

How sound therapy can help children recover from language deficits resulting from COVID-19 lock downs: A literature review

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Abstract

The early years of a child's development have the greatest impact on their future, as all later learning is based on these early foundations. During the COVID-19 lockdowns, young children missed out on many normal social experiences at crucial times in their development. Research has been undertaken in the United Kingdom where professionals and parents in 96% of the schools surveyed raised serious concerns about their children's communication and language development and were also concerned about social and emotional development and the flow-on effects for literacy and academic performance. Tomatis Sound therapy has proven effective in addressing a wide range of learning and developmental issues including speech and language development. A literature review of 58 studies was undertaken to summarize findings on the benefits of the Tomatis method, and its adaptation by Joudry and Joudry for portable use as the Sound Therapy International program. While language and speech were some of the greatest benefits observed, the studies also highlighted improvements in state of mind, academic performance, cognitive ability, motor skills and coordination, focus and concentration, social skills, laterality and self-regulation. Therefore, sound therapy could be an important method to mitigate the impacts of lockdowns on language development.

Keywords: Tomatis, sound therapy, lockdown, language development, speech delay, learning difficulties, auditory processing

Introduction

Concerns have been raised internationally about the impact of COVID-19 lockdowns on early language development. The early years of a child's development have the greatest impact on their future, as all later learning is based on these early foundations.

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Due to the way the brain develops, if speech acquisition is delayed during the key formative years, it can significantly impact children's later development.

How the brain develops language

Just like a tree, the brain must develop trunks and main branches, before the more delicate twigs can be added. The development of language skills depends on exposure to multiple environments, interaction with a variety of people, seeing facial expression, interacting and having the opportunity to practice hearing and making sounds in a wide range of activities prior to entering the classroom, where more complex language skills must be mastered (1).

Language and learning specialists have been aware for some decades that the early stages of development have a great impact on a child's future. Brain pathways and language skills develop sequentially, with each new skillset depending on the previous one. Therefore, if certain skills are missed, such as crawling, facial identification or babbling, it sets the child back in the next stages of development (2). Therefore, if children miss out on social contact, conversation and normal interactions during their early formative years, catching up to fill these gaps may be slower than expected. Researchers say the first 1001 days after a child is born are crucial for laying the foundations for later development (3).

It has been very difficult for parents raising their children during lockdowns, as they could not access many activities that help to develop vocabulary, such as visiting a farm or seeing the grandparents. Extensive evidence, described below, is now showing that children are suffering developmental delays due to the recent lockdowns, and the children who are already at risk are the most severely affected. It is very important to enrich a child's environment with added opportunities to rectify the losses and delays of lockdowns. This paper argues that one easy and accessible way of doing this, which will dynamically enhance other supports, is Sound Therapy, which stimulates the activation of speech and language pathways.

The impacts of lockdowns on language development

During the COVID-19 lockdowns, young children missed out on many normal social experiences at crucial times in their development. Studies by a range of organisations in different countries have reached similar conclusions. A study of over 500 parents in the United Kingdom (UK), by the University of Oxford and four other leading universities raised concerns about the impacts of lockdowns on social development in children under three years of age (4). A survey of schools and parents, conducted by the Education Endowment Foundation in the UK, found that children who started school in 2020 needed more support than in previous years. Of the schools surveyed, 96% raised serious concerns about communication and language development, while 91% were concerned about social and emotional development and 89% raised concerns about literacy (5). Mask wearing has also impacted language development, as children who are learning to speak rely a great deal on lip reading to help them in learning how to form sounds, such as 'p' or 't'. Facial expression is a key to language, to help us understand the meaning of words, and this too has been limited by mask wearing during a child's formative months and years (6).

Research in the UK suggests that up to 1.5 million children face being left behind in their speaking and understanding due to disruption caused by COVID-19 and a majority of teachers are worried that children who are behind will not be able to catch up (7). Similar concerns have been published in the United States (US), e.g., Charney et al. (8). Also Sparks (9) reported "To avoid widespread school readiness gaps, experts say teachers and parents need to give children born since the pandemic an immediate language infusion". Further, although much of the concern has been focussed on speech delay, we know that speech delay is also an indicator of other types of learning difficulties or sensory processing difficulties which will affect children once they enter school (10).

Evidence that children who are already at risk are the most severely affected was reported by Amplify (11) who found the percentage of students who were far behind at mid-year in learning to read had

increased across all demographics, but that learning losses due to COVID-19 were greater among Black and Hispanic students in the early grades. The report issued a call to action saying we have a once in a generation opportunity to catch up, for students who have fallen behind due to the impacts of COVID-19 (11).

These concerns have caused a number of groups and researchers to lobby governments to take more action. BBC News reported that more than 100 charities and parent and carer organisations had written to the UK government to say long-term investment is needed to plug gaps in the specialist workforce supporting children in schools - including speech and language therapists. Jane Harris, Chief executive of I CAN (Institute for the Clinical Advancement of Neuroplasticity) said: "For 1.5 million children to be struggling to be able to speak and to understand what is being said to them should be a wake-up call to government and the education sector." Figures show that nearly one in five children are not meeting expected development standards by the time they reach two-and-a-half, making gaps 'more difficult to close' (7).

Due to the increased demand, waiting times for remedial services are growing, and for many families the wait is too long to meet the pressing needs of children who require immediate support. The chief executive of the Royal College of Speech and Language Therapists, (RCSLT) Kamini Gadhok said: 'Our members tell us that growing lists and waiting times for speech and language therapy are dramatically impacting on their ability to provide the support which children need for the best start in life' (12). This concern is also being highlighted by the National Health Service (NHS) in the UK. NHS England and NHS Improvement (NHSEI) data from January 2022 estimated that over 900,000 children and adults were waiting for services as part of a community services care backlog (13). As remedial specialists and Speech Pathologists struggle to catch up with the unprecedented backlog, looking for more time-effective methods that can be used at home could help fill the gap. This paper examined Tomatis Sound therapy which has proven effective in addressing a wide range of learning and developmental issues including speech and language development (14, 15).

History and development of Alfred Tomatis's Sound therapy

In the early 1950s a Paris based ear specialist, Alfred Tomatis (1920-2001), opened a new field of pursuit in the therapeutic application of music, which has become known as "Sound therapy," "Audio-psycho-phonology" or Tomatis therapy (16). He went on to develop a method of treatment which addresses hearing and listening from both the physical and the psychological aspects. Through his experiments he also discovered that high frequency sounds, softly played, stimulate and replenish brain energy, and are in fact essential for optimum functioning of the cortex.

The Tomatis method of sound therapy applies gating and frequency filtration, combined with right ear emphasis, to achieve enhanced integration in not just the auditory pathways but also many other parts of the nervous system. This produces auditory stimulation through the use of music that has been electronically modulated by a device of Tomatis's invention called the electronic ear, which uses a gating system to deliver alternating high and low frequencies in order to activate the middle ear muscles, and in turn the entire auditory pathway. For a therapeutic application, the sound must be listened to through headphones to facilitate transmission of the delicate, high frequencies, and in order to deliver the built-in right-ear emphasis. Research on the Tomatis method has been underway since the mid-1970s, spanning five decades of exploration into this multi-faceted method (17).

The self-help method

Patricia Joudry, a Canadian author, underwent the Tomatis treatment in the late 1970s and experienced total relief of her chronic insomnia, exhaustion, writers block and the listening disorder for which she was first referred to the treatment. This is known as "The cocktail effect," which is the inability to discriminate between different sounds in a noisy environment.

Patricia and her daughter, Rafaele Joudry, then released the self-help Sound therapy audio program along with their book: *Sound therapy: Music to*

recharge your brain (17). Rafaele has since published two further books entitled *Triumph over tinnitus* (18) and *Why aren't I learning?* (19).

In 2011 the Sound Therapy SYNERGY practitioner program was launched, providing a clinical program that can be offered by a range of allied health practitioners and educators to their clients (see www.Soundtherapysynergy.com).

The self-help program was made so pleasant to listen to that both adults and children enjoy using it for many years. This means that when it is calculated over time, the cost per hour of listening is far less than other programs. Also, it is supplied on robust, portable equipment, making it more convenient for using in daily life than other programs.

New research supporting Tomatis' theories

In the last few decades, the American neuro-physiologist Stephen Porges (born 1945), developed the Polyvagal theory and confirmed how animating the middle ear muscles switches on the social engagement nerve. This gave confirmation in modern scientific techniques of Dr Tomatis' original findings. His theory and explanation of vagal nerve function has given us great insights into self-regulation and neural development.

Stephen Porges has developed his own listening program. However, he did not include several key elements of Tomatis' work such as using classical music, and including language programs, which are included in Joudry's Sound therapy method. Perhaps the greatest contribution of the Joudry method has been to show how extended listening, over several years, produces ever-increasing results.

There is a wide range of ways in which sound therapy helps children. In the last few decades there have been numerous controlled studies, surveys, clinical experiments and case histories, which confirm the benefits of the Tomatis method, and its evolution into the portable program developed by the Joudrys, for a variety of conditions. The main topics that have been studied are: auditory processing, speech and language development, learning difficulties, attention and focus, autism spectrum, coordination and motor skills.

Meanwhile, extensive research has been taking place in fields of relevance such as the evolution of the nervous system, brain plasticity, speech and language development, the causes and treatment of tinnitus, anxiety, sleep, autism, ADHD, focus and brain performance. This background research has given a level of understanding and scientific explanation for many of Tomatis's theories which occurred through clinical observation, prior to this scientific understanding being available.

The present aim is to review the literature in order to demonstrate the usefulness of Tomatis therapy for a range of learning and developmental difficulties and support the claim that sound therapy can assist in overcoming the delays caused by lockdown.

Methods

A literature review of 112 studies was undertaken to review findings on the benefits of the Tomatis method, and its adaptation by Joudry and Joudry for portable use as the Sound Therapy International program. These range from single case studies to some large-scale studies covering several hundred such as the Eurocopter study in France, involving 580 participants, or the study of 408 autistic children done at Azad University in Iran, or the Polish school study of 1,330 pupils by the Institute of Physiology and Pathology of Hearing. This paper is limited to studies relevant to children.

The total number of studies reviewed that related to the relevant conditions was fifty-eight. These articles were sourced from a range of special interest reports and peer reviewed journals via internet searches on Tomatis Research, sometimes using the key words for the particular conditions.

We included all of the studies which undertook to measure the impact of Tomatis or Joudry therapy on listeners with the relevant conditions relating to learning and developmental challenges.

The total number of participants recorded in all of the included studies was 3,695. This number is certainly underestimated as some studies worked with a number of schools but did not specify the number of participants.

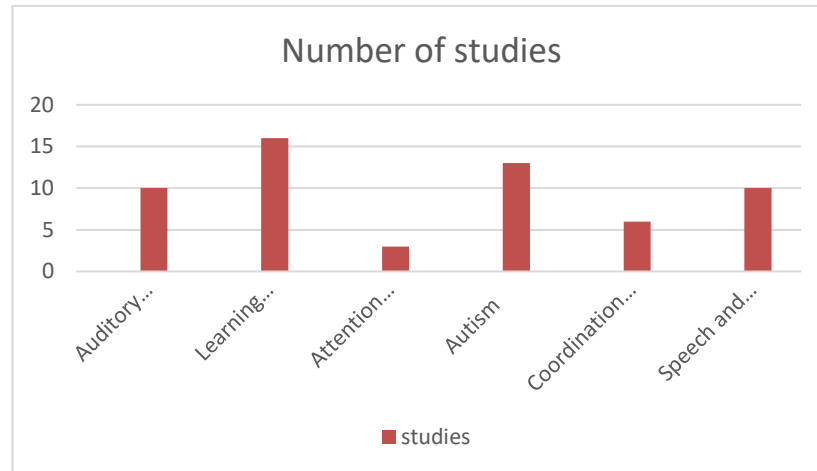


Figure 1. Number of studies conducted on each category of condition.

The studies were grouped into six categories for the purpose of analysing the different impacts of the therapy (see Figure 1).

Some studies were not restricted to focusing on solely one of the conditions named. It is for the purpose of analysis that we have grouped them in order to do some comparisons, but there are often overlaps as each study may include children with multiple deficits. Due to the overlaps between deficits that were being studied and benefits found in the subjects, the categories of studies are not mutually exclusive.

Results and discussion

The review identified studies focused on six main conditions, being: auditory processing, learning disabilities, attention deficit disorder, autism, coordination and motor skills, speech and stuttering. A summary discussion of the results from these studies now follows. First each of the conditions is described with the associated findings. Then the insights from the pattern across conditions are examined.

Studies on auditory processing

On the topic of auditory processing, ten studies were reviewed, with a total of over 300 participants. Auditory processing is the key component of many developmental disorders which respond positively to Sound therapy. Most of them have a component of

auditory processing difficulty, which, when it is addressed, makes life, learning and skills development easier for the individual.

Tomatis found that sound perception, discrimination and hierarchical processing - which are facets of auditory processing - can be improved by stimulating and re-educating the listening function. Tomatis was unique in his claim that high frequency sound is an essential component of this rehabilitation, enabling the brain to improve its sound processing. The following studies confirm these findings. He also found that when the right ear takes the primary organising role language processing improves. The studies on Tomatis therapy for auditory processing found the following:

- Self-regulation was enhanced for University students who used sound therapy (20).
- Children with auditory processing problems showed improved performance on auditory and spatial tasks, pitch discrimination, and lateralisation (21–23).
- Benefits from the treatment included improved academic skills, leadership, attention and productivity (24).
- Students from the 1st to the 5th grade experienced significant improvements in learning, socialisation and motor skills (25)
- Left lateralisation correlated with dyslexia and processing problems, while right ear lateralisation enhanced processing speed (26–28).

- In studies across dozens of schools in Poland it was found that the improvements applied to children both with and without learning delays, and that results ranged across age groups from primary to university (20, 29).

Studies on learning disabilities and behaviour problems

Fifteen studies were reviewed with a total of 1,724 participants. Studies on learning disabilities and behaviour problems include some longitudinal, some targeting larger populations and many comparing small treatment and control groups. Most focus on children with a variety of learning disabilities and behaviour problems, many of whom are from disadvantaged backgrounds. The Polish schools' study (29) involving over 1,300 students for a three-year period is of particular note. Most of the studies utilised the original clinic or classroom-based Tomatis therapy. However, the studies by Brown (30, 31) and Rintel (32) used the Joudry portable system, within a classroom or tutoring setting, and produced similar results.

The common factors found among all these studies are statistically significant improvements in language skills, attention, academic performance, self-esteem, and behaviour. In summary, the studies on Tomatis therapy for children with learning disabilities found the following:

- When combined with the Equipping Minds program, Joudry Sound therapy helped improve academic performance, verbal and non-verbal abilities and IQ (31).
- This combined program also assisted visual spatial skills, reading comprehension, spelling, writing and maths (30).
- Sound therapy proved beneficial for the whole school population, including children with or without special needs (29)
- Sound therapy was beneficial to assist reading fluency in students from a non-English speaking background (33).
- The treatment enhanced audio vocal control and phonological processing (34–37)
- Literacy and language gains were retained 14 months after treatment (35).
- Right ear training enhances reading (28)
- Children with reading disorders or dyslexia improved their performance in reading and audio-vocal control plus phonological and lexical disorders (28, 36–39).
- Children improved performance on several measures of standardised test batteries post treatment (32, 40, 41).
- Disadvantaged children developed greater motivation, concentration and language skills (42).

Studies on attention deficit disorders (ADD/ADHD)

Three studies were reviewed with a total of 27 participants. ADD/ADHD is a particular deficit which affects capacity for learning, focus and socially acceptable behaviour. Although the diagnosis is formally based purely on clinical observations by a doctor on a very basic scale of behaviours, researchers are now identifying measurable brain anomalies in children with this condition. Quantitative analysis of EEGs and ERP (event related potentials) can now give clues into the underlying brain dysfunction behind this condition (43). Perhaps because ADD/ADHD was not a known condition during Tomatis's era, studies on this condition have been relatively few. However, strong anecdotal plus clinical research evidence has shown that Sound therapy can significantly reduce ADD/ADHD symptoms, calming behaviour, reducing oppositional behaviour, anger, distractibility and hyperactivity. The studies on Tomatis therapy for children with ADD/ADHD found the following:

- Tests using quantitative EEG (QEEG) and event related potential (ERP) showed an increase in slow brain activity for the group receiving Tomatis treatment, along with statistically significant improvements including enhanced processing speed, phonological awareness, reading, behaviour and auditory attention (43)

- Improvements were measured in the treatment group in cognition, attention and behaviour (43).
- The results indicate that Sound therapy is potentially a brief and effective approach to benefit ADD/ADHD (43).
- Parents noted 73% improvement on a range of abilities after Tomatis treatment (44).
- A boy progressed from 2nd to 5th grade in phonological awareness following Tomatis treatment (45).

Studies on autism

Fourteen studies were reviewed with a total of 244 participants. On the topic of autism, Tomatis was widely criticized in the 1980s and '90s for his theories about the contribution of the mother's behaviour to the development of autism. Likely founded on Freud's theories, these views were a product of his time. More recent research is revealing both the genetic and environmental (chemical toxicity) contributions to autism spectrum disorders (46).

There is now a much greater understanding of sensory processing and awareness in particular of the strong correlation of auditory hypersensitivity with autism. As the causes are progressively more clearly understood, the common factor is that Sound therapy is found to be very beneficial for those with autism. Some of the improvements most commonly observed include: reduction and normalization of auditory sensitivity and of sensory processing in general; reduction of stress and social discomfort; an increase in the capacity to make eye contact, connect, converse and socially engage with others.

Work by Stephen Porges in recent decades on polyvagal theory and sound therapy has confirmed that rehabilitation of the middle ear muscles enhances vagal response and is beneficial for those on the autism spectrum. This modern scientific exploration is a significant step in objectively proving the veracity of Tomatis's hypothesis that enhancing ear function with sound is beneficial for those with autism. One way of assessing vagal nerve activity is through the measure of heart rate variability, which was assessed in a study using the portable Joudry program (47), thus demonstrating that the Joudry program results in

similar impacts on the nervous system. The studies on Tomatis therapy for children on the autism spectrum found the following:

- Sound therapy acts on the Cranial nerves to cause the middle ear muscles to block the perception of low frequency sounds, thereby creating a greater feeling of safety in the environment (48, 49).
- The stimulation of the middle ear muscles with dynamically activated sounds enhanced vagal regulation and enhanced heart rate variability (47, 48).
- Living skills improved after Sound therapy treatment (50–52).
- Autism symptoms, anxiety and hyperactivity, OCD and motor skills were significantly reduced following treatment (37, 53–57).
- Social skills and self-confidence, living skills and relationships were enhanced by the treatment, (45, 51).
- Normalisation of brain activity was shown on EEG and Auditory Evoked Potentials (58).
- Parents reported 64% improvement in a wide spectrum of children's abilities (52).
- Interpersonal communication, increased eye contact and improved posture were noticed, (59, 60).

Studies on coordination and motor skills

One of the interesting aspects of Sound therapy is its benefits for balance, coordination and muscle tone, as well as small and gross motor skills. The field of sensory processing disorders gives rise to the understanding of how all sensory inputs are gathered and assimilated in the cerebellum, which then re-routes them to other areas. While it was initially thought that the cerebellum was primarily a centre for physical coordination, it was later determined that it is in fact the initial processing centre for all sensory inputs. While it was observed in some of the early Tomatis literature that sudden improvements in posture are often seen in Tomatis listeners, the benefits for global developmental delay is a more complex issue, bringing together improvements in vestibular function and spatial perception while also

assisting with hypertonic or hypotonic muscle tone to enhance fine and gross motor skills. Six studies were reviewed with a total of 277 participants. The studies on Tomatis therapy for coordination and motor skills found the following:

- Treatment helped to restore mobility after cerebellar ataxia due to inflammation of the cerebellum, enabling the boy to overcome the need for a wheelchair (61).
- Psycho motor improvement was a common response (58, 62).
- Visual motor delays and sensory processing disorder improved.
- Improved motor skills impacted on daily living (50).
- Significant gains were found in motor skills, visual perception and pronunciation (53).

Studies on speech and stuttering

Eleven studies were reviewed including 1,140 participants. Speech and language development are one of the most significant treatment areas of Tomatis' discoveries in relation to the impact of Sound therapy. Speech involves many different body systems, including the breathing, lungs, vocal apparatus as well as the hearing and language pathways. It requires gross and fine motor skills of the tongue and throat, plus all the neural requirements for expressive and receptive language in five areas: pragmatics – semantics – syntax – morphology and phonology. Sound therapy has proven to have benefits in a wide range of speech and language difficulties as it provides stimulation through the whole auditory system and extends through the neural, cognitive and emotional system, due to the deep involvement of the ear and hearing in all of these brain areas. In recent decades, advances in awareness of auditory processing disorders and its progressive inclusion into audiological practice has facilitated awareness of Tomatis' pioneering actions in this field. Of particular note, Sound therapy is effective for stuttering as it streamlines auditory processing by training for the right ear to be the directing ear. The studies on Tomatis therapy for speech and stuttering found the following:

- The Forbrain vocal feedback device improves vocal parameters and speech quality (63, 64).
- The treatment rendered significant relief for stuttering -- which proved to be related to laterality (65, 66).
- Helps various neuropsychological speech impediments (14).
- Enhances fluency, sound localisation, and self listening (14).
- Improved linguistic memory (67).
- Improves dyspraxia, dyslalia and motor planning disorder (14, 67).
- Improvements occurred in hearing speech and voice disorders (15).
- Those with right sided deafness had more language disorders (26).
- Vocal fold nodules were reduced by 83% (68).

Pattern of results across conditions

The number of studies in each category (see Figure 1) is an indication of which areas have attracted the most attention of researchers. It may not necessarily mean that this is where the therapy is most effective. The reasons for variation in the size of categories of studies include:

1. Real world impact of the condition, therefore leading to a large number of studies
2. The evolution of identification of functional disorders (EG: ADHD was not a widely recognised condition in the first few decades of research on Tomatis)
3. An artefact of the categorisation of condition and overlap between groupings

The number of participants in each study (see Figure 2) again shows how the studies were grouped for analysis, with learning difficulties being a bit of a general catch-all. The number of children studied with ADD is quite small, possibly reflecting the fact that during the early years of Tomatis research this condition had not yet been identified, so there was a greater focus on autism and dyslexia.

Categories of benefits

The studies of the effects of Tomatis therapy demonstrated a wide variety of benefits, and each category of benefits contained several sub-categories, as shown in Table 1.

Figure 3 illustrates the relative size of each category of benefit. It is not surprising that language is the highest category, since Sound therapy is known

to significantly impact speech, hearing and auditory processing. It is a little surprising, however, to see so much focus on internal state. This is probably an indicator that some of the most important benefits of sound therapy are how it makes the listeners feel and how it improves peace of mind, mood, self-esteem, confidence and wellbeing, although these benefits may not be what the researchers set out to identify.

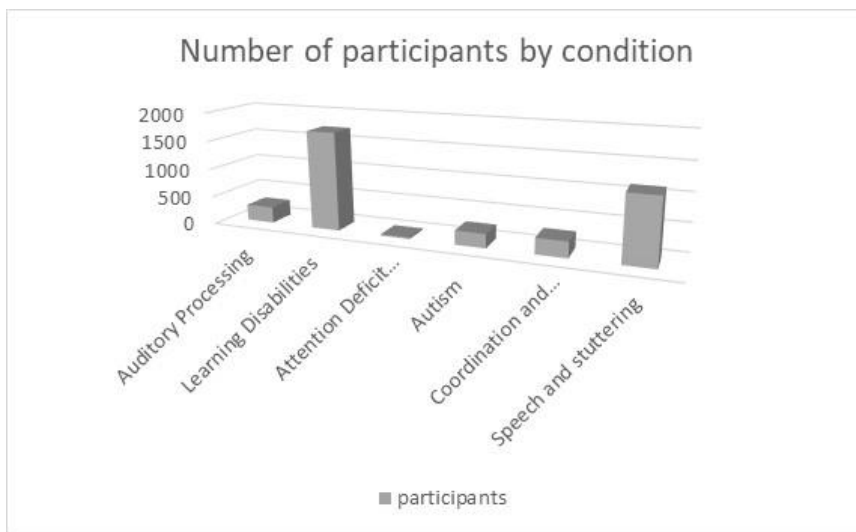


Figure 2. Number of participants by condition.

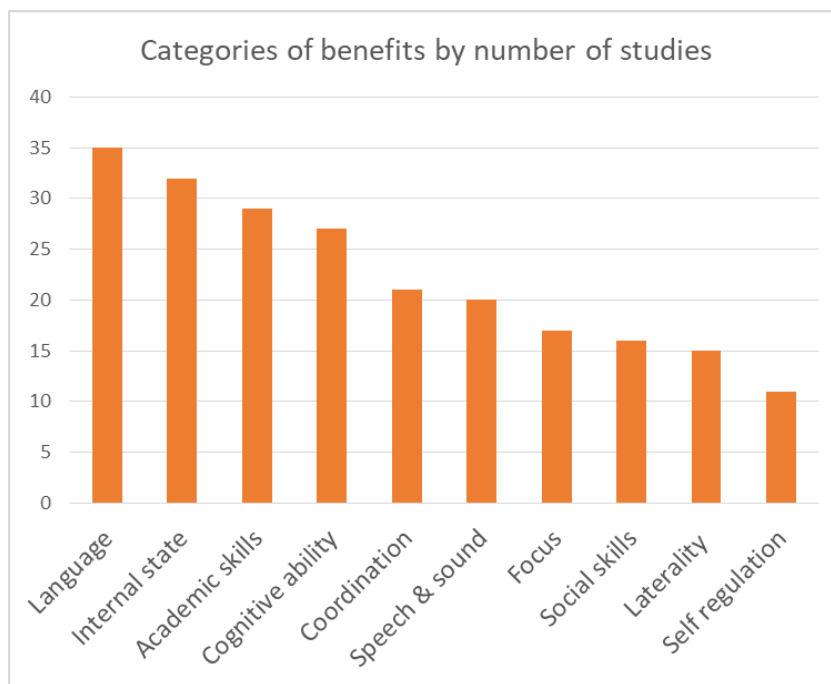


Figure 3. Number of studies demonstrating each category of benefit.

Table 1. Types of benefits from the use of Sound therapy

Self-Regulation	Self-regulation/hyperactivity
	Repetitive movements/echolalia
	Increase in slow brain activity/EEG/AEP
Laterality	Spatial tasks/sense
	Lateralisation/improved or importance of
Language	Auditory processing
	Language/verbal/auditory tasks/
Speech	Pitch discrimination/music/fluency
	Discrimination and localisation
	Stuttering
	Timbre/vocal control/dyspraxia/fluency
Cognitive skill	IQ/cognitive/academic skills/learning
	Learning/memory
	Visual
Academic skills	Comprehension/cognition
	Reading
	Spelling
	Writing
Coordination	Math
	Posture/movement/sports/rhythm/balance
	Coordination/motor skills/balance
Focus	Reflexes
	Attention/concentration
Social skills	Focus/reaction time
	Performance/productivity
	Leadership/creativity
	Responsibility/socialisation
Internal state	Attitude/behaviour
	Confidence/social skills/anxiety/body image
	Self-esteem/personality
	Mood and wellbeing
	Stress/emotional adaptability

One of the main factors affecting the strength of each category is how many different sub-groups it contains. For instance, the category of ‘Speech’ includes timbre, vocal control, fluency, stuttering, localisation and pitch-discrimination. The category ‘Inner State’ includes stress, emotional adaptability, mood, wellbeing and self-esteem. It should be noted that the benefits selected were derived through several processes:

1. the researchers decided to measure for them
2. measurable changes were found
3. these changes were named and identified in the written results of each study
4. these changes were then chosen as significant enough to be listed in compiling this summary

There may have been biases in the categorisation process, resulting in some important impacts not having been sufficiently highlighted. An example of a high impact category that may not have been well represented is self-regulation, which appears as a small group. However, given our recent knowledge about the importance of self-regulation (69) it seems highly likely that that is at the base of most other improvements, but may not have been something that researchers specifically highlighted in most studies. For example, even in the studies on autism, where self-regulation must be a very significant factor, the areas most highly reported were language skills and social skills. This may reflect the fact that these are easy for outsiders to observe, whereas self-regulation, which is a key underlying aspect of performance, is more subtle and harder to measure. This is also something that would likely show up more in studies

on ADHD, but only three studies specifically on ADHD were found.

Benefits by participants

“Estimated number of participants for each benefit” (see Figure 4), reveals how many participants were in the studies that picked up each particular group of benefits. It shows that in the largest studies—for

example the school study in Poland-- language was the area in which most participants improved. Next was cognition, followed by academic skills, then speech and then coordination. These larger studies often included children who did not have learning difficulties or delays, so this is probably an indication of how Sound therapy may benefit children in general, no matter what their level of academic performance. This would be of interest to parents just wanting to give their children that extra head start.

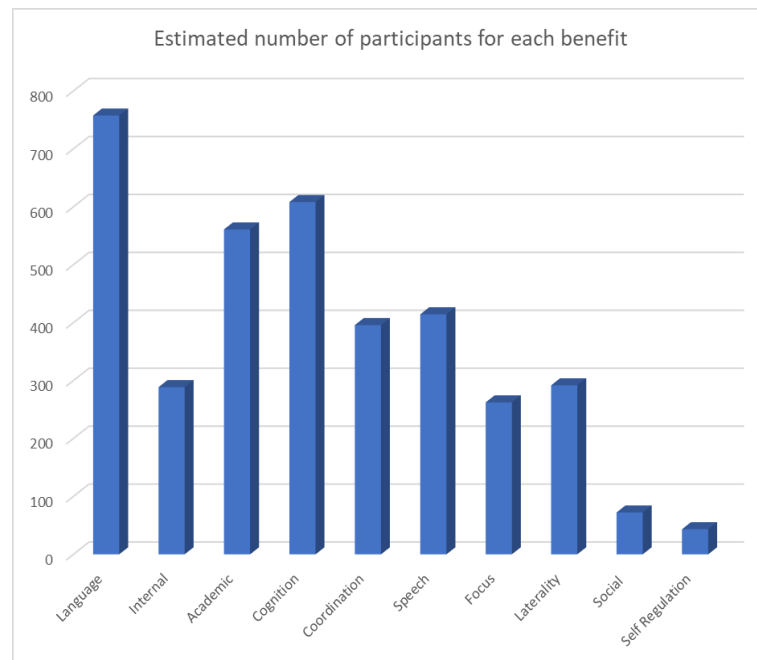


Figure 4. Estimated number of participants for each benefit.

In comparing benefits per participant (Figure 4) to benefits per number of studies (see Figure 3), the most obvious difference is that inner state is much smaller in the participants per benefit (see Figure 4). Social skills are also notably smaller. The two types of study which picked up most strongly on internal state and social skills were those on auditory processing and autism. Although these two categories of study each included ten or more studies, the number of participants was small compared to most other categories of study. This shows that although the researchers felt these benefits were important to study, they represent a smaller population niche than for instance, academic and language skills.

Benefits by condition studied

Figure 5 shows which benefits were found most often in each group of studies. Some of the benefits were diverse and quite different to the condition that the study was aiming to investigate. This is an indication of the wholistic impact of Sound therapy, which seems to help children in a broad array of skills and processing abilities:

- In the autism group of studies, we see that internal state (orange) is very important. This is an interesting insight, as children with autism are not always able to communicate their experience. Language is almost as strong, with self-regulation coming next.

- In the learning difficulties group, we see cognition, academic skills and language rating most highly, which is a good indicator that fundamental mental processing ability, as well as language is being improved for these children.
- In the speech and stuttering group, we see, not surprisingly high percentages for both speech and for language. In the auditory processing group, laterality is the stand-out benefit.
- In the coordination group, both coordination and cognition rate highly. These results are interesting as they draw out the close relationship between certain types of functionality e.g., coordination and cognition.

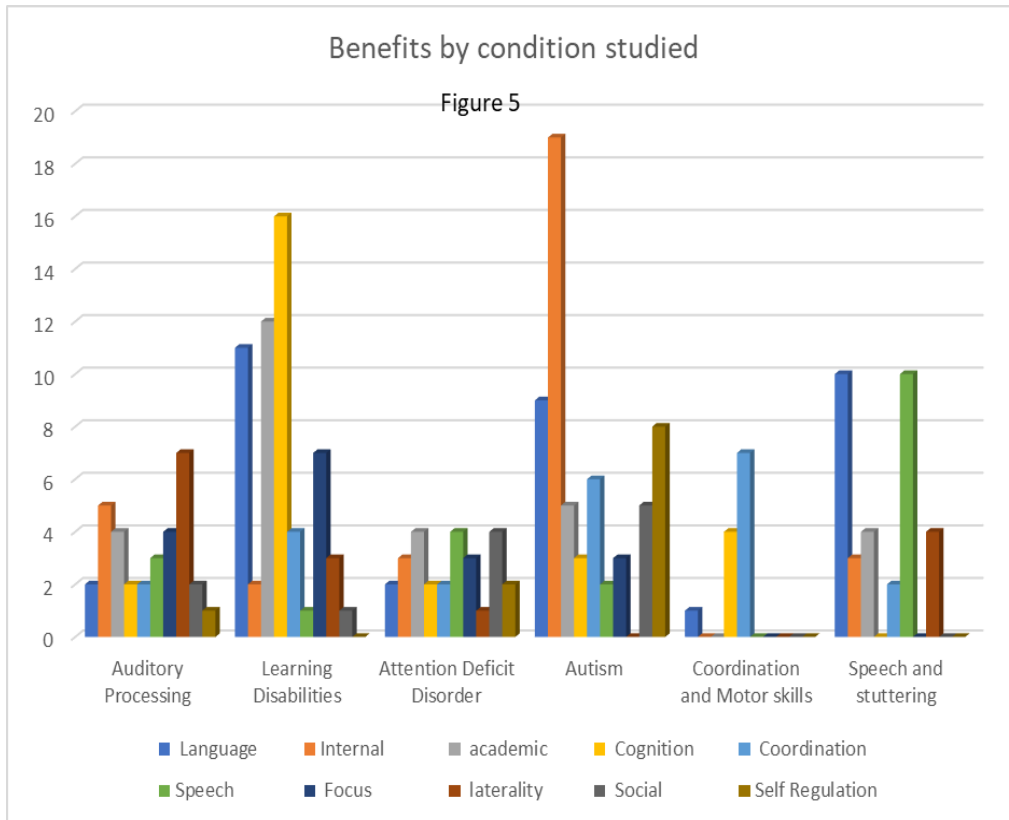


Figure 5. Benefits by condition studied.

What is interesting, in all the studies reviewed, is not only the fact that the majority of participants showed improvement, but the great range of conditions which proved responsive to the stimulation of Sound therapy. The important conclusion from this data is that when you set out to study one area, it overlaps with many others. We are studying complex, integrated beings and Sound therapy enhances a great many aspects of their development. Showing how Sound therapy impacts so many areas of function, underscores the importance of including Sound therapy in any remedial treatment program in order to optimise results.

Conclusion

Tomatis’ unique discoveries showed that the ear is an active organ whose development can be accelerated with the right auditory input (16). This review of 58 studies confirms extensive benefits from Tomatis Sound therapy treatment for children with a wide variety of speech language and learning problems. It also confirms benefits for children who are functioning well or above average.

This literature revealed that Sound therapy enhances the ear brain connection, stimulating brain

plasticity and increasing both receptive and expressive language skills. It improves coordination, enhances auditory processing, alleviates learning disabilities, and reduces the symptoms of ADD/ADHD and autism. Further there are indications that it enhances social skills and self-esteem, improves academic outcomes and relationships, leading to more fulfilling pathways for children. Therefore, early intervention is of crucial importance to enable them to fulfil their best potential in life.

Given the increased need for services and the difficulty in adequately meeting the surge in demand following the COVID-19 lockdowns, using a home-based program may be a practical option to help fill the gap and stimulate greater language development in school age children. Further, Sound therapy as a home-based program is affordable and accessible and can be offered by practitioners or parents to help their clients in any location, with no delays. It is a valuable early intervention, as it is beneficial for any child, whether they have a language difficulty or not. No specific testing is required, and families can take the program home and start using it right away. While waiting for other treatments, Sound therapy may be a good way to give the child a head-start, as it will immediately begin correcting neural language deficits so that any future intervention is likely to be more successful.

Acknowledgments

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