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A QEEG Study on the Usage of Yellow Overlays for Reading among Autism Spectrum Disorder Children with Irlen Syndrome Symptoms

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Abstract

This research was carried out in order to compare the difference of brainwaves with and without using yellow overlays when reading among ASD children with the symptoms of Irlen Syndrome. The population from this research consists of sixteen children with chronological ages between six to fourteen years old from Kota Samarahan and Kuching, Sarawak. Quasi-experiments one group pre-test and post-test design was applied in this research. The participants completed the reading task using yellow and without yellow overlays. Subsequently, the QEEG was used to record and analyses the electrical activity in the Region of Interest (frontal and temporal). The analysis results on the paired sample t-test indicated the significant differences for beta brainwaves at frontal t (15) = -2.791, p = 0.014, and temporal area t (15) = -2.218, p = 0.042 while using yellow overlays. However, only the frontal area found significant differences for the alpha brainwaves when using yellow overlays t (15) = -2.428, p = 0.028. Apparently, the results of this research show that yellow overlays can help improve reading achievements and produce extra attention when reading more than without using yellow overlays among ASD children with the Irlen Syndrome symptoms.

Keywords: Autism Spectrum Disorder, Irlen Syndrome, Yellow Overlays, QEEG, Brainwaves.

Introduction

A QEEG is one of the medical imaging tools that can explain the pathophysiological nature of brain dysfunctions in persons who have ASD (Chabot et al., 2015). The advantages of QEEG are the painless, inexpensive, and easy procedure to diagnose persons with ASD (Azouz et al., 2018). In addition, this tool also can be used to identify how brain activity is linked with the person's symptoms like anxiety, depression, attention problem, learning problems, and memory problems (Zukiwski, 2019). Previous research done by Fauzan and Amran (2015) found the results from QEEG showed insufficient beta brainwaves in the majority parts of the brain regions in ASD subjects. According to Zukiwski (2021), insufficient beta waves can cause learning difficulties, brain damage, and also attention problems.

As Lim (2015) perceived, the number of persons diagnosed with ASD in Malaysia had been increased year by year. Additionally, YB Mdm Hannah Yeoh mentioned that even though

the department of Welfare stated that the registrations of persons diagnosed with ASD comprise 22,000 persons, the actual number of these people is higher (Chung, 2019). Omar and Bidin (2015) observed that people with ASD might be facing a lot of difficulties in reading compared to ordinary people. These difficulties occur due to a deficit in mental capacity, and also, they take a long time to finish the reading tasks.

Apart from that, Irlen Institute (2017) stated that around 30 % of persons with ASD could experience the Irlen Syndrome symptoms. Irlen Syndrome has been recognized as one of the causes of reading problems (Harries et al., 2015). Individuals who experience Irlen Syndrome symptoms visibly see the distortion on the printed page as shaky, blurry, swirl, moving, or a halo (Brien et al., 2013).

Irlen and Lass (1989) suggested that colour overlays can be an alternative intervention to reduce Irlen Syndrome symptoms when reading. Previous studies have reported the benefit of colour overlays for people with ASD in terms of reading (Ludlow et al., 2012; Omar & Bidin, 2015). Additionally, Giuliani and Schwarz (2017) found that while wearing colour lenses, the patients with ASD have reduced their Irlen Syndrome symptoms. Kim et al (2015) observed that the activation occurs at superior temporal cortices in patients with Irlen Syndrome after using color lenses. Besides, a study by Fauzan and Zani (2017) discovered that respondents increased alpha waves in the temporal and frontal area with the use of colour overlays when reading Surah Ar-Rahman from the Holy Quran.

Furthermore, the yellow colour can produce happiness and influence emotional activities. The brain will increase serotonin while around with yellow colour, and thus, individuals surrounded by this colour feel cheerful and more confident. In other words, the use of this colour can increase positive results in terms of performance (Cerrato, 2012; Kumar et al., 2013). Likewise, the previous research by Ray et al (2005) found that children with reading problems improved in their reading abilities after using yellow filters for three months. Kumar et al (2013) identified that participants could solve the tasks faster using yellow conditions compared to other colours. Another study done by Fauzan and Yang (2018) suggested that children with ASD stated the highest mean by using yellow overlays while reading compared to other colour overlays. In Malaysia, the effectiveness of yellow overlays when reading among individuals with ASD with Irlen Syndrome has not been explored using the QEEG machine. The brainwave pattern that occurs when reading while using yellow overlays can be identified and proven scientifically using the QEEG machine.

Research Objectives and Research Questions

This research was set out to investigate the effect of yellow overlays on brainwaves reading using a QEEG machine among ASD children with the symptoms of Irlen Syndrome. This research seeks to address the following questions:

a) Are there any significant differences in alpha brainwaves reading on the usage of the yellow overlays by comparing it without yellow overlays at the temporal and frontal areas?
b) Are there any significant differences in beta brainwaves reading on the usage of the yellow overlays by comparing it without yellow overlays at the temporal and frontal areas?

Methodology

This research used a quasi-experimental design in order to compare the differences between pre-test (without yellow overlays) and post-test (yellow overlays) on brainwaves while reading. Children who were diagnosed with ASD experienced Irlen Syndrome symptoms and can read have been included as participants in this research.

This research was carried out after getting permission from the parent's participants. Only 16 out of 30 participants ranging from 6 to 14 years old who meet the inclusion criteria were chosen to continue with the reading task after being tested with the Self-Test for Irlen Syndrome symptoms. This Self-Test was referred from the Irlen Institute (2021).

In this research, QEEG was used to record and measure the brainwave reading of the participants when using and not using yellow colour overlays while reading. This research used the Mitsar-EEG-201 amplifier with the WinEEG software. The EEG data from nineteen electrodes (FP1, FP2, F3, F7, FZ, F4, F8, T3, C3, CZ, C4, T4, T5, P3, PZ, P4, T6, O1, and O2) were collected. The WinEEG program was used to compute and generate the raw data taken from the participants. The Independent Component Analysis (ICA) was used to remove all the artifacts from the raw data.

Moreover, the QEEG data were recorded in two sessions. For this first session, all the participants read without using overlays (pre-test), and the reading of brainwaves was recorded for three minutes. Nevertheless, for the second session, the participants were given the yellow overlays (post-test) during the reading tasks and the brainwaves reading was also recorded for three minutes. All the data obtained during the recording sessions were saved. Finally, the cap was removed gently from the participant's head. Additionally, the Shapiro-Wilk test was run in this research to make sure the assumptions of the statistical test that had been used were not violated (Coakes, 2012). The data were analysed using the paired samples t-test to compare the differences in the brainwaves between pre and post-test while reading.

Results and Discussion

Alpha Brainwaves

Figure 1 and Figure 2 present the results of alpha brainwaves at the frontal and temporal area for the pre-test (without yellow overlays) and post-test (yellow overlays) while reading. The results for alpha brainwaves at the frontal area showed an improvement for 11 participants, while another 5 participants were decreased when using yellow overlays. Next, at the temporal area, alpha brainwaves for 9 participants were improved with yellow overlays, while another 7 participants showed a decrease when using yellow overlays.

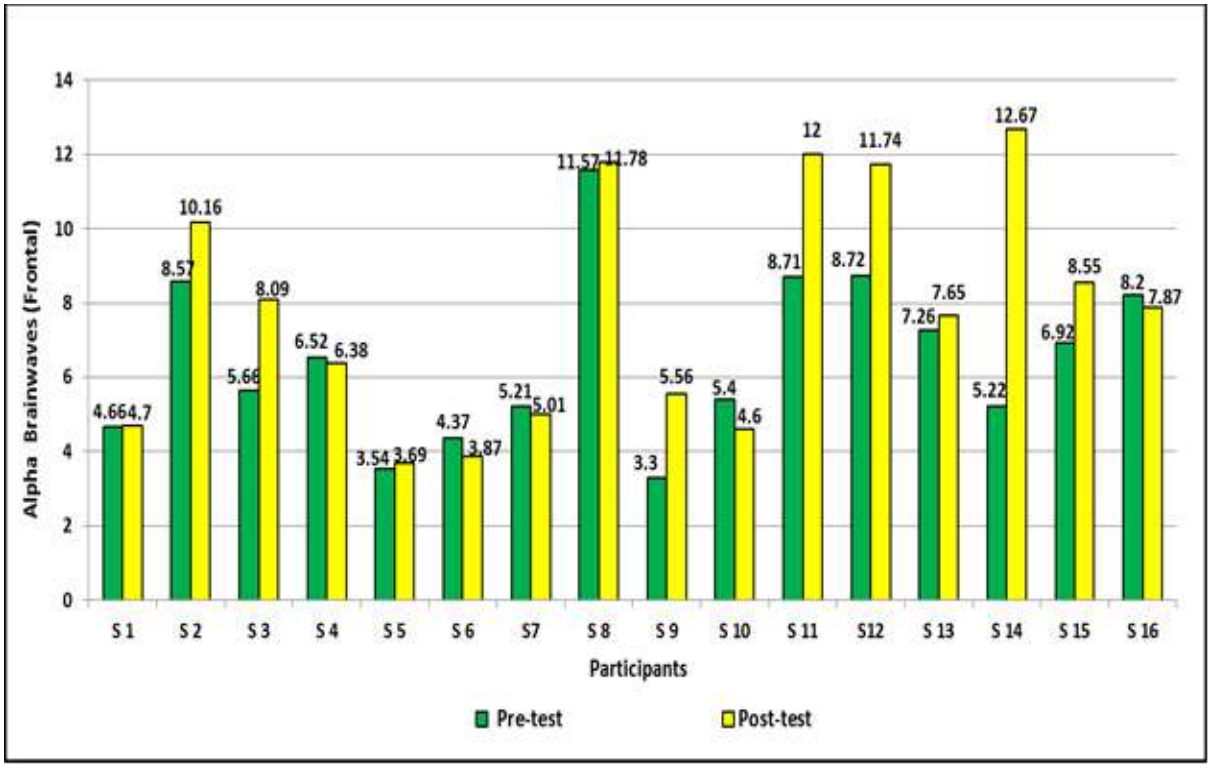

FIGURE 1. Results for Alpha Brainwaves at the Frontal Area

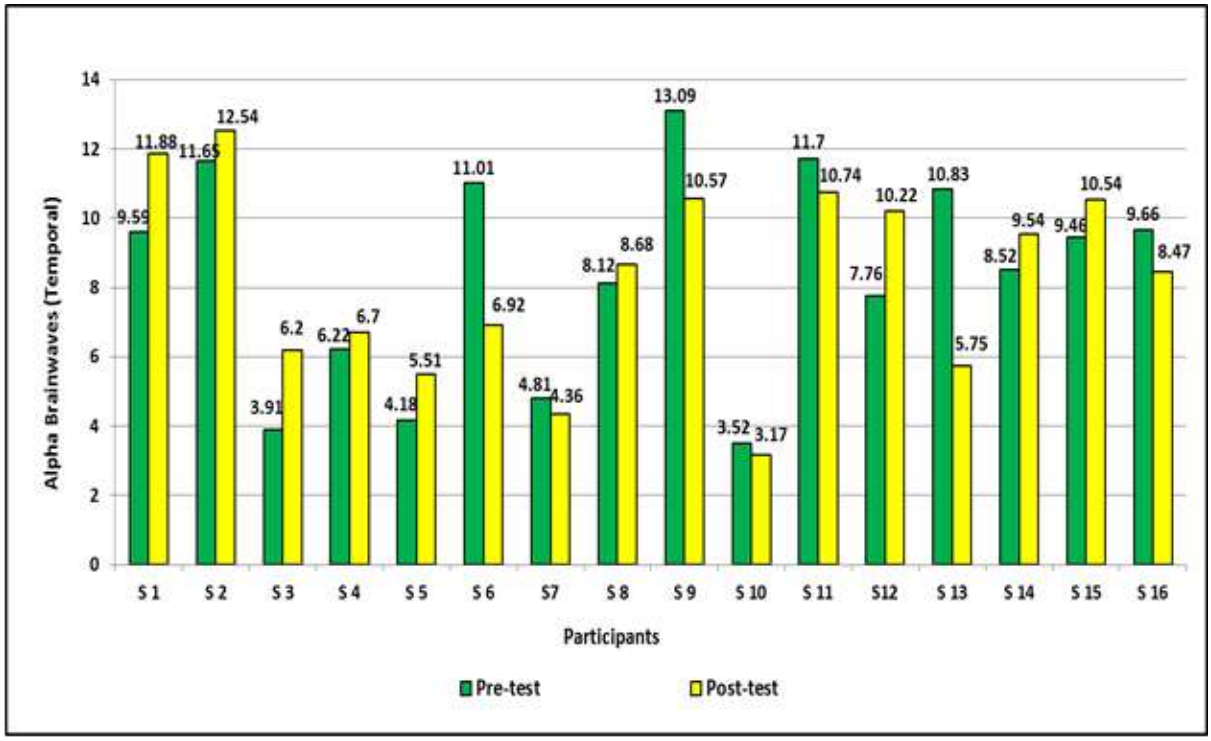

FIGURE 2. Results for Alpha Brainwaves at the Temporal Area

Table 1 showed the significant increase of alpha brainwaves at frontal area t (15) = -2.428, p = 0.028 when using yellow overlays while reading. In contrast, no significant differences were found at temporal areas using yellow overlays.

TABLE 1
Results for Alpha Brainwaves at Frontal and Temporal Area (Pre-Test and Post-Test)

Area	Mean	SD	t	df	Sig.
Frontal					
(Pre-Test)	6.490	2.246			
			-2.428	15	**0.028**
(Post-Test)	7.770	3.118			
Temporal					
(Pre-Test)	8.375	3.056			
			0.254	15	**0.803**
(Post-Test)	8.235	2.795			

Beta Brainwaves

Figure 3 and Figure 4 show the results of beta brainwaves at the frontal and temporal area for the pre-test (without yellow overlays) and post-test (yellow overlays) while reading. The results for beta brainwaves at frontal and temporal areas show an improvement for 12 participants while using yellow overlays. However, both areas showed a reduction for 4 participants when using yellow overlays while reading.

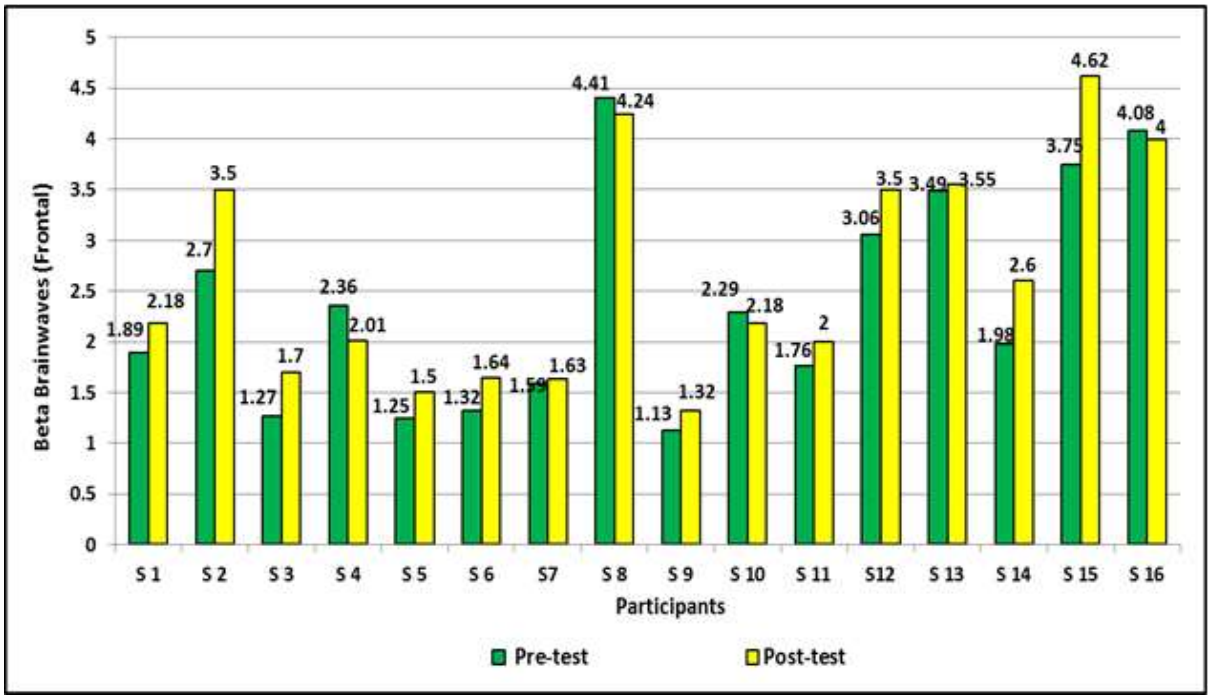

FIGURE 3. Results for Beta Brainwaves at the Frontal Area

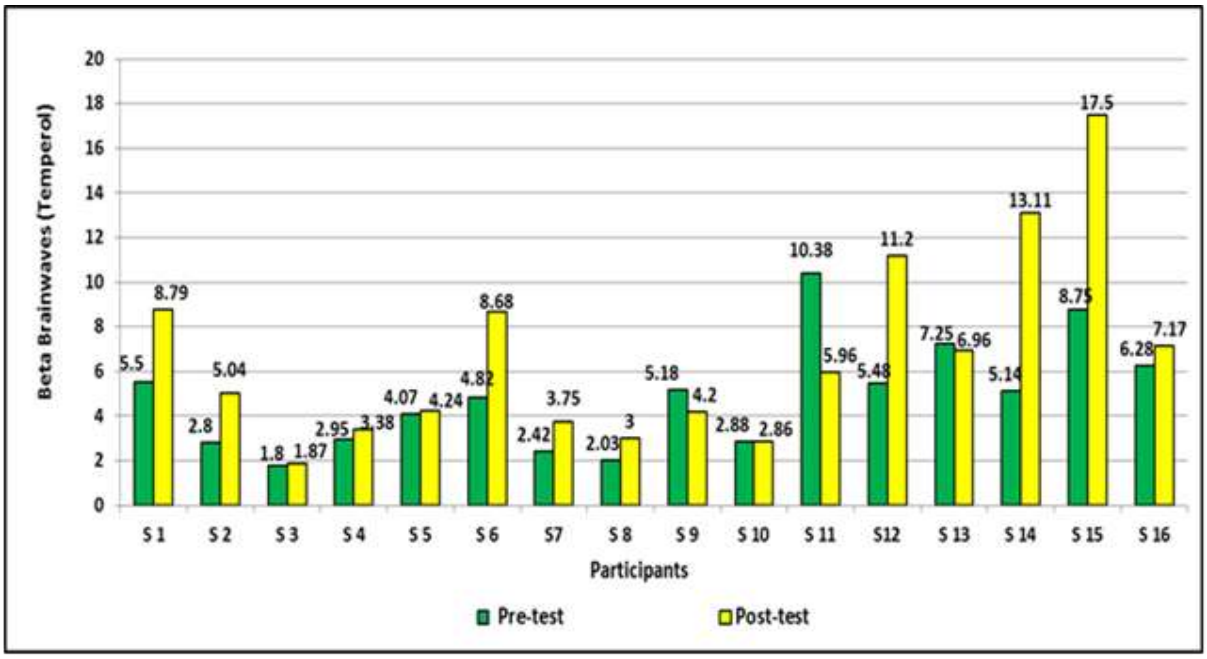

FIGURE 4. Results for Beta Brainwaves at the Temporal Area

Table 2 indicated the significance increasing in beta brainwaves at frontal area t (15) = -2.791, p = 0.014 and temporal area t (15) = -2.218, p = 0.042 by using yellow overlays when reading.

TABLE 2
Results for Beta Brainwaves at Frontal and Temporal Area (Pre-Test and Post-Test)

Area	Mean	Std. Deviation	t	df	Sig.
Frontal					
(Pre-Test)	2.397	1.074			
			-2.791	15	**0.014**
(Post-Test)	2.635	1.09			
Temporal					
(Pre-Test)	4.855	2.451			
			-2.218	15	**0.042**
(Post-Test)	6.731	4.271			

Discussion

In this research, the results of alpha brainwaves only showed a significant difference t (15) = -2.428, p = 0.028 at the frontal area when using yellow overlays while reading. These results align with those previously studied by (Fauzan and Zani, 2017). They found that while using overlays when reading Surah Ar-Rahman from the Holy Quran, the respondent showed a significant increase in alpha waves at the frontal area.

Besides, Fauzan and Amran (2015) also found that respondents with ASD showed a deficiency of beta waves in most areas of the brain. As a result, they might have attention

problems, learning disabilities, and suffer from brain damage (Zukiwski, 2021). In this research, the results show the significance differences at frontal t (15) = -2.791, p = 0.014 and temporal area t (15) = -2.218, p = 0.042 in beta brainwaves while using yellow overlays when reading. Thus, from these results, it can be concluded that by using overlays, the brainwaves increase. In other words, it can make the readers give extra attention while reading, and the reading achievement was improved (Cardinal et al., 1993).

The results of this research have shown that by using yellow overlays, the beta brainwaves increase at frontal and temporal areas. However, the increase only occurs at the frontal area for the alpha brainwaves. Thus, the reading achievements of the respondents have been improved because their attention was increased after using yellow overlays. This result accords with earlier research by Kumar et al (2013), which discovered that with the use of yellow colour settings, the respondents could finish the tasks faster because this colour can affect emotions. Consequently, the respondents' achievements can be improved. Ray et al (2005) observed that yellow filters can improve magnocellular activity in children with reading difficulties, so their reading achievements are also being improved. Additionally, the yellow colour produces more serotonin which is important for controlling mood, and the people surrounded by this colour feel more positive and happy. Therefore, their performances also improved while using the yellow colour (Berger et al., 2009; Cerrato, 2012; Kumar et al., 2013).

Conclusion

In a nutshell, this research is expected to identify the best approach for these particular children in enhancing their reading skills and ability. Hence, it significantly improves beta brainwaves at frontal and temporal areas. Meanwhile, a significant difference only occurs at the frontal area when using yellow overlays for the alpha brainwaves. This research reveals that yellow overlays can be used as interventions to increase reading achievement and produce extra attention for ASD children with the Irlen Syndrome symptoms. Overall, the result from this study has given important implications for ASD children with Irlen Syndrome symptoms to help them increase their performance in the reading activity. In the meantime, the parents, educators, and community can play a vital role in supporting and motivating these particular children for better self-esteem until they can read faster, longer, and fluently. Additionally, this research can contribute to the body of knowledge relating to this particular area. The research framework used in this research can also be applied as a guideline for other researchers who would like to conduct further research in a similar area.

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