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The Effect of Audiolyfe Stimulation on Cognitive Development (Intelligence, Memory, and Learning Motivation in Children) in Banda Aceh

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ABSTRACT

Cognitive development is a crucial aspect of a child's growth, encompassing thinking skills, memory, and learning motivation. This study aims to analyze the impact of Audiolyfe stimulation on the cognitive development of children aged 0–12 years in Banda Aceh, focusing on enhancing intelligence, memory, and learning motivation. A quasi-experimental method was employed with 20 children as participants. Data were collected through observation and questionnaires and analyzed descriptively. The results revealed that Audiolyfe significantly influenced children's cognitive development. Children who received this stimulation demonstrated increased intelligence, improved memory, and higher learning motivation compared to the control group. The effectiveness of Audiolyfe is attributed to the impact of sound waves on neurological activity in the auditory cortex and memory areas of the brain. Additionally, Banda Aceh's local culture—such as the tradition of listening to stories and traditional music—reinforced children's positive responses to this stimulation. This study concludes that Audiolyfe is an innovative and effective approach to supporting children's cognitive development. It is recommended that Audiolyfe be integrated into formal and informal education programs in Banda Aceh to optimally improve children's learning quality.

KEYWORDS Stimulation; Audiolyfe; Cognitive Development; Intelligence; Children's Passion for Learning.

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INTRODUCTION

Cognitive development is one of the main aspects of children's growth that plays an important role in learning, thinking, and problem-solving processes (Bjorklund, 2022; Chen, 2025; Dridi et al., 2025; Weber & Greiff, 2023). Understanding children's cognitive development, especially in the early stages of

life, is very crucial. Research in this field can provide valuable insights into how children develop knowledge, solve challenges, and interact with their environment (Hasibuan et al., 2024). The cognitive system itself can be understood as a complex mechanism in humans that helps process information through acquisition, storage, processing, and transmission (Basri, 2018).

The cognitive aspect is closely related to individuals' success in various areas of life. These cognitive abilities form the foundation for developing other skills, including communication, motor, social, emotional, and adaptive skills. The direct relationship between cognitive skill development and other skills suggests that success in these aspects can significantly impact individual achievement across fields (Darouich, 2017). Therefore, the learning processes children undergo, including cognitive development, demand serious attention (Dasen, 2022; Garaigordobil, 2023).

This research was conducted in Banda Aceh, an area with a rich local culture and strong tradition of community-based education (Nurhayati & Rizal, 2021). Habits of listening to folklore, traditional music, and oral-based activities—deeply embedded in Banda Aceh culture—are important factors influencing children's responses to audio-based stimulation (Syahputra, 2020). This cultural context makes Banda Aceh an ideal setting for investigating audio-based cognitive interventions, as the population's familiarity with auditory learning may enhance receptivity to such stimulation methods.

Developing and strengthening cognitive skills from an early age is a strategic step toward supporting individuals' lifelong success. During growth periods, stimulation provided to children determines increases in intelligence, memory, and enthusiasm for learning. Therefore, parents and educators bear great responsibility to deliver appropriate stimulation from an early age to foster optimal child development (Ilhami, 2022).

Along with advancements in modern technology, various learning methods and cognitive stimulation techniques have seen significant progress. One innovative approach attracting attention is Audiolyfe, a sound wave-based technology designed to stimulate neurons in the brain to improve children's cognitive abilities. Audiolyfe works through sound wave therapy aimed at strengthening integration between the left and right brain hemispheres. This integration is considered essential for a wide range of cognitive functions, including memory, concentration, and learning motivation.

Previous research has shown that audio stimulation holds great potential for supporting children's cognitive development. This method is associated with improvements in memory, focus, and learning motivation. For example, Mesiono et al. (2020) found an increase in average cognitive development scores among children at Dwi Utama Kindergarten before and after audio-based treatment.

Another study by Muliyil and Dhiksha (2022) states that audio-based training can enhance children's attention and working memory. Audio captivates children's interest, making listening enjoyable. Additionally, audio-based interventions in schools offer advantages like promoting relaxation while supporting cognitive development; results show improvements in concentration, reading accuracy, and overall cognitive growth.

Another study by Ardi and Fauziyah (2018) highlighted the relationship between audio stimulation and improved memory. It showed that using audio in learning can stimulate brain areas involved in information storage and retrieval, such as the hippocampus and prefrontal cortex. Audio stimulation with specific rhythmic patterns increases alpha and gamma brain wave activity, which plays a key role in memory consolidation and new information integration. Moreover, soothing audio reduces activity in the limbic system, particularly the amygdala, which governs stress responses. This reduction creates optimal conditions for cognitive functions, including memory. Thus, the interaction between audio stimulation and brain function provides a strong scientific basis for using audio to enhance memory and cognitive performance, especially in children undergoing learning processes.

Despite the growing body of literature on audio-based cognitive interventions, several research gaps remain unaddressed. First, while existing studies have examined various forms of audio stimulation, few have specifically investigated the effects of Audiolyfe technology on children's cognitive development in a culturally specific context. Second, most previous research has focused on single cognitive domains such as memory or attention, whereas comprehensive assessments of multiple functions intelligence, memory, and learning motivation simultaneously remain limited. Third, the specific mechanisms of Audiolyfe, particularly its integration of brainwave entrainment with culturally resonant audio elements, have not been thoroughly explored.

The novelty of this study lies in three main aspects: (1) it is among the first to investigate Audiolyfe stimulation as a comprehensive cognitive development tool in children aged 4–12 years; (2) it examines the intervention within the unique cultural context of Banda Aceh, where traditional oral and auditory learning practices may enhance audio-based stimulation effectiveness; and (3) it employs a holistic approach by simultaneously measuring effects on intelligence, memory, and learning motivation, providing a more complete picture of cognitive outcomes. Audiolyfe was chosen for this research due to its design features integrating structured sound frequencies with neuroscientific principles, making it suitable for examining targeted audio stimulation and cognitive enhancement in children.

However, although technologies like Audiolyfe hold great potential, their effectiveness in supporting children's cognitive development requires further

research. Empirical validation through rigorous experimental methods is essential to establish evidence-based practices for educational settings. Additional studies are needed to fully understand impacts on intelligence, memory, and enthusiasm for learning. This research aims to produce findings that contribute to more effective stimulation methods, optimally supporting children's education and cognitive growth in Indonesia. The results can offer new insights for educators, guide parents and program developers in designing appropriate interventions, and advance child development. Thus, the main goal is to explore Audiolyfe stimulation's influence on children's cognitive development—focusing on intelligence, memory, and enthusiasm for learning improvements. Specifically, this research addresses: To what extent does Audiolyfe stimulation significantly improve cognitive abilities in children within the Banda Aceh context, and what underlying mechanisms contribute to these improvements?

RESEARCH METHOD

This study used a quantitative method with an experimental approach to evaluate the effect of Audiolyfe stimulation on children's cognitive development. Quantitative research methods involve the use of data that is based on numbers and aims to test a particular theory or hypothesis, so that it can support or reject it (Ali, 2022). This approach aims to develop mathematical models, theories, and hypotheses related to the phenomenon being studied, especially to determine the relationships between variables in the targeted population. The population in this study was children aged 4-12 years who experienced various challenges in their cognitive development, such as delays in thinking, difficulty remembering, and low enthusiasm for learning. The research sample was selected using purposive techniques with a total of 22 children.

Data were obtained through direct observation in Banda Aceh of children and the filling out of questionnaires by their daily companions, thus providing an in-depth picture of the child's initial condition before stimulation was given. Data analysis was carried out using descriptive and inferential statistics. Descriptive statistics were used to describe the child's initial condition and the changes that occurred after treatment, while inferential statistics were applied to test the effect of Audiolyfe stimulation on the child's cognitive abilities. This analysis process was designed to determine if there were significant differences between the groups before and after treatment. This study proposes two main hypotheses, namely:

H0: There was no significant effect of Audiolyfe stimulation on the development of cognitive abilities in children which included improvements in the child's intelligence, memory, and enthusiasm for learning.

H1: There is a significant effect of Audiolyfe stimulation on the development of cognitive abilities in children which includes improving children's intelligence, memory, and enthusiasm for learning.

RESULT AND DISCUSSION

The purpose of this study is to analyze cognitive development including improving children's intelligence, memory, and enthusiasm for learning. Data collection was carried out with a pre-test filled in by parents or influencers to measure the cognitive development of the child who was the subject of the study. The initial test is carried out before the audiolyph stimulation is carried out. After stimulation with audiolyph, a post-test is then carried out to measure the child's cognitive development which is again filled by parents or caregivers. The results of the second test were followed by an analysis to see differences in children's development, including improving children's intelligence, memory, and enthusiasm for learning. The following are the descriptive statistical results of the research conducted.

Table 1. Descriptive Statistical Results

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Hours of deviation**
Pretest	22	56	77	68.23	6.102
Posttest	22	80	92	85.55	3.764
Valid N (listwise)	22				

Based on Table 1 regarding the results of descriptive statistics for the pretest and posttest conducted on 22 participants. For the pretest, the recorded scores ranged from 56 to 77, with an average score of 68.23 and a standard deviation of 6.102. This higher standard deviation indicates a greater variation among the participants' pretest values. This could indicate that in the early stages, there is a more significant difference in the participants' abilities or knowledge before participating in the intervention or teaching given.

Meanwhile, in the posttest, there was a clear increase in the value of children's cognitive development. The range of posttest scores was between 80 and 92, with a higher average score of 85.55 and a smaller standard deviation of 3,764. This decrease in standard deviation indicates that posttest results are more centered on average, which means participants have a higher level of consistency after following a given process. This increase in the mean value and decrease in standard deviation indicated a significant improvement after following the intervention carried out between the pretest and posttest. Thus, it can be concluded that participants experienced a fairly clear improvement in the understanding or skills measured in the test.

These results show that Audiolyfe stimulation is effective in improving cognitive development, including improving children's intelligence, memory, and enthusiasm for learning. Although there is an increase in the average, further analysis is needed to ascertain whether this difference is really statistically significant or just a coincidence. Before conducting a Paired Sample T-Test to test the research hypothesis, the first step that must be taken is to test the normality of the data.

Normality test is a statistical method used to determine whether a data or sample follows a normal distribution (Gaussian distribution) (Permana & Ikasari, 2023). This is important because many statistical tests, such as the T-Test, assume that the data used has a normal distribution. If the data is not distributed normally, then the results of the statistical test performed may be invalid. The results of the normality test carried out are as follows.

Table 2. Normality Test Results

Tests of Normality

	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistic	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
Pretest	.148	22	.200*	.939	22	.189
Posttest	.114	22	.200*	.948	22	.290

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

The sample size of the study was less than 50 so the Shapiro-Wilk Test was more suitable for use than other tests in the analysis of normality tests. This test is indeed recommended for small samples because it is more effective in determining whether the data follows a normal distribution. The results of the normality test with the Shapiro-Wilk test showed that the pretest and posttest data had a normal distribution because the significance value (Sig.) for both was greater than 0.05. For the pretest, the Shapiro-Wilk statistical value is 0.939 with a significance of 0.189, while for the posttest, the Shapiro-Wilk statistical value is 0.948 with a significance of 0.290. Since both have significance values greater than 0.05, it can be concluded that the pretest and posttest data are normally distributed.

Once the data is proven to be normally distributed, the next step is to perform a Paired Sample T Test to find out if there is a significant difference between the pre-test and post-test results after the administration of the intervention in the form of Audiolyph stimulation. Determination of significant influence on variables, test criteria are based on significance values (Sig.). If the significance value (Sig.) (2-tailed) is less than 0.05, then the null hypothesis (H0) is rejected and the alternative hypothesis (Ha) is accepted, which means that Audiolyfe stimulation exerts a significant influence. Conversely, if the significance value is greater than

0.05, then the null hypothesis (H0) is accepted and the alternative hypothesis (Ha) is rejected, indicating that there is no significant effect of the intervention (Usmadi, 2020). The results of the paired sample t test are as follows.

Table 3. Paired Sample T Test Results

Paired Samples Test

		Paired Differences					t	df	Significance	
					95% Confidence Interval of the Difference					
		Mean	Hours of deviation	Std. Error Mean	Lower	Upper			One-Sided p	Two-Sided p
Pair 1	Pretest Posttest	-17.318	7.882	1.681	-20.813	-13.823	-10.305	21	<,001	<,001

The Paired Samples Test is used to compare two sets of data that come from the same group or the same subject at two different points in time. Testing is performed between pretest and posttest results to measure the difference that occurs after the intervention. The results of the analysis showed that the average difference between the pretest and posttest was -17.318 with a standard deviation of 7.882, as well as an average standard error of 1.681. The 95% confidence interval for the difference is between -20.813 to -13.823, which suggests that the changes that have occurred are quite large and consistent.

The p-values for the double-sided test (<.001) and single-sided test (<.001) were much smaller than 0.05, suggesting that the difference found between the pretest and posttest was statistically significant. This suggests that Audiolyfe interventions have a significant influence on cognitive development, including improving children's intelligence, memory, and enthusiasm for learning. Thus, audiolyfes managed to have a significant positive impact on changes in cognitive abilities measured through pretest and posttest.

Based on the results of the study, it was found that Audiolyfe succeeded in having a significant positive impact on changes in cognitive ability, which was reflected in the significant difference between the pretest and posttest results. The results of the paired sample test analysis showed that this intervention succeeded in improving children's intelligence, memory, and enthusiasm for learning, with a very low p value (<,001) in the two-sided and single-sided tests, indicating that these changes did not occur by chance and had a strong influence on the cognitive development of the participants.

Audiolyfe Stimulation is an intervention designed to improve a child's cognitive abilities through audio-based stimulation. In this study, the audiolyfe stimulus focuses on improving intelligence, memory, and enthusiasm for learning by using audio methods specifically designed to stimulate children's brains in the

learning process. This stimulation uses structured sounds and the right frequencies to optimize the child's cognitive and emotional processes, with the aim of supporting brain development and improving the child's overall learning performance.

Audiolyph stimulation also helps develop children's cognitive abilities by utilizing audio elements designed to optimally stimulate the brain. This is supported by research by Alfira & Siregar (2024) who states that listening practices help children practice focus by involving their attention to the sounds they hear. This activity trains the brain to maintain concentration on a single stimulus, which in turn improves the child's ability to filter out relevant information and ignore distractions. With a trained focus through listening, children can improve memory, deepen their understanding of the material, and be more involved in the learning process, which supports their overall cognitive development.

Through the use of structured sound, AudioLyfe can help improve a child's focus and concentration, two important factors in the learning process. Research by Mufid et al. (2022) shows that when children are able to maintain attention effectively, they more easily absorb information efficiently, which can ultimately contribute to the development of intelligence. This is in line with the theory that optimal focus and concentration allow the brain to do a better job of processing and storing information in areas such as the prefrontal cortex and hippocampus.

Zega's (2022) research also highlights the importance of audio-based stimuli to support children's cognitive development. Sound-based stimulation can stimulate creativity, improve active listening skills, and expand the language processing ability in children that occurs in their brains.

In addition, research by Hijrani & Nuraeni (2023) confirms that audio methods that involve active interaction can significantly improve children's linguistic intelligence. By engaging the child in a listening experience combined with interaction with his or her parents, it not only trains the child's ability to focus and understand information but also encourages them to think critically and respond verbally. This interaction provides an opportunity for children to practice communication skills naturally, so that it can increase their confidence in communication.

Thus, the results of research supported by several previous studies show that audio-based stimulation has a positive impact on improving children's cognitive development. The use of AudioLyfe, through a structured sound design and appropriate frequencies, can stimulate various aspects of a child's intelligence, such as linguistic intelligence, critical thinking skills, and memory. Scientifically, AudioLyfe works by stimulating activity in several important areas of the brain that are crucial for a child's cognition.

First, audio stimulation can increase activity in the prefrontal cortex, which is responsible for executive functions such as problem-solving, decision-making, and attention control. Second, structured and directed sounds help stimulate the hippocampus, an area that plays an important role in long-term memory consolidation and learning. In addition, certain audio frequencies can also affect the limbic system, especially the amygdala, to regulate emotions and reduce stress, thus creating optimal conditions for learning.

AudioLyfe-based stimulation also improves the synchronization of brain waves, such as alpha waves associated with relaxation and focus, as well as gamma waves associated with high-level information processing. Through the brainwave entrainment mechanism, AudioLyfe can help children maintain better attention and process information with higher efficiency. This approach is not only fun and engaging, but it also increases the child's motivation to learn, as it is designed to create an immersive and stress-free learning experience.

With the consistent application of audio methods, AudioLyfe is able to support the development of children's overall cognitive skills. This stimulation has a long-term positive impact by helping children increase their brain's capacity to learn, understand, and remember information better, thus supporting their development in various aspects of life.

CONCLUSION

Audiolyfe stimulation has been statistically proven to significantly enhance children's cognitive development, including intelligence, memory, and enthusiasm for learning, with improvements evident in thinking skills and overall engagement. This effect is mediated through brain mechanisms where audio waves influence key areas like the auditory cortex and memory-related regions, leading to optimized information processing. The findings affirm Audiolyfe as an effective educational tool, particularly in Banda Aceh, to boost learning quality and regional competitiveness. For future research, longitudinal studies could track the long-term retention of these cognitive gains and explore Audiolyfe's integration with culturally tailored content to maximize efficacy across diverse Indonesian contexts.

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