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Predicting The Receptiveness to Clinical Dyslexia Interventions with A Dynamic Reading and Writing Test

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ABSTRACT

In this study, we were interested in the effectiveness of a dynamic reading and writing test for children diagnosed with dyslexia (N = 42) aged seven to eleven. Most of all, we were interested in whether the results of a dynamic reading and writing test could predict receptiveness to clinical dyslexia intervention. This study employed a pre-test-training-post-test design with two conditions: experimental (n = 21) for trained children and control (n = 21) for children without training. Results showed that, despite the absence of statistically significant growth in accuracy scores from pre-test to post-test, children diagnosed with dyslexia could benefit from training in phonemic awareness and writing competency. Dynamic post-test accuracy scores of the subtests Context-Dependent Words, Writing Competence and Phonemic Awareness predicted receptiveness to clinical dyslexia interventions. Implications for dyslexia clinicians are discussed.

Keywords:
Dynamic testing, learning potential, dyslexia, clinical dyslexia interventions, reading and writing.

1. Introduction

Dyslexia clinicians often measure the effect of their interventions by utilising one-time, single-administrated, static tests. While these tests have clear advantages, such as measuring what knowledge a child has already acquired and easily interpretable results (Caffrey et al., 2008), educational scientists have debated the usability of these static tests. Central to this discussion is whether these tests provide sufficient insight into a child's potential for learning and needs for instruction (Grigorenko, 2009; Jeltova et al., 2007). In addition, researchers have argued that static tests disadvantage certain groups of children, for example, children with learning difficulties or children from ethnic minorities (Caffrey et al., 2008; Verpalen et al., 2018).

Therefore, opponents of static testing have introduced dynamic testing as an alternative or at least as an addition to static testing (Bridges & Catts, 2011; Kazemi et al., 2021). Dynamic tests explicitly include help or instruction in the testing procedure, whereby the relationship between the child and the adult is essential (Feuerstein, 2002; Grigorenko & Sternberg, 1998; Jeltova et al., 2007). In so doing, the primary aim of dynamic tests is to provide insight into the learning process and potential for an individual child's learning. Studies show that using dynamic testing principles could reduce under- and over-identification of learning difficulties in young children (Dixon et al., 2022) and, consequently, could provide better insight into future reading and

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writing difficulties than static tests (Aravena et al., 2017; Gellert & Elbro, 2017; Petersen et al., 2016). Unfortunately, in the Netherlands, dyslexia clinicians have not yet embraced dynamic testing principles in their interventions. As such, there could be an over and under-identification of children diagnosed with dyslexia (Dixon et al., 2022) in the Netherlands. As a result, children who need clinical dyslexia interventions might miss out, while those who don’t qualify for those interventions might receive them. Therefore, in the current study, we aimed to gain insight into the usefulness of a dynamic reading and writing test among children diagnosed with dyslexia by examining whether children's dynamic reading and writing test outcomes could predict receptiveness to a clinical dyslexia intervention.

1.1. Dynamic Testing

Unlike static tests, which evaluate existing skills and knowledge, dynamic tests measure the potential for learning by tapping into the zone of proximal development (Jeltova et al., 2007). This zone refers to the gap between what a child can do alone (the current level of development) and what a child can do with an adult or expert's supervision (potential development) (Vygotsky, 1978). This is often achieved by incorporating a training procedure into the testing procedure (Resing et al., 2020), such as in a pretest-training-posttest design (Grigorenko, 2009). The pretest assesses the independent performance, while the posttest, similar in form and content to the pretest, measures the level of potential development (Donovan, 2019). These designs provide insights into a child's learning processes (Donovan, 2019) and receptiveness to instruction, helping to identify educational needs. Dynamic testing can guide decisions on areas for development and necessary instructional support. In this respect, dynamic testing outcomes can be used as a first step to determine which areas in the skills tested could develop further and what help (Dixon et al., 2022).

Numerous studies have explored the usefulness of dynamic testing in various domains. However, research into dynamic testing of reading and writing mainly occurred in kindergarten settings and concentrated on children's decoding processes and phonological awareness (Petersen et al., 2016). Although dynamic testing can be laborious (Caffrey et al., 2008), research indicated that dynamic tests could be used to predict future reading difficulties over and beyond the effects of static tests (Caffrey et al., 2008; Dixon et al., 2022; Dörfler et al., 2009). More importantly, dynamic tests are instrumental in identifying responsiveness to instruction, distinguishing between children with and without language difficulties and predicting learning difficulties before formal reading instruction starts (Aravena et al., 2017; Caffrey et al., 2008; Gellert & Elbro, 2017; Petersen et al., 2016).

1.2. Reading and Writing

Reading or decoding is the process of understanding and interpreting written words and involves recognising graphemes (written symbols representing a unit of sound) and subsequently connecting them to corresponding phonemes (the individual letter sounds; Serrano & Defior, 2008). In contrast, writing or encoding is the ability to produce words by correctly arranging graphemes to represent the phonemes of words based on knowledge of letter-sound relationships and oral language (Vadasy et al., 2022). In every language, literacy development consistently progresses from an initial declarative phase to a procedural one. During the declarative phase, children acquire knowledge through conscious, effortful engagement with language skills as they lay the foundation for their reading and writing abilities (Tilanus et al., 2016). This phase involves explicit instruction on grapheme-phoneme correspondence, grammar rules and techniques for memorising frequently used words. As children transition into the procedural phase, they move towards perfecting their skills and adopting more strategies. Here, literacy is more characterised by automaticity, fluency and reduced reliance on conscious effort and explicit knowledge (Melby-Lervåg et al., 2012; Tilanus et al., 2016). In this phase, children develop advanced decoding abilities, comprehend textual content more effectively, and grasp basic decoding skills essential for structuring their thoughts into coherent narratives (Graham et al., 2002).

Basic decoding and encoding skills involve acquiring alphabetical knowledge and understanding grapheme-phoneme correspondences (Galuschka et al., 2020), phonological awareness and prosodic awareness (Serrano et al., 2016; Vadasy et al., 2022). Phonological awareness refers to listening and consciously understanding that sentences consist of words, words of syllables, and letters, and it is a requirement for the ability to rhyme (Jing et al., 2019).

In orthographically transparent writing systems, correspondences between graphemes and phonemes are predominantly direct and transparent, with a grapheme typically representing one phoneme. In contrast, orthographically opaque systems involve more complex relationships in which multiple graphemes may represent the same phoneme, or one grapheme may represent multiple phonemes (Serrano & Defior, 2008). It is widely recognised that alphabetic writing systems vary in their degree of orthographic transparency or opacity, depending on the consistency of their coding. On this continuum, for example, Spanish is often seen as having orthographic transparency, while English as having orthographic opacity.

On the other hand, Dutch falls somewhere between orthographic transparency and orthographic opacity (Hengeveld & Leufkens, 2018; Serrano & Defior, 2008). Research has indicated that phonological decoding abilities are acquired earlier in orthographically transparent languages than in orthographic opaque languages (Serrano & Defior, 2008). The level of orthographic transparency influences whether children use indirect or direct reading routes (Ardila & Cuetos, 2016). In transparent orthographic languages, readers typically rely on the indirect strategy of converting graphemes to phonemes individually due to the consistent grapheme-phoneme correspondence, which leads to accurate pronunciation. Conversely, in orthographic opaque languages, the direct strategy relies upon word recognition directly from memory, where word representations are stored as necessary due to inconsistent grapheme-phoneme correspondence (Ardila & Cuetos, 2016). Phonological awareness strongly predicts reading and writing development (Bridges & Catts, 2011; Lyster et al., 2020; Wackerle-Hollman et al., 2015).

Furthermore, basic decoding and encoding skills require phonemic awareness, which concerns the smallest units of spoken language and the ability to manipulate, isolate and process these sound representations (Nithart et al., 2011). Prosodic awareness indicates or distinguishes an emphasis while reading or writing (Serrano & Defior, 2008; Serrano et al., 2016). As such, phonological, phonemic and prosodic awareness are essential to developing reading and writing skills, which can remain challenging for many children, especially those diagnosed with dyslexia.

1.3. Dyslexia

Dyslexia is a language-based learning and neurodevelopmental disorder that affects decoding, fluent word recognition, accurate reading and writing despite adequate instruction (Catts et al., 2016; Elbro et al., 2012; Lyon et al., 2003). Dyslexia manifests differently in orthographic transparent and orthographic opaque languages, with reading speed difficulties being a key marker in orthographic transparent languages and accuracy difficulties more prevalent in orthographic opaque languages (Serrano & Defior, 2008). Although the aetiology of dyslexia is multifactorial (Werth, 2018), and the manifestation of dyslexia is heterogeneous (McArthur & Castles, 2016), dyslexia is primarily believed to be a phonological deficit (O'Brien & Yeatman, 2021; Sigurdardottir et al., 2017), and involves deficits in verbal processing speed, phonological processing and verbal short-term memory (Catts et al., 2016; Tilanus et al., 2016). In addition, other factors, such as visual difficulties, sensory deficits, tone perception deficits and heredity (O'Brien & Yeatman, 2021) cannot be excluded because there are also children who, despite phonological deficits, learn to read and write at an acceptable level (Lyster et al., 2020). Solid language skills and good executive functioning (O'Brien & Yeatman, 2021) are believed to compensate for reading and writing difficulties.

In addition to reading and writing difficulties, dyslexia can affect children's social-emotional development. Research, for example, shows that being diagnosed with dyslexia affects self-confidence and can lead to social problems, anxiety and even depression (McArthur & Castles, 2016; van der Zandt et al., 2018). In light of these findings and those mentioned above, it is no surprise that much research has been conducted on appropriate and effective clinical dyslexia intervention (Macdonald et al., 2021). Clinical dyslexia interventions aim to improve or compensate for reading and spelling difficulties. Although clinical dyslexia interventions vary in approach, use of a computer, theoretical background, and duration, they generally improve short- and longer-term reading and writing skills (Vaessen et al., 2014). Various factors have been shown to influence the effect of such interventions, including the age of children and the severity of dyslexia (Vaessen et al., 2014). Research indicates that interventions are particularly effective if they focus on morphological and phonemic awareness and integrate explicit reading and spelling instruction (Galuschka et al., 2020; Hall et al., 2022). Moreover, at least 20 weekly clinical dyslexia treatment sessions are necessary to achieve observable intervention effects

(Isabel et al., 2012). While static tests have been employed to predict responsiveness to clinical dyslexia interventions (Tilanus et al., 2016), dynamic tests have not been utilised yet.

1.4. Aims of the Current Study

The current study had two aims. The first aim was to evaluate the applicability of a dynamic reading and writing test for children between seven and eleven, diagnosed with dyslexia. An age group that has received limited attention in dynamic research on reading and writing. Research has mainly focused on younger children and the start of their literacy development (Dixon et al., 2022). Furthermore, the dynamic testing of reading and writing did not receive much attention in the Dutch language area. Secondly, this study aimed to investigate the potential predictive value of dynamic reading and writing measures in relation to the outcomes of a clinical dyslexia intervention.

The first research question concerned children's progression on the dynamic test for reading and writing from the pretest to the posttest. It was expected that all children, regardless of condition, would show progression in accuracy scores, but, more importantly, that those who were trained would show significantly more progression in accuracy scores (Aravena et al., 2017; Dixon et al., 2022; Mata & Serrano, 2019; Navarro & Lara, 2017), indicating that training contributed to developing reading and writing skills (Mata & Serrano, 2019).

The second research question focused on the potential predictive value of dynamic reading and writing measures in relation to the outcomes of clinical dyslexia intervention. Posttest scores of the children in the control condition were regarded as static measures, and the posttest scores of the trained children were regarded as dynamic measures. We hypothesised that dynamic reading and writing measures would better predict the outcomes of the evaluation of intervention than static reading and writing measures (posttest scores of the children in the control condition). This hypothesis was based on previous studies in which dynamic decoding and phonological awareness measures were found to significantly predict intervention response (Fuchs et al., 2011; Petersen et al., 2018b).

2. Methodology

2.1. Research Model

To test the causal hypotheses, this study had an experimental pretest-training-posttest design with two conditions: experimental (training) and control (no training). Children were allocated to the experimental or the control condition, using a randomised block design based on age and gender. As such, this approach controls for the variability related to the blocking factors. Furthermore, it consisted of three phases, as seen in Table 1. In the first phase, the dynamic test was administered. Children in the experimental condition received training between the pretest and posttest, while children in the control condition did not receive training. Then, in phase two, all the children received the clinical dyslexia intervention 'Letterlicht' (see below for more details). Finally, in phase three, an evaluation of the clinical dyslexia intervention was administered. Trained master's students and clinicians acted as test leaders under the supervision of the first author.

Table 1. *Schematic Overview of the Design of the Study*

	Phase 160-75 minutes			Phase 12x45 minutes	Phase 3 45-60 minutes
	The dynamic test of reading and writing			Dyslexia treatment [1]	Evaluation of intervention [2]
	Pretest	Training	Pos-test		
Control Condition (*n*= 22)	X	-	X	X	X
Experimental Condition (*n*=20)	X	X	X	X	X

Note 1. Clinical dyslexia intervention Letterlicht. The evaluation of the intervention consisted of the following tests: Word Reading Fluency, Pseudoword Reading, Letter Dictation, Naming Letters and Word Dictation.

2.2. Research Sample

In the current study, children diagnosed with dyslexia, aged between seven and eleven, participated, including 20 boys and 22 girls (Mage = 9.5 years, SDage =1.3 years). The children attended regular or special primary schools and were recruited from 1801 Jeugd en Onderwijsadvies, an educational service and clinical dyslexia assessment and intervention centre in the Netherlands. All children were classified with severe dyslexia, according to the definition used in the Dutch Protocol for Dyslexia Diagnostics and Intervention (Tijms et al., 2021), which implied that their reading and writing performance was at or lower than the 10th percentile compared to their age mates.

2.3. Data Collection Tools and Procedure

Word Reading Fluency [EenMinuut Test] (Brus &Voeten, 2019): Word Reading Fluency tests measured real-world reading skills. In one minute, the child had to recognise words as accurately and efficiently as possible. The child received a piece of paper with 116 words of increasing difficulty and length. The words are placed in four columns of equal length and presented in Universe typeface, font size 18. The child was given a minute to read as many words as possible. Scoring is based on the number of words read correctly. The test consisted of two parallel tests, form A, administered during the dyslexia assessment, and form B, administered during the evaluation of intervention. Brus and Voeten (2019) reported a test-retest reliability of *r* =. 96.

Pseudoword Reading [Klepel-R$_{1\ min}$ form A] (van den Bos et al., 2019): Pseudoword Reading $_{1\ min}$ was used to assess the children's decoding skills. Alphabetical knowledge must be deployed to integrate the graphemes into a word. The child received a paper with 116 unrelated pseudowords of increasing difficulty. The words were placed in four columns of equal length and presented in Universe typeface, font size 18. The child had to read as many words as correctly as possible in one minute. Scoring is based on the amount of correctly read words. The test consists of two parallel tests: form A, administered during the dyslexia assessment, and form B, administered during the evaluation of intervention. The Klepel-R$_{1min}$ has a test-retest reliability *r* =. 97 for nine and ten-year-old children and test-retest reliability of *r* = .91 for seven and eight-year-olds (van den Bos et al., 2019).

Letter Dictation [foneemkennis accuratesse] (Struiksma et al., 2018): This task was used to test the accuracy of writing 36 phoneme-grapheme associations in about five minutes.

Letter Naming [letterbenoemtaak] (Struiksma et al., 2018). This task was used to test the accuracy and speed of 34 grapheme-phoneme associations presented on a card. Scoring is based on the number of correctly named graphemes and the time on task. The required time is displayed in an A score for completing the task within 26 seconds and an E score for completing the task in more than 48 seconds.

Word Dictation [PI-dictee] (Geelhoed et al., 2019): Word dictation assessed single-word writing skills. The dictation consisted of nine blocks of 15 words, and new spelling categories appeared in each block. The words were read aloud, and the child was asked to write down the specific word first presented in a sentence. The test was discontinued when a child had written seven or fewer words out of 15 words correctly. The maximum score is 135. Therefore, the duration of the dictation is, at the most, 45 minutes. Scoring was based on the number of correctly written words. The test consisted of two parallel tests, form A, administered during the dyslexia assessment, and form B, administered during the. The testing manual reports an internal consistency of α = . 87 for the A form and α = .89 for the B form.

Dynamic reading and writing test (Mata & Serrano, 2019): Assesses the potential for learning reading and writing. The test is structured into four subtests: Phonemic Awareness, Prosodic Awareness, Writing Competence skills and Context-Dependent Words. Each subtest follows a consistent format, comprising a pretest, a standardised training phase and a posttest. During the pretest, the child solves the tasks independently. During the posttest, the child is challenged to show what was learned by solving the same tasks of the pretest. The second or training phase involves task accuracy scores reflection, task retelling and various exercises using materials. These exercises advance from abstract to task-specific levels to improve the targeted skills. Each subtest yields two scores: the pretest score, reflecting the current level of (a static test score), and the posttest score, which measures the improvement from pretest to posttest. The test lasts 60 to 80 minutes and designates 15 to 20 minutes for each subtest. The dynamic reading and writing test was initially developed in Spanish by Mata and Serrano (2019) and translated into Dutch.

Phonemic Awareness: The phonemic awareness subtest assesses the ability to construct words by identifying smaller units (phonemes). Fourteen words are presented in sounds, and the child must determine which word has been said. The test is stopped after three consecutive errors. The reported reliability of this subtest is α = .89 (Mata & Serrano, 2019).

Prosodic Awareness: The prosodic awareness subtest measures the awareness of emphasis in a word. The children listen to eighteen recorded words and must determine the sound group with the most force. The test is stopped after three consecutive errors. The reliability of this subtest is α = .87 (Mata & Serrano, 2019).

Writing Competence: The subtest evaluates the child's ability to write words correctly, and the use of writing and phonological rules in words and sentences are evaluated with this subtest. Twenty-five words are dictated twice to the child. The test is stopped after three consecutive errors. The reported reliability of this subtest α = .83 (Mata & Serrano, 2019).

Context-Dependent Words: The subtest measured the ability to determine the correct form of a homophonic word in the context of a sentence. Eighteen sentences with a missing homophone are presented. The correct answer must be chosen from three words: a word slightly similar to the homophones and two homophones. The test is stopped after three successive errors. The reported reliability of this subtest is α = .62 (Mata & Serrano, 2019).

Clinical Dyslexia Intervention [Letterlicht by 1801 jeugdenonderwijsadvies]: Letterlicht is a computer-controlled dyslexia intervention that aims to improve language skills and increase motivation and pleasure in reading and writing. It is created by 1801 jeugd- en onderwijsadvies. Although the programme is protocolled, it can be adjusted to the child's educational needs by speeding up, slowing down or providing additional exercises. Letterlicht aims to strengthen basic literacy skills like phonemic awareness by mainly working on auditory perception (listening to the sounds in a word). The sound structure of words is taught explicitly. For example, much attention is paid to the vowels because the pronunciation of vowels in Dutch does not always correspond to the writing. Furthermore, the position of the vowels is essential because the properties of the vowel (long or short) will determine the basic writing rules. The primary strategy taught is to divide words into sounds (phonological awareness), starting with one sound group of words and, after that, with more than one sound group. Roadmaps and visual support cards are deployed to support the children visually.

The total duration of the intervention more or less equals a school year, including 38 weekly 45-minute sessions with a trained dyslexia clinician who provides feedback and support. Each session has the same structure every week, including discussing homework, activating prior knowledge, learning new writing rules, reading letters and words, and reading sentences/texts. At the end of each session, the child is given four homework assignments on which he or she must work with the parents. The child's progress in reading and writing is evaluated regularly pending the duration of the clinical dyslexia intervention and at the end of the Intervention. Parents and teachers are expected to be involved in the intervention by helping with homework.

2.4. Data Analysis

A one-way MANOVA was performed before addressing the research questions and examining potential initial differences between groups. The dependent variables in this analysis included age and the pretest accuracy scores of the four dynamic reading and writing subtests. The independent variable was Condition (experimental versus control condition).

Test-retest reliability for each dynamic reading and writing subtest was calculated separately for the experimental and control groups using Pearson’s correlations.

A Repeated Measures Multivariate Analysis of Variance (RM MANOVA) was employed to address the first research question. Session (pretest versus posttest) was considered a within-subjects factor, and Condition (experimental versus control) a between-subjects factor. In addition, the dependent variables were accuracy scores on the dynamic reading and writing subtests of Phonemic Awareness, Prosodic Awareness, Writing Competence, and Context-Dependent Words.

Six linear regression analyses were performed, one for each measure of the evaluation of the intervention, to investigate whether the dynamic test's posttest scores could predict the evaluation of the intervention to address the second research question. For this analysis, the results of the children in the two conditions were analysed separately. The dependent variables included Word Reading Fluency, Pseudoword Reading, Word Dictation, Letter Dictation, and Letter Naming (speed and accuracy). The independent variables were the posttest accuracy scores on Phonemic Awareness, Prosodic Awareness, Writing Competence, and Context-Dependent Words.

2.5. Ethical

The study was reviewed and approved by the ethics committee of Leiden University under number 2021-10-01-B. Vogelaar-V2-3409. Furthermore, informed consent was obtained from all subjects involved in the study.

3. Findings

Before conducting our analyses, assumptions for normality were checked for the accuracy scores of the dynamic reading and writing subtests through the Shapiro-Wilk test. The findings indicated that assumptions for normality were met in the control group for Prosodic Awareness D (21) = .910, $p > .05$. In the experimental condition, assumptions for normality were met for Prosodic Awareness D (21) = .919, $p > .05$. Furthermore, assumptions for homogeneity were checked through Levene's test. The assumptions for the homogeneity analysis indicated that assumptions were met for all variables.

Initial group comparisons

A one-way MANOVA was conducted to explore potential initial group differences. An analysis of the multivariate and univariate Condition effects revealed no significant differences between the children in the two conditions, as seen in Table 2 (Means and standard deviations can be found in Table 3).

Table 2. *MANOVA Results for Differences in Condition*

	Wilk's λ	$F(1,40)$	p	η_p^2
Multivariate between-subjects effect of condition	.98	.17	.97	.02
Univariate condition effects				
Age		.18	.67	.01
Phonemic Awareness		.35	.56	.01
Prosodic Awareness		.01	.93	<.01
Writing Competence		.04	.85	<.01
Context-Dependent Words		.03	.86	<.01

Table 3. *Basic Statistics for Scores on all Dynamic Reading and Writing Subtests at Pre- and Posttest*

		Experimental Condition		Control Condition		Total	Total
		Pretest	Posttest	Pretest	Posttest	Pretest	Posttest
n		21	21	21	21	42	42
Phonemic Awareness	M (SD)	8.95 (2.58)	10.62 (2.46)	8.38 (3.60)	9.14 (4.68)	8.67 (3.11)	9.88 (3.77)
Prosodic Awareness	M (SD)	5.76 (4.88)	5.29 (5.93)	5.90 (5.30)	4.67 (5.62)	5.83 (5.03)	4.98 (5.72)
Writing Competence	M (SD)	14.33 (5.76)	15.67 (6.41)	14.67 (5.27)	14.52 (5.41)	14.50 (5.45)	15.10 (5.89)
Context-Dependent Words	M (SD)	11.24 (4.35)	11.29 (5.39)	11.00 (4.18)	11.62 (3.50)	11.12 (4.22)	11.45 (4.49)

Finally, a chi-square analysis was conducted to investigate whether boys and girls were equally distributed across the two conditions. Results revealed a similar distribution of boys and girls across conditions ($\chi2(1) < .001$, $p = 1.00$).

Psychometric properties of the dynamic reading and writing test

Test-retest reliability of all dynamic reading and writing subtests was analysed using Pearson's correlations separately for the control and experimental conditions. Positive, significant correlations, ranging from moderate to strong, between pretest and posttest scores were found for all subtests in the control and experimental conditions, as seen in Table 4.

Table 4. *Pearson Product-Moment Correlation Matrix between Dynamic Reading and Writing Measures at Pretest and Posttest*

	Pretest			
	Phonemic Awareness	Prosodic Awareness	Writing Competenc e	Context-Dependent Words
Posttest				
Control condition	.92**	. 67**	.82**	.55**
Experimental condition	.78**	.64**	.73**	.48*

Significance * $p< .05$, ** $p< .01$

Fisher's *r*-to-*z* transformations were performed to investigate if these correlations differed significantly between the two conditions. These analyses revealed that the difference between test-retest correlations of the Phonemic Awareness subtest bordered on statistical significance ($z = 1.63$, $p = .051$). In contrast, no statistically significant differences were found for the test-retest correlations of Prosodic Awareness ($z = 0.16$, $p = .437$), Writing Competence ($z = 0.68$, $p = .247$), and Context-Dependent Words ($z = 0.29$, $p = 0.387$).

Cronbach's alpha coefficients were calculated to analyse the internal consistency of the subtests at the pretest with scores ranging from $\alpha = .83$ for the subtest Phonemic Awareness, $\alpha = .84$ for the subtest Context-dependent Words, $\alpha = .91$ for the subtest Prosodic Awareness, and finally $\alpha = .98$ for the subtest Writing Competence.

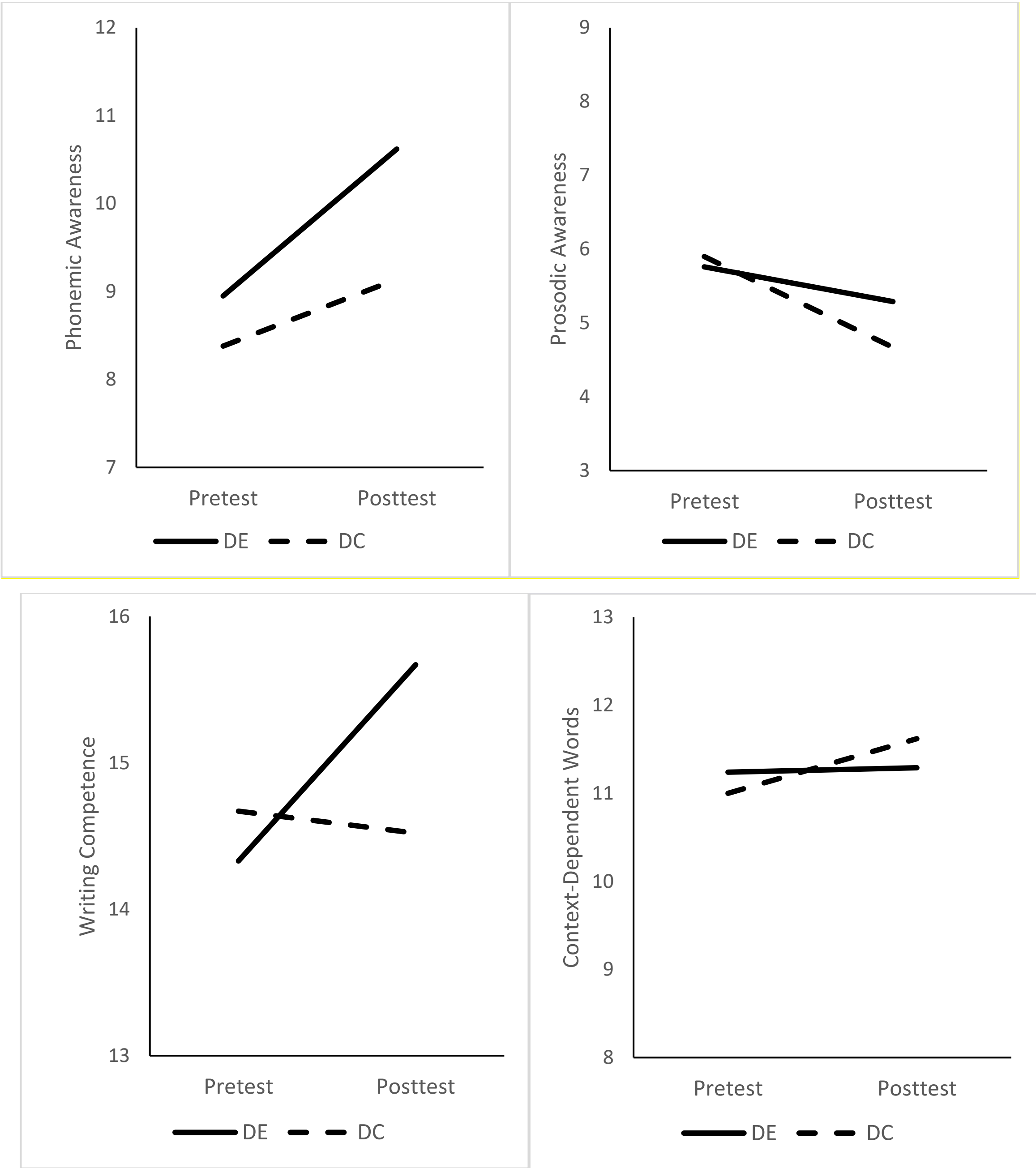
Effect of training

A Repeated Measures Multivariate Analysis of Variance (RM MANOVA) was employed to address the first research question. All effects are displayed in Table 5. The multivariate results indicated a significant Session effect ($p < .001$, $\eta_p^2 =.44$) but no significant Session x Condition effect ($p =.781$, $\eta_p^2 = .05$). These findings indicate a significant difference between pretest to posttest in at least one dynamic reading and writing subtest, irrespective of whether the children were trained. Basic statistics for the different subtest scores are provided in Table 6. Additionally, the mean scores of all subtests are displayed in Figure

Follow-up analyses of the univariate effects further demonstrated that only the Session effect for Phonemic Awareness ($p < 001$, $\eta_p^2 = .42$) was significant, indicating in combination with a visual check of the mean scores that all groups of children progressed from the pretest to the posttest. Moreover, no significant differences in progression were found between the two conditions, as witnessed by non-significant Session x Condition effects for all subtests.

Table 5. *Between-subject Effects and Multivariate and Univariate RM MANOVAOoutcomes*

	Wilk's λ	*F*	*p*	η_p^2
Multivariate within-subjects effects				
Session	.57	7.11	<.001	.44
Session x Condition	.96	.44	.781	.05
Univariate within-subjects effects				
Phonemic Awareness				
Session		29.23	< .001	.42
Session x Condition		.36	.551	.01
Prosodic Awareness				
Session		1.49	.230	.04
Session x Condition		.29	.591	.01
Writing Competence				
Session		1.62	.211	.04
Session x Condition		.91	.346	.02
Context-Dependent Words				
Session		.17	.679	.00
Session x Condition		.12	.730	.00



Note. DE= children diagnosed with dyslexia Experimental Condition, DC= children diagnosed with dyslexia Control Condition.

Figure 1. *Mean Accuracy Scores of Dynamic Reading and Writing Subtests*

Predicting receptiveness to clinical dyslexia intervention.

Six linear regression analyses were conducted, one for each evaluation measure of the intervention, to examine whether the posttest scores of the dynamic test could serve as a predictor of the intervention's evaluation. All effects of these analyses are provided in Table 6, and only the significant effects are discussed in the text.

Table 6. *Linear Regression Matrix between the Dynamic Reading and Writing Posttest Subtests and the First Dyslexia Intervention Test Results*

	Experimental Condition		Control Condition	
Independent variables	*B (SE)*	β	*B (SE)*	β
Word Reading Fluency				
Constant	-0.42 (9.34)		10.72 (9.50)	
Phonemic Awareness	0.59 (0.77)	0.12	0.15 (0.53)	0.06
Prosodic Awareness	0.18 (0.32)	0.09	0.55 (0.44)	0.24
Writing Competence	1.03 (0.29)	0.53**	1.33 (0.47)	0.56
Context-Dependent Words	1.16 (0.35)	0.50**	0.61 (0.67)	0.17
R^2	0.67		0.511	
F	7.94**		4.19*	
Pseudoword Reading				
Constant	0.40 (11.63)		12.23(10.72	
Phonemic Awareness	0.65 (0.96)	0.16	0.86 (0.60)	0.28
Prosodic Awareness	0.20 (0.40)	0.12	1.17 (0.50)	0.46*
Writing Competence	0.40 (0.37)	0.25	0.71 (0.53)	0.27
Context-Dependent Words	0.49 (0.43)	0.28	1.07 (0.76)	0.26
R^2	0.215		0.499	
F	1.10		3.99*	
Word Dictation				
Constant	-34.30 (21.44)		6.67 (14.14)	
Phonemic Awareness	1.73 (1.77)	0.13	0.83 (0.79)	0.17
Prosodic Awareness	0.73 (0.73)	0.13	0.44 (0.66)	0.11
Writing Competence	3.53 (0.67)	0.68**	2.68 (0.70)	0.64**
Context-Dependent Words	2.19 (0.80)	0.36*	1.28 (1.00)	0.20
R^2	0.750		0.646	
F	12.00**		7.30**	
Letter Dictation				
Constant	33.61** (1.44)		34.54** (1.89)	
Phonemic Awareness	-0.03 (0.12)	-0.05	-0.06 (0.11)	-0.01
Prosodic Awareness	0.004 (0.05)	0.02	0.09 (0.09)	0.25
Writing Competence	0.05 (0.05)	0.25	0.05 (0.09)	0.15
Context-Dependent Words	0.09 (0.05)	0.37	-0.07 (0.13)	-0.13
R^2	0.225		0.120	
F	1.16		0.54	
Letter Naming (speed)				
Constant	54.65** (8.36)		31.48* (11.98)	
Phonemic Awareness	-2.01 (0.69)	-0.58*	-0.24 (0.67)	-0.09
Prosodic Awareness	0.06 (0.28)	0.04	0.85 (0.56)	0.38
Writing Competence	0.20 (0.26)	0.15	-0.07 (0.59)	-0.03
Context-Dependent Words	-0.62 (0.31)	-0.39	-0.13 (0.85)	-0.04
R^2	0.434		0.173	
F	3.06*		0.84	
Letter Naming (accuracy)				
Constant	33.10** (0.93)		32.36** (0.68)	
Phonemic Awareness	0.08 (0.08)	0.22	0.06 (0.04)	0.40
Prosodic Awareness	-0.05 (0.03)	-0.37	0.04 (0.03)	0.29
Writing Competence	-0.05 (0.03)	-0.33	-0.03 (0.03)	-0.24
Context-Dependent Words	0.06 (0.04)	0.36	0.07 (0.05)	0.31
R^2	0.316		0.251	
F	1.85		1.34	

*$p<.05$. **$p<.01$.

In the experimental condition, a significant model fit was found for Word Reading Fluency ($F(1,16) = 7.94$, $p = .001$), explaining 67% of the variance ($R^2 = 0.67$). Both Writing Competence ($b = 1.03$ $p = .003$) and Context-Dependent Words ($b = 1.16$, $p = .004$) significantly predicted Word Reading Fluency. Furthermore, a significant model fit was found for Word Dictation ($F(4,16) = 12.00$, $p <.001$), explaining 75% of the variance ($R^2 = 0.75$). Both Writing Competence ($b = 3.53$, $p < .001$) and Context-Dependent Words ($b =2.19$, $p = .014$) were found to predict Word Dictation significantly. Lastly, results revealed a significant model fit for Letter Naming (speed) ($F(4,16) = 3.06$, $p = .047$), explaining 43% of the variance ($R^2 = 0.43$). Phonemic Awareness ($b = -2.01$, $p = .010$) significantly predicted the subtest Letter Naming (speed). These findings suggest that higher accuracy scores on Writing Competence and Context-Dependent Words led to children scoring higher on Word Reading Fluency and Word Dictation. Furthermore, higher accuracy scores on Phonemic Awareness could predict Letter Naming (speed). Overall, these findings support the hypothesis that the posttest scores of the children in the experimental condition could predict the outcomes of the evaluation of the intervention, especially for the subtests Phonemic Awareness, Writing Competence and Context-Dependent words. For the children in the control condition, results also revealed a significant model fit for Pseudoword Reading ($F(4,16) = 3.99$, $p = .02$), explaining 50 % of the variance ($R^2 = 0.50$). Prosodic Awareness ($b = 1.17$, $p = .032$) significantly predicted Pseudoword Reading. Furthermore, a significant model fit for Word Dictation ($F(4,16) = 7.30$, $p = .002$) was found, explaining 65% of the variance ($R^2 = 0.65$). Writing Competence ($b = 2.68$, $p = .001$) significantly predicted Word Dictation. These findings, in turn, suggest that higher accuracy scores on Prosodic Awareness could predict pseudoword reading, and scores on Writing Competence could predict word dictation. These findings partially align with our hypothesis that the dynamic measures would possess greater predictive validity for outcomes of clinical dyslexia interventions.

4. Discussion and Conclusion

This study sought answers to two questions. We investigated whether a dynamic reading and writing test could provide insights into the potential for learning in children diagnosed with dyslexia. Research on dynamic testing has mainly concentrated on predicting future reading and writing difficulties among kindergarten children (Dixon et al., 2022). Nonetheless, we took a different approach and examined whether the posttest accuracy scores of children, on average in second grade, could be utilised to predict their receptiveness to a clinical dyslexia intervention.

Regarding the first question about insights into the potential for learning, all groups of children showed improved accuracy scores from the pretest to the posttest in Phonemic Awareness and Writing Competence subtests, suggesting a learning effect. These findings are consistent with previous studies, which demonstrate that children diagnosed with dyslexia can improve their accuracy scores from the pretest to the posttest (Mata & Serrano, 2019; de Vreeze-Westgeest et al., 2023). However, unlike in those studies, where significant improvements in accuracy as a consequence of training were observed, this study did not find that training significantly impacted children's accuracy score beyond the impact of practice. One possible reason for this discrepancy could lie in different characteristics of the participants in the current study vis-à-vis those conducted in the past. In the current study, children were generally older and had not yet undergone targeted reading and writing interventions typically associated with clinical dyslexia interventions. It is plausible that children might need some time to adapt to the interventions. Perhaps the duration of the training procedure that was part of the dynamic test was not sufficient to capture a significant improvement in accuracy scores (Isabel et al., 2012). It is conceivable that a more intensive training procedure would give the children more adaptation time. This remark seems especially salient, considering that a key aspect of a reading disorder is often a limited or insufficient response to treatment, making it challenging to demonstrate responsiveness to interventions, particularly in studies with small sample sizes (Toffalini et al., 2021).

Moreover, differences in orthographic language transparency between Dutch and Spanish could also explain the lack of significant progress from the pretest to the posttest in the current study. The influence of orthographic transparency on the direct route Dutch children takes in learning to read may result in variations in the pace at which Dutch children diagnosed with dyslexia develop reading and writing skills compared to their Spanish age-mates. It is proposed that the progression of reading skills in children diagnosed with dyslexia reflects differences in the orthographic complexity of the writing system (Serrano & Defior, 2008). Additionally, it is speculated that Dutch children diagnosed with dyslexia might encounter more errors in accuracy, potentially impacting their ability to demonstrate progress from pretest to posttest compared to Spanish children (Serrano & Defior,2008). Nevertheless, although no significant effect of training on children's accuracy scores was observed, it was found that children in both conditions, trained or not trained, demonstrated large individual differences in their level of initial ability on the reading and writing subtests, as well as their performance after training, as evidenced by examining their mean and standard scores. These findings indicate that utilising a dynamic reading and writing test, and in so doing obtaining information about individual children's learning curves and progress, may be a useful starting point for teachers and dyslexia clinicians to understand better the specific assistance required by children diagnosed with dyslexia and tailor their interventions to their individual needs.

More importantly, in relation to the second research question on the predictive value of the dynamic reading and writing test, this study revealed that the dynamic posttest measures were better predictors of receptiveness for clinical dyslexia interventions than the static posttest measures. The subtests Writing Competence and Context-Dependent Words mainly emerged consistently as predictors of various reading and writing subtests of the dyslexia evaluation of the intervention. The writing skills focused on during training may especially correspond with the reading and writing skills addressed in the clinical dyslexia intervention program. In this respect, our findings align with the literature where the predictive value of dynamic testing, especially for children with learning difficulties, exceeded that of static tests (Caffrey et al., 2008; Dixon et al., 2022).

5. Limitations and Recommendations

In this study, we encountered some limitations. We worked with children diagnosed with dyslexia who had not started clinical dyslexia treatments yet. Because of these strict criteria, there was only a short window to find children eligible for research participation and connect them with dyslexia clinicians and trained master students, leading to logistical challenges. Even though the logistical challenges will remain, in the future, it would be better to aim for larger groups of participants to improve the statistical power. Furthermore, finding no significant training effect raised questions about the specific effectiveness of the dynamic reading and writing test. Evaluating the test items, the content of the training, and the training intensity will present an opportunity for future studies to build upon these findings. In addition, the original dynamic reading and writing test (Mata & Serrano, 2019) contained an observation scale. Integrating quantitative and qualitative dynamic reading and writing measures might help comprehend the individual differences between children. The utilisation of the scale was beyond the scope of this research. However, future studies may consider employing the observation scales. In doing so, they might be able to develop even more personalised interventions.

To conclude, the current study indicates that dynamic measures of reading and writing have robust predictive abilities for receptiveness to dyslexia interventions, especially in the domain of writing. The findings underscored the ability of dynamic reading and writing tests to capture additional information beyond static tests, offering valuable insight to dyslexia clinicians for tailoring the interventions to the educational needs of children diagnosed with dyslexia.

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