**Original Article**

# The Effectiveness Of Integrated Sensory Therapy As A Stimulation Of Speech Ability In Children Aged 2-5 Years With Functional Speech Delay Disorder

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## ABSTRACT

***Background:*** *Early childhood is a golden age and a critical period because there is a speedy growth and development process in the human life span, and it is irreplaceable in the future. Speech delay is functional. It is a delay in speaking due to lack of stimulation or the wrong parenting. One way to stimulate speech ability is through integration sensory therapy. The purpose of the study is to determine the effectiveness of integrated sensory therapy as a stimulation of speech ability in children aged 2-5 years with functional speech delay disorder at Kires Spa Dalung*

***Methods:*** *The design of this study is a quantitative quasi-experimental with a nonequivalent control group design. The sampling technique used was Simple Random Sampling, with a sample of 60 respondents divided into 2 groups, namely the treatment group and the control group. Data Analysis Techniques m Mann-Whitney Test.*

***Results:*** *The results of the study showed that of the 30 respondents in the treatment group before sensory integration therapy, the mean value (SD) of speech ability was 0.13 (0.346), and 30 respondents in the control group before the study was 0.23 (0.681). After 8 times of integrated sensory therapy on 30 respondents, the mean value (SD) of speech ability was 20.87 (0.571), and the control group after the study of the mean value (SD) of speech ability was 3.13 (0.819. The results of data analysis using the Mann-Whitney test showed a significance value of 0.000<(a=0.05), meaning that H0 was rejected and H1 was accepted; this means that there is the effectiveness of sensory integration therapy as a stimulation of speech ability in children aged 2-5 years with functional speech delay disorder.*

***Conclusion:*** *Integrated sensory therapy is very effective in helping improve speech skills in children with functional speech delays. Future research should explore the long-term effects of integrated sensory therapy on speech development in children with functional speech delays across diverse populations and age groups.*

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## Introduction

Early childhood is a child who is vulnerable to the age of 0-6 years. The World Health Organization states that children aged 0-6 years are said to be in a golden age, often called *golden age*. This

period is short and cannot be repeated. Therefore, the toddler period is often called the "golden age," "window of opportunity," and "critical period" (Wati, 2021). This happens because of the process of growth and development that is very fast in human life and is irreplaceable in the future. Child development in the next stage will be influenced by the fulfillment of child development tasks in the previous stage (Kim, 2020). Early childhood is a group of children who are in the process of growth and development with unique characteristics (Suryana, Tika, & Wardani, 2022). In the golden period, almost all potential children experience a sensitive period to grow and develop, and there are 5 developmental aspects, namely: physical, cognitive, language, emotional, and social development (Alam, 2022; Vollam, Dutton, Young, & Watkinson, 2015). As one of the aspects of child development, language ability can be an indicator of all aspects of child development; through language, the ability can also detect delays or abnormalities in other systems, such as cognitive, sensorimotor, psychological, emotional, and social abilities (Hasanah, Decatur, & Training, 2020; Meriem, Khaoula, Ghizlane, Asmaa, & Ahmed, 2020).

Language aspect is one of the aspects of a child's development that begins from birth. The development of language and speaking do not go together because, at first, the child will develop his language skills and then learn to speak. There are 4 language elements, namely: 1) listening, 2) speaking, 3) reading, and 4) writing (Mujahidah, Damayanti, & Afiif, 2021; Qureshi, Mahdiyyah, Mohamed, & Ardchir, 2022); children's speaking skills will be maximum if they are able to master the four language subjects. This will be easy for children to get if there is stimulation or stimulation obtained by children that is fulfilled according to their development. One of the factors that affect speech ability in children is the input system and speech induction. The input system and speech inlet are oral expressions of language; the ability to speak is needed in various daily lives. States that speaking is a form of language that uses articulation or words used to convey intent". The ability to speak will continue to develop along with the support of the environment; they must listen to conversations related to daily life and other knowledge about the world; they must express themselves, share experiences with others, and express their desires. This starts with his reaction to the sounds or voices of his parents; even at the age of 2 months, the child already shows a social smile to everyone who interacts with him (Bell, 2020). At the age of 18 months, children are able to understand and produce about 20 meaningful vocabularies.

Meanwhile, at the age of 2 years old, they are able to say 1 sentence consisting of 2 words, such as "I pee" and "I go" (Frank, 2021). It is possible to classify children with speech delays as not having speech delays (Aporbo, Barabag, Catig, & Claveria, 2024). Children are said to be late in speaking if their voice production and communication abilities are below the average of children their age. If the child does not experience this, it can be categorized as having a speech delay (*speech delay*); children who experience speech delays can be identified based on their speech skills that are below the standard for their age.

Speech disorder (*speech delay*) is a delay in language or speaking. Language impairment is a delay in the language sector experienced by a child (Kiogora, 2021; Langbecker, Snoswell, Smith, Verboom, & Caffery, 2020). Children are said to be late in speaking if their voice production and communication abilities are below the average of children their age. The ability to speak is essential for children because by

speaking, children can communicate about their situation. Several factors cause children to experience *speech delay*, including (1) watching too much television or using gadgets. Watching TV and videos from gadgets will only allow children to receive information without doing the interaction process because television does not stimulate children to digest and process interactions; (2) Minimal interaction with parents. Parents who rarely invite their children to have conversations are very likely to make their children experience *speech delay* (Sundqvist, Koch, Birberg Thornberg, Barr, & Heimann, 2021; Xu & Warschauer, 2020). Stimulation from the environment is minimal, resulting in limited vocabulary; (3) Hearing loss. Children with hearing loss will make it impossible for them to hear the conversations around them. This hearing loss can occur due to trauma, infection, congenital abnormalities, infections during pregnancy, or the influence of medications that the mother takes during pregnancy; (4) Abnormalities of speech organs, such as short tongue, cleft lip, deformities of teeth and jaws, or laryngeal abnormalities will also affect the ability to speak. For example, a child with a short tongue will have difficulty proposing the letters t, n, r, and l; (5) Autism. Autism is a pervasive developmental disorder characterized by delays and impairments in the areas of cognitive, behavioral, communication (language), and social interaction. It is recommended to consult a therapist specializing in autism to get more accurate treatment; (6) Obstruction of the brain and nerves, especially in the oral motor area.

The existence of this disorder will cause children to experience problems in processing voices. Disorders in the neurological system are also very likely to cause children to experience speech delays. For example, a child who has muscular dystrophy can also affect the muscles to speak, causing children to have difficulty producing words." *Speech delay* is not a diagnosis but an early symptom of some kind of disorder. The problems related to language development in early childhood, especially in speech delays (*speech delay*), have been found frequently lately. Speech delay in children is a serious problem that must be dealt with immediately. Speech delay can be known from the accuracy of the use of words, which is characterized by unclear pronunciation in communication. The most apparent impact of speech delay in children is that children will have difficulty communicating with their environment, and the people around them will find it difficult to understand children even though they understand what is being discussed. Speech delay affects not only the child's social and personal adjustments but also the child's academic adjustments.

Seeing the impact of language delays in early childhood, it is essential to optimize the process of language development in this period. Early detection of speech delays and disorders in early childhood is a significant measure of assessing children's level of language development. Early treatment is needed to help optimize the child's development process to be age-appropriate. When language development in children wants to increase, the role of parents and people around them should also need to know what things must be done to improve children's language skills (Gleason & Ratner, 2022). Communication will be significant if the recipient of the message can well receive the message conveyed. If communication does not go well, especially in early childhood, where language skills are still developing, communication problems will arise in children. When communication is hampered, children must be given a series of interventions so that they are able to communicate well with

others around them and at least others understand what is being said.

The World Health Organization (2016) determined that 250 million children, or 43% of children in poor and middle-income countries, do not reach their full developmental potential (Khatib, Gaidhane, Ahmed, Saxena, & Syed, 2020; McCoy, Seiden, Cuartas, Pisani, & Waldman, 2022). "UNICEF says that communication is a child's right"; therefore, it does not deprive children of their right to communicate. The rate of growth and development disorders in toddlers is still high at 27.5%, while the incidence of children with speech and language disorders is still relatively high, ranging from 5-10% (Pérez-Pereira, 2021; Przybysz, Crippa, Bruck, Luiz, & Leite, 2022). A Cochrane study in the United States reported data on children's speech skills, language, and a combination of both in early childhood preschool and school; the prevalence of language and speech development delays for children aged 2 to 4.5 years is 5-8%, where the prevalence of language delays ranges from 2.3% to 19%. Most studies report on speech and language development disorders in children with a prevalence of 40% to 60%. Only about 5-10% of Indonesian preschool children are actually speech-impaired (Julianti et.al.. 2018). The prevalence data of speech and language disorders is estimated to range from 2.3% to 24% in various studies

IDAI data (2023): 5-8 percent of preschool children experience *speech delay* in Indonesia. Data from the Indonesian Speech Therapy Association (IKATWI, 2022) 20% of children in Indonesia experience *speech delay*, which means that out of 5 million children, 1 million children experience speech delays. A research journal published by the National Center for Biotechnology Information 2022 mentions that the prevalence of speech delay in early childhood ranges from 1-32% of the normal population of children. Data from 7 Educational Hospitals in Indonesia in 2007 showed that speech and language disorders ranked first in the form of growth and development disorders. Data from the North Kuta Health Center in 2022 shows that the number of children who have been subjected to Early Detection of Growth and Development, especially for speech and language skills in kindergartens/early childhood education in the North Kuta Health Center Work Area, is 10 boys and 14 girls who have speech impairments so that they can hinder the learning process both academically and environmentally. In the screening carried out by Kires Spa in participating in posyandu activities in January 2024 in 4 banjars in the Dalung Permai area, it was found that speech and language delays from visits of 40-50 children under 5 years old were found to have speech and language delays from the visit data of toddlers in 4 Independent Midwives Practice and 1 Kires Spa (mom's kids and Baby) in the Dalung area found cases of speech delay (*speech delay* 10-20% of the total visits of toddlers every month. Based on medical record data at PMB Ni Wayan Sriadnyani, from January to December 2023, a total of 918 infants were visited, and 1219 people were visited by toddlers aged 1 year to 5 years who came with complaints of late speech, as many as 243 people. Meanwhile, from the medical record data of Kires Spa, there were 489 child visits from 12 months to 3 years, and there were 79 children whose mothers complained that they were late in speaking. Data on visits for children under five years old from June to August 2024 at pmb Sriadnyani, Kires Spa, and posyandu activities in 4 banjars in the Dalung area, 90 children experienced speech delays and from the DDST screening carried out and referrals to Growth and Development

specialists were declared to have functional speech delays.

Language has four competencies that must be mastered by children, namely listening, speaking, reading, and writing. One of the competencies that can be used by children so that children can express their feelings clearly using their words is speaking. Speaking is part of expressive language that helps children express their language. Speech delay is one of the causes of speech development delays in children. Early childhood development includes not only physical aspects but also motor, psychosocial, cognitive, and linguistic aspects (Pramanik, Kustanti, & Iqlima, 2022; Putri, Sutrisno, & Widiastuti, 2023). Factors that cause language delays in children include multilingualism, lack of opportunities to practice, lack of motivation to speak, lack of guidance, lack of motivation, peer relationships, gender, electronic use, and the number of extended families (Istiqlal, 2021). stated that several factors affect speech delay in early childhood; the essential leading cause is the lack of stimulation from parents and the surrounding environment or social environment, the input or infusion system, and the language center system. In children with functional speech delay disorder, this disorder is relatively mild. It occurs due to a lack of stimulation or the wrong parenting style from parents and the surrounding environment. *Speech delay* is the initial symptom of several types of disorders. If no intervention or appropriate treatment is carried out, it will significantly affect the child's academic and social abilities in the future (Lestari, 2022). Early detection of speech delays in children is critical so that interventions can be carried out as early as possible so that children have a longer time to pursue the development of their speaking skills.

In handling children with functional speech delay, several types of therapy can be done in addition to stimulation that can be done by parents at home, one of which is integration sensory therapy. The sensory therapy given every day since the child was diagnosed with late speech has a very significant impact on the child's environmental response. Sensory integration therapy is the process that organizes the senses of a person's body, and from the environment, this organization will expect the body to respond effectively to its environment (Ilić-Savić, Petrović-Lazić, & Resimić, 2021; Longfei, 2022). Sensory integration therapy is one of the latest and most comprehensive therapy methods for children with speech disorders. Jean Ayres first initiated this integrative sensory therapy in 1972 (Pozsár & Nemes, 2023). One of the factors that affect speech ability in children is the input or input system. According to Ayres (1979), the ability to respond or organize sensory input or intrusion received from the environment is called a sensory process. Sensory integration involves organizing sensory stimuli that the brain will process to produce an additive response/response to environmental guidance. The primary function of the multisensory integration system is to combine signals that enter the brain through separate sensory epithelium so that it shares a form of energy that comes from the same energy object or event is treated as a perceptual unit (Gnaoré, 2021; Roan, Mailloux, Carroll, & Schaaf, 2022). The sensory process begins with the receipt (*Registration*); in the process, the individual will be aware of the presence of an infection from the environment. The following process occurs in *orientation*; at this stage, the individual notices the incoming infections. The next stage of the individual begins to interpret the infection (*interpretation*), followed by the

*Organization* that is, the brain process will decide to notice or otherwise this infection, and in the last stage is *execution* is a real action taken against the sensory infection. Sensory information received by the child will enter the brain through body sensors, namely vision (*visual*), hearing (*auditory*), olfactory (*olfactory*), stamping (*gustatory*), tactile (*tactile*), the work system of muscles and joints (*proprioceptive*), and the balance system (*Balance*).

Sensory and perceptual development makes the basis of sensory impressions that are woven into social behaviors and neurological processes, added to create perceptions. Hence, the importance of involving children in an environment that encourages active participation will strengthen existing neural connections (Ilić-Savić et al., 2021). Children will be able to communicate verbally; auditory perception and visual perception must be well developed so that children will understand the topic of conversation that is taking place. Perception *visual* Propagates itself as being sensitive to incoming light, while perception *auditory* is the process by which the ear collects incoming sounds at different frequencies and sends them to the brain. The brain will process it and store it as needed. Perception *gustatory* That is, the tongue also plays a vital role in the process of phonation or speech in addition to its function as a sense of taste. Still, when the sensitivity of the tongue and mouth wall is high, the role of the tongue will not function. Perception is *proprioceptive. It is a proper reflex*ive system. Most of them cooperate with the vestibular system, where the receptors are distributed to ligaments joints, and the work of muscles and joints can affect the working system of motor muscles related to the speech organs, namely mouth muscles, jaw muscles, neck muscles, and abdominal muscles motor muscles. With strong motor muscles, these muscles can function better in producing sound (Loeb, 2021; Saxena, Russo, Cunningham, & Churchland, 2022). Balance system or *Balance System* It is centered on the inner ear, which can affect the hearing and vision systems. With a good balance, children will be more focused on paying attention and more easily grasping the information conveyed (Gandasetiawan, 2009). Children with high skin sensitivity will stay away from objects that enter their mouths so that it becomes one of the obstacles to training the muscles around the mouth that can hinder the speech process (Gandasetiawan, 2009). System *tactile* It is a tactile perception that receives information from receptors located in the skin of the whole body. Feedback signals are received from the tactile system which will facilitate motor planning and greatly affect the stability of speech, emotion and social functioning, (Yack et al., 2013).

The ability to process or organize sensory input or infusion received is called sensory process. The information obtained will enter the brain from body sensors such as vision, hearing, smell, taste, skin touch, muscle and joint work systems, and balance. Sensory integration therapy is one of the latest and most comprehensive therapeutic methods used in children with speech, psychomotor, and sensory dysfunction disorders. Sensory integration allows our brains to process, organize, and select all the information received from the environment in order to respond adequately to it with several activities (Resimic et al., 2021). Sensory integration means that the therapist or person transmits information regarding contact between the body and the surrounding environment through one or more sensory systems (i.e., *system visual, auditory, tactile, gustatory, olfactory,* vestibular, and progressive to the brain, for integration, and then the brain tells the motor system to

respond. Sensory and motor experiences are the basis of speech development. Stated that the process of Sensory Integration underlies the relationship between neurological function and speech development, where delays in sensory stimulation and processing affect multi-sensory integration and will directly affect the ability to perceive speech in children. Integrative sensory therapy interventions have a particular impact on children with pathological disorders, especially speech disorders. They are very beneficial for the development of integrative sensory therapy courses and interventions for children with speech disorders and autism in the future.

In addition to sensory therapy, speech therapy integration is also a therapy to optimize a person's ability to say words gradually. However, in children who experience *speech delay,* The ability to process the sensory inputs and inputs received must be optimized first to stimulate and maximize language production that will determine language and motor development in the following child (Petursdottir, Haraldsdottir, & Svavarsdottir, 2019; Vogindroukas, Stankova, Chelas, & Proedrou, 2022), by seeing the importance of the role of sensory therapy integration in optimizing or improving speech skills in early childhood who experience *speech delay*, so the researcher is interested and wants to research the effectiveness of sensory integration therapy as one of the stimulation of speech skills in early childhood by *speech delay*.

## Methods

The type of research conducted in the study was Quasi-experimental research with *a nonequivalent control Group Design*, which revealed cause and effect by involving two groups of subjects, namely the treatment group and the control group. In this study, the population is all children aged 2-5 years who experience *speech delay* with functional disorders obtained by DDST screening and have been referred to pediatricians and growth and development polyclinics in the working area of the North Kuta Health Center, Badung, Bali from May to June 2024 as many as 90 children. The sampling technique in this study uses *the Simple Random Sampling Technique.*

The number of samples in this study used *the software* "*GPower*" affiliation to obtain a sample of 60 children aged 2-5 years with *functional speech delay disorder*. The selection of the treatment group and the control group used *the software "http://www* affiliation.*random.org*," where the selection of the group of subjects uses a sequence number in the form of numbers from sequence number 1 to sequence number 90. The results of the above method obtained the number of treatment groups totaling 30 children aged 2-5 years with *functional speech delay* disorder and the control group totaling 30 children aged 2-5 years with *functional speech delay disorder.*

The initial data collection was carried out after obtaining permission from the UPTD of the North Kuta Health Center to conduct research. The first step in data collection is to select prospective respondents based on the inclusion criteria and the DDST screening observation sheet. After getting the desired respondents, an examination referral system will be carried out to a growth and development pediatrician and a growth and development polyclinic. After the doctor stated that the respondent was declared to have functional *speech delay disorder*, the next step was for the researcher to ask for consent from the respondent's parents by providing a letter of authorization and asking for the signature of the respondent's parents if they were willing to be researched.

The following table outlines the core elements of Sensory Integration Therapy and the therapist's role in facilitating these elements through specific attitudes and behaviors:

1. **Providing Sensory Stimulation:** The therapist offers opportunities for the child to experience various sensory modalities, including tactile, vestibular, proprioceptive, visual, auditory, and gustatory. The interventions involve multiple sensory modalities to enhance sensory processing.
2. **Providing Appropriate Challenges:** The therapist offers activities that are challenging but not overly complicated or too easy, aimed at eliciting the child's adaptive response to sensory challenges, helping to develop practical skills.
3. **Collaboration in Decision Making:** The therapist encourages the child to actively participate in the process, allowing them to take part in choosing activities and making decisions during therapy.
4. **Activities:** Therapy involves providing the child with control over the activities being performed. The therapist avoids setting strict schedules or plans without affecting the child in the process, promoting their autonomy in managing their therapeutic experience.
5. **Guiding Independent Organization:** The therapist supports and guides the child in organizing their behaviors independently. This includes helping the child choose and plan actions according to their abilities, encouraging initiative, developing ideas, and planning activities.
6. **Supporting Optimal Stimulation:** The therapist ensures that the therapy environment is conducive to achieving or maintaining optimal stimulation. This might involve modifying the environment or activities to capture the child's attention and enhance comfort.
7. **Creating Play Contexts:** The therapist designs play activities that foster the child's intrinsic motivation and enjoyment. These activities may involve object play, social play, motor activities, and imaginative play to promote development.
8. **Maximizing the Child's Success:** The therapist adapts or provides activities that allow the child to succeed at least partially, which encourages positive responses to the challenges they face during therapy.
9. **Ensuring Physical Safety:** The therapist ensures that the child's physical safety is maintained throughout therapy by using safe equipment or providing close supervision during sessions.
10. **Organizing the Space for Interaction:** The therapist arranges the therapy environment to motivate the child to engage in activities, ensuring that the space and equipment are appropriate for encouraging active participation.
11. **Facilitating Therapeutic Bonding:** The therapist builds rapport with the child, respecting their emotions, maintaining a positive outlook towards them, and creating an atmosphere of trust and emotional safety.

The technique used to collect data was carried out by interviews and observations of objective signs of respondents, and the measuring tools used to measure the dependent variable were speech ability, observation sheet, and interview sheet; the measuring tool used to measure the independent variable was the observation interview sheet.

The quality of the measuring tool used to measure variables is quite as good as the standard standard measuring tool used to measure speech ability. Meanwhile, to

increase the validity and reliability of the measurements in this study by:

a. The appropriate time to administer Sensory Integration therapy is adjusted to the age of the child, and the child is in a calm and healthy condition
b. The correct measurement time is when Sensory Integration therapy is carried out with observation and after Sensory Integration therapy is carried out with an interview sheet.
c. Seeing the child's situation and response. The way to measure changes in dependent variables is to determine the reaction of speech skills before and after Sensory Integration therapy using an interview sheet.

Table 1. Integrated Sensory Therapy Program

| Program | Purpose | Activities given | Program duration | Time |
|---|---|---|---|---|
| Visual | 1. Boost Coordination, eye, and hands.<br>2. Improve Focus on Activities.<br>3. Improve Attention (ability to Maintain- focus). | 1. Meronce piece<br>2. Eyedropper.<br>3. Insert the ball inside the basket | 10 minutes | 2x a week |
| Auditory | 1. Boost Concentration Auditory<br>2. Improve Perception Auditory. | 1. Different types of animal sounds and children requested to Guess the name of the animal<br>2. aforementioned.<br>3. A therapist gives various Instructions. | 10 minutes | 2x a week |
| Gustatory | 1. Boost understanding of various flavors.<br>2. Reduce Sensitivity to Oral organs. | Oral brush | 5 minutes | 2x a week |
| Tactile | 1. Reduce Skin sensitivity<br>2. Improve Awareness body. | 1. Brushing<br>2. Massage entire body | 10 minutes | 2x a week |
| Vestibular | 1. Reduce Skin sensitivity<br>2. Improve Awareness body. | Stand with 1 foot | 5 minutes | 2x a week |
| Proprioceptive | 1. Boost Muscle Strength and joints<br>2. 2. Improve coordination gestures | 1. Crawl<br>2. Jump right, back, Side right and left | 10 minutes | 2x a week |

In this study, the *independent* variable is Integrated Sensory Therapy and children aged 2-5 years with *Functional Speech Delay* disorder, while the *dependent* variable is the ability to speak. The research was conducted at Kires Spa Dalung, which is the working area of the North Kuta Badung Bali Health Center. This research was conducted from June 2024 to September 2024.

In this study, as many as 30 children in the treatment group for 1 month will be manipulated 8 times. Their speech ability will be measured by conducting tests, namely before manipulation and after being given manipulation (Integrated Sensory Therapy). In contrast, in the control group, as many as 30 people will be measured, and their speech ability will be tested, namely before and after. The significance level used is 0.05. If the significance > 0.05, then Ha is rejected. However, if the importance < 0.05, then Ha is accepted. The data must be distributed normally; if the data is not distributed normally, the analysis of the data for the different tests (*T.Test*) is changed to the *Man Whitney test*.

## Results

Table 2. Table of Frequency Characteristics of Age and Gender of Research Subjects

| Characteristic variable | Treatment Groups | | Control Group | |
|---|---|---|---|---|
| | Frequency | Percent (%) | Frequency | Percent (%) |
| Age | | | | |
| 2 – 2.5 years | 12 | 40,0 % | 17 | 56,7 % |
| 2.5 – 3 years | 9 | 30,0 % | 10 | 33,3 % |
| 3 – 4 years | 6 | 20,0 % | 0 | 0,00 % |
| 4 – 5 years | 3 | 10,0 % | 3 | 10,0 % |
| Gender | | | | |
| Men | 20 | 66,7 % | 13 | 43,3 % |
| Woman | 10 | 33,3 % | 17 | 56,7 % |
| Total | 60 | 100 % | 30 | 100 % |

Based on the table above, it can be concluded that in the treatment group aged 2-2.5 years, as many as 12 (40.0%) respondents aged 2.5 – 3 years, as many as 9 (30.0%) respondents, aged 3-4 years as many as 6 (20.0%) respondents, and as many as 3 (10.0%) respondents aged 4 - 5 years and in the control group aged 2-2.5 years as many as 17 (56.7%) respondents, aged 2.5 – 3 years as many as 10 (33.3%) respondents and as many as 3 (10.0%) respondents aged 4 - 5 years, while based on gender, in the treatment group, as many as 20 (66.7%) respondents were male and female gender, as many as 10 (33.3%) respondents and in the control group, as many as 13 (43.3%) respondents were male and female gender, as many as 17 (56.7%) respondents.

Based on Table 8 above, it can be concluded that the pre-test score of speech ability before the Integrated Sensory Therapy treatment group scored 0 as much as 26 (86.7%) and score 1 as much as 4 (13.3%), while in the control group, the speech ability score was 23 (76.7%) and score 1 was 7 (23.3%). The highest Post-Test 1 result of speech ability in the treatment group was a score of 26 (86.7%), while in the control group, it was a score of 0, as much as 23 (76.7%). The highest Post-Test 2 result in speech ability in the treatment group was a score of 4 out of 17 (56.7%), while in the control group, it was a score of 0 out of 16 (53.3%). The result of Post-Test 3 was the highest speech ability in the treatment group, which was a score of 10, as much as 17 (56.7%), while in the control group, it was a score of 13 (43.3%). The results of Post-Test 4 were the highest speech ability in the treatment group was a score of 13, as many as 11 (36.7%), while in the control group, it was a score of 2, as much as 12 (40.0%).

The highest Post-Test 5 result of speech ability in the treatment group was a score of 15, as many as 19 (63.3%), while in the control group, it was a score of 3, as much as 14 (46.7%). The results of Post-Test 6 were the highest speech ability in the treatment group was a score of 20, as much as 14 (46.7%), while in the control group, it was a

score of 4, as much as 16 (53.3%). The results of Post-Test 7 had the highest speech ability in the treatment group with a score of 20, as many as 14 (46.7%), while in the control group, it had a score of 3, as many as 17 (56.7%). The results of Post-Test 8 showed that the average improvement in speech ability in the treatment group was the highest score of 21, as much as 20 (66.7%), a score of 20, as much as 7 (23.3%), a score of 22 as much as 3 (10.0%), while in the control group was the highest score of speech ability was a score of 3 as much as 12 (53.0%). Score 2 as much as (20.0%), score 4 as much as 6 (20.0%), score 5 as much as 2 (6.7%).

**Mean Score and Standard Deviation of Speaking Ability Before and After Sensory Integration Therapy between Treatment Group and Control Group**

In the table below, the average results of the speaking ability score and the square root value of the variance are presented and show standard of data deviation against the average value.

Table 3. Mean Score and Deviation Standard of Sensory Therapy Integration between Treatment Group and Control Group

| | Pre – Test | Post – Test 1 | Post – Test 2 | Post – Test 3 | Post – Test 4 | Post – Test 5 | Post – Test 6 | Post – Test 7 | Post – Test 8 |
|---|---|---|---|---|---|---|---|---|---|
| Group | Mean (SD) | Mean (SD) | Mean (SD) | Mean (SD) | Mean (SD) | Mean (SD) | Mean (SD) | Mean (SD) | Mean (SD) |
| Treatment<br>Control | 0,13 (0,346)<br>0,23 (0,681) | 1,87 (0,346)<br>0,23 (0,430) | 3,93 (1,258)<br>0,23(0,430) | 9,23 (2,459)<br>0,50 (0,572) | 12,67 (1,269)<br>2,83 (0,791) | 15,63 (1,426)<br>2,97 (0,809) | 20,40 (0,894)<br>3,00 (0,695) | 20,47 (0,860)<br>3,07 (0,740) | 20,87 (0,571)<br>3,13 (0,819) |

Based on table 3 above, it can be concluded that the average speech ability before Integrated Sensory Therapy in the treatment group was 0.13 and in the control group was 0.23 after 1x Integrated Sensory Therapy was 1.87 and in the control group 0.23 after 2 times of Integrated Sensory Therapy the average speech ability in the treatment group was 3.93 and in the control group 0.23, after 3 times of Integration Sensory Therapy the average speech ability in the treatment group was 9.23 and in the control group 0.50, after 4 times of Integration Sensory Therapy the average speech ability in the treatment group was 12.67 and in the control group 2.83 after 5 times of Integration Sensory Therapy the average speech ability in the treatment group was 15.63 and in the control group 2.97, after 6x Integration Sensory Therapy the average speech ability in the treatment group was 20.40 and in the control group 3.00, after 7x Integration Sensory Therapy the average speech ability in the treatment group was 20.47 and in the control group 3.07, and after 8x Integration Sensory Therapy the average speech ability increased in the treatment group 20.87 while in the control group the average speech ability increased is 3.13

Table 11. Mann *Whitney U Statistical Test Results*

| Group | N | Mean Rank | *P* – Value |
|---|---|---|---|
| Pre-Test | | | |

| Group | N | Mean Rank | *P* – Value |
|---|---|---|---|
| Treatment<br>Control | 30<br>30 | 29,00<br>32,00 | 0,321 |
| Post-Test 1<br>Treatment<br>Control | <br>30<br>30 | <br>45,03<br>15,97 | 0,000 |
| Post-Test 2<br>Treatment<br>Control | <br>30<br>30 | <br>44,75<br>15,97 | 0,000 |
| Post-Test 3<br>Treatment<br>Control | <br>30<br>30 | <br>44,88<br>16,12 | 0,000 |
| Post-Test 4<br>Treatment<br>Control | <br>30<br>30 | <br>45,50<br>15,50 | 0,000 |
| Post-Test 5<br>Treatment<br>control | <br>30<br>30 | <br>45,50<br>15,50 | 0,000 |
| Post-Test 6<br>Treatment<br>control | <br>30<br>30 | <br>45,50<br>15,50 | 0,000 |
| Post-Test 7<br>Treatment<br>control | <br>30<br>30 | <br>45,50<br>15,50 | 0,000 |
| Post-Test 8<br>Treatment<br>control | <br>30<br>30 | <br>45,50<br>15,50 | 0,000 |

Based on Table 11 above, it can be concluded that *the p*-value is 0.000 < α 0.05, so Ho is rejected and Ha is accepted. This means that there is a significant effectiveness of Integrated Sensory Therapy as a stimulation of speech skills in children aged 2 -5 years with *Functional Speech Delay* disorder at Kires Spa Dalung in 2024

## Discussion

Functional *Speech Delay disorder* before stimulation of Sensory Integration therapy in the treatment group of 30 respondents was a score of 0 as many as 26 (86.7%), a score of 1 as many as 4 (13.3%), and in the control group a score of 0 as many as 23 (76.7%), a score of 1 as many as 7 (23.3%) and the average result score was 0.13. This is in accordance with the theory that the

input system and speech input system is an oral expression of language; the ability to speak is needed in various daily lives; it is said that speech delay occurs if, at the age of the child, the ability to produce sound and communicate is below the average of children of the same age if the child has speech delay (*speech delayed*) can be identified based on their speech ability which is below the standard for their age. The elements that cause speech delays in children are that children do not get a good model to imitate in 23 speaking using the right words, children do not have a strong motivation to say, and the opportunity to talk is less intense for children. So, it can be concluded that if a child experiences *speech delay,* it can be seen from the average results of the speech ability score according to the age of the child, and the type of speech delay can be identified based on the cause of speech delay in children. Lack of stimulation and wrong parenting style cause children to experience regression in speech skills, especially in early childhood, where the process of growth and development is very rapid and requires maximum stimulation from parents and the surrounding environment.

Functional *Speech Delay* disorder before stimulation of sensory integration therapy in the control group of 30 respondents was a score of 0 as many as 23 (76.7%), a score of 1 as many as 7 (23.3%), and an average score of 0.23. This is in line with Aram (Soetjiningsih, 1995), who said that one of the factors that affect speech ability is the input system and speech inset. If a child has speech *delays*, it can be identified based on his speech ability, which is below the standard for his age. Therefore, it is essential to involve the child in stimulation with an environment that encourages active participation from the child, which will strengthen the existing neural connections (Jing, Jia, & Yang, 2024; Tafuri, Martinez-Roig, Susanto, Setyawan, & Latino, 2024). So, it can be concluded that children will experience *speech delay* because they are very little or rarely involved in daily active participation, which can affect children's ability to speak and are below average for children of their age. Lack of input and speech Two-way communication plays a vital role in speech skills, especially in early childhood, because early childhood is a golden period to maximize the growth and development of children.

Functional *Speech Delay* disorder after 8 times of integrated sensory therapy in the treatment group of 30 respondents was a score of 21 as many as 20 (66.7%), a score of 20 as many as 7 (23.3%), and a score of 22 as many as 3 (10.0%), the average score of speech ability was 20.87. These results are in line with the theory that sensory therapy of speech integration will be optimized by activating, restoring, and optimizing the individual's neurological processes through the sensory system so that the individual is able to respond quickly and appropriately to his environment. The sensory information received will enter the brain through the *visual, auditory, tactile, vestibular, and proprioceptive sensory systems, and the human gustatory* acquires information about the physical condition and the surrounding environment (Aurangzeb, Daghfous, Innes, Dubuc, & Zielinski, 2021). The process of sensory integration underlies the relationship between neurological and speech development; sensory processing disorders in children will affect multisensory integration, which directly affects the ability to perceive speech. So, it can be concluded that sensory therapy will be optimized by activating, recovering, and optimizing the child's neurological processes through the existing sensory system so that the child will be able to respond to stimulation obtained from parents and the surrounding

environment quickly and appropriately. This therapy is very effective in helping maximize the growth and development of children, especially in speech skills.

Functional Speech Delay disorder after conducting an integration sensory therapy study in the control group of 30 respondents was a score of 3 as many as 16 (53.3%), a score of 4 as many as 6 (20.0%), a score of 2 as many as 6 (20.0%), and a score of 5 as many as 2 (6.7%), and the average score of speech ability in the control group was 3.13. This is in accordance with the theory that children's speaking skills will be maximized if the stimulation or stimulation obtained by the child is fulfilled according to their development, Bromley (1992) (Puspita & Leny, 2022). This is in line with Aram (Soetjiningsih, 1995), who said that one of the factors that affect speech ability is the input system and speech inset. The process of sensory integration underlies the relationship between neurological and speech development; sensory processing disorders in children affect multisensory integration, which directly affects the ability to perceive speech (Resimic et al., 2021). Speech delay needs early and correct treatment and therapy because the most apparent impact of speech delay in children is that children will have difficulty communicating with their environment and those around them. With sensory therapy, integration can improve focus and the ability to maintain focus on activities and stimulation obtained from the surrounding environment.

Speech ability in children aged 2-5 years with functional *speech delay* disorder. The results of the *Mann-Whitney U* statistical test showed that there was no significant difference in the speech ability score before treatment in the treatment group and the control group, with a p-value of 0.321 > α 0.05. at the same time, the results of the *Mann-Whitney U statistical test* after 8 treatments in the treatment group had a p-value of 0.000 < α 0.05, so Ho was rejected, and Ha was accepted. This means that sensory integration therapy is significantly effective in stimulating speech ability in children aged 2 – 5 years with functional speech delay disorder. This is in accordance with the theory that children's speaking skills will be maximized if the stimulation or stimulation obtained by the child is fulfilled according to their development (Puspita & Nuroh, 2022). One of the factors that affect speech ability is the input system and speech inset. With sensory therapy, the integration of speech skills will be optimized by activating, recovering, and optimizing the individual's neurological processes through the sensory system so that the individual is able to respond appropriately to his environment. The sensory information received will enter the brain through *the visual, auditory, tactile, vestibular, and proprioceptive sensory systems, and the human gustatory* acquires information about the physical condition and the surrounding environment. Integrative sensory therapy interventions can improve the behavior and quality of life of autistic children by 86.11% (Nichols et al., 2022; Wang, Li, Liu, & Zhang, 2023). The sensory integration process underlies the relationship between neurological and speech development; sensory processing disorders in children affect multisensory integration, which directly affects the ability to perceive speech. Speech delay needs early and correct treatment and therapy because the most apparent impact of speech delay in children is that children will have difficulty communicating with their environment and people. Speech delays affect not only children's social and personal adjustments but also their academic adjustments. With sensory therapy, the ability to speak will be optimized by activating, recovering, and

optimizing the individual's neurological processes through the sensory system so that the individual is able to respond appropriately to his environment.

## Conclusion

The implementation of integrative sensory therapy as a form of stimulation for speech development in children aged 2-5 years with functional speech delay at Kires Spa Dalung demonstrated significant and effective results. This was supported by the Mann-Whitney U statistical test, which showed a p-value indicating that the therapy was statistically significant. These findings align with the Integrated Sensory Theory, which suggests that the brain's ability to receive and process sensory stimuli from the environment plays a crucial role in speech development. Additionally, research by Aram supports the idea that sensory input significantly affects speech abilities in children. This emphasizes the importance of the sensory processing system in facilitating speech. Integrative sensory therapy can be considered as a supplementary intervention for children with speech delays, as it shows promising results in enhancing speech abilities and overall sensory processing. Future studies are encouraged to explore the long-term effects of integrative sensory therapy on speech development in children with functional speech delay. Additionally, research could focus on comparing the effectiveness of this therapy with other speech stimulation methods across different age groups and developmental conditions to provide a broader understanding of its applicability and benefits.

## Authors Contributions

This manuscript is the result of a collaborative effort among the authors, with one member responsible for the study design and data collection, another conducting the literature review and data analysis, and a third handling the drafting and revision of the manuscript. All authors actively contributed to the process and approved the final version for submission.

## Conflicts of Interest

We affirm that no relationships or activities existed during any stage of the research process, from its inception to publication, that could be construed as conflicts of interest, thereby safeguarding the integrity and impartiality of our findings.

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