

Brainwave Music as a Supportive Intervention for Improving Reading Skills in Students with Dyslexia

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ABSTRACT

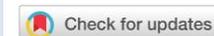
This study aims to analyze the effect of Brainwave Music on the reading ability of students with dyslexia at Sekolah Luar Biasa (Special Needs School) Negeri 2 Makassar. Reading ability is a fundamental skill for learners; however, it often becomes a major obstacle for children with dyslexia. This study employed a quantitative approach using a quasi-experimental design with a pre-test and post-test control group design. The research sample consisted of eight students identified as having dyslexia based on the screening results of the Colorado Learning Disabilities Questionnaire Research (CLDQ-R), who were divided into an experimental group and a control group. The research instrument was a reading ability test covering letter reading, syllable reading, word reading, and sentence reading. The experimental group received Brainwave Music intervention for 10 days, while the control group received no treatment. Data were analyzed using the Shapiro–Wilk test, Wilcoxon test, and MANOVA. The results showed that Brainwave Music had a significant effect on improving letter reading and word reading abilities in the experimental group, with p -values < 0.05 . However, no significant effect was found on syllable reading and sentence reading abilities. In the control group, no significant differences were found between pre-test and post-test scores across all aspects of reading ability. It indicates that Brainwave Music is effective as a supportive method for improving basic reading skills in individuals with dyslexia, particularly in letter recognition and word reading.

Keywords: *Brainwave Music, dyslexia, reading ability, special needs school*

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1. Introduction

Reading ability is a fundamental skill in the learning process, particularly for students at the primary education level. Reading not only functions as a means of obtaining information but also serves as a foundation for cognitive, linguistic, and overall academic development. Snowling and Hulme (2020) emphasize that early reading ability plays a crucial role in shaping long-term academic success, as reading serves as a gateway to mastering other subjects. Therefore, delays or impairments in reading ability can have wide-ranging effects on students' academic and psychosocial development (Tammasse et al., 2019; Junaid et al., 2023).

However, not all students are able to acquire reading skills effectively. One of the most common learning disorders associated with reading difficulties is dyslexia. According to the American Psychiatric Association (2022), dyslexia is a specific learning disorder characterized by persistent difficulties in word reading accuracy and fluency that are not caused by intellectual, sensory, or educational deprivation. Recent research by Peterson and Pennington (2021) also indicates that dyslexia is closely associated with deficits in phonological processing, which affect the ability to recognize and connect letters with their corresponding sounds.

Dyslexia is frequently found among students in special needs schools (Sekolah Luar Biasa/SLB), including SLB Negeri 2 Makassar, which provides educational services for children with diverse special needs. Children with dyslexia generally experience difficulties in recognizing letters and reading syllables, words, and sentences fluently. According to Lyon et al. (2020), reading difficulties in children with dyslexia can lead to low self-confidence, increased learning anxiety, and decreased academic motivation if not addressed through appropriate interventions.

Based on initial observations and teachers' recommendations at SLB Negeri 2 Makassar, several students were identified as exhibiting learning difficulties, particularly in reading ability. These students experienced obstacles in letter recognition, syllable and word reading, and understanding simple texts. This condition negatively affected their academic achievement and classroom engagement. In line with this, Fletcher et al. (2021) emphasize that early and sustained intervention is essential to help children with dyslexia optimally develop basic reading skills.

Various methods have been developed to improve reading ability in children with dyslexia, including pedagogical approaches, cognitive therapy, and sensory stimulation. One alternative approach that has received increasing attention over the past five years is the use of Brainwave Music. According to Chaudhury and Banerjee (2020), music with specific frequencies can influence brainwave activity and help create optimal states of relaxation and focus for learning. Research by Fernández-Sotos et al. (2022) also demonstrates that music stimulation can enhance attention and cognitive readiness in children with learning difficulties.

Brainwave Music refers to music designed with specific frequencies to influence brainwaves, such as alpha and theta waves, which are associated with relaxation and focused attention. According to Thaut and Hoemberg (2021), a relaxed yet alert brain state strongly supports language learning and linguistic information processing. Therefore, Brainwave Music is expected to assist children with dyslexia in processing visual and linguistic information more effectively, particularly during the early stages of reading.

This study was conducted to examine the effect of Brainwave Music on the reading ability of students with dyslexia at SLB Negeri 2 Makassar. The study focused on four aspects of reading ability: letter reading, syllable reading, word reading, and sentence reading. The results indicate that Brainwave Music had a significant effect on improving letter and word reading abilities in the experimental group, while no significant effect was found for syllable and sentence reading. Meanwhile, no significant differences were observed between pre-test and post-test results in the control group across all aspects of reading ability.

These findings are consistent with Snowling's (2021) assertion that interventions enhancing focus and cognitive readiness tend to be more effective for basic reading skills than for higher-level reading skills. Therefore, Brainwave Music has potential as a supportive method for improving basic reading ability, particularly letter recognition and word reading, among children with dyslexia. This study is expected to contribute scientifically to the development of applicable learning strategies and non-pharmacological interventions in special needs schools.

2. Literature Review

2.1 Dyslexia

Dyslexia is a form of specific learning disability that primarily affects reading, writing, and spelling abilities. The International Dyslexia Association (IDA) defines dyslexia as a disorder characterized by difficulties with accurate and/or fluent word recognition, poor spelling ability, and difficulties in decoding, which are typically caused by deficits in the phonological component of language. This disorder is neurobiological in nature and is not related to intelligence level, learning motivation, or access to educational opportunities (Snowling & Hulme, 2020; Peterson & Pennington, 2021; Junaid et al., 2025).

Recent neurocognitive research indicates that dyslexia is associated with differences in the functioning and connectivity of brain areas involved in language processing, particularly within phonological and visual-verbal pathways (Ozernov-Palchik & Gaab, 2021). Children with dyslexia often experience difficulties in distinguishing letters that have similar shapes or sounds, such as b-d, p-q, or m-n, which subsequently affects reading accuracy and fluency. In the context of inclusive education and special schools, dyslexia requires structured, multisensory, and

continuous instructional approaches. Lyon et al. (2020) emphasize that without appropriate intervention, children with dyslexia are at risk of long-term academic difficulties as well as psychosocial problems, such as low self-confidence and increased learning anxiety.

2.2 Reading Ability in Children with Dyslexia

Reading ability is a complex cognitive process that involves visual symbol recognition, phonological processing, integration of sound and meaning, and language comprehension. Snowling (2021) states that reading is not merely a mechanical activity, but rather the result of coordination among visual, auditory, and linguistic systems that develop gradually.

In general, reading ability can be classified into several stages: letter reading, syllable reading, word reading, and sentence reading. In children with dyslexia, reading difficulties are most prominent at the early stages, particularly in letter recognition and in associating letters with their corresponding sounds (grapheme–phoneme correspondence) (Peterson & Pennington, 2021; Tammasse et al., 2025; Rahman & Weda, 2019). These difficulties subsequently affect the ability to read words and sentences fluently.

Research by Fletcher et al. (2021) shows that children with dyslexia require greater cognitive effort when reading, making them more susceptible to mental fatigue and loss of focus, especially when dealing with longer texts. Therefore, in learning activities at special schools, strengthening basic reading skills such as letter and word recognition becomes a primary priority before training higher-level reading skills and reading comprehension.

2.3 Brainwave Music

Brainwave Music is a type of music designed to stimulate specific brain waves through sound frequencies, such as alpha, beta, theta, and delta waves. Each type of brain wave has a different function: alpha waves are associated with relaxation and light focus, beta waves with active concentration, theta waves with learning and creativity, and delta waves with sleep and recovery (Thaut & Hoemberg, 2021). In educational and therapeutic contexts, Brainwave Music is used to create optimal brain conditions for learning processes. Chaudhury and Banerjee (2020) explain that frequency-based music stimulation can help reduce anxiety levels, increase attention, and improve concentration, particularly in individuals with learning difficulties and attention problems.

Recent studies also indicate that music with specific brainwave stimulation can enhance basic cognitive performance, such as visual attention and learning readiness (Fernández-Sotos et al., 2022). This serves as the foundation for using Brainwave Music as a supportive method in learning for children with dyslexia.

2.4 Brainwave Music and Reading Ability

The relationship between Brainwave Music and reading ability can be explained through a neurocognitive perspective. Reading requires coordination among various brain areas involved in visual, auditory, and language processing. In children with dyslexia, this coordination often does not function optimally, thereby hindering decoding processes and word recognition (Ozernov-Palchik & Gaab, 2021; Tammasse et al., 2022). Brainwave Music that stimulates alpha and theta waves is believed to create a more relaxed yet alert brain state, thereby enhancing cognitive readiness to receive and process linguistic information. Thaut and Hoemberg (2021) state that this condition is highly supportive of language learning and basic reading skills.

Several studies over the past five years indicate that the effects of Brainwave Music tend to be more significant on basic cognitive skills than on more complex skills (Snowling, 2021; Fernández-Sotos et al., 2022). This finding is consistent with the results of this study, in which significant improvements were found in letter and word reading abilities, but not in syllable and sentence reading, which require higher levels of linguistic integration and comprehension.

3. Method

This study employed a quantitative approach with a quasi-experimental design. This design was used to examine the effect of Brainwave Music on the reading ability of individuals with dyslexia by involving a treatment group and a control group. The study applied a pre-test and post-test control group design, in which reading ability was measured before and after the intervention. The treatment group received Brainwave Music intervention, while the control group did not receive any treatment. In addition to quantitative measurements, this study also involved interviews with teachers or homeroom teachers as supporting data in the initial screening process.

The population of this study consisted of all students enrolled at State Special School (SLB) Negeri 2 Makassar. Sample selection was conducted using total sampling technique, in which all students who met the inclusion criteria and did not meet the exclusion criteria were included as research samples. Based on the screening results using the Colorado Learning Disabilities Questionnaire Research (CLDQ-R) and interviews with teachers, eight students met the research criteria and were subsequently divided into two groups: the treatment group and the control group.

The inclusion criteria of this study included students who were willing to participate, students who experienced reading difficulties, and students identified as having dyslexia based on the CLDQ-R screening results. The exclusion criteria included students with communication and interaction disorders, visual, hearing, and intellectual impairments, students with Attention Deficit Hyperactivity Disorder (ADHD), and students who withdrew from the study for certain reasons. Samples were declared dropouts if

they did not complete the entire intervention process or did not participate in either the pre-test or post-test of reading ability.

The study was conducted at State Special School (SLB) Negeri 2 Makassar from September to December 2018. The selection of the research location was based on the availability of students who met the research criteria and the support provided by the school for the implementation of the study. The instruments and materials used in this study included the Colorado Learning Disabilities Questionnaire Research (CLDQ-R) dyslexia screening questionnaire, a letter screening test developed by Abdurrahman (2003), Brainwave Music as the intervention medium, observation sheets and teacher interview guidelines, and audio devices for playing Brainwave Music.

Data collection was conducted using pre-test and post-test methods. Prior to the intervention, all samples were given a pre-test of reading ability using the letter screening test. The reading ability test consisted of four components: reading 34 letters, 10 syllables, 6 words, and 5 sentences. After the pre-test, the treatment group received the intervention in the form of listening to Brainwave Music for approximately 45 minutes every night for 10 consecutive days, while the control group did not receive any intervention. After the entire intervention process was completed, all samples were given a post-test using the same instrument to assess changes in reading ability.

The obtained data were processed and analyzed using Microsoft Excel 2013 and SPSS version 24. Data analysis began with a normality test using the Shapiro–Wilk Test to determine data distribution. Differences between pre-test and post-test scores were analyzed using the Wilcoxon test because some of the data were not normally distributed. To examine the simultaneous effect of Brainwave Music on reading ability between the treatment and control groups, multivariate analysis using MANOVA was conducted. The results of data analysis were presented in the form of tables and descriptive explanations, organized according to the research objectives and variables examined, namely letter reading ability, syllable reading, word reading, and sentence reading.

This study was conducted with careful consideration of research ethics. Prior to the implementation of the study, the researcher obtained ethical approval and recommendations from the Research Ethics Committee of the Faculty of Medicine, Universitas Hasanuddin. The study was also conducted after obtaining written consent from parents or guardians of the participants through informed consent. The ethical approval for this study was granted under approval number 871/H4.8.4.5.31/PP36-KOMETIK/2018.

4. Results and Discussion

4.1 Results

Brainwave Music is a type of music designed to stimulate specific brain waves through sound frequencies

This section presents the research findings obtained during the implementation of the study at State Special School (SLB) Negeri 2 Makassar. The results include a general overview of the research setting, the characteristics of the research subjects, and the results of measuring the reading abilities of students with dyslexia before and after the intervention in the form of Brainwave Music. The data presented in this section were obtained through observations, interviews, and the results of pre-tests and post-tests that were statistically analyzed.

Table 1. Learning Load of Face-to-Face Activities at SLB Negeri 2 Makassar

Grade	1 Lesson Hour (minutes)	Hours/Week	Effective Weeks	Time/Year (minutes)	Total Hours/Year
1–2	30	32	36	34,560	576
3	30	34	36	36,720	612
4–6	30	38	34–36	38,760– 41,040	646–684

Source: Curriculum Book of SLB Negeri 2 Makassar

Table 1 shows the learning load of face-to-face instructional activities at SLB Negeri 2 Makassar based on grade level. Each instructional hour lasts for 30 minutes. It can be seen that the number of instructional hours per week and per year increases according to grade level. This learning load is adjusted to the characteristics and needs of students with special needs, so that the learning process can take place optimally without imposing excessive burdens on the students.

Table 2. Sample Data of the Treatment Group and Control Group

No	Code	Treatment (Male)	Treatment (Female)	Control (Male)	Control (Female)
1	A	–	–	–	√
2	B	–	–	–	√
3	C	–	–	–	√
4	D	√	–	–	–
5	E	√	–	–	–
6	F	–	–	√	–
7	G	√	–	–	–
8	H	√	–	–	–

Total	4	0	1	3
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Source: Primary Data

Table 2 illustrates the distribution of the research sample consisting of a treatment group and a control group based on gender. The total sample consisted of eight students, with four students in the treatment group and four students in the control group. The treatment group consisted entirely of male students, while the control group consisted of one male student and three female students. This grouping was based on the results of the screening process and the pre-test scores of reading ability.

Table 3. Pre-test and Post-test Data of the Treatment Group

No	Code	Letter Pre	Letter Post	Syllable Pre	Syllable Post	Word Pre	Word Post	Sentence Pre	Sentence Post
1	D	20.6	32.4	30	40	0	33.3	0	20
2	E	47.0	55.8	40	40	0	16.7	0	0
3	G	44.1	67.6	70	80	0	16.7	0	0
4	H	50.0	61.7	80	80	83.3	100	60	60

Source: Primary Data

Table 3 presents the pre-test and post-test results of reading ability in the treatment group. In general, all samples in the treatment group showed an improvement in letter and word reading abilities after being given Brainwave Music. Improvements in syllable and sentence reading abilities did not occur evenly across all samples. This indicates that the provision of Brainwave Music tends to have a greater impact on basic reading skills than on more complex reading abilities.

Table 4. Pre-test and Post-test Data of the Control Group

No	Code	Letter Pre	Letter Post	Syllable Pre	Syllable Post	Word Pre	Word Post	Sentence Pre	Sentence Post
1	A	100	100	100	100	100	100	80	80
2	B	100	100	90	100	100	83.3	100	80
3	C	100	100	100	100	100	100	100	100
4	F	70.6	79.4	90	90	83.3	100	60	60

Source: Primary Data

Table 4 shows the pre-test and post-test results of reading ability in the control group. Based on the table, it can be seen that most samples in the control group did not

experience significant changes in scores between the pre-test and post-test. Minor changes that occurred in several aspects of reading are presumed to be caused by routine learning activities at school rather than by any specific intervention.

Table 5. Shapiro–Wilk Normality Test

Reading Test	Group	N	p value
Letter Pre-test	Treatment	4	.086
	Control	4	.001
Letter Post-test	Treatment	4	.375
	Control	4	.001
Syllable Pre-test	Treatment	4	.488
	Control	4	.024
Syllable Post-test	Treatment	4	.024
	Control	4	.001
Word Pre-test	Treatment	4	.001
	Control	4	.001
Word Post-test	Treatment	4	.051
	Control	4	.001
Sentence Pre-test	Treatment	4	.001
	Control	4	.272
Sentence Post-test	Treatment	4	.161
	Control	4	.683

Table 5 presents the results of the data normality test using the Shapiro–Wilk Test. The results indicate that most variables have p values below 0.05, suggesting that the data are not normally distributed. Therefore, further statistical analyses were conducted using non-parametric tests, namely the Wilcoxon test and MANOVA.

Table 6. Wilcoxon Test Results for the Treatment Group

Variable	p value	Interpretation
Letter	0.023	Significant
Syllable	0.182	Not significant

Word	0.015	Significant
Sentence	0.391	Not significant

The Wilcoxon test results for the treatment group indicate significant differences between pre-test and post-test scores in letter reading and word reading ($p < 0.05$). In contrast, syllable reading and sentence reading did not show significant differences. These findings suggest that Brainwave Music is effective in improving basic reading skills in students with dyslexia.

Table 7. Wilcoxon Test Results for the Control Group

Variable	p value	Interpretation
Letter	0.391	Not significant
Syllable	0.391	Not significant
Word	1.000	Not significant
Sentence	0.391	Not significant

Table 7 shows the results of the Wilcoxon test for the control group. All reading variables have p values greater than 0.05, indicating no significant differences between pre-test and post-test scores. This finding suggests that, without Brainwave Music intervention, students' reading abilities did not show meaningful improvement.

Table 8. Differences Between Pre-test and Post-test Scores

Group	Code	Letter	Syllable	Word	Sentence
Treatment	D	11.8	10	33.3	20
	E	8.8	0	16.7	0
	G	23.5	10	16.7	0
	H	11.7	0	16.7	0
Control	A	0	0	0	0
	B	0	10	-16.7	-20
	C	0	0	0	0
	F	8.8	0	16.7	0

Table 8 illustrates the differences between pre-test and post-test reading scores in both the treatment and control groups. The treatment group shows positive score differences in letter and word reading, whereas the control group generally shows zero

or negative differences. These results further support the statistical findings that Brainwave Music has an effect on specific reading abilities.

Table 9. MANOVA Test Results

Variable	df	Mean Square	p value	Interpretation
Letter	1	276.125	.024	Significant
Syllable	1	12.500	.537	Not significant
Word	1	869.445	.040	Significant
Sentence	1	200.000	.207	Not significant

Table 9 presents the MANOVA results comparing the differences in reading ability scores between the treatment and control groups. The analysis reveals significant differences in letter reading and word reading ($p < 0.05$). Conversely, no significant differences were found in syllable reading and sentence reading. These findings confirm that Brainwave Music has a significant effect on basic reading skills.

4.2 Discussion

This discussion aims to interpret the research findings regarding the effect of Brainwave Music on the reading ability of students with dyslexia at SLB Negeri 2 Makassar. The discussion focuses on four aspects of reading ability, namely letter reading, syllable reading, word reading, and sentence reading, and relates the findings to relevant theories and previous studies.

4.3 The Effect of Brainwave Music on Letter Reading Ability

The results indicate that Brainwave Music had a significant effect on letter reading ability in the treatment group. This is evidenced by the Wilcoxon and MANOVA test results, which showed p values < 0.05 . The improvement in letter reading ability suggests that Brainwave Music can assist students with dyslexia at the initial stage of linguistic symbol recognition.

This finding is consistent with Shaywitz (2003), who states that the primary difficulty experienced by children with dyslexia lies in phonological processing and letter symbol recognition. Brainwave Music, which stimulates alpha and theta brain waves, can create a state of relaxation and focused attention, enabling the brain to more effectively receive and process visual and auditory information simultaneously. This condition supports the association between letter forms and their corresponding sounds, which is fundamental to reading development.

Furthermore, Jensen (2008) explains that music with specific frequencies can enhance attention and reduce emotional tension, making it particularly beneficial for

learners with learning difficulties. Therefore, the improvement in letter reading ability observed in this study can be understood as a result of increased focus and cognitive readiness during the learning process.

4.4 The Effect of Brainwave Music on Word Reading Ability

The findings also reveal a significant improvement in word reading ability in the treatment group. This result reinforces the improvement observed in letter reading, as word reading is a continuation of the process of letter recognition and sound blending (decoding).

According to Snowling (2013), children with dyslexia experience difficulties in word decoding due to weak integration between visual and phonological representations. Brainwave Music may facilitate this process by enhancing concentration and reducing cognitive load during reading. When the brain is in a calmer and more focused state, children with dyslexia are better able to process sequences of letters into meaningful words.

These findings are also in line with Hallam (2015), who reported that music can enhance basic cognitive performance, particularly in tasks requiring attention and simple information processing. Thus, the effectiveness of Brainwave Music in improving word reading ability suggests that this intervention is more influential for basic reading skills than for higher-level reading skills.

4.4 The Effect of Brainwave Music on Syllable and Sentence Reading Ability

In contrast to letter and word reading abilities, the results indicate that Brainwave Music did not have a significant effect on syllable and sentence reading abilities. This is reflected in p values > 0.05 in both the Wilcoxon and MANOVA tests. This finding can be explained by the reading processing theory proposed by Perfetti (2007), which states that syllable and sentence reading require the integration of decoding skills, syntactic processing, working memory, and semantic comprehension. These processes are considerably more complex than isolated letter or word recognition.

Brainwave Music primarily functions as a facilitator of cognitive readiness rather than a direct intervention targeting higher-level linguistic skills. Therefore, the relatively short intervention duration (10 days) may not have been sufficient to produce a significant impact on complex reading skills such as sentence reading, which requires deeper semantic and syntactic understanding. This explanation is supported by Vellutino et al. (2004), who emphasize that improvements in advanced reading skills among children with dyslexia require systematic, intensive, and long-term interventions, particularly those focusing on reading strategies and text comprehension.

4.5 Comparison Between the Treatment and Control Groups

The findings show that the control group did not experience significant improvements in reading ability across all measured aspects. This indicates that the improvements observed in the treatment group were not due to routine classroom instruction but were attributable to the Brainwave Music intervention.

The differences between the treatment and control groups strengthen the validity of the study's findings. As noted by Creswell (2014), the use of a control group in quasi-experimental research allows researchers to isolate the effect of the treatment variable on the dependent variable. Therefore, Brainwave Music can be considered to have a tangible contribution to improving basic reading skills in children with dyslexia.

4.6 Theoretical and Practical Implications

Theoretically, this study supports a neurocognitive approach to reading instruction for children with dyslexia, emphasizing the importance of brain readiness, attention, and emotional regulation in the learning process. Brainwave Music can be viewed as a supportive strategy that helps create optimal learning conditions.

Practically, the findings provide implications for teachers and special schools in utilizing Brainwave Music as a supplementary method in teaching basic reading skills. Although it cannot replace conventional instructional methods, Brainwave Music can be used as an additional intervention to enhance concentration and learning readiness in students with dyslexia.

5. Conclusion

Based on the research findings and discussion regarding the effect of Brainwave Music on the reading ability of students with dyslexia at SLB Negeri 2 Makassar, several conclusions can be drawn. First, Brainwave Music has a significant effect on improving letter reading ability in students with dyslexia, indicating that it supports the initial stage of linguistic symbol recognition by enhancing focus and cognitive readiness.

Second, Brainwave Music also has a significant effect on word reading ability in the treatment group. This improvement suggests that a more relaxed and focused brain state can support word decoding processes, which are fundamental reading skills for children with dyslexia. Third, Brainwave Music does not have a significant effect on syllable reading or sentence reading abilities. This finding indicates that more complex reading skills require more intensive, systematic, and long-term instructional interventions and cannot be sufficiently improved through cognitive readiness stimulation alone.

Fourth, no significant differences were found between pre-test and post-test results in the control group across all reading aspects. This confirms that the improvements observed in the treatment group were due to the Brainwave Music

intervention rather than routine classroom instruction. Overall, this study concludes that Brainwave Music has potential as a supportive method for improving basic reading skills, particularly letter and word reading, among children with dyslexia in special education settings.

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