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Music and Dyslexia: The Therapeutic Use of Instrument (Piano) Training with a Child with Dyslexia (A Case Study)

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Abstract
Dyslexia is defined as a difficulty in learning at an expected level according to age, intelligence and education that is given, even though the intelligence level of the individual is normal or above normal. Individuals with dyslexia have difficulties in many developmental areas that can be considered in the scope of music therapy. Interventions using multi-and-interdisciplinary approaches can support children with dyslexia to overcome their difficulties. There are studies showing that music interventions involving children with dyslexia provide both therapeutic and educational support for these children. In this study, instrument training as an intervention that helps children with dyslexia will be presented by referring the effects of music on the learning process. Instrument training sessions in which the piano was preferred as an agent, were carried out once a week for 45 minutes throughout an 8 month period. Various supplementary musical activities such as sight reading and writing notes, rhythmic exercises, improvisation trials and public performing were included in the process. During the sessions, the child was systematically reinforced. All the sessions were recorded with a video-camera and the recordings were analyzed and reported in the form of descriptive analysis. Findings refer positive progress in all developmental areas especially in social and emotional development in addition to the musical development while music made a significant effect on motivating the child with dyslexia and a significant role in contributing to the learning process.
Keywords: Dyslexia, Music, Instrument Training.

1. Introduction

Dyslexia is a specific learning disability that appears to be based upon the brain and its functioning (IDA, 2014:2). It has a neurological origin that does not imply low intelligence or poor educational potential, and which is independent of race and social background (DFES, 2004). Dyslexia is defined as a specific difficulty typically characterized by 'an unusual balance of skills', and increasingly being recognized as a difference in cognition and learning rather than a deficit (DFES, 2004). Dyslexia is a variable condition and not all people with dyslexia will display the same range of difficulties or characteristics. Regardless of the emphasis on learning difficulties in the definition of dyslexia, it appears to include a wide range of symptoms (Geredakis, Vergou & Zakopoulou, 2017). Dyslexia affects information processing (receiving, holding, retrieving and structuring information) and the speed of processing information. It therefore has an impact on skills such as reading, writing, using symbols and carrying out calculations. However, there are many differing definitions; dyslexia is also an umbrella term for specific learning disabilities and it may overlap with other related conditions (DFES, 2004) such as dyslexia, dyscalculia, dysgraphia, dyspraxia, dysphasia and other related deficits[1].

Children with dyslexia often need specialized instruction to overcome the problems (IDA, 2014). Therefore, some arrangements on the learning-teaching process should be planned to help them to overcome their difficulties. The arrangements can be applied on the fundamental components of the learning-teaching process which are teacher, student, content/concept, methods/approaches, environment/media, materials/interventions and the relationships between these components. Necessary arrangements for children with dyslexia can be executed on any component of the learning-teaching process except the child component; such as an individualized education plan, multi-and-interdisciplinary methods, child appropriate approaches, special environmental regulations and personalized materials and interventions. On the other hand, the child should feel fully accepted regarding who he/she is and how he/she is.

Since dyslexia has a wide range of characteristics, not all children with dyslexia will experience the same difficulties. Therefore, a standardized education would not help them to learn efficiently. The components of the

[1] *Dyslexia* is defined as difficulty in learning to read or spell, problems related to language and memory, difficulty in verbalisation,
Dyscalculia is identified as severe difficulty in making artihmetical calculations and math, difficulty in understanding symbols and difficulty in choosing and writing numbers.
D*ysgraphia* is characterized with inability to write coherently, problems in grammar, writing wrong, spelling mistakes;
Dyspraxia is explained as difficulty in activities requiring coordination and movement, difficulties in motor coordination, difficulties in fine and coarse motor movements, sensory integration disorders,
D*ysphasia* is defined as difficulty in the generation of speech, abnormality in perception and expression, difficulties in receptive and expressive language skills.

learning-teaching process, other than the student component, should be planned very specifically to tolerate the difficulties that the child with dyslexia has to confront. Besides individualized education, children with dyslexia should be approached with an appropriate methods and they should be in an environment in which they feel accepted socially and emotionally (Bender & Smith, 1990). There are studies showing that children with dyslexia have social and emotional problems besides and as a result of their learning difficulties (Bender & Wall, 1994; Chapman, 1988; Durrant; 1990; Fox& Wiever, 1989).

Many different types of interventions have been proposed regarding dyslexia treatment, based on the varied theories that stem from the diverse nature of dyslexia. A solid base of evidence emphasizes on traditional educational models such as direct teaching, many alternative therapies for dyslexia have been proposed. Each dyslexia treatment method, such as biofeedback, sensory integration therapy, music therapy, chiropractic technique, homeopathy, Dyslexia-Dyspraxia-Attention Deficit Therapy (DDAT), perceptual-motor training, visual interventions, auditory interventions, and fatty acid interventions, has its own supporters (Geredakis, Vergou & Zakopoulou, 2017).

As we can see in the list above, music therapy is one of the alternative methods offered to children with dyslexia and there have been many studies on the relationship between dyslexia and music (Aldridge, Gustorff & Neugebauer, 2002; Linden & Ostermann, 2010; Overy, 2000; Overy, 2003; Overy, Nicolson, Fawcett & Clarke, 2003; Patel, 2012).

Music therapy is considered an efficient discipline in the treatment of individuals with special needs but above all else music itself has an important place in human life both biologically and aesthetically (Jensen, 2000). It is known that music has the power to affect the human brain, body, energy level, mood and ideas. Music can excite or soothe, stimulate or relax, direct or set free (Harwey, 2004). Compelling evidence supports the position that when implemented properly, the musical arts can provide a positive, significant, and lasting benefit to learners. Benefits are explained in two main categories: benefits as a *direct* result of music and benefits as an *indirect* result of music (Jensen, 2000). In order to explain the effects of music on humans both biologically and beyond, it is important to know what music is made of.

The basic elements of music are rhythm (duration, tempo, meter), dynamics, melody (pitch, scales), harmony, timbre, texture, form/structure (Levitin, 2006; Schmidt-Jones, 2013). Music that contains all these elements affects humans itself, even without association with any other discipline or form. Yet association with the other disciplines makes the effect of music more specific and thus the purpose of the use of music becomes prominent. In either discipline (education or therapy), varying responses of the child to each element naturally match up with the stages of his development (Schwartz, 2008).

According to the purpose, needed implementations of music can be classified differently. These mainly are performance, education and therapy. Putting “performance” aside, “music education” and “music therapy” can be considered as distinct yet also collaborative disciplines and professions. Music education focuses primarily on music-related goals such as learning to sing, perform, compose, and analyze music. On the other hand, music therapy aims to use the music to achieve non-musical goals such as developments in cognitive, behavioral, physical, emotional, social and communication areas. Both professions use the same medium, namely music, for a different purpose (Adamek & Darrow, 2007).

Music, a medium used mutually in both disciplines, is not something that can be isolated from our sensory responses (Schwartz, 2008). We move as we listen, we dance as we sing, we sing as we hear, we feel as we perform. Therefore, music making is considered as a multi-sensory activity, and it is well recognized that multi-sensory training is a valuable form of teaching for dyslexic children (Hornsby & Miles, 1980; Hulme, 1981). Music, as a multisensory and multidimensional phenomenon, is one of the most appropriate agents to approach children with dyslexia since dyslexia has also a wide range of characteristics including auditory, visual, kinesthetic, lingual, cognitive, communicative, social and emotional dimensions. Besides all the sensory and developmental dimensions that music affects, music takes on different roles at different times in the life of the child such as stimulation, relaxation, motivation, affirmation, satisfaction (cognitive, aesthetic, kinesthetic).

Large volumes of research and investigations have been devoted to the issue of dyslexia, and more recently to dyslexia and music. Many of them claim that music lessons have a positive effect on other areas of academic achievement (McMillen, 2004). It is agreed in therapeutic and educational literature – both general and musical – that a multisensory approach is beneficial when teaching people with dyslexia. The learner needs to look, listen, touch, attend to hand movements and/or mouth movements, and co-ordinate eye/ hand movements. Strategies such as listening to a new piece while silently practicing the fingering, or singing the piece in one’s head before playing it, are recommended. Other research suggests that knowledge of how a less able person handles musical material might add to a general understanding of how a more able person handles similar material (McMillen, 2004).

Douglas and Williats (1994) studied areas regarding the relationship between musical ability and literacy skill. They found a direct relationship between the association of rhythmic ability and reading. Another study by Forgeard, Schlaug, Norton, Rosam, Iyengar and Winner (2008) was looking at the relationship between music

and phonological processing in normal-reading children and with children with dyslexia and found a strong relationship between musical discrimination abilities and language-related skills.

There are also many studies that involve instrumental music interventions. Tomatis (1991) suggested forms of music listening and music making as tools for increasing auditory sensitivity and preventing or remediating speech and language difficulties. He also emphasized that music making is valuable because it is an activity requiring very accurate auditory and motor timing skills, and thus presents a potential tool for remediation in the before mentioned areas. Oglethorpe (2001) suggests that practicing an instrument daily, which involves listening, looking and touching, may compensate for dyslexic tendencies. Ganschow, Lloyd-Jon, and Miles (1994) agree that early practice using multisensory techniques such as instrument playing- can assist children with dyslexia to overcome their difficulties. Vladikovic (2013) indicates in her doctoral dissertation that learning to play an instrument requires the utilization of complex brain processes because it involves far more than the simple memorization, recognition, and execution of symbols. Learning music and rhythmic notation is but a first step in that process. The complexity of written music language and the execution of the same on any instrument requires the simultaneous employment of a multitude of brain functions. The interpretation of written music text combines not just the act of reading notation, but also comprehension and translation into a physical action of producing the sounds on an instrument. The more complex the instrument, the more challenging it is for learners with dyslexia. Instruments capable of producing harmonies such as stings, keyboard or piano, pose additional difficulty for children with dyslexia (Vladikovic, 2013).

Practicing a musical instrument involves multiple components of the central (brain and the spinal cord) and peripheral (nerves outside the brain and spinal cord) nervous system and leads to numerous structural changes in the brain after only 15 months of training in early childhood. These changes correlate with improvements in certain motor and auditory skills (Zatorre, Chen & Penhune, 2007; Hyde, Lerch, Norton, Forgeart, Winner, Evans & Schlaug, 2009). While practicing an instrument, motor systems in the brain control both gross and fine movements needed to produce sound. The sound is processed by *auditory* circuitry, which in turn can adjust signaling by the motor control centers. In addition, *sensory* information from fingers, hands and arms is sent to the brain for processing. If reading music is also involved in the process, *visual* information is sent to the brain for processing and interpreting commands for the motor centers. And of course, the brain processes *emotional* responses to the music as well (Zatorre, Chen & Penhune, 2007). Musical practice may therefore enhance neurogenesis linked to improved learning and memory activity (Hyde et al., 2009).

1.1. Problem Statement

Beyond music itself, practicing music instrumentally has a profound impact on the learning process. Piano can be considered one of the most complex instruments where all sensory associations listed above may occur. Therefore, piano training can be effective on the child's brain and more so on his/her learning process. The therapeutic effects of practicing piano on the development of a child with dyslexia, the individualization of the piano training for the child with dyslexia in view of the fact of the components of the learning-teaching process, the achievements on the sensory and developmental areas of a child with dyslexia during and as the result of the process of piano training and the therapeutic relationship between piano teacher and the child with dyslexia were investigated in this study.

1.2. Research Questions

In this study, the therapeutic effects of practicing an instrument, in this case piano, on the development of a child with dyslexia was investigated. The following research questions were formulated in view of the components of the learning-teaching process:

1- Which kind of arrangements/adaptations/reductions were made on the setting, piano training program, and materials for the child with dyslexia?
2- Which kind of approaches/methods/techniques were utilized with the child with dyslexia during the process of piano training?
3- Which kind of accomplishments were observed on the sensory and developmental areas of the child with dyslexia (cognitive, kinesthetic, visual, audial, lingual, communicative, social, emotional) during and as a result of the piano training process?
4- What kind of therapeutic relationship developed between the music teacher and the child with dyslexia during the process of piano training?

1.3. Purpose of the Study

The purpose of this study was

- to introduce details of a piano training process being carried out with a child with dyslexia,
- to describe the approaches/methods/techniques being used to teach piano to the child with dyslexia,
- to exhibit the accomplishments of the child with dyslexia as the result of the piano training process,

- to identify the developed therapeutic relationships between music teacher and the child with dyslexia during the piano training process.

In addition to these purposes, an attempt was made within this study to establish a general understanding regarding an individualized instrument (piano) training with a dyslexic child by emphasizing the therapeutic benefits provided.

1.4. Limitations of the Study

This study was limited to

- one child with dyslexia,
- one main instrument which is piano,
- 12 songs from the same source book "Learning to Play Piano"
- An 8 month-process of piano training,
- the teaching techniques and piano training program planned by the researcher.

2. Method

2.1. Research Design

The study was designed as a holistic single case study in a qualitative perspective. The case study method enables a researcher to closely examine the data within a specific context. The single case study design is used in the following conditions; when the events are limited to a single occurrence, when generalizing the conclusion is not possible, or when the events are rare (Zainal, 2007).

In most cases, a case study design selects a very limited number of individuals as the subjects of study. Case studies, in their true essence, explore and investigate contemporary real-life phenomenon through detailed contextual analysis of a limited number of events or conditions, and their relationships (Zainal, 2007). The researcher was also the attendant observer during the training.

The literature regarding dyslexia and music was reviewed, and a semi-structured piano training program was prepared to be utilized with a child with dyslexia. It was aimed to describe the process in detail and to reveal the therapeutic effect of the piano training on the development of the child. A semi-structured training plan was preferred to be able to follow the lead of the child during the process.

The data was collected, evaluated and a descriptive analysis was conducted to reveal the relationships between the components. Findings of the study were discussed.

2.2. Participants

The participants of this study consisted of a child with dyslexia and a piano teacher. Detailed information regarding the participants is given in the following sections.

2.2.1. The Child with Dyslexia

Demographic Information:

A 15-year-old boy with dyslexia is one of the participants of the process. For ethical considerations, the identity of the child with dyslexia was kept anonymous during the study. He was referred to as Bob for a nick name. No identifying information was stored, and only the researcher had access to personal data.

Bob was studying in 5th grade at a state school within an inclusion program. Additionally, he was attending a private special education center to get individual support for the difficulties he experienced. He was the only child in the family and both parents are alive and together.

Since the age of 3 Bob has been attending a workshop for early-age music activities where he associated with musical activities based on Orff-Schulwerk elementary music and movement education. Bob's family approached the piano teacher to improve his musical skills further on a specific instrument.

Assessment:

It was observed in the first assessment that Bob had the following characteristics of dyslexia;

- Difficulty in identifying his left and right hands,
- Difficulties with time-processing skills,
- The characteristics of dyscalculia besides dyslexia,
- The characteristics showing obsession with routines,
- Showed a negative attitude towards desk-based studies,
- A tendency to speak loud and unnecessarily,
- A tendency to share daily experiences and complaints,
- Impatience and a short attention span,
- Dependence on reinforcement (No inner motivation)
- A tendency and willingness towards music
- Lack of self-confidence, showing the characteristics of "learned helplessness"
- Expressions of anger due to lack of social acceptance

The following musical characteristics were examined in the first assessment. These were also the musical skills aimed to be improved during the piano training process.

- Bob was attending the music class in his school.
- He had no skill of reading musical notes.
- He had no previous experience with piano or any other instrument similar to piano such as accordion, melodica, electronic organ.
- He attempted to play piano but it made no sense.
- He could not sing a song fully in tone with the right lyrics.
- He could not play any song on the piano (even with 2 notes)
- He had never performed before in front of other people.

2.2.2. Piano Teacher

The music teacher has been teaching piano for 15 years and has had numerous experiences with children with autism spectrum disorders, intellectual disability, and dyslexia. Her main instrument was piano during her undergraduate and graduate years. Her doctoral dissertation includes special education and music professions[1] and she has been working on music education and therapy with children with special needs for 8 years. She has had numerous experiences in the profession of music therapy for 1 year in Germany, and 1 year in the U. S.

2.3. Setting

The piano training was carried out in a 12 m^2 music room in a private studio. The room had a light-colored wood floor, green colored walls and a window opening to the outside. The atmosphere was calm yet fresh. Piano lessons were carried out in an "one-to-one setting".

2.4. Materials

The Materials used in the piano training process are listed below.

2.4.1. Materials for Piano Training

a. A Kawai CA51 Concert Artist" model, dark brown, standard electro-piano.
b. An adjustable piano seat.
c. An orange rolled chair was positioned by the piano.
d. A portable adjustable black table for writing exercises.
e. Black plastic boxes in which small instruments were placed
f. Small rhythm instruments such as maracas, rhythm sticks, bells etc.
g. A book shelf, full of piano sheets.
h. A printer located on the book shelf to multiply the sheets immediately when it was needed.
i. A selection of coloring pens and paper were placed on the piano.
j. A Piano Book for Beginners "Learning to Play Piano I" by Denes Agay
k. Piano Training Program

2.4.2. Materials for Data Collection/Data Analysis

The Materials used for data collection and data analysis processes were listed below.

a. A Sony DCR-SR 37 brand video camera,
b. A tripod
c. A HP Pavilion brand laptop were utilized for
d. The programs such as windows media player, word and excel.

2.5. Data Collection

In qualitative research, the data is usually obtained in the form of notes and tape recordings (Elliot & Timulak, 2005). In this study, all the piano lessons (n=32) were recorded with a video camera for data collection, and for each lesson the video recording was transferred to a laptop and recorded with a date and a number.

Data collection in qualitative approach focuses on verbal accounts or descriptions in words, or it puts observations into words. If data is collected in the form of tape recordings, the data should be first transcribed verbatim (Elliot & Timulak, 2005). Therefore, observations of all video recordings were described explicitly, and transcript notes from the observations of piano trainings were prepared for data analysis process.

2.6. Data Analysis

Data was prepared for analysis first by reading the whole data set and the whole picture of the study was exposed in detail. After preparation, the main units were decided which were also formulated as the research questions. Analysis focused on these units. The units were determined as following: (1) the

[1] Eren, B., Duzkantar, A., & Deniz, J. (2012). The effectiveness of embedded teaching through the most-to-least prompting procedure in concept teaching to children with autism witihin Orff-based music activities, *Educational Sciences: Theory & Practice,* 13(3), 1877-1885.

arrangements/adaptations/reductions being made on the piano training program for the child with dyslexia, (2) The approaches/methods/techniques being utilized with the child with dyslexia during the process of piano training, (3) the achievements (sensory/developmental) of the child with dyslexia during and at the end of the piano training process and (4) the therapeutic relationship being developed between the music teacher and the child with dyslexia. After explicit descriptions were exposed, an abstracting process was carried out based on the research questions.

3. Training Process

In qualitative research, data collection, data analysis, and interpretations are made continually and simultaneously during the research process. In contrast to quantitative research, findings collected during the process are considered also as results in the qualitative research. Considering this information, the findings derived from process listed, based on the research questions are shown in the "Results" section.

3.1. Arrangements/adaptations/reductions

In this section, to answer the first research question, the arrangements/adaptations/reductions being made in the piano training for Bob were descriptively explained.

Details of the setting was explained in the "Setting" section touched on before. Here we show the special arrangements/adaptations/reductions that planned on setting to increase the productivity of Bob during the process;

(1) The room was lit from 3 different points. One from above, one from the side and one from the wall of the piano. According to Bob's needs (since he may have sometimes felt over sensitive towards light and might have been noxious for him), various light combinations were arranged to make him feel better. The light on the piano was especially important for him to get concentration on the colored piano sheet.
(2) The volume level of the piano was especially adjusted on a level 5 in 10. It was observed that the louder the volume became, the more he hesitated to play, since he was afraid to make mistakes.
(3) Various characteristics of the various tone were especially utilized to create motivation on repetition of the same song more than once. Bob could choose for each time a different tone, besides piano tone, such as organ, strings, vocal, harpsicord etc.
(4) Bob tended to play faster. Playing faster than he could cause him to make mistakes which was the opposite of what the music teacher was trying to do. Therefore, a metronome was used frequently to provide a rhythmic base while Bob played.
(5) A portable black table was used for the note writing exercises. This table was placed close to the piano and Bob didn't even need to move away from the piano while he studied on writing notes. This arrangement was necessary since as mentioned before table work was not his favorite.
(6) Various musical instruments and other equipment were put in the open boxes where Bob could choose the instrument he wanted to experience without any hesitation and create an accompaniment to the piano.
(7) The teacher's seat was placed on the right side of the piano since the right hand was more engaged while playing. This sitting position gave the teacher opportunity to give an immediate physical prompt when it was necessary.
(8) Piano Training Program:

The piano training program was planned by the researcher and aimed to create a therapeutic atmosphere while teaching Bob how to play piano. The program involved 5 various sections aimed at (a) music language (distinguishing/pairing/reading/writing notes) (b) playing piano, (c) rhythmic exercises, (d) producing accompaniment to piano with other instruments, (e) improvisation trials, (f) performing in public in a recital setting. These sections were carried out in association with each other while "a therapeutic relationship/atmosphere" covered the process. The intrinsic information and the arrangements of the training process is shown in Table 1.

Table 1. Context of Piano Training Program Details

	Section Title	Details			
a	Musical Language	Distinguishing Notes	Pairing Notes	Reading Notes	Writing Notes
b	Piano Playing	Right Hand Alone	Left Hand Alone	Both Hands Together	Four Hands with Teacher
c	Rhythmic Exercises	Repeating Given Pattern		Creating New Pattern	
		Basic	Complex	Basic	Complex
d	Producing Accompaniment to Piano	Instrument A Hand Drum	Instrument B Maracas	Instrument C Agogo	Instrument D Claves
e	Improvisation Trials	Individual Improvisation Trials Random		Improvisation Trials Learned Musical Patterns with Teacher	
f	Performance	For Family Every 2 months		For Unknown Public At the end of 8 months	

Not all the sections of the piano training program were applied simultaneously. Some of them proceeded the other activities. The work-plan of the piano training program is shown in Table 2.:

Table 2. *Piano Training Program Work Plan*

	Program Months	1	2	3	4	5	6	7	8	
a	**Music Language**	X	X	X	X	X	X	X	X	**Therapeutic Relationship**
b	**Playing Piano**		X	X	X	X	X	X	X	
c	**Rhythmic Exercises**		X	X	X	X	X	X	X	
d	**Producing Accompaniment**				X	X	X	X	X	
e	**Improvisation Trials**					X	X	X	X	
f	**Performance**		X		X		X		X	

The program was started with musical language (distinguishing, pairing, reading and writing note) interventions. Playing piano and rhythmic exercises were started just after the first intervention. The producing an accompaniment came after the 3rd month, improvisation trials started after 4 months and performance sections were carried out every second month. The following section explains the details:

(a) *Musical Language*:

This section included musical skills such as distinguishing, pairing, reading and writing notes at both G (for right hand) and F clefs (for left hand). The teaching process was carried out by using a playful approach to make the process easier for Bob. Some note cards were used to apply the games. The note cards varied. The 1st version of note cards included only one clef either G or F, on a white piece of paper. The 2nd version of note cards included only one clef but this time on assorted colored paper. The 3rd version of note cards included two clefs together as seen on the piano sheet to help Bob to transfer his knowledge from "game" to the reality where he needed to read notes in order to play piano.

Notes were taught gradually starting with "note C" to the left and right. For instance, the notes were practiced in the following order: 1) C, 2) B and D, 3) A and E, 4) G and F and 5) F and G and so on. It is shown on the Figure 1.

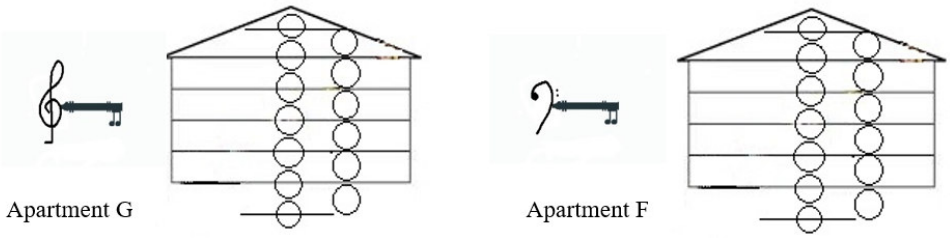
Figure 1. Teaching orders of notes

Reading note exercises followed on the piano songs after the game cards. Each time, after distinguishing and pairing interventions were completed, reading and writing activities were carried out.

(b) Playing Piano:

The training started with a story of "Two Music Apartments" which could be opened with a key shaped like G Clef and a key shaped like F Clef, and all the notes live in these two apartments on different floors. Every note was placed one by one with a exclusive story regarding that note. For instance, there was no empty space for "middle C" in Apartment G so he could only find the basement empty and started to live there. His twin brother had the same destiny as him, he could not find an empty space in Apartment F so he had to live in the loft.

Figure 2. Two Music Apartments



The note values were also given in a "Family Story" to explain in full, half and quarter notes. In this story, the father was 4 years old and bald, mother was 2 years old and had long hair and the child was 1 year old and had black eyes. Notes' names and notes' values were taught with this story. Bob was told these stories to help him to embody the music and musical language which might have been abstract for him.

Figure 3. Family Story

Father 4-years-old	Whole Note	Mother 2-years-old	Half Note	Child 1-year-old	Quarter Note
					

After learning to read and write the musical note(s), a related piano piece was practiced with Bob. For instance, just after learning the middle C on the G clef, the exercise for C was trained on the piano with the first finger which was the thumb on the right hand, and after learning middle C on the F clef, the exercise for C was trained on the piano this time with the first finger which was the thumb on the left hand. The middle C position was preferred to begin playing piano since it was the best for the right and left-hand coordination.

Every piano lessons started with practicing the learned notes. Besides reading and writing exercises, pairing and distinguishing exercises were also carried out with the card game.

The more notes Bob learned in both clefs, piano pieces became more musical and he started to play with his right and left hands first in order and then at the same time. The music teacher and Bob also played four hand piano pieces. Four hand playing was important to practice the synchronism between them.

"Learning to Play Piano I" was used as the source book. In addition to some etudes written by the music teacher, 12 piano pieces from the "Learning to Play Piano I" book were studied in 8 months. Some arrangements were made on the piano pieces according to the development level of Bob. For instance, chords were simplified, the notes played initially using only right hand or only left hand for both hand playing piano pieces. The music teacher played the left-hand part when Bob played right hand, and doing the same with the other hand. Eventually, Bob played two parts together with both hands.

Individualized reductions on the piano sheets were as follows:

(1) All the sheet music was transferred to a landscape oriented A4 page which had a larger version of scale. It was aimed to help Bob to distinguish the notes with ease.
(2) During the beginning of learning a new song, each time the same notes were colored with the same color pen to help Bob to identify the notes in ease. When Bob made progress, an uncolored version was used to generalize the skill.
(3) During the beginning of learning a new song, finger numbering was preferred to help assure Bob played correctly. When Bob made progress, finger numbers were erased one by one from the obvious ones to more complex ones.
(4) With some songs, arrangements were made such as playing only right hand which plays the melody or easing the version of the chord stance. Thus, Bob could play the song without feeling unsuccessful.

(c) *Rhythmic Exercises:*

Bob was asked to repeat the rhythmic patterns after the music teachers played. The patterns were developed from easy to more complex ones. At the next phase, Bob was asked to create his own rhythmic pattern alone. In time, the patterns were asked to become more complex. Examples of easy and complex rhythm patterns are given in Figure 4.

Figure 4: Examples of Rhythmic Pattern

Example of easy rhythmic pattern:	Example of complex rhythmic pattern:
	

(d) *Producing Accompaniment:*

In order to enhance musical experiences, a variety of instruments were used to accompany the piano music. The music teacher gave examples of accompaniments while Bob played the piano, then Bob was asked to create similar type of accompaniments to the piano music while she played. Easily applicable Orff instruments such as claves, maracas, hand drum, and the agogo were utilized to create the accompaniments.

(e) Performance:

Every second month, the parents were invited to the music studio in order to share the development and prepare Bob to perform in front of others. Bob performed the pieces in front of them, he had been practicing up until that time. At the end of eight months, a mixed group recital including 7 other children was organized in a small concert hall and Bob participated in this recital as the only child with special needs. He performed in front of more than 50 people not including his family members.

3.2. Approaches/Methods

A holistic approach was utilized during the piano training process. In the beginning, behavioral approach and errorless teaching methods were preferred. A behavioral approach is interested in the actions more than tendencies; therefore, this approach was considered the most effective while teaching a new skill. For instance, Bob was asked for playing a piece on the piano and he was prompted before he made any mistakes (errorless teaching) and, he was reinforced as soon as he showed a positive reaction which was playing correctly (behavioral approach). After a couple of months, the behavioral approach was not utilized as strictly as before. After 4 months, Bob did not need to be reinforced for each positive reaction and he did not need any reward but music itself. Up until then, improvisational and creative approaches were preferred more often than before. These approaches were preferred to give Bob more freedom and a foundation to express himself more liberally.

3.2.1. Prompting Procedure

The prompting procedure was based on the necessity. This procedure was decided by the music teacher according to Bob's needs. In some songs, especially at the beginning of the piano training process, the procedure was followed systematically. After couple of months some prompting steps were skipped as they were not necessary. Even though, Bob always needed to be prompted at the beginning of each new song.

The systematics of the procedure was applied from most to least prompting. The order was (1) physical prompting (full and partial), (b) modelling, (c) verbal prompting and (d) independent performance. Physical prompting was applied hand on hand and fingers on fingers according to the necessity of the situation. Each song was practiced in the beginning with full physical prompting while reading the notes simultaneously and when he succeeded in some steps, prompting was gradually withdrawn. After physical prompting, modeling was applied in which teacher showed first and Bob did the same move. As the child became more confident, prompting was converted to verbal prompting. Verbal prompting was applied as teacher read the notes and Bob played it. Playing independently was targeted for Bob. As soon as Bob succeeded in playing a piano piece independently, a new song was added to the repertoire.

3.2.2. Reinforcement Schedule

A reinforcement schedule was decided together with Bob and the music teacher. Oral, symbol, social and activity reinforcements were applied in this order, according to Bob's demand.

Table 4. Reinforcement Schedule

	Reinforcement Months	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
a	**Oral**	X	X						
b	**Symbol**			X	X				
c	**Activity**					X	X		
d	**Social**							X	X

A reinforcement schedule was used in a system to motivate Bob. Reinforcements were decided together with Bob and teacher. At the beginning of the piano training process; after playing each song 3 times, Bob was reinforced with his favorite candy. After 2 months, reinforcement was converted to the symbol reinforcement. In symbol reinforcement schedule some stickers, coins, luminescent stars were used. After 2 months, reinforcement was converted to the activity reinforcement. As an activity, playing different instruments, singing a song, playing some card games, reading books, and investigating different animals were chosen by Bob. Eventually, Bob was reinforced socially. Giving a Hi-Five, giving an applause, inviting parents to the piano lesson to listen, conversing about the daily life, which was his favorite activity, were implemented.

3.3. Accomplishments

The accomplishments of Bob being observed on the sensory and developmental areas, during and as a result of the process of piano training, are listed in this section.

For the musical language part of the training process, Bob achieved in reading the notes B, C, and D directly and the other notes by relating to C at the end of the process. He achieved in copying the notes independently and writing the notes asked of him with verbal prompting. Bob was also successful in pairing two different notes by shape and by name. He sometimes needed verbal prompting for the name shape pairing exercise. Bob succeeded in reading the notes of piano pieces with and without the melody by heart after a process of reading with verbal prompting.

For the playing piano part of the training process, Bob was more successful in differentiating his left and right hands without prompting with the help of melody he played. At the end of the training process, approximately 16 piano pieces from the book "Learning to Play Piano 1" by Denes Agay were practiced and 12 of them were completed. Completed piano pieces was listed in the Table 5.:

Table 5: Piano Pieces

No	The name of the song	No	The name of the song
1	Mary had a little lamb	7	Cuckoo
2	I'm Waltzing	8	Old Woman
3	Yankee Doodle	9	Jump Tune
4	Old McDonald	10	Marching Intervals
5	The Evening Bells	11	Lightly Row
6	Little Chinese Song	12	Zulu War Chant

For the rhythmic exercises part of the training process, Bob achieved in repeating the 2, 3, and 4-unit rhythm patterns. He was also successful in creating his own rhythmic patterns

For the producing accompaniment part of the training process, Bob succeeded in producing some creative rhythmic accompaniment while the music teacher played the piano. He was able to start and stop simultaneously with the music teacher while they played four hands. He even showed success in giving the same nuance in dynamics (piano, forte, crescendo, decrescendo) while both played.

For the improvisation trials part of the training process, Bob was able to produce meaningful musical phrases inspired from the motives he practiced in the structured piano pieces. He succeeded in improvising cooperatively with the music teacher. He could concentrate his own part while playing together and also showed a tendency to perform integration musically.

For the performance part of the training process, at the end of the training process, Bob performed with 4 piano pieces in front of more than 50 people at a piano recital with sharing the stage with 7 other children of different genders and ages. He received a certificate and a trophy which showed his achievements in the piano training process.

3.4. Therapeutic Benefits

The therapeutic relationship was valued in all the parts of the training process. Bob was supported for every slight improvement. A prompting procedure and reinforcement schedule was dominantly effective in therapeutic relationship. The unconditional acceptance for Bob was provided with the positive and supportive attitude of the music teacher. In the beginning of the training process, Bob showed a tendency to compare the music teacher with his previous music teacher who worked with him since he was 3 years old. For around 2 months he was obsessed with mentioning the previous teacher. After a positive atmosphere was built between him and the music teacher, he engaged with the trainings.

He was very curious regarding playing piano pieces that were of a higher difficulty than what he could actually play. The music teacher never refused or criticized his exaggerated demands and she made some arrangements on some of them, which were possible to play, and gave him a chance to practice. This attitude was helpful in building a positive rapport between Bob and the music teacher.

In the beginning of the training process, Bob showed more expressions of anger because he had a lack of social acceptance from his friends at school. As time went on, he started to feel positively different and more special since playing piano was a privileged and very rare activity amongst his friends. Therefore, he started to feel more self-confident.

The piano training process was also considered effective on the other sensory and developmental areas based on observations. The attention span was lengthened and reading, writing, pairing and distinguishing the notes helped him to improve cognitive connections. He showed more encouragement each day and he was accepted more socially while playing piano was not a common activity in public. He also started to feel more confident in front of people and got some positive reactions from people other than his family. He discovered his own way to find out auditorily his left and right without any prompting, and experienced a lot of multi-sensory activities such as playing while reading, listening while playing, performing while other distractions existed. He

also improved his fine motor skills, left right hand and hand-eye coordination, and also performing simultaneously with another person.

These accomplishments occurred because of the therapeutic atmosphere that emerged during the piano training process.

4. Discussion and Conclusion

During and after the piano training process, Bob had great improvements in the musical area. He gained skills in reading, writing, pairing, and distinguishing musical notes, he accomplished playing 12 songs on the piano without any prompting or help, he became good enough to create some musical improvisations on piano, he gained skills in singing and playing a song from beginning to end without any prompting or help. Eventually he accomplished in performing in front of a public audience that consisted of people he hasn't known before, and he showed great achievement and self-confidence.

He also gained several positive acquisitions in different areas besides a musical area. He experienced a significant acceptance from society with his musical achievements. He had a strong rapport with the music teacher. He became more self-confident and showed this confidence also with the music teacher. Since he had some negative past experiences regarding the table studies. These table studies were carried out on the piano lid. He conversed more in the context and unnecessary talking was reduced. He also talked less loudly and expressed less anger in his conversations with the music teacher. Self-confidence and dedication took place instead of learned helplessness. Daily conversations focused on positive experiences and creative ideas instead of expressions of anger. His attention strengthened and memory extended. Each day less reinforcement was needed and his attention span lasted for a whole lesson while engaging in playing piano. Musical motivation increased and gradually creative musical ideas showed themselves. He showed the ability to work towards the targets he planned. Finally, he expressed that he wanted a life engaging with music. He has been planning to study at a Fine Arts / Music High School in the future. He has continued his second year in piano playing after a summer break.

This study was limited with one child with dyslexia. Therefore, the results cannot be generalized and used for the children with other disabilities. More structured studies are needed to support these results to be able to generalize the conclusions.

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