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# The Efficacy of Melodic Based Communication Therapy for Eliciting Speech in Nonverbal Children with Autism

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School of Allied Health Professionals
in conjunction with the
Faculty of Graduate Studies

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# The Efficacy of Melodic Based Communication Therapy for Eliciting Speech in Nonverbal Children with Autism

by

Givona A. Sandiford

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A Dissertation submitted in partial satisfaction of
the requirements for the degree of
Doctor of Philosophy in Rehabilitation Sciences

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June 2012

Each person whose signature appears below certifies that this dissertation in his/her opinion is adequate, in scope and quality, as a dissertation for the degree Doctor of Philosophy.

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I would like to first and foremost thank God for allowing me the humbling experience of working with his children suffering from an inability to communicate and for giving me the strength and patience to complete this work even when it seemed at times impossible. He says in Isaiah 35:4-6 NLT, "Say to those with fearful hearts, "Be strong, and do not fear, for your God is coming . . . He is coming to save you." And when he comes . . .those who cannot speak will sing for joy!" Repeating these words helped me continue on with the various phases of research always hoping to see the children in the study singing for joy.

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# ABBREVIATIONS

| | |
|---|---|
| ADOS | Autism Diagnostic Observational Schedule |
| ASHA | American Speech-Language-Hearing Association |
| DSM | Diagnostical and Statistical Manual of Mental Disorders |
| IPA | International Phonetic Alphabet |
| MBCT | Melodic Based Communication Therapy |
| PLSI | Pragmatic Language Skills Inventory |
| PPVT-IV | Peabody Picture Vocabulary Test 4th edition |

ABSTRACT OF THE DISSERTATION

The Efficacy of Melodic Based Communication for Eliciting Speech in Nonverbal Children with Autism

by

Givona A. Sandiford

Doctor of Philosophy, Graduate Program in Rehabilitation Sciences
Loma Linda University, June 2012
Dr. Karen J. Mainess, Chairperson

The purpose of this dissertation is to compare the efficacy of Melodic Based Communication Therapy (MBCT) to traditional speech and language therapy for eliciting speech in nonverbal children with autism. Efficacy was assessed by number of: verbalizations, correct words, words reported by parent, and imitative attempts. Additionally it examines the effect of exposure to MBCT on social language abilities as measured by score on the *Pragmatic Language Skills Inventory* (PLSI); the effect of age on the response to treatment, and the predictors of overall effectiveness of treatment.

Participants were 12 nonverbal children with autism ages 5 through 7 randomly assigned to the MBCT or traditional therapy group. Measures included: a criterion referenced test administered weekly over 5 consecutive weeks, parent survey administered pre and post therapy, *Peabody Picture Vocabulary Test 4th Edition* (PPVT-IV), *Autism Diagnostic Observational Schedule* (ADOS) and PLSI.

The MBCT group progressed significantly in number of verbalizations after weeks 1, 2, 3, and 4, while the traditional group progressed significantly after weeks 4 and 5. The MBCT group progressed significantly in number of correct words after weeks 1 and 3, while the traditional group progressed significantly after weeks 4 and 5. Parents

reported a significant number of words heard externally for the MBCT group (p=.04). Participants in the MBCT group had more imitative attempts (p=.02). The MBCT group showed significant improvement in PLSI score (p=.04). All participants irrespective of age demonstrated progress as a result of treatment. Receptive vocabulary score at baseline and imitative ability were significant predictors of response to treatment. Combined, they accounted for 75% of variability in the improvement in the number of correct words following treatment

Results suggest MBCT is a valid means of treatment for nonverbal children with autism. The MBCT group responded earlier, showed more progress in the home setting, had more imitative attempts, and showed greater improvements in social language scores. Additionally stronger receptive language scores and imitative abilities may lead to better therapeutic outcomes regardless of the age of the child. Further research with a larger sample size is needed to examine the full benefit of MBCT.

# CHAPTER ONE

# INTRODUCTION

According to the Center for Disease Control and Prevention (2012), the prevalence of autism in the United States of America is one in 88 children, described as a 23% increase since the last report in 2009. With the number of children with autism on the rise, the number of children with autism who are nonverbal is also rising. It is estimated that 30 to 50 percent of children with autism never develop functional speech (Pickett, Pullara, O'Grady & Gordon, 2009; Prizant & Wetherby, 1993). Furthermore, if a child has not developed verbal speech by the age of five it is generally agreed upon that the likelihood of him or her acquiring speech or language in the future is extremely poor (Charlop & Haymes, 1994). Though some research has indicated that speech and language can be acquired after this critical age (Pickett et.al, 2009) such evidence is limited in nature and often does not clearly specify the methods used to promote such late speech/language acquisition (Pickett et.al, 2009).

Autism has often been described as a disorder of social communication characterized by a distinct lack of social instinct (Allely & Wilson, 2011). The *Diagnostical and Statistical Manual of Mental Disorders* (DSM)-IV criteria for autism incudes, among other impairments, an impairment in social functioning (4th ed., text rev.; *DSM–IV–TR*; American Psychiatric Association, 2000). In their proposed revisions to the DSM-V criteria for autism spectrum disorder (5th ed.; *DSM-5*), the American Psychiatric Association lists "persistent deficits in social communication and social interaction, as

manifested by deficits in social emotional reciprocity, deficits in nonverbal communication behaviors used for social interaction, and deficits in developing and maintaining relationships appropriate to developmental level," as key components in the diagnosis of autism (DSM-5 Development (2011); Frazier et. al., (2011); Mandy, Charman, & Skuse, 2012). Thus it is clear that successful and appropriate speech therapy for children with autism must, in addition to addressing the expressive and receptive components of language, address the social components of language.

Multiple research studies have found neurological differences between children with autism and children who are developing normally (Altgassen, Kliegel, & Williams, 2005; Flagg, Cardy, Roberts, & Roberts, 2005; Heaton, Davis, Happe, G.E., 2008; Herbert M.R., et. al., 2004; Lazarev, Pontes, Mitrofanov, & deAzevedo, 2010). These studies have commonly found asymmetry between the left and right hemispheres of the brain with the dominant hemisphere being the right hemisphere in individuals with autism while the left was favored in normally developing controls. While the left hemisphere is responsible for language the right hemisphere is known to be responsible for processing melody, intonation, prosody and art (Ono et. al., 2011). Other research has indicated that the corpus callosum, which joins both hemispheres and allows for transfer of information between hemispheres, is often impaired in children with autism (Shukla, Keehn, Lincoln & Muller, 2010). Studies conducted on the corpus callosum indicate that it can be strengthened by exposure to music prior to the age of seven in typically developing individuals (Schlaug, Jancke, Huang, Staiger, & Steinmetz, 1995; Schlaug et. al., 2009). A review of such literature makes it clear that traditional speech/language therapy, which often focuses on imitation of single spoken words and spoken phrases, a

left hemispherical task, may no longer represent best practice when treating individuals with autism.

Other therapies such as the teaching of sign language or the use of Augmentative Communication (AAC) Devices, though far better than the complete lack of communication, have also proven somewhat ineffective. Imaging scans of the brain have revealed that sign language is also a predominantly left hemispherical task (Newman, Supalla, Hauser, Newport, & Baveller, 2010). Sign language cannot be easily transferred to all settings, as not all individuals understand sign language. It also requires the "listener" to look at the signer at all times, something which spoken language does not require. AAC Devices, though better than the alternative, also have their problems. The *DynaVox Vmax+ High Performance Standard,* one of the top-of-the-line AAC devices offered by DynaVox is priced as high as $13,999.00 (http://www.Spectronics.com; http://www.dynavoxtech.com/products/vmaxplus/). An AAC device must be kept with the device user at all times in order for him or her to be able to use it to communicate. This can be especially taxing on an active child playing in various settings such as the playground, pool or beach. An AAC device requires charging and can weigh around 7 pounds (http://www.dynavoxtech.com/products/). Even if a more cost effective AAC device is used, such as the recently popular communication applications, which can be purchased for a smartphone or electronic tablet, research has shown that AAC devices in general can have a negative impact on quality of life (Bailey, Parette, Stoner, Angell & Carroll, 2006; Parette & Angell, 1996; Saito & Turnbull, 2007). For instance, limited symbol availability, incorrectness of the message, lack of voice appropriateness, inadequate training of device users, and an inability of the device user to use symbols to

communicate were listed as causes of stress and barriers to effective use of AAC devices (Bailey et. al., 2006).

Various forms of music therapy have been attempted with children who have autism in the past (Accordino, Comer, & Heller, 2006; Finnigan & Starr, 2010; Hoelzley, 1993; Kern & Aldridge, 2006; Kim, Wigram, & Gold, 2008; Kim, Wigram, & Gold, 2009; Lim, 2010; Miller & Toca, 1979; Pasiali, 2004; Starr & Zenker, 1998; Stephens, 2008;Wimpory, Chadwick, & Nash, 1995). Such therapies, however have often focused only on improving social interaction by influencing peer interaction, play, and/or social compliance, while failing to integrate effective language interventions, or have solely focused on improving language, without assessing for improvements in social functioning, one of the key components in the diagnosis of autism spectrum disorders (4th ed., text rev.; *DSM–IV–TR*; American Psychiatric Association, 2000; 5th ed.; *DSM-5*; Allely & Wilson, 2011). Furthermore, these studies have typically been done on children below the age of 5 with mild-moderate disabilities, which might lead to the question of whether or not such therapies would be effective on an older more severe population. Additionally problems such as a sample size of 1 or two subjects can make findings difficult to generalize to the population as a whole, lack of a control group may make it difficult to determine what factors most contributed to the improvement of the subject, and poor description of therapy techniques may create difficulty for clinicians who wish to reproduce the therapy in a clinical setting (Accordino, et.al., 2006; Finnigan & Starr, 2010; Hoelzley, 1993; Kern & Aldridge, 2006; Kim, et. al., 2008; Kim, et. al., 2009; Lim, 2010; Miller & Toca, 1979; Pasiali, 2004; Starr & Zenker, 1998; Stephens, 2008; Wimpory, et.al, 1995).

In one such study, researchers found the social responsiveness of a single preschool subject with autism was increased by music (Finnigan & Starr, 2010). Researchers also found that avoidant behaviors were absent during music-based therapy when compared to non-music treatments in the single subject. Researchers use of only one subject, however, makes it difficult for such results to generalize to all children with autism. Furthermore, results may have been confounded by the introduction of both music and non-music treatments to the same subject within a short span of time, making it difficult to determine which one of the two factors independently resulted in the overall change in socialization. Further research targeting language development as well as a larger sample size and use of a control group would be necessary to benefit the field and determine whether results can be generalized.

Another similar study utilized 50 subjects with autism ages 3-5 (both low and high functioning). Individuals were made to watch 3 days of either music treatment videos, speech treatment videos, or no treatment. Improvements were seen in both the speech and music treatment groups; however, low functioning individuals had the greatest gains with the music treatments (Lim, 2010). While this study does support the use of music as a viable source of treatment for young children with autism, it is unclear whether low functioning subjects were considered nonverbal. It should also be noted that the age range of children in this study was 3 to 5, which is within the range for which normal acquisition of verbal speech can still be expected. It cannot be known from this study whether older subjects who are nonverbal would have made similar gains. Particularly since the likelihood of acquiring language after the age of 5 is commonly accepted as low.

Another study tested a variation of melodic intonation therapy (MIT) on a 3-year-old nonverbal male with autism (Miller & Toca, 1979). The male subject received one year of traditional therapy involving signed and verbal language with little to no improvement at which time adapted melodic intonation therapy was attempted. The adapted melodic intonation therapy made use of signed language as well as an intoned stimulus. After treatment, the subject was noted to use trained, imitative and spontaneous intoned verbalizations that were observed to generalize to other settings (Miller & Toca, 1979). Despite the success of this case study, the use of a single subject cannot be generalized to the greater population, nor can it be determined without the use of a control group whether the adapted melodic intonation therapy in and of itself resulted in the increase in language as other factors such as maturation of the child as well as introduction of traditional therapy prior to the adapted melodic intonation therapy may have played a role in eventual language acquisition. It should also be noted that the subject was under the age of 5, an age at which acquisition of language is still considered probable. In addition, the social aspect of language, previously described as a key component to effective treatment of individuals with autism, was not listed as an outcome variable for this study; therefore no assessments can be made about its appropriateness for treatment of this component of the disorder.

Another study of a 6-year-old nonverbal female with autism found that the subject imitated a trombone by grunting (Hoelzley, 1993). The clinician continuously sang utterances to the subject in tone with the trombone. The subject moved from grunting to singing words to finally singing phrases. After a year of treatment the subject was observed to speak the utterances that had been sung to her (Hoelzley, 1993). Again, use

of a single subject does not allow for generalization of these results to the general population. Though this study was done on an older subject, lack of a control group makes it impossible to determine whether other factors such as maturation of the subject were responsible for the improvement. Again improvements in social functioning were not indicated as an outcome variable, despite the importance of addressing pragmatics in children with autism.

Recent literature has addressed the theory of Auditory-Motor Mapping Training (AMMT) (Wan, Demaine, Zipse, Norton & Schlaug, 2010; Wan, Rüber, Hohmann & Schlaug, 2010; Wan & Schlaug, 2010; Wan et. al., 2011). AMMT, a treatment geared towards children with autism, in which the clinician introduces a target high frequency word or phrase by singing while simultaneously tapping out a matching rhythm and pitch on a set of tuned drums is based on the theory that mirror neurons necessary for imitation may respond better to music. The client is expected to progress from passive listening, to unison singing, to partially supported singing, to immediate repetition and eventually to independent production of the word or phrase (Wan et al., 2010; Wan & Schlaug, 2010). In their 2011 proof of concept study, researchers performed a single-subject design on six nonverbal children, defined as having no intelligible words, using the previously described methods five times a week over an eight-week period of time. Researchers found that subjects improved in their ability to articulate words and phrases over time. This was noted to generalize to words not trained in therapy (Wan et. al., 2011). While these results are promising and continue to indicate the need for more music-based interventions, lack of a control group makes it difficult to determine whether a cause-effect relationship exists between treatment and outcome and whether other factors such

as maturation of the child or the intensity of the particular intervention played a role in the outcome. The effects of the treatment on the social aspects of the child's language were not investigated.

Despite the evidence supporting the benefit of music therapy, therapy using spoken language continues to be the standard among speech language pathologists for the elicitation of verbal speech among children with autism as well as for the improvement of pragmatic abilities in such children. When this fails, the use of other forms of communication treatment such as the training of the use of AAC devices, picture exchange programs and sign language are regularly taught. The American Speech-Language-Hearing Association's (ASHA's) position statement on *Roles and Responsibilities of Speech-Language Pathologists in Diagnosis, Assessment, and Treatment of Autism Spectrum Disorders Across the Life Span* (2006), in support of this practice, emphasized the importance of training "verbal and nonverbal means of communication, including natural gestures, speech, signs, pictures, written words, functional alternatives to challenging behaviors, and other augmentative and alternative communication systems." The use of techniques combining spoken language with the musical strengths of children with autism to train communication was not identified in the 2006 ASHA position statement (www.asha.org/policy).

## Melodic Based Communication Therapy

Melodic Based Communication Therapy (MBCT), developed by the author of this dissertation based on a review of the literature and personal experiences with children with autism, proposes to make use of the right hemispherical musical strengths of the

child with autism in order to: increase verbal output by strengthening the corpus callosum in order to better transfer learned information from the stronger right hemisphere to the weaker left hemisphere, thus improving overall language ability. The purpose of this dissertation is to compare the efficacy of MBCT to traditional speech and language therapy for eliciting speech in nonverbal children with autism as assessed by: number of verbalizations, number of correct words, number of new words reported by the parent in external environments, and number of imitative attempts. This dissertation also examines the effect of exposure to Melodic Based Communication Therapy (MBCT) on pragmatics/social language abilities as measured by score on the *Pragmatic Language Skills Inventory* (PLSI); the effect of age on the response to treatment, and the predictors of overall effectiveness of treatment. The predictors examined were number of verbalizations, number of correct words, progression to 2 and 3 word utterances, number of imitative attempts, social language (PLSI) score, and number of words spoken in environments other than the clinical setting such as the home environment.

# CHAPTER TWO

# A PILOT STUDY ON THE EFFICACY OF MELODIC BASED COMMUNICATION THERAPY FOR ELICITING SPEECH IN NONVERBAL CHILDREN WITH AUTISM


## Abstract

The purpose of this study was to compare the efficacy of Melodic Based Communication Therapy (MBCT) to traditional therapy for eliciting speech in nonverbal children with autism. Efficacy was assessed by number of: verbalizations, correct words, words reported by parent, and imitative attempts.

Participants were 12 nonverbal children with autism ages 5 through 7 randomly assigned to the MBCT or traditional therapy group. Baseline measures included: a criterion referenced test administered weekly over 5 consecutive weeks and parent survey administered pre and post therapy.

The MBCT group progressed significantly in number of verbalizations after weeks 1, 2, 3, and 4, while the traditional group progressed significantly after weeks 4 and 5. The MBCT group progressed significantly in number of correct words after weeks 1 and 3, while the traditional group progressed significantly after weeks 4 and 5. Parents reported a significant number of words heard externally for the MBCT group ($p=.04$). The participants in the MBCT group showed a significant improvement in number of imitative attempts following treatment ($p=.02$).

Results suggest MBCT is a valid means of eliciting speech in nonverbal children with autism. The MBCT group responded earlier and showed more progress in the home setting. Further research is needed to examine the full benefit of MBCT.

## Introduction

According to the Center for Disease Control and Prevention (2012), the prevalence of autism in the United States of America is one in 88 children, described as a 23% increase since the last report in 2009. With the number of children with autism on the rise, the number of children with autism who are nonverbal is also rising. It is estimated that 30 to 50 percent of children with autism never develop functional speech (Pickett, Pullara, O'Grady & Gordon, 2009; Prizant & Wetherby, 1993). Furthermore, if a child has not developed verbal speech by the age of five, it is generally agreed upon that the likelihood of him or her acquiring speech or language in the future is extremely poor (Charlop & Haymes, 1994). Though some research has indicated that speech and language can be acquired after this critical age (Pickett et al., 2009) such evidence is limited in nature and often does not clearly specify the methods used to promote such late speech/language acquisition (Pickett et al., 2009).

Multiple research studies have found neurological differences between children with autism and children who are developing normally (Altgassen, Kliegel, & Williams, 2005; Flagg, Cardy, Roberts, & Roberts, 2005; Heaton, Davis, Happe, G.E., 2008; Herbert M.R., et al., 2004; Lazarev, Pontes, Mitrofanov, & deAzevedo, 2010). These studies have commonly found asymmetry between the left and right hemispheres of the brain with the dominant hemisphere being the right hemisphere in individuals with

autism while the left was favored in normally developing controls. While the left hemisphere is responsible for language the right hemisphere is known to be responsible for processing melody, intonation, prosody and art (Ono et al., 2011). Other research has indicated that the corpus callosum, which joins both hemispheres and allows for transfer of information between hemispheres, is often impaired in children with autism (Shukla, Keehn, Lincoln & Muller, 2010). Studies conducted on the corpus callosum indicate that it can be strengthened by exposure to music prior to the age of seven in normally developing individuals (Schlaug, Jancke, Huang, Staiger, & Steinmetz, 1995; Schlaug et al., 2009). With this plethora of research available it is clear that traditional speech/language therapy, which often focuses on imitation of single spoken words and spoken phrases, a left hemispherical task, may no longer represent best practice when treating individuals with autism.

Other therapies such as the teaching of sign language or the use of Augmentative Communication (AAC) Devices, though far better than the complete lack of communication, have also proven somewhat ineffective. Imaging scans of the brain have revealed that sign language is also a predominantly left hemispherical task (Newman, Supalla, Hauser, Newport, & Baveller, 2010). Sign language cannot be easily transferred to all settings, as not all individuals understand sign language. It also requires the "listener" to look at the signer at all times, something which spoken language does not require. AAC Devices, though better than the alternative, also have their problems. They are costly, priced as high as $13,999.00 (http://www.Spectronics.com; http://www.dynavoxtech.com/products/vmaxplus/). An AAC device must be kept with the device user at all times in order for him or her to be able to use it to communicate.

This can be especially taxing for an active child playing in various settings such as the playground, pool or beach. Even if a more cost effective AAC device is used, such as the recently popular communication applications, which can be purchased for a smartphone or electronic tablet, research has shown that AAC devices in general can have a negative impact on quality of life (Bailey, Parette, Stoner, Angell & Carroll, 2006; Parette & Angell, 1996; Saito & Turnbull, 2007).

Various forms of music therapy have been attempted for children with autism in the past (Accordino, Comer, & Heller, 2006; Finnigan & Starr, 2010; Miller & Toca, 1979; Starr & Zenker, 1998;Wimpory, Chadwick, & Nash, 1995). However, no commonly used evidence based music therapy currently exists which successfully combines language and melodic tones to stimulate verbal speech and language in severely nonverbal children with autism over the age of 5. Furthermore, while some studies have found improvements in the abilities of their subjects when music was introduced as a factor, these studies are often plagued with problems such as an insufficient sample size making findings difficult to generalize to the population as a whole, poor study design making it difficult to determine what factors contributed most to the improvement of the subject, or poor description of therapy techniques resulting in an inability to reproduce the therapy in a clinical setting (Finnigan & Starr, 2010; Lim, 2010; Miller & Toca, 1979; Hoelzley, 1993).

Recent literature has addressed the theory of Auditory-Motor Mapping Training (AMMT) (Wan, Demaine, Zipse, Norton & Schlaug, 2010; Wan, Rüber, Hohmann & Schlaug, 2010; Wan & Schlaug, 2010; Wan et al., 2011). AMMT, a treatment geared towards children with autism, in which the clinician introduces a target high frequency

word or phrase by singing while simultaneously tapping out a matching rhythm and pitch on a set of tuned drums is based on the theory that mirror neurons necessary for imitation may respond better to music. In their 2011 proof of concept study, researchers performed a single-subject design on six nonverbal children, defined as having no intelligible words, using the previously described methods five times a week over an eight-week period of time. Researchers found that subjects improved in their ability to articulate words and phrases over time. This was noted to generalize to words not trained in therapy (Wan et al., 2011). While these results are promising and continue to indicate the need for more music-based interventions, lack of a control group makes it difficult to determine whether a cause-effect relationship exists between treatment and outcome and whether other factors such as maturation of the child or the intensity of the particular intervention played a role in the outcome.

Melodic Based Communication Therapy (MBCT) proposes to make use of the right hemispherical musical strengths of the child with autism in order to increase verbal output by strengthening the corpus callosum in order to better transfer learned information from the stronger right hemisphere to the weaker left hemisphere, thus improving overall language ability. The purpose of this study was to compare the efficacy of Melodic Based Communication Therapy (MBCT) to traditional therapy for eliciting speech in nonverbal children with autism. For the purposes of this paper, efficacy was assessed by: number of verbalizations, number of correct words, number of new words reported by the parent in external environments, and number of imitative attempts.

## Method

### Participants

Permission to conduct this study was obtained from the Institutional Review Board (IRB) of Loma Linda University ensuring appropriate adherence to informed consent procedures and handling of all research data. Participants were recruited from the southern California area using local media/newspapers, letters to paraprofessionals, flyers in local clinics, hospitals, universities, schools, contacting of local support groups, social networks and word of mouth.

A randomized control design was used in order to determine the effectiveness of the experimental treatment and control for external factors such as maturation of the participants and the intensity of the administered therapy. Participants were included in the study if they received a diagnosis of autism based on the *Autism Diagnostic Observational Schedule* (ADOS) and were nonverbal. Nonverbal was defined as having an expressive vocabulary of no more than 10 words which were not used on a daily basis and having no functional speech. Participants also needed to be between the ages of 5 and 7 years. Individuals were excluded from the study if they were receiving other language or articulation treatments or therapy at the time of the study, were unable to regularly attend four 45 minute sessions of therapy weekly for 5 weeks, had a history of severe hearing impairment, had severe visual impairment/blindness, had a diagnosis of an organic impairment of oral or laryngeal structures, or had a significant medical illness or condition which would prevent the child's participation in the treatment procedures. These conditions included, but were not limited to cerebral palsy, paraplegia, spina bifeda, uncontrolled seizures, dysarthria, and amputation of arm(s). Twelve participants

who resided in the Southern California area were included in the study, 11 males and 1 female.

Upon entering the study, children were put into three groups according to their age, and then were randomly assigned to one of two treatment groups. The two groups were: the traditional therapy group, which represented the standard therapy procedures the participant would receive in a private practice setting and the Melodic Based Communication Therapy (MBCT) group, which represented the experimental group. Participants who joined late were randomly assigned to either group (see figure 1 for a flowchart on the movement of participants through the study). Participants received 5 weeks of intervention, with four 45-minute individual sessions a week.

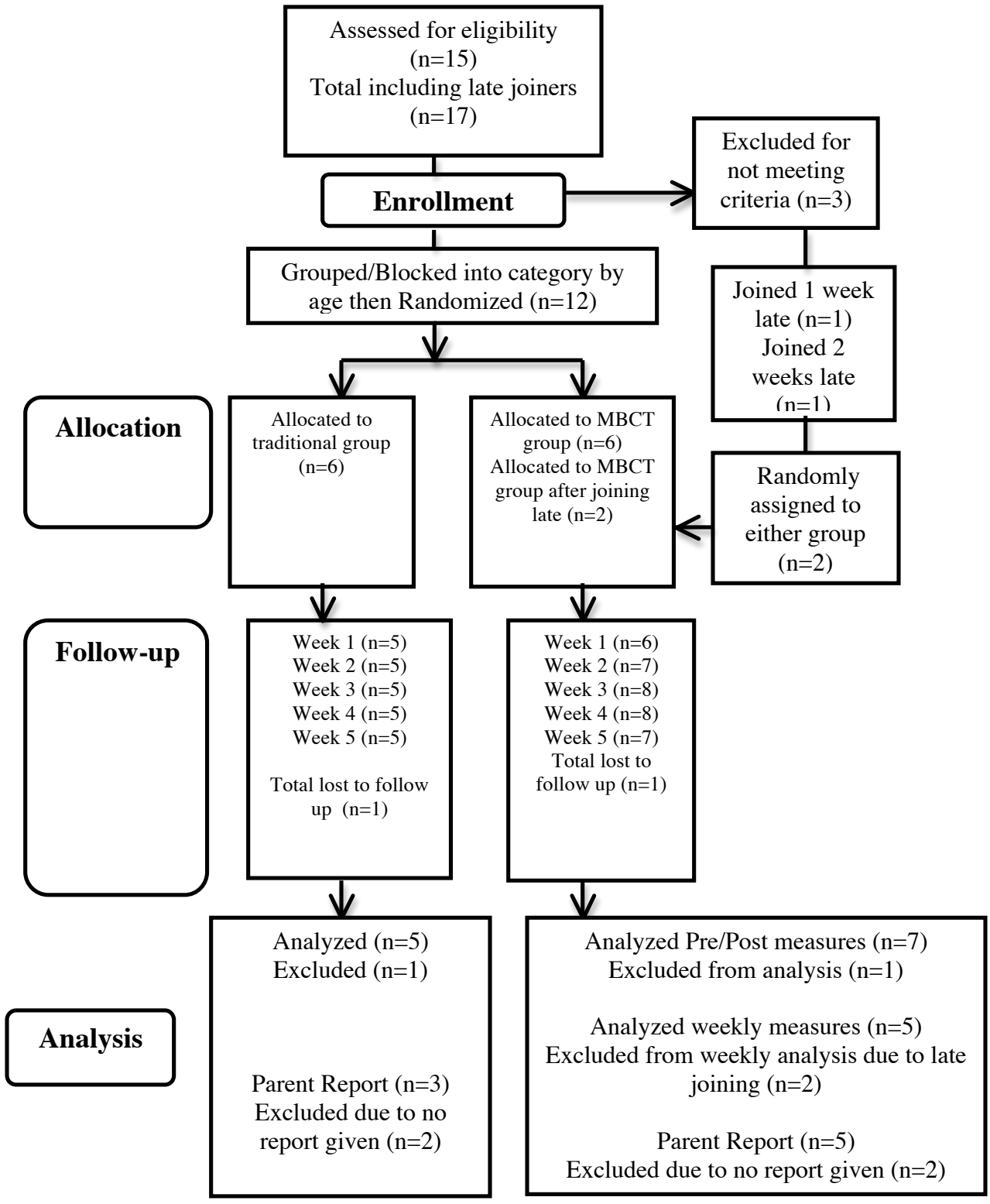


**Figure 1.** Sampling and Flow of Participants through Randomized Control Trial

## Instrumentation and Materials

The parent survey was compiled based on the information needed for inclusion/exclusion criteria as well as the information needed for a reinforcer assessment. The reinforcer assessment was a modification of Sturmey's reinforcer assessment (2008) which requires parents to list possible reinforcers with corresponding examples followed by a list of their child's top three reinforcers.

The *Autism Diagnostic Observation Schedule* (ADOS) is a semi-structured, standardized assessment of communication, social interaction, and play consisting of four modules that can be administered in 30-45 minutes and used to accurately diagnose individuals with autism across age levels, developmental skills and language abilities (Lord, et al., 1989; Lord, et al., 2000; Overton, Fielding, de Alba, 2008). Module 1, intended for children who do not use phrase speech consistently, was used for the purposes of this study. Module 1 consists of the following: free play, response to name, response to joint attention, bubble play, anticipation of a routine with objects, responsive to social smile, anticipation of social routine, functional and symbolic imitation, birthday party, and snack (Lord, et al., 1989).

Twenty-five target words were chosen based on high frequency words children typically use first (Appendix A). Twenty-five stimulus items were chosen to represent the target words. Target words and stimulus items were the same for each group. Score sheets for weekly criterion referenced vocabulary testing were used to document the participants' responses over time using the International Phonetic Alphabet (IPA).

Portable Compact Disc (CD) players and Compact Discs (CDs) were used for the MBCT group. CDs consisted of the 25 target words set to 25 different melodies. Words

were set to repeat 10 times with approximately a 10 second break between repetitions. Video cameras were used to record sessions.

Reinforcers were chosen based on the responses of parents on the reinforcer assessment. Reinforcers were kept with a list of the participants known allergies and special instructions as indicated by the parent. Some parents opted to bring in their child's reinforcers due to special diet considerations when food reinforcers were used.

## Procedure

The goal of therapy for each treatment group was to train the production of the twenty-five target words. If the twenty-five target words were learned, then two word utterances incorporating the twenty-five target words were then trained (e.g. "kick ball"). Baseline measures for the purposes of this paper included: a criterion referenced vocabulary test to determine which of the target words the child could verbally identify and a parent survey to determine what words the child could already say. The parent survey was also used to determine the top three reinforcers that could be used to help motivate the child to participate in the therapy.

Weekly measures included a criterion referenced vocabulary test to determine which of the target words the child could independently name. Attempted verbalizations in response to the test item were also documented. Sessions were videotaped and imitative attempts tallied from the first and final sessions. Final measures were taken following the final week of therapy. Final measures were a repeat of the baseline and weekly measures. Attempts were made to blind parents to the type of therapy their child received by keeping parents in an external waiting room with therapy doors closed;

however, the thinness of the therapy walls may have allowed some parents to make assumptions about the type of therapy their child was receiving.

Clinicians were first year graduate students in the Communication Sciences and Disorders program at Loma Linda University trained to provide both traditional therapy and Melodic Based Communication Therapy under the supervision of the first and second authors. Treatment procedures for the traditional therapy consisted of using the child's three primary reinforcers, as previously identified by the parent, to train and reward correct productions as well as attempts to name stimulus items. The clinician stated the word clearly while holding up the stimulus item, then asked the child to repeat the word after him/her. Acceptable cues were: phonemic cues, manual manipulation of lips/articulators, visual cues for placement and verbal instructions about where and how to use articulators. Therapy progressed from having the child imitate nouns and verbs to asking the child to independently name the items in response to the question: What is this? If the child was able to name the majority of the words independently, the procedures were repeated for two word utterances such as "kick ball." See Appendix B for a complete list of procedures used for traditional therapy.

Procedures for MBCT were similar to the traditional therapy in that the same 25 words and stimulus items were used. The child's top three reinforcers as identified by the parents were also used to provide rewards for correct responses and attempts during therapy. A compact disc (CD) recording of the 25 target words set to 25 different melodies was utilized for all participants in the MBCT group providing a greater level of standardization of melodies. The children were allowed to listen to the CD recording of the word set to melody while the therapist presented the stimulus item to the child

simultaneously. Therapy then progressed from listening to a recording of the word set to melodic tone, to hand over hand clapping of the rhythm, to unison clapping of the rhythm, to independent clapping of the rhythm, to independent clapping of the rhythm while singing to the recording with the clinician, to singing with just the clinician while clapping, to singing with just the clinician without clapping, to singing while the clinician mouthed the word silently, to singing the word independently, to answering the sung question, "What is this?" with the melodic version of the expected target word, to answering the spoken question, "What is this?" with the expected target word. If the child was able to name the majority of the words independently, then the same procedures were followed for two word utterances. See Appendix C for a complete list of instructions used for MBCT.

Outcome measures for this study were: number of verbalizations, number of correct words, number of words reported by the parent, and number of imitative attempts. In order to measure number of verbalizations and correct words over time, a criterion referenced vocabulary test was given at baseline and the beginning of each treatment week. The criterion referenced vocabulary test was given again at the close of the last treatment week. The criterion referenced vocabulary test was conducted as follows: the clinician would pull one of the stimulus items from a bin and ask the participant, "What is this?" The participant's response was then transcribed verbatim using the International Phonetic Alphabet (IPA). Criterion referenced testing was also videotaped in order to ensure the accuracy of the clinician's phonetic transcription.

The investigator scored criterion referenced testing using the following procedures: verbalizations which were close approximations to the target word such as

/hæ/ for /hænd/ were scored as correct words. Verbalizations which were nonsensical and bore no resemblance to the target word such as /owio/ for /hænd/ were tallied under verbalizations.

A parent survey was used to tally number of words reported by the parent. Prior to beginning treatment, parents of participants were asked to fill out a questionnaire that asked the parent to list the number of words as well as the actual words they had heard their child say in the past. Following the study the parents were asked to list all the new words they had heard the child say in the past five weeks. Based on the list provided by the parent, the total number of new words for each participant was tallied. Imitative attempts were tallied based on a review of the video recordings from the first and final treatment sessions. Any attempt to imitate the clinician was scored as one imitative attempt. The first 10 sets were tallied for every participant's first and last session.

Data was summarized using descriptive statistics. A two-way mixed factorial ANOVA (2 groups x 6 times) was used to examine changes between the two groups over time. The outcome measures for the two groups were compared using the Mann-Whitney U Test at weekly intervals. Changes in outcome variables over time were assessed using Wilcoxon Signed Ranks Test. The level of significance was set at $p < .05$.

## Results

Fourteen participants were originally included in the study; however, one dropped out after a few days and the other was not readily available for testing due to illness. As shown in figure 1, the traditional group had 5 participants. The MBCT group had 7 participants. Two participants, however, did not receive the full five weeks of therapy due

to later enrollment in the study. All participants received at least 3 weeks of therapy. Ten participants received 5 weeks of therapy, five participants in the traditional group and five participants in the MBCT group (see Figure 1 for the flow of participants through each stage of the experiment). No significant differences were found between the two groups prior to therapy for age, number of verbalizations, number of correct words, or number of words reported by the parent (see Table 1).

**Table 1.** Median (min, max) of participant baseline characteristics

| | Traditional (n=5) | MBCT✢ (n=7) | p-value** |
|---|---|---|---|
| Male | n=5 | n=6 | .58*** |
| Age* | 5.8 (.8) | 5.9 (.9) | 0.93 |
| Number of Verbalizations | 11 (0,22) | 8(3,18) | 0.75 |
| Number of Correct Words | 0 (0,9) | 3 (0,5) | 0.15 |
| Number of Words reported by Parent | 5(0,8) | 8(0,10) | 0.34 |
| Number of Words Imitated | 3 (0,9) | 1 (0,5) | 0.43 |

*Results reported as Mean (SD)
** Mann-Whitney U-Test
*** Fisher's Exact Test
✢ MBCT = Melodic Based Communication Therapy

Both treatment groups made significant progress in number of verbalizations ($F_{5,.05}$=6.9, p<.001), number of correct words ($F_{5,.05}$=4.1, p=.04), and number of imitative attempts following treatment (z=-2.5, p=.01). For participants in the MBCT group, the number of verbalizations following completion of treatment increased (z=-1.4, p= .08). There was no significant difference in number of correct words between the two groups at the completion of therapy (z=-0.2, p=.40) (see Table 2 and Figure 2).

**Table 2.** Median (min, max) of differences* in verbalizations and correct words over time by type of therapy for all subjects.

| | Traditional | MBCT✢ | p-value** |
|---|---|---|---|
| Verbalizations | 2 (-1,16) | 12(7,22) | 0.08 |
| correct words | 5 (1,6) | 5(-1,22) | 0.4 |

* Difference = post –pre
**1 tailed test
✢ MBCT = Melodic Based Communication Therapy

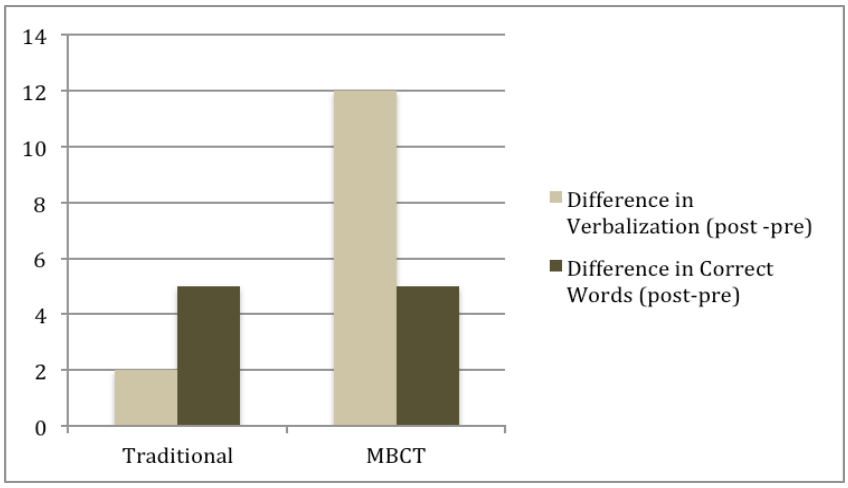


**Figure 2.** Median difference in number of verbalizations and number of correct words by type of treatment for individuals who completed 5 weeks of therapy

In the MBCT group, the number of verbalizations increased significantly after week one (z=-2.4, p= .02), week two (z=-2.0, p= .04), week three (z= -2.0, p= .04), and week four (z=-2.2, p= .03). The participants in the traditional group, however, had significant progress in number of verbalizations only after week four (z=-2.0, p= .04) and week five (z= -2.1, p= .04).

For the number of correct words, the participants in the MBCT group had significant progress after week one (z=-2.2, p= .03) and week three (z=-2.0, p= .05). For participants in the traditional group, however, the number of correct words increased significantly only after week four (z=-2.0, p= .04) and week five (z=-2.0, p= .04) (see Figure 3).

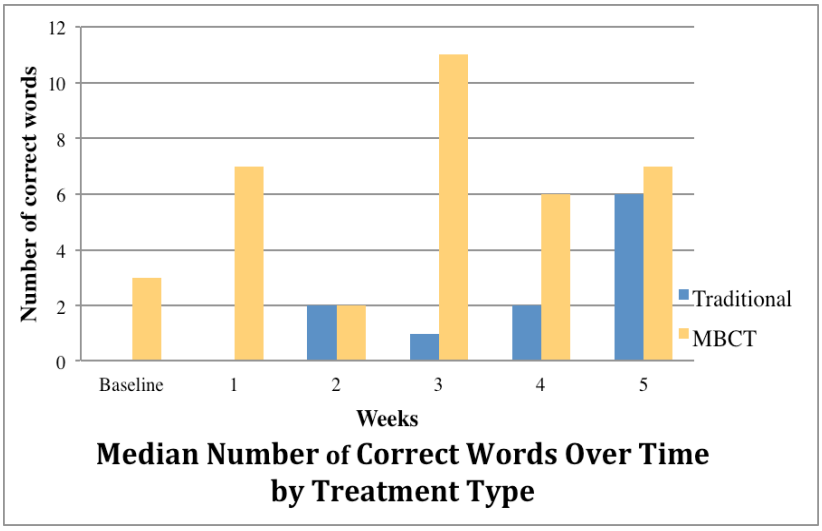


**Figure 3.** Median number of correct words over time by treatment group for subjects who completed 5 weeks of therapy.

Parents reported a significantly greater number of new words heard in the home and other environments for participants in the MBCT group (z = -2.0, p= .04). On the other hand, there were no significant changes in the number of new words heard in the homes of the participants in the traditional group (z=-1.6, p= .11) (see Figure 4). The participants in the MBCT group showed significantly more imitative attempts than the traditional group overall (z=-2.2, p=.03) (see Figure 5).

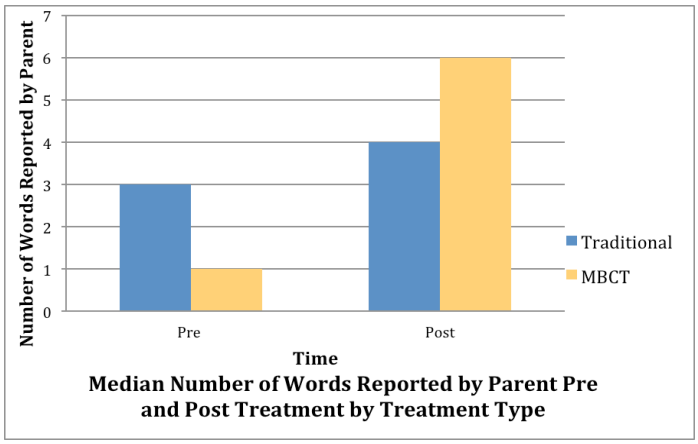


**Figure 4.** Median number of words reported by parents pre and post treatment by treatment group.

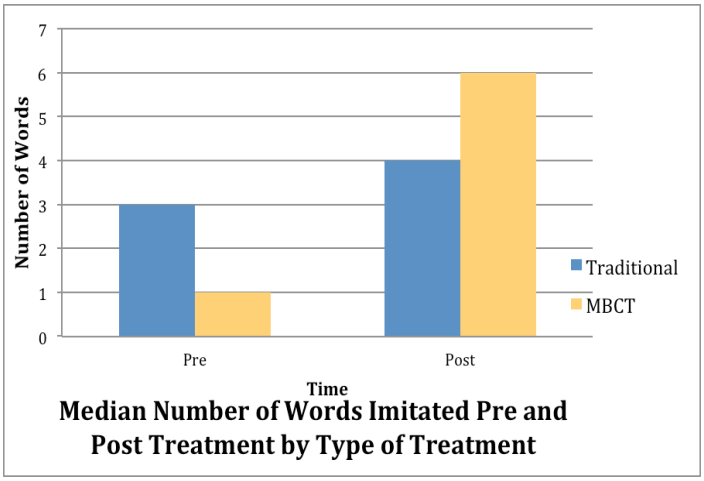


**Figure 5.** Median number of words imitated pre and post treatment by type of treatment for all subjects.

## Discussion

The aim of this study was to compare the efficacy of Melodic Based Communication Therapy (MBCT) and traditional therapy in eliciting speech in nonverbal children with autism. Efficacy was evaluated by number of verbalizations, number of correct words, number of external words reported by the parent and number of imitative

attempts. Results of this study suggest that MBCT is more effective within a shorter period of time when compared to traditional therapy. Comparatively, results indicate traditional therapy is effective only after an extended period of time. Results further indicate that MBCT is more effective in eliciting imitative attempts. These findings further support the positive effects of music-based treatments previously found by multiple researchers (Finnigan & Starr, 2010; Lim, 2010; Miller & Toca, 1979; Hoelzley, 1993; Wan et al., 2011).

Furthermore, reports from parents suggest that MBCT is more effective in providing generalization of learned skills to external settings than traditional therapy. The words reported at home were a combination of learned words and unlearned words, supporting other recent findings regarding the generalization of skills taught using music to production of words not taught during therapy (Wan et al, 2011). Overall, these findings seem to support the hypothesis that this population will benefit more from receiving treatments that use melody and rhythm, components of their right hemispherical strengths. Moreover, the generalization of these skills to words not trained in therapy may substantiate the researcher's theory that therapy using melody and rhythm may promote an increase in corpus callosum growth/volume providing better communication between hemispheres. In order to determine the true effects of MBCT on the brains of children with autism over time, current brain imaging techniques used to measure the length and thickness of the corpus callosum as well as brain activity may be needed.

Although the MBCT group initially showed greater progress, a plateau effect was noted after 4 weeks of therapy resulting in an overall lack of difference between

treatment groups. The lack of a difference in overall number of words and number of verbalizations during criterion referenced testing over the full five-week period may have been due in part to the law of diminishing returns, which holds that when all factors are held constant, the successive increase in one factor will result in the decline of its effectiveness (http://www.websters-online-dictionary.org). This may indicate a need for a change in the target words or trained melodies after a period of 3-4 weeks has passed in order to continue the desired result. Further research using a larger sample size is needed to determine the full benefits of MBCT.

The use of parent reports to determine how many words the child could say pre and post treatment may have had an effect on the results. While attempts were made to blind the parents to the type of therapy their child was receiving by having the therapy door closed and parents wait in the waiting room, it is possible that some parents may have been able to make assumptions about the type of therapy their child was receiving based on sounds heard through the walls, introducing bias to the study. In future studies on MBCT, greater care may need to be taken to avoid bias from parents. While MBCT has proven to provide earlier results in an intensive one-on-one, 45 minute, four days a week setting when compared to traditional therapy given at the same intensity level, the practicality of using MBCT in the public school system where such a level of intensity may not be possible due to high caseloads/workloads or multiple school sites requires more research. Such research should be conducted on the benefits of MBCT at a lower intensity level in order to determine how best speech language pathologists working with children who have autism in the public school system can practically implement MBCT. In addition with the rise in the cost of treatment and healthcare for children with autism

(Wang & Leslie, 2010) further research into the effectiveness of using MBCT in the home environment, as conducted by a parent or family member in order to facilitate speech in nonverbal children with autism is warranted.

As the number of children being diagnosed with autism continues to rise, the need for appropriate interventions has risen as well. Despite research indicating the right hemispherical strengths of children with autism (Altgassen, Kliegel, & Williams, 2005; Flagg, Cardy, Roberts, & Roberts, 2005; Heaton, Davis, Happe, G.E., 2008; Herbert M.R., et al., 2004; Lazarev, Pontes, Mitrofanov, & deAzevedo, 2010), therapy using spoken language to train verbal and nonverbal means of communication remains the accepted norm for the treatment of children with autism by speech language pathologists (http//:www.asha.org/policy). Preliminary findings of this study indicate that Melodic Based Communication Therapy may provide more rapid results as well as generalize to other settings when compared to therapy using spoken language. These findings may indicate the need for MBCT and other music therapies to be implemented by speech language pathologists in clinical settings and public school systems as well as the need for universities to offer more training in music-based interventions to students enrolled in speech language pathology programs.

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CHAPTER THREE

# EFFECTIVE THERAPY FOR NONVERBAL CHILDREN WITH AUTISM: MELODIC BASED COMMUNICATION THERAPY


## Abstract

The objectives of this study were to examine the effect of exposure to Melodic Based Communication Therapy (MBCT) on pragmatics; the effect of age on the response to treatment, and the predictors of overall effectiveness of treatment. Participants were 12 nonverbal children with autism ages 5 through 7 randomly assigned to the MBCT or traditional therapy group. Measures included scores on the *Pragmatic Language Skills Inventory* (PLSI), *Peabody Picture Vocabulary Test IV* (PPVT-IV), a criterion-referenced test administered weekly over 5 consecutive weeks and a parent survey.

Following treatment, the MBCT group showed significant improvement in PLSI score ($p=.04$). All participants irrespective of age demonstrated progress as a result of treatment. Receptive vocabulary score at baseline and imitative ability were significant predictors of response to treatment. Combined, they accounted for 75% of variability in the improvement in the number of correct words following treatment. Results suggest MBCT is a viable means of improving pragmatics in children with autism. Results further suggest that intensive therapy results in progress for children ages 5-7 irrespective of age. In addition imitation skills and receptive vocabulary are indicators of therapeutic success.

## Introduction

Effective speech and language therapy for individuals with autism is paramount if such individuals hope to progress. However, what makes therapy successful? What components of therapy are necessary and what predictors do we have as to whether or not a child will succeed in therapy? Autism has often been described as a disorder of social communication characterized by a distinct lack of social instinct (Allely & Wilson, 2011). The *Diagnostical and Statistical Manual of Mental Disorders* (DSM)-IV criteria for autism incudes, among other impairments, an impairment in social functioning (4th ed., text rev.; *DSM–IV–TR*; American Psychiatric Association, 2000). In their proposed revisions to the DSM-V criteria for autism spectrum disorder (5th ed.; *DSM-5*), the American Psychiatric Association lists "persistent deficits in social communication and social interaction, as manifested by deficits in social emotional reciprocity, deficits in nonverbal communication behaviors used for social interaction, and deficits in developing and maintaining relationships appropriate to developmental level," as key components in the diagnosis of Autism (DSM-5 Development, 2011; Frazier et. al., 2011; Mandy, Charman, & Skuse, 2012). Thus it is clear that successful and appropriate speech therapy for children with autism must address the social components of language.

Multiple research studies have found neurological differences between children with autism and children who are developing normally (Altgassen, Kliegel, & Williams, 2005; Flagg, Cardy, Roberts, & Roberts, 2005; Heaton, Davis, Happe, G.E., 2008; Herbert M.R., et al., 2004; Lazarev, Pontes, Mitrofanov, & deAzevedo, 2010). These studies have commonly found asymmetry between the left and right hemispheres of the brain with the dominant hemisphere being the right hemisphere in individuals with

autism while the left was favored in normally developing controls. While the left hemisphere is responsible for language, the right hemisphere is known to be responsible for processing melody, intonation, prosody and art (Ono et al., 2011). Other research has indicated that the corpus callosum, which joins both hemispheres and allows for transfer of information between hemispheres, is often impaired in children with autism (Shukla, Keehn, Lincoln & Muller, 2010). Studies conducted on the corpus callosum indicate that it can be strengthened by exposure to music prior to the age of seven in normally developing individuals (Schlaug, Jancke, Huang, Staiger, & Steinmetz, 1995; Schlaug et al., 2009). Based on the previously mentioned studies, addressing the social aspects of language using traditional speech/language therapy, which primarily makes use of spoken language, a left hemispherical task, may no longer represent best practice when treating individuals with autism.

Music therapies have been shown to influence social functioning in children with autism in the past (Kern & Aldridge, 2006; Kim, Wigram, & Gold, 2008; Kim, Wigram, & Gold, 2009; Lim, 2010; Pasiali, 2004; Stephens, 2008). Such therapies, however often focused on improving social interaction by influencing peer interaction, play, and/or social compliance, while failing to integrate effective language interventions, seemingly overlooking another key area of deficit for many individuals with autism. Furthermore, these studies were typically done on children below the age of 5 with mild-moderate disabilities, which might lead to the question of whether or not such therapies would be effective on an older population. Though the importance of early intervention for children with autism has been well established (Bakare & Munir, 2011; Limon, 2007; Peacock & Lin, 2012; Wise, Little, Holliman, Wise, & Wang, 2010) it is clear that many

children will not receive the early intervention services they are in need of due to the inability of many early intervention programs across the United States to meet the demand (Wise et. al, 2010). This highlights the need for further study of a clearly defined intervention targeting the social aspects of language along with expressive and receptive language in children with severe autism over the age of 5.

When providing services to children with autism, knowing the predictors for success allows the clinician greater success in making a prognosis and justifying the recommendation or continuation of services. Multiple research studies have addressed the subject of predictors for successful therapy outcomes in individuals with autism (Charman, Baron-Cohen, Swettenham, Baird, Drew, & Cox, 2003; Charman, Taylor, Drew, Cockerill, Brown, & Baird, 2005; Gillberg & Steffenburg, 1987; Luyster, Kadlec, Carter, & Tager- Flusberg, 2008; Oliver, Dale, & Plomin, 2004; Thurm, Lord, Lee, Newschaffer, 2007; Stone, Ousley, & Littleford, 1997; Stone & Yoder, 2001). These studies have examined joint attention, imitation, age, and standardized tests as predictors for how an individual with autism would progress over time. They have commonly found standardized measures of language abilities at various ages (Charman et. al 2005; Oliver et. al 2004), communicative abilities prior to the age of six (Gillberg & Steffenburg, 1987), and the ability to imitate (Charmon et. al 2003; Charman et. al 2005; Stone & Yoder, 2001; Stone, Ousley & Littleford, 1997) to be important prognostic predictors. In general, children, with autism have been shown to have poorer imitation skills than other children with language disabilities (Rogers, Hepburn, Stackhouse, & Wehner, 2003; Young, Rogers, Hutman, Rozga, Signman, & Ozonoff, 2011; Williams, Whiten, Suddendorf, & Perrett, 2001), which likely plays a large role in poorer prognosis

for these children. Taking this into account, effective therapies for children with autism need to positively impact imitative abilities in order to render positive changes in the language abilities of the child.

Melodic Based Communication Therapy (MBCT) is a research based speech and language intervention shown to improve verbal output and imitative abilities in nonverbal individuals with autism over the age of 5 (Sandiford, Mainess, Daher, 2012). MBCT is based on the theory that the right hemispherical musical strengths of the child with autism can be used to increase verbal output by strengthening the corpus callosum, the bundle of fibers connecting the hemispheres, in order to better transfer learned information from the stronger right hemisphere to the weaker left hemisphere, thus improving overall language ability (Sandiford, et. al., 2012). Sandiford, et.al., found individuals who received MBCT progressed significantly in number of verbalizations after weeks 1, 2, 3, and 4, while the traditional group progressed significantly only after weeks 4 and 5. Individuals receiving MBCT progressed significantly in number of correct words after weeks 1 and 3, while the traditional group progressed significantly only after weeks 4 and 5. The participants in the MBCT group had more imitative attempts overall (Sandiford, et. al., 2012).

The objectives of this study were to examine the effect of exposure to Melodic Based Communication Therapy (MBCT) on pragmatics/social language abilities as measured by score on the *Pragmatic Language Skills Inventory* (PLSI); the effect of age on the response to treatment, and the predictors of overall effectiveness of treatment. The predictors examined were number of verbalizations, number of correct words, progression to 2 and 3 word utterances, number of imitative attempts, social language

(PLSI) score, and number of words spoken in external environments such as the home environment.

## Method

### Participants

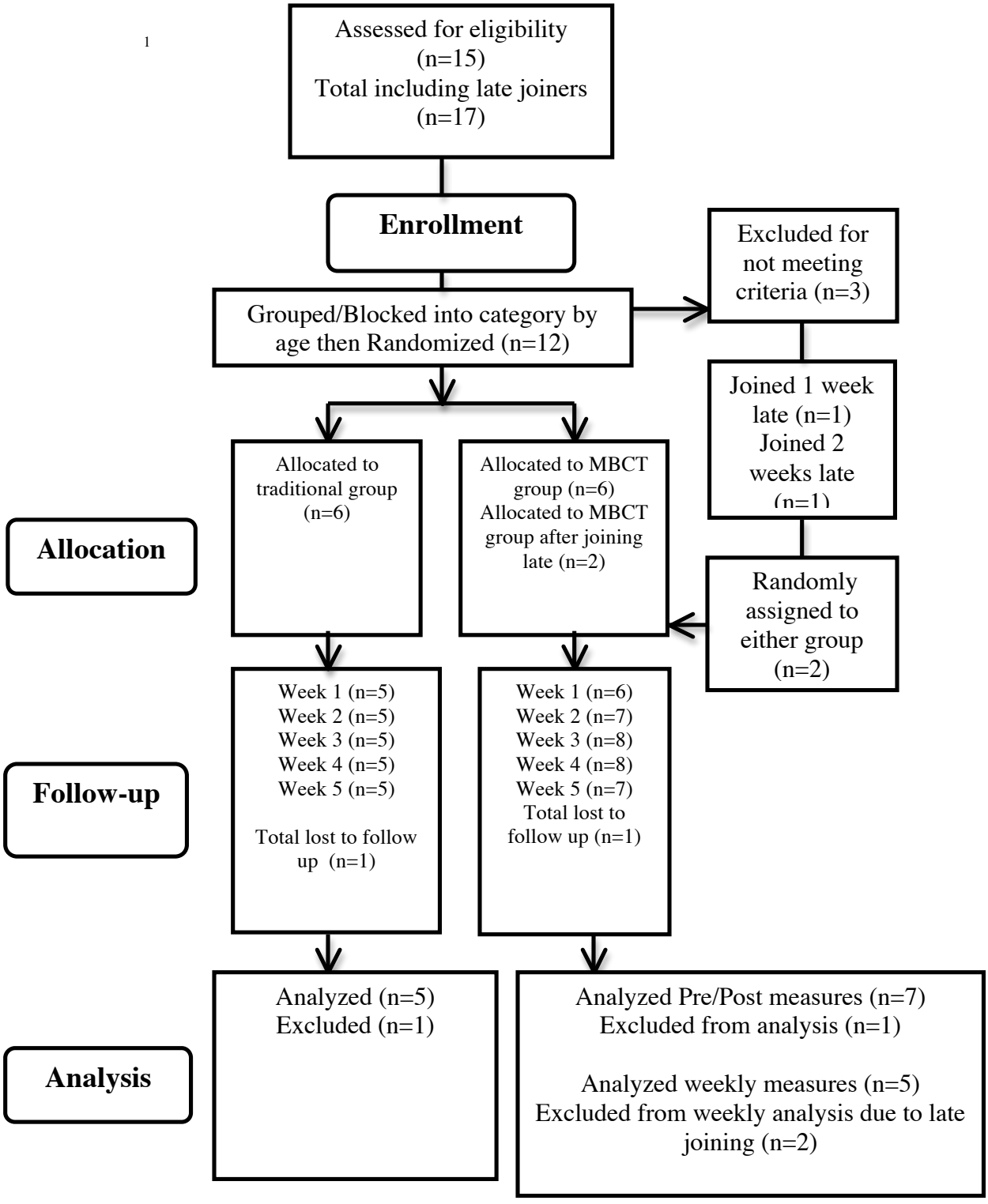
Permission to conduct this study was obtained from the Institutional Review Board (IRB) of Loma Linda University ensuring appropriate adherence to informed consent procedures and handling of all research data. Participants were recruited from the southern California area using local media/newspapers, letters to paraprofessionals, flyers in local clinics, hospitals, universities, schools, contacting of local support groups, social networks and word of mouth.

A randomized control design was used for components of this study in order to determine the effectiveness of the experimental treatment and control for external factors such as maturation of the participants and the intensity of the administered therapy. Participants were included in the study if they received a diagnosis of autism based on the *Autism Diagnostic Observational Schedule* (ADOS) and were nonverbal. Nonverbal was defined as having an expressive vocabulary of no more than 10 words which were not used on a daily basis and having no functional speech. Participants also needed to be between the ages of 5 and 7 years. Individuals were excluded from the study if they were receiving other language or articulation treatments or therapy at the time of the study, were unable to regularly attend four 45 minute sessions of therapy for 5 weeks, had a history of severe hearing impairment, had severe visual impairment/blindness, had a diagnosis of an organic impairment of oral or laryngeal structures, or had a significant

medical illness or condition which would prevent the child's participation in the treatment procedures. These conditions included, but were not limited to cerebral palsy, paraplegia, spina bifeda, uncontrolled seizures, dysarthria, and amputation of arm(s). Twelve participants who resided in the Southern California area were included in the study, 11 males and 1 female.

Upon entering the study, children were put into three groups according to their age, and then were randomly assigned to one of two treatment groups. The two groups were: the traditional therapy group, which represented the standard therapy procedures the participant would receive in a private practice setting and the Melodic Based Communication Therapy (MBCT) group, which represented the experimental group. Participants who joined late were randomly assigned to either group (see figure 1 for a flowchart on the movement of participants through the study). Participants received 5 weeks of intervention, with four 45-minute individual sessions a week.

[1]




[1] **Figure 1.** Sampling of flow of participants through randomized control trial

## Instrumentation and Materials

The parent survey was compiled based on the information needed for inclusion/exclusion criteria as well as the information needed for a reinforcer assessment. The reinforcer assessment was a modification of Sturmey's reinforcer assessment (2008), which requires parents to list possible reinforcers with corresponding examples followed by a list of their child's top three reinforcers.

The *Autism Diagnostic Observation Schedule* (ADOS) is a semi-structured, standardized assessment of communication, social interaction, and play consisting of four modules that can be administered in 30-45 minutes and used to accurately diagnose individuals with autism across age levels, developmental skills and language abilities (Lord, et al., 1989; Lord, et al., 2000; Overton, Fielding, de Alba, 2008). Module 1, intended for children who do not use phrase speech consistently, was used for the purposes of this study. Module 1 consists of the following: free play, response to name, response to joint attention, bubble play, anticipation of a routine with objects, responsive to social smile, anticipation of social routine, functional and symbolic imitation, birthday party, and snack (Lord, et al., 1989).

The *Pragmatic Language Skills Inventory* (PLSI) is a norm-referenced rating scale that can be administered in 5-10 minutes designed to assess the pragmatic and language abilities of children ages 5.0-12.11. It has three subscales: personal interaction skills, social interaction skills, and classroom interaction skills. Reliability and validity ratings are reported as strong (Gilliam & Miller, 2006)

The *Peabody Picture Vocabulary Test* 4th Edition (PPVT-IV) is an extremely reliable and valid individually administered norm-referenced measure of receptive

vocabulary for standard English offered in two parallel forms in order to ensure reliable testing and retesting. Developed over a five-year period, the normative sample matches the U.S. Census for gender, race/ethnicity, region, socioeconomical status, and clinical diagnosis or special education placement. The sample at ages 2 through 18 included representatives from the following populations: speech/language impairment, intellectual disabilities, specific learning disabilities, emotional/behavioral disturbance, attention-deficit/hyperactivity disorder, autism, and other low incidence disabilities. It can be administered in 10-15 minutes to ages 2:6 to 90+ years (Dunn & Dunn, 2007; A Guide to Assessment in Early Childhood; Infancy to Age Eight. Washington State Office of Superintendent of Public Instruction, 2008).

Twenty-five target words were chosen based on high frequency words children typically use first (Appendix A). Twenty-five stimulus items were chosen to represent the target words. Target words and stimulus items were the same for each group. Score sheets for weekly criterion referenced vocabulary testing were used to document the participants' responses over time using the International Phonetic Alphabet (IPA).

Portable Compact Disc (CD) players and Compact Discs (CDs) were used for the MBCT group. CDs consisted of the 25 target words set to 25 different melodies. Words were set to repeat 10 times with approximately a 10 second break between repetitions. Video cameras were used to record sessions.

Reinforcers were chosen based on the responses of parents on the reinforcer assessment. Reinforcers were kept with a list of the participants known allergies and special instructions as indicated by the parent. Some parents opted to bring in their child's reinforcers due to special diet considerations when food reinforcers were used.

## Procedure

The goal of therapy for each treatment group was to train the production of the twenty-five target words. If the twenty-five target words were learned, then two word utterances incorporating the twenty-five target words were then trained (e.g. "kick ball"). Baseline measures for the purposes of this paper included: a criterion referenced vocabulary test to determine which of the target words the child could verbally identify, a parent survey to determine what words the child could already say, the *Peabody Picture Vocabulary Test* (PPVT-IV) in order to measure receptive vocabulary, and the *Pragmatic Language Skills Inventory* (PLSI) in order to measure social language ability. The PLSI ratings were given by the parents and scored by researchers.

Weekly measures included a criterion referenced vocabulary test to determine which of the target words the child could independently name. Attempted verbalizations in response to the test item were also documented. Sessions were videotaped and imitative attempts tallied from the first and final sessions. Final measures were taken following the final week of therapy. Final measures were a repeat of the baseline and weekly measures. Attempts were made to blind parents to the type of therapy their child received by keeping parents in an external waiting room with therapy doors closed; however, the thinness of the therapy walls may have allowed some parents to make assumptions about the type of therapy their child was receiving.

Clinicians were first year graduate students in the Communication Sciences and Disorders program at Loma Linda University trained to provide both traditional therapy and Melodic Based Communication Therapy under the supervision of the first and second authors. Treatment procedures for the traditional therapy consisted of using the child's

three primary reinforcers, as previously identified by the parent, to train and reward correct productions as well as attempts to name stimulus items. The clinician stated the word clearly while holding up the stimulus item, then asked the child to repeat the word after him/her. Acceptable cues were: phonemic cues, manual manipulation of lips/articulators, visual cues for placement and verbal instructions about where and how to use articulators. Therapy progressed from having the child imitate nouns and verbs to asking the child to independently name the items in response to the question: What is this? If the child was able to name the majority of the words independently, the procedures were repeated for two word utterances such as "kick ball." See Appendix B for a complete list of procedures used for traditional therapy.

Procedures for MBCT were similar to the traditional therapy in that the same 25 words and stimulus items were used. The child's top three reinforcers as identified by the parents were also used to provide rewards for correct responses and attempts during therapy. A compact disc (CD) recording of the 25 target words set to 25 different melodies was utilized for all participants in the MBCT group providing a greater level of standardization of melodies. The children were allowed to listen to the CD recording of the word set to melody while the therapist presented the stimulus item to the child simultaneously. Therapy then progressed from listening to a recording of the word set to melodic tone, to hand over hand clapping of the rhythm, to unison clapping of the rhythm, to independent clapping of the rhythm, to independent clapping of the rhythm while singing to the recording with the clinician, to singing with just the clinician while clapping, to singing with just the clinician without clapping, to singing while the clinician mouthed the word silently, to singing the word independently, to answering the sung

question, "What is this?" with the melodic version of the expected target word, to answering the spoken question, "What is this?" with the expected target word. If the child was able to name the majority of the words independently, then the same procedures were followed for two word utterances. See Appendix C for a complete list of instructions used for MBCT.

Outcome measures for this study were PLSI score, number of verbalizations, number of correct words, progression to 2 and 3 word utterances, number of imitative attempts, and number of words spoken in the external/home environment as reported by the parent. In order to measure number of verbalizations and correct words over time, a criterion referenced vocabulary test was given at baseline and the beginning of each treatment week. The criterion referenced vocabulary test was given again at the end of treatment. The criterion referenced vocabulary test was conducted as follows: the clinician would pull one of the stimulus items from a bin and ask the participant, "What is this?" The participant's response was then transcribed verbatim using the International Phonetic Alphabet (IPA). Criterion referenced testing was also videotaped in order to ensure the accuracy of the clinician's phonetic transcription.

The investigator scored criterion referenced testing using the following procedures: verbalizations which were close approximations to the target word such as /hæ/ for /hænd/ were scored as correct words. Verbalizations which were nonsensical and bore no resemblance to the target word such as /owio/ for /hænd/ were tallied under verbalizations.

A parent survey was used to tally the number of words reported by the parent. Prior to beginning treatment, parents of participants were asked to fill out a questionnaire

that asked the parent to list the number of words as well as the actual words they had heard their child say in the past. Following the study, the parents were asked to list all the new words they had heard the child say in the past five weeks. Based on the list provided by the parent, the total number of new words for each participant was tallied. Imitative attempts were tallied based on a review of the video recordings from the first and final treatment sessions. Any attempt to verbally imitate the clinician was scored as one imitative attempt. The first 10 sets were tallied for every participant's first and last session.

Data was summarized using descriptive statistics. A two-way mixed factorial ANOVA (2 groups x 6 times) was used to examine changes between the two groups over time. The outcome measures for the two groups were compared using the Mann-Whitney U Test at weekly intervals. Changes in outcome variables over time were assessed using Wilcoxon Signed Ranks Test. Multiple regression analysis was used to examine whether the participant's receptive vocabulary score as measured by the *Peabody Picture Vocabulary Test 4th Edition* (PPVT-IV) prior to therapy and the number of imitative attempts were predictors of improvement in the number of correct words. To examine the relationship among ADOS score, number of correct words, and ability to progress to 2 and 3 word utterances, spearman rank order correlation was conducted. The level of significance was set at $p < .05$.

## Results

Fourteen participants were originally included in the study; however, one dropped out after a few days and the other was not readily available for testing due to illness. The

traditional group had 5 participants. The MBCT group had 7 participants. Two participants, however, did not receive the full five weeks of therapy due to later enrollment in the study. All participants received at least 3 weeks of therapy. Ten participants received 5 weeks of therapy, five participants in the traditional group and five participants in the MBCT group (see Figure 1 for the flow of participants through each stage of the experiment). There were no significant differences for age and PLSI scores between the two groups at baseline. The MBCT group showed a significant improvement in PLSI score ($p=.04$) following treatment, however no significant difference in PLSI score ($p=.18$) was found for the traditional group following treatment.

Irrespective of their treatment group all participants made significant progress in number of verbalizations ($p<.01$), number of correct words ($p<.01$), and number of imitative attempts following treatment ($p=.01$), There were no significant differences, however, in number of verbalizations ($p=.64$), number of correct words ($p=.15$), progression to two and three word utterances ($p=.92$), number of imitative attempts ($p=.14$), PLSI score ($p=.14$), and number of words reported in external/home environments ($p=.13$) following treatment among 5, 6, and 7 year olds.

Number of imitative attempts was a significant predictor of improvement in number of correct words ($t=2.75$, $p=.03$) regardless of treatment group. Sixty-four percent of the variability in number of correct words was explained by its relationship to the number of imitative attempts. When receptive vocabulary score as measured by the PPVT IV was added to the model, 11% of the variability in number of correct words was explained by its relationship to receptive vocabulary regardless of the treatment group.

Both variables combined accounted for 75% of the variability in the number of correct words regardless of treatment group.

There was a significant correlation between the number of correct words at baseline and progression to 2 and 3 word utterances ($\rho$ =.67, p=.02). Also, there was a significant correlation between the ADOS score and progression to 2 and 3 word utterances ($\rho$=.77, p=.004). Results of the logistic regression showed that neither number of correct words at baseline nor ADOS scores were significant predictors of progression to 2 and 3 word utterances (p>.05).

## Discussion

Results indicated that social language scores improved for participants in the MBCT group. This finding supports what other researchers have found on the importance of music-based interventions for improvements in social functioning (Kern & Aldridge, 2006; Kim, Wigram, & Gold, 2008; Kim, Wigram, & Gold, 2009; Lim, 2010; Pasiali, 2004; Stephens, 2008), and may support the notion that MBCT can be used to strengthen social language skills in children with autism.

In this study, children improved with therapy regardless of their age. It is possible that the level of intensity of the therapies may have played a role in the progress of the children. Further research using a larger sample size may be warranted to fully determine the effect of age and intensity on the outcome of therapy. However, if these findings are true, the importance of continuing intense therapy over time for older children with autism should be examined.

Results of this study support previous findings that improvements in the ability to imitate as well as a strong receptive vocabulary score are predictors of future success in therapy – with ability to imitate being the largest predictor (Charmon, Baron-Cohen, Swettenham, Baird, Drew, & Cox, 2003; Charman, Taylor, Drew, Cockerill, Brown, & Baird, 2005; Gillberg & Steffenburg, 1987; Luyster, Kadlec, Carter, & Tager- Flusberg, 2008; Oliver, Dale, & Plomin, 2004; Thurm, Lord, Lee, Newschaffer, 2007; Stone, Ousley, & Littleford, 1997; Stone & Yoder, 2001). Age as a predictor of success, however, was not supported by this study. This may be due to the small sample size in each of the age groups.

Although significant correlations were found between the number of correct words at baseline and progression to 2 and 3 word utterances as well as ADOS score and progression to 2 and 3 word utterances, these were not found to be strong predictors of progression to 2 and 3 word utterances. This may also have been due to the small sample size.

Findings of this study suggest that MBCT is a viable means of improving social language abilities in children with autism. Improvements in overall imitative ability are a predictor of success in therapy and further support the validity of MBCT as a therapy for nonverbal children with autism over the age of 5 (Sandiford, et al., 2012). Receptive vocabulary combined with imitative ability may add to the improved prognosis in therapy regardless of type of therapy. Further research on the effect of number of correct words prior to therapy and ADOS scores on the outcome in therapy using a larger sample size may be warranted.

MBCT four days a week on a one on one basis in the public school system may not be feasible. Further research on the benefits of MBCT at a lower intensity level should be conducted in order to determine how best speech language pathologists working with children with autism in the public school system can practically implement MBCT. In addition with the rise in the cost of treatment and healthcare for children with autism (Wang & Leslie, 2010) further studies into the effectiveness of using MBCT in the home environment, as conducted by a parent or family member are needed.

As the number of children being diagnosed with autism continues to rise (Center for Disease Control and Prevention, 2009), the need for appropriate interventions targeting multiple modalities of the disorder has risen as well. Appropriate interventions should affect social language as well as receptive/expressive language and imitative abilities. Despite research indicating the right hemispherical strengths of children with autism (Altgassen, Kliegel, & Williams, 2005; Flagg, Cardy, Roberts, & Roberts, 2005; Heaton, Davis, Happe, G.E., 2008; Herbert M.R., et al., 2004; Lazarev, Pontes, Mitrofanov, & deAzevedo, 2010), therapy using spoken language to train verbal and nonverbal means of communication remains the accepted norm for the treatment of children with autism by speech language pathologists (http//:www.asha.org/policy). Preliminary findings of this study indicated that Melodic Based Communication therapy effectively addresses social language deficits in addition to expressive language and imitative ability in children with autism ages 5-7. These findings may indicate the need for MBCT and other music therapies to be implemented by speech language pathologists in clinical settings and public school systems. Also universities may need to offer more

training in music-based interventions to students enrolled in speech language pathology programs.

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# CHAPTER FOUR

# DISCUSSION

The findings of this research study appear to support the researcher's original theory that Melodic Based Communication Therapy (MBCT) may improve overall language ability, particularly number of verbalizations, number of words spoken in the clinical and home environments, number of imitative attempts, and pragmatic/social language ability. These findings lend support to what other researchers have found about the viability of using music-based interventions for children with autism (Finnigan & Starr, 2010; Hoelzley, 1993; Kern & Aldridge, 2006; Kim, Wigram, & Gold, 2008; Kim, Wigram, & Gold, 2009; Lim, 2010; Miller & Toca, 1979; Pasiali, 2004; Stephens, 2008; Wan et al., 2011). Additionally the results of the study add support to other findings that imitative ability and receptive language scores are among the predictors of therapeutic success (Charmon, Baron-Cohen, Swettenham, Baird, Drew, & Cox, 2003; Charman, Taylor, Drew, Cockerill, Brown, & Baird, 2005; Gillberg & Steffenburg, 1987; Luyster, Kadlec, Carter, & Tager- Flusberg, 2008; Oliver, Dale, & Plomin, 2004; Thurm, Lord, Lee, Newschaffer, 2007; Stone, Ousley, & Littleford, 1997; Stone & Yoder, 2001).

Age was not found to be a factor in success of therapy as was originally assumed by researchers' in this study. Blocking participants into three categories by age for 5, 6, and 7-year-olds prior to randomization was done to control for age as a factor since it was assumed the younger the child the better he/she would do in therapy. Researchers' believed the results would be skewed should randomization result in one group being

composed of all 5-year-olds. This assumption was supported by multiple research articles and books which state the importance of early intervention for children with autism, lending support to the theory that the younger the child the better the assumed outcome (Dawson, 2008; Peacock & Lin, 2012; National Research Council, 2001; Prelock & Nelson, 2012; Stahmer, Schreibman, & Cunningham, 2011). Early intervention typically refers to intervention prior to the age of 4 (Stahmer, et. al., 2011). As the children in this research study were all over this age, this may have played a factor in the lack of difference between 5, 6 and 7 year-olds for overall success in therapy. Introducing younger participants into the analysis may have brought about different results. Additionally the small sample size for each age range may have played a role. Further research with a larger sample size and greater age range may be needed to determine the full effect of age on response to treatment.

The increase in imitative ability noted in subjects who participated in the MBCT group seems to further support the use of MBCT as a suitable means of therapy for children with autism who are nonverbal as imitative ability was found to be a predictor of therapeutic success. Furthermore the early spike in results noted as early as week one for children who participated in the MBCT group appears to lend further support to MBCT's use as therapeutic tool for this population. While children who participated in the traditional speech and language therapy treatment group were still noted to make significant progress after 4-5 weeks of therapy, these results were much later than the results for the MBCT group, which showed significant progress within the first week of therapy. This seems to suggest that traditional speech and language therapy while effective for children with autism who are nonverbal at the intensity level of four 45

minute sessions a week for five weeks, may not be as effective as MBCT is if one is looking for rapid results. The lack of a significant difference between groups in number of words spoken and number of verbalizations at the close of the five weeks of therapy and the plateau effect observed by the MBCT group after week four may suggest that the stimulus items for the MBCT group or the stimulus tunes may need to be changed after 3-4 weeks of therapy in order to continue the desired effect. Further research into the change of stimulus items and tunes after this time frame is needed to determine if this is indeed the case. In addition, research looking into initial treatment with MBCT followed by the use of traditional speech and language therapy after week 4 may also be warranted to determine if using MBCT initially will produce a spike in the therapeutic success of traditional speech and language therapy when traditional therapy is used as a secondary treatment.

Attempts were made to reduce sources of bias by keeping parents in an external waiting room, however as noted previously, the thin therapy walls may have allowed some parents to make guesses about what type of therapy their child was receiving introducing some bias into the study. Furthermore as children were most familiar with their therapist and as such most cooperative with that individual, criterion-referenced testing was administered by the same therapist who provided the therapy, making it difficult to blind therapists as to the type of therapy their client received, introducing some level of bias based on the therapists preconceived notions about which therapy was more effective. Videotaping of criterion-referenced testing was used to help control for this. The skill level of the therapists may have also been a factor as some were able to more accurately sing the notes of the therapy while others were not as musically inclined.

The introduction of the CD recording as a stimulus item was used to help control for level of musical talent in the clinician, however musical talent may still have played a role in therapeutic success. Further research on this is needed to determine if this is a factor in therapeutic success.

Additionally another area of difficulty for researchers was noted when attempting to compare the imitative attempts of the traditional group to the MBCT group. The traditional group treatment was based on one major step, "say what I say" with various levels of cuing (see appendix B). Therefore if the child attempted to imitate it was a clear yes. If the child did not it was a clear no. The MBCT group had multiple steps beginning from simple clapping and singing and ending in spoken speech (see appendix C). For the purposes of comparing the two, it was determined that if the child did not attempt to imitate, action or word, it would be marked as a no. If the child imitated an action, it would not be counted as a yes or a no. It was simply ignored. If the child attempted to imitate a word it would be counted as a yes. In this way attempts were made to fairly compare the verbal imitative attempts of both groups, however it is possible that this method of comparison may have impacted the results on some unknown level. Future researchers may wish to count all imitative attempts verbal and nonverbal or create a separate criterion referenced measure all together.

Another weakness of the study pertained to the number of sessions each participant received. Some participants joined the study late, while others missed one or two sessions due to various unforeseen factors. Thus the decision to include only subjects who had received five weeks of therapy in the final analysis may have played a role in the results, particularly since the two subjects who did not receive all five weeks

of therapy had been randomly assigned to the MBCT group. Introducing the results of these subjects into the final analysis may have resulted in a different outcome overall, particularly since the MBCT group was shown to have significant results within the first few weeks of therapy, while the traditional group was shown to have significant results only after four to five weeks of therapy. These individuals were included in pre vs. post measures, which may have accounted for the significance of results, particularly the significance of results in imitative attempts over time. Further study with a larger sample size is necessary.

Participants who joined late were assigned at random to either group. Upon assigning the first participant randomly to the MBCT group, another participant was found. Placing the second participant arbitrarily in the traditional group, would have resulted in an even number of participants in both groups, but would have negatively affected the randomization of participants and introduced further bias to the study. Randomization of the participant's group selection resulted in an MBCT group placement, resulting in an uneven number of subjects in groups. Despite the slightly unequal sample sizes, the data did not show any significant differences between groups allowing for the two groups to be effectively compared for the purposes of this dissertation.

While the results of this pilot study are promising, in order to generalize these findings to the target population at large, a larger sample size may be needed. The specificity of the exclusion and inclusion criteria made it difficult to collect the desired sample as multiple candidates were excluded due to having too many words overall and therefore not meeting the criteria for nonverbal. A future study using nonverbal to low

verbal participants may be more practical. Setting the limit higher than 10 words would allow for more participants to be included in the study, but would also increase the variability between participants, begging the question, can an individual who speaks one word be fairly compared to one who speaks 25 words? Increasing the age range may also be another practical way of allowing for more participants to be included in the study, however the decisions to use five to seven year olds was made based on a review of the literature and the theory that children over the age of five who are nonverbal are likely to remain such (Charlop & Haymes, 1994), as well as children exposed to music prior to the age of seven showed increases in corpus callosum thickness (Schlaug, et. al., 1995; Schlaug et. al., 2009).

As the number of children being diagnosed with autism continues to rise (Center for Disease Control and Prevention, 2012), the need for appropriate interventions targeting multiple modalities of the disorder has risen as well. Appropriate interventions should affect social language as well as receptive/expressive language and imitative abilities. Despite research indicating the right hemispherical strengths of children with autism (Altgassen, Kliegel, & Williams, 2005; Flagg, Cardy, Roberts, & Roberts, 2005; Heaton, Davis, Happe, G.E., 2008; Herbert M.R., et al., 2004; Lazarev, Pontes, Mitrofanov, & deAzevedo, 2010), more traditional therapy using spoken language to train verbal and nonverbal means of communication remains the accepted norm for the treatment of children with autism by speech language pathologists (http//:www.asha.org/policy). Preliminary findings of this study indicated that Melodic Based Communication Therapy effectively addresses social language deficits in addition to expressive language and imitative ability in children with autism ages 5-7 who were

nonverbal. These findings may indicate the need for MBCT and other music therapies to be implemented by speech language pathologists in clinical settings and public school systems. Equally if these findings are found to be reproducible, appropriate training of speech language pathologists in the area of music-based interventions such as MBCT may also be necessary. In addition, with the rise in the cost of treatment and healthcare for children with autism (Wang & Leslie, 2010), further research into the value of training parents and caregivers to use MBCT in the home environment in order to more cost effectively facilitate speech in nonverbal children with autism may be warranted.

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APPENDIX A

TWENTY-FIVE HIGH FREQUENCY WORDS

| |
|---|
| 1. Apple |
| 2. Ball |
| 3. Banana |
| 4. Bed |
| 5. Book |
| 6. Boy |
| 7. Bubbles |
| 8. Candy |
| 9. Car |
| 10. Cat |
| 11. Cookie |
| 12. Cow |
| 13. Cup |
| 14. Dog |
| 15. Eat |
| 16. Girl |
| 17. Go |
| 18. Hand |
| 19. Jump |
| 20. Kick |
| 21. More |
| 22. Open |
| 23. Shoe |
| 24. Want |
| 25. Water |

APPENDIX B

TRADITIONAL THERAPY

**(Say What I Say)**

Instructions

Note: You will not need the CD player for this therapy.

a. Pull out the corresponding item (note for more and want use reinforcer item as stimulus)
b. Say the word carefully enunciating every sound
c. Draw attention to your mouth by holding the object near your mouth or pointing to your mouth
d. Ask the child to "say _____"
e. Reinforce for any approximations/attempts to imitate (e.g., closing lips for the /b/ sound in ball)
f. Move through all 25 words each session (allow at least 10 trials for each word but no more than 15 before moving on to next word)
g. Acceptable cues:
    a. Manual manipulation of lips and articulators (use universal precautions)
    b. Visual cues for placement (e.g., velars tap underneath chin in back where tongue elevates)
    c. Instruction about where/how to use articulators (e.g., "close your lips")

d. Allow child to feel vibration of vocal folds on the sound

h. Finish each session by asking: “What is this?” or “What am I doing?” for each word (except “more” and “want”). Answer with the spoken word and repeat the question. Cue as needed and repeat the question. Reinforce for any attempts to verbally answer.

APPENDIX C

MELODIC BASED COMMUNICATION THERAPY CHEAT SHEET

**(Sing & Say)**

Note: For each session only go as far as the child can attain success **before** moving on to the next word (e.g., if the child can only do hand over hand clapping do this for all of the trials on all of the words that session).

Instructions

The word will repeat 10 times. There is approximately a 10 second pause between each repetition of the word.

a. Pull out object corresponding to CD number. For more and want use reinforcer items as stimulus.

**b. Listen first**

c. Clap and sing melody 3x immediately after

**d. Listen again**

e. Hand over hand clap and sing with child 3x **

**f. Listen again**

g. Remove hands and see if child will clap Independently in **unison** with your clapping and singing 3x** (repeat step e if not*)

**h. Listen again**

i. Fade your clapping and only sing while child is clapping independently 3x** (repeat step g if child can't do*)

**j. Listen again**

k. Reinforce if child moves lips, hums, or attempts any vocalization with the clapping (continue this step until the last of the word repetitions is complete – reinforce for closer and closer approximations**)

**l. Listen again**

m. Sing in unison with child 3x – child continues to clap and sing** (repeat step k if child can't do*)

**n. Listen again**

o. Mouth word while child claps and sings 3x** (repeat step m if child can't do*)

**p. Listen again**

q. Fade mouthing of word while child claps and sings 3x** (repeat step o if child can't do*)

r. Sing "What is this?" and answer by singing the word – reinforce for any approximation of the target – reinforce for closer and closer approximations (clapping optional)

s. Say "What is this?" or "What am I doing?" and answer by saying the word in as close a spoken intonation to the melodic word as possible – reinforce for closer and closer approximations of the spoken word (no clapping – ask child to do with quiet hands).

** reinforce with successful completion or attempt

* move back to previous step if not successful – do not reinforce.