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SOUND THERAPY FOR THE LEARNING DISABLED CHILD

The Effect of High Frequency Filtered Music on Listening and Learning Ability

ABSTRACT

This pilot study tests the efficacy of Joudry Sound Therapy Tapes as an aid to a remedial program for primary aged children. Six children chosen randomly from a group of 20 identified for remedial assistance received the Joudry high frequency music over a period of 16 weeks during remedial class. A control group listened to the same classical music without the additional high frequencies. The target group showed greater gains in tests of Auditory Discrimination, Reading Ability, Reading Comprehension and Spelling than did the control group.

INTRODUCTION

The ability to listen effectively is one of the major factors that distinguish remedial children from those who progress normally. Classroom teachers frequently comment on the remedial child's poor listening ability. Audiometric testing usually shows that these children have normal hearing although the teacher believes that the child is unable to discriminate between sounds. Problems with memory, laterality, attention span, organization, speech articulation and motor control are often symptoms of poor listening (Thompson, 1993) These problems affect the successful learning of cognitive skills. In the classroom situation good listeners are able to put aside background noise and focus on, understand and remember information they require.

According to (Gilmor, 1989) a pupil's ability to process the sounds of language may affect the ability to interpret the sounds of language in their written form. Reading, for example, is not only a visual process as it involves rapid analysis of graphic images (letters) which represent sounds; it is the sound which gives meaning to the letter. The process of decoding letters into sound is more efficient when auditory processing skills are well developed. Similarly writing is the reverse process whereby processing skills are well developed. Similarly writing is the reverse process whereby sounds are translated into written (graphic) form. Poor integration of sounds into language is likely to cause problems with the written form and result in poor spelling and comprehension. Children with weak auditory discrimination or acute hearing are likely to tune out unpleasant speech noise. If this becomes a habit they may lose the ability to

respond to specific frequencies. A listening problem occurs when the ability to focus one's hearing is not mastered or fully developed by the child.

The number and range of problems pupils experience means that any mechanical remedial aid must be flexible for individual or group usage. This study sets out to test if the Joudry Tapes could provide a suitable system to enhance the remedial child's academic performance without interfering with the smooth running of the normal classroom.

BACKGROUND

Sound Therapy was pioneered by Dr Alfred Tomatis while he was researching industrial deafness for the French Ministry of War (Gilmor et al. 1989). Tomatis is a physician and specialist in Oto-rhino-laryngology (Ear nose and throat), and a professor of psycholinguistics. He developed a method of auditory stimulation to restore hearing loss. The rock musician Sung recently undertook a course of Sound Therapy to improve his increasing deafness. Tomatis found there were many other health benefits in addition to accelerating the development of listening skills, language and communication. Dr Tomatis discovered several laws of hearing and was awarded a medal from the French Academy of Medicine and Science for his contribution to auditory knowledge (1958). His first law is now a universally observed phenomenon known as "The Tomatis Effect":

1. a person can only reproduce vocally what he is capable of hearing. Comparison of audiograms and spectrograms of singers and factory workers by Tomatis indicated that hearing and voice are part of the same neurological loop. Therefore, changes in the ear will immediately affect the voice and vice versa, (Thompson 1991).

3. Auditory stimulation administered over a certain time produces lasting effects on audition and phonation.

The orthodox view holds that the ear is a passive receptor and that the oval window has the function of reducing the kinetic energy to the cells of the corti (lessening the noise), the listener only needs to be motivated (Weeks, 1989). Tomatis, on the other hand, believes that bone conduction is the major route of sound to the inner ear. The ossicles provide a way of reducing the amplitude of the sound and the stapedius muscle assists in dampening excessive volume by tensioning the oval window. His clinic program consists of listening

and speaking exercises over a period of eight to twelve weeks. Alternating frequencies of sound stimulate the middle ear therefore causing constant adaptation so that the middle ear muscles are strengthened and tympanic pressure increased. The inner ear then becomes receptive to a wider frequency range.

The Tomatis system requires control of sound issuing to each ear in both pitch (measured in hertz - hz) and intensity (measured in decibels - dbs). The sound is divided into two channels of high and low frequency. Normal listeners have a dominant right ear so a bias to the right provides a more direct route to the left (language) lobe of the brain. This dominance is explained by the fact that the neural links between the sensory fibres of the right ear to the left brain have a shorter pathway than those from the left ear to the left brain. (Maduale, 1993).

Patricia Joudry developed a portable system which can be used with a personal tape player in any location (Joudry 1984). Joudry has been able to record on to analogue tapes high frequency filtered classical music similar to that of Dr. Tomatis. She processes the sound through a machine which divides the sound into two channels, high and low frequencies. An interdependence of pitch and volume causes a switch from low to high channels. She accentuates the higher frequencies progressively eliminating frequencies below 8,000 hz. There is also a bias in volume toward the right ear. Joudry's system involves listening to a series of tapes, each one giving more of the higher frequencies, for approximately 100 hours. The period of listening varies with age and the severity of the problem. Children tend to respond faster than adults. The children are not required to attend to the music, merely being exposed to it at low volume will bring the desired results. Joudry states that improvements in auditory discrimination, left/right confusion, attention deficit disorder and communication are common. Other benefits noted, include reduced stress, improved sleep and reduced motion sickness.

EXISTING RESEARCH

Wilson et al. (1982) studied pre-school children with language disorders using the Tomatis program in addition to the proven remedial 'Wilson program' for the experimental group. The control group were on the 'Wilson program' only. The results

were taken over a period of two years. A follow up evaluation was also conducted in the children's' third year of school.

Results of the study found that the children in the experimental group showed statistically significant findings in favour of the Tomatis group in Auditory Closure and Auditory Mimicry. Teachers and parents judgments agreed that the Tomatis group were ahead of the control group in expressive language (expression of thoughts, ideas and feelings).

Jordan, (1987, 1989) studied the effect of the Joudry tapes on over 200 Tinnitus clients with encouraging results. Bell, (1991) was able to show significant changes upon a single remedial child within three weeks. Children apparently show results faster than adults.

Sidlauskas (1969) addressed The American Orthopsychiatric Conference on the ideas of Dr Tomatis and suggested the program would be suitable for children. She emphasised these three developmental stages of children;

1. Pre linguistic; the link between the sound of the human voice and feeling;
2. Lateralisation of the ear effecting motor skills (including eye tracking);
3. Expression and directionality on communication.

Kershner et al (1990) conducted a follow up of a Tomatis Listening Training Program (TLP) with learning disabled (LD) children in Canada. However, Kershner's definition of LD excluded children with the type of problems commonly encountered in Australian remedial classes. The study was unable to demonstrate significant gains in reading none-the-less the children's' self esteem rose to the level of their peers and the LD children improved significantly in visuo-spacial conceptualisation and constructive abilities. It is noted that Kershner et al. treated target and control groups to different experiences, withdrawing the E group from classes for five hours per week but the C group for only one hour. Thompson (1993) found the study had methodological shortcomings and overdrawn conclusions which limit the extent to which the results can be generalised. Thompson agreed with Gilmore that "all the children in this study were attending a private school with a low teacher pupil ratio and individual remedial programs. It is probable that the TLP could not add significantly to such an intensive private school program which was so strongly supported by staff and parents..." (33).

Roy (1980) and Roy (1980) completed their PhD theses (unpublished) on the Tomatis method with the same group of five dyslexic boys who received Tomatis LTP. The study was conducted over a period of 14 months at The Child Study Centre in Ottawa, Canada. No remedial teaching was provided with the Tomatis treatment but pre and post testing was completed. The Santo Stefano's Cognitive Control test measured four principles of cognitive control - Focal Attention, Field Articulation, level sharpening and Equivalence Range. Four of the five boys improved in cognitive control functioning and spontaneous speech. R.T. Roy concluded that academic skills and perceptual processing progressed by use of the Tomatis audio - vocal method,

Rimland and Edelson (1992) conducted a pilot study with seventeen adolescent children diagnosed as autistic. Eight subjects were placed in an experimental group and nine in a control group. Multiple assessment measures were administered before and after the ten day Berard Auditory Integration Training. Finding significant < differences favoured the experimental group the authors concluded that a further larger study should be undertaken.

Berard learned from Tomatis and although he uses the same basic concepts he advocates a shorter more intensive approach. Like Tomatis he controls selected frequencies reducing the sound to over-sensitive receptors and stimulating reluctant receptors. His system uses greater volume to over-ride the body's defensive mechanisms.

Tomatis, Joudry, Berard and Maduale all use high quality analogue tape recordings where they claim the whole spectrum of sound can be recorded. Steinbach (1990) appears to have adapted the work of Tomatis, Berard and others for use with a CD player. The objective being to gain greater control over the elements of sound. However Joudry and Tomatis claim that too much of the important high harmonics that are detected by our peripheral hearing are lost in the digitisation process. Dr. John Diamond claims that digitised sound is actively damaging to our central nervous system (1980, 1984). Levinson (1984) also links poor auditory discrimination to dyslexia, he treated children diagnosed as mentally inferior with drugs affecting the inner ear and they gained in scholastic competence.

SOUND THERAPY AND LANGUAGE

Tomatis has shown that people from different countries hear in different ways because languages are spoken in different frequencies:

"Every ethnic ear can be defined by its spectrum of receptivity... An envelope curve could be established for each group which is based on the average recorded values of all the frequency peaks found in the spoken language... The French ear for example hears between 1,000 and 2,000hz... the British ear is between 2,000 and 12,000hz... the North American ear is between 750 and 3,000hz... This does not mean that in each of these examples there is deafness to frequencies outside the basic frequency band. But an undeniable sensitivity to certain frequencies exists which explains the under-use of other frequencies..." (Tomatis, 1991, 71-2).

Tomatis has used Sound Therapy for assisting the learning of foreign languages or for assistance with children learning English. The actor Gerard Depardieu utilised the Tomatis method to help him learn English for the film Green Card.

THE STUDY

This study researched the effect of Joudry's high frequency filtered classical music on children's ability to learn during a normal remedial reading class. By using a specially constructed stereo "listening post" up to four children can listen simultaneously to the tapes. Mono listening posts are in common use throughout Queensland schools. Children were also allowed to have a separate player with the identical sound therapy tape if they needed to move around. The control group were able to move around with a mono walkman with the same music without the high frequency. The earphones ensure the true stereo effect no matter where the child sits in the classroom. The 32 hours of Joudry tapes were played over sixteen weeks, one hour for each of the two days the remedial teacher was in a Queensland State School.

AIMS OF THE REMEDIAL PROGRAM

- (a) to improve pupil's auditory discrimination skills
- (b) to assist pupils with poor receptive language; e.g. children who:
 1. need to have instructions repeated,

2. who are distractible, restless, day-dreaming, have poor attention and concentration,
3. who tend to misinterpret what is being said,
4. have difficulty with following and/or participating in conversation in a noisy environment.

(c) to assist dysfluent readers to improve reading fluency so they can complete sentences with less hesitation and therefore have a chance to comprehend the meaning of the passage.

THE SAMPLE

Class teachers normally refer to the remedial teacher children who through observation and testing are found to be more than 20 months behind the class average in reading, writing and mathematics. Some children had been tested by the school guidance officer and all had been tested by the remedial teacher. Two groups of seven children, from grades two to four, were assigned to experimental (E) or control (C) groups with the aim of having the two groups as similar as possible. Because one teacher was concerned that one child might miss out on valuable additional help the experimental group contained one child who was a non-reader. This resulted in the E group having an average reading level lower than that of the control group. Therefore the focus of the study changed to whether or not the experimental group could reach or exceed the progress of the control group.

The children's problems included visual perception, poor auditory discrimination and distractibility. Most were either overactive or hypo-active (underactive) with some laterality problems and low motivation towards reading and writing. Fine motor problems were evident (handwriting) and there were two slow learning children (two standard deviations below the norm) plus two pupils with foreign born parents who spoke both their native language and English at home. Two children had visual perception problems as well as auditory perception. One child was assigned to each group. Two hypoactive children were assigned to different groups. The overactive pupils were evenly distributed between both groups. Interviews with the pupils'

mothers indicated that many pupils had ear infections or tonsillitis as babies. Preliminary screening indicated none of the children had a hearing problem (nurse's records).

ATTRITION

One child in the control group left the school after the second week. Another member of the control group was absent from school, did not receive the complete remedial program and was dropped from the study. One child from the experimental group was dropped after irregular attendance. The final analysis was conducted on a group of 11 (six E and 5 C).

METHOD

The procedure used included standardised normed pre and post experiment tests, questionnaires to teachers and interviews with parents. A systematic observation schedule comprising six indices of individual classroom behaviour was completed by the teacher after or during each period. Children in both E and C groups received identical lessons while listening to the music through earphones. The E group had a stereo (HiFi) listening post while the C group used a mono listening post. The E group were exposed to Joudry's tapes, and the C group, exposed to the same classical music without the "electronic ear" filtering. No person other than the experimenter knew which children were in the experimental group. As is normal in remedial classes there were more males than females. The children were taught in small groups of five or six.

Tests

Five normed tests were administered, these were chosen for their familiarity, accessibility and reliability:

(1) Test of Auditory Discrimination (TAD) Goldman-Fristoe-Woodcock. (AGS 1970)

Revised 1976 using a standard audio cassette.

(2) Neale Analysis of Reading Age (Neale 1988).

(3) Neale Analysis of Reading Comprehension (Neale 1988).

(4) Westwood Spelling (1979)

(5) S I Graded Spelling Test A Schonell (1967?)

The TAD is a taped test with an American voice (accent). This test was trialled on other remedial children who had auditory discrimination problems who were not included in this study. No problems with administration were encountered as the TAD allowed two complete practice sets and the examiner was permitted to explain any pictures from the test without compromising the test. Any pupil who obviously had trouble with the accent was to be excluded from the study. Only one pupil experienced this difficulty and was withdrawn.

Behavioural Observation

Six behavioural indices were developed and employed to rate the children on a four point scale for each index.

- (1) Word Attack preventing fluency;
- (2) Focused While Reading;
- (3) Interest in Writing;
- (4) Ability to Recall specific information;
- (5) Ability to answer questions;
- (6) Talking/Distractibility

The means of each group were then graphed and compared for significance and trends.

The Remedial Program

A normal group remedial program in this case consists of a short motor program of kinesiology exercises consisting of alternate limb body patterning, eye and hand movements. Whole language reading (words in context), plus word building, word attack skills, e.g. initial consonants, mid word phonemes, and word endings. Cloze exercises were included for contextual reading. Critical and inferential thinking skills were encouraged to assist in comprehension. Reading games helped children to read in their

normal talking voice to improve tone and timbre. Comprehension strategies included use of prior knowledge, main idea, and problem solving. Written work consisted of written questions and answers about dairy happenings, story webs, retelling a story in their own words, writing letters, lists, directions and story writing. Spelling was generated from their own stories.

The instructions for the Joudry tapes suggest that children be allowed to listen to the tapes for two hours a day for 100 hours. However, Joudry asserts "Some children will begin to achieve results in the first few days of listening" (Joudry 1992). The children attended the normal remedial periods of one hour a day for two days per week. The study ran for 16 weeks, a total of 32 hours.

It was not possible to continue the study due to the summer holidays. The researchers hoped to gain an indication of the program's effectiveness in the time available. The other major query was whether the stereo equipment and headphones for each child would be an impediment to learners. By using a control group with an essentially parallel experience of music, equipment and teaching method it was possible to compare the outcomes of the two groups.

RESULTS

Table 1.

Goldman-Fristoe-Woodcock Test of Auditory Discrimination (in percentiles for age group).

	Group size	PRE			POST		
		Mean	SD	t	Mean	SD	t
EXP	6	18.16	13.09		37.8	16.38	
CON	5	25.8	28.45	-.55	37.6	32.89	.01

E group started 7.64 percentile points lower than C group and finished at almost the same position Pre and post difference of E group shows significance at .024, while the Pre and post difference of C group does not reach significance at .31.

Table 2.

Rosner Test Of Auditory Analysis Skills

Not all the children were tested on The Rosner TAAS as it only scaled to year three, one child in each group were in year four.

	Group size	PRE Mean	POST Mean
EXP	5	56.8	80.7
CON	4	76.9	70.7

The children in the E group rose 23.9 percent The children in the C group dropped 6.2 per cent.

Table 3.

Neale Reading Age Group Means (in months)

Note: where starting scores were below norm tables the lowest available score was given.

	Group size	PRE Mean	SD	t	POST Mean	SD	t
EXP	6	78.16	10.1		88.5*	9.9	
CON	5	80.2	10.7	-.32	86.0	6.1	.62

E group started 2 months lower than C group, while the post test indicates E group was 2 months above C group. *Pre and post difference of E group (10.4 months) shows significance at .001. Pre and post difference of C group (at 5.8 months) is not significant. The starting difference between the groups was not significant at .75. Final difference between the groups was not significant at .62, however the experimental group increased more than the control by 4.6 months a difference of 79%.

Table 4.

Neale Comprehension Age group means (in months).

Note: Where starting scores were below group norms the lowest available score was given. Each child in both groups read short passages and answered comprehension questions on those passages in which they had less than 16 errors

	No of Cases	Mean	SD	t	Mean	SD	t
EXP	6	79	9.9		83,1	9.3	
CON	5	85.0	2.5	-1.42	84.8	5.0	-.37

Differences between groups at the start and finish are not statistically significant although the E group comprehension improved by 4.1 months and the C group comprehension remained static.

Table 5.

Spelling Age Group Means (in months).

Both groups were scored on Westwood prior to trials and the SI Spelling test A at the conclusion of the study. Note: Where starting scores were below group norms the lowest available score was given.

	Group size	PRE			POST		
		Mean	SD	t	Mean	SD	t
EXP	6	76.6	5.2		88.5*	5.2	
CON	5	75.4	4.8	.41	87.6 *	5.6	.79

Experimental group started one month ahead of control and finished a month ahead of control. The between group difference is not significant. The E group moved 11.9 months which is significant at .001. The C group improved 12.2 months which is less significant at .027.

Behavioural Observations by Teacher (see Appendix 1. graphs 1-6)

The means of each group were graphed and compared for significance. While there were no statistically significant differences between the groups it is striking that the E group tended to stay above the C group. The period studied was from July to December and it was noticeable that the behaviour of both groups of children deteriorated in the last observation period just before the summer holiday break. (See graph "Distractibility") Both the hypoactive children were reluctant writers at the start of the study.

Class Teacher and Parent Comments

The indicators reflected the teachers concerns:- Distractibility; Overactive behaviour; Reading improvement; Misinterpretation of questions. There were six students in the E group, five students in the C group. Appendix 2 indicates positive response to questions e.g. 5 children were distractible pre and all improved (equal to 0).

The TAD (but not the Rosner) and another may have had a cold. However the mean movement of the other children in C group was only 7 percentile points on the TAD. Supporting evidence from the Rosner (TAAS) showed a surprising drop in the C group and a rise in the E group of 23%. As this test is really to determine whether a child is ready to start school the norms only extend to grade three. This meant that the two year 4 children were not tested on the TAAS. We can only wonder if the absence of ear infections in E group has significance in *itself*.

As spoken English has a large percentage of high frequency consonant sounds (up to 12,000 HZ) it is imperative for fluent native speakers to be able to distinguish between high frequency fricatives and sibilants etc.

The change in the E group reaches significance at .015. There was no specific effort to teach auditory discrimination to either group so we can conclude that the change was due to the high frequencies in the Joudry tapes. The increase of the E group in both reading and comprehension could be considered to be due to the increase in auditory discrimination.

Reading Age

It is significant that the Reading Age of the E group showed a rise of four and a half months over the control group. The E group rose 10.4 months while the C group rose 5.8 in the same period. The teacher, the curriculum and the methods employed were all constant for the period for both groups. Experienced teachers consider an increase of five months in reading in four months is good progress for a remedial child. The control group as a whole made 5.8 months progress. While there are occasional children who make rapid progress, it is unusual for a group to make ten months gain in the period studied.

Reading Comprehension

Comprehension as measured by the Neale improved four months in the E group and remained static in the C group during a four month period. These gains were in the normal range that is one month gain for one calendar month. The control group did not make any gain although this is not statistically significant. Low achievers were assigned to both groups evenly and only small gains were expected.

Spelling

Spelling was taught in conjunction with written work but not as a separate subject. The E group spelling mean was one month in advance of the control group at the commencement of the trial period and stayed one month in advance at the last trial period, an increase of 11.8 and 12.2 months respectively. Due to the wider starting variation of the E group the increase was statistically significant (.001) although the difference between the two groups is not significant. The increase in the C group also reached significance (.027).

Teacher Observations

A behavioural observation schedule was written up after each lesson however with the number of children involved and a series of six indices for each child the task proved taxing for the researcher. For the last two observation periods a trained helper was co-opted to assist with observations as it was felt that the researcher may bias the study by marking the E group too hard in an effort to be fair. Observations were also discussed with the classroom teachers.

Behavioural Graphs (see Appendix 1. graphs 1 - 6.)

1. Interest in Writing

Interest in writing shows E group starting lower with a steep upward curve peaking at period four, two periods earlier than C group. The researcher was interested to note that both the hyperactive and hypoactive children became more enthusiastic in their written work earlier than would be expected in a remedial class. A longer study could confirm such results

2 Distractibility

A trend is noticeable in the graphs that the E group seemed to take a sharp rise on the fourth observation period while the C group rose to the same level after the sixth exposure the index of distractibility showed the most significant rise over the period. It is noted that the TAD and the distractibility index correlate quite highly.

3 Recall Directions

Recall Teacher's Directions shows the E group starting approximately equal and then dipping low just after the September holidays catching up in the third, sixth and last period.

4 Ability to Answer Questions

Ability to answer questions shows the same trend for the E group to draw ahead at the third observation period in front of the C group. However the closeness of the two graphs shows no significant difference.

5 Focused While Reading

The E group children were able to concentrate on their reading earlier than the control group, and continued to improve throughout the study. The control group took to the sixth period to reach a satisfactory level. From the seventh to eight period the C group rose steeply to almost reach the E group. This co-relates with the E group Neale Reading Age which accelerated faster than the control and ended four months ahead. Although the final difference does not reach significance an extended study would show whether the E group would continue to pull ahead of the Control group.

6 Word Attack

Word Attack Preventing Fluency (analysis of the phonemic structure of a word and recognition of word units such as prefixes and suffixes) shows both groups starting at the same level but the E group rises from the second period and gradually draws ahead of the C group. This divergence is not statistically

significant but shows the same trend as the other graphs. Word attack requires both visual and auditory processing and is particularly difficult for children biased toward multi-channeled learning auditory, tactile and visual processing. The non reader in E group began to read in the fourth period by using whole word teaching (sight words) in context.

Laterality

The last informal test of left/right confusion (see Appendix 3) indicates the experimental group made one mistake when touching the Right eye with the Left hand. While the control group made two errors.

DISCUSSION

Parents were unaware of which group their children were in but all parents commented favourably on the improvement in the children of both groups. Two E group parents did comment upon the improvement in laterality, one child stopped reversing in three periods (e.g. was-saw, on-no, and-dan). The other mother indicated an improvement in written reversals three months later. Testing of laterality was not complete and would need to be addressed in a further study. The figures quoted for improvements are conservative. Where the experimental group means surpassed the control group simple comparison does not show significance.

The general trend on most of the indices of standard tests, observations and questionnaires was that the experimental group advanced faster than the control group. The hypothesis that the E group could exceed the C group if given limited exposure to Sound Therapy appears to be true. The researchers are aware that by the standards of Sound Therapy Australia insufficient time was allocated. Greater validity would have been assured if larger numbers of children had been available, as always constraints of time and resources limit the ideals to the practical.

CONCLUSION

It appears that from standardised tests and the behavioural observation schedule that the children who received the high frequency music showed more rapid advances than those who received classical music alone. For a better controlled study the children should be tested before and after for auditory acuity and auditory discrimination, preferably by an independent examiner.

All the children in this study used headphones connected to a four way splitter (listening post) to obtain the maximum effect consistent with the teacher being able to control the input. For Special children being integrated into the classroom it is entirely feasible for an individual child to wear a Walkman player with the tapes while attending to lessons in the normal way. It is clear that larger group studies would be worthwhile especially in view of the policy of integrating as many disadvantaged children as possible into the normal school. Sound Therapy may allow them to speed up the learning process.

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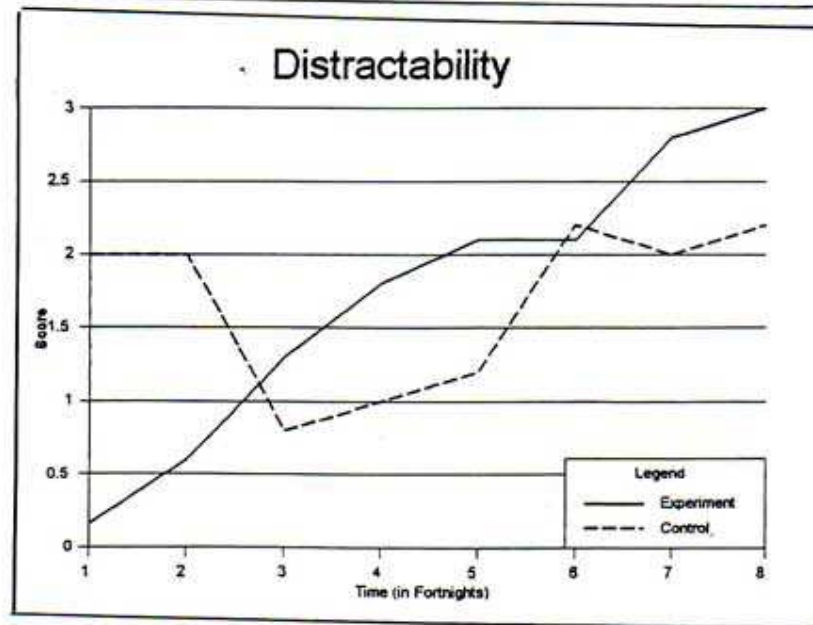
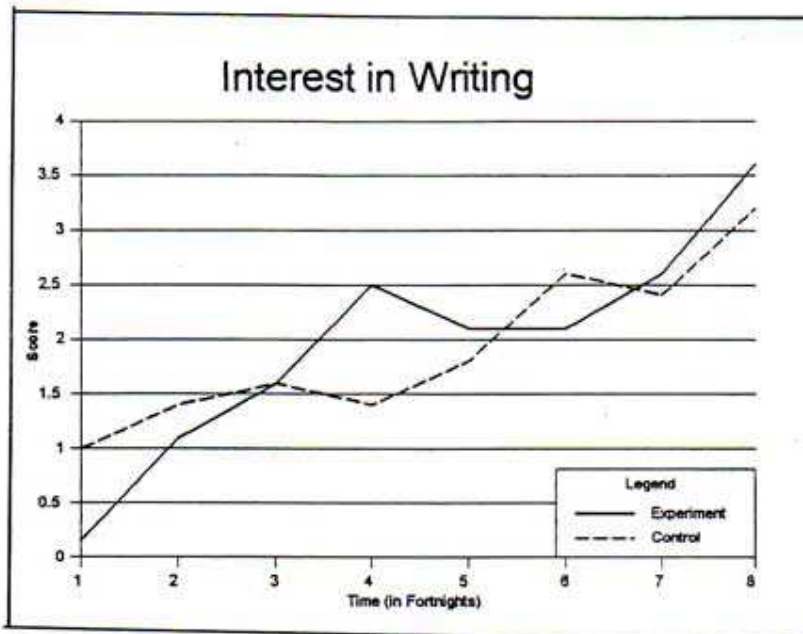
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Thompson, B.M. (2) "Listening Disabilities: The Plight of Many", in Wolvin A and Coakley C, Eds., *Perspectives in Listening*. Ablex Publishers. 1993.

Tomatis, A. A. *The Conscious Ear*. N.Y. Station Hill Press. 1991.

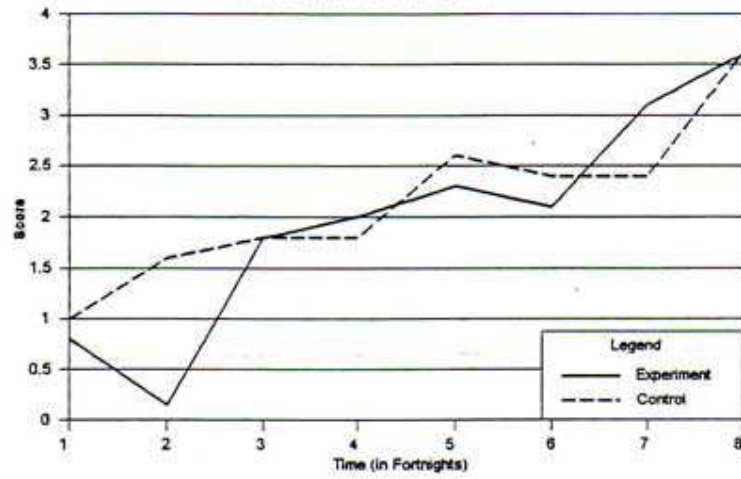
Wilson, B.C., Iacoviello J.M., Meflay W. Risucci D., Rosati R., & Palmaccio T. *Tomatis Project Final Report*. Ontario. The Listening Centre. 1992.

APPENDIX 1



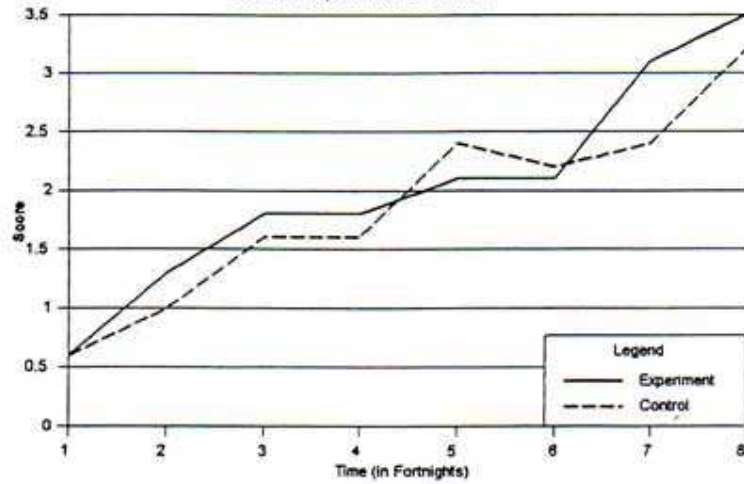
Recall Directions

Mean of Experimental to Control

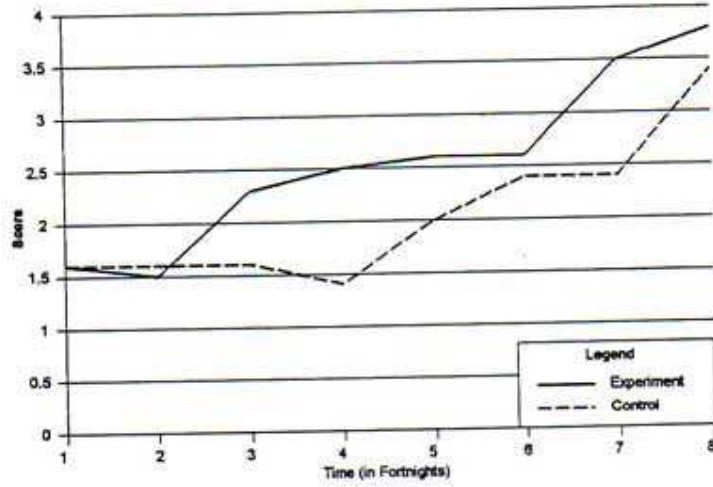


Ability to Answer Questions

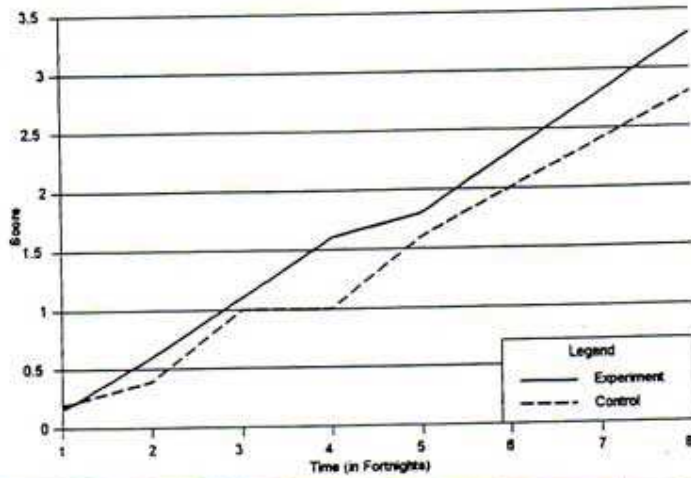
Mean of Experimental to Control



Focussed While Reading



Word Attack



APPENDIX 2

1. Teacher Observations

Four sets of behaviors were classified for class teachers and parents to comment upon. They were Distractibility, Overactivity, Reading Ability and Misinterpretation of questions. The Experimenter interviewed the Teachers and Parents before and after the study. A zero indicates no children exhibited the negative behavior, the maximum score was 6 meaning all children in the group had the unwanted behavior or problem. Not all children had all the symptoms so no statistical analysis was attempted.

	Experimental				Control				Parents	Teachers
	Parents		Teachers		Parents		Teachers			
	Pre	Post	Pre	Post	Pre	Post	Pre	Post		
Distract: *	5	0	42		32		41			
Overactive :	3	2	22		11		11			
Poor: Reading	60		60		50		50			
Misinterpreta- tion of questions	30		30		42		40			