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TITLE: THE EFFECTIVENESS OF MELODIC INTONATION THERAPY AND THERAPEUTIC SINGING ON FUNCTIONAL COMMUNICATION SKILLS FOR ADULTS WITH EXPRESSIVE APHASIA

By

Yea Ju Rhee

A THESIS

Submitted to
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2009

ABSTRACT

By

Yea Ju Rhee

The study of music and speech for persons with expressive aphasia by Sparks and Holland attracted a fair amount of critical attention in the 1970s. The effectiveness of Therapeutic Singing (TS) and Melodic Intonation Therapy (MIT) in improving the speech production of persons with expressive aphasia has been established in subsequent research since that time. Based on the present research, the reframing study of Modified Melodic Intonation Therapy (Baker, 2000), which is the systematic combination of Melodic Intonation Therapy and Therapeutic Singing, gives convincing answers to some of this study's research questions regarding whether or not the addition of TS to MIT helps persons with aphasia improve their speech production. Two case studies were conducted to investigate the effectiveness of MIT and TS to improve functional communication skills. Eight variables of spoken language were compared: total length of samples, total number of utterances, total number of words, average length of utterances, average number of words per minute, total number of items named, total number of prompts per item named, and scores for MIT performance. The results showed that MIT and TS interventions helped the subject who had low functioning speech to improve functional communication skills in both the long term and short term. On the other hand, the subject who had high functioning speech skills showed positive numerical gains on some of the variables in functional communication, but there were not statistically supported differences between pre and post-tests in the short-term.

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CHAPTER I

INTRODUCTION

Music is a method of communication that is both nonverbal and verbal. Music helps people who have difficulty speaking their minds mentally or physically, in order to give them a voice in a nonverbal musical medium. On the other hand, music also helps the people who have a functional difficulty in verbal expression, in order to improve their ability to communicate by training them with musical cues, such as rhythm and melody. When I visited the meeting of the aphasia support group as a volunteer, an intriguing observation was that persons with expressive aphasia could sing with steady rhythmic patterns and speech production without long pauses between words, although they couldn't speak when they tried talking to someone. This research will seek to provide important information to help the persons who have functional difficulty in producing language expression by demonstrating the effectiveness of music in functional communication through singing.

There are different conditions that contribute to functional language difficulty, and stroke is one of the major causes. According to data from the American Heart Association and the National Institute of Health, 600,000 to 750,000 strokes occur in the US each year. A stroke, which causes damage to the posterior part of the frontal lobe in the left hemisphere of the brain, results in language disorders including Broca's aphasia (expressive) and Wernicke's aphasia (receptive). Expressive aphasia is characterized by disturbed prosody, effortful and slow speech with long pauses between words, poor sentence construction, difficulty naming objects, word-finding difficulties, and poor word repetition (Baker & Tamplin, 2006).

Speech and music share neural networks in the brain because music and language both use structured patterns of pitch (melody), duration (rhythm), and intensity (dynamics) (Patel, Peretz, Tramo, & Labreque, 1998). According to the research (Borchgrevink, 1982; Zatorre, Evans, & Meyer, 1994), pitch in melody is processed only by the right hemisphere, but rhythm is processed by the left hemisphere, so music including rhythm and pitch stimulates both right and left hemisphere in the brain. This rationale would support the idea that singing which includes pitch and rhythm could activate both hemispheres in the brain; music would be beneficial to persons who have Broca's aphasia with damage to expressive speech functions by stimulating the left side of their brains.

Neurologic Music Therapy (NMT) is one of the dominant music therapy approaches, which is based on a neuroscience model of music perception and production and the influence of music on functional changes in nonmusical brain and behavior functions (Thaut, 2005). NMT has several standardized techniques in three different areas of functional training: 1) Sensorimotor Training, 2) Speech and Language Training, and 3) Cognition Training. The dominant domain is the Sensorimotor area in NMT training, which is well established by plenty of research, live demonstration with patients, and collaboration with physiological experts. In recent years, several studies have attempted to find the reasons for the treatment effect of MIT and establish standardized techniques in Speech and Language Training and Cognition Training. According to the present research by speech and language pathologists, rhythmic stimulus can be an important

musical element to activate the human nervous system. For this reason, rhythmic instruments were used to stimulate the subject by rhythmic beats in the present study.

In NMT, Melodic Intonation Therapy (MIT) is one of the most important techniques of Speech and Language Training. MIT was established first from the speech pathologist, Sparks, in the1970s, and later the speech pathologist, Galloway, made the first contribution that connected music therapists and speech therapists by investigating the effectiveness of MIT in speech functions (Galloway & Kraus, 1982). This technique proved the power of musical elements, such as rhythm and melody, in brain functions (Sparks, Helm, & Albert, 1974).

While I participated in the NMT training in 2009 at Colorado State University, music therapists mentioned that research on the Speech and Language domain is still in its early stages, as the brevity of the bibliography attests in the Music Therapy field. I have observed from small workshops to national conferences in music therapy that many music therapists use NMT techniques without clear recognition of what techniques they are using, such as MIT, Musical Speech Stimulation (MUSTIM), Rhythmic Speech Cueing (RSC), Vocal Intonation Therapy (VIT), Therapeutic Singing (TS), Oral Motor and Respiratory Exercises (OMREX), Developmental Speech and Language Training through Music (DSLM), and Symbolic Communication Training through Music (SYCOM). This study will be intended to broaden our horizons of understanding of the effectiveness of functional communication through music in the Speech and Language Training area of music therapy.

STATEMENT of PURPOSE

With the intent of identifying effective music therapy techniques, the purpose of this study is to ascertain the effectiveness of Therapeutic Singing and Melodic Intonation Therapy in improving the functional communication skills of adults with expressive aphasia.

The goals for subject L's case study, who had a lower level of functional communication skills, are as follows: (1) to give specific information whether Therapeutic Singing (TS) combined with Melodic Intonation Therapy (MIT) helps adult clients who are diagnosed with expressive aphasia as measured by the quality of their functional communication skills; (2) to gain some information as to whether MIT treatment itself helps clients improve the quality of their functional communication skills; (3) to compare the effectiveness of TS combined with MIT and MIT alone in increasing functional communication skills; and (4) to investigate whether TS enhances the benefits of MIT treatment.

The goal for subject R's case study, who had a higher level of functional communication skills, is as follows: 1) To acquire information as to whether Therapeutic Singing (TS) itself helps clients improve the quality of their functional communication skills.

CHAPTER II

LITERATURE REVIEW

This literature review reflects information in the following areas: 1) music and brain; 2) stroke and aphasia; 3) music and speech; 4) melodic intonation therapy (MIT) and therapeutic singing (TS); 5) modified melodic intonation therapy (MMIT); and 6) measurement tools for functional communication skills.

Music and Brain

Throughout brain science research over the past two decades, the element of music has emerged as a factor in answering the question of what stimulates brain functionality. Sacks (2006) addresses this question by stating that music provides one of the most powerful sources of auditory stimulation in the human brain. Also, evidence from developmental studies indicates that music can increase auditory cortical functions of the brain (Engineer, et al., 2004).

The belief that music is processed only in the right hemisphere has been rejected by researchers (Hachinski & Hachinski, 1994). They found musical activity involved almost every region of the brain that was known, and almost every neural subsystem. They also insisted that different neural locations throughout the cortex handled different aspects of the music. Actually, the brain uses functional segregation for music processing, and employs a system of feature detectors whose job is to analyze specific aspects of the musical signal, such as pitch, rhythm, tempo, timbre, and harmony (Levitin, 2006). These cerebral locations in the brain are not restricted to only the right hemisphere as past information suggests (Prior, Kinsella, & Giese, 1990).

Stroke and Aphasia

According to data from the American Heart Association and the National Institute of Health, 600,000 to 750,000 strokes occur in the US each year (Schlang, Marchina, & Norton, 2008). Moreover, according to the World Health Organization, Cerebral Vascular Accidents (CVA) affect 15 million people worldwide each year, with five million people left permanently disabled. A CVA, commonly known as a stroke, results in the rapidly increasing loss of brain functions when a part of the brain is deprived of blood flow, and brain cells subsequently die. Overall, CVA affects 11% of females and 8.4% of males (Mackay & Mensah, 2004). The most well-known Neurogenic speech disorder, aphasia, is most often caused by a cerebral vascular accident.

People who have experienced a CVA are known as having a left CVA or right CVA, depending on the site of the lesion. The patients with a left CVA experience problematic physical functions and communication. The left CVA causes the most apparent impairments of the motor control and sensory experience of the right side of the body and causes a right hemi-paresis. Furthermore, a left CVA also causes language disorders including Broca's aphasia (expressive) and Wernicke's aphasia (receptive) (Baker & Tamplin, 2006).

Expressive aphasia is caused by damage to a region of the inferior left frontal lobe, and it is also called motor aphasia, non-fluent aphasia, or Broca's aphasia. This results in the disorders of speech production characterized by slow, laborious, and non-fluent speech. People with expressive aphasia have difficulty saying basic words with semantic meaning. On the other hand, people with receptive aphasia, otherwise known as

sensory aphasia, fluent aphasia, or Wernicke's aphasia, show poor speech comprehension and production of meaningless speech (Goodglass & Kaplan, 1972).

According to several examinations of auditory comprehension, a person with Broca's aphasia shows understanding and retention of spoken language that is essentially normal in a variety of contexts (Sparks & Deck, 1986). Sparks also indicates that the examination of verbal expression provides a profile of the good candidate for Melodic Intonation Therapy (MIT). He states:

1. "Almost no responses occur in confrontation naming, responsive naming, word and phrase repetition, or sentence completion. However, an occasional response will be poorly articulated but accurate enough to indicate correct encoding of the target word."
2. "Articulation of stereotype phrases will be precise and easily transcribed into phonetic symbols. On the other hand, any attempt to duplicate or initiate propositional language results in slurred articulation and phonemic substitutions."
3. "Effort at self-correction is often vigorous. This is to be expected in an aphasic who is acutely aware of making errors in his verbal output. Unfortunately, the product is not improved by this effort." (p. 255)

There are useful selection criteria for adult aphasia patients, with the best candidates for MIT including: "(a) no evidence of bilateral brain damage, (b) average-to-high receptive abilities, (c) poor repetition of single words, (d) non-fluent verbal production with inadequate articulation agility and effortful ignition of verbal communication, and (e) a well motivated, emotionally stable patient with an appropriate attention span" (Benson, Dobkin, Rothi, Helm-Estabrooks, & Kertesz, 1994, pp. 566-568)

However, Sparks et al. (1986) also show that the other three kinds of aphasia are not receptive to MIT as a form of treatment. There are three types of poor candidates for MIT treatment: Wernicke's, Transcortical, and Global aphasia. People with these types of aphasia are very difficult to engage in MIT and achieve minimal therapeutic success.

Music and Speech

According to Sacks (2008), speech is not just a succession of words in the proper order. It contains inflections, intonations, tempo, rhythm, and melody. Speech and music both are dependent on phonology and articulatory mechanisms that are elementary in other primates, and for their appreciation both are dependent distinctly on human brain mechanisms dedicated to the analysis of complex, segmented, rapidly changing streams of sound.

Brain processing of music and speech overlaps, and there has been extensive research to figure out how music stimulates speech. Belin (1996) insists that musical intervention has been used as part of speech therapy in stroke rehabilitation. There is evidence that music therapy practice is effective in alleviating speech disorder problems, such as Broca'a aphasia (Naeser & Helm-Estabrooks, 1985). King (2007) also gives convincing information of the effectiveness of music in brain functionality. This is important for music therapists to know and use in reviewing the definitions and characteristics of adult onset aphasia, as well as apraxia and dysarthria.

Jackson (1871) characterized propositional speech from so called automatic speech. He stated that even when propositional speech became seriously damaged, automatic speech could be preserved in aphasia. Hobson (2006) gives a rationale for applying music therapy methods to communication disorders, as well as definitions and

descriptions of several speech disorders relevant to music therapy practice. He notes that people with aphasia are able to sing familiar songs but are not able to engage in conversations. The classical interpretation of this observation is that singing familiar songs would depend on right hemisphere functions, whereas propositional speech would depend on left hemisphere functions. But it has not been substantiated by quantitative data yet (Hebert, Racette, Gagnon, & Perets, 2003). Sacks (2008) pointed out that singing familiar songs was a form of automatic speech as well as cursing or reciting a poem. With this apt observation, Sacks (2008) reformulated the question of music therapy:

> A person with aphasia may be able to sing or curse or recite a poem but not to utter a propositional phrase. The question of whether singing has any use in the recovery of speech, then, can be formulated another way: can language embedded in unconscious automatism be "released" for conscious, propositional use? (p. 218)

This shows an important role of music, especially singing, for speech therapy as a "trigger". In his view, it could be possible that by re-experiencing language even though it is a kind of wholly automatic language embedded in music, cortical areas previously inhibited but not damaged can be de-inhibited (Sacks, 2008).

Melodic Intonation Therapy

Melodic Intonation Therapy (MIT) was introduced in 1973 through successful research using three chronic non-fluent aphasics (Albert, Sparks, & Helm, 1973). MIT is a treatment technique for the rehabilitation of expressive (Broca's) aphasia. There is also support for its use with apraxia. Fitting candidates for MIT are clients with left-side stroke lesions in Broca's area, which is responsible for encoding speech production, or

clients with lesions interrupting the nervous connections between Wernicke's and Broca's area. MIT utilizes a patient's unimpaired ability to sing to make speech production possible. The rationale is based on a hemispheric transfer of speech functions from the left-hemisphere (Wernicke's area) to its right-hemisphere homologue during encoding of speech into singing (Albert, et al., 1973; Helfrich-Miller, 1994; Keith & Aronson, 1975; Overy, Norton, & Ozdemir, 2005; Popovici, 1995; Sparks, et al., 1974).

Several published reports over the years have outlined a programmed technique for MIT,(Helm-Estabrooks & Albert, 1991; Sparks & Holland, 1976) which include relatively strict criteria for patient selection. Functional sentences or utterances in MIT are translated into a song by translating the speech inflection patterns into musical rhythm and intonation. Therefore, it is technically more accurate to refer to the sung utterances not as songs, but as melodic intonations. Singing is reduced to Sprechgesang (speech singing) and finally to normal speech pattern in later steps of the therapy.

The important characteristics are the rhythmic and melodic elements for the therapeutic stimulus (Thaut, 2005). The range of musical notes is limited to representing only slightly greater inflection than the pattern of normal speech. MIT works in a gradual progression and is designed to lead the client through a sequence of therapy steps, which gradually increases the length of intoned sentences, decreases dependence on the therapist by fading hand tapping and singing, and increases the client's independence from intonation. The client is guided through a sequence of four progressive levels of difficulty, each containing a series of discrete steps. A criterion of 90% correct responses at each level is needed to ensure gradual progression, as well as the advancement up to the next level. In each step, target sentences or phrases are practiced until the level is

completed or failure occurs for that particular sentence (Sparks & Deck, 1986). Based on the supportive literature and clinical observation, the song strategy proves helpful for patients with left frontal lobe damage or bilateral damage that leaves singing centers of the right temporal lobe relatively intact (Lucia, 1987) .

According to research from Emory University, neurological development is steady, but critical periods of rapid cognitive growth are known to occur. Musical techniques such as MIT could be beneficial to children suffering speech and language problems due to some subtle cerebral dysfunction, since the child's brain possesses resilience and plasticity to some developmental point (Galloway & Kraus, 1982). According to the research (Albert, et al., 1973), MIT is effective for 75% of adults with non-fluent aphasia, and for 25% of people with severe non-fluent aphasia with little change in their ability to communicate verbally in meaningful ways. There are currently very few treatment techniques for in use of language therapy, and many are not uniformly practiced to allow for consistent measurements. MIT can satisfy consistency requirements to offer beneficial variation for research-level studies (Benson, et al., 1994).

Therapeutic Singing

Both singing and speech are essential tools for human expressive communication in both nonverbal and verbal ways. Singing has been described as an "automatic speech skill" which generally leads to functional speech treatment (Lucia, 1987). According to Thaut (2005), therapeutic singing (TS) refers to an unspecific use of singing activities in groups to facilitate initiation, development, and articulation in speech and language, as well as to increase functions of the respiratory apparatus, used with a variety of

neurological or developmental speech and language dysfunctions. (S. Jackson, Treharne, & Boucher, 1997; Thaut, 2005)

Singing has also been recommended as a therapeutic intervention specifically for people with Broca's aphasia. (Benton, 1977; Gerstman, 1964; Gleason & Goodglass, 1984; Keenan, 1987). According to the research, while examining the preservation of singing in 24 patients with Broca's aphasia, 87.5% of the subjects produced accurate melodies, and 57% sang with correct diction (Yamadori, Osumi, Masuhara, & Okubo, 1977). Singing was recommended for the rehabilitation of expressive deficits as early as 1953 (Vargha & Gereb), when it was observed that many aphasics could sing the words of previously learned songs better than they could speak.

Speech therapists are looking for new interventions to use with speech-disordered patients. Singing can be a valuable tool in speech rehabilitation because of its similarities to speech production. Singing is a musical behavior which shares with the speech elements of fundamental frequency, fundamental frequency variability, vocal intensity, rhythm or rate, and diction (Cohen, 1992). The use of singing has been successfully demonstrated to facilitate speech development with speech-disordered clients (Crocker, 1958; Darrow & Starker, 1986; Lathom, Edson, & Toombs, 1965; Leung, 1985; Ogden, 1982; Vanderark, 1986).

Another research study (Keith & Aronson, 1975) was conducted with an adult woman with severe expressive aphasia. After a month of traditional speech therapy, her progress had been minimal, so the researchers decided to give her a one-hour singing therapy session once a week. After a short period of treatment, the patient was able to

initiate speech with song-like phrases. Two months later, she had progressed to the point where she could eliminate the singing entirely from her speech.

Differences between MIT and TS

At this point the author needs to give convincing answers to the questions regarding the differences between MIT and TS. Therapeutic singing (TS) has distinct melodies and melodic intonation therapy is based on the spoken prosody of verbal utterances, so MIT has a limited range of sung notes and is comfortable for the untrained voice of adults.(Sparks & Holland, 1976). MIT, when using an intoned utterance which resembles a familiar song, may produce disastrous results. The familiar melody will stimulate a recall of the words of that song. According to the article by Sparks (1974), researchers selected for their client the target phrase, "meat and potatoes." Then researchers asked the client to use a melody that resembled a popular song, "I love my baby, my baby loves me". When the target phrase was presented and the aphasia client was asked to join in, the client altered it to, "Meat and potatoes, my baby loves me". For this reason, MIT prohibits the use of familiar or popular melody lines in order to sing target phrases. Therapists must create a new melody prosody. On the other hand, for TS it is valuable to use popular or common songs which the clients already know and prefer to sing in order to improve their utterances of speech by the possible stimulation of the brain regions for long term memory.

Modified Melodic Intonation Therapy

Modified Melodic Intonation Therapy (MMIT) makes use of the strong association between MIT and TS. Baker (2000) has developed a modified version of MIT technique for working with persons with non-fluent expressive aphasia. In this technique, target phrases are more melodic than sprechgesang (speech song), and the natural pattern of speech inflection is revised to create a more musical structure. The phrases chosen in modified MIT (MMIT) should be meaningful for functional communication (Baker & Tamplin, 2006).

MMIT phrases are composed of a limited range of pitches within an octave to ensure that the patients are able to sing them comfortably. Two criteria prescribe the choice of musical phrases: first, the phrase is essentially different from the phrases preceding and following it; and second, the creation of a melodic phrase that can be easily encoded in memory and then produced on the researcher's requests (Baker & Tamplin, 2006).

Baker designed a procedure with six steps involved in the process:

> 1) Client sings familiar songs; 2) Therapist sings and plays functional phrases to clients; 3) Therapist sings the phrases; 4) Therapist withdraws participation; 5) Client practices independent production of learned words and phrases. (Musical cues may be provided initially and later faded); and 6) Client practices use of the phrases out side of music therapy context (pp.148-149).

In the first step clients are encouraged to sing familiar, well-known songs. It provides clients with immediate positive feedback of verbal output, motivation, and distraction when progress is slow and difficult. The second step involves the introduction of a small number of meaningful phrases set to simple melodies. However, it is important

that phrases used should not resemble familiar melodies, as this might result in the accidental generation of non-propositional speech comprising the original lyrics of the song. The third is that clients are directed to sing the phrases with the therapist. And then, a therapist gradually withdraws participation and clients encourage to sing the phrases unaided in the fourth step. In the fifth step a therapist asks clients questions to test independent word generation. When this step has been completed, new phrase or short sentence can be introduced with new melodic phrases. The final step involves the use of the target words in normal conversation outside of the music therapy session (Baker & Tamplin, 2006).

Measurement tools for functional communication skills

Lezak (Lezak, Howieson, Loring, Fischer, & Hannay, 1995) suggests that a review of client's language and speech functions to indicate whether communication problems are present will include examination of the following aspects of verbal behavior: 1) Spontaneous speech; 2) Repetition of words; 3) Speech comprehension; 4) Naming; 5) Reading; and 6) Writing.

The Multimodal Communication Screening Test for Aphasia (MCST-A) is one of 3 criterion-referenced assessment tools in the Augmentative and Alternative Communication (AAC) Assessment Battery for Aphasia (AAC-ABA) developed by K. Garrett & J. Lasker. The MCST-A is designed to systematically assess whether people with severe aphasia can use alternative or augmentative modalities to communicate via alternative pictorial symbols. The second tool is Systems Trials protocol for Aphasia (AAC-STA), and the third tool is AAC Categorical Assessment (AAC-CAT) which will

aid in determining whether the person with aphasia can benefit from partner dependent or independent alternative communication strategies (Garrett & Lasker, 2005). MCST-A will be used to modify the Naming measurement picture sheets in order to investigate the effectiveness of functional communication in this research.

Another clinical application for measurement is the Aphasia Diagnostic Profiles (ADP) by Nancy Helm-Estabrooks. ADP is a systematic method of assessing language and communication impairment associated with aphasia. Designed to meet the needs of medical settings, it creates profiles that explain critical areas of the client's performance. Nine brief subtests create composite scores. It indicates overall severity and specific strengths and weaknesses. The severity profile identifies the client's strongest response modalities. Error profiles identify the communication value of a client's response. Behavioral profile indexes the client's overall social-emotional state during testing. This assessment takes 40 to 50 minutes, but the tool will be revised to 10 minutes for pre-post tests in the current study.

With the intent of identifying effective music therapy techniques, the purpose of this study is to ascertain the effectiveness of Therapeutic Singing and Melodic Intonation Therapy in improving the functional communication skills of adults with expressive aphasia. The two case studies were conducted with subjects who were in different level of functional speech. The goals of for subject L's case study are as follows: (1) to determine whether Therapeutic Singing (TS) combined with Melodic Intonation Therapy (MIT) helps adult clients who are diagnosed with expressive aphasia as measured by the quality of their functional communication skills; (2) to determine whether MIT treatment

itself helps clients improve the quality of their functional communication skills; (3) to compare the effectiveness of TS combined with MIT and MIT alone in increasing functional communication skills; and (4) to investigate whether TS enhances the benefits of MIT treatment. On the other hand, the goal for subject R's case study is as follows: 1) To give information whether Therapeutic Singing (TS) itself helps clients improve the quality of their functional communication skills.

CHAPTER III

METHOD

Subjects

Two adults with diagnoses of expressive aphasia with different levels of functional speaking were selected to participate in this study. One was described by the speech pathologist as high level and the other as low level in functional speaking. The subjects were recruited with the help of speech-language pathologists from the Aphasia Support Group in the Lansing area, explaining the research study in the group meeting. Announcements were also placed in the e-mail newsletters of the Aphasia Support Group (see Appendix 9- Flyer). Three restrictions were imposed on selecting the subjects: 1) Diagnosis of expressive aphasia caused by CVA; 2) Adult males; 3) No other therapy received, such as speech or physical therapy, during the course of this study.

There are some differences in the two subjects. L is considered to have a the low level of functional communication skills, while R is considered to have a high level of functional communication skills, which means is that R did not need to receive MIT treatment because he was capable of success in the final level of MIT treatment. (see Table 1)

Table 1 ***Subject Description***

Subjects	Treatments	Age	Gender	Diagnosis	Onset of Aphasia	*SLC	*SLE	Fluency
L	TS & MIT	62	Male	Expressive Aphasia Mild Apraxia	1 year	Level 6	Level 3	Level 2
R	TS	53	Male	Expressive Aphasia Right Dysfunction	7 years	Level 7	Level 5	Level 5

(* SLC – Spoken Language Comprehension, * SLE – Spoken Language Expression)

Subject L - Low Functional Communication Skill

On May 09, 2008, L had a sudden onset cerebrovascular accident (CVA) from a blood clot in the left parietal lobe. It resulted in expressive aphasia, mild apraxia of speech and the loss of memory function, both long-term and short-term. His spouse stated that his stroke was caused by high cholesterol and the distribution of stress. He was hospitalized after onset of the stroke and had undertaken speech therapy and physical-occupational therapy, but he wasn't receiving any other treatments while this research treatment was being provided.

In the area of Speech and Communication, L showed some limited characteristics in functional communication skills: 1) non-fluent, effortful, slow, halting and uneven speech; 2) limited word output, with short phrases and sentences; 3) misarticulated and distorted sounds; 4) agrammatical speech; 5) impaired repetition of words and sentences; 6) impaired naming; and 7) poorer production of speech than comprehension.

The Spoken Language Comprehension (SLC) level was rated at a high level 6. According to the FCMs in America Speech and Hearing Association (ASHA), the level 6 in SLC states that "the individual is able to understand communication in most activities, but some limitations in comprehension are still apparent in vocational, avocational, and social activities. The individual rarely requires minimal cueing to understand complex sentences. The individual usually uses compensatory strategies when encountering difficulty" (See APPENDIX 11). On the other hand, the Spoken Language Expression (SLE) level was rated at a low level 3. According to the FCMs in ASHA, a level 3 in SLE means that "the communication partner must assume responsibility for structuring the communication exchange, and with consistent and moderate cueing, the individual can

produce words and phrases that are appropriate and meaningful in context" (See APPENDIX 12). Furthermore, L was rated at the low level 2 in Fluency. According to the FCMs in ASHA, a level 2 in Fluency refers to Speech that is "functional most of the time, but labored in many day-to-day situations due to extended disruptions of speech flow which sometimes renders the individual difficult to understand. Participation in vocational, avocational, and social activities requiring speech is reduced overall. Listener discomfort is evident throughout conversational interactions" (See APPENDIX 13).

In the area of Sensorimotor skills, his fine motor function on the right side was not fully stable, but he was able to ride a bike by himself. There also was limited control and ability in the facial muscles because he was diagnosed with mild apraxia. Therefore, the limited usage of tongue and mouth muscles caused limited accuracy of pronunciation in vowel sounds and especially in consonant sounds.

In the area of cognitive function, there was a slight loss of memory functions. His wife stated that during the year after onset of the stoke, his short-term memory was coming back, but some of his long term memories were still blank.

Subject R – High Functional Communication Skill

R had a second stroke (CVA) seven years ago, with his first stroke (CVA) occurring twelve years ago. He was diagnosed with acute expressive aphasia and right side dysfunction. He had received speech, physical, and occupational therapies after the onset of the stroke, but he hasn't been given any other therapy for several years, and there was no input from other therapies during the music therapy intervention.

In the area of Speech and Communication, L showed some limited characteristics in functional communication skills: 1) fluent, effortful, slow; 2) limited word output; 3) no impaired repetition of words and sentences; and 4) poorer production of speech than comprehension.

The Spoken Language Comprehension (SLC) level 7 was higher than subject L's. According to the FCMs in ASHA, a level 7 in SLC states, "the individual's ability to independently participate in vocational, avocational, and social activities are not limited by spoken language comprehension. When difficulty with comprehension occurs, the individual consistently uses a compensatory strategy" (See APPENDIX 11). On the other hand, the Spoken Language Expression (SLE) level 5 was higher than L's. According to the FCMs in ASHA, a level 5 in SLE indicates "the individual is able to successfully initiate communication using spoken language in structured conversations with both familiar and unfamiliar communication partners. The individual occasionally requires minimal cueing to frame more complex sentences in messages. The individual occasionally self-cues when encountering difficulty" (See APPENDIX 12). Furthermore, The Fluency level of 5 for subject R was higher than that of that of subject L. According to the FCMs in ASHA, a level 5 in Fluency indicated that "Speech is functional for communication, and fluency can be maintained in some situations. Self-monitoring is inconsistent. The frequency and severity of disruptions of speech flow within problem situations is distracting some of the time. Speech difficulties are noticeable when they occur, and sometimes limit vocational, avocational, and social activities requiring speech in problem situations. Listeners are occasionally aware of fluency difficulties relative to particular situations" (See Appendix 13).

In the area of Sensorimotor skills, there was a weakness in right side vision and limited horizontal range of vision in the right eye. R had difficulty in reading letters line by line because of the loss of vision. The fine motor skill was functioning quite well, but the tactile sensation in his right hand somewhat dysfunctional.

In the area of cognitive function, his memory had returned since the onset of the stroke. His long term and short term memory was satisfactory, but there was a memory loss of specific professional skills in his occupation.

This study was explained to each subject and the general content was reiterated to the subjects. Test measurements were presented briefly by using a Macintosh notebook. After subjects verified their agreement, their guardians and subjects were asked to sign the informed consent. (See Appendix 10 – Consent form)

Setting and Apparatus

The study was conducted in an available meeting room to which subjects had access, such as the living room or dining room at the subject's homes. The materials and equipment used in the study were: response sheets, lyric sheets, pencils, castanets, a keyboard, a stop watch, a iMovie software, and PowerPoint software in the Macintosh notebook.

While testing with the Spontaneous Speech Measure, iMovie software in the Macintosh notebook was used to record the subject's production of speech, and while testing with the Naming Measure, PowerPoint software was used to randomize 90 pictures to form each sixteen-picture test. A Samsung stop watch was used to measure the given minutes. During MIT Treatment, castanets were used to help subjects and

therapists make rhythmic stimulus with one hand, instead of working on hand tapping with both hands. Lyric sheets and castanets were also used for the TS treatment.

Research Design

A pre-experimental design consisting of a one-group pre-test-post-test study was used to administer the procedure. The subjects were pre-tested, received treatments, and then post-tested in each session (Albert, et al., 1973). A benefit of this design is the inclusion of a pre-test to determine baseline scores (2005), a useful design when there are not enough subjects to provide a control group. (See Figure 1)

Figure 1. One Group pre-test-post-test Design

(Source: Dooley, 1990)

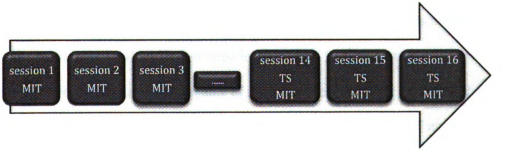
There were eight dependent variables for subject L who had low functioning expressive aphasia, and seven dependent variables for subject R, who had high functional speech because this subject did not need to receive MIT treatment: 1) Total length of samples; 2) Total number of utterances; 3) Total number of words spoken by subjects; 4) Average length of utterances; 5) Average Number of Words per Minute in the Spontaneous Speech assessment of the Functional Communication Measure; and in the naming test: 6) the number of items named by a client; and 7) the number of prompts per item named given by a therapist in the Naming Assessment of the Functional Communication Measure (FCM); and in MIT test; 8) the percent scores collected by the

Melodic Intonation Therapy Measure; these variables were obtained from the pre-test, post-test, and MIT test, revised with the support of a speech-language pathologist and based on Aphasia Diagnostic Profiles (ADP) and Functional Communication Measures (FCMs) from the Adult National Outcomes Measurement System (NOMS).

Procedure

The intervention period for the two subjects consisted of sixteen individual sessions, three to five times a week for 80 minutes, including pre and post-tests. The period for subject L (low function) was divided into two different terms of interventions of eight sessions each (16 sessions in all): 1) MIT in the first period of 8 sessions; 2) TS combined with MIT in the second period of 8 sessions (see Figure 2. Subject L's Sessions Diagram). On the other hand, Subject R (high function) received TS itself for all 16 sessions because he could complete the final level of MIT at the outset and did not require MIT treatment. He could repeat items in normal speech patterns from the beginning of the sessions. When the researcher gave signals, he replied with appropriate and accurate sentences.

Figure 2. ***Subject L's Sessions Diagram***



Subject L's Intervention

The intervention strategies consisted of the original MIT protocol (Albert, et al., 1973) in the first period of sessions and TS protocol preceding MIT treatment in the each of second period of sessions. After pre-testing the Spontaneous Speech Test for 13 min. and the Naming Test for 5 min. before every session, a form of Melodic Intonation Therapy (MIT) was introduced, and L worked on the steps of each level of MIT for around 30 min. for eight sessions (from session 1 to 8). After half way through, by the eighth session of the procedure, Therapeutic Singing (TS) treatment was added from sessions nine to sixteen after the pre-test measures. Therefore, subject L received the pre-test, TS, MIT, and the post-test during the second period of sessions. There were two techniques used during his intervention: 1) Melodic Intonation Therapy (MIT); 2) Therapeutic Singing (TS), described in the following paragraphs.

1) Melodic Intonation Therapy (MIT)

The primary goal of MIT for non-fluent aphasics is the basic recovery of verbal utterances with the accurate use of language. There is also research evidence for its use with apraxia (Galloway & Kraus, 1982). Therefore, Subject L is a good candidate to practice MIT, as a subject who suffered from both non-fluent expressive aphasia and mild apraxia, to improve functional communication skills. There are four levels of MIT hierarchy and it includes three to four steps in each level. Subject L started his first sessions on level I and II and was capable of improving to level III at the end of the session. Before interventions began, the relevant sample materials of MIT needed to be collected.

Linguistic Contents

The selection of linguistic content is important, depending on the severity of the aphasic's communication inability and the usefulness of the verbal material (Sparks & Deck, 1986). Subject L's sentences were chosen by the suggestions of his wife and himself about things as basic as family relationships, personal needs, and his background information. Content was subsequently selected regarding the complexity of syllables in each level, but some level II sentences were used in level III. According to the Sparks' article (1986), meaningful stimulus samples for the aphasic who has no impairment other than phonological errors should focus on producing more intelligible speech. Subject L's collection of contents, however, was more focused on the usefulness to his daily life. Regarding the ability to produce utterances, less important words, such as prepositions, were eliminated from the contents. The phrases and sentences are illustrated in Table 2.

Table 2. ***L's Linguistic Contents***

Subject L's Sample linguistic contents for Level II		
What time?	My name is L	My wife is Marlene
Take Sadie walk	I had a stroke	Today is Friday
Good girl Sadie	I had a dog	What time want eat?
One, two, three	I love you, Marlene	I have trouble speaking
Cup of coffee	Thanks for being	I work at GM
Go to sleep	One, two, three, four	I can understand you
Jump Sadie	My lovely wife	Happy birthday to you
Stay with me	I love hunting	The love in my life
Thank you	I love my country	Thank you so much
One O'clock	God bless you	
I love you	Time for lunch	

Subject L's Sample linguistic contents for Level III		
Happy birthday to you	Go to bed at night	I love to go hunting
My name is L	I love my wife, Marlene	There will be a baby deer
My wife is Marlene	I have had a stroke	I saw a deer this morning
One or two babies	I can understand you	I've been walking with Sadie
I saw female deer	I love to take a bike	I go to the gas station
	I mow this morning	

What follows is the original MIT hierarchy from level I to level IV (see Appendix 2)(Sparks & Deck, 1986), and also the subject L's MIT description for a non-fluent aphasia.

MIT Hierarchy Level I

The goal of the first level is the establishment of the client's comfortable adaptation to the technique by learning intoning, hand tapping, and response to hand-signal controls of the therapist. The linguistic contents of level I were used from the sample materials in level II depending on the subject's comfortable adaptation. When the researcher gave a stimulus by humming the sentence prosody and asking subject L to join humming in unison, he produced some unintelligible output instead of simply humming, but the researcher accepted his production as a humming response because the muscle movement of his tongue and face was restricted for speaking due to the symptoms of mild apraxia. For a convenient provision of the rhythmic stimuli, a castanet was used to produce rhythmic beats instead of hand tapping. In the beginning of the session, subject L utilized his more comfortable left-hand because he had a right-side weakness. On the first day of the sessions, the researcher repeated this level as long as L felt comfortable intoning, hand tapping, and responding to hand-signals.

Subject L took about 5 to 10 minutes in the beginning of MIT treatment, then proceeded onto the next level as soon as he was comfortable with the first level goals. No scoring took place at this level. See more detailed procedures in table 3-1.

Table 3-1. ***MIT Hierarchy Level I***

LEVEL I – learn intoning and hand tapping, response to hand-signals		
Stimulus (Therapist) (T)	Hums melody twice with (HT)	*(HT) Hand Tapping*
Response (Client) (C)	Unison humming with (HT). Fades participation but continues (HT)	*Unison (Together)*
Score and Progression	No score. Proceed to next step II.	

MIT Hierarchy Level II

The goal of the second level is the aphasic subject's immediate repetition of the target intoned sentence and the response to a question. Level II is a four-step procedure. He had remained at this level II protocol for thirteen sessions, and then proceeded to the next level III for sessions fourteen to sixteen. Subject L spent 20 to 30 minutes for level II of MIT technique in each session. For more detailed information on each of the four steps, scoring procedures are in Table 3-2.

The researcher needed to modify the melody pattern on the target sentence whenever the subject was unable to produce verbal utterance of the melody. In other words, once the researcher modified the melody pattern on the target sentence, the change of melody stimulated the subject to produce clearer utterances. According to the book, *Rhythm, Music, and the Brain* (Thaut, 2005), musical elements as reinforcement are classified by three aspects; 1) Spatial (Pitch, Dynamic, Sound duration, Harmony); 2) Temporal (Tempo, Meter, Rhythmic pattern, Form); and 3) Force cueing (Dynamic, Harmony, Timbre, Tempo). This modification of melody pattern is included in the area of spatial cueing, such as pitch. There is research evidence based on the effect of musical cues for persons with aphasia (Cohen & Ford, 1995). Namely, when the researcher modified the melody with high pitch intonation on the last word, subject L produced

clearer utterance, so the change of pitch stimulated his speech production. For example, the melody for the phrase (*go to sleep*) was changed, so that the last word (*sleep*) had a higher pitch than before. For more information about the modification of melody patterns, refer MIT article (Sparks & Deck, 1986).

The linguistic contents of level II was selected from the contents of subject L's daily-based usage. The numbers of syllables were in the range of two to six syllables for a sentence or a phrase. His first sentence was selected from the sentence with the most usage, such as *Take Sadie Walk,* which was reduced from full sentences such as *I love to take Sadie out for a walk*, depending on the level of his functional communication skills. Six to eight sentences were used for this level II procedure from the sample materials for linguistic contents (see Table 2).

There are five specific techniques of level II technique: 1) Hand Tapping; 2) Control by hand signals; 3) Fading Participation; 4) Unison Repetition; and 5) Verbal Cueing.

Hand Tapping with a Castanet

Rhythmic stimulus has proved to be an effective musical element to activate the human nervous system through several decades (Sacks, 2006). The castanets were used to stimulate the subject by rhythmic sound. While humming the melody, the researcher started making the rhythmic beats with the castanet, and then asked the subject to join making the rhythm first with the castanet alone and then in unison with the intoned sentence with the castanet. Subject L used his more functional left hand for the castanet at the beginning of the sessions, and the researcher also encouraged him to gradually use his right hand depending on his adjustment. The researcher asked the subject to turn a little

bit in his chair, so that the performance was visible to each other, the researcher and the subject.

Control by Hand Signals

Using a castanet for hand signals was an effective way to control the subject's response as a nonverbal means. It was used in many steps when the researcher asked the subject to join in humming or intoning sentences by hand signals. It was also used to guide the subject on when to take turns, such as the subject needed to listen or to take turns with the researcher for the repetitions in step 3. Also the castanet was held up and forward toward the subject to produce one strong rhythmic sound. This way the signals were useful in enforcing latency and inserted delay for responding, if used consistently (Sparks & Deck, 1986).

Fading Participation & Immediate Repetition

Level II of the hierarchy involved fading the participation of the researcher in step 2 and the immediate repetition by the subject after the researcher had just presented in step 3. If the researcher faded her participation in order to allow the 'solo' performance, subject L sometimes stopped producing the intoned sentence at early stages in sessions, but he did gradually keep going to perform solo by making beats with his castanet. When the subject stopped his vocal production, the researcher needed to rejoin in unison because it was evident that he was not ready to proceed to step 3 of solo repetition on his own.

Verbal Cuing

The use of verbal cuing is shown in step 3 and step 4 in Level II, and the cue has an effect on counting scores (see Table 3-2). If he wasn't able to repeat the intoned

sentence in step 3 as a solo, the researcher gave verbal cuing of the initiation of the utterance in the target sentence. L needed the cuing in most sentences in steps 3 and 4.

Table 3-2 ***MIT Hierarchy Level II***

	LEVEL 2 – Ability repeating intoned sentences immediately, Response to a question	
Step 1	Stimulus (Therapist) (T)	**1.Hums** melody with (HT), **2.Intones** sentence with (HT), 3.Signals (C) to join in **unison** intoning of sentence
	Response (Client) (C)	**Intone** sentence **together** with (HT) - **Unison**
	Score and Progression	Acceptable- 1 point. Proceed to Step 2, same sentence Unacceptable - Discontinue progress for sentence.
Step 2	Stimulus (Therapist) (T)	Same as Step 1 But **fades** participation except (HT)
	Response (Client) (C)	**Intone** sentence with (HT) **gradually Solo**
	Score and Progression	Acceptable- 1 point. Proceed to Step 3, same sentence Unacceptable - Discontinue progress for sentence.
Step 3	Stimulus (Therapist) (T)	1.Signals (C) to listen 2.Intones sentence with (HT) 3.Signals (C) to repeat, **Cueing** for initiation of utterance if necessary
	Response (Client) (C)	**Repeat** intoned sentence with (HT) **immediately**
	Score and Progression	Acceptable– 2 point without cue, 1 point with cue Proceed to step 4, same sentence Unacceptable - Discontinue progress for sentence.
Step 4	Stimulus (Therapist) (T)	1.Intones question, "What did you say?" 2.Signal (C) to repeat **Cueing** for initiation of response if necessary
	Response (Client) (C)	**Repeat** intoned sentence with (HT)
	Score and Progression	Acceptable– 2 point without cue, 1 point with cue Proceed to step 1, for next sentence Unacceptable - Discontinue progress for sentence.

(Table.3-2. MIT Hierarchy Level II)

MIT Hierarchy Level III

The goal of the third level is the aphasic's ability to delay responses and respond to less specific questions. Through this level of training, the subject was able to respond with the intoned sentence even if the researcher signaled to wait for 2 to 3 seconds.

Backup

The important technique, Backup, was introduced in level III and IV, which was the means of attempting indirect correction of errors by repeating the previous step. This manner of correcting errors is meaningful, as the subject may or may not be aware of the purpose of this procedure, but his failure is not drawn to his attention (Sparks & Deck, 1986). If the subject presented an unacceptable response in step 2, he was guided to return to the previous step of listening to the intoned sentence and following in unison, followed by a retrial of the repetition after a 1 or 2 second delay. This backup procedure was used in level III and IV.

There are three steps in the procedures for level III. The subject received this level III protocol from the 14^{th} to 16^{th} sessions and was unable to precede to the last level of MIT. L took 20 to 30 minutes for the level III techniques in each session. He showed comfortable adaptation in intoning sentences with gradual solo performance after the researcher removed her unison participation, but he was challenged by repeating intoned sentence after the 1 or 2 second delay in step 2. For more detailed information on each of the three steps in Level III procedures and scoring are in Table 3-3.

Table 3-3. ***MIT Hierarchy Level III***

LEVEL 3 – Ability to the delay of responses, Response to specific questions		
Step 1	Stimulus (Therapist) (T)	1.**Intones** sentence with (HT), 2.Signals (C) to join in **unison** sentence 3. Fade participation except (HT)
	Response (Client) (C)	**Intone** sentence with (HT) **gradually Solo**
	Score and Progression	Acceptable- 1 point. Proceed to Step 2, same sentence Unacceptable - Discontinue progress for sentence.
Step 2	Stimulus (Therapist) (T)	1.Signals (C) to listen 2.Intones sentence with (HT) 3.Signals (C) to repeat after **1 or 2 second Delay** 4. If (C) fails, **Backup** step 1 ***(B) Back up***
	Response (Client) (C)	**Repeat** Intoned sentence with (HT) after **Delay** If fail, **backup step 1 and retrial**
	Score and Progression	Acceptable- 2 point without (B), 1 Point with (B) Process to Step 3, same sentence Unacceptable - Discontinue progress for sentence.
Step 3	Stimulus (Therapist) (T)	1.Intone a related question (e.g. what kind of, How many) 2.Signals (C) to answer 3. If (C) fails, **Backup** step 2 ***(B) Back up***
	Response (Client) (C)	**Appropriate Answer** (Intoned or Spoken) If fail, **backup step 2 and retrial**
	Score and Progression	Acceptable- 2 point without (B), 1 Point with (B) Process to Step 1 for next sentence Unacceptable - Discontinue progress for sentence.

(Table.3-3. MIT Hierarchy Level III)

MIT Hierarchy Level IV

The goal of this last level of MIT is the aphasic's ability to return to normal speech prosody, which is facilitated by a technique called sprechgesang (speech-song). In this technique the melodic line remained the same as the intoned sentence of the preceding step, but the pitches of intoned words were replaced by the variable pitch of natural speech, retaining the tempo, rhythm, and stress of the target sentences. More

complex and longer sentences are used as the target materials in this level. There are four procedural steps in level IV, but subject L was unable to precede to this level. For more detailed information on each four-step procedure and scoring, see Table 3-4. More descriptive explanations of MIT procedures can be found in the literature (Sparks & Deck, 1986).

Table 3-4. ***MIT Hierarchy Level IV***

	LEVEL 4 – Ability of Normal Speech	
Step 1	Stimulus (Therapist) (T)	1.Signal (C) to listen 2.Intone sentence with (HT) 3.Present it twice in Sprechgesang 4.Signal (C) **unison Sprechgesang** of sentence (HT) 5. If (C) fails, **Backup** to present in Sprechgesang 6. Retrial No. 4
	Response (Client) (C)	**Sprechgesang** of sentence with (HT)
	Score and Progression	Acceptable- 2 point with Sprechgesang. - 1 point with Backup - Proceed to Step 2, same sentence Unacceptable - Discontinue progress for sentence.
Step 2	Stimulus (Therapist) (T)	1.Signal (C) to listen 2.Present sentence in **Sprechgesang** with (HT) 3.Signals (C) to repeat after **2 or 3 second Delay** 4. If (C) fails, **Backup** to Step 1 same sentence
	Response (Client) (C)	**Sprechgesang** of sentence with (HT) after **2 or 3 second Delay.**
	Score and Progression	Acceptable- 2 point without Backup - 1 point with Backup - Proceed to Step 3, same sentence Unacceptable - Discontinue progress for sentence.

(Continued)

Table 3-4. ***MIT Hierarchy Level IV*** **(Continued)**

	Stimulus (Therapist) (T)	1.Signal (C) to listen 2.Present sentence once in Sprechgesang 3.Present sentence **twice in Normal Speech Prosody** 4.Signals (C) to repeat after **2 or 3 second Delay** 5.If (C) fails, **Backup** to Step 2 same sentence
Step 3	Response (Client) (C)	Repeat sentence in **Normal Speech Prosody** after**2 or 3 second Delay**, no (HT)
	Score and Progression	Acceptable- 2 point without Backup - 1 point with Backup - Proceed to Step 4, same sentence Unacceptable - Discontinue progress for sentence.
	Stimulus (Therapist) (T)	1.Ask question about substantive information on the same sentence. 2. If fail, Backup step 3 same sentence and retrial 3. Ask question about associative information 4. If fail, No backup and retrial if fail one.
Step 4	Response (Client) (C)	**Answer appropriate responses**
	Score and Progression	3 point – bonus point, one or more associative responses 2 point – without Backup, substantive content 1 point – with Backup. Proceed to next sentence.

Seven Principles

There are seven important principles of speech-language therapy involved in MIT that the researcher should remember while leading MIT hierarchy (Sparks & Deck, 1986): 1) gradual progression of increased length and difficulty of task; 2) indirect attempts to correct by the 'backup' technique; 3) repetition; 4) timing and controlled latency; 5) avoidance of practice effect; 6) attention to the purpose of the subject's verbal utterance; 7) frequency of sessions.

2) Therapeutic Singing (TS)

According to Thaut's book (2005), Therapeutic Singing (TS) is a reinforcing and supporting technique for speech and language development, used with a variety of neurological or developmental speech and language dysfunctions. This technique is able to be used for a broad range of therapeutic goals, and also to support the goals of other specific therapeutic techniques, such as Melodic Intonation Therapy (MIT), Vocal Intonation Therapy (VIT), musical speech stimulation (MUSTIM), and so on. Modified Melodic Intonation Therapy (MMIT) is the modified technique of MIT by combining the Therapeutic Singing technique in MIT procedure.

The Therapeutic Singing (TS) technique was added to subject L's intervention before conducting MIT in the second period of sessions, from the 9th to the 16$^{th.}$ Subject R, who was in high level of functional communication skill, utilized only TS without MIT. There are different hierarchies of treatment outlined by the researcher, depending on the level of speech and language for each subjects L and R.

Therapeutic Singing Hierarchy for subject L

1. Stimulate memory function
   - Therapist (T) play a familiar song with keyboard
   - Client (C) listen to the song
   - Acceptable – (C) respond to the song as familiar
   - Unacceptable – (C) don't respond at all. Use next song

2. Initiation of Utterance
   - (T) sing the song by accompanying on the keyboard.
   - (T) invite (C) unison singing to the song.
   - Acceptable – (C) produce utterances (unclear, humming acceptable)
   - Unacceptable – (C) don't respond at all. Retrial step 1.

3. Adjustment of syllables and Repetition
   - (T) sing in unison by adjusting to a comfortable beat of song for (C)
   - (T) repeat the song twice in unison
   - (C) sing the song in unison with 20% or more accurate syllables produced
   - Acceptable - (Full participation required, unclear production acceptable)

- Unacceptable - (C) did not respond at all. Retrial step 2.
  - If Second retrial fails, proceed to next song material

4. Fade (T) participation
   - (T) withdraw participation and encourage (C) to produce utterances
   - (T) check (C) accuracy of production while (C) sing SOLO
   - Acceptable – (C) sing alone with 20 % or more production of lyrics
   - Unacceptable – (C) terminate participation, Retrial step 3.

5. Correct with articulated speech
   - (T) distinguish the unclear errors between consonant and vowel errors
   - (T) ask (C) to imitate the oral movement of intoned vowel sounds on unclear words
   - (T) ask (C) to imitate the oral movement of consonant sounds on unclear words
   - (C) correct his utterance of words by training the oral motor movement

6. Unison again
   – (T) encourage (C) to sing in unison again with instrumental accompaniment

This hierarchy was designed by the researcher and focused on the goals based on his weaknesses in speech skills. Because of the symptoms of acute expressive aphasia and mild apraxia, two primary goals were founded; 1) to increase verbal utterance through the song lyrics; 2) to improve the accurate speech articulation by focusing on a number of syllable, consonant, and vowel sounds. This procedure was generally utilized for subject L's TS based on his goals. An average of four songs were used in each session, and he had the repeated usage of song materials with one or two new songs added in each session. As a result, subject L increased the production of a number of words through song lyrics and also gradually improved the accuracy of verbal utterances of syllables, consonant and vowel sounds. By repeating the song materials from sessions the 9^{th} to the 16^{th}, he accomplished 100% of word production with accurate verbal syllables and vowel sounds in lyrics, except for accuracy of consonant sounds. His improvement was usually ordered: first, gradually producing the accurate number of syllables by singing on vowel sounds. Second, gradually improving the clarity of vowel

sounds in matching rhythm and beat of the target song materials, and finally, producing the exact consonant sounds. While he participated in this hierarchy, his slurred speech was greatly reduced.

The list of song selections was taken from the books: The Great Family Songbook (Weisssman, 2007); America's All-Time Favorite Songs (Stone, 2009); The Best Songs Ever (Leonard, 1985); Rise Up Singing (Patterson, 2004). The song materials were given to subject L to assist in making his own song profiles, which were used for the second period of the sessions. Songs were listed such as *Home on the Range, God Bless America, My Country' Tis of Thee (America), If You're Happy, I've Been Working on the Railroad, My Bonny Lies Over the Ocean*, etc.

Therapeutic Singing Hierarchy for subject R

1.Reading lyrics
- Therapist (T) ask Client (C) to read the lyric on the song sheet.
- Client (C) read the lyrics on the sheet.
- Acceptable – (C) reads the lyrics with (T)'s prompts (Verbal or Physical)
- Unacceptable – (C) stops to read with frustration

2.Listening Stimulation
- (T) ask (C) to listen to the song with sight-reading by matching the rhythmic beat with castanets simultaneously.
- (T) make the rhythmic beat with a castanet while listening.
- (C) listen to the song with sight-reading and playing the castanet simultaneously.
- Acceptable – (C) listening with sight-reading and making rhythmic beats with the castanet.
- Unacceptable – (C) don't respond with the sight-reading and making beats

3.Adjustment to the song
- repeat #. 2
- (T) focus on (C) verbal outputs

4.Unison singing with accompaniment on the keyboard
- (T) encourage (C) unison singing by accompanying on the keyboard.
- (C) sing in unison with sight-reading and matching the rhythmic beat with the castanet

- Acceptable – (C) sings the lyric with 80% of accuracy
- Unacceptable – (C) shows frustration and stops singing

5.Fade (T) participation
- (T) withdraw participation and encourage (C) to sing alone
- (T) check (C) accuracy of production while (C) sings SOLO
- (C) sing alone by matching the rhythmic beat of the song with the castanet
- Acceptable – (C) sings alone with 80 % or more accuracy of lyrics
- Unacceptable – (C) terminates participation

This hierarchy was designed by the researcher and focused on the goals based on his areas of weakness in both speech functions and other dysfunctional areas. Because of his loss of range of vision, he had feelings of frustration whenever he tried to do any reading. Two primary goals were established in the TS intervention: 1) to improve the reading skill without frustration; 2) to improve accurate speech articulation by matching the right rhythmic beats of the song. This procedure was generally utilized for subject R's TS intervention based on his goals. An average of four songs was used in each session, along with repeated usage of the same song materials. Several new songs were gradually added. As much as repeating the materials were important, steps 1 and 2 were skipped and the intervention procedure and time consumption for the song material was reduced. If new song material was added, the new material started from step 1. As a result, subject R improved the reading skills without having frustration. Through repeating the song materials from sessions 1 to 16, he accomplished steady reading skills without any prompts or terminations while performing the song materials. While he participated in this hierarchy of treatment, his slow speech with unmatched rhythmic beats and his reading failures were reduced.

Subject R's song materials were collected from the Beatles CD Album to make his own song profile, which were used for the full period of sixteen sessions. Songs were

listed such as *Let it Be (Beatles), A Hard Days Night (Beatles), A Day in The Life (Beatles),Venus (Frankie Avalon), Look What You've Done to Me (Boz Scaggs), Imagine (John Lennon), Woman (John Lennon), Hey, Jude (John Lennon),Yesterday (John Lennon), Everybody Talking (John Lennon),* and so on.

Measurement & Analysis

There were two measuring procedures used for data collections: Functional Communication Measure (FCM) used in both the pre-tests and post-tests and Melodic Intonation Therapy Measure (MITM). On the pre and post-test, FCM was used to examine whether two musical interventions (TS & MIT) had effectiveness in improving functional communication skills. FCM was composed of two different parts: Spontaneous Speech Measurement (SPM) and Naming Measurement (NM). See the measurement forms in Appendix 4 (SPM) and Appendix 6 (NM).

According to aphasia assessment (Lezak, et al., 1995), there are six examination areas that are aspects of verbal behavior: 1) Spontaneous Speech; 2) Repetition of words; 3) Speech Comprehension; 4) Naming; 5) Reading; and 6) Writing. A review of language and speech functions indicates whether communication problems are present in those six areas (Lezak, et al., 1995). In order to reduce the measuring spans during each session, two examinations, 1) Spontaneous Speech and 2) Naming, were chosen from among the six examination areas above to make up the Functional Communication Measurement (FCM).

Spontaneous Speech Measurement & Naming Measurement in FCM

In the Spontaneous Speech Measurement, five variables were collected through each pre-test and post-test: 1) Total Length of Samples; 2) Total Number of Utterances; 3) Total Number of Words; 4) Average length of Utterances; and 5) Average Number of Words per Minute. For more information about the Scoring Hierarchy of the Spontaneous Speech, see Table 4-1. The video recorded data was analyzed by utilizing the i-movie program in the Macintosh notebook for the 2 to 3 hours of time used in each session. Before the pre-test, subjects were asked to choose the questions they would like to answer, but the set time to answer was no longer than 13 minutes. The same questionnaire was conducted in both the pre-test and post-test. The list of questions was made from the materials in the Aphasia Needs Assessment (Garrett & Beukelman, 1995) and the Aphasia Diagnostic Profiles questions (ADP)(Helm-Estabrooks, 1992).

Table 4-1. ***Scoring Hierarchy of Spontaneous Speech Measurement***

Scoring Hierarchy of Spontaneous Speech Measurement in FCM	
1. Total Length of Samples	**Sum of Seconds, including both intelligible and unintelligible words** The unspoken times were deleted after 10 second without subject's responses.
2. Total Number of Utterances	**Including paraphasic errors** The effort in seconds of words produced was included in the utterances. If the subject stops to speak by saying 'I don't know', then the utterance was ended as counting an utterance.
3. Total Number of Words	Counting Total Number of Words produced for 13 minutes.
2-1. Average Length of Utterances	Average number of words for three longest intelligible phrases e.g.) 1. I like a ball (4 words) * .me too (2 words) 2. I want to go home (5 words) 3. I love peanut (3 words) *. Lovely (1 word) = 4+5+3/3 = 4 (average length of utterances)
3-1. Average Number of Words per Minute	Total number of words are divided the average length of samples. It means the Speed of Speaking

On the other hand, the Naming Test content was composed of the picture stimulus sheets, which was edited from the picture materials in the Boston Naming Test (Kaplan, Goodglass, & Weintraub, 2001), the Aphasia Diagnostic Profiles (ADP) (Helm-Estabrooks, 1992), and the Test of Adolescent/Adult Word Finding (TAWF) (German, 1992). A total of 90 pictures were selected from the references with the assistance of a speech and language pathologist. A total of sixteen different picture sets were manipulated by randomizing the order of ninety pictures, which was made by using the PowerPoint slideshow program in the Macintosh Notebook. A total of five minutes was given to the test, and the same ordered set of pictures was used both pre and post-test in each session. In the naming test, two variables were measured: 1) Number of items named by subjects; 2) Average Number of prompts per item named. Subjects L and R each had a different scoring hierarchy, according to the level of speaking. See table 4-2.

Table 4-2. ***Scoring Hierarchy of Naming measurement***

Scoring Hierarchy of Naming Measurement in FCM	
1. Number of Items named by subjects	* Subject L – Counted the total number of items named, including writing letters * Subject R – Counted the total number of items named with verbal speaking.
2. Average Number of Prompts per item named	Counted the total number of prompts given by the researcher, then divided into #.1 above (Total number of Items named) * Subject L – Included the prompts in Appendix 7 (Hierarchy of Word Retrieval Prompts for the Client with Aphasia) and written prompts by correction of the letter errors. Unacceptable – if no response after four prompts given, pass to the next picture. * Subject R – Included the verbal prompts in Appendix 7 Unacceptable – If no response after 5 seconds, given a prompt, then if no response, given another prompt, then after 5 seconds, pass to the next picture

On the other hand, MIT measure was conducted while the subject was participating in MIT treatment procedure. There are brief guidelines for the scoring

hierarchy in Table 4-3 to illustrate management of errors in the subject's response (Sparks & Deck, 1986).

Table 4-3. ***Scoring Hierarchy of MIT Measurement***

Scoring Hierarchy of Melodic Intonation Therapy (MIT) Measurement

Level II

Scoring Examples description	Step 1	Step 2	Step 3	Step 4
First sentence: Subject succeeds in all steps. Maximum scores attained	1	1	2	2
Second Sentence: Succeeds in all steps but requires a cue to initiate response in Steps 3 and 4.	1	1	1	1
Third Sentence: Succeeds in Steps 1 and 2, requires a cue to initiate response in Step 3, and fails Step 4 because of an unacceptable response after backup	1	1	1	0
Fourth Sentence: Succeeds in Steps 1 and 2, requires a cue to initiate response in Step 3, and requires a backup to initiate Step 4.	1	1	1	1
Fifth Sentence: Succeeds in Step 1, fails in Step 2. Progression stopped and no scores given for Steps 3 and 4.	1	0	-	-
Total 18/24 (75%)	5/5	4/5	5/8	4/6

(Continued)

Level III

Scoring Examples description	Step 1	Step 2	Step 3
First sentence: Subject succeeds in all steps. Maximum scores attained	1	2	2
Second Sentence: Succeeds in all steps but requires backups for Steps 2 and 3.	1	1	1
Third Sentence: Succeeds in Steps 1, requires a backup to initiate Step 2, Succeeds in Step 3 without backup.	1	1	2
Fourth Sentence: Succeeds in Steps 1, requires a backup in Step 2 because of inaccurate response, fails to initiate response in step 3 after a backup.	1	1	0
Fifth Sentence: Succeeds in Step 1, fails to repeat accurately in step 2, and fails again after a backup. Progression stopped and no score may be given for step 3.	1	0	-
Total 15/23 (65%)	5/5	5/10	5/8

(Table 4-3 – Scoring Hierarchy of MIT Measurement (Sparks & Deck, 1986)

Table 4-3. ***Scoring Hierarchy of MIT Measurement*** **(Continued)**

Level IV

Scoring Examples description	Step 1	Step 2	Step 3	Step 4
First sentence: Succeeds in Steps 1, 2, and 3, requires a backup for one specific question in step 4, but answers all associative questions.	2	2	2	2
Second Sentence: Succeeds in Steps 1, 2, and 3, requires a backup for Step 4, fails to answer any associative question.	2	2	2	1
Third Sentence: Succeeds in Steps 1 and 2, requires a backup to initiate normal prosody in Step 3. Succeeds in Step 4 but no bonus because of failure on last associative question.	2	2	1	2
Fourth Sentence: Succeeds in Step 1, requires backups for Steps 2 and 3. Succeeds with bonus in Step 4.	2	1	1	3
Fifth Sentence: Requires a backup to succeed in Step 1 and then succeed in subsequent steps.	1	2	2	3
Total 37/45 (82%)	9/10	9/10	8/10	11/15

(Table 4-3 – Scoring Hierarchy of MIT Measurement (Sparks & Deck, 1986)

CHAPTER IV

RESULTS

Findings and Analysis

Through the Functional Communication Measurement (FCM) and Melodic Intonation Therapy Measurement (MITM), data on eight variables were collected. There are two different measurements in the Functional Communication Measurement; First, Spontaneous Speech Measurement; second, Naming Measurement. Five variables were collected in the Spontaneous Speech Measurement (SPM) and two variables were collected in in the Naming Measurement (NM), and one variable was collected in the Melodic Intonation Therapy Measurement (MITM).

There were four problems for subject L's case study: (1) to investigate whether Therapeutic Singing (TS) combined with Melodic Intonation Therapy (MIT) helps adult clients who are diagnosed with expressive aphasia as measured by the quality of their functional communication skills; (2) to investigate whether MIT treatment itself helps clients improve the quality of their functional communication skills; (3) to compare the effectiveness of TS combined with MIT and MIT alone in increasing functional communication skills; and (4) to determine whether TS enhances the benefits of MIT treatment.

On the other hand, there was only one goal for the subject R's case study; 1) to investigate whether Therapeutic Singing (TS) itself helps clients improve the quality of their functional communication skills.

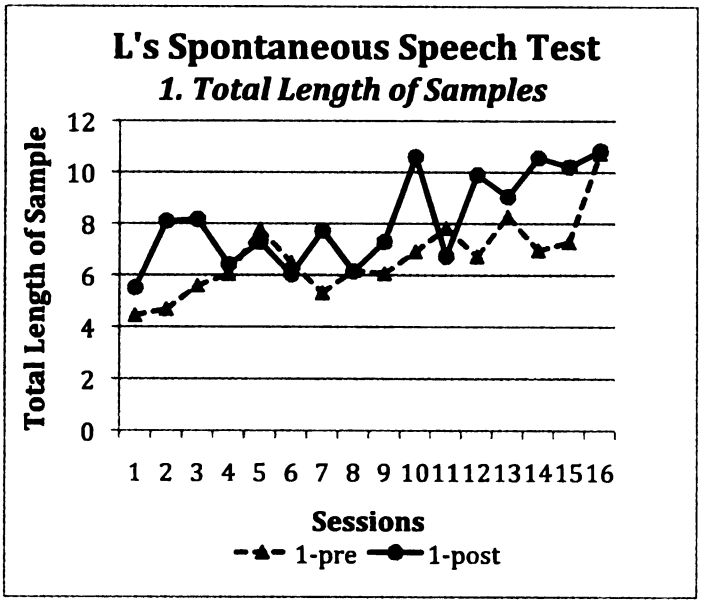
In order to select an appropriate statistical test in these two case studies, descriptive statistics was conducted after collecting the data on the eight variables. There are two methods of evaluating the data: first, the analysis of the short-term effect and second, the analysis of a long-term effect of the interventions. In order to prove the short-term effect, paired t-tests were conducted to compare and contrast the differences between pre and post-test variables. The subjects received the pre-test, interventions, and then post-test in each session, so this t-test could indicate the short-term effect of the intervention by comparing pre and post-test data.

Second, a long-term effect of intervention was evaluated by comparing the means of eight variables. The long-term effect is shown by whether or not the means of second-half sessions are higher than the means of first-half sessions. The first-half data collections from the 1st to the 8th sessions were calculated as the means for the first-half, and the means for the second-half data were calculated from the 9th to the 16th sessions.

Spontaneous Speech Measurement

The results for the Spontanous Speech Measurement were determined by collecting data on five different variables: 1) Total Length of Samples (See Figure 3-1 and 3-2); 2) Total Number of Utterances (See Figure 3-3 and 3-4); 3) Total Number of Words (See Figure 3-5 and 3-6); 4) Average Length of Utterance (See Figure 3-7 and 3-8); 5) Average Number of Words per Minute (See Figure 3-9 and 3-10). For more information about raw data, See Appendix 14-1 and 14-2.

1. Total Length of Samples



(Figure 3-1. Total Length of Sample in L's Spontaneous Speech Test)

Figure 3-1 shows the increasing tendency in post-test data for subject L's total length of samples. There was a long-term effect of the intervention demonstrated by comparing the means between the first-half and the second-half sessions.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre_Test_1	6.7114	16	1.52915	.38229
	Post_Test_1	8.1625	16	1.81219	.45305

(Table 5-1. L's Paired t-test on Total Length of Samples)

Paired Samples Test

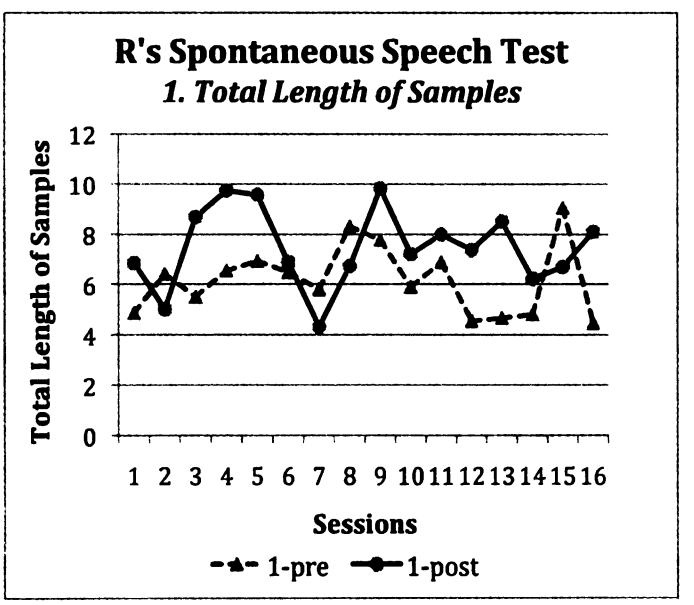
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pre_Test_1 - Post_Test_1	-1.45111	1.64604	.41151	-2.32822	-.57399	-3.526	15	.003

(Table 5-2. L's Paired t-test on Total Length of Samples)

The mean for the second-half sessions (the 9th – the 16th) on the pre-test (M=7.6) was higher than the mean for the first-half sessions (the 1st – the 8th) on the pre-test (M=5.8). Also, the mean of the post-tests of the second-half sessions (M=9.4) was higher

than the mean of the post-tests of first-half sessions (M=6.9). It indicated that the total length of samples increased on the second-half sessions. Therefore, it is shown that the intervention of MIT and MIT combined with TS had a positive effect on the improvement of total length of samples as a long-term effect.

In order to investigate whether there was the short-term effect on the sample length, a paired-samples t-test was conducted to compare pre-test and post-test from the first session to the sixteenth session. There was a statistically significant difference in the scores for pre-test (M=6.71, SD=1.52) and post-test (M=8.16, SD=1.82); t(15)=-3.526, p = 0.003 ($p<0.05$) (See Table 5-1 & 5-2). These results suggest that each intervention does have an effect on the difference between pre and post-test. Therefore, the results indicate that with both the interventions of MIT and MIT combined with TS, the total length of samples increased.



(Figure 3-2. Total Length of Sample in R's Spontaneous Speech Test)

Figure 3-2 shows there was the tendency of slightly higher points on post-tests than on the pre-tests in the R's total length of samples. There was a slight difference on R's long-term effect of intervention by comparing the mean of the first-half and the second-half of sessions.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre_Test_1	6.1885	16	1.39134	.34784
	Post_Test_1	7.4896	16	1.58987	.39747

(Table 5-3. R's Paired t-test on Total Length of Samples)

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pre_Test_1 - Post_Test_1	-1.30104	2.03471	.50868	-2.38526	-.21682	-2.558	15	.022

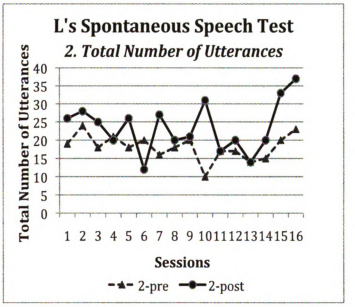
(Table 5-4. R's Paired t-test on Total Length of Samples)

The mean of second-half sessions on the pre-test (M=6.02) was slightly lower than the mean of first-half sessions on the pre-test (M= 6.36). There were no improvements on the pre-tests. On the other hand, the mean of the post-tests of the second-half sessions (M=7.74) was slightly higher than the post-test mean of first-half sessions (M=7.23). It indicates that the total length of samples increased during the second-half sessions on only the post-tests. Therefore, it is shown that the intervention of TS had a positive effect, though less than the L's improvement of total length of samples, as a long-term effect.

In order to investigate whether there was a short-term effect on the sample length, a paired-sample t-test was conducted to compare pre-test and post-test from the first session to sixteenth session. There was a statistically significant difference in the scores for pre-test (M=6.18, SD=1.39) and post-test (M=7.48, SD=1.58); t (15)=-2.558, p = 0.022 ($p<0.05$) (See Table 5-3 & 5-4). These results suggest that each intervention does

have an effect on the difference between pre and post-tests. Therefore, the total length of samples increased through the intervention of TS alone.

2. Total Number of Utterances



(Figure 3-3. Total Number of Utterances in L's Spontaneous Speech Test)

Figure 3-3 shows the increasing tendency in post-test data in L's total number of utterances. The long-term effect of the interventions was shown through comparing the means between the first-half and the second-half sessions.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre_Test_2	18.1250	16	3.44238	.86060
	Post_Test_2	23.5625	16	6.81145	1.70286

(Table 6-1. L's Paired t-test on Total Number of Utterances)

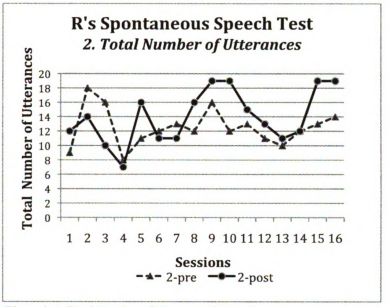
Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pre_Test_2 - Post_Test_2	-5.43750	7.00446	1.75112	-9.16991	-1.70509	-3.105	15	.007

(Table 6-2. L's Paired t-test on Total Number of Utterances)

The mean for second-half sessions on the pre-test (M=17) was lower than the mean for first-half sessions (M=19.25). There was no improvement on the pre-test. On the other hand, the mean of the post-tests of second-half sessions (M=24.12) was higher than the post-test mean of first-half sessions (M=23). It indicates that the total number of utterances increased on the second-half sessions on only the post-test. Therefore, it is shown that the intervention of MIT and MIT combined with TS had a positive effect on the improvement of the total number of utterances on the post-tests as a long-term effect.

In order to investigate whether there was the short-term effect on number of utterances, a paired-samples t-test was conducted to compare pre-tests and post-tests from first session to sixteenth session. There was a statistically significant difference in the scores for pre-test (M=18.12, SD=3.44) and post-test (M=23.56, SD=6.81); $t(15)=-3.105$, $p = 0.007$ ($p<0.05$) These results suggested that there was a short-term effect of the interventions shown by the difference between pre and post-tests data. Therefore, the results suggested that when MIT or MIT combined with TS were conducted, the total number of utterances increased on the post-tests.



(Figure 3-4. Total Number of Utterances in R's Spontaneous Speech Test)

Figure 3-4 shows the slightly increasing tendency in post-test data for R's total number of utterances. There was a long-term effect in the interventions by comparing the means between the first-half and the second-half sessions.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre_Test_2	12.5000	16	2.60768	.65192
	Post_Test_2	14.0000	16	3.74166	.93541

(Table 6-3. R's Paired t-test on Total Number of Utterances)

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pre_Test_2 - Post_Test_2	-1.50000	3.65148	.91287	-3.44574	.44574	-1.643	15	.121

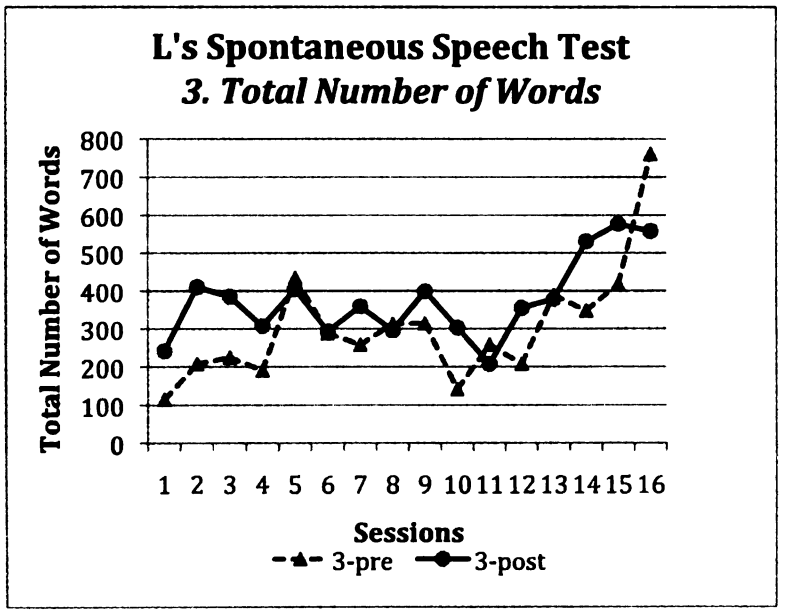
(Table 6-4. R's Paired t-test on Total Number of Utterances)

The mean for the second-half sessions (the 9th- the 16th) on the pre-test (M=12.63) was slightly higher than the mean for the first-half sessions (the 1st – the 8th) on the pre-test (M=12.38). Also, the post-test mean for the second-half sessions (M=15.88) was

notably higher than the post-test mean for the first-half sessions (M=12.16). It indicated that the total number of utterances increased during the second-half sessions both pre and post-tests. Therefore, it is shown that the intervention of the TS had a positive effect on the improvement of total number of utterances as a long-term effect.

In order to investigate whether there was the short-term effect on the number of utterances, a paired-samples t-test was conducted to compare the pre-tests and the post-tests from the first to the sixteenth sessions. There was no statistically significant differences in the scores for pre-test (M=12.5, SD=2.6) and post-test (M=14, SD=3.74); t(15)= -1.643, p = 0.121 (p>0.05) (See Table 6-3 & 6-4). Although there was a slight difference between the means (pre = 12.5 and post = 14), this result indicated that the intervention did not result in a statistical difference between pre and post-test. Therefore, the result showed that the total number of utterances did not significantly increase through the intervention.

3. Total Number of Words



(Figure 3-5. Total Number of Words in L's SP Test)

Figure 3-7 shows an increasing tendency in L's total number of words. The long-term effect of the intervention was shown through comparing the means between the

first-half and the second-half sessions.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre_Test_3	304.3750	16	153.31139	38.32785
	Post_Test_3	375.5000	16	106.62082	26.65521

(Table 7-1. L's Paired t-test on Total Number of Words)

Paired Samples Test

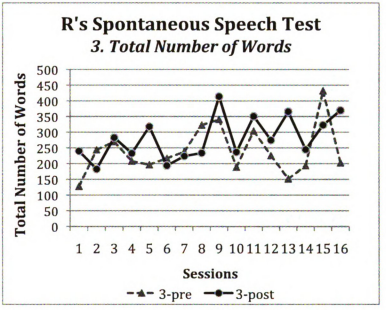
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pre_Test_3 - Post_Test_3	-71.12500	110.91310	27.72828	-130.22642	-12.02358	-2.565	15	.022

(Table 7-2. L's Paired t-test on Total Number of Words)

The mean for the second half-sessions on the pre-test (M=354.6) was higher than the mean for the first-half sessions on the pre-test (M=254). Also, the post-test mean for the second-half sessions (M=413.7) was higher than the post-test mean for the first-half sessions (M= 337.2). It is indicated that the total number of words increased through the second-half sessions for both the pre and the post-tests. Therefore, it is shown that the interventions of MIT and MIT combined with TS have a positive effect on the improvement of total number of words, as a long-term effect.

In order to investigate whether there was a short-term effect on total number of words, a paired-samples t-test was conducted to compare pre-test and post-test data from the first session to the sixteenth session. There was a statistically significant difference in the scores for pre-test (M=304, SD=153) and post-test (M=375, SD=106) : $t(15)= -2.565$, $p = 0.022$ ($p<0.05$) (See Table 7-1 & 7-2). These results indicated that each intervention

does have an effect on the difference between the pre and the post-test scores Therefore, the total number of words increased through the interventions of MIT and MIT combined with TS.



(Figure 3-6. Total Number of Words in R's SP Test)

Figure 3-8 shows a slight increasing tendency in R's total number of words. The long-term effect of the intervention was shown through comparing the means between the first-half and the **second-half sessions.**

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre_Test_3	241.6250	16	76.98474	19.24618
	Post_Test_3	280.6250	16	68.67981	17.16995

(Table 7-3. R's Paired t-test on Total Number of Words)

Paired Samples Test

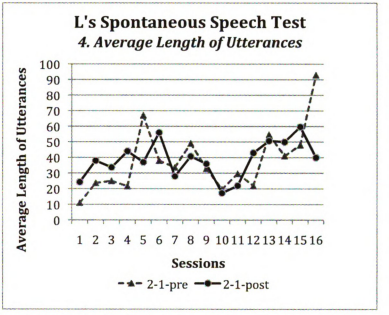
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pre_Test_3 - Post_Test_3	-39.00000	88.09843	22.02461	-85.94434	7.94434	-1.771	15	.097

(Table 7-4. R's Paired t-test on Total Number of Words)

The mean for the second-half sessions on the pre-test (M=255) was higher than the mean for the first-half sessions (M=228). Also, the mean for the second-half sessions (M=322.6) was higher than the mean for the first-half sessions on the post-tests (M= 238.6). It is indicated that the total number of words increased through the second-half sessions in both the pre and the post-tests. Therefore, it is shown that the intervention of TS had a positive affect on the improvement of total number of words as a long-term effect.

In order to investigate whether there was the short-term effect on the total number of words, a paired-samples t-test was conducted to compare pre-test and post-test data. There was no significant difference in the scores for pre-test (M=241.62, SD=76.98) and post-test (M=280.62, SD=68.67); t (15)= -1.771, p = 0.097 (p>0.05) (See Table 7-3 & 7-4). These results indicated that each intervention did not have a strong effect on the difference between pre-test and post-test. Although there was no statistical difference between pre and post-test, the post-test mean (M=280.62) was greater than the pre-test mean (M=241.62). Therefore, the intervention TS did not have statistically significant effect, but the total number of words increased on the post-tests as a short-term effect.

4. Average Length of Utterances



(Figure 3-7. Average Length of Utterances in L's Spontaneous Speech Test)

Figure 3-5 shows there was no increasing short-term tendency in L's average length of utterances as a result of the interventions. The long-term effect of intervention was shown through comparing the means between the first-half and the second-half sessions.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre_Test_2_1	38.1375	16	20.73007	5.18252
	Post_Test_2_1	38.7750	16	11.99592	2.99898

(Table 8-1. L's Paired t-test on Average Length of Utterances)

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pre_Test_2_1 - Post_Test_2_1	-.63750	19.71662	4.92916	-11.14375	9.86875	-.129	15	.899

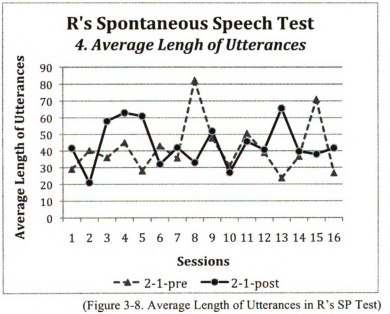
(Table 8-2. L's Paired t-test on Average Length of Utterances)

The mean for the second-half sessions on the pre-test (M=42.6) was higher than the mean for the first-half sessions (M=33.6). Also, the mean of the post-tests for second half sessions (M=39.8) is higher than the mean of the first-half sessions (M= 37.7). It

indicates that the average length of utterances increased in both pre and post-tests through the second-half sessions. Therefore, it is shown that the intervention of MIT and MIT combined with TS gave a positive effect on the improvement of average length of utterances as a long-term effect.

In order to investigate whether there was a short-term effect on the sample length, a paired-samples t-test was conducted to compare the pre and the post-tests. There was no statistically significant difference in the scores for pre-test (M=38.13, SD=20.73) and post-test (M=38.77, SD=11.99) ; t(15)=-0.129, p = 0.899 (p>0.05)(See Table 8-1 & 8-2). These results indicat

ed that although the pre and post means slightly increased, each intervention did not have a statistically significant effect on the difference between the pre-tests and the post-tests. Therefore, the intervention of MIT and MIT combined with TS did not affect the improvement on the average length of the three longest utterances as a short-term effect.



(Figure 3-8. Average Length of Utterances in R's SP Test)

Figure 3-6 shows that there is no increasing tendency on the post-test data in R's average length of utterances. There was no long-term effect of the

intervention by comparing the means between the first-half and the second-half sessions.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre_Test_2_1	41.6125	16	15.81459	3.95365
	Post_Test_2_1	43.8875	16	13.02955	3.25739

(Table 8-3. R's Paired t-test on Average Length of Utterances)

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pre_Test_2_1 - Post_Test_2_1	-2.27500	23.22144	5.80536	-14.64883	10.09883	-.392	15	.701

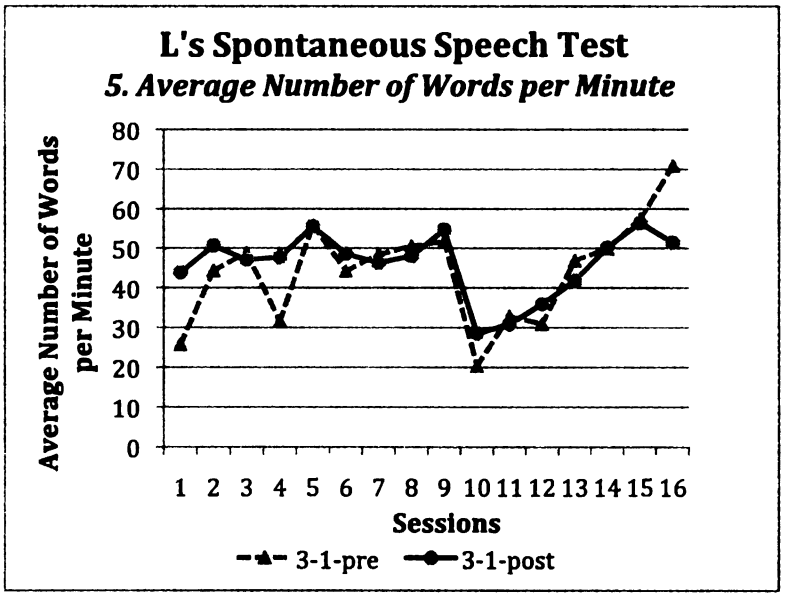
(Table 8-4. R's Paired t-test on Average Length of Utterances)

The mean for the second-half sessions on the pre-test (M=40.81) was lower than the mean for the first-half sessions (M=42.41). Also, the mean for the second-half sessions (M=43.81) was slightly lower than mean for the first-half sessions in the post-tests (M= 43.96). There was no progression in both pre and post-tests. It is indicated that the average length of utterances did not increased in both the pre and the post-tests through the second-half sessions. Therefore, it is shown that the intervention of TS did not have a positive affect on the improvement on the average length of three longest utterances as a long-term effect.

In order to investigate whether there was the short-term effect on the sample length, a paired-samples t-test was conducted to compare the pre and the post-tests. There was no significant difference in the scores for pre-test (M=41.61, SD=15.81) and post-

test (M=43.88, SD=13.02); t(15)=-0.392, p = 0.701 (p>0.05) (See Table 8-3 & 8-4). These results indicated that each intervention did not effect the difference between the pre-tests and post-tests. Although the mean for the post-tests (M=43.88) was slightly greater than the pre-test mean (M=41.61), there is no statistically significant difference between the pre and the post-tests. Therefore, the intervention of the TS did not affect an improvement on the average length of the three longest utterances as a short-term effect.

5. Average Number of Words per Minute



(Figure 3-9. Average Number of Words per Minute in L's SP Test)

Figure 3-9 shows that there was no significant increasing tendency in L's average number of words per minute. The long-term effect of the interventions was shown through comparing the means between the first and second-half session.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre_Test_3_1	44.4563	16	13.09488	3.27372
	Post_Test_3_1	46.1562	16	8.23941	2.05985

(Table 9-1. L's Paired t-test on Average Number of Words per Minute)

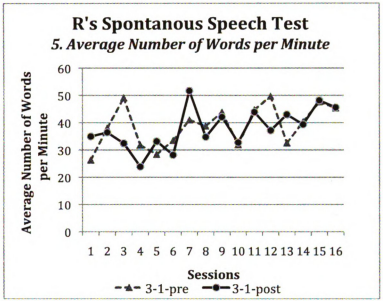
Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pre_Test_3_1 - Post_Test_3_1	-1.70000	8.65602	2.16400	-6.31247	2.91247	-.786	15	.444

(Table 9-2. L's Paired t-test on Average Number of Words per Minute)

The mean for the second-half sessions on the pre-test (M=45.2) was higher than the mean for the first-half sessions (M=43.8). On the other hand, the mean for the second-half sessions (M=43.79) was lower than that of the first-half sessions on the post-tests (M= 48.52). It is indicated that the average number of words per minute increased in the second-half sessions on the only pre-tests. Therefore, it is shown that the interventions of MIT and MIT combined with TS did not have a positive effect on both the pre and the post-test on the improvement in the average number of words per minute as a long-term effect.

In order to investigate whether there was a short-term effect on the average number of words per minute, a paired-samples t-test was conducted to compare to pre-tests and post-tests from the first to the sixteenth session. There was no statistically significant difference in the scores for pre-test (M=44.45, SD=13.09) and post-test (M=46.15, SD=8.23); $t(15) = -0.786$, $p = 0.444$ ($p>0.05$) (See Table 9-1 & 9-2). Although these results showed that the interventions do have no statistically significant effect on the difference between pre and post-tests, there was a slight increase in means (pre=44.45, post= 46.15). Therefore, the results indicated that MIT and MIT combined with TS did not have a strongly positive effect on the average number of words per minute.



(Figure 3-10. Average Number of Words per Minute in R's SP Test)

Figure 3-10 shows that there was no significant increase in R's average number of words per minute. The long-term effect of intervention was shown through comparing the means between the first and second-half sessions.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre_Test_3_1	38.9375	16	7.48027	1.87007
	Post_Test_3_1	38.0000	16	7.41791	1.85448

(Table 9-3. R's Paired t-test on average number of words per minute)

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pre_Test_3_1 - Post_Test_3_1	.93750	7.54214	1.88553	-3.08142	4.95642	.497	15	.626

(Table 9-4. R's Paired t-test on Average Number of Words per Minute)

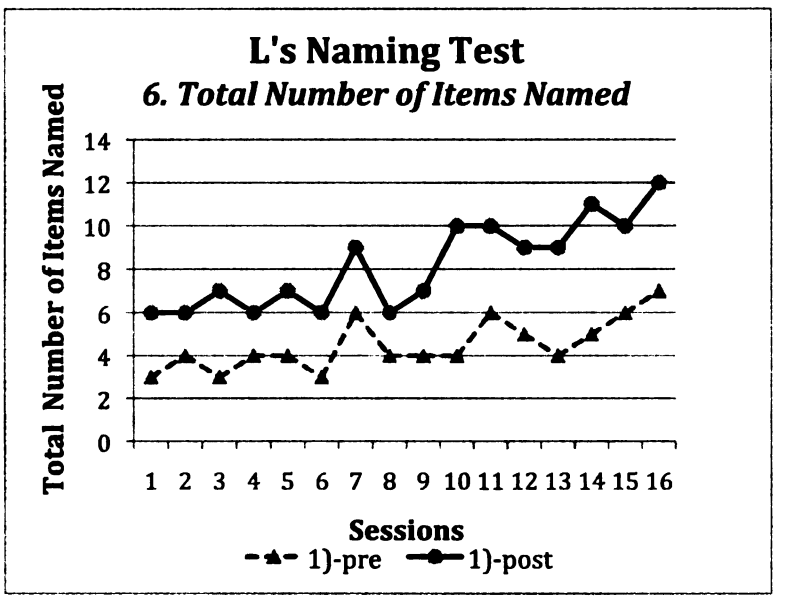
The mean for the second-half sessions (M=42.01) was higher than the mean of first-half sessions on the pre-test (M=35.86). Also, the posttest mean for the second-half

sessions (M=41.52) was higher than that for the first-half sessions (M= 34.47). It is indicated that the average number of words per minute increased through the second-half sessions in both pre and post-tests. Therefore, it is shown that the intervention of TS had a positive effect to improving the average number of words per minute in both pre and post-test as a long-term effect.

In order to investigate whether there was a short-term effect on the average number of words per minute, a paired-samples t-test was conducted to compare pre-test and post-test data from the first session to the sixteenth session. There was no statistically significant difference in the scores for pre-test (M=38.93, SD=7.48) and post-test (M=38, SD=7.41); $t(15)= 0.497$, $p = 0.626$ ($p>0.05$) (See Table 9-3 & 9-4). These results indicated that the interventions generated no statistically significant difference between pre and post-tests scores, as well as the difference of means in pre (M=38.93) and post-test (M=38). Therefore, the TS did not affect the average number of words per minute as a short-term effect.

Naming Measurement

6. Total Number of Items Named



(Figure 4-1. Total Number of Items Named in L's Naming Test)

Figure 4-1 shows the significant increasing tendency in L's total number of items named. The long-term effect of the interventions was shown through comparing the means between the first-half and the second-half sessions.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre_Test	4.5000	16	1.21106	.30277
	Post_Test	8.1875	16	2.04022	.51006

(Table 10-1. L's Paired t-test on Total Number of Items named)

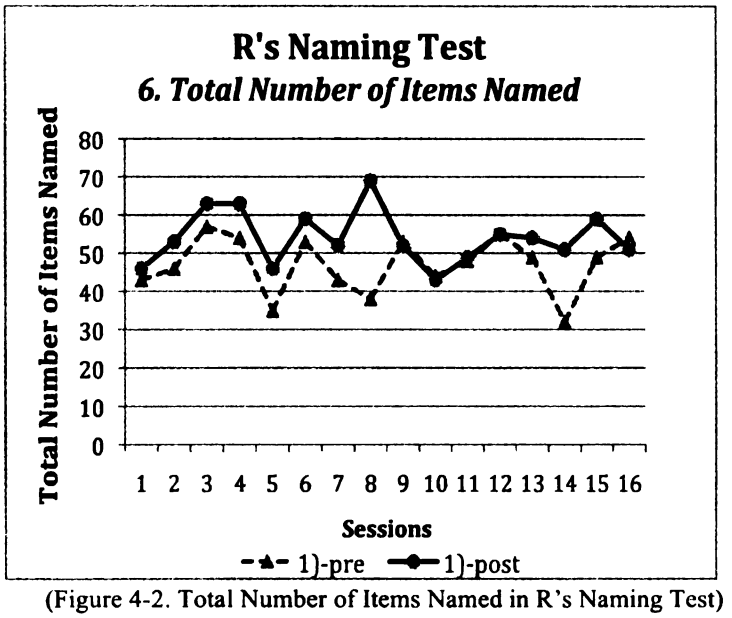
Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1 Pre_Test - Post_Test	-3.68750	1.30224	.32556	-4.38142	-2.99358	-11.327	15	.000

(Table 10-2. L's Paired t-test on Total Number of Items named)

The mean for the second-half sessions on the pre-test (M=5.12) was higher than the mean for the first-half sessions (M=3.88). Also, the mean for the second-half sessions on post-tests (M=9.75) was higher than that of the first-half sessions (M= 6.62). It indicates that the total number of items named increased through the second-half sessions on both pre and post-tests. Therefore, it is shown that the interventions of MIT and MIT combined with TS had a positive effect on the improvement of the total number of items named as a long-term effect.

In order to investigate whether there was a short-term effect on the total number of items named, a paired-samples t-test was conducted to compare pre-test and post-test results through all sixteen sessions. There was a statistically significant difference in the scores for pre-test (M=4.50, SD=1.21) and post-test (M=8.18, SD=2.04); t (15)= -11.327, p = 0.000 ($p<0.05$) (See Table 10-1 & 10-2). These results suggest that each intervention does have an effect on the difference between pre and post-test scores. Therefore, the results suggest that when the interventions of MIT and MIT combined with TS were conducted, the total number of Items named increased as a short-term effect.



(Figure 4-2. Total Number of Items Named in R's Naming Test)

Figure 4-2 shows a slightly increasing tendency in R's total number of items named. The long-term effect of intervention was shown through comparing the means between the first half and the second half sessions.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre_Test_1	47.0625	16	7.46073	1.86518
	Post_test_1	54.0625	16	7.01872	1.75468

(Table 10-3. R's Paired t-test on Total Number of Items named)

Paired Samples Test

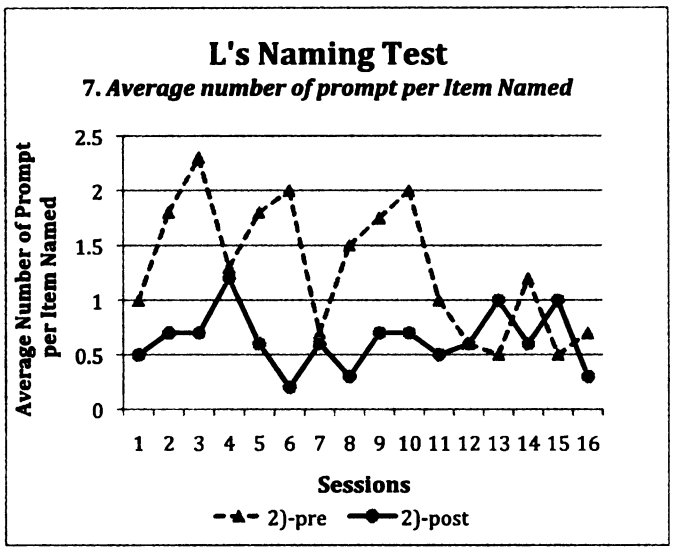
	Paired Differences					t	df	Sig. (2-tailed)
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1 Pre_Test_1 - Post_test_1	-7.00000	8.51665	2.12916	-11.53820	-2.46180	-3.288	15	.005

(Table 10-4. R's Paired t-test on Total Number of Items named)

The mean for the second-half sessions on the pre-test (M=48) was higher than the mean for the first-half sessions on the pre-test (M=46). On the other hand, the mean of the post-test for the second-half sessions (M=51.75) was lower than that of the first-half sessions (M= 56.37). It is indicated that the total number of items named increased through the second-half sessions only on the pre-tests. Therefore, it is shown that the intervention of TS gave a positive effect on the improvement of the total number of items named only on the pre-test as a long-term effect.

In order to investigate whether there was a short-term effect on the total number of items named, a paired-samples t-test was conducted to compare pre-test and post-test data for all sixteen sessions. There was a statistically significant difference in the scores for pre-test (M=47, SD=7.46) and post-test (M=54, SD=7.01); t (15)= -3.288, p = 0.005 ($p<0.05$) (See Table 10-3 & 10-4). These results indicated that each intervention does have an effect on the difference between pre and post-test scores. Therefore, the total number of Items named increased after the intervention of TS was conducted.

7. Average Number of Prompts per Item Named



(Figure 4-3. Average Number of Prompts per Item Named in L's Naming Test)

Figure 4-3 shows the reducing tendency in post-test data for L's average number of prompts per item named. The long-term effect of the interventions was shown through comparing the means between the first-half and the second-half sessions.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre_Test_2	1.2906	16	.60006	.15002
	Post_Test_2	.6375	16	.26552	.06638

(Table 11-1. L's Paired t-test on Average Number of Prompts per Item Named)

Paired Samples Test

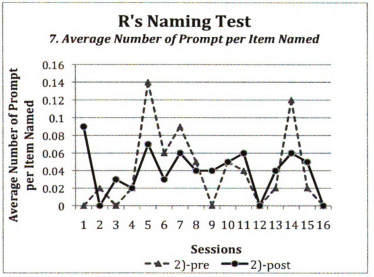
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pre_Test_2 - Post_Test_2	.65312	.70225	.17556	.27892	1.02733	3.720	15	.002

(Table11-2. L's Paired t-test on Average Number of Prompts per Item)

The mean for the second-half sessions on the pre-test (M=1.03) was lower than the mean of first-half sessions on the pre-test (M=1.55) The goal in this variable is to decrease the number of prompts, so there was a slight improvement by reducing the mean

in the post-tests. On the other hand, the post-test mean for the second-half sessions (M=0.68) is slightly higher than that of first-half sessions (M=0.6). It indicates that the average number of prompts per item increased through the second-half sessions on the post-test. Namely, the pre-test results were an improvement, while the post-test increase was a slight regression. Therefore, it is shown that the intervention of MIT and MIT combined with TS did not have a significantly positive effect in decreasing the average number of prompts both on the pre and post-tests as a long-term effect.

In order to investigate whether there was the short-term effect on the average number of prompts, a paired-samples t-test was conducted to compare pre-test and post-test results for all sixteen sessions. There was a statistically significant difference in the scores for pre-test (M=1.29, SD=0.60) and post-test (M=0.63, SD=0.26); $t(15)= 3.72$, $p = 0.002$ ($p<0.05$) (See Table 11-1 & 11-2). These results suggest that each intervention does have an effect on the difference between pre and post-test performance. Therefore, the results indicate that the prompts by the researcher were reduced in the post-test as a short-term effect.



(Figure 4-4. Average Number of Prompts per Item Named in R's Naming)

Figure 4-4 shows that there was difference between pre and post-test data in R's average number of prompts per items named. The long-term effect of the interventions was

shown through comparing the means between the first half and the second-half sessions.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre_Test_2	.0394	16	.04404	.01101
	Post_Test_2	.0400	16	.02608	.00652

(Table11-3. R's Paired t-test on Average Number of Prompts per Item Named)

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pre_Test_2 - Post_Test_2	-.00062	.03924	.00981	-.02153	.02028	-.064	15	.950

(Table11-4. R's Paired t-test on Average Number of Prompts per Item)

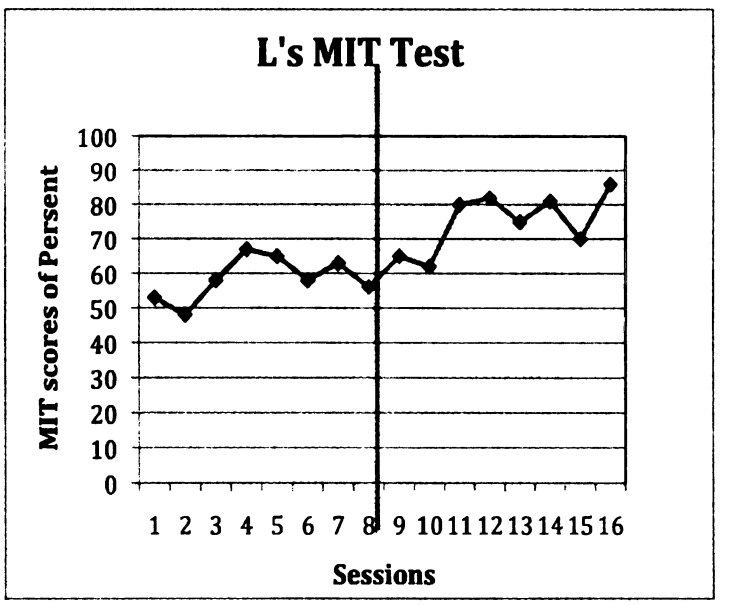
The mean for the second-half sessions on the pre-test (M=0.031) was lower than the mean of first half sessions on the pre-test (M=0.047). Also, the mean for the second-half sessions (M=0.037) was lower than that of the first-half sessions on the post-test (M=0.042). There was improvement by reducing the number of the researcher's prompts on both the pre and post-test. It indicates that the average number of prompts per item was reduced through the second-half sessions. Therefore, it is shown that the intervention of the TS gave a positive effect on reducing the average number of prompts per item as a long-term effect.

In order to investigate whether there was a short-term effect on the average number of prompts per item, a paired-samples t-test was conducted to compare pre-test

and post-test data for all sixteen sessions. There was no statistically significant difference in the scores for pre-test (M=0.039, SD=0.044) and post-test (M=0.04, SD=0.026) ; t (15)= -0.064, p = 0.950 (p>0.05) (See Table 11-3 & 11-4) These results suggest that each intervention has no statistically significant effect on the difference between pre and post-test. The post-test mean (M=0.04) was slightly higher than the pre-test mean (M=0.039). Therefore, the results indicate that the prompts by the researcher were not reduced by the intervention, so there was no improvement on the average number of prompts as a short-term effect.

Melodic Intonation Therapy Measurement

8. MIT Scores of Percent



(Figure 5-1. MIT Scores of Percent in L's MIT Test)

Figure 5-1 shows that there was the increasing tendency in L's MIT scores. To be exact, there was the tendency toward an average rate of increase in the second-half sessions more than in the first-half sessions. The mean for the second-half sessions (M=75.1) was higher than the mean for the first-half sessions (M=58.5). Therefore, it indicates that there was an improvement in L's MIT scores continuing through the second-half sessions.

CHAPTER V

DISCUSSION

Summary and Conclusion

The summary of results is shown in Table 12. There are two ways in which the data for the eight variables are interpreted: 1) Long-term effect; 2) Short-term effect. First, a long-term effect was measured by comparing the means of the first-half sessions with the means of the second-half sessions on both pre and post-tests (Independent t-test). If the second-half mean is higher than the mean of the first-half sessions, this result may indicate that the interventions in the second-half period of sessions have been effective. Table 12 shows a numerical increase, as 'Yes', and no increase, as 'No'.

Secondly, the short-term effect was measured by comparing the scores of pre-tests with those of post-tests (Paired t-test). Table 12 shows only whether or not there was a statistically significant difference between the pre-test means and the post-test means. If there was a significant difference (p values < 0.05), it is labeled as 'Yes', and if none, as 'No'.

Table 12. ***Summary of the data result in t-test***

Variables	*L*			*R*		
1. Long-term: No test of Significance "Yes" indicates that Second-half means > First-half means *2. Short-term: Test of Significance*	*1 Long-Term*		*2 Short Term*	*1 Long-Term*		*2 Short Term*
	Pre	*Post*		*Pre*	*Post*	
1. Total Length of Samples	Yes	Yes	Yes	No	Yes	Yes
2. Total Number of Utterances	No	Yes	Yes	Yes	Yes	No
3. Total Number of Words	Yes	Yes	Yes	Yes	Yes	No
4. Average Length of Utterances	Yes	Yes	No	No	No	No
5. Average Number of Words per Minute	Yes	No	No	Yes	Yes	No
6. Total Number of Items Named	Yes	Yes	Yes	Yes	No	Yes
7. Average Number of Prompts per Item Named	Yes	No	Yes	Yes	Yes	No
8. MIT Scores of Percent	Yes		-	-		-

(1. Long-term effect- Independent t-test, 2. Short-term effect – Paired samples t-test)

L's Results

The summary of results indicated that the music therapy interventions of Melodic Intonation Therapy (MIT) and Therapeutic Singing (TS) had a positive effect on L's functional communication skill. In L's long-term effects on pre-test measures, there was improvement in six variables: 1.the total length of samples; 3.the total number of words; 4.the average length of utterances; 5.the average number of words per minute; 6.the total number of items named, and 7.the average number of prompts per item named, and no improvement on only one variable, 2.the total number of utterances. On the other hand, in the post-tests, there was improvement in five variables: 1.the total length of samples;

2.the total number of utterances; 3.the total number of words; 4.the average length of utterances; and 6.the total number of items named, and no improvement on the two variables: 5.average number of words per minute, and 8.the average number of prompts per item named. It was shown that the means of eleven among the fourteen variables showed increases in both the pre-test and the post-test. Therefore, it might be indicated that there was a long-term effect on L's functional communication skills through the last period of sessions. However, statistical significance was not achieved.

Also, in L's short-term effect, there were statistically significant differences in five variables: 1.the total length of samples; 2.the total number of utterances; 3.the total number of words; 4.the total number of items named; and 5.the average number of prompts per item named, and no differences in two variables: 1.the average length of utterance; and 2.the average number of words per minute. It was shown that there were statistically significant differences in most variables between pre and post-tests. Therefore, it is indicated that MIT and TS interventions helped L improve his functional communication skills in several areas as short-term effects.

Discussion of L's Four Goal's Areas

There were four goals targeted in L's study. The first goal was to investigate whether or not Therapeutic Singing (TS) combined with Melodic Intonation Therapy (MIT) helps adult clients who are diagnosed with expressive aphasia as measured by the quality of their functional communication skills. For investigating the first goal, the paired t-test was conducted in the second-half sessions (9^{th} – 16^{th} sessions), which is the second period of sessions conducted with MIT combined with TS, by comparing the means of pre and post-tests.

Table 13-1 shows that the means for post-tests are distinctly higher than those of pre-tests in all seven variables (see Appendix 15-1). It supports that there was improvement on the post-tests in all seven variables after conducting MIT combined with TS through the second-half sessions. On the other hand, table 13-2 shows that there were statistically significant differences ($p<0.05$) in three variables: 1.the total length of sample, 2.the total number of utterances, and 6.the total number of items named, through the second-half sessions, while there were no statistically significant differences ($p>0.05$) in four variables: 3.the total number of words, 4.the average length of utterances, 5.the average number of words per minute, and 7.the average number of prompts per item named.

As a result, the increases in measured numerical quantities indicated that the interventions of MIT combined with TS had a slightly supportive effect in the Functional Communication Skills by increasing the means. The means for post-tests in all seven variables were higher than the means for pre-tests, although the results did not show statistically supported differences between the means of pre and post-tests. It is believed that the limited number of sessions (N=8) may be the reason for a lack of statistically supportive differences (See Table 13-1 in Appendix 15-1).

The second goal was to explore whether MIT treatment itself helps clients improve the quality of their functional communication skills. For investigating the second goal, the paired t-test was conducted in only the first-half sessions (1^{st} – 8^{th} sessions), in which only MIT intervention was conducted, by comparing the means for pre and post-tests.

Table 14-1 shows that the means for post-tests are also distinctly higher than the means of pre-tests in all seven variables. It supports that there was improvement on the post-tests after conducting the MIT intervention during the first-half sessions (See table 14-1 in Appendix 15-2). However, the results in table 14-2 (see Appendix 15-2) shows that there were statistically significant differences ($p<0.05$) in three variables: 3.the total number of words, 6.the total number of items named, and 7.the average number of prompts per item named during the first-half sessions, while, there were no statistically significant differences ($p>0.05$) in four variables: 1.the total length of samples, 2.the total number of utterances, 4.the average length of utterances, and 6. Average number of words per minute (See Table 14-2 in Appendix 15-2).

As a result, the means for post-tests improved more than those for pre-tests in all seven variables although the results did not show statistically significant differences on all seven variables (see Table 13-1). Therefore, MIT also had a positive effect on the post-test results, but did not have a statistically supported difference in all seven variables.

The third goal was to compare the effectiveness of TS combined with MIT and MIT alone in increasing functional communication skills. For investigating goal III, the independent sample t-test was conducted on sessions by comparing the two means of a variable: the numerical differences between the post-tests and the pre-tests in the first-half and the second-half sessions. (Post-test Means *Minus* Pre-tests Means ($1^{st} - 8^{th}$) vs. Post-test Means *Minus* Pre-test Means ($9^{th} - 16^{th}$) (See table 15-1 in Appendix 15-3)

Table 15-1 shows that the means in groups 2 (Post-test means *minus* Pre-test means in the second-half sessions) had more improvement than the means in groups 1

(Post-test means *minus* Pre-test means in the first-half sessions) on three variables: 1.total length of samples, 2.total number of utterances, and 6.total number of items named, on the other hand, four variables showed no improvement: 3.total number of words, 4.average length of utterances, 5.average number of words per minute, and 7.average number of prompts per item named.

Table 15-2, however, shows that there were no statistically significant differences between the first-half (MIT) and the second-half (MIT+TS) sessions ($p>0.05$) except the one variable: 6.the total number of items named. However, it is noted that the second-half (MIT+TS) sessions had higher means than those of the first-half sessions on three variables: 1.the total length of samples, 2.the total number of utterances, and 6.the total number of items names. To be exact, the negative scores of Mean Difference in Table 15-2 implied that the means of the second-half (MIT+TS) sessions were higher than the means of the first-half (MIT) sessions. On the other hand, the positive scores of Mean Difference showed that the means of the first-half (MIT) sessions were higher than the means of the second-half (MIT+TS) sessions on four variables: 3.total number of words, 4.average length of utterances, 5.average number of words per minute, and 7.the average number of prompts per item named. As a result, it can be shown that MIT combined with TS had a slightly positive effect on the improvement of functional communication skills on those four variables. Therefore, no clear trend can be attributed to the interventions.

The fourth goal was to determine whether TS enhances MIT treatment (See Figure 5-1 in Ch. 4). The results shows that MIT combined with TS interventions had a positive effect on MIT scores, more so than MIT intervention alone. As the result, it is considered that the TS intervention is beneficial in enhancing MIT treatment.

As the evidence of its effectiveness, TS can support the goals of other techniques, not by taking their place as primary interventions, but as a separate technique in support of the other. For example, the primary goal of this study is improving the functional communication skills of the aphasic subjects, and MIT is one of the significant techniques for this goal in enhancing speech function. Significantly, the supportive role of TS could serve as an important reinforcement for improving the goals of MIT and this study. TS is the practice of combining elements of speech production and also incorporates emotional elements of speech and language. People who suffer from the symptoms of a stroke also suffer from the emotional wounds such as depression, and this emotional dysfunction may affect language and speech function negatively. A change in therapeutic focus by combining TS with MIT could provide a more beneficial intervention in the functional goals of this study, as well as the goals of MIT.

R's Results

R, who had high functional speech, received only the TS intervention, as has been mentioned in the Methods chapter, because he already had the ability to repeat full sentences, which represents the final stage of MIT. In R's long-term effect, reflected in the pre-tests, there was improvement in five variables: 2.the total number of utterances; 3.the total number of words; 5.the average number of words per minute; 6.the total

number of items named; and 7.the average number of prompts per item named, and no improvement in two variables: 1.the total length of samples; and 4.the average length of utterances. On the other hand, in the post-tests, there was improvement in five variables: 1.the total length of samples; 2.the total number of utterances; 3.the total number of words; 5.the average number of words per minute; and 7.the average number of prompts per item named, and no improvement in two variables: 4.the average length of utterances; and 6.the total number of items named. It was shown that the means of most variables were increased in both the pre-test and the post-test as a long-term effect, except in the average length of utterances. Therefore, it could be considered that there were possible long-term effects on R's functional communication skills through the sixteen sessions although R did not show the improvement in the length of longest utterances. These results represent only numerical directions in improvement, as statistical significance was not established.

In contrast, there was no statistically significant difference in the short-term effect. Only the mean of two variables (1. the total length of samples and 6. total number of items named) improved in the post-test. There was no short-term effect in five variables (2.the total number of utterances, 3. the total number of words, 4. the average length of utterances, 5. the average number of words per minute, and 7. the average number of prompts per item named). The result shows that even though the mean of post-tests is slightly higher than the mean of pre-tests, there was no statistically significant difference between pre and post-tests. Therefore, it is considered that the TS interventions may have helped R to improve functional communication skill as a long-term effect, but there seems to be no statistically significant short-term effect.

Specifically, R's result showed there was no improvement at all in the average length of utterances both long-term and short-term. As discussed in chapter III, R had a high functional communication level, and most functional ability may have been recovered previously because the onset of his stroke was seven years ago. This fact may indicate that the TS intervention may not have a significantly positive effect on the short-term gains for a person who had been diagnosed with expressive aphasia several years ago and had already recovered speaking functions. The goal for R in this study was to gain information as to whether TS treatment itself helps clients improve the quality of their functional communication skills. Although the TS gave positive results on some variables in the functional communication measurement, R's results did not show a stronger effect than L's results. This may be explained by the fact that R already had recovered many functions during the seven years after onset of his stroke.

Anecdotal Improvement

L's spouse stated at the middle of the research, "L is feeling like this is helping him!", and he had started to ride a bike for 4 miles away from his home and communicated with the cashier of the gas station during the last period of sessions. This was his positive feedback regarding gains assessed through the Spontaneous Speech Measurement.

One day during the last period of sessions, R mentioned that his brother said that R was talking more clearly than before by phone, and both his close friend and his wife stated that his speech function was more stabilized than in the past.

Implications for Intervention

Music is not a simple stimulus for activating brain function, but music is a complex combination of many supportive ways to trigger response to improve restricted functions in a human being. We cannot say that taking a dose of singing activities three times a day will help clients to return to a normal state of speech function. However, we can say that singing can trigger improvement in speech function by activating long-term memory, supporting states of emotion, and triggering unconscious automatic words. Jackson (1871) differentiated propositional speech from so-called automatic speech. He stated that even when propositional speech became seriously damaged, automatic speech could be preserved in aphasia. TS may be able to trigger unconscious memory for producing automatic speech.

The findings of this study lent support to the idea that MIT and TS have positive effects on improving functional communication skills. Therapeutic Singing (TS) was added to serve a supportive role during the sessions in order to investigate whether TS would help to improve functional communication skills in L's MIT interventions, as well as a main intervention in R's sessions. The reason for investigating the combination of both interventions was that TS and MIT have reciprocally important roles. MIT has the benefit of focusing on the target phrases more than TS, and TS may be able to activate long-term memory functions through the usage of familiar songs, as well as support a state of pleasurable emotion to counteract depression. Singing also can help a person to engage actively in pleasure and emotional satisfaction. Investigating whether there is effectiveness in both MIT and TS can uniquely add to the body of knowledge in this area.

Since the 1970's many researchers have been investigating whether or not singing can help enhance speech intelligibility, as well as the effectiveness of MIT in speech therapy. Studies until the 2000's supported the effectiveness of MIT in speech production (Baker, 2000; Belin, et al., 1996; Bonakdarpour, Eftekharzadeh, & Ashayeri, 2003; Carroll, 1996; Galloway & Kraus, 1982; Laughlin, Naeser, & Gordon, 1979; Sparks & Deck, 1986; Sparks, et al., 1974), as well as the effectiveness of Therapeutic Singing in speech function (TS) (Cohen, 1992; Cohen & Ford, 1995; Cohen & Masse, 1993; Glover, Kalinowski, Rastatter, & Stuart, 1996; Keith & Aronson, 1975).

Some recent, however, research studies showed that there was dissociation between singing and speaking (Hebert, et al., 2003; Peretz & Hébert, 1995; Racette, Bard, & Peretz, 2006). They stated that singing did not affect word production by producing normal speech. Even though the subjects produced more word utterances while singing, after repetition of the singing activity, speaking production with the same lyrics did not improve. Similar to these studies, when the researcher asked subject L to speak target phrases after MIT treatment with same materials, subject L could not speak most of the target phrases even though he had produced the target contents within the musical condition of MIT. As explanation, if a two-year-old toddler, for example, who has not started speaking yet, sings *Twinkle Twinkle Little Star* along with his mom, the toddler can then sing producing 60% of the lyrics. No matter how many words the toddler can produce while singing, can the toddler speak the lyrics without music? Of course, the answer is 'No,' because the toddler's brain is not fully activated for speaking, even though spoken language comprehension may have started already. Even so, can we conclude there is dissociation between singing and speaking?

In contrast to Hebert's study (2003), this study used, as pre and post-tests, different measurement tools within a non-musical condition. In the most of NMT intervention in Speech and Language Training, as well as Hebert's research, word production has been measured within a musical condition. This study, however, has used measurement techniques designed after speech pathology tests of Functional Communication Measurement within non-musical conditions. This differs from other neurologic music therapy techniques. For a concrete example, MUSTIM is one of the effective NMT techniques, and the variables are measured by how many words the client produces during the MUSTIM intervention under musical conditions. For this reason, the measurement tools chosen and used in this study can be valuable methods for future researchers.

Also, the number of numerical variables gave this study integrity, even though it developed into two case studies. The Paired t-test and Independent sample t-test was conducted on fourteen to fifteen variables.

The rhythmic factor in speaking, emphasized by using castanets, also served as a memory reinforcement in this study. Resent research showed that the intoned melody was not the important factor in improving word production (Hebert, et al., 2003). The drum, however, played an important role for all children in increasing the length and clarity of response in one study (1996, Carroll).

The amount of time consumed was one of the limitations to having a large subject pool in this study. In order to obtain the Spontaneous Speech Measurement data, it required two and one-half hours for each session, including driving to the subject's

location, as well as three hours for coding data. Using five and one-half hours for each session to obtain data on the fourteen to eighteen variables was prohibitive to having more subjects. However, this study gains credibility from the amount of date collected from the two subjects.

There was also a limitation in the recruitment of aphasic participants who are at the same in level of speaking ability, because most of the clients who are diagnosed with cerebrovascular accidents (CVA) have combined disorders with other diagnoses. For example, L and R were diagnosed the same with expressive aphasia, but the researcher recognized that L also had motor functioning problems in using his oral muscles. It was discovered that L was also diagnosed with mild apraxia after engaging in several sessions. For this reason, recruiting a homogeneous pool of subjects is a most difficult step at the outset of the research. Although five subjects were recruited who were diagnosed with adult expressive aphasia, the study was limited to just two, due to the wide variation in speech abilities and the time consuming nature of the intensive sessions.

Implications for Future Research

There are several suggestions for future research. First, the more sessions and longer period, such as a year, the better will be the results in data analysis. This study was conducted with restricted time line as a masters thesis, so subjects participated in a two-month time line. The speech and language pathologists recommended that they have sessions with persons with expressive aphasia for over a year in order to evaluate improvement.

A second recommendation is in the intensity of treatment. According to the original MIT protocols, it suggested a six-week intensive plan. At a rehabilitation center in Michigan, speech pathologists also meet stroke patients five times a week in an intensive plan. Subjects L and R had interventions around three to four times a week during the second period of sessions.

For the future researcher, it is also recommended that a better way to measure would be to reduce the time consumed by examining only a pre and post-test at the first and last sessions. This would generate valuable data if gathered in long-term treatment over a year with an intensive plan of intervention. Pre and posttests might also be given at the beginning and end of each week.

Also, length of time post stroke had an effect on results. R, whose stroke occurred seven years ago, had slightly more improvement than L, whose onset of stroke was a year ago. This can be a reference for future researchers in recruiting subjects.

This research design may be a good model for a treatment plan, which was conducted in the order of pre-test, treatment, and posttest. Namely, each session was conducted in the order of conversation about favorite themes, musical intervention, and conversation on the same topic. This design may be a stable model for music therapy intervention.

Lastly, even though the testing is time consuming, the seven different variables in functional communication skills can be good evaluation materials: 1.Total length of samples, 2.Total number of utterance, 3.Total number of words, 4.Average length of utterance, 5.Average number of words per minute, 6.Total number of items named, 7.Average number of prompts per item named. Those variables were selected with the

help of an expert in speech therapy, so they can be credibly used in the music therapy field.

It would be encouraging news if persons with severe expressive aphasia could find the means to speak again. As to the question of whether singing has any use in the recovery of speech, the researcher would answer that language can be embedded with unconscious automatic words ready to be "released" for conscious uses, and music can trigger this unconscious automatism by stimulating the production of verbal utterances. This study is this researcher's first step in learning the power of music in rehabilitation for persons with neurological conditions such as expressive aphasia. Through this first step of these two case studies, the researcher is convinced of the effectiveness of MIT and TS techniques to improve communication through speech for persons with expressive aphasia.

APPENDICES

APPENDIX 1

Table 1. Overview of Melodic Intonation Therapy and Scoring Criterion

Level	*Step*	*Number of Points*
I.	1. Humming melody 2X (HT)	No score
	2. Humming in unison (HT)	
	3. Fade (HT)	
II.	1. Humming (HT)	
	2. Unison singing (HT)	1
	3. Unison singing with fading (HT)	1
	4. Immediate repetition	1
	5. Response to a probe question	1
III.	1. Introduction of item (HT)	No score
	2. Unison with fading (HT)	1
	3. Delayed repetition (HT)	2
	(Back up: unison with fading)	(1)
	4. Response to probe question	2
	(Back up: Delayed repetition)	(1)
IV	1. Delayed repetition (HT)	2
	(Back up: Unison with fading)	(1)
	2. Introducing sprechgesang (HT)	No score
	3. Sprechgesang with fading (HT)	2
	(Back up: Unison sprechgesang)	(1)
	4. Spoken repetition with delay	2
	(Back up: Sprechgesang with fading)	(1)
	5. Response to probe question	2
	(Back up: Delayed repetition)	(1)

(HT: Hand Tapping)

APPENDIX 2

Melodic Intonation Therapy Measurement Form5

Name of Client:	Session #.
Date	Pre-test / Post-test

Level	*Step*	*Number of Points*
I.	1. Humming melody 2X (HT) 2. Humming in unison (HT) 3. Fade (HT)	No score
II.	1. Humming (HT) 2. Unison singing (HT) 3. Unison singing with fading (HT) 4. Immediate repetition 5. Response to a probe question	
III.	1. Introduction of item (HT) 2. Unison with fading (HT) 3. Delayed repetition (HT) (Back up: unison with fading) 4. Response to probe question (Back up: Delayed repetition)	No score
IV	1. Delayed repetition (HT) (Back up: Unison with fading) 2. Introducing sprechgesang (HT) 3. Sprechgesang with fading (HT) (Back up: Unison sprechgesang) 4. Spoken repetition with delay (Back up: Sprechgesang with fading) 5. Response to probe question (Back up: Delayed repetition)	No score

Total scores : _____.

APPENDIX 3

Melodic Intonation Therapy (MIT) Hierarchy

LEVEL I – learn intoning and hand tapping, response to hand-signals	
Stimulus (Therapist) (T)	Hums melody twice with (HT) *(HT) Hand Tapping* (T) fades participation but continues (HT)
Response (Client) (C)	Unison humming with (HT).
Score and Progression	No score. Proceed to next step II.

LEVEL 2 – Ability repeating intoned sentences immediately, Response to a question		
Step 1	Stimulus (Therapist) (T)	**1.Hums** melody with (HT), **2.Intones** sentence with (HT), 3.Signals (C) to join in **unison** intoning of sentence
	Response (Client) (C)	**Intone** sentence **together** with (HT) - **Unison**
	Score and Progression	Acceptable- 1 point. Proceed to Step 2, same sentence Unacceptable - Discontinue progress for sentence.
Step 2	Stimulus (Therapist) (T)	Same as Step 1 But **fades** participation except (HT)
	Response (Client) (C)	**Intone** sentence with (HT) **gradually Solo**
	Score and Progression	Acceptable- 1 point. Proceed to Step 3, same sentence Unacceptable - Discontinue progress for sentence.
Step 3	Stimulus (Therapist) (T)	1.Signals (C) to listen 2.Intones sentence with (HT) 3.Signals (C) to repeat, **Cueing** for initiation of utterance if necessary
	Response (Client) (C)	**Repeat** intoned sentence with (HT) **immediately**
	Score and Progression	Acceptable– 2 point without cue, 1 point with cue Proceed to step 4, same sentence Unacceptable - Discontinue progress for sentence.
Step 4	Stimulus (Therapist) (T)	1.Intones question, "What did you say?" 2.Signal (C) to repeat **Cueing** for initiation of response if necessary
	Response (Client) (C)	**Repeat** intoned sentence with (HT)
	Score and Progression	Acceptable– 2 point without cue, 1 point with cue Proceed to step 1, for next sentence Unacceptable - Discontinue progress for sentence.

APPENDIX 3
(continued)

Melodic Intonation Therapy (MIT) Hierarchy

LEVEL 3 – Ability to the delay of responses by fading Therapist's participation Response to specific questions		
Step 1	Stimulus (Therapist) (T)	1.**Intones** sentence with (HT), 2.Signals (C) to join in **unison** sentence 3. Fade participation except (HT)
	Response (Client) (C)	**Intone** sentence with (HT) **gradually Solo**
	Score and Progression	Acceptable- 1 point. Proceed to Step 2, same sentence Unacceptable - Discontinue progress for sentence.
Step 2	Stimulus (Therapist) (T)	1.Signals (C) to listen 2.Intones sentence with (HT) 3.Signals (C) to repeat after **1 or 2 second Delay** 4. If (C) fails, **Backup** step 1, same sentence ***(B) Back up***
	Response (Client) (C)	**Repeat** Intoned sentence with (HT) after **Delay**
	Score and Progression	Acceptable- 2 point without (B), 1 Point with (B) Process to Step 3, same sentence Unacceptable - Discontinue progress for sentence.
Step 3	Stimulus (Therapist) (T)	1.Intone a related question (e.g. what kind of, How many) 2.Signals (C) to answer 3. If (C) fails, **Backup** step 2, same sentence
	Response (Client) (C)	**Appropriate Answer** (Intoned or Spoken)
	Score and Progression	Acceptable- 2 point without (B), 1 Point with (B) Process to Step 1 for next sentence Unacceptable - Discontinue progress for sentence.

APPENDIX 3
(continued)

LEVEL 4 – Ability of Normal Speech		
Step 1	Stimulus (Therapist) (T)	1.Signal (C) to listen 2.Intone sentence with (HT) 3.Present it twice in Sprechgesang 4.Signal (C) **unison Sprechgesang** of sentence (HT) 5. If (C) fails, **Backup** to present in Sprechgesang 6. Retrial No. 4
	Response (Client) (C)	**Sprechgesang** of sentence with (HT)
	Score and Progression	Acceptable- 2 point with Sprechgesang. - 1 point with Backup - Proceed to Step 2, same sentence Unacceptable - Discontinue progress for sentence.
Step 2	Stimulus (Therapist) (T)	1.Signal (C) to listen 2.Present sentence in **Sprechgesang** with (HT) 3.Signals (C) to repeat after **2 or 3 second Delay** 4. If (C) fails, **Backup** to Step 1 same sentence
	Response (Client) (C)	**Sprechgesang** of sentence with (HT) after **2 or 3 second Delay.**
	Score and Progression	Acceptable- 2 point without Backup - 1 point with Backup - Proceed to Step 3, same sentence Unacceptable - Discontinue progress for sentence.
Step 3	Stimulus (Therapist) (T)	1.Signal (C) to listen 2.Present sentence once in Sprechgesang 3.Present sentence **twice in Normal Speech Prosody** 4.Signals (C) to repeat after **2 or 3 second Delay** 5.If (C) fails, **Backup** to Step 2 same sentence
	Response (Client) (C)	Repeat sentence in **Normal Speech Prosody** after **2 or 3 second Delay**, no (HT)
	Score and Progression	Acceptable- 2 point without Backup - 1 point with Backup - Proceed to Step 4, same sentence Unacceptable - Discontinue progress for sentence.
Step 4	Stimulus (Therapist) (T)	1.Ask question about substantive information on the same sentence. 2. If fail, Backup step 3 same sentence and retrial 3. Ask question about associative information 4. If fail, No backup and retrial if fail one.
	Response (Client) (C)	Answer appropriate responses
	Score and Progression	3 point – bonus point, one or more associative responses 2 point – without Backup, substantive content 1 point – with Backup. Proceed to next sentence.

APPENDIX 4

Spontaneous Speech Measurement Form
On Functional Communication Measure (FCM)

Name of Client:	Session #.
Date	Pre-test / Post-test

Subject is asked to choose the question from the questionnaire sheets
Response limited within 5 min.

Score Summary

1. Total Length of Samples	
2. Total Number of Utterances	
3. Average Length of Utterances	
4. Total Number of Words	

Scoring Hierarchy

1. Total Length of Samples	**Sum of Seconds, including both intelligible and unintelligible words**
2. Total Number of Utterances	**Including paraphasic errors**
3. Average Length of Utterances	**Average number of words for three longest intelligible phrases** **e.g.) 1. I like a ball (4 words)** *** .me too (2 words)** **2. I want to go home (5 words)** **3. I love peanut (3 words)** ***. Lovely (1 word)** **= 4+5+3/3 = 4 (average length of utterances)**
4. Total Number of Words	**Counting intelligible & correct words (Included Nouns, Verbs, Articles, Adjectives, Pronouns, and Preposition)**

APPENDIX 4
(continued)

Spontaneous Speech Measurement Form
On Functional Communication Measure (FCM)

Questionnaire

Question 1:		
Number of Utterance	Subject's responses	Length of Utterances
Total:		Total:

APPENDIX 5

Questionnaire sheet

Spontaneous Speech On Functional Communication Measure (FCM)

What would you like to talk about during conversations?

1. Funny stories about your children
2. Your adventures as a young child/growing up
3. Dating and getting married
4. Being in the military
5. Your worst jobs
6. Your most important job/ career
7. Moving or traveling
8. Hobbies or unique interests
9. Family history/ ancestry/ genealogy
10. Local events
11. Current events
12. Sports
13. Favorite TV program
14. Politics/ the economy/ the government
15. Weather
16. Favorite meals/ restaurants
17. My house/ home town/ things to fix
18. My stroke and/ or other medical issues
19. Religion
20. Favorite movies

(Revised from Aphasia Need Assessment, written by Kathryn L. Garrett & David R. Beukelman, (2005)

APPENDIX 6

Naming Measurement Form
On Functional Communication Measure (FCM)

Name of Client:	Session #.
Date	Pre-test / Post-test

Subject is asked to see the Picture Stimuli Sheets and to answer the names of pictures. Response limited within 5 min.

The list of Name (Client's responses)	*Number of Prompts (by Therapist)*

Total Number of Items Named: .

Average Number of Prompts pet Item Named: .

APPENDIX 7

Hierarchy of Word Retrieval Prompts the Client with Aphasia

Naming Measurement Form
On Functional Communication Measure (FCM)

Ask person to "say _____"

•Ask person to complete a sentence with phonemic cues "You sleep in a be____"

•Less phonemic cues "You sleep in a b___"

•Verbal lead in without phonemic cues "You sleep in a _____"

•State or demonstrate function "You sleep on it..motion sleep, it's a _____"

•State function and supply a carrier phrase

•Direct person to demonstrate function "Show me what you do with it."

•Direct person to state the function "What do you do with it?

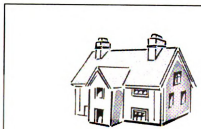
Request the name "What's this?"

APPENDIXS 8

Picture Stimuli Sheets

Naming Test On Functional Communication Measure (FCM)

APPENDIX 8



House

Comb

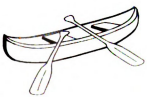
Toothbrush

Octopus

Bench

Volcano

APPENDIX 8
(continued)



Canoe

Beaver

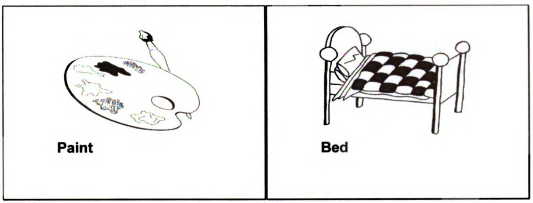
Cactus

Stethoscope

Unicorn

Tripod

APPENDIX 8
(continued)



APPENDIX 8
(continued)

Saw

Helicopter

Broom

Mushroom

Hanger

Wheelchair

APPENDIX 8
(continued)

Camel

Mask

Pretzel

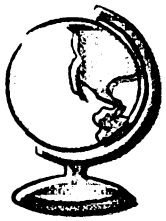
Racquet, Badminton

Snail

Seahorse

APPENDIX 8
(continued)

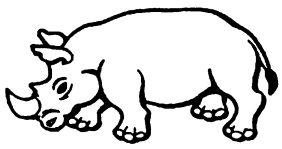
Dart



Globe

Wreath

Harmonica



Rhinoceros

Acorn

APPENDIX 8
(continued)

Igloo

Dominoes

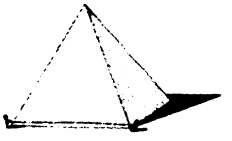
Escalator

Harp

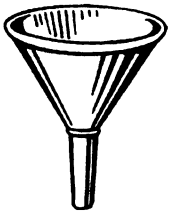
Knocker

Bird, Pelican

APPENDIX 8
(continued)



Pyramid

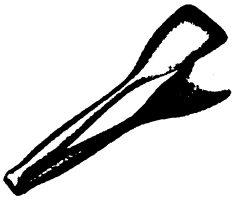


Funnel

Accordion

Asparagus

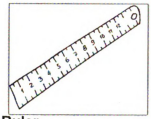
Script, Scroll



Tongs

APPENDIX 8
(continued)

Trellis

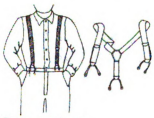


Ruler

Antenna

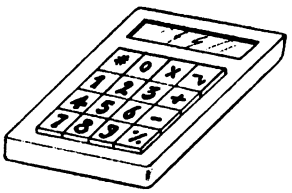
Statue

Crutch



Suspenders

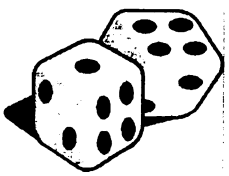
APPENDIX 8
(continued)



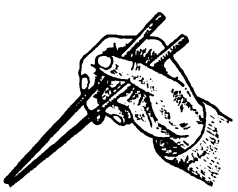
Calculator

Palm, hand

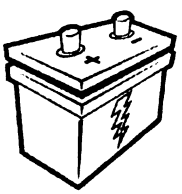
Microphone



Dice



Chopsticks

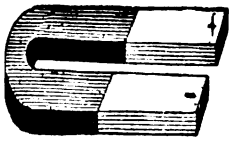


Battery

APPENDIX 8
(continued)

Eyebrow, eye

Binoculars



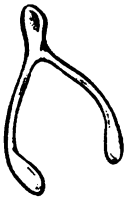
Magnet

Starfish

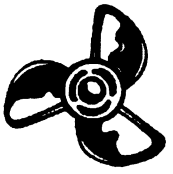
Flim

Backpack

APPENDIX 8
(continued)



Wishbone



Propeller

Pliers

Dustpan

Blimp

Coffee pot

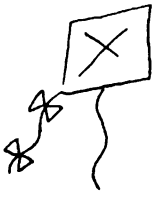
APPENDIX 8
(continued)

Tambourine

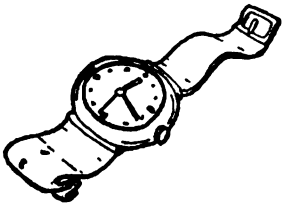
Spatula

Nose

Thumb



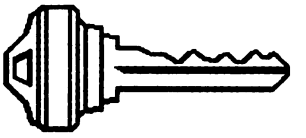
Kite



Watch

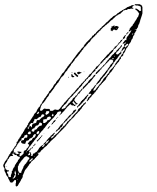
APPENDIX 8
(continued)

Gun, Pistol



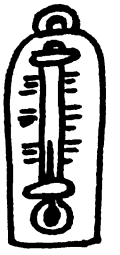
Key

Scissors



Tweezers

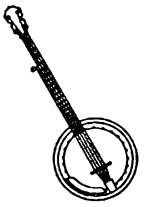
Wrench



Thermometer

APPENDIX 8
(continued)

Typewriter

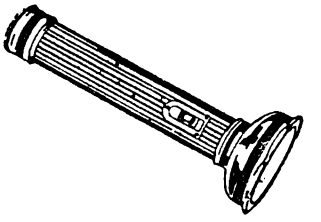


Banjo

Stool

Candle

Ladder



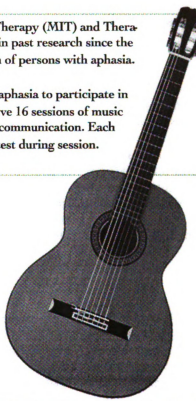
Flashlight

APPENDIX 9

MUSIC HELPS APHASIA
Research Project

The effectiveness of Melodic Intonation Therapy (MIT) and Therapeutic Singing (TS) has been established in past research since the 1970s in improving the speech production of persons with aphasia.

Seeking individuals who have expressive aphasia to participate in research project. Participants would receive 16 sessions of music therapy targeted at increasing functional communication. Each session will include a brief pre- and post-test during session.



Where: MSU Music Therapy Clinic
Home visit Available

Times: 50 min. 16 sessions

Cost: Free

Researcher: Emily YeaJu Rhee

If you have questions, you are encouraged to contact me, rheeyea@msu.edu, 517-643-0631at Michigan State Univ. Music Therapy Department

APPENDIX 10

CONSENT FORM

The Effectiveness of Melodic Intonation Therapy and Therapeutic Singing on Functional Communication Skills for Adults with Expressive Aphasia

You are invited to be in a research study of music therapy about the effectiveness of Melodic Intonation Therapy and Therapeutic Singing on Functional Communication Skills. You were selected as a possible participant because of your diagnosis of expressive aphasia. We ask that you read this form and ask any questions you may have before agreeing to be in the study.

This study is being conducted by YeaJu Rhee who is a graduate student in the music therapy department at Michigan State University.

Background Information

The purpose of this study is to ascertain the effectiveness of Therapeutic Singing and Melodic Intonation Therapy in improving the functional communication skills of adults with expressive aphasia.

The problems to be investigated by this study are as follows: (1) to determine whether Therapeutic Singing (TS) combined with Melodic Intonation Therapy (MIT) helps adult clients who are diagnosed with expressive aphasia as measured by the quality of their functional communication skills; (2) to determine whether MIT treatment itself helps clients improve the quality of their functional communication skills; (3) to compare the effectiveness of TS combined with MIT and MIT alone in increasing functional communication skills; and (4) to investigate whether TS enhances the benefits of MIT treatment.

Procedures:

If you agree to be in this study, we would ask you to do the following things:

The procedures will consist of Melodic Intonation Therapy (MIT) in the first series of sessions and Therapeutic Singing (TS) combined with MIT treatment in the second series of sessions. For MIT treatment, you will be asked to sing and speak selected word phrases with a therapist, and for TS interventions, you will be asked to choose the songs that would like to sing, and participate in singing activity with the therapist. Previous music experience or training is not required for your participation in this study.

Two measurement procedures will be used in a pre-test and post-test for each session: A Functional Communication Measure (FCM) and Melodic Intonation Therapy Measure (MITM). FCM will be composed of two different parts: Spontaneous Speech and Naming. In the Spontaneous speech part, you will be asked to choose the questions you would like to talk about and will have 5 minutes to talk in each pre and post-test. In the Naming part, picture stimuli sheets will be given to identify by name. The MIT measure will be conducted while subjects are participating in the treatment sessions. All sessions will be videotaped for the purpose of data collection.

The intervention period will consist of between 16 and 20 individual or small group sessions, three times or five times a week for 50 minutes, including pre and post-tests. The period will be divided into two different terms of interventions of 9 to 11 sessions each: 1) MIT in first series; 2) TS combined with MIT in second series.

For the purpose of gathering data, every session for every subject will be videotaped. In order to be included in this study each subject must agree to be taped

APPENDIX 10
(Continued)

Risks and Benefits of being in the Study

The study has no known risks at all. Potential benefits are those that arise from participation of enjoyable musical experiences. There may be some gains in functional speech resulting from the treatments though they are not guaranteed.

Confidentiality:

The records of this study will be kept private. In any sort of report we might publish, we will not include any information that will make it possible to identify a subject. Research records will be stored securely in a locked area, and only researchers will have access to the records. The videotapes will be used for the purposes of research, and they will be erased after completion of this research project.

Voluntary Nature of the Study:

Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relationship with any health care facilities or treatment providers. If you decide to participate, you are free to not answer any question or withdraw at any time with out affecting those relationships.

Contacts and Questions:

The researcher conducting this study is YeaJu Rhee. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact me, 517-643-0631, Rheeyea@msu.edu at Michigan State University Music Therapy Department, or Associate Professor Roger Smeltekop, 517- 355-6753, Smeltokop3@msu.edu

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher(s), **you are encouraged** to contact the Michigan State University's Human Research Protection Program at 517-355-2180, Fax 517-432-4503, or e-mail irb@msu.edu or
regular mail at 202 Olds Hall, MSU, East Lansing, MI 48824.

You will be given a copy of this information to keep for your records.

Statement of Consent:
I have reviewed the above information. I have had opportunity to ask questions and have received answers. I consent to participate in the study.

Signature:_____ Date: _____

Signature of parent or guardian:_____ Date: _____

Signature of Investigator:_____ Date: _____

APPENDIX 11

Spoken Language Comprehension

ASHA. (2003). FCMs. National outcomes Measurement System (NOMS): Adult Speech-language Pathology User's Guide.

LEVEL 1: The individual is alert, but unable to follow simple directions or respond to yes/no questions, even with cues.

LEVEL 2: With consistent, maximal cues, the individual is able to follow simple directions, respond to simple yes/no questions in context, and respond to simple words or phrases related to personal needs.

LEVEL 3: The Individual usually responds accurately to simple yes/no questions. The individual is able to follow simple direction out of context, although moderate cueing is consistently needed. Accurate comprehension of more complex directions/messages is infrequent.

LEVEL 4: The individual consistently responds accurately to simple yes/no questions and occasionally follows simple directions without cues. Moderate contextual support is needed to understand complex sentences/messages. The individual is able to understand limited

LEVEL 5: The individual is able to understand communication in structured conversations with both familiar and unfamiliar communication partners. The individual occasionally requires minimal cueing to understand more complex sentences/messages. The individual occasionally initiates the use of compensatory strategies when encountering difficulty.

LEVEL 6: The individual is able to understand communication in most activities, but some limitations in comprehension are still apparent in vocational, avocational, and social activities. The individual rarely requires minimal cueing to understand complex sentences. The individual usually uses compensatory strategies when encountering difficulty.

LEVEL 7: The individual's ability to independently participate in vocational, avocational, and social activities are not limited by spoken language comprehension. When difficulty with comprehension occurs, the individual consistently uses a compensatory strategy.

APPENDIX 12

Spoken Language Expression

ASHA. (2003). FCMs. National outcomes Measurement System (NOMS): Adult Speech-language Pathology User's Guide.

LEVEL 1 : The individual attempts to speak, but verbalizations are not meaningful to familiar or unfamiliar communication partners at any time.

LEVEL 2: The individual attempts to speak, although few attempts are accurate or appropriate. The communication partner must assume responsibility for structuring the communication exchange, and with consistent and maximal cueing, the individual can only occasionally produce automatic and/or imitative words and phrases that are rarely meaningful in context.

LEVEL 3: The communication partner must assume responsibility for structuring the communication exchange, and with consistent and moderate cueing, the individual can produce words and phrases that are appropriate and meaningful in context.

LEVEL 4: The individual is successfully able to initiate communication using spoken language in simple, structured conversations in routine daily activities with familiar communication partners. The individual usually requires moderate cueing, but is able to demonstrate use of simple sentences (i.e., semantics, syntax, and morphology) and rarely uses complex sentences/messages.

LEVEL 5: The individual is successfully able to initiate communication using spoken language in structured conversations with both familiar and unfamiliar communication partners. The individual occasionally requires minimal cueing to frame more complex sentences in messages. The individual occasionally self-cues when encountering difficulty.

LEVEL 6: The individual is successfully able to communicate in most activities, but some limitations in spoken language are still apparent in vocational, avocational, and social activities. The individual rarely requires minimal cueing to frame complex sentences. The individual usually self-cues when encountering difficulty.

LEVEL 7: The individual's ability to successfully and independently participate in vocational, avocational, and social activities is not limited by spoken language skills. Independent functioning may occasionally include use of self-cueing.

APPENDIX 13

Fluency

ASHA. (2003). FCMs. National outcomes Measurement System (NOMS): Adult Speech-language Pathology User's Guide.

LEVEL 1: Fluency is so disrupted that speech is often not functional for communication. Attempts at speech communication are extremely labored in all situations, which renders the speaker virtually unintelligible. Alternative means of speaking are used most of the time. Listeners avoid spoken interaction with the individual.

LEVEL 2: Speech is functional most of the time, but labored in many day-to-day situations due to extended disruptions of speech flow which sometimes render the individual difficult to understand. Participation in vocational, avocational, and social activities requiring speech is reduced overall. Listener discomfort is evident throughout conversational interactions.

LEVEL 3: Speech is functional. Dysfluencies are evident in all situations, but are particularly frequent in problem situations. Vocational, avocational, and social participation requiring speech is occasionally reduced overall, and significantly reduced within what the individual perceives as problem situations. Some listener discomfort is evident throughout interactions.

LEVEL 4: Speech is functional for communication, but there is extreme situational variation. The frequency and severity of disruptions of speech flow within problem situation is distracting most but not all of the time. Vocational, avocational, and social participation requiring speech is limited most of the time in problem situations. Listeners are often aware of fluency difficulty.

LEVEL 5: Speech is functional for communication, and fluency can be maintained in some situations. Self-monitoring is inconsistent. The frequency and severity of disruptions of speech flow within problem situations is distracting some of the time. Speech difficulties are noticeable when they occur, and sometimes limit vocational, avocational, and social activities requiring speech in problem situations. Listeners are occasionally aware of fluency difficulties relative to particular situations.

LEVEL 6: Speech is functional for communication, and fluency can be maintained most of the time. Self-monitoring is consistent. Vocational, avocational, and social activities requiring speech is not restricted most of the time. Listeners are infrequently aware of fluency difficulties even in problem situations.

LEVEL 7: Disruptions in speech flow do not call attention to the speaker, and participation in activities requiring speech is not limited. May include self-monitoring as needed.

APPENDIX 14 & 15

Raw Data Tables
&
Statistics Data Tables
For L' Goal Areas

APPENDIX 14 -1

Subject L's Raw Data of Eight Variables

Subject L's SP test

Session	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*
1-pre	4 m. 27 s.	4 m. 41 s.	5 m. 36 s.	6 m. 3 s.	7 m. 47 s.	6 m. 30 s.	5 m. 19 s.	6 m. 11 s.	6 m. 4 s.	6 m. 55 s.	7 m. 50 s.	6 m. 44 s.	8 m. 17 s.	6 m. 58 s.	7 m. 17 s.	10m. 44 s.
1-post	5 m. 31 s.	8 m. 6 s.	8 m. 10 s.	6 m. 25 s.	7 m. 17 s.	6 m. 2 s.	7 m. 44 s.	6 m. 9 s.	7 m. 18 s.	10m. 36 s.	6 m. 44 s.	9 m. 54 s.	9 m. 3 s.	10m. 34 s.	10m. 13 s.	10m. 50 s.
2-pre	19	24	18	21	18	20	16	18	20	10	17	17	14	15	20	23
2-post	26	28	25	20	26	12	27	20	21	31	17	20	14	20	33	37
3-pre	115	208	225	191	435	288	258	313	314	141	258	208	389	348	418	761
3-post	242	411	385	307	405	293	359	296	399	303	208	355	379	531	577	558
2-1-pre	11	23.7	25	21.7	67	38	33.7	49	33	19.7	29.7	22	54.7	41	48	93
2-1-post	24.3	38	33.7	44	37	56	28	40.7	36	17.3	22	43	50.7	50	59.7	40
3-1-pre	25.8	44.4	48.9	31.6	55.9	44.3	48.5	50.6	51.8	20.4	32.9	30.9	47	50	57.4	70.9
3-1-post	43.9	50.7	47.1	47.8	55.6	48.6	46.4	48.1	54.7	28.6	30.9	35.9	41.9	50.3	56.5	51.5

1. Total Length of Samples, 2. Total Number of Utterances, 3. Total Number of Words,
2-1. Average Length of Utterances, 3-1. Average Number of Words per Minute

Subject L's Naming

Session	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*
1)-pre	3	4	3	4	4	3	6	4	4	4	6	5	4	5	6	7
1)-post	6	6	7	6	7	6	9	6	7	10	10	9	9	11	10	12
2)-pre	1	1.8	2.3	1.3	1.8	2	0.7	1.5	1.75	2	1	0.6	0.5	1.2	0.5	0.7
2)-post	0.5	0.7	0.7	1.2	0.6	0.2	0.6	0.3	0.7	0.7	0.5	0.6	1	0.6	1	0.3

1) Total Number of Items Named
2) Average Number of Prompt per Item Named

Subject L's MIT

session	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*
MIT(%)	53	48	58	67	65	58	63	56	65	62	80	82	75	81	70	86
Level	II	II	II	II	II	II	II	II	II	II	II	II	II	III	III	III

APPENDIX 14 - 2
(Continued)

Subject R's Raw Data of Seven Variables

Subject R's Spontaneous Speech test

Session	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*
1-pre	4 m. 52 s.	6 m. 25 s.	5 m. 30 s.	6 m. 33 s.	6 m. 56 s.	6 m. 29 s.	5 m. 48 s.	8 m. 20 s.	7 m. 47 s.	5 m. 54 s.	6 m. 53 s.	4 m. 33 s.	4 m. 40 s.	4 m. 49 s.	9 m. 4 s.	4 m. 28 s.
1-post	6 m. 51 s.	5 m. 1 s.	8 m. 42 s.	9 m. 45 s.	9 m. 35 s.	6 m. 53 s.	4 m. 20 s.	6 m. 44 s.	9 m. 50 s.	7 m. 13 s.	8 m.	7 m. 23 s.	8 m. 31 s.	6 m. 13 s.	6 m. 42 s.	8 m. 7 s.
2-pre	9	18	16	8	11	12	13	12	16	12	13	11	10	12	13	14
2-post	12	14	10	7	16	11	11	16	19	19	15	13	11	12	19	19
3-pre	128	244	270	208	197	217	238	323	341	189	304	226	152	194	432	203
3-post	240	183	283	233	318	194	224	234	414	237	351	275	366	245	323	370
2-1-pre	29	40.3	36	45	28	43	35.7	82.3	47.7	31	50.7	39	23.7	36.7	71	26.7
2-1-post	41.7	21	58	63	61	32	42	33	52	27	45.7	40.7	65.7	39.7	38	41.7
3-1-pre	26.3	38.0	49.1	31.8	28.4	33.5	41.0	38.8	43.8	32.0	44.7	49.7	32.6	40.3	47.6	45.4
3-1-post	35.0	36.5	32.5	23.9	33.2	28.2	51.7	34.8	42.1	32.8	43.9	37.2	43.0	39.4	48.2	45.6

1. Total Length of Samples, 2. Total Number of Utterances, 3. Total Number of Words,
2-1. Average Length of Utterances 3-1. Average Number of Words per Minute

Subject R's Naming Test

Session	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*
1)-pre	43	46	57	54	35	53	43	38	53	44	48	55	49	32	49	54
1)-post	46	53	63	63	46	59	52	69	52	43	49	55	54	51	59	51
2)-pre	0	0.02	0	0.02	0.14	0.06	0.09	0.05	0	0.05	0.04	0	0.02	0.12	0.02	0
2)-post	0.09	0	0.03	0.02	0.07	0.03	0.06	0.04	0.04	0.05	0.06	0	0.04	0.06	0.05	0

1) Total Number of Items Named
2) Average Number of Prompt per Item Named

APPENDIX 15-1

Subject L's Paired t-test Data For Goal I

(Table 13-1 – The second-half period in L's paired t-test)

Paired Samples Statistics

			Mean	N	Std. Deviation	Std. Error Mean
1.Total Length of Samples	Pair 1	TSMIT_Pre_1	7.6021	8	1.43475	.50726
		TSMIT_Post_1	9.4000	8	1.57735	.55768
2.Total Number of Utterances	Pair 2	TSMIT_Pre_2	17.0000	8	4.07080	1.43925
		TSMIT_Post_2	24.1250	8	8.35699	2.95464
3.Total Number of Words	Pair 3	TSMIT_Pre_3	354.6250	8	188.41591	66.61508
		TSMIT_Post_3	413.7500	8	131.30200	46.42227
4.Average Length of Utterances	Pair 4	TSMIT_Pre_2_1	42.8375	8	23.68127	8.37259
		TSMIT_Post_2_1	39.8375	8	14.47490	5.11765
5.Average Number of Words per Minute	Pair 5	TSMIT_Pre_3_1	45.1625	8	16.25677	5.74764
		TSMIT_Post_3_1	43.7875	8	10.98771	3.88474
6.Total Number of Items Named	Pair 6	Naming_Pre_1_2half	5.1250	8	1.12599	.39810
		Naming_Post_1_2half	9.7500	8	1.48805	.52610
7.Average Number of Prompts per Item Named	Pair 7	Naming_Pre_2_2half	1.0313	8	.57875	.20462
		Naming_Post_2_2half	.6750	8	.23755	.08399

(Table 13-2 – The second-half period in L's paired t-test)

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	TSMIT_Pre_1 - TSMIT_Post_1	-1.79793	1.79794	.63567	-3.30104	-.29481	-2.828	7	.025
Pair 2	TSMIT_Pre_2 - TSMIT_Post_2	-7.12500	7.88194	2.78669	-13.71447	-.53553	-2.557	7	.038
Pair 3	TSMIT_Pre_3 - TSMIT_Post_3	-59.12500	136.11491	48.12389	-172.91991	54.66991	-1.229	7	.259
Pair 4	TSMIT_Pre_2_1 - TSMIT_Post_2_1	2.80000	22.34541	7.90029	-15.88123	21.48123	.354	7	.733
Pair 5	TSMIT_Pre_3_1 - TSMIT_Post_3_1	1.37500	8.39043	2.96646	-5.63957	8.38957	.464	7	.657
Pair 6	Naming_Pre_1_2half - Naming_Post_1_2half	-4.62500	1.06066	.37500	-5.51173	-3.73827	-12.333	7	.000
Pair 7	Naming_Pre_2_2half - Naming_Post_2_2half	.35625	.65978	.23327	-.19634	.90784	1.527	7	.171

(Pair 1) 1.Total Length of Samples, (Pair 2) 2.Total Number of Utterances, (Pair 3) 3.Total Number of Words. (Pair 4) 4. Average Length of Utterances, (Pair 5) 5. Average Number of Words per Minute, (Pair 6) 6.Total Number of Items Named, (Pair 7) 7.Average Number of Prompts per Item Named.

APPENDIX 15-2

Subject L's Paired t-test Data For Goal II

(Table 14-1 – The first-half period in L's paired t-test)

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
1.Total Length of Samples	Pair 1 MIT_Pre_1	5,8207	8	1,06716	,37730
	Pair 1 MIT_Post_1	6,9250	8	1,02412	,36208
2.Total Number of Utterances	Pair 2 MIT_Pre_2	19,2500	8	2,43487	,86086
	Pair 2 MIT_Post_2	23,0000	8	5,37188	1,89925
3.Total Number of Words	Pair 3 MIT_Pre_3	254,1250	8	95,36462	33,71648
	Pair 3 MIT_Post_3	337,2500	8	61,44626	21,72453
4.Average Length of Utterances	Pair 4 MIT_Pre_2_1	33,6875	8	17,71367	6,26273
	Pair 4 MIT_Post_2_1	37,7125	8	9,81114	3,46876
5.Average Number of Words per Minute	Pair 5 MIT_Pre_3_1	43,7500	8	10,10078	3,57116
	Pair 5 MIT_Post_3_1	48,5250	8	3,45243	1,22062
6.Total Number of Items Named	Pair 6 Naming_Pre_1_1half	3,8750	8	,99103	,35038
	Pair 6 Naming_Post_1_1half	6,6250	8	1,06066	,37500
7.Average Number of Prompts per Item Named	Pair 7 Naming_Pre_2_1half	1,5500	8	,53184	,18803
	Pair 7 Naming_Post_2_1half	,6000	8	,30237	,10690

APPENDIX 15-2
(Continued)

Subject L's Paired t-test Data For Goal II

(Table 14-2 – The first half period in L's paired t-test)

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	MIT_Pre_1 - MIT_Post_1	-1.10429	1.51606	.53601	-2.37175	.16317	-2.060	7	.078
Pair 2	MIT_Pre_2 - MIT_Post_2	-3.75000	6.04152	2.13600	-8.80084	1.30084	-1.756	7	.123
Pair 3	MIT_Pre_3 - MIT_Post_3	-83.12500	86.62800	30.62762	-155.54782	-10.70218	-2.714	7	.030
Pair 4	MIT_Pre_2_1 - MIT_Post_2_1	-4.07500	17.51283	6.19172	-18.71609	10.56609	-.658	7	.531
Pair 5	MIT_Pre_3_1 - MIT_Post_3_1	-4.77500	8.27919	2.92714	-11.69658	2.14658	-1.631	7	.147
Pair 6	Naming_Pre_1_1half - Naming_Post_1_1half	-2.75000	.70711	.25000	-3.34116	-2.15884	-11.000	7	.000
Pair 7	Naming_Pre_2_1half - Naming_Post_2_1half	.95000	.64807	.22913	.40820	1.49180	4.146	7	.004

(Pair 1) 1.Total Length of Samples, (Pair 2) 2.Total Number of Utterances, (Pair 3) 3.Total Number of Words. (Pair 4) 4. Average Length of Utterances, (Pair 5) 5. Average Number of Words per Minute, (Pair 6) 6.Total Number of Items Named, (Pair 7) 7.Average Number of Prompts per Item Named.

APPENDIX 15-3

Subject L's Paired t-test Data For Goal III

(Table 15-1. Independent t-test for L's Goal III)

1.Total Length of Samples

2.Total Number of Utterances

3.Total Number of Words

4.Average Length of Utterances

5.Average Number of Words per Minute

6.Total Number of Items Named

7.Average Number of Prompts per Item Named

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Diff_1	1	8	1.1043	1.51606	.53601
	2	8	1.7979	1.79794	.63567
Diff_2	1	8	3.7500	6.04152	2.13600
	2	8	7.1250	7.88194	2.78669
Diff_3	1	8	83.1250	86.62800	30.62762
	2	8	59.1250	136.11491	48.12389
Diff_2_1	1	8	4.0750	17.61283	6.19172
	2	8	-2.8000	22.34541	7.90029
Diff_3_1	1	8	4.7750	8.27919	2.92714
	2	8	-1.3750	8.39043	2.96646
Naming_Diff_1	1	8	2.7500	.70711	.25000
	2	8	4.6250	1.06066	.37500
Naming_Diff_2	1	8	-.9500	.64807	.22913
	2	8	-.3563	.65978	.23327

Group 1 – Post-tests *minus* Pre-tests in the first-half sessions (1st – 8th)
Group 2 – Post-tests *minus* Pre-tests in the second-half sessions (9th -16th)

APPENDIX 15-3
(Continued)

Subject L's Paired t-test Data For Goal III

(Table 15-2. Independent t-test for L's Goal III)

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Diff_1	Equal variances assumed	.646	.435	-.834	14	.418	-.69364	.83149	-2.47701	1.08973
	Equal variances not assumed			-.834	13.612	.419	-.69364	.83149	-2.48179	1.09452
Diff_2	Equal variances assumed	1.449	.249	-.961	14	.353	-3.37500	3.51114	-10.90565	4.15565
	Equal variances not assumed			-.961	13.115	.354	-3.37500	3.51114	-10.95363	4.20363
Diff_3	Equal variances assumed	1.815	.199	.421	14	.680	24.00000	57.04349	-98.34612	146.34612
	Equal variances not assumed			.421	11.871	.681	24.00000	57.04349	-100.43654	148.43654
Diff_2_1	Equal variances assumed	.000	.998	.685	14	.505	6.87500	10.03753	-14.66337	28.41337
	Equal variances not assumed			.685	13.244	.505	6.87500	10.03753	-14.76928	28.51928
Diff_3_1	Equal variances assumed	.141	.713	1.476	14	.162	6.15000	4.16750	-2.78839	15.08839
	Equal variances not assumed			1.476	13.998	.162	6.15000	4.16750	-2.78854	15.08854
Naming_Diff_1	Equal variances assumed	2.011	.178	-4.160	14	.001	-1.87500	.45069	-2.84164	-.90836
	Equal variances not assumed			-4.160	12.196	.001	-1.87500	.45069	-2.85523	-.89477
Naming_Diff_2	Equal variances assumed	.015	.904	-1.816	14	.091	-.59375	.32698	-1.29505	.10755
	Equal variances not assumed			-1.816	13.996	.091	-.59375	.32698	-1.29507	.10757

Group 1 – Post-tests *minus* Pre-tests in the first-half sessions (1^{st}-8^{th})
Group 2 – Post-tests *minus* Pre-tests in the second-half sessions (9^{th}-16^{th})
(Difference-1) 1.Total Length of Samples, (Diff-2) 2.Total Number of Utterances, (Diff-3) 3.Total Number of Words. (Diff-2-1) 4.Average Length of Utterances, (Diff-3-1) 5.Average Number of Words per Minute, (Naming-Diff-1) 6.Total Number of Items Named, (Naming-Diff-2) 7.Average Number of Prompts per Item Named

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