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# The Effect of Colour Overlays on Reading Achievement among The Children with Irlen Syndrome

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This study aims to determine the effectiveness of blue colour overlays among children with learning disabilities with Irlen Syndrome symptoms. 20 subjects aged between 7 to 12 years old from Special Need's Class at Sekolah Kebangsaan Dato Haji Musa, Kota Samarahan, Sarawak, Malaysia involved in this study. A quasi-experimental design of pre and post-test was conducted to compare the findings between the application of blue colour overlays and without colour overlays in terms of reading score and reading time. The findings through the paired samples t-test analysis found the significant differences for reading score, $t$ (19) = 3.923, $p$ = 0.001 and reading time $t$ (19) = 4.081, $p$ = 0.001. The findings indicated a significant improvement in reading score and reading time as shown in children with learning disabilities with the symptoms of Irlen Syndrome while using blue colour overlays. This study disclosed that blue colour overlays could help increase reading comfort in children with learning disabilities who experienced Irlen Syndrome symptoms.

**Keywords:** Learning Disabilities; Colour Overlays; Irlen Syndrome; Reading Achievement

## I. INTRODUCTION

Irlen Syndrome was identified as one of the keys that can cause reading difficulties (Harries *et al.,* 2015). The individuals who experience this syndrome might have symptoms like eyestrain, headaches, tiredness, fatigue, and visual perceptual distortions that occur when reading. For instance, a text or word will appear blurring, shaky, poor comprehension, slow reading, and sometimes they are skipping lines or words, loss of text, and rereading lines (Albon *et. al.,* 2008; Brien *et. al.,* 2013; Wilkins *et al.,* 2004).

Most of the previous research found that colour overlays can improve reading achievement for people with learning disabilities and experience the symptoms of Irlen Syndrome. Referring to Harries *et al.* (2015), they found that 35 % of the participants involved in this research had reported that their symptoms were resolved entirely, while 72 % of the 68 children gained improvements in three or more symptoms of Irlen Syndrome when they were reading by using the colour overlays. In similar research conducted by Faraci (2009), he also identified that reading achievement yielded significantly higher average reading fluency scores for the participants using the colour overlays. Reading Assessment-Oral Text Reading Fluency results showed a positive increase ($p$ < 0.01). Alencar *et al.* (2014) later found that using colour overlays when reading results from Visagraph System showed significant improvements in reading performance among subjects with visual stress symptoms. Research done by Salyers (2018) found that participants with reading deficits increased 12.5% of improvements in their reading scores after using colour overlays. Veszeli and Shepherd (2019) identified that with the use of overlays, children reduce their reading time and can read faster.

Cerrato (2012) states that the blue colour is strongly related to calmness and tranquillity; therefore, this colour can have a positive effect on the human body and mind. Previous research by Rim and Yoon (2015) found that students enhance their memorisation skills in English when

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using the blue paper sheet. A study by Ikeshita *et al.* (2018) identifies that the blue band can positively affect children with dyslexia because they can read more efficiently when the digital text is highlighted with a blue band. Besides, a study conducted by Imaizumi *et al.* (2016) found that using the bluish colour overlays can make the reading more comfortable for the participants with and without Irlen Syndrome in the Japanese syllabary as well as English alphabets condition. Apart from that, the blue colour overlay also can increase reading achievement, especially for individuals who suffer from the symptoms of Irlen Syndrome (Imaizumi *et. al.,* 2016; Wilkins *et al.,* 2004).

In Malaysia, in 2012, the Department of Social Welfare reported that the registrations of individuals with reading difficulties were increasing yearly. Furthermore, in 2014, the United Nations International Children's Emergency Fund (UNICEF) identified this problem due to the absence of expertise in determining the intervention process. Thus far, in Malaysia, no previous study has been done to examine the effect of using blue colour overlays in children with reading disabilities who experienced Irlen Syndrome symptoms. Otherwise, previous studies of blue overlays by Fauzan and Yang (2018) only dealt with ASD children. Also, the result of this study has failed to show any significant improvements in using blue overlays among children with ASD when reading. Therefore, this particular research was conducted to determine the effectiveness of blue colour overlays on reading achievement among learning disabilities students with symptoms of Irlen Syndrome.

## II. MATERIALS AND METHODS

Quasi-experiments one group pre-test and post-test designs were used in this study to compare the findings between pre-test (without colour overlays) and post-test (blue colour overlays) in terms of reading score and reading time. The inclusion criteria in this study include students diagnosed with learning disabilities by a doctor who experienced the symptoms of Irlen Syndrome. However, the students under medication and diagnosed with genetic disorders were excluded from this study.

The data was collected after getting approval from the Malaysia Ministry of Education Department (KPM), the Education District Office (PPD), and the headmaster of Sekolah Kebangsaan Dato Musa. Fifty students have been chosen by their class teacher to participate in this study based on the subjects' achievement and reading ability. All of the subjects were tested during the screening phase to determine whether they had the symptoms of Irlen Syndrome symptoms or not. On the other hand, for the screening phase, all questions were referred from the Perceptual Development Corp/Helen Irlen (Irlen Institute, 2010). However, only 20 subjects met the Irlen Syndrome symptoms criteria and continued with the next phase. Other 30 subjects who did not meet the criteria of Irlen Syndrome symptoms were eliminated from this study.

Meanwhile, the reading task has been divided into two steps, i.e., without using colour overlays (pre-test) and blue colour overlays (post-test). The reading task that had been given to all of the 20 subjects was referred to their class teacher depending on their reading ability level in the class. Apart from that, all the reading tasks were standardised, referring to the textbooks and following the Kurikulum Standard Sekolah Rendah (KSSR). All subjects were reading by using the Malay language. For the pre-test, all subjects read without using colour overlays to determine their reading score and reading time during the reading task.

In contrast, all 20 subjects were given blue colour overlays (intervention) when reading for the post-test. The reading score and reading time were taken to determine the effectiveness of the blue colour overlays while reading. Besides, all the reading scores were calculated using the formula from the Oral Reading Fluency (ORF) Calculation, The Meadows Center for Preventing Educational Risk (MCPER).

In order to compare the improvement of the reading score and the reading time of the subjects, the data were analysed using the paired sample t-test. In this research, before the paired samples t-test was conducted, the normality test was run to ensure that the assumptions of the paired samples t-test had not been violated. The Shapiro-Wilk test was run as a normality test because the sample size that was used in this research was less than one hundred (Coakes, 2011).

## III. RESULTS AND DISCUSSION

### *A. Reading Score*

Based on the Table 1, it has showed that the results for reading score from paired sample t-test were significantly higher for the post-test (M = 75.850, SD = 43.930) as being compared than the pre-test (M = 57.500, SD = 31.905), t (19) = 3.923, (p = 0.001, p < 0.05). The result reveals that using blue colour overlays increased reading scores for all 20 subjects during reading sessions. Therefore, it had been proven that there was a significant difference in the reading score between the usage of the blue colour overlays and without colour overlays. Likewise, this finding is similar to the previous research by Salyers (2018), which indicated that using colour overlays showed positive improvements (12.5%) in the reading score of respondents with a reading deficit.

From this study, it is disclosed that by using the blue colour overlays, the reading score of the subject has increased. The finding parallels with the previous research by Imaizumi *et al.* (2016), which emphasises that bluish colour overlays make reading more comfortable to the participants with and without symptoms of Irlen syndrome compared to other colours in the Japanese syllabary and also English alphabets condition.

Besides, a lot of studies have found that the blue colour has a positive impact on the individual that suffers from magnocellular deficits. By using the blue colour overlays, it can improve the Magno function and also convergent binocular control. As a result, individuals suffering from the symptoms of Irlen Syndrome can increase their reading fluency and improve their reading achievement (Ludlow *et. al.,* 2006; Wilkins *et al.,* 2004).

Table 1. Paired Samples t-test Results for Reading Score

| | **Mean** | **Std. Deviation** | **t** | **df** | **Sig. (2-tailed)** |
|---|---|---|---|---|---|
| **Pre-Test (Without Colour Overlays)** | 57.500 | 31.905 | | | |
| | | | 3.923 | 19 | 0.001 |
| **Post-Test (Blue Colour Overlays)** | 75.850 | 43.930 | | | |

### *B. Reading Time*

As shown in Table 2, result for paired sample t-test has indicated that the reading time was significantly decreasing for post-test (M = 143, SD = 57.220) as being compared than the pre-test (M = 187, SD = 87.830), t (19) = 4.081, (p = 0.001, p < 0.05). Thus, from these findings, it can be concluded that all subjects can read faster using blue colour overlays because the reading time decreased during the reading tasks. The findings from this research have supported the result of previous research conducted by Veszeli and Shepherd (2019), which found a reduction in reading times in young children after using colour overlays.

Additionally, using the colour overlays decreased the number of pauses when reading; hence the time speed of reading also decreased. As a result, the subject can read faster (Robinson & Conway, 1994). Besides, Irlen (1991) highlighted that reading speed would improve by using the colour overlays because the colour overlays facilitated the reduction of visual stress symptoms, especially for an individual with Irlen Syndrome symptoms.

Table 2. Paired Samples t-test Results for Reading Time

| | Mean | Std. Deviation | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|
| **Pre-Test (Without Colour Overlays)** | 187 | 87.830 | | | |
| | | | 4.081 | 19 | 0.001 |
| **Post-Test (Blue Colour Overlays)** | 143 | 57.220 | | | |

### *C. Observation Results for Reading Score and Reading Time*

In brief, Figures 1 and 2 showed the finding in terms of pre-test and post-test for each of the 20 subjects selected in this study. The finding revealed that the reading scores for all 20 subjects were increased using blue colour overlays. Meanwhile, for the reading time, it can be seen that all of the 20 subjects had decreased their reading time by using blue colour overlays. Thus, from this finding, it has been proven that all subjects enhance their reading achievements and can read faster by using the blue colour overlays in contrast without using colour overlays.

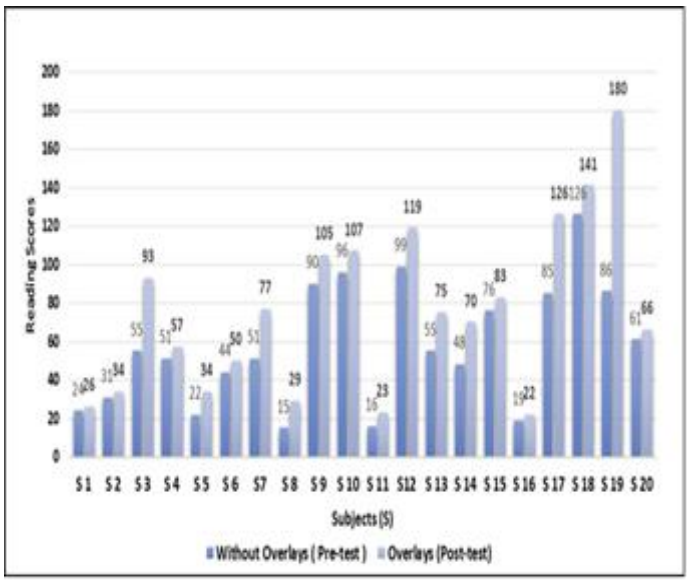


Figure 1. Results for reading score on the pre-test (without overlays) and post-test (blue colour overlays)

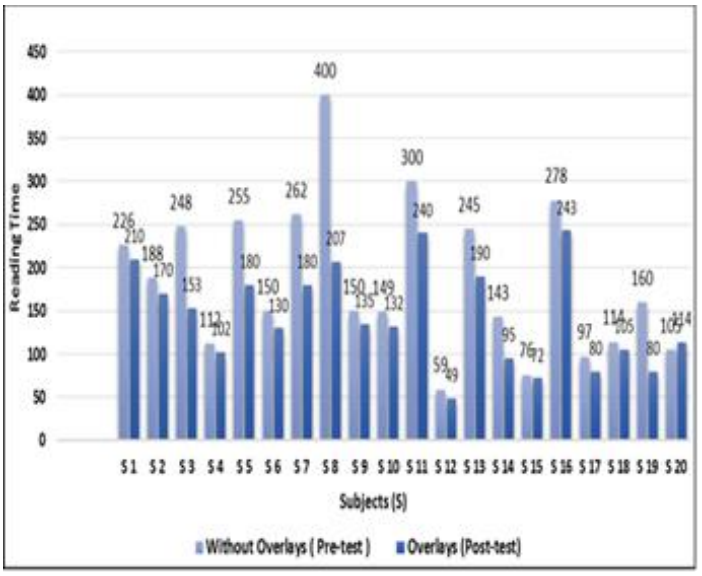


Figure 2. Results for reading time on the pre-test (without overlays) and post-test (blue colour overlays)

### *D. Percentage Improvement for Reading Score and Reading Time*

Table 3 summarises the percentage improvements for reading score and reading time in terms of pre-test and post-test for each of the 20 subjects. As seen in the table above, the subjects were diagnosed with dyslexia, attention deficit hyperactivity disorder (ADHD), and other disorders. For the reading score, all subjects showed a percentage of improvement when using blue colour overlays. Apart from that, during the reading tasks, the percentage for the reading time also showed that all the subjects were decreased in their reading time when using the blue colour overlays. This result clearly showed that all subjects could read faster using blue colour overlays.

Table 3. Summary of the Percentage Improvement for Reading Score and Reading Time each of the Subject

| Learning Disabilities | Subjects (S) | Reading Score | | | Reading Time | | |
|---|---|---|---|---|---|---|---|
| | | Pre-Test | Post-Test | Percentage of improvement (%) | Pre-Test | Post-Test | Percentage of improvement (%) |
| Others Disorder | S 1 | 24 | 26 | 8.33 | 226 | 210 | 7.08 |
| | S 5 | 22 | 34 | 54.55 | 255 | 180 | 29.41 |
| | S 6 | 44 | 50 | 13.64 | 150 | 130 | 13.33 |
| | S 13 | 55 | 75 | 36.36 | 245 | 190 | 22.45 |
| | S 15 | 76 | 83 | 9.21 | 76 | 72 | 5.26 |
| ADHD | S 2 | 31 | 34 | 9.68 | 188 | 170 | 9.57 |
| | S 7 | 51 | 77 | 50.99 | 262 | 180 | 31.30 |
| | S 10 | 96 | 107 | 11.46 | 149 | 132 | 11.41 |
| | S 16 | 19 | 22 | 15.79 | 278 | 243 | 12.59 |
| | S 17 | 85 | 126 | 48.26 | 97 | 80 | 17.53 |
| | S 19 | 180 | 86 | 52.22 | 160 | 80 | 50.00 |
| | S 20 | 61 | 66 | 8.20 | 105 | 114 | 8.57 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Dyslexia | S 3 | 55 | 93 | 69.09 | 248 | 153 | 38.31 |
| | S 4 | 51 | 57 | 11.76 | 112 | 102 | 8.93 |
| | S 8 | 15 | 29 | 93.33 | 400 | 207 | 48.25 |
| | S 9 | 90 | 105 | 16.67 | 150 | 135 | 10 |
| | S 11 | 16 | 23 | 43.75 | 300 | 240 | 20 |
| | S 12 | 99 | 119 | 20.20 | 59 | 49 | 16.95 |
| | S 14 | 48 | 70 | 45.83 | 143 | 95 | 33.57 |
| | S 18 | 126 | 141 | 11.90 | 114 | 105 | 7.89 |

Based on this finding, the percentage improvement of seven (7) subjects with ADHD showed an increase in reading achievements while using blue colour overlays. Many individuals with ADHD have suffered from Irlen Syndrome symptoms because the overlapping between Irlen Syndrome and ADHD behaviour was more extensive. They might experience the symptoms of Irlen Syndrome, such as having a problem when reading in terms of tracking the lines and words, quickly giving up, poor concentration, and daydreaming during reading activity (Brien *et. al.,* 2013; Stone, 2002). Helen Irlen found that colour transparencies can become a treatment for a group of students with reading difficulties who experienced the symptoms of Irlen Syndrome (Irlen, 2005; Wilkins *et al.,* 2004).

Additionally, from the finding, for S8, who has been diagnosed with dyslexia, the percentage of improvement for the reading score for this subject was 93.33%, whereby for the reading time, it was 48.25%. This type of individual might see the text and word blur, shaky, and move on the white paper with the black print; thus, they will have difficulties reading (Evans, 2001; Wilkins, 2003). In contrast, by using the colour overlays, individuals with dyslexia will improve their reading achievement because the colour overlays can remove the perceptual problem of the printed pages, especially on white paper with black print (Irlen, 1991; Zuccone, 2008).

## IV. CONCLUSION

This research paper has shown a significant difference in the reading score and reading time between the usage of the blue colour overlays and without colour overlays. Apart from that, a significant improvement was shown in terms of reading score and reading time while using blue colour overlays when reading by the dyslexia children, subsequently were being followed by ADHD and other disorders in children who suffered from the symptoms of Irlen Syndrome. To sum up, this research suggested that blue colour overlays can positively impact reading comfort more than without colour overlays for children who have learning disabilities and experienced the symptoms of Irlen Syndrome.

## V. ACKNOWLEDGEMENT

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