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The effectiveness of a new reading intervention to improve reading fluency: Tow-Reading

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Foreword

During the pre-master it was the first time I got acquaintance with statistics. I have always liked mathematics and science, so I was sure statistics would be as interesting. The first lectures were fascinating. To pass the class I needed to study the book of Andy Field. He has a lively and funny way of describing statistics and I became more enthusiastic. I like statistics and enjoy conducting analyses in SPSS. For the pre-master thesis I could bring my knowledge into practice. Still, it was much guided and there was not much room for initiative. For the master thesis I conducted research for the company of my internship: Braams&Partners bv. I evaluated a new reading intervention for dyslectic children. This subject was well suited for me, because I have always had much affinity with dyslexia. During this master thesis I had the liberty to make my own research design and conduct my own analyses. I really enjoyed writing this master thesis and I am proud to present the result. In the process I had help from my internship supervisor Sanne Kuster and I would like to thank her for guiding me through this process. Secondly I would like to thank Evelyn Kroesbergen for providing her guidance and feedback on my thesis. Finally, I would like to thank my parents and my friend Suzanne van Weelden for listening to me during the moments I did not know what my next was going to be of this process.

Abstract

In this article the new reading intervention Tow-Reading is evaluated. This intervention aims at improving reading fluency and increasing reading rate of children with reading difficulties. Children with dyslexia (N = 46) between seven and twelve years old received a standard intervention for 11 weeks. After this first period they were assigned to either a second standard intervention (N = 23) or the Tow-Reading intervention (N = 23). This second period also lasted 11 weeks. Significant differences did not occur in reading rate for the control versus the experimental conditions. In addition to the between group analysis, a repeated-measure analysis was conducted comparing the first en second period for the same participants. The children improved significantly more during the first period than during the second on word level.

Keywords: Tow-Reading, dyslexia, reading rate, intervention.

The effectiveness of a new reading intervention: Tow-Reading

Although research in the past decennia has led to more insight in the causes of dyslexia, there is still need for further knowledge, especially in the area of treatment of dyslexia. Furthermore, the definitions that are used differ considerably (Kleijnen et al., 2008). For the purposes of this study, the definition of Lyon, Shaywitz, and Shaywitz (2003, p.2) is used:

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 of 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.

This is a complete definition. It not only describes the characterizations, but also defines the cause and how persistent the disorder stays even after effective intervention (Blomert, 2006; Kleijnen et al., 2008). Following the definition of Lyon et al. (2003) the question remains what is to be considered the most effective intervention to improve reading fluency, particularly considering the various known interventions to stimulate reading fluency and help dyslectic children to improve their reading skills (Duff & Clark, 2011). The aim of this study is to evaluate the effectiveness of a new intervention: Tow-Reading (Stoppelenburg, 2012).

According to Struiksma, van der Leij, and Vieijra (1997) the reading process consists of three possible routes to pronounce a printed word: the analyzing, semi direct, and direct route. Children who use the analyzing route first analyze the word by dividing it into letters. Each letter must be recognized and transformed into a sound that corresponds with that letter. After that, all sounds are composed (synthesized) together and a word is formed and read aloud. This route is typical for beginning readers. The second route is the semi direct route. When following this route, a letter string is converted directly into the corresponding sound. The third route is the direct route in which words are recognized directly. This is the final route readers eventually use when they are advance readers (Struiksma et al., 1997).

There are two major factors affecting the direct route: phonological awareness and phonological processing skills (Duff & Clark, 2011; Meyer & Felton, 1999). As stated in the definition of dyslexia, the difficulties associated with dyslexia are mainly caused by a deficit

of a phonological component (Lyon et al., 2003). This component consists of phonological awareness and phonological processing skills. Dyslectic children have problems recognizing a letter and transforming it into a sound, resulting in problems with reading fluency (Bosman, Leerdam, & Gelder 2000). This is consistent with Blomert (2006) who defined a lack in reading fluency as the most basic characteristic of dyslexia. It is reasonable to assume that a deficit in phonological processing results in problems using the direct route. Consequently, dyslectic children keep using the analyzing route and the semi direct route, resulting in problems in reading fluency.

It could be suggested that an intervention focusing on phonological awareness and phonological processing would be effective for dyslectic children to improve reading fluency. It has been proven that phonological awareness is an important factor to predict the reading skills of a child (Hulme et al., 2002). Several studies verify this and conclude that a phonological-based intervention appears to be most effective in improving reading skills of dyslectic children (Duff & Clark, 2011; Hatcher, Hulme, & Ellis, 1994; Thijms, 2007). According to the meta-analyses of the National Reading Panel (NRP, 2000) there are two effective approaches for a phonological-based intervention: phonological awareness training and phonics instruction. Phonological awareness training consists of activities such as rhyming words and identifying, discriminating and manipulating sounds within words. During phonics instruction children are taught that the acquisition of letter-sound is similar to the use in reading and spelling and how letters are linked to sounds. This conclusion is consistent with the theory of Hulme, Snowling, Caravolas, and Carroll (2005), who state that phonological awareness and letter-sound knowledge have both a direct and indirect influence on reading skills.

To only focus on phonological awareness during the intervention is not sufficient, because children need to be aware of the link between phonemes and reading and writing (Hatcher et al., 1994; Hulme et al., 2005; NRP, 2000). An effective intervention should include linking activities. Another important factor which should be included in a reading intervention is an increase in the reading amount (Kuhn & Stahl, 2003; NRP, 2000).

Various theories suggest different ways of improving reading: repeating, individual guidance versus reading groups, and reading aloud. Blok, Oostdam, and Boendermaker (2012) concluded that guided oral reading is the most effective for improving reading fluency. Wexler, Vaughn, Edmonds, and Klein Reutebuch (2008) came to an equal conclusion. Therrien (2004) conducted a meta-analysis and concluded that a text should be repeated three or four times for an effective intervention. This meta-analysis however merely investigated

the effect of repeated reading without comparing it to other interventions such as oral guided or silent reading. No conclusions were stated whether repeated reading is the most effective intervention. It merely states that repeated reading is considered to be effective when a text is read three or four times.

According to Kuhn and Stahl (2003) it makes no difference whether children use repeated reading, oral guided reading or silent reading. The main reason for improving reading fluency is the amount of text that is read. Consequently, all interventions appear to be effective. The accounted factor is the amount of reading practice (Kuhn & Stahl, 2003). The NRP (2000) was unable to collect enough data concerning the effectiveness of silent reading. It is thus important for future studies to investigate this topic. The meta-analyses of Wexler et al. (2008) suggests that increasing the reading amount and using different text structures improves the word accuracy and consequently improves the reading fluency.

In addition to increasing the reading amount, it is important that children receive feedback. Therrien (2004) states that it is essential the student is provided with a cue to focus on speed and receives corrective feedback. Also Wexler et al. (2008) found a positive correlation between reading rate and corrective feedback. According to the meta-analyses children who received corrective feedback made more improvement in reading rate compared with children who did not receive feedback.

To summarize, children with dyslexia have a deficit in the phonological component, which interferes with their reading skills. These children tend to use the analyzing route instead of the direct route. An effective intervention improving the reading fluency consists of the following elements: phonological awareness, an increase of reading amount, and providing feedback.

Stoppelenburg (2012) created an intervention that stimulates children to read faster by setting an even pace. This intervention is called: Tow-Reading. The main goal of this intervention is to increase the reading rate by synthesizing directly, instead of analyzing letters first and synthesizing them into words afterwards. As a result, children will read a larger amount of text, which is a main factor for improvement (Kuhn & Stahl, 2003). When using Tow-Reading, the children are forced to follow the pace of the trainer. To force a child into a pace, the trainer uses a special pen with a red point. This pen is moved across the words by the trainer at a slightly faster pace than the child's current pace, during which the trainer and child read the text together aloud. When the child is able to keep up with the pace, the trainer falls silent. By adjusting the reading pace, children are forced to decode and synthesize directly (Stoppelenburg, 2012). As such, there is no time for the child to use the analyzing

route and thus they are forced to read faster, resulting in using the direct route. The master thesis of Bruggraaff and Steneker (2008) revealed a positive effect of the intervention on the reading fluency of special education children. A limitation of this study is the number of participants. In their design Bruggraaff and Steneker (2008) divided 24 children in two groups. Only 12 children received the intervention Tow-Reading. It is questionable if the number of participants is enough to make a statement about the effectiveness of Tow-Reading.

Another master thesis (Wijs, 2009) studied the intervention Tow-Reading to investigate whether the intervention could be effective in theory. It concluded that the phonological-based strategy of synthesizing directly could result in a successful intervention. In addition, the intervention consists of oral guided reading and feedback. These are important elements of an effective intervention (Blok et al., 2004; Kuhn & Stahl, 2003; NRP, 2000; Wexler et al., 2008). With all these elements combined it is plausible to suggest that children can read faster and more fluent by using the intervention Tow-Reading.

The aim of this study is to determine whether the intervention Tow-Reading (once a week) improves the reading rate, both on text and on word level, in children with dyslexia in comparison with a standard intervention. The effects of Tow-reading will be measured within and across groups: it will be tested whether children improve more during an intervention with Tow-Reading, compared with the standard intervention they received before, and it will be tested if these children improve more than a control group that receives a standard intervention during the same period. In this study the standard intervention consists of reading instruction and oral guided reading. Aim of the standard intervention is to improve reading fluency by increasing the amount of reading practice by focussing on motivation and experiencing success.

Method

Participants

The participants for this study included 46 Dutch children between seven and twelve years old, with an average age of 9 (sd = 1.0). The group consisted of 33 boys and 13 girls. All children were diagnosed with severe dyslexia. This means that the children were considered to be the 10% poorest readers.

Considering the timetable, there was no time to start two whole new groups. Consequently, children were selected from an existing client file. This study examines the effectiveness of Tow-Reading by comparing a standard intervention with Tow-Reading across

groups and within the groups. Therefore it was necessary that the experimental group received a standard intervention first, followed by a Tow-Reading intervention. There were 23 children who met this criterion. All these children were selected for the experimental group. For the control group the selection criterion was that the children received two standard interventions and never have had Tow-Reading. In total 47 children met this criterion. From these 47 children 23 were randomly selected as control group.

Procedure

The intervention consisted of two periods in order to study the improvement of the same participants between the two interventions. Each participant was assigned to an individual trainer. In total there were 19 different trainers, who are all certified for Tow-Reading.

At baseline all participants took a pre-test. During the first period all children participated in the same standard intervention. This standard intervention was given for 11 weeks. Succeeding the first period was a post-test to determine the reading rate on word level as well as on text level. This post-test was used as a pre-test for the second period as well. For the second period of 11 weeks the children were divided into two groups: the control group and experimental group. The control group received the same standard intervention as in the first period, while the experimental group received the intervention Tow-Reading. After the second period there was a post-test.

Standard intervention. During the standard intervention the children participated in an individual lesson of 45 minutes once a week. The first 15 minutes of the lesson was spent on reading. During this exercise the trainer and child succeeded each other after one sentence, half a page or a whole page. The trainer acted as a role model and gave instructions about how to read a word when the child hesitated. The focus is on the reading motivation, reading amount and experiencing success. There is only positive feedback directed on the strategy, fluency, the child's effort etc. After the reading exercise the intervention continued examining the homework and explaining a new spelling rule. Besides the weekly lesson, parents made a commitment to practice at home four times a week for 20 minutes. Participants who neglected to practice at home, were ruled out of the study. Throughout these 20 minutes the child read for ten minutes and continued with spelling exercises for the remaining ten minutes. During the practices at home the parent was the role model. Therefore it was important that the parent knows what to do and how to do it. For this reason one of the parents was present during the lesson. The trainer explained the parent how to practice at home.

Tow-Reading. The intervention Tow-Reading only differs from the standard intervention during the first 15 minutes. These 15 minutes are being used for reading with the child. The trainer uses a pen to set an even pace for reading, which is always a bit faster than the pace of the child. The trainer then reads the text aloud along with the child. When the child is able to keep up with the pace, the trainer remains silent (Stoppelenburg, 2012). There are five phases within the intervention:

1. The child watches as the trainer reads.
2. The child watches as the trainer reads and the child is invited to read along aloud.
3. The child reads aloud along with the trainer.
4. The child reads aloud without the trainer with the pen to guide the pace
5. The child reads aloud by itself without the pen to guide the pace.

The feedback that is being given merely consists of positive comments. Children never need to read a sentence again nor have to correct their mistakes.

Instruments

In order to establish whether the children improved their reading rate, the scores were measured in raw scores and in didactic age equivalent. This is a Dutch standard score that indicates the level of the hypothetical average student. Every month of education is counted for one didactic age (DL). Hypothetically a child who has had five months of education, has learned all subject material and therefore has a DL of five. In reality there are many factors responsible for the learning progress of a child. Therefore the actual DL of a child can be higher or lower. This actual DL is called the didactic age equivalent (DLE) (Kievit, Tak, & Bosch, 2008).

To determine the reading rate of the children the Dutch tests Drie-Minuten-Toets (DMT) and Analyse Van Individualiseringsvormen (AVI) were used (Jongen & Krom, 2009). The reliability and validity of these tests were examined by the COTAN in 2010. Both tests were rated 'good' on all criteria (Krom, Jongen, Verhelst, Kamphuis, & Kleintjes, 2010).

Drie-Minuten-Toets. The reading rate on word level was determined by the DMT. The DMT consists of three lists of words. The first list contains one syllable words with only one consonant at a time. The second list contains words with a maximum of two syllables and more consonants sounds. The third list contains words with more than two syllables. For every list the child has got one minute to read as many words as possible. The raw-score is calculated by subtracting the total number of mistakes from the total number of read words.

(Jongen & Krom, 2009). For the purpose of this study all lists were read and all raw-scores were added together to get one raw-score.

AVI. The CITO AVI was used to establish the reading rate on text level. This test consists of eleven different kinds of texts. Every text is consistent with a grade level in the Dutch primary school and is supposed to be taken at the middle and at the end of every school year. When a child for example is able to read text M4, the child has an interaction level of February grade four. The text is presented to the child and the child is asked to read the text as fast and correct as possible. The reading time and total number of mistakes determines whether the child can continue to the next text. The child has to read as many texts until too many mistakes are made or the text is read too slow (Jongen & Krom, 2009).

The original CITO AVI test does not measure the scores in DLE. Since it is necessary to determine the exact progress of a child, the scores needed to be converted to DLE. Because every month of education is counted for one DLE, a coping level of February grade 4 is the same as a DLE of 15 (one schoolyear consists of 10 DLE). Besides the coping level, CITO AVI also uses an instruction level. This level can be considered as a zone of proximal development from Vygotsky (1962). When a child has a coping level of M4, but an instruction level of E4, the child has neither a DLE of 15 nor a DLE of 20. The real DLE of the child has to be somewhere in the middle. In this study the instruction level of CITO AVI was rated to add 2,5 DLE to the DLE of the highest interaction level.

Analyses

In order to establish an increase in reading rate, a between group and a repeated-measure design was used with the DLE and raw score improvements between the pre- and post test. To determine whether within group factors were significantly relevant a chi-square test and tests of normality were conducted on age, grade, gender, intelligence, and phonological processing skills. None of these factors were significantly relevant. Consequently, a multivariate analysis of variance (MANOVA) was used to establish whether the Tow-Reading group improved significantly more than the control group. After the MANOVA a two-way repeated measures multivariate analysis of variance determined whether the same group improved more during the second period in comparison with the first period.

Results

Both groups received two intervention periods. During the first period both groups received a standard intervention. During the second period the control group received a

standard intervention and the experimental group received Tow-Reading. The descriptive statistics appear in Table 1.

Table 1

Descriptive Statistics of the Control Group and the Experiment Group

Group	<i>n</i>	Min.	Max.	<i>M</i>	<i>SD</i>
DMT					
Experimental; standard intervention	23	-2	74	31.78	24.76
Experimental; Tow-Reading	23	-1	60	20.09	18.70
Control: first period	23	-46	69	26.86	25.31
Control: second period	23	-9	65	21.26	18.95
AVI					
Experimental; standard intervention	23	-2.5	20	5.11	4.68
Experimental; Tow-Reading	23	0	17.5	5.44	4.98
Control: first period	23	0	22.5	8.04	4.94
Control: second period	23	0	10	3.37	2.98

Note. *N* = Total participants; Min = minimum; Max = Maximum; *M* = Mean; *SD* = Standard Deviation

First the MANOVA was conducted to test whether dyslexic children benefitted more from Tow-Reading compared with a standard intervention. The control group consisted of children who received the standard intervention during the second period and the experimental group consisted of children who received Tow-Reading during the second period. In this analyse the dependent variables were increase in DLE-score for AVI and increase in raw-score for DMT. There was neither for AVI nor for DMT a significant improvement in reading rate between the control group and the experimental group, $V = 0.09$, $F(2, 43) = 2.01$, $p = .15$.

Following the MANOVA a two-way repeated measures multivariate analysis of variance determined whether a significant difference could be found between the two periods for the same participants. In this analysis the dependent variables were increase in DLE-score for AVI and increase in raw-score for DMT. For the children who first received a standard intervention followed by Tow-Reading, no significant effect for AVI was found, $V = 0.14$, $F(1, 22) = 3.65$, $p = .07$. There was however a significant effect for DMT. Contrasts revealed that, with a large effect, the children improved more during the standard intervention in the first period, $V = 0.69$, $F(1, 22) = 49.14$, $p < .01$, $r = .83$. With a large effect, the children who

received two standard intervention also improved more on DMT during the first period, $V = 0.54$, $F(1, 22) = 24.34$, $p < .01$, $r = .54$. No significant effect was found for AVI, $V = 0.13$, $F(1, 22) = 3.22$, $p = .09$.

Discussion

The aim of this study was to determine whether the intervention Tow-Reading is more effective than the standard intervention. Children receiving the Tow-Reading intervention did not perform better than the control group receiving the standard intervention. A significant value was found between the same participants in comparison with the two periods. Both groups benefitted more from the first period. A possible explanation to this finding is that the standard intervention was given first. According to Jolles and Crone (2012) the learning curve is steep at the beginning of training. At the beginning participants learn new strategies that improve their performances. Subsequently, the participants are used to the new strategy resulting in a flatter learning curve (Jolles & Crone, 2012). During the first period in this study all participants received a standard intervention. Therefore, the participants learned strategies to improve their reading skills. Since the Tow-Reading also consists of strategies that were used during the standard intervention, it is a reasonable assumption that the first period caused the flatter learning curve during Tow-Reading. Future research may confirm this suggestion to conduct a crossover design.

According to Hulme et al. (2005) an effective intervention improving reading fluency should include linking activities to focus on phonological awareness. Tow-Reading does not practice those linking activities. During Tow-Reading the center of attention is on synthesizing directly. Consequently, Tow-Reading is considered to be a phonological based intervention. However, without the linking activities the intervention is not sufficiently phonological based (Hatcher et al., 1994; Hulme et al., 2005; NRP, 2000). It is plausible that Tow-Reading becomes more effective when using linking activities.

This study holds certain limitations that could have had consequences for the results. The first is the pace the trainer uses to read. The pace should be constant and a little faster than the child his own pace. However, it is hard to determine the exact pace of a participant and keep an even pace. Considering the participants had different trainers and each trainer sets the pace differently, it is plausible that not all trainers used the most effective pace, which could have influenced the effectiveness of the intervention negatively. In 2012 Stoppelenburg made a computer program based on Tow-Reading. This program makes it possible to set a constant pace. Future research can determine whether Tow-Reading with a trainer or Tow-

Reading with the computer program differ from each other. It is reasonable to suggest that a combination of both is most effective. The computer program sets the even pace, which stimulates an increase in reading amount and the trainer provides feedback. These are two main factors for an effective intervention (Kuhn & Stahl, 2003; NRP, 2000; Therrien, 2004; Wexler et al., 2008).

The second limitation to this study is that not all children in the experimental group have had 11 weeks of Tow-Reading. Reason for this is that the participants were selected from an existing client file. There was not enough time to start two complete intervention periods with new participants. Therefore participants were selected if they approximately started Tow-Reading at the end of the first period or the beginning of the second period. Participants varied from eight to thirteen weeks of Tow-Reading. This variation could have interfered with the results of the post-test. It is also uncertain how many lessons of Tow-Reading are necessary to make the intervention effective. Wijs (2009) suggests the intervention should last for at least 12 months. Following that implication it is reasonable this study did not find a difference between the standard intervention and Tow-Reading. An implication for the future is to guarantee that the amounts of lessons given to all participants are equal and the intervention is given for a period of 40 weeks.

Further, the measurement of AVI in DLE is not accurate. It is an estimation based on the performance. For example, a participant who reads a text in 1 minute and 13 seconds gets the same DLE as a participant who reads the same text within 1 minute and 48 seconds. The first participant obviously read faster, but this difference cannot be distinguished by the dependent variables used in current analyses. Future studies should use more standardized scores to circumvent this problem.

The final limitations are the group size and the selection. Participants were selected from an existing client file. There was but one client file that provided participants and the total number of participants was small. Due to this, there are limited generalization possibilities.

Conclusively, based on current study the Tow-Reading intervention does not appear to improve reading in comparison with the standard intervention. This result is not consistent with the research of Wijs (2009) and Bruggaaff and Steneker (2008). Both the standard intervention and Tow-Reading are based on increasing the reading amount and providing feedback. Research (Kuhn & Stahl, 2003; NRP, 2000; Therrien, 2004; Wexler et al., 2008) suggests these are main factors for an effective intervention. It is possible both the standard intervention and Tow-Reading are equally effective. Future research should evaluate this by

comparing a standard intervention and Tow-Reading to a control group without an intervention.

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