

**Research Article** 

# An Online Approach for Dyslexia Screening to Test a Child

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#### Abstract

Dyslexia is a learning disability, which manifests itself in a limited reading and spelling ability. Dyslexia, when not diagnosed early could have serious implications in later life, such as limited educational and professional development. The method involved the application of the psychometric tool Dyslexia Screening Test – Secondary (DST-S) and the observation of disability specific traits, such as handwriting. The male child's psychometric screening test score (1.0) indicated a strong risk at dyslexia. The implications of the results and the potential addition of the two absent test items are taken into account to view possible result differences.

Keywords: Dyslexia, Diagnosis, Screening, Dysgraphia, Children, Psychometric testing

# Introduction

Approximately, 5-10% of the world population appears to have dyslexia, which is a moderately common learning disability, specifically in the area of reading and spelling fluency.<sup>1</sup> Males are statistically more often diagnosed with dyslexia than females.<sup>2</sup> Dyslexia (historically known as *congenital word blindness*) appears to have gained scientific relevance, when a British medical doctor published an article on a 14 year old intelligent male child, who was unable to learn how to read.<sup>3</sup> A study using positron-emission tomography (PET) on dyslexic men found, that the left brain region *temporoparietal* did not activate during a phonological task (rhyme detection) against a control group without dyslexia, which was activated.<sup>4</sup>

The mother of a male child (Age: 12) reported that her child might have dyslexia, dysgraphia and dyspraxia. The mother stated that there is a family history of reading difficulties. Dysgraphia is a learning disability and neurological disorder, which results in an incapability to write coherently and is derived from the Greek language 'dys-' for 'disorder or difficult' and '-graphia' for 'writing or drawing'.<sup>5</sup> This is an important factor, not only asked in the psychometric test itself but there are suggestions that genetic factors are at least correlating with the inheritance and dyslexia development in children.<sup>6</sup> The DST-S is traditionally applied with the tester and testee being present physically and not virtually. However, this was not possible due to the long distance between the tester and the child. It is important to note that two items were impossible to be applied online, as they required physical attendance and the use of



specific psychometric tools. The DST-S has 13 items but two items had to be excluded, namely 'Test 2: Bead Threading' and 'Test 4: Postural Stability'. The DST-S manual states that it is still possible to calculate the 'At Risk Quotient' (ARQ), if there are more than 5 items tested, which serves as an indication or no signs for dyslexia.<sup>7</sup>

The British Psychological Society's (BPS) rules for conducting assessments online were adhered too. It was ensured that, during the psychometric test, the audio/video was well visible and audible, making the assessment and observation valid.<sup>8</sup> The consent for conducting the psychometric test with the child and the potential publication of the results was gained from the mother. Any potential differences in the final scores and therefore outcomes, added with the application of *Test 2* and *Test 4*, for the child will be discussed further in the article.

## Method

Prior to the actual psychometric test, the mother and the child were briefed about the general outline and the lengths of the test. As the child was 12 years old, at the time of the test, the psychometric test DST-S (Age range: 11:6 to 16:5) was chosen, as the form of indicating any signs for dyslexia. It is important to mention, that the DST-S is not applied as a psychometric tool to diagnose a person but to screen for any likelihood for dyslexia. Therefore, it is a very useful tool to identify a child, which is at risk of having dyslexia, so measures can be taken to accommodate the affected child. The DST-S consist of 13 subtests, as follows: Rapid Naming; Bead Threading; One Minute Reading; Postural Stability; Phonemic Segmentation; Two Minute Spelling; Backwards Digit Span; Nonsense Passage Reading; One Minute Reading; Verbal Fluency; Semantic Fluency; Spoonerisms and Non-verbal Reasoning. The individual total scores in each subtest is than used to match this to a specific criteria (corresponding index: +, 0, -, ---), as follows: the plus (+) sign indicates, 'above average' (no risk) of dyslexia and lies in the 78-100 percentile; the number 0 indicates, 'normal' (no risk) of dyslexia and lies in the 23-77 percentile' the single minus (-) sign indicates, 'mild risk' of dyslexia and lies in the 12-22 percentile; the double minus (--) sign indicates 'moderate risk' of dyslexia and lies in the 5-11 percentile and finally the triple minus (---) sign indicates 'high risk' of dyslexia and lies in the 0-4 percentile.7

The audio and video were checked prior to the psychometric test, so that all items were audible and also clearly visible. The items which had to be read out loud by the child had to be held up to the notebook camera and the speed (using a stopwatch), as well as the correct responses checked. The subtest, which had to be listened too, were further supported by a separate CD player and loudspeakers, so it was clearly audible to the child for recall.

The benefit of the DST-S is, that it shows not only the weakness-

es in the individual subtests but can also identify specific strength of the child. Therefore, the DST-S results can be applied to serve as a guide to support the individual child at school and could also lead to gaining permission for extra time during exams to balance it out for the dyslexia. Noteworthy factors in the DST-S were, that it asks also observable questions, such as test behaviour (concentration), anxiety or other indicators for example verbal capabilities. The child showed a generally good concentration during the test, was verbally able and his anxiety level was minimal, e.g. once biting nails for a very short period of time. The mother and the child were debriefed about the psychometric test at the end and the overall results were shared with them.

# Results

During the writing tasks, one could not notice a severe difference in writing ability and it was deemed readable, but the holding of the pen was very different from the norm of children his age and had similarities to a 'modified tripod grip'. This kind of pencil holding appears to be related more to children who are 3-4 years old.<sup>9</sup> One could also notice that the writing was not uniformly, as sometimes the words were written in individual separated letters, sometimes partially together in a word, for example, 'H' slight gap and 'ouse' written together, for the word 'House' or all letters with gaps 'l' gap 'o' gap 'o' gap 'k', for the word 'look'. Furthermore, in a word reading task, it has been noticed that the child struggled with the word 'girl' and pronounced it as 'grow', which might need further attention.

The graph below Figure 1, illustrates the individual scores of the subtests, achieved by the child, visibly.



From the above graph, one can see the child's strength in the subtests 'One Minute Reading', 'Non-sense Passage Reading' and 'Semantic Fluency'. Therefore, one could suggest that there are strengths in the general fluidity and literacy. The slight to moderate weaknesses were in subtests 'Two Minute Spelling', 'One Minute Writing', 'Phonemic Segmentation', 'Spoonerisms', 'Backwards Digit Spin', 'Rapid Naming', 'Verbal Fluency' and 'Non-verbal Reasoning'. From the results, there is an indication for phonological deficits and slight weaknesses in processing speed. According to Bowers and Wolf<sup>10</sup> double deficit hypothesis, namely that a child who has both weaknesses in phonological and naming-speed, will be poorer in reading than a child who has only one of those deficits or have no deficit in the two areas. The findings of the 'double deficit hypothesis' for dyslexia were later supported by another research.<sup>11</sup> One can also identify slight weaknesses in the 'phonemic segmentation' subtest, which is a very good predictor for dyslexia and research suggests, that phonemic awareness is a crucial factor in reading and spelling ability in a child.<sup>12</sup> In the 'Spoonerisms' subtest, one could observe also a slight weakness, where the first letters of two words had to be exchanged, e.g. 'milk bottle' to 'bilk mottle'. Varvara.<sup>13</sup> found out in a study that children with developmental dyslexia had also weaknesses in several executive functions and that 'spoonerism' abilities was a more effective indication for word and non-word reading weaknesses. One can clearly see that the child had also slight problems in the subtest 'Backwards Digit Span', where he had to state back specific number combinations in reverse order and increasing intensity level (lengths of digits), e.g. '0 1' to '1 0'. This subtest forms also part of intelligence tests, as the Wechsler Adult Intelligence Scales (WAIS) employs it to test for working memory.<sup>14,15</sup> The 'Two Minute Spelling' subtest, was one of the weakest elements of the child and consisted of easier to slightly difficult written spelling, which was also related to slightly more letters in the word. Some words caused difficulty, such as 'doctor' was spelled in writing as 'Docter'. Dyslexic individuals have weaker phonological skills and it is required for decoding the word, which they have difficulties doing so.<sup>16</sup> In this case, as the words were read out, the child struggled to put all heard words into correct writing. In the subtest 'Verbal Fluency', the child was also weaker, as he struggled to state very many words with a particular letter start (e.g. 'A') in 1 minute. In the 'Non-verbal Reasoning' subtest, where the child had to identify the next sequence in a series of shapes, he performed also the weakest. From the graph above, one can see, there were slight weaknesses in the 'Rapid Naming' subtest, where the child named the pictures on a card (e.g. an illustration of a subject or object), as quickly as possible. Wolf and Bowers<sup>17</sup> suggest that dyslexic individuals are also slower in naming even familiar images to them.

#### Discussion

It is paramount to note that being dyslexic does not equate to not being intelligent. Contrary to this, many dyslexic individuals are very intelligent, but still have reading and spelling difficulties.<sup>18</sup> It is a common misconception to claim that individuals who are dyslexic are also not smart, which might also be due to general intelligence tests and also educational settings, putting so much weight on this, as a form of cognitive ability. Additionally, the general intelligence test, can also serve to identify reading disorders, such as dyslexia. A study conducted the WAIS-III intelligence test on Brazilian adults with dyslexia indicated, that they scored lower on Verbal IQ than on Performance IQ and had lower skills on working memory than verbal comprehension.<sup>19</sup>

In the graph, one could notice the slight weakness in the subtest 'One Minute Writing' and even though this is not a direct indicator for dyslexia or at least not a clear diagnostic criteria, it suggests that the child would likely need more time in exams to fulfil his potential.<sup>7</sup> An exam is time constraint and therefore is based on the speed of a child's reading and writing ability, which would be in a dyslexic individual compromised.

The awareness of dyslexia could vary from country to country and therefore a more universal awareness and training in schools worldwide might be essential, to support any child with potential dyslexia. Mather<sup>20</sup> conducted an extensive review of the world's approach to dyslexia with 195 countries and found that even though many countries have been very proactive in their approach to raise awareness for dyslexia; other countries have sometimes not even acknowledged dyslexia or at the very least have no thorough understanding about the subject. According to Mather,<sup>20</sup> the teacher's lack of knowledge in regards to dyslexia is a key area of a child not receiving support. A study conducted in England, indicated the issue, as only 2 teachers were able to identify dyslexia specific factors in students and the other 42 teachers were not able to do so.<sup>21</sup> Another study showed that teachers were misidentifying visual features as a problem, rather than the phonological impairments in dyslexia.<sup>22</sup> Therefore, it is crucial to inform teachers about dyslexia in detail to overcome these misunderstandings. It is also very important to give teachers the *time* to attend to this issue, as the profession is under pressure with a lot of additional work to the teaching itself, such as immense administrative tasks, especially in the UK.23

To simulate the 'worst case scenario', the Bead thread score has to be kept at 0, meaning no beads correctly threaded and Postural Stability at a Maximum score of 24, which would have resulted in a more indicating score, such as 'strongly at risk' of having dyslexia (**ARQ = 1.3**). To simulate for the 'best possible scenario', the Bead Thread test score needs to be at a maximum score of 10 and the Postural Stability test score minimum at 0. One could observe a difference in the indication score, but the result still showed that the individual would be 'at risk' of having dyslexia (**ARQ = 0.8**). Even though the lowest ARQ score, would indicate a mild risk of having dyslexia. Therefore, a full dyslexia assessment is required to diagnose formally, if the child has dyslexia for certain.

A research result indicated that phonemic segmentation can be improved by further training, such as teaching children with increasingly difficult phonemic stimuli to that extent that they were comparable to non-disabled readers.<sup>24</sup> The research suggests that specific strategies, such as constant training and increasing the difficulty level of phonemics, specifically at an early level could have immense positive consequences for dyslexic individuals. Fawcett and Nicolson<sup>25</sup> claim that 'pig-Latin', a child friendly game for dyslexics, could help with skill building and fluency. In 'pig-Latin', the child has to say a word, where the first letter of the word is added to the end, before the addition of 'ay' put at the end, for instance, e.g. the word 'dog' is spoken as 'ogday'. In regards to written spelling, a dyslexic child needs to employ a complex strategy, namely creating a grapheme (symbol applied to recognize phonemes, such as a letter representing the individual sound) for each phoneme. Herbert et al. (2018) state, that combining sentences in exercises could support a dyslexic child with linking the verbal language with the written one, e.g. using a connector term to combine ideas, sentences or clauses. Two sentences (Sea turtles eat jellyfish.; Sea turtles eat sea grasses.) can then be combined to make sense to the dyslexic child, e.g. 'Sea turtles eat jellyfish and sea grasses'.; 'Sea turtles eat jellyfish or sea grasses.' Verbal fluency is commonly assessed in relation to dyslexia and a recent research study suggests potential links between verbal fluency and reading abilities in dyslexic individuals.<sup>26</sup> Fawcett and Nicolson<sup>7</sup> state that it might be possible for a child to be weak in the 'Verbal Fluency' subtest but moderately good in the 'Semantic Fluency' subtest, which seems to be confirmed with this child. As dyslexic individuals have usually no serious issues with reasoning abilities, it is important to identify the shortcomings, such as further testing.<sup>27</sup> However, it is also important to consider that the online application, of the 'Non-verbal Reasoning' subtest might have caused an issue in identifying the shapes and therefore the sequence order, even though there was no visual problem reported by either the child or the mother.

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# **Conflicts of Interest**

The Author declares that there are no conflicts of interest.

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