a significance level of $p<0.05$) and with the questionnaires by nine (resulting in a significance level of $p<0.0056$). With this research, the significance level is not adapted; the results are shown directly from the output of SPSS. This is because the character of research is partly exploratory with only a few participants and if the significance level is strongly reduced, no significant differences are likely to be found (unless the effect of the intervention turns out to be much larger than anticipated). Consequently, the results will primarily give an indication for further research and cannot be considered as a definite outcome.

Pre- and posttest

CB&WL

The time scores of the CB&WL are measured by the number of seconds they need to read the test card. These time scores could be linked to the age of the child and with this combination, standard scores could be determined on each individual test. To calculate the standard scores, both the age of the children and their time scores needed to be entered on the website of the publisher (Boom Test Uitgevers, n.d.). After entering these scores the standard scores were presented.

The standard scores are measured in a Wechsler's-scale (Bos & Lutje Spelberg, 2010), which is a scale with a range from 1 to 19, with an average of 10 and a standard deviation of 3. If the participants score below 7 it gives an indication of insufficient reading skills (Bos & Lutje Spelberg, 2010). Finally, the scores of the CB&WL resulted in six standard scores for the different tests. At the end of the intervention, the standard scores were available for pre- and posttest, for both experimental and control group. With these scores the improvement scores were calculated by subtracting the posttest scores from the pre-test scores, because it was expected that the children performed their tasks faster in the posttest then in the pre-test. After calculating the improvement scores, the differences between the groups were calculated by an independent samples T-test.

Based on the test results the children could be classified into four different deficit groups; (1) children without any deficits, (2) children with only a phonological deficit, (3) children with only a semantic deficit and (4) children with a double deficit. The phonological deficit is measured by both the monosyllabic word reading test and the EMT-B (T-50 determination). The scores of both tests were combined to one word reading score, by taking the scores average. The combination score is also measured with the same Wechsler's scale with a range of 1 to 19, an average of 10 and a standard deviation of 3. Scores of 7 and below were identified as participants with a word reading deficit (Bos & Lutje Spelberg, 2010). The semantic deficit was measured by the alphanumeric naming tests; the number and letter naming tests. Also these scores were combined to one naming score, by taking the scores average. The same Wechsler's scale was used (range of 1 to 19, an average of 10 and a standard deviation of 3) and the scores of 7 and below were identified as participants with a naming deficit (Bos & Lutje Spelberg, 2010). After the calculation of both combination scores the participants were classified into one of the four deficit groups and a comparison between pre- and posttest was made.

De Klepel

On the contrary, De Klepel used the number of words that are read correctly, by subtracting the wrong number of words from the total number of words. This number of correctly read words were standardized by the age of the children, in which the standardized scores were measured with the same scale as with the CB&WL: a Wechsler's-scale with a range from 1 to 19, with an average of 10 and a standard deviation of 3 (Bos et al., 1994). The scores on both pre- and posttest resulted in the improvement score. This time by subtracting the pre-test scores from the posttest scores as it was expected that the children would read the second time more words correctly in the two minute time. Similarly as with the CB&WL, the differences of the improvement scores of both experimental and control group were compared with each other by an independent samples T-test.

Furthermore, De Klepel also measured the level of decoding, by standardizing the fault percentages by the grade of schooling. These scores have a range from 1 to 10, of which the scores below 4 give the indication of an insufficient decoding level (Bos et al., 1994). In addition these scores

are measured for both pre- and posttest, calculated into the improvement score of the decoding level and compared with an independent samples T-test.

Questionnaire

The outcomes of the questionnaires consisted of the perceptions of three different sources, the attitude of the children and the perceptions of both parents and teachers on the attitude towards reading of their children and students. The data was measured both before and after the intervention, from which the improvement score was calculated. This calculation was done by subtracting the pre-questionnaire scores from the post questionnaire scores, because of the expectation that the students would be more positive about reading after the intervention. The differences between the experimental and control group were calculated by an independent samples T-test, separately for both the different groups and the three questions.

The questionnaires were tested on the internal consistency, calculated by Cronbach's alpha (Field, 2009), shown in table 5. From the results of the first questionnaire the first set of questions, regarding to the statement whether the children enjoyed reading, the internal consistency is high in all groups (children α=0.869, parents α=0.847 and teachers α=0.801). The second set of questions, regarding to the statement whether the children have good reaching achievement scores, had a sufficient internal consistency (children α=0.672, parents α=0.793 and teachers α=0.705). On the other hand, the third set of questions, regarding to the statement whether the children think it is important to read, the internal consistency is rather low, especially with regard to the children (children α=0.505, parents α=0.662 and teachers α=0.699).

Table 5
Cronbach's α for all set of questions for each different group

Construct	Cronbach's α			#items		
	Students (N=49)	Parents (N=49)	Teachers (N=48)	Students	Parents	Teachers
Enjoy reading	0.869	0.847	0.801	5	5	5
Reading achievement	0.672	0.793	0.705	5	5	5
Importance of reading	0.505	0.662	0.699	4	4	4

To prevent missing data the questions of the questionnaires were compulsory. This made that there is no missing data except from the questionnaires that were not submitted. By sending reminders the number of questionnaires that were not submitted was kept to a minimum. 99% of the questionnaires were submitted and could be used for analyses.

4. Results

This chapter provides an overview of all the results of the study. At first the sampling characteristics are shown (paragraph 4.1). After this, the effect on the different reading skills will be presented by both naming and word reading tasks (paragraph 4.2). The results of the decoding level of the children are revealed (paragraph 4.3) and finally the results of the questionnaire are presented (paragraph 4.4).

4.1 Sampling characteristics

In total 49 children participated (25 male & 24 female) in this study with a mean age of 11.1 years (SD= 1.1 year, range 8.8 to 13.3). In total 11 Dutch primary schools participated, where children were seated at grade 5 until 8 (in other countries also known as grade 3 until grade 6). These children were divided into two groups; an experimental group of 21 children (11 male & 10 female, X=11.3, SD=1.2, range 8.8 to 13.3) and a control group of 28 children (14 male & 14 female, X=11.0, SD=1.0, range 9.3 to 13.3).

Table 6
Sampling characteristics

	Total group (N=49)	Experimental group (N=21)	Control group (N=28)
Age [1]			
X (SD)	11.1 (1.1)	11.3 (1.2)	11.0 (1.0)
Range	8.8 - 13.3	8.8 - 13.3	9.3 - 13.3
Gender [1]			
Boy	25	11	14
Girl	24	10	14
Group			
Grade 5	5	2	3
Grade 6	13	5	8
Grade 7	20	8	12
Grade 8	11	6	5

[1] No significant differences between experimental and control group (t-test with $p<0.10$)

Other sample characteristics are the phonological and semantic understanding of the children, which were calculated to find out which deficits were present in both groups during the pre-test as well as the posttest. The results of the tests show small groups, which made it impossible to do a proper comparison. Nevertheless, the results of the number of children in each deficit group are shown in table 7. As can be seen in table 7, after the intervention period the experimental group shows a double amount of children with no identified deficits (from 4 to 8) and the children identified with a both deficits is reduced by half (from 14 to 7). The results of the control group show only minor changes.

Table 7
Deficit distribution within the different research groups

Deficits	Total group (N=49)		Experimental group (N=21)		Control group (N=28)	
	Pre-test	Posttest	Pre-test	Posttest	Pre-test	Posttest
No deficit	9	13	4	8	5	5
Phonological deficit	5	10	2	5	3	5
Semantic deficit	3	3	1	1	2	2
Double deficit	32	23	14	7	18	16

4.2 The effect on the different reading skills

The tests that were used to study the first hypothesis are split into two different groups of tests; tests to measure effects on the semantic deficit and tests to measure effects on the phonological deficit. Both tests will be discussed.

4.2.1 The effect on the semantic deficit

The results to see the effects on the semantic deficit are shown in table 8. Table 8 present the results obtained from both pre- and posttest, as well as the improvement score between both tests. It shows

that there was a significant difference between the two conditions in two cases, by $p<0.05$; color naming as well as number naming. Both other tests show slightly more improvement in favor of the experimental group, but are not significantly different; figure naming and letter naming.

Table 8
Differences on the RAN tasks (semantic deficit), measured by an independent samples T-test[1]

	Experimental group (N=21)	Control group (N=28)	Sig. (one-tailed)	Mean differences	Std. Error differences
Color naming					
Pre-test *M (SD)*	7.0 (3.1)	7.1 (3.0)			
Posttest *M (SD)*	7.8 (3.2)	6.9 (2.9)			
Change scores *M (SD)*	1.4 (2.7)	-0.1 (2.6)	0.035	1.45	0.77
Number naming					
Pre-test *M (SD)*	6.4 (2.8)	6.5 (2.9)			
Posttest *M (SD)*	7.6 (3.2)	6.5 (3.0)			
Change scores *M (SD)*	1.0 (1.6)	0.0 (1.3)	0.020	0.92	0.43
Figure naming					
Pre-test *M (SD)*	7.5 (2.4)	6.6 (2.8)			
Posttest *M (SD)*	8.7 (2.7)	7.4 (2.5)			
Change scores *M (SD)*	1.0 (1.9)	0.9 (2.1)	0.435	0.10	0.57
Letter naming					
Pre-test *M (SD)*	6.3 (2.7)	6.0 (2.6)			
Posttest *M (SD)*	8.1 (3.4)	7.3 (3.1)			
Change scores *M (SD)*	1.7 (2.3)	1.3 (2.5)	0.290	0.38	0.68

[1]Scores measured with a range of 1 to 19, with an average of 10 and a standard deviation of 3.

4.2.2 The effect in the phonological deficit

The results of table 9 show the effects on the phonological deficit, measured by an independent samples T-test with $p<0.05$. Two out of three outcomes of the tests show significant differences between the experimental group and the control group. Both the EMT-B and De Klepel show that the experimental group made more progression than the control group on these word reading tests. The results of the monosyllabic word reading tasks showed a p-value of 0.325, which is not significant.

Table 9
Differences on the word reading tasks (phonological deficit), measured by an independent samples T-test [1]

	Experimental group (N=21)	Control group (N=28)	Sig. (one-tailed)	Mean differences	Std. Error differences
Monosyllabic word reading					
Pre-test *M (SD)*	6.8 (2.8)	5.9 (2.3)			
Posttest *M (SD)*	8.0 (3.1)	6.6 (3.0)			
Change scores *M (SD)*	1.0 (2.2)	0.7 (1.8)	0.325	0.27	0.59
EMT-B (T-50 determination)					
Pre-test *M (SD)*	5.3 (2.6)	5.2 (2.6)			
Posttest *M (SD)*	6.8 (3.3)	5.7 (3.1)			
Change scores *M (SD)*	1.1 (1.4)	0.5 (1.2)	0.045	0.64	0.37
De Klepel					
Pre-test *M (SD)*	4.5 (2.3)	5.3 (2.1)			
Posttest *M (SD)*	5.1 (1.8)	5.2 (2.8)			
Change scores *M (SD)*	0.7 (1.3)	0.0 (1.5)	0.045	0.70	0.40

[1]Scores measured with a range of 1 to 19, with an average of 10 and a standard deviation of 3.

4.3 The effect on the decoding level of nonsense word reading

The results of the second hypothesis, shown in table 10, present the results of the decoding level of the children. Despite of the significant result of De Klepel (as shown in table 9) the difference of the decoding level is not significant.

Table 10
Differences on the decoding level, measured by an independent samples T-test [1]

	Experimental group (N=21)	Control group (N=28)	Sig. (one-tailed)	Mean differences	Std. Error differences
Decoding					
Pre-test *M (SD)*	1.9 (1.3)	2.5 (1.6)			
Posttest *M (SD)*	1.7 (1.0)	2.6 (1.7)			
Change scores *M (SD)*	-0.1 (1.3)	0.0 (1.7)	0.665	-0.18	0.42

[1]Scores measured with a range of 1 to 10, of which scores below 4 indicates insufficient decoding.

4.4 The effect on the attitude towards reading

The effect on the attitudes towards reading is split in three set of questions, representing the statements whether the child (1) child likes to read, (2) performs reading activities well and (3) think it is important to read. The results of these statements are described below.

4.4.1 Do children enjoy reading

Table 11 provides the results of the independent samples T-test of the question whether children like to read. As can be seen in table 11, there were no significant differences of the improvement scores based on the responses of the children themselves, their parents or their teachers. Surprisingly, there are some unexpected results, which present that at all three groups of participants from the control group indicate a higher enjoyment of reading than the experimental group.

Table 11
Differences on the questions on: Enjoyment in reading, measured by an independent samples T-test [1]

	Experimental group (N=21)	Control group (N=28)	Sig. (one-tailed)	Mean differences	Std. Error differences
Children					
Pre-test *M (SD)*	2.1 (0.9)	2.6 (0.9)			
Posttest *M (SD)*	2.3 (0.8)	2.7 (0.8)			
Change scores *M (SD)*	0.2 (1.0)	0.1 (0.7)	0.380	0.08	0.25
Parents					
Pre-test *M (SD)*	2.4 (0.9)	2.8 (0.8)			
Posttest *M (SD)*	2.3 (0.7)	2.6 (0.6)			
Change scores *M (SD)*	-0.1 (1.0)	0.1 (0.9)	0.715	-0.16	0.28
Teachers					
Pre-test *M (SD)*	2.4 (0.7)	2.6 (0.8)			
Posttest *M (SD)*	2.2 (0.9)	2.4 (0.7)			
Change scores *M (SD)*	-0.1 (0.8)	-0.2 (0.7)	0.370	0.07	0.22

[1] Scores measured with a range of 1 to 4.

4.4.1 Reading achievement

Table 12 provides the results regarding the reading achievement of the children in their own perceptions and those of their teachers and parents, measured with an independent samples T-test. As can be seen from the table below, there were no significant differences of the improvement scores by the children, their parents or their teachers. Nevertheless, noteworthy are the scores of both the children and their parents. Both participant groups show a reduction of the attitude towards reading in the experimental group and an improvement of the control group. Especially the change scores of the children are remarkable, because these scores are almost significant in favor of the control group. Besides this, all the children have shown less confidence in their reading then the parents and teachers.

Table 12
Differences on the questions on: Self-efficacy, measured by an independent samples T-test [1]

	Experimental group (N=21)	Control group (N=28)	Sig. (one-tailed)	Mean differences	Std. Error differences
Children					
Pre-test *M (SD)*	2.7 (0.8)	2.9 (0.7)			
Posttest *M (SD)*	2.5 (0.8)	3.1 (0.5)			
Change scores *M (SD)*	-0.1 (0.7)	0.1 (0.6)	0.940	-0.29	0.18
Parents					
Pre-test *M (SD)*	2.9 (0.9)	3.0 (0.7)			
Posttest *M (SD)*	2.8 (0.8)	3.2 (0.6)			
Change scores *M (SD)*	-0.1 (0.9)	0.2 (0.5)	0.815	-0.20	0.22
Teachers					
Pre-test *M (SD)*	3.1 (0.7)	3.2 (0.5)			
Posttest *M (SD)*	3.0 (0.8)	3.1 (0.6)			
Change scores *M (SD)*	-0.2 (0.8)	-0.1 (0.5)	0.675	-0.10	0.21

[1] Scores measured with a range of 1 to 4.

4.4.1 Children's motivation to read

Table 13 provides the results of the independent samples T-test of the questions with regard to the childs motivation to read. As can be seen in table 13, there were no significant differences of the improvement scores based on the responses of the children, their parents or their teachers. Also with this question the results of the children show a more negative score then both parents and teachers.

Table 13
Differences on the questions on: Motivation to read, measured by an independent samples T-test [1]

	Experimental group (N=21)	Control group (N=28)	Sig. (one-tailed)	Mean differences	Std. Error differences
Children					
Pre-test *M (SD)*	1.6 (0.5)	1.9 (0.8)			
Posttest *M (SD)*	1.9 (0.5)	2.1 (0.5)			
Change scores *M (SD)*	0.3 (0.6)	0.2 (0.6)	0.350	0.07	0.18
Parents					
Pre-test *M (SD)*	2.2 (0.7)	2.3 (0.7)			
Posttest *M (SD)*	2.2 (0.6)	2.3 (0.6)			
Change scores *M (SD)*	0.0 (0.6)	0.0 (0.8)	0.430	0.04	0.21
Teachers					
Pre-test *M (SD)*	2.2 (0.7)	2.1 (0.6)			
Posttest *M (SD)*	2.0 (0.8)	2.1 (0.8)			
Change scores *M (SD)*	-0.3 (0.7)	0.0 (0.6)	0.815	-0.21	0.20

[1] Scores measured with a range of 1 to 4.

5. Discussion and conclusions

In this chapter the hypotheses, drafted in chapter 1, are discussed according to the results of chapter 4 (paragraph 5.1). In addition, the outcomes of the study are discussed by both methodological and substantive issues (paragraph 5.2) along with the limitations (paragraph 5.3). Based on these first three paragraphs the implications of further research are provided (paragraph 5.4) and a short conclusion is presented (paragraph 5.5).

5.1 Conclusion

The results of the first hypothesis, whether both phonological scores (word reading) and the semantic scores (RAN) improved after following the dyslexia version of typewriting course TypeTopia, gives some positive results but the results cannot be considered conclusive. Four of the seven outcomes on the tests show a significant difference (color naming, number naming, EMT-B [T-50 determination; word reading] and De Klepel [nonsense word reading]), where the other three also show a positive, but not significant, difference in favor of the experimental group (picture naming, letter naming and Monosyllabic word reading). The differences are found at word reading as well as RAN tasks, which suggest that both problems are addressed during the typewriting course. This indicates that the dyslexia version of typewriting course TypeTopia might have a positive effect on the reading skills of dyslexic children, but after the Bonferroni correction (Field, 2009) is applied these effects are no longer significant.

The second hypothesis, that the decoding level of nonsense word reading would improve after the intervention, is also not confirmed by this study. Although the comparison of the outcomes of De Klepel (nonsense word reading) shows a significant difference, the decoding level of the children did not or hardly change. The decoding level shows no improvement on the control group and the mean of the experimental group shows even a slight reduction on their improvement scores.

The results of the questionnaire, addressing the third hypothesis (whether the attitude towards reading improved after following the dyslexia version of the typewriting course TypeTopia), shows no significant differences to confirm the hypotheses. Not for the children themselves, their parents nor their teachers. This indicates that neither the experimental group nor the control group did change their attitude towards reading.

In short, this research tried to answer the question '*To what extent does the dyslexia version of the typewriting course TypeTopia affect the reading skills of dyslexic children?'* On the basis of the results it can be concluded that the dyslexia version of the typewriting course TypeTopia may have the potential to improve reading skills of dyslexic children, but further research is necessary to confirm this theory. The present study does not provide compelling evidence.

5.1 Discussion

This discussion starts with the question what did the children actually learn during the typewriting course. The actual learning process stimulated primarily the typewriting skills of the children. The children of the experimental group learned to recognize the letters corresponding with keys that needed to be typed by both audio and text trainer exercises, and made progress in typewriting speed as well as the accuracy (appendix I). The reflex scores went up, which suggests that the automaticity process of the typewriting skills were in full swing. Compared to another group, with children who already have completed the dyslexia version of typewriting course TypeTopia, the experimental group shows no significant differences (see appendix I for details). This means, that the external validity of this study is sufficient and the experimental group is representative of dyslexic children in general and the results apply to other dyslexic children.

These automaticity skills shown during the typewriting course were probably also observed during reading tests: the naming speed and the word reading speed of the experimental group went up, as shown in the results. Although the average test scores of the control group also improved in most cases, the improvement of the experimental group was significantly higher in four out of seven outcomes, compared with the control group.

Regarding to these RAN and word reading tests, a comment must be made. All outcomes do show improvement with the experimental group and even four of them are significant, but only when the Bonferroni correction is not applied. If the Bonferroni correction is applied there are no significant

differences. Nevertheless, it can be questioned whether the results shown in this study are all based on coincidence. The chance of finding a lucky shot by a 95% confidence interval is one out of 20, so the chance to find at least 4 lucky shots in 8 outcomes by an 95% confidence interval is 0.0004 (Moore, McCabe, & TransVorm, 1994). This means that based on the outcomes of the study, it could be suggested that the dyslexia version of typewriting course TypeTopia might be a tool for dyslexic children to improve their reading skills.

Although the deficit distribution is not used in a statistical comparison, the results show a large displacement within the experimental group and only minor changes within the control group. The experimental group has a remarkable amount of children who improved from the group identified with both deficits to only one or even no measured deficits. The number of children with a double deficit is reduced by half and the number of children identified with no deficits has doubled. The control group shows only a shift by two children from the group with both deficits to only a phonological deficit. These results are consistent with previous mentioned outcomes. With a closer look, in total 16 children of the experimental group had a deficit in word reading identified according to the pre-test and only 12 children according to the posttest, which is a difference of four children. The differences with the RAN tests were even larger, 15 children were identified with the semantic deficit according to the pre-test and only eight according to the posttest. This means that seven children improved to a sufficient RAN level. These results underpin the above mentioned conclusion that it is suggested that both deficits are addressed during the typewriting course. Furthermore, unexpectedly, the results of the decoding of De Klepel did not show a significant difference between both groups. This was unexpected because all the standardized scores of the tests scores of the CB&WL and De Klepel did show improvement. This means the children read faster, but did not improve their decoding skills. An explanation could be that the children probably made a lot of progress in memorize sight words during the typewriting course, but the decoding was not practiced during the typewriting course. Another reason could be that during the typewriting course the children trained on their reflexes in the retrieving speed of recognition of both letters and words. This is congruent with the arguments of Bosch et al. (1995) that children do have accurate decoding skills, but find it difficult to apply the knowledge fast and efficiently. If the typewriting course trained the reaction speed of the letters and words, this probably would have led to a faster recognition time in both typewriting and reading resulting in a higher word reading and naming speed. The results of this study emphasize the same theory; the results of letter naming and monosyllabic word reading show no significant differences between both groups, probably because the children have the knowledge of recognizing them easily. The word reading tests EMT-B and De Klepel on the other hand, did show a significant difference, probably because they could apply their knowledge faster and with more accuracy. So, with the results of this study it can be expected that the children perhaps need more practice with the knowledge they already have and the use of a typewriting course could be an option.

Besides the cautious suggestions from the results, also the literature shows positive signals towards teaching children typewriting skills improves their reading skills. Both Graham and Hebert (2010) and Francken (2013) indicate, handwriting can enhance reading. This, because the visual of the letter can be linked to the motor program to write the letter. Although a lot of research is done regarding the question whether handwriting does or does not belong in the 21st century anymore, Hopman (2014) states the importance of why we should keep the handwriting education instead of learning how to type. After this study it is questioned whether it is possible that both handwriting and typewriting could be the answer for reading remediation. Francken (2013) suggests it would probably not be essential to learn handwriting, because it is not proven that the connection of a motor program is necessary for learning to read. Doing both hand- and typewriting could make an extra connection in the memory, which could make the memorisation even stronger: (1) the connection between both the motor program and the form of the letters, and (2) the connection between the location on the keyboard and the letters. In addition to this the letters will be taught all over again and intensively practiced. Besides this, Callebaut (2006) states it is important to learn skilled typewriting to benefit the most from the possibilities of the computer and in addition MacEwen (2013) indicates it is important to keep up with the state of the art of the 21st century technology. Consequently, to go along with the changes in the society and to enhance the memorization process of reading and writing the outcomes of this research would indicate that it has an added value to perform a typewriting course.

The results of the questionnaire did not show any significant differences between the experimental and control group, which indicates that the attitude towards reading from both groups did not differ from each other. Noticeable is one large, but non-significant difference between the perceptions of the children. For the second question, whether the participants thought they were performing better reading tasks, the children of the control group were a little more positive about their reading achievement than the experimental group. However, it is noteworthy that the results show the opposite. Students in the experimental group show a larger improved at all reading tests compared to the control group. An explanation for this result could be that the children of the experimental group had a lot to read, because of their hard and intensive practice, and this felt like an obligation. The children might have been aware of their reading achievement and their slow progress. They probably might have needed more time to experience better reading performance and only a few triumphs would not turn around their attitudes.

5.2 Limitations

All the results together suggests that the dyslexia version of typewriting course TypeTopia has a potential as remediation for reading problems of dyslexics, but of course there are some limitations on this study. One limitation is the fact that the study is executed in a short time span of 22 weeks, which made it impossible to use the complete typewriting course as intervention. Another limitation is the degree of generalization. The research is done within a relative small sample of children only in the region near the city of Alkmaar, and only the schools that volunteered to participate. Last identified limitation is that this research did not use any degree of difficulty of the questions in the questionnaires, by calculating the sum scores of the measured constructs. The sub questions could weigh differently from each other, but this is not included in the analyses. The study has its limitations, but has used the full possibilities within the methodological boundaries.

5.3 Further research

This study focused on technical reading skills. Concerning dyslexics, the technical reading skill is an important research topic, because the basic reading techniques need to be mastered before reading comprehension can be accomplished. However, after the indication that the typewriting could help with the reading techniques, it is also important to see whether the results can also enhance reading comprehension. Mastering the technical reading takes place in the memory to understand the text better, which consequently improves comprehension (Leij, 2003).

Moreover, more research is needed to find out which remediation tools are capable to improve the different problems of dyslexic children. The classification which deficits affect the reading ability of dyslexic children could help find out which remediation tools are suitable for them. A good start would be to explore the possibilities of the different remediation tools and the effect these remediation tools have on the different deficits.

Another focus in further research could be the generalization. With a more representative group of participants the research would have more reliable data. Also the use of the whole typewriting course, instead of only a part of it, would create a more valid conclusion. In addition, it could also be helpful if the dyslexia version of the typewriting course TypeTopia is compared to another typewriting course: for example the original version of typewriting course TypeTopia or some other course. This could show the added value of this version of the typewriting course or if the conclusion could be drawn for all kinds of typewriting courses.

In addition, it could be questioned in further research whether the improvement is made because of the typewriting course itself or just because of the typewriting practices. So, further research could explore the possibilities of typewriting exercises with and without a typewriting course, and even a comparable research to find out whether typewriting exercises after the completion of the typewriting course could still be a good investment of reading education.

Furthermore, long-term research would be a good addition to further research. The test is done twice, just before and just after the intervention. This means, the typewriting experiences are fresh in the memory of the children. On long-terms this effect may weaken, because the skills are not automatized and forgotten, or improve even more, for the reason that the memorization and automatization process is still going on and not at its maximum yet. It would be interesting to find out.

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Appendices (II – IV present original documents in Dutch language)

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Appendix I: Test scores of typewriting course TypeTopia

To show the experimental group is a representative group of dyslexic children and can be used for generalization, the experimental group of this study is compared to 222 other children who already fully completed the dyslexia version of typewriting course TypeTopia. This group is further called the TypeTopia group.

The performances of both groups are tracked on every day assignments at three different kinds of exercises; (1) reflex exercises, (2) audio trainer exercises and (3) text trainer exercises. These tracked scores are combined into five mean scores for every module; (1) reflex score in keystrokes a minute, (2) speed scores of the audio trainer in keystrokes a minute, (3) speed scores of the text trainer in keystrokes a minute, (4) neatness scores of the audio trainer in percentage of good keystrokes and (5) neatness scores of the text trainer in percentage of good keystrokes.

In the graphics below, the results are shown from both the experimental group and the TypeTopia group. Each graphic shows the results of the experimental group in blue and the results of the TypeTopia group in red. For the experimental group only the mean scores are presented. The TypeTopia scores are shown in term of the minimum and maximum of the scores (shown in pink), the 95% confidence interval (two sigma; dotted line) and the mean of the group (dashed line).

Reflex scores

The reflex scores are measured in terms of keystrokes per minute. The children perceive one letter at the time and in a reflex they need to type the letter. This reflex score tells something about the recognition speed and the automaticity of the typewriting skills.

Figure I shows the results of the reflex scores during the typewriting course for each module. The mean score in the first module is approximately 40 keystrokes per minute for both group and at the end of the course the TypeTopia group shows a mean of approximately 55 keystrokes per minute. The company Computype indicates in the reports on the own TypeTopia page the scores between 0 and 30 keystrokes per minute are insufficient, scores between 30 and 50 are moderate and scores above the 50 are sufficient, as can be seen in Figure II (Computype, 2014b). Resulting in a mean of the TypeTopia group above the minimum level of a sufficient reflex score at module 19.

As can be seen in figure I, the mean differences are small in the beginning and with module 12 this difference is getting slightly larger, but still in the 95% confidence interval of the larger TypeTopia group.

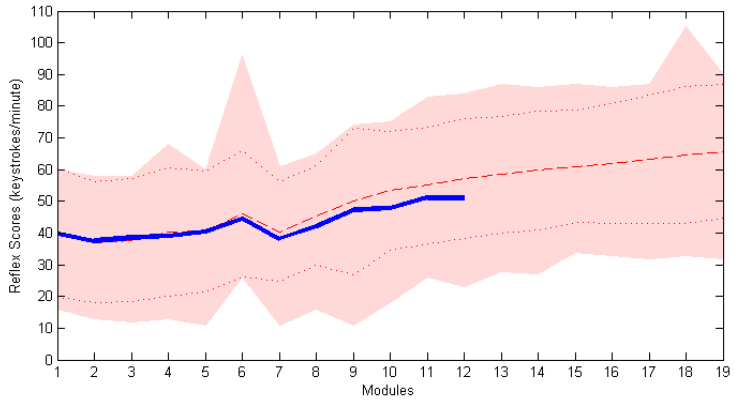

Figure I
Reflex scores

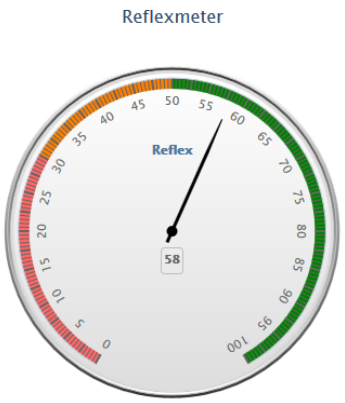

Figure II
Reflex meter (Computype, 2014b)

Speed scores

The speed scores show how fast a child could type the letters that need to be typed, which is also measured in keystrokes per minute. These scores are measured with two different exercises; with (1) audio trainer exercises and (2) text trainer exercises. The differences between the two kind of exercises is the extra auditory support with the audio trainer exercises. Both kind of exercises shows a ruler of letters or words that need to be typed, showing with colors exactly which letter is next. In the audio

trainer letters and words are also read out loud, which makes it easier for some children to focus only on typing instead of both reading and typewriting.

The examination requirements applied by the company Computype is at least 120 keystrokes per minute (Computype, 2014a). The mean scores of the TypeTopia group show on both the audio trainer exercises (figure III) and the text trainer exercises (figure IV) at least 135 keystrokes per minute, which means the majority of the children succeed this requirement.

Figure III shows the audio trainer speed scores. Both mean scores are rather close together, accept for the scores of the first module. In the first module, the experimental group has a mean speed score of approximately 80 keystrokes a minute and the TypeTopia group has a mean of 100 key strokes a minute. This difference is larger than could be expected based on the other mean scores. Furthermore, the mean scores are between the 95% confidence interval, which leads to the conclusion that with this results there are no significant differences between both groups.

In comparison with figure III, the results of figure IV shows that the speed scores of the text trainer exercises are not noteworthy different accept for the first module. With the results of module one there could be questioned whether there is a significant difference, but based on module two up to and including module 12 there is probably no differences between both groups.

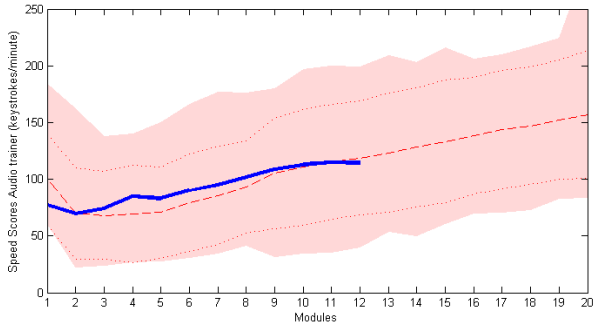

Figure III
Audio trainer speed scores

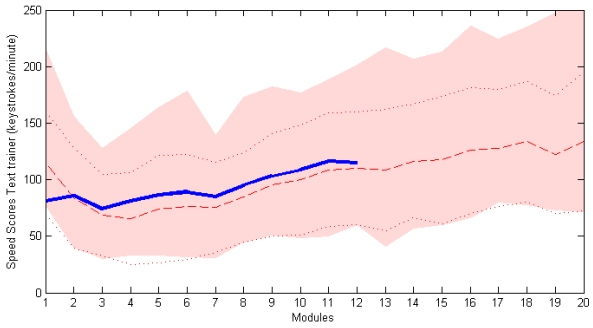

Figure IV
Text trainer speed scores

Accuracy scores

The accuracy scores are also measured with both (1) the audio trainer exercises and (2) text trainer exercises. These scores are measured in terms of the percentage of correct keystrokes. The accuracy requirements for examination is at least 96% of correct keystrokes (Computype, 2014a), which is in most cases insufficient on both the audio trainer exercises (figure V) and the text trainer exercises (figure VI). This need to be improved if they want to obtain the diploma.

In figure V, the mean scores of the accuracy of the audio trainer exercises of both groups are almost the whole time equivalent on 95% correct keystrokes. As it can be seen, there are no differences expected between the experimental group and the TypeTopia group.

Comparably, also the results of the accuracy text trainer exercises are almost the same. At these kinds of exercises, there are several differences peaks presented in figure VI. However, it can be seen that both the experimental and the TypeTopia groups shows these diversity, which means that the results show that the two groups are comparable to each other.

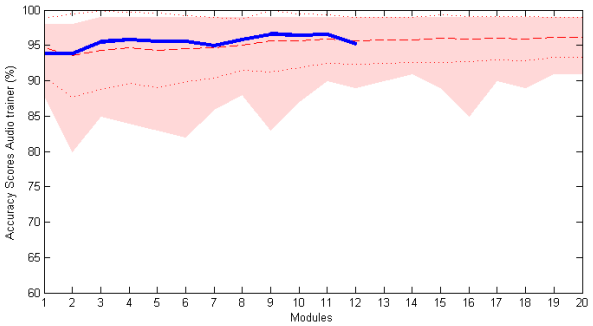

Figure V
Audio trainer accuracy scores

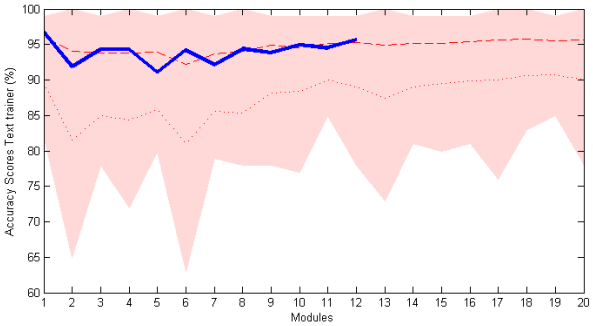

Figure VI
Text trainer accuracy scores

Generalization

The results of both the experimental and the TypeTopia group are quite similar, examined at the reflex scores, the speed scores as well as the accuracy scores. This means that the experimental group is a valid representation of dyslexic children and these scores can be used to make a generalization to other dyslexic children in the conclusion.

Appendix II: Training schedule (mark list) - Group B

Trainingsschema (streeplijst) Groep B

Week 4 20 januari tot 26 januari	Module 1 Dagopdracht 1	Module 1 Dagopdracht 2	Module 1 Dagopdracht 3
Week 5 27 januari tot 2 februari	Module 1 Dagopdracht 4	Module 1 Dagopdracht 5	Module 2 Dagopdracht 1
Week 6 03 februari tot 09 februari	Module 2 Dagopdracht 2	Module 2 Dagopdracht 3	Module 2 Dagopdracht 4
Week 7 10 februari tot 16 februari	Module 2 Dagopdracht 5	Module 3 Dagopdracht 1	Module 3 Dagopdracht 2
Week 8 17 februari tot 23 februari	Module 3 Dagopdracht 3	Module 3 Dagopdracht 4	Module 3 Dagopdracht 5
Week 9 24 februari tot 02 maart	Module 4 Dagopdracht 1	Module 4 Dagopdracht 2	Module 4 Dagopdracht 3
Week 10 03 maart tot 09 maart	Module 4 Dagopdracht 4	Module 4 Dagopdracht 5	Module 5 Dagopdracht 1
Week 11 10 maart tot 16 maart	Module 5 Dagopdracht 2	Module 5 Dagopdracht 3	Module 5 Dagopdracht 4
Week 12 17 maart tot 23 maart	Module 5 Dagopdracht 5	Module 6 Dagopdracht 1	Module 6 Dagopdracht 2
Week 13 24 maart tot 30 maart	Module 6 Dagopdracht 3	Module 6 Dagopdracht 4	Module 6 Dagopdracht 5
Week 14 31 maart tot 6 april	Module 7 Dagopdracht 1	Module 7 Dagopdracht 2	Module 7 Dagopdracht 3
Week 15 7 april tot 13 april	Module 7 Dagopdracht 4	Module 7 Dagopdracht 5	Module 8 Dagopdracht 1
Week 16 14 april tot 20 april	Module 8 Dagopdracht 2	Module 8 Dagopdracht 3	Module 8 Dagopdracht 4
Week 17 21 april tot 27 april	Module 8 Dagopdracht 5	Module 9 Dagopdracht 1	Module 9 Dagopdracht 2
Week 18 28 april tot 4 mei	Vakantie (eventueel dagopdrachten inhalen)		
Week 19 5 mei tot 11 mei	Vakantie (eventueel dagopdrachten inhalen)		
Week 20 12 mei tot 18 mei	Module 9 Dagopdracht 3	Module 9 Dagopdracht 4	Module 9 Dagopdracht 5
Week 21 19 mei tot 25 mei	Module 10 Dagopdracht 1	Module 10 Dagopdracht 2	Module 10 Dagopdracht 3
Week 22 26 mei tot 01 juni	Module 10 Dagopdracht 4	Module 10 Dagopdracht 5	Module 11 Dagopdracht 1
Week 23 02 juni tot 08 juni	Module 11 Dagopdracht 2	Module 11 Dagopdracht 3	Module 11 Dagopdracht 4
Week 24 09 juni tot 15 juni	Module 11 Dagopdracht 5	Module 12 Dagopdracht 1	Module 12 Dagopdracht 2
Week 25 16 juni tot 22 juni	Module 12 Dagopdracht 3	Module 12 Dagopdracht 4	Module 12 Dagopdracht 5

Appendix III: Information package for the participants

Hengelo, 1 november 2013

Beste ouder(s)/verzorger(s),

Mijn naam is Evelien Dam en ik studeer aan de universiteit Twente de master opleiding Educational, Science and Technology, ook wel bekend als onderwijskunde. Voor het afronden van mijn master ben ik bezig met mijn afstudeeronderzoek aan de Universiteit Twente in samenwerking met CompuType.
In het onderzoek wordt gekeken naar de effecten die de dyslexieversie van de typecursus TypeTopia heeft op de leesprestaties van dyslectische leerlingen.

Voor het onderzoek ben ik op zoek naar dyslectische leerlingen, tussen de 8 en 12 jaar oud, met een officiële verklaring. Deelname aan het onderzoek houdt in dat uw kind zal deelnemen aan de dyslexieversie van typecursus TypeTopia, verzorgd door het bedrijf CompuType. De helft van de leerlingen zal dit tijdens het onderzoek doen en de andere helft krijgt de mogelijkheid om de cursus na het onderzoek te volgen. Voor beide groepen zal de cursus geheel worden vergoed, als de leerling het vast gestelde onderzoeksdeel van de cursus netjes volbrengt.

Meer informatie over het onderzoek kunt u vinden in de bijgevoegde informatiebrief en brochure.

Vriendelijke groet,

Evelien Dam

UNIVERSITEIT TWENTE.

Informatiebrief

Hengelo, 1 november 2013

Beste ouder(s)/verzorger(s),

Voor het onderzoek wordt gekeken welke effecten de dyslexieversie van de typecursus TypeTopia heeft op de leesprestatie van dyslectische leerlingen. Hiervoor ben ik op zoek naar dyslectische leerlingen, tussen de 8 en 12 jaar oud, met een officiële verklaring. Kinderen die een typecursus volgen of hebben gevolgd zijn uitgesloten van deelname.

Deelname aan het onderzoek houdt in dat uw kind de dyslexieversie van typecursus TypeTopia zal volgen, verzorgd door het bedrijf CompuType. Deze cursus (ter waarde van €184,95) wordt geheel vergoed door ons, als alle onderzoeksactiviteiten volledig worden afgerond. Deze onderzoeksactiviteiten bestaan uit de eerste 12 modules van typecursus TypeTopia, vragenlijsten en een aantal korte testen, die hieronder verder worden uitgelegd. Worden de onderzoeksactiviteiten niet volledig afgerond, dan zal er €50,- in rekening worden gebracht. In geval van overmacht, bij bijvoorbeeld ziekte of verhuizing, kan redelijkerwijs worden besloten van de sanctie af te zien.

Om de leesprestaties van leerlingen met en zonder typecursus te vergelijken, zal er tegelijkertijd ook een controlegroep worden gebruikt. Deze leerlingen zullen gedurende het onderzoek niet deelnemen aan de typecursus, maar na afronding van het onderzoek zullen ook zij kunnen beginnen aan de typecursus. Ook voor de controle groep zal de cursus volledig vergoed worden. Na aanmelding zullen leerlingen in één van de groepen worden ingedeeld.

Het volgen van de typecursus zal thuis gebeuren, na schooltijd. Meer informatie over de typecursus is te vinden in de bijgevoegde brochure en op www.typetopia.com.

Tijdens het onderzoek zullen er verschillende onderzoeksactiviteiten worden uitgevoerd, om de leesprestaties van uw kind bij zowel de start als aan het eind van het onderzoek te kunnen bepalen. Op deze manier meten we de vooruitgang in het leesproces.

Voor de bepaling van het startniveau wordt er, door zowel uw kind als u, een online vragenlijst ingevuld. Deze vragenlijst zal voor uw kind bestaan uit 12 vragen en voor u, als ouder, uit 11 vragen. Beide zullen maar 10 minuten van uw tijd in beslag nemen. Het startniveau wordt daarnaast gemeten door middel van een zevental kleine testen, waarin de snelheid van het benoemen en woordlezen van uw kind gemeten wordt. Deze testen zullen ieder maximaal 2 minuten tijd kosten en op school, tijdens schooltijd, worden uitgevoerd.

Na 22 weken wordt er weer, door zowel de u als uw kind, een online vragenlijst ingevuld en zullen dezelfde testen opnieuw worden afgenomen. Ditmaal om het eindniveau van uw kind te bepalen.

De onderzoeksactiviteiten zullen worden uitgevoerd vanaf half december tot en met eind juni. De aanvang van de eerste onderzoeksactiviteit, het invullen van de vragenlijst, zal starten op 16 december. Via de mail zal u een oproep krijgen met daarin een directe link naar de vragenlijsten. U ontvangt op dat moment ook de data van de overige activiteiten en krijgt u te horen in welke groep uw kind is ingedeeld. Het laatste testonderdeel zal uiterlijk 27 juni uitgevoerd worden, op de school van uw kind.

Om deel te nemen moet u het volledig ingevulde *aanmeldingsformulier* inleveren bij de groepsleerkracht. Dit moet uiterlijk voor *donderdag 12 december 2013*.

Voor verdere vragen over het onderzoek kunt u contact opnemen met mij, via het e-mailadres e.dam@student.utwente.nl.

Vriendelijke groet,

Evelien Dam

Aanmeldingsformulier
Inleveren voor: donderdag 12 december 2013

Schoolgegevens:
Naam van de school: .....

Naam van de groepsleerkracht: .....

Groep: .....

Gegevens van deelnemer:
Naam van de ouder(s)/Verzorger(s): .....

Naam het kind: .....

Jongen/meisje: .....

Mailadres: .....

☐ Ik meld mijn kind aan voor deelname aan het onderzoek. Hiervoor zal mijn kind de typecursus volgen, de vragenlijsten invullen en bijbehorende testen uitvoeren. Daarnaast zullen wij, als ouders/verzorgers, ook de bijbehorende vragenlijsten invullen.
☐ Mijn kind volgt op dit moment geen typecursus en heeft dit eerder ook niet gedaan.

Bij aanmelding stemt u geheel vrijwillig in met deelname van uw kind aan dit onderzoek. U behoudt daarbij het recht deze instemming weer in te trekken zonder dat u daarvoor een reden behoeft op te geven. Uw kind mag op elk moment stoppen met het onderzoek.
Indien de onderzoeksresultaten van uw kind gebruikt zullen worden in wetenschappelijke publicaties, dan wel op een andere manier openbaar worden gemaakt, zal dit volledig geanonimiseerd gebeuren. De persoonsgegevens van uw kind zullen niet door derden worden ingezien zonder uw uitdrukkelijke toestemming.
Als u nog verdere informatie over het onderzoek wilt ontvangen, nu of in de toekomst, kunt u zich wenden tot de onderzoeker Evelien Dam; bereikbaar via e.dam@student.utwente.nl of telefoonnummer 06-36205982. Voor andere vragen en ook voor klachten over dit onderzoek kunt u zich wenden tot de secretaris van de Commissie Ethiek van de faculteit Gedragswetenschappen van de Universiteit Twente, mevr. J. Rademaker (telefoon: 053-4894591; e-mail: j.rademaker@utwente.nl , Postbus 217, 7500 AE Enschede).
De schoolleiding van de school van uw kind stemt in met deelname van uw kind aan dit onderzoek en verleent haar volledige medewerking.

Datum: .....

Handtekening: .....

UNIVERSITEIT TWENTE.

Dyslexieversie van typecursus

TypeTopia

En het onderzoek naar:

De effecten van de dyslexieversie van typecursus TypeTopia op de leesvaardigheid van dyslectische kinderen

UNIVERSITEIT TWENTE.

Typecursus TypeTopia

Wat is TypeTopia?

TypeTopia is een intensieve maar zeer effectieve training die uw kind gegarandeerd blind leert typen. Dit gebeurt door middel van actieve begeleiding en een krachtig cursist volgsysteem.
Natuurlijk beginnen we eerst op een rustig tempo, maar naarmate uw kind verder komt in de training wordt het steeds meer uitgedaagd om z'n reactievermogen op de proef te stellen.

De dyslexieversie

Doordat verschillende oefeningen uit de reguliere cursus zijn aangepast, biedt de training meer ondersteuning bij het leerproces. Deze aanpassingen zijn te vinden in:

- Het speciale lettertype "Dyslexie"
- Vergrote weergave van de te typen tekst
- Audio-ondersteuning
- Aangepaste oefenvormen
- De typesnelheid kan worden bijgesteld naar een lager niveau
- Extra aandacht aan moeilijke lettercombinaties

Ervaar zelf wat het verschil is en bekijk de Dyslexie Demo op:
http://www.typetopia.com/typecursus/Dyslexie-typecursus

Voordelen van het volgen van de typecursus

- Tijdwinst: computeropdrachten kunnen veel sneller uitgevoerd worden.
- Concentratie: leren blind typen verbetert het concentratievermogen.
- Minder fouten: door het blind typen maak je ook minder fouten en wordt ook de lees- en schrijfvaardigheid verbeterd.
- Hogere cijfers: wie het blind typen beheerst haalt hogere cijfers op school.
- Werkhouding: minder kans op RSI klachten (ergonomische werkhouding).

Het gebruik van TypeTopia in het onderzoek

In het onderzoek wordt gebruik gemaakt van de dyslexieversie van typecursus TypeTopia. Hiervoor wordt gebruik gemaakt van een speciaal trainingsschema waarin 3 dagopdrachten per week gemaakt worden. Dit betekent dat gedurende het onderzoek in totaal 12 modules gemaakt zullen worden.
De dagopdrachten kunnen vrij verdeeld worden over de week en er is rekening gehouden met de voorjaarsvakantie. Deze vakantie kan ook gebruikt worden om dagopdrachten in te halen.

Na het onderzoek mag de cursus kosteloos (op eigen snelheid) afgemaakt worden, waarbij de cursus natuurlijk afgesloten wordt met het type-examen.

Hoe is TypeTopia opgebouwd?

TypeTopia bestaat uit 20 modules. Elke module bevat 5 dagopdrachten. In totaal dienen er dus 100 dagopdrachten te worden gemaakt. Iedere dagopdracht duurt ongeveer 20 minuten.

MODULE 1

Dagopdracht	Leerinhoud	Geschatte duur in minuten
1	Letter F en J	20
2	Letter K en D	20
3	Letter I en E	20
4	Letter L	20
5	Letter S	20

Overzicht leerinhoud per module

Module	Leerinhoud:
1	Letters j, f, k, d, i, e, l, s
2	Letters a, h, g, u, r
3	Letters o, w, p, q, t
4	Letters y, m, v, n, b
5	Letters c, x, z, komma, punt
6	Hoofdletters
7	Speciale tekens ; en : en ? en ! en ‘ en “
8	Cijfers
9	Vaardigheidstraining + persoonlijke oefeningen
10	Vaardigheidstraining + persoonlijke oefeningen
11	Vaardigheidstraining + persoonlijke oefeningen
12	Vaardigheidstraining + persoonlijke oefeningen
13	Vaardigheidstraining + persoonlijke oefeningen
14	Vaardigheidstraining + persoonlijke oefeningen
15	Vaardigheidstraining + persoonlijke oefeningen
16	Vaardigheidstraining + persoonlijke oefeningen
17	Vaardigheidstraining + persoonlijke oefeningen
18	Vaardigheidstraining + persoonlijke oefeningen + proefexamens 1-3
19	Vaardigheidstraining + persoonlijke oefeningen
20	Vaardigheidstraining + persoonlijke oefeningen + examen Computertypen

Kan er midden in een dag-opdracht gestopt worden?

Jazeker. De volgende keer gaat uw kind weer verder waar het gebleven was. De dagopdrachten hebben echter wel een logische opbouw die uw kind optimaal ondersteunt in het aanleren van het blindtypen.
Het beste is daarom om iedere dag een dagopdracht van begin tot eind te maken. Tussendoor stoppen kan dus wel,maar doorbreekt de logische lesopbouw.

Voor meer informatie
www.typetopia.com

of mail naar:
e.dam@student.utwente.nl

"De spannendste typecursus van het universum"

Contactgegevens onderzoeker:
Evelien Dam
E: e.dam@student.utwente.nl

Contactgegevens TypeTopia:
Computype B.V.
Postbus 951
3700 AZ Zeist
T: +31(0)343-493222
F: +31(0)343-491378
E: klantenservice@typetopia.com

Dit is een onderzoek van Evelien Dam in samenwerking met CompuType en Universiteit Twente.

Appendix IV: Questionnaires

In this appendix the used questionnaires are shown. The questions that are struck through were not included in the analyses. The questions were excluded because the reliability of the measurements was reduced by these questions and the similarity of all three questionnaires was ensured.

Children questionnaire:

Lees vragenlijst 1

Welkom bij de eerste vragenlijst over lezen.

In de vragenlijst staan 12 vragen, waarin ik aan jou vraag hoe leuk jij het vind om te lezen, of je het moeilijk vind en hoe vaak je leest.

Alvast bedankt voor het invullen.

Voornaam en achternaam:

1. Ben je een jongen of een meisje *

- Jongen
- Meisje

2. Wanneer ben je geboren?

Dag:

Maand:

Jaar:

3. Hoeveel boeken hebben jullie in huis?
(kranten, tijdschriften en schoolboeken niet mee geteld) *

- Geen of weinig (0-10 boeken)
- Genoeg voor 1 boekenplank (11-25 boeken)
- Genoeg boeken voor 1 boekenkast (26-100 boeken)
- Genoeg boeken voor 2 boekenkasten (101-200 boeken)
- Genoeg boeken voor meer dan 2 boekenkasten (meer dan 200 boeken)

4. Hoeveel tijd besteed je aan lezen, buiten schooltijd op een normale schooldag? *

- Minder dan 30 minuten
- Tussen de 30 minuten en 1 uur
- Tussen de 1 en 2 uur
- Meer dan 2 uur

5. Hoe vaak doe je deze dingen buiten schooltijd?

	Elke dag			Nooit
1) Ik lees voor mijn plezier				
2) Ik lees dingen die ik zelf gekozen heb				
3) Ik lees om dingen uit te zoeken die ik wil leren				

6. Hoe vaak doe je deze dingen buiten schooltijd?

	Elke dag			Nooit
Ik lees verhalen				
Ik lees informatieboeken				
Ik lees tijdschriften				
Ik lees stripboeken				

7. Hoe vaak leen je boeken van de bibliotheek? *

- Minimaal 1 keer per week
- 1 of 2 keer per maand
- Een paar keer per jaar
- (Bijna) nooit

8. Denk aan het lezen op school.
Hoeveel ben je het eens met de volgende uitspraken?

	Helemaal mee eens			Helemaal mee oneens
Ik vind lezen op school leuk	○	○	○	○
Ik vind dat mijn juf/meester mij leuke dingen geeft om te lezen	○	○	○	○
Ik weet wat mijn juf/meester van mij verwacht	○	○	○	○
Ik vind mijn juf/meester makkelijk te begrijpen	○	○	○	○
Ik ben geïnteresseerd in wat mijn juf/meester zegt	○	○	○	○

9. Hoe vaak doe je deze dingen op school?

	Elke dag			Nooit
Zelfstandig stil lezen	○	○	○	○
Een boek lezen die ik zelf gekozen heb	○	○	○	○

10. Wat vind je van lezen? Hoeveel ben je het eens met de volgende uitspraken?

	Helemaal mee eens			Helemaal mee oneens
Ik lees alleen als het moet	○	○	○	○
~~Ik vind het leuk om met anderen te praten over wat ik gelezen heb~~	○	○	○	○
Ik ben blij als iemand mij een boek cadeau geeft	○	○	○	○
Ik vind lezen saai	○	○	○	○
Ik zou meer tijd willen hebben om te kunnen lezen	○	○	○	○
Ik vind het leuk om te lezen	○	○	○	○

11. Hoe goed kan je lezen? Hoeveel ben je het eens met de volgende uitspraken?

	Helemaal mee eens		Helemaal mee oneens	
~~Normaal gesproken ben ik goed in lezen~~	○	○	○	○
Lezen is gemakkelijk voor mij	○	○	○	○
Lezen is moeilijker voor mij dan voor mijn meeste klasgenoten	○	○	○	○
Als een boek interessant is maakt het mij niet uit hoe moeilijk het te lezen is	○	○	○	○
Ik heb moeite met leesverhalen met moeilijke woorden erin	○	○	○	○
~~Mijn juf/meester vertelt me dat ik goed kan lezen~~	○	○	○	○
Lezen vind ik moeilijker dan de andere dingen die we op school moeten doen	○	○	○	○

12. Welke reden heb je om te lezen? Hoeveel ben je het eens met de volgende uitspraken?

	Helemaal mee eens		Helemaal mee oneens	
Ik vind het leuk dingen te lezen die me aan het denken zetten	○	○	○	○
Ik vind het belangrijk om goed te kunnen lezen	○	○	○	○
~~Mijn ouders willen dat ik lees~~	○	○	○	○
Ik leer veel van lezen	○	○	○	○
Ik moet goed kunnen lezen voor mijn toekomst	○	○	○	○
~~Ik vind het leuk als een boek me helpt om andere werelden te verbeelden~~	○	○	○	○

Bedankt voor het invullen van de vragenlijst. Er komt aan het einde van het onderzoek nog een keer een vragenlijst. Hiervoor krijg je automatisch weer een mail.

Groetjes,

Evelien

Parents questionnaire:

Eerste ouder vragenlijst

Welkom bij de eerste vragenlijst. De tweede vragenlijst zal in juni worden afgenomen, waarvoor u op tijd automatisch een uitnodiging krijgt over de mail.

In deze vragenlijst zal u 10 vragen beantwoorden over uw leesgedrag en dat van uw kind.

De gegevens van de vragenlijsten zullen alleen worden gebruikt voor het onderzoek en niet aan derden worden verstrekt.

Alvast bedankt voor het invullen.

Uw volledige naam: *

Volledige naam van uw kind: *

1. De vragenlijst wordt ingevuld door: *

- Een ouder
- Een grootouder
- Een verzorger
- Anders

2. In een gewone week, hoeveel tijd besteed u dan aan lezen (magazines, kranten, boeken, alles inbegrepen/digitaal of op papier)? *

- Minder dan een uur per week
- 1 tot 5 uur in de week
- 6 tot 10 uur in de week
- meer dan 10 uur in de week

3. Als u thuis bent, hoe vaak leest u dan voor uw plezier? *

- Elke dag of bijna elke dag
- 1 a 2 keer per week
- 1 a 2 keer per maand
- nooit of bijna nooit

4. Vul in hoeverre u het eens bent met de volgende uitspraken over lezen;

	Helemaal mee eens			**Helemaal mee oneens**
Ik lees alleen als ik moet				
Ik hou er van om in mijn vrije tijd te lezen				
Ik lees alleen als ik informatie nodig heb				
Lezen is een belangrijke activiteit bij ons thuis				
Ik zou meer tijd willen hebben om te lezen				
Ik heb plezier als ik lees				

5. Hoeveel boeken heeft u in huis?
(kranten, tijdschriften en schoolboeken niet mee geteld) *

- Geen of weinig (0-10 boeken)
- Genoeg voor 1 boekenplank (11-25 boeken)
- Genoeg boeken voor 1 boekenkast (26-100 boeken)
- Genoeg boeken voor 2 boekenkasten (101-200 boeken)
- Genoeg boeken voor meer dan 2 boekenkasten (meer dan 200 boeken)

6. Hoeveel kinderboeken heeft u in huis? *

- Geen of weinig (0-10 boeken)
- Genoeg voor 1 boekenplank (11-25 boeken)
- Genoeg boeken voor 1 boekenkast (26-100 boeken)
- Genoeg boeken voor 2 boekenkasten (101-200 boeken)
- Genoeg boeken voor meer dan 2 boekenkasten (meer dan 200 boeken)

7. Hoe vaak leent u boeken van de bibliotheek? *

- Minimaal 1 keer per week
- 1 of 2 keer per maand
- Een paar keer per jaar
- (Bijna) nooit

Vul bij de volgende vragen zo goed mogelijk in, in hoeverre de uitspraken op uw kind van toepassing zijn.

8. Wat vind uw kind van lezen? In hoeverre bent u het eens met de volgende uitspraken over uw kind?

	Helemaal mee eens			**Helemaal mee oneens**
Uw kind leest alleen als het moet				
Uw kind is blij als iemand hem/haar een boek cadeau geeft				
Uw kind vindt lezen saai				
Uw kind zou meer tijd willen hebben om te kunnen lezen				
Uw kind vindt het leuk om te lezen				

9. Hoe goed kan uw kind lezen?
In hoeverre bent u het eens met de volgende uitspraken over uw kind?

	Helemaal mee eens			Helemaal mee oneens
Uw kind vindt lezen gemakkelijk	○	○	○	○
Uw kind vindt lezen moeilijker dan zijn/haar meeste klasgenoten	○	○	○	○
Uw kind maakt het niet uit hoe moeilijk het te lezen is, als het maar een interessant boek is	○	○	○	○
Uw kind heeft moeite met leesverhalen met moeilijke woorden erin	○	○	○	○
Uw kind vindt lezen moeilijker dan de meeste andere dingen die hij/zij op school moet doen	○	○	○	○

10. Welke reden heeft uw kind om te lezen? In hoeverre bent u het eens met de volgende uitspraken over uw kind?

	Helemaal mee eens			Helemaal mee oneens
Uw kind vindt het leuk dingen te lezen die hem/haar aan het denken zetten	○	○	○	○
Uw kind vindt het belangrijk om goed te kunnen lezen	○	○	○	○
~~Uw kind vindt dat U als ouders willen dat hij/zij leest~~	○	○	○	○
Uw kind vindt dat hij/zij veel leert van lezen	○	○	○	○
Uw kind vindt dat hij/zij goed moet kunnen lezen voor zijn/haar toekomst	○	○	○	○

Dank u voor het invullen van de eerste vragenlijst.

Voor het invullen van de tweede vragenlijsten zal u ter zijner tijd een mail ontvangen!

Vriendelijke groet,

Evelien Dam

Teacher questionnaire for each student:

Eerste leerkracht vragenlijst

Welkom bij de eerste leerkracht vragenlijst.

In deze vragenlijst vragen wij u, voor elke deelnemende leerling aan het onderzoek, 3 vragen te beantwoorden. De vragen bestaan uit stellingen waarbij u aan kunt geven in hoeverre u het eens bent. Een voorbeeld van een stelling is; 'Uw leerling leest alleen als het moet'. U kunt daarna aangeven in welke mate de vraag van toepassing is. Houd bij het invullen van deze vragen het gedrag en de leerprestaties van het kind in gedachten.

Alvast bedankt voor het invullen.

Uw volledige naam: *

Volledige naam van uw leerling: *

1. Wat vind uw leerling van lezen? In hoeverre bent u het eens met de volgende uitspraken over uw leerling?

	Helemaal mee eens			**Helemaal mee oneens**
Uw leerling leest alleen als het moet	○	○	○	○
Uw leerling is blij als iemand hem/haar een boek cadeau geeft	○	○	○	○
Uw leerling vindt lezen saai	○	○	○	○
Uw leerling zou meer tijd willen hebben om te kunnen lezen	○	○	○	○
Uw leerling vindt het leuk om te lezen	○	○	○	○

2. Hoe goed kan uw leerling lezen?
In hoeverre bent u het eens met de volgende uitspraken over uw leerling?

	Helemaal mee eens			Helemaal mee oneens
Uw leerling vindt lezen gemakkelijk	○	○	○	○
Uw leerling vindt dat lezen voor hem/haar moeilijker is dan voor zijn/haar meeste klasgenoten	○	○	○	○
Uw leerling maakt het niet uit hoe moeilijk het is om een boek te lezen, als het maar interessant genoeg is	○	○	○	○
Uw leerling heeft moeite met leesverhalen met moeilijke woorden erin	○	○	○	○
Uw leerling vindt lezen moeilijker dan de meeste andere dingen die op school gedaan moeten worden	○	○	○	○

3. Welke reden heeft uw leerling om te lezen? In hoeverre bent u het eens met de volgende uitspraken over uw leerling?

	Helemaal mee eens			Helemaal mee oneens
Uw leerling vindt het leuk dingen te lezen die hem/haar aan het denken zetten	○	○	○	○
Uw leerling vindt het belangrijk om goed te kunnen lezen	○	○	○	○
~~Uw leerling vindt dat zijn/haar ouders willen dat hij/zij leest~~	○	○	○	○
Uw leerling vindt dat hij/zij veel leert van lezen	○	○	○	○
Uw leerling vindt dat hij/zij goed moet kunnen lezen voor zijn/haar toekomst	○	○	○	○

Bedankt voor het invullen van de eerste vragenlijst. Vergeet u, alstublieft, niet de algemene vragenlijst ook in te vullen?

Voor het invullen van de tweede vragenlijsten zal u ter zijner tijd een mail ontvangen.

Vriendelijke groet,

Evelien Dam

General teacher questionnaire:

Algemene Leerkrachten vragenlijst

Welkom bij het algemene deel van de eerste vragenlijst. In deze vragenlijst vragen wij u 4 vragen te beantwoorden over uw klas.

Alvast bedankt voor het invullen.

School: *

Groep: *

Uw volledige naam: *

1. Hoeveel leerlingen heeft u in uw klas? *

2. Hoeveel van deze leerlingen hebben moeite met lezen? *

3. Hoeveel van deze leerlingen hebben een officiële dyslexie verklaring? *

4. Als u van een normale schoolweek uitgaat, hoeveel tijd besteed u dan aan leesonderwijs? (in aantal minuten) *

Bedankt voor het invullen van de eerste vragenlijst. Vergeet u niet de vragenlijsten per leerlingen ook nog in te vullen?

Nogmaals bedankt voor uw medewerking aan het onderzoek.

Met vriendelijke groet,

Evelien Dam