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The Benefits of Therapeutic Horseback Riding on the Expressive Language of Toddlers who Present with Delays

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Abstract

A variety of evidence shows that therapies involving animals, such as dogs and horses, have benefitted individuals with special needs in many areas including physical, cognitive, emotional, and communication skills. However, there is a limited amount of empirical evidence for the benefit of therapeutic horseback riding on speech and language skills. The present study aimed to provide evidence for the efficacy of therapeutic horseback riding as a treatment for toddlers who present with language delays. The treatment group consisted of two children, ages 2;2 and 2;5, who received 6 therapeutic horseback riding lessons over the course of 4 weeks, while one also received speech therapy. The control group consisted of two children, ages 2;4 and 2;8 who did not receive therapeutic horseback riding lessons, while one received speech therapy and the other did not. MLU, Number of Total Words (NTW) and Number of Different Words (NDW) were measured through pre-and post-language samples collected in the childrens' homes. Results showed that all four children made gains, providing insufficient evidence for the efficacy of therapeutic horseback riding as a treatment for language delay. Therapeutic horseback riding may be considered as a supplemental therapy to other traditional therapies such as speech and occupational therapy, on a case by case basis. Additional research is needed regarding the efficacy of therapeutic horseback riding for the treatment of language delays.

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Chapter 1: Introduction and Review of the Literature

Introduction

Speech and language acquisition begins the moment a child is born and continues to develop throughout the lifespan. Developmental milestones help identify children who develop speech and language typically and those who may require speech and language intervention.

All children develop at different stages; however, when a child does not follow the norms of speech and language development, they may have a delay or disorder. Atypical speech or language development is often due to another condition such as a developmental disorder or genetic disease, and is known as a *secondary* condition (Plante, 1998). However, children can also develop language atypically without a co-occurring condition as the cause (Plante, 1998), referred to as a *primary* condition, or *specific language impairment*.

A child may be identified as having a disorder or delay when their speech and language development does not match that of their typically developing peers. By age 1, children should have 2 to 3 words (Loraine, 2008). Between the ages of 1 and 2, there is a spurt of growth and the vocabulary repertoire typically expands to around 20 words (Loraine, 2008). Children are expected to have about 300 words by age 3 and 1500 words by age 4 (Loraine, 2008). That vocabulary repertoire continues to expand and by the time a child is 6 years old, they typically have an expressive vocabulary of 2600 words (Loraine, 2008). Rogers (n.d.) and Paul (1991) reported similar milestones.

It has been found that when children with a disorder or delay do not receive any treatment, they continue to perform below their typically developing peers (Catts, 1993; Johnson et al., 1999). This finding suggests the importance of intervention for individuals with speech

and language disorders. Furthermore, research has demonstrated the importance of early intervention, remarking that the earlier the treatment begins, the greater the likelihood that the child will make gains (Koegel et. al, 2014). The best type of treatment or combination of treatments however, is still, and perhaps always will be, an area of debate and topic of ongoing research.

Although the best treatment may never be known, effective treatments can be found through the use of Evidence Based Practice (EBP). EBP is the use of current and high-quality research, coupled with a professional's own judgment and the client's values and goals, to determine the most appropriate treatment method for an individual (ASHA, 2005). Speech-language pathologists and audiologists (ASHA, 2005), along with other professionals such as social workers (Howard et al., 2003) and occupational therapists (Egan, Dubouluz, von Zweck & Vallerand, 1998) are encouraged to implement EBP, as outlined by the American Speech-Language and Hearing Association (ASHA) and other governing organizations. As such, continuous and varied research is of great need.

Traditional therapies, such as speech and language therapy, have extensive research which documents the efficacy of such methods. A meta-analysis conducted by Law, Garrett, & Nye (2004) evaluated 13 articles and found speech and language therapy an effective method for treating children and adolescents with phonological and/or expressive vocabulary delays or disorders. After review of the studies, Law and colleagues concluded that children who do not receive intervention, have persistent difficulties and those who receive therapy for a longer duration, tend to make more progress (Law, Garrett, & Nye, 2004). The evidence suggests high validity for the implementation of speech and language therapy including phonological and

expressive vocabulary based interventions administered by either trained parents or clinicians (Law, Garret, & Nye, 2004).

Alternative therapies, such as therapeutic horseback riding, however, have a minimal amount of research to support their efficacy. Therapeutic horseback riding (THR) is an equine-assisted activity that focuses on teaching riding skills to people with special needs ("Learn," 2012). For someone with physical, cognitive or emotional challenges, interaction with horses can benefit flexibility, balance, and muscular strength as well as increase confidence, patience and self-esteem ("Learn," 2012). In addition, riding often acts as the precursor to many developmental milestones, such as talking ("Learn," 2012). Given these preliminary findings, further research is needed to quantify the efficacy of therapeutic horseback riding.

In addition to conventional therapy, complementary and alternative medicine (CAM) is a route used by many families with special needs. Hansen et. al (2006) found that about 83 of 112 families of children with Autism Spectrum Disorder, Pervasive Developmental Disorder - Not Otherwise Specified (PDD-NOS), Asperger syndrome, Mental retardation, global developmental delay, learning disability, Landau Kleffner, and/or Fragile X, used CAM. Through a survey approach, it was found that the conventional therapies, including educational techniques (e.g. ABA, TEACCH, Floortime), sensory therapies (e.g. art, dance, music), and prescription drugs (e.g. Adderal, Clonidine, Concerta), were ranked the highest in the area of "helpfulness" or most effective (Hansen et. al, 2006). In addition, about half of the families reported that complementary approaches, including biologically based (e.g. herbs, foods and vitamins), mind-body intervention (e.g. meditation and prayer), manipulation and body based methods (e.g. manipulation and/or movement of parts of the body), energy therapies (e.g. qi gong), and alternative medical systems (e.g. acupuncture/acupressure) to be beneficial as well (Hansen et.

al, 2006). The specific benefits of such complementary and alternative therapies have been found in other studies (Wiedeman-Rouse, 2012; Clock Bell, n.d.; O'Haire, 2013).

An example of alternative therapy involves horticultural activities, which include plant and/or plant materials (Wiedeman-Rouse, 2012). A sixteen week study was conducted to evaluate the effectiveness of horticultural activities on preschool children with challenging behaviors, such as aggression, defiance, and off-task behavior, who had been identified by the classroom teacher (Wiedeman-Rouse, 2012). During teacher interviews, the teachers commented that they felt the horticultural activities had a positive impact on the students (Wiedeman-Rouse, 2012). They reported that the students who were previously characterized as "at risk/challenging behaviors" seemed to be more focused, have a calmer demeanor, were able to stay seated, and were more willing to participate (Wiedeman-Rouse, 2012). The results suggest that alternative therapies such as horticultural activities can be beneficial for the development of young children.

Music therapy, another form of alternative therapy which involves music intervention to help individuals reach their goals (Smith, 2011), was paired with literacy therapy, and was shown to aid in expansion of expressive vocabulary of toddlers (Clock Bell, n.d.). Two children, ages 22 months and 24 months, were found to be delayed given the *MacArthur Communicative Development Inventories: Words and Sentences* (Fenson et al., 2007), as evidenced by having 10-50 words; and the *Preschool Language Scale - 4th Edition* (Zimmerman et al., 2002) as evidenced by having expressive language at least 1 standard deviation below the mean, to assess their expressive language (Clock Bell, n.d.). The participants received either music therapy or literacy therapy, in a cycles or alternating pattern, and received a probe pre-treatment, mid-treatment, and post-treatment (Clock Bell, n.d.). The results found that both participants made gains in the area of expressive language and vocabulary inventory as evidenced by an increase in

the production of target words from pre-treatment to post-treatment baseline (Clock Bell, n.d.). This study suggests that alternative therapies such as music therapy can be beneficial for the speech and language development of young children.

A literature review, conducted by O'Haire, of twelve studies documenting the effects of animal assisted interventions (AAI) showed that in general, therapies including animals, are beneficial for individuals with Autism Spectrum Disorders (ASD). Dogs, horses, guinea pigs, llamas and rabbits were the most common animals used among the twelve studies, and the settings varied from riding centers, to participant's homes, to schools (O'Haire, 2013). O'Haire (2013) found that AAI resulted in increases in the use of language, in frequency and duration of topic maintenance, as well as "significant increases" on standardized scores on formal assessments such as the *Communicative subscale of the Vineland Adaptive Behavior Scales* (Sparrow, Cicchetti & Balla, 2005) and the *Speech/Language Communication subscale on the Autism Treatment Evaluation checklist* (Rimland & Edelson, 1999).

The literature sets up a preliminary basis for the efficacy of therapeutic horseback riding (THR), a form of AAI. However, only a limited number of empirical studies have been conducted.

Herrero and colleagues wrote an article discussing a single-blind stratified randomized control study which investigated if hippotherapy - the use of horses as a modality during speech-language, occupational or physical therapy - improves balance and posture in children with cerebral palsy (Herrero et al., 2012). Thirty-eight children, ages four to eighteen, were randomly placed in an intervention or control group (Herrero et al., 2012). The intervention group received treatment once a week, for fifteen minutes, for ten weeks (Herrero et al., 2012). The treatment consisted of sitting on a hippotherapy simulator while the stimulator was "on in the workout

mode" with active extension of the trunk (Herrero et al., 2012). The control group received a similar treatment regime including sitting on the hippotherapy simulator while the stimulator was switched off (Herrero et al., 2012). After comparing the sitting balance, hip range of motion, electromyographic activity and global motor development of the participants before and after treatment, it was found that hippotherapy does benefit the sitting balance of children with high levels of cerebral palsy (Herrero et al., 2012). This study did not discuss the effects of the gained strength on the participants riding skills or other daily living activities such as speaking.

A similar study by Giagazoglou and colleagues (2012) tested the impact of hippotherapy on the balance and strength of adolescents with intellectual disabilities. A group of 19 adolescents with Intellectual Disabilities were divided into an experimental group of ten and a control group of nine. The experimental group attended a ten week long hippotherapy program and the control group did not receive hippotherapy intervention (Giagazoglou et al., 2012). Through measurement with an EPS Pressure Platform, a device that measures plantar pressures (Becerro de Bengoa Vallejo et al., 2013), or foot and ankle functioning during weight bearing and shifting (Orlin & McPoil, 2000), a significant increase in strength and balance was found in those who received hippotherapy (Giagazoglou et al., 2012). The authors concluded that this improvement could influence functional activities and the overall quality of life (Giagazoglou et al., 2012). This conclusion made by the authors is an assumption that is not connected to the results and what is included in the terms "functional activities" and the "overall quality of life" was not explained. A reader might assume that initiating communication is a functional activity that influences one's quality of life; however, it is not known from this study whether hippotherapy has an impact on one’s ability to initiate communication.

Bass and colleagues hypothesized that children with ASD who received therapeutic horseback riding lessons, would demonstrate improvement in social functioning when compared to those in a control group (Bass, Duchowny & Llabre, 2009). The experimental group, a total of 19 participants ranging from five to ten years of age, took lessons for 12 weeks, riding one hour each week (Bass, Duchowny & Llabre, 2009). The control group, 15 participants ranging from four to ten years of age, did not ride at all. Through use of the *Social Responsiveness Scale* (Constantino, 2002), a questionnaire measuring the severity of ASD and *The Sensory Profile* (Dunn, 1999), a questionnaire administered to parents or teachers, it was shown that children with ASD in the experimental group, had increased sensory integration, directed attention, social motivation and sensory sensitivity (Bass, Duchowny & Llabre, 2009). T-tests were run to determine the significance of the changes across therapy and it was found that the gains made by the treatment group were significant while the changes in the control group were only moderate (Bass, Duchowny & Llabre, 2009). Through listening to directions, verbalizing commands, and identifying shapes and horse anatomy, an improvement in direct attention was also seen in the participants (Bass, Duchowny & Llabre, 2009). Further explanation of how these areas were defined was not included. However, as Bass, Duchowny & Llabre (2009) indicated that direct attention improved as a result of riding, further research should be done to evaluate if these outcomes included increases in other areas of communication such as initiation of communication, turn taking and topic maintenance.

Very few studies regarding the speech and language benefits of therapeutic horseback riding and hippotherapy can be found. Macauly and Gutierrez (2004) conducted a study evaluating the benefits of hippotherapy on children with language-learning disabilities. A sample of three boys, ages nine, ten and twelve, were included in this study to investigate the effects of

hippotherapy on speech and language abilities (Macauly & Gutierrez, 2004). Each participant had been receiving traditional speech and language services since the age of five due to testing results from the *Clinical Evaluation of Language Fundamentals - Third Edition* (CELF-3; Semel, Wiig, & Secord, 1995) that indicated each participant fell at least 1.5 standard deviations below the mean (Macauly & Gutierrez, 2004). A client satisfaction questionnaire was completed by the participant and a parent prior to initiation of the six-week hippotherapy program (Macauly & Gutierrez, 2004). After one hour lessons, twice a week, for six weeks, the participants and parent filled out the same questionnaire (Macauly & Gutierrez, 2004). Sample questions or a further description of the questionnaire was not provided. Both the boys and their parents reported improvement in speech and language abilities after the six weeks of hippotherapy (Macauly & Gutierrez, 2004). Specifically, the overall scores on the satisfaction questionnaire increased from pre-treatment to post-treatment, indicating that the parents and participants found the hippotherapy to be beneficial to the language-learning abilities of the boys (Macauly & Gutierrez, 2004). The small sample of this study makes it difficult to generalize the findings and the means of measurement offers chance for bias as it is not a quantitative measurement of the subjects' language. In addition, the type of language-learning disabilities and the type of improvements were not specifically stated.

The current research on THR has an emphasis on the physical benefits and the benefits for individuals with ASD. Further research regarding the value of therapeutic horseback riding on the speech and language development of individuals with disabilities or delays would produce findings that could direct professionals and families in therapy planning. As therapeutic horseback riding has been proven to offer many benefits for those with special needs, further

studies need to be done to determine how this equine assisted activity and therapy could benefit the areas of speech and language development.

The purpose of this study was to determine the efficacy of therapeutic horseback riding for the increase of expressive language in two year olds who present with delays.

Chapter 2: Methodology

Participants

The present study consisted of a treatment group and a control group. Each group had two participants, for a total of four participants. Participants in the treatment group were recruited from the waitlist at PoVa Therapeutic Riding Center. Participants in the control group were recruited from a five week long early intervention program at The Crimson Center for Speech and Language Pathology. The program, *Parent-Child Sign and Speak*, was designed to help parents and families learn to enhance the communication of their children (Searcy, 2014)

Participants were selected based on set inclusion and exclusion criteria. Inclusion criteria were as follows: between the ages of 24 and 36 months, and present with delayed speech and language as determined by a parent and/or speech language pathologist. Exclusion criteria were as follows: experience with therapeutic horseback riding and have other known conditions/diagnoses.

For the purposes of confidentiality, A1 and A2 will be used to identify the participants in the treatment group, while B1 and B2 will be used to refer to the participants in the control group. A1 and A2 were both female, ages 2;2 and 2;5, respectively. The language spoken in the home was English, and both participants lived with both birth parents, and one sibling. A1's sibling presented with typical development, while A2's sibling had special needs per parent report. Both A1 and A2 had previously received speech and language therapy for receptive and

expressive language, though A1 did not receive speech and language therapy during the study, while A2 did, though frequency and goals are unknown. A1 also received physical and occupational therapy during the study due to physical delays, while A2 did not receive any other therapies. Information such as frequency and goals were not reported. The parents reported that A1 had "poor intrauterine growth in the 2nd trimester" while A2 did not have any prenatal complications. A1 attended preschool during the study. A2's parents did not report if she was in school.

In the control group, B1, female and B2, male were ages 2;4 and 2;8, respectively. The language spoken in the home was English, and both participants lived with both birth parents. B1 also lived with one sibling with special needs, as reported by the parent. B2 did not have any siblings. Both B1 and B2 had previously received speech and language therapy for expressive and receptive language, but were not receiving any other therapies. B1 did not receive speech and language therapy during the study, whereas B2 did, though frequency and goals are unknown. It was reported by their parents that B1 had prenatal complications, she is a twin and had "no fluid at 28 weeks" although the ultrasound showed fluid again "after a few days in the hospital." B2 did not have any prenatal complications. Both participants attended preschool during the study. Table 1 displays information about each participant.

Table 1: Participant Information (Speech-Language-Hearing Case History Form; Super Duper Publications, 2004)

	A1	**A2**	**B1**	**B2**
Group	Treatment	Treatment	Control	Control
Gender	Female	Female	Female	Male

Age	2;2	2;5	2;4	2;8
Race/Ethnicity	Caucasian, Non-Hispanic	Caucasian, Non-Hispanic	Caucasian, Non-Hispanic	Asian or Pacific Islander
Language(s) Spoken in Home	English	English	English	English
Lives with:	Birth Parents	Birth Parents	Birth Parents	Birth Parents
Siblings and Development	1 - Typical	1 - Special Needs	1 - Special Needs	0 - N/A
Previous Speech Therapy	Yes - Expressive & Receptive Language	Yes - Expressive & Receptive Language	Yes - Expressive & Receptive Language	Yes - Expressive & Receptive Language
Current Speech Therapy	No	Yes - Details unknown	No	Yes - Details unknown
Other Therapy	Physical Therapy, Occupational Therapy	None	None	None
Mother Age at Child's Birth	31	40	33	Not Reported
Prenatal Complications	Yes	No	Yes	No
Parental Concerns	Physical: Yes Speech and Language: Yes	Physical: No Speech and Language: Yes	Physical: No Speech and Language: No	Physical: No Speech and Language: Yes

In School	Yes	Not Reported	Yes	Yes

Design

The current research took place over the course of six weeks during the months of July to October. Due to scheduling conflicts, research did not take place during the same six weeks for each participant. See Table 2 for the exact dates. First, the participants' parents completed a Speech-Language-Hearing Case History Form (2004) to gather background information for the purposes of participant comparison, and a vocabulary repertoire to ensure reliability of language sample. The vocabulary repertoire of each participant, either pre or pre and post treatment, can be found in Appendix A. Post treatment vocabulary repertoires were requested but not submitted by the parents of two participants. The researcher then collected a language sample in the participant's home. The activities during the language sample included a parent and the child interacting with familiar toys. A sibling was sometimes present. A1 and A2 then received six therapeutic horseback riding lessons over the course of four weeks. A2 also received three, one hour speech and language therapy sessions. B1 received no therapy for four weeks, and B2 received four, half hour speech and language therapy sessions. After four weeks, another language sample was collected in the same manner. The parents then collected another vocabulary repertoire.

Table 2: Treatment Schedule

	A1 *7/13/2014 - 8/13/2014*	**A2** *7/29/2014 - 8/12/2014*	**B1** *8/25/2014 - 9/23/2014*	**B2** *9/2/2014 - 10/9/2014*
Week 1	Collect Case	Collect Case	Collect Case	Collect Case

	History Form, Vocabulary Repertoire, and Language Sample	History Form, Vocabulary Repertoire, and Language Sample	History Form, Vocabulary Repertoire, and Language Sample	History Form, Vocabulary Repertoire, and Language Sample
Week 2 - 5	6 Therapeutic Horseback Riding Lessons; 30 min each	6 Therapeutic Horseback Riding Lessons, 30 min each; Three 1-hour speech & language therapy sessions	No Therapy or Treatment	Four 30-minute speech & language therapy sessions
Week 6	Collect Vocabulary Repertoire, and Language Sample	Collect Vocabulary Repertoire, and Language Sample	Collect Vocabulary Repertoire, and Language Sample	Collect Vocabulary Repertoire, and Language Sample

Setting

All therapy took place at PoVa Therapeutic Riding Center in southern California. Pre and post data was collected in the childrens' homes.

Materials

Materials used included the Speech-Language Hearing Case History Form (2004) to gather background information for the purposes of participant comparison, and a vocabulary repertoire to ensure reliability of language samples. *Semantic Analysis of Language Transcripts* Software (SALT; Miller, Andriacchi, & Nickerts, 2011) was used to analyze the language samples collected and collect Mean Length of Utterance (MLU), Number of Total Words (NTW), and Number of Different Words (NDW). Mean length of utterance in morphemes (MLUm) is used to measure linguistic maturity (Paul, 2007) and has been found a reliable

measure of general language development (Rice, Redmond & Hoffman, 2006; Rondal, Ghiotto, Bredar & Bachelet, 1987). Watkins, Kelly, Harbers, and Hollis (1995) found that using the Number of Total Words (NTW) and Number of Different Words (NDW) to be a sensitive measure of children's expressive language, specifically lexical diversity (Paul, 2007). Lexical diversity involves having flexible and precise expressive language which allows for effective communication (Paul, 2007). During collection of language samples, the materials used included a video camera and the child's toys present in the home. During therapeutic riding lessons, materials utilized included the horse, appropriate tack (saddle pad, surcingle, bridle...etc.), and items on the sensory trail (bubbles, bean bag toss, stuffed animals, balls...etc.).

Procedure

Therapeutic horseback riding lessons were taught by the researcher, an experienced therapeutic horseback riding instructor preparing for her Certification through PATH and graduate student in Speech-Language Pathology. All lessons were supervised by an Advanced Certified Therapeutic Riding Instructor. Also present in the lesson were two volunteers: a leader to be responsible for the horse, and a sidewalker to help support the rider.

Each lesson followed the typical lesson structure, which consisted of the following:

1) Instructor greeted the rider, helped him/her put on his/her helmet, and help him/her mount the horse.

2) The lessons were 30 minutes long and included some of the following activities:

- Using the reins to steer the horse - this required the rider to nonverbally communicate with their horse by steering them right and left

- Riding in different areas of the property - this requires the rider to communicate his/her desires with the instructor (e.g., using a complete sentence to request, saying one word, or answering a yes/no questions)
- Manipulating objects such as opening/closing gates - this requires the rider to communicate with the volunteer by requesting actions (e.g., using a complete sentence to request that the sidewalker close the gate or signing the word *close*)
- Using materials on the trail such as blowing bubbles and throwing bean bags at the bean bag toss - this requires the rider to communicate with the instructor, horse and volunteer and challenges their fine and gross motor skills (e.g., telling the instructor they want the "fish" bean bag or signing the word *blue* for the blue bubbles)
- Riding in different positions (forwards, sideways and backwards) - this requires the rider to fix and adjust their balance, strength and coordination

3) Throughout the lesson, the instructor encouraged the rider to communicate with the horse, instructor and volunteers as independently as possible. For example, the instructor would instruct the leader to continue walking the horse forward, even if that meant stopping at an object such as a fence, to prompt the rider to steer; or simply looking at a closed gate upon approach to give the rider indirect cues as to what they needed to ask the sidewalker to do. The instructor sang interactive songs (e.g., "If You're Happy and You Know It") that encouraged the rider to be engaged and interactive. The instructor led the rider in activities such as reaching for objects, playing catch with a ball, and opening and closing a mailbox, which challenged the rider's strength and balance.

4) Each lesson concluded with an assisted dismount and feeding of carrots to the horse. The instructor took time to give the parent an overview of the lesson, focusing on the rider's accomplishments, and discussing any gains the parent is seeing in the home.

Analysis

The language samples were transcribed by the researcher and another graduate student in Speech-Language Pathology. The language samples were transcribed beginning at ten minutes into the 30- minute video, to allow the child to warm-up and become comfortable with the camera, and transcribed until 50 utterances/communicative attempts were made. The language sample was then entered into the *Semantic Analysis of Language Transcripts* Software (Miller, Andriacchi, & Nickerts, 2011). A standard measures report was calculated to determine the Mean Length of Utterance by morphemes (MLUm), Number of Total Words (NTW), and Number of Different Words (NDW). MLUm is the average number of words spoken in an utterance, or per breath.

Reliability

Inter-rater reliability was calculated by having a second rater transcribe the language samples. Due to time constraints, the second rater transcribed seven of the eight language samples. Both raters, the first being the researcher, were graduate students studying Speech-Language Pathology. The researcher then compared the two transcriptions of the seven of the eight language samples. The utterances that were transcribed the same by each rater were considered "agreements" and the utterances that were transcribed differently by the raters, were considered "disagreements". Reliability was calculated by dividing the number of agreements by the number of disagreements plus agreements. An overall mean reliability was calculated by averaging the reliability of each of the seven language sample transcriptions. The mean

reliability was 75%. Disagreements consisted mostly of differences in intelligibility (e.g., one rater transcribed a phrase and the other marked it as unintelligible). Other disagreements included extra utterances (e.g., one rater transcribed a phrase and the other did not); and differences in articles (e.g., one rater transcribed "a book" and the other transcribed "the book").

Chapter 3: Results

The goal of this study was to expand on the research documenting the efficacy of therapeutic horseback riding. Specifically, the expressive language of toddlers who were characterized as delayed was evaluated. A total of four children participated. The specific areas of expressive language assessed were MLU, NTW, and TDW gathered from a language sample. A vocabulary repertoire collected by the parents was used to ensure that the language sample was representative of the speech and language observed by the parents across settings.

Vocabulary Repertoire

The researcher compared the vocabulary repertoires collected by each of the participant's parents to the language samples gathered. For example, the research compared the types of communication and the length of utterances in the vocabulary repertoire and the language sample gathered. For example, participant A1 used vocalizations, word approximations and signs to communicate in the pre-language sample. Similarly, her mother reported through the vocabulary repertoire that A1 did not use any complete words at home. This was completed for all four participants. It was found that the speech and language recorded by the families was similar to the speech and language gathered in the language sample. This indicated that the language samples gathered were representative of the child's abilities.

Mean Length of Utterance

Mean length of utterance in morphemes (MLUm) is used to measure linguistic maturity (Paul, 2007). For the purposes of this study, MLUm was calculated at baseline and post treatment. A 30-minute video was collected in the participant's home with familiar toys, a parent, and sometimes a sibling. The video was transcribed by two graduate students, beginning at ten minutes, and continued until 50 utterances were transcribed. Utterances included meaningful vocalizations and gestures or signs that were clear means of communication. The language samples were inputted into SALT and a standard measures report was gathered.

In the treatment group, participant A1 had a pretreatment MLU of 1.25 and a post treatment MLU of 1.27. A2 had a pretreatment MLU of 1.16 and a post treatment MLU of 1.22. Using reference group data from Miller and Chapman (1981) and the equation *z-score = score-mean/SD*, z-scores were calculated for each data point, a means of standardizing the raw score, or MLU, by age (Schriberg et al., 2010). When a z-score is found to be less than or greater than 1 standard deviation (SD) from the mean of the sample group, it is indicative of a reason for concern (Shriberg et al., 2010). When compared to four children of the same age, plus or minus 1 month (Miller & Chapman, 1981), participant A1 had a z-score of -2.25, indicating an MLU of 2.25 SD below the mean. When compared to 6 children of the same age, plus or minus 1 month (Miller & Chapman, 1981), participant A2 had a z-score of -2.78, indicating an MLU of 2.78 SD below the mean. A1 did not demonstrate an increase in MLU from pre to post treatment. A2 had an increase in MLU from pre to post treatment, although not enough to result in a z-score less than 1 SD from the mean. The results can be seen in Table 2.

In the control group, participant B1 had a pretreatment MLU of 1.88 and a post treatment MLU of 2.39. B2 had a pretreatment MLU of 1.42 and a posttreatment MLU of 2.13. Z-scores were calculated same as the treatment group. When compared to four children of the same age,

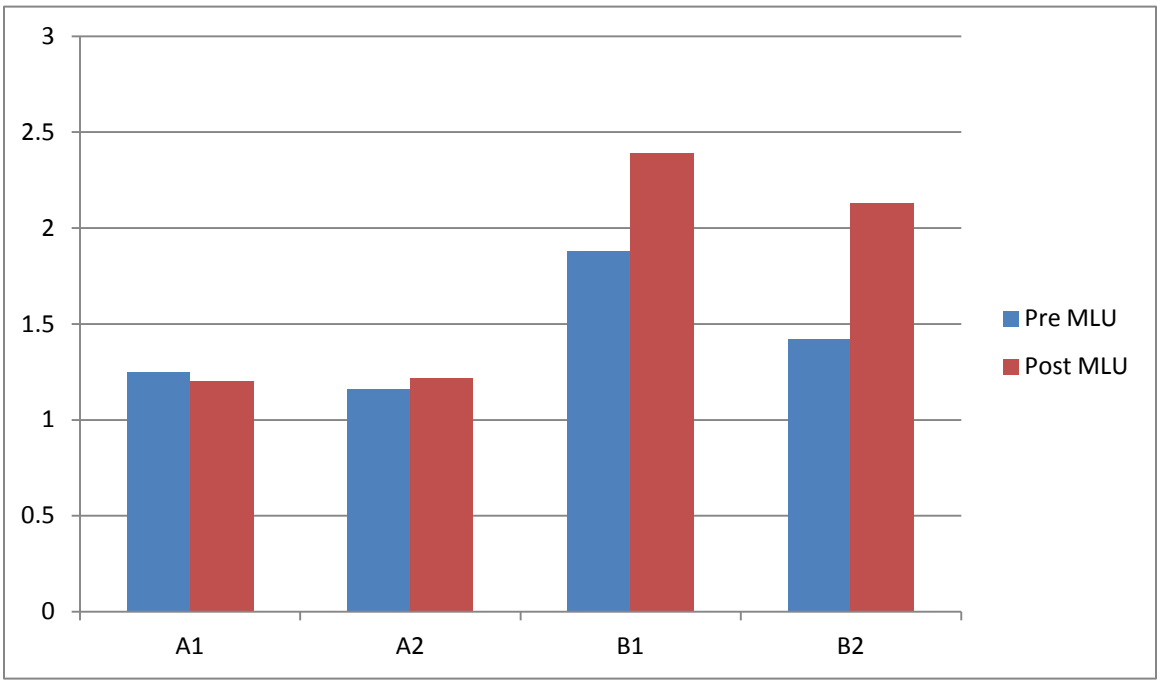
plus or minus 1 month (Miller & Chapman, 1981), B1 had a z-score of -1.02, indicating a SD 1.02 below the mean. When compared to eleven children of the same age, plus or minus 1 month (Miller & Chapman, 1981), B2 had a z-score of -1.98, indicating a SD 1.98 SD below the mean. Both participants in the treatment group demonstrated an increase in MLU length from pre to post, resulting in z-scores within 1 SD of the mean, or within the average range. The results can be seen in Table 3.

The participants in the treatment group, A1 and A2 demonstrated -0.10 and 0.10 changes in z-score from pre to post, respectively. The participants in the control group, B1 and B2 demonstrated 1.00 and 1.12 changes in z-score from pre to post, respectively. On average, the participants in the control group made greater gains in the area of MLU, than those in the treatment group. Table 3 displays the pre and post MLU of all participants, as well as the correlating z-scores. The results can be seen in Table 3.

Table 3: Pre and Post MLU by participant, z-score calculated from reference sample (Miller and Chapman, 1981): z score = score-mean/SD

Participant	**Age (months)**	**Sample Mean MLU (SD) (Miller & Chapman, 1981)**	**Pre MLU**	**Pre MLU Z-Score**	**Post MLU**	**Post MLU Z-Score**
A1	26	2.40 (.51)	1.25	-2.25	1.20	-2.35
A2	29	2.75 (.57)	1.16	-2.78	1.22	-2.68
B1	28	2.40 (.51)	1.88	-1.02	2.39	-0.02
B2	32	2.67 (.63)	1.42	-1.98	2.13	-0.86

Graph 1: Pre and Post MLU by participant



Number of Total Words and Number of Different Words

Watkins, Kelly, Harbers, and Hollis (1995) found that using the Number of Total Words (NTW) and Number of Different Words (NDW) to be a sensitive measure of children's expressive language, specifically lexical diversity (Paul, 2007). Lexical diversity involves having flexible and precise expressive language which allows for effective communication (Paul, 2007). Using SALT (SALT Software, LLC, 2013), the NTW and NDW was calculated from the pre- and post treatment language sample for each participant.

In the treatment group, participant A1 had a total of 5 words prior to treatment. When compared to 6 children ages 28 to 33 months (Hoerning & Retherford), with an average of 140 total words, A1 had a z-score of -7.86, which is 7.68 SD below the mean. Post treatment, A1 had 12 words, a z-score of -7.45 and was 7.45 SD below the mean. When compared to the same sample, participant A2, with 52 total words pre treatment, had a z-score of -5.12, which indicates

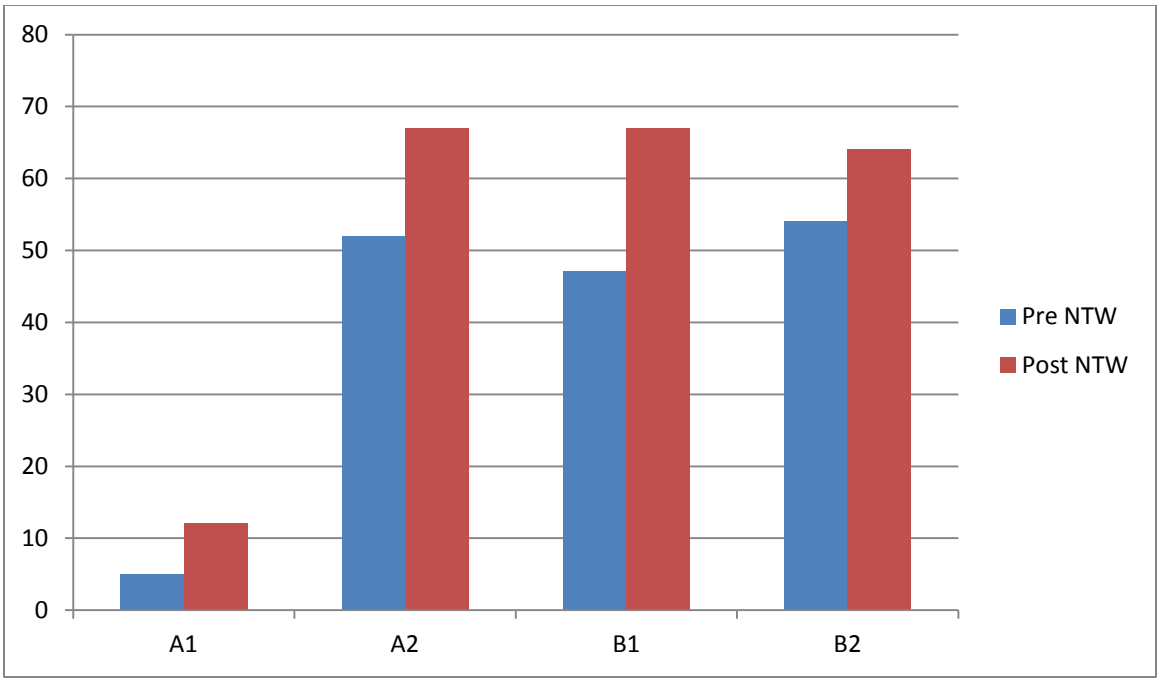
a 5.12 SD below the mean and 67 total words post treatment, a z-score of -4.25 and was 4.25 SD below the mean.

In the control group, participant B1 had a total number of 47 words prior to treatment. When compared to 6 children ages 28 to 33 months (Hoerning & Retherford), with an average of 140 total words, B1 had a z-score of -5.41, which indicates 5.41 SD below the mean. Four weeks later, B1 had 67 words, a z-score of -4.25 and was 4.25 SD below the mean. Participant B2, had 54 words pre treatment and 64 words post treatment with a z-score going from -5.01 to -4.42 and SD moving from 5.01 below the mean to 4.42 below the mean. The results can be seen in Table 4.

Table 4: Number of Total Words; z-score calculated from reference sample mean: 140 (Hoerning & Retherford)); z score = score-mean/SD

Participant	**Pre NTW**	**Sample Mean (SD) (Hoerning & Retherford)**	**Pre NTW z-score**	**Post NTW**	**Post NTW z-score**
A1	5	140 (17.18)	-7.86	12	-7.45
A2	52	140 (17.18)	-5.12	67	-4.25
B1	47	140 (17.18)	-5.41	67	-4.25
B2	54	140 (17.18)	-5.01	64	-4.42

Chart 2: Pre and Post NTW by participant



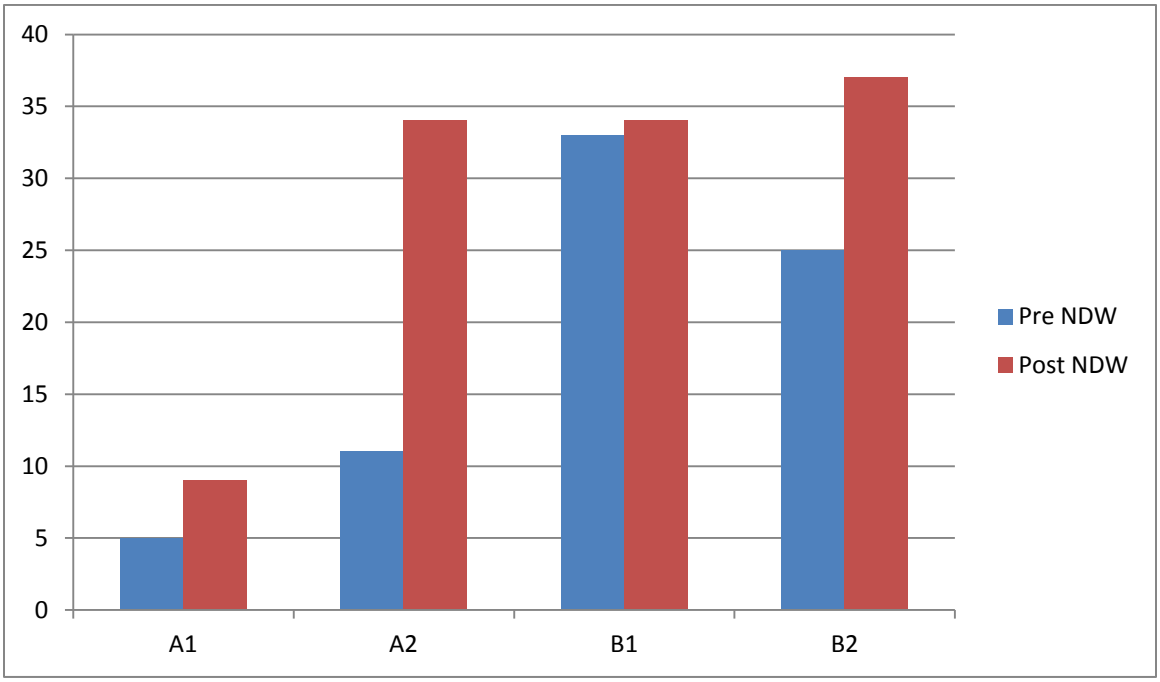
In the treatment group, participant A1 had 5 different words prior to treatment. When compared to 6 children ages 28 to 33 months (Hoerning & Retherford), with an average of 62.2 different words, A1 had a z-score of -8.51, which is 8.51 SD below the mean. Post treatment, A1 had 12 different words, a z-score of -7.91 and was 7.91 SD below the mean. When compared to the same sample, participant A2, with 11 different words pre treatment, had a z-score of -7.61, which indicates a 7.61 SD below the mean and 34 different words post treatment, a z-score of -4.19 and was 4.19 SD below the mean.

In the control group, participant B1 had 33 different words prior to treatment. When compared to 6 children ages 28 to 33 months (Hoerning & Retherford), with an average of 62.2 different words, B1 had a z-score of -4.34, which indicates 4.34 SD below the mean. Four weeks later, B1 had 34 different words, a z-score of -4.19 and was 4.19 SD below the mean. Participant B2, had 25 different words pre treatment and 37 different words post treatment with a z-score going from -5.53 to -3.75 and SD moving from 5.53 SD below the mean to 3.75 SD below the mean. The results can be seen in Table 5.

Table 5: Number of Different Words; z-score calculated from reference sample mean: 62.2 (Hoerning & Retherford)); z score = score-mean/SD

Participant	**Pre NDW**	**Sample Mean (Hoerning & Retherford)**	**Pre NDW z-score**	**Post NDW**	**Post NDW z-score**
A1	5	62.2 (6.72)	-8.51	9	-7.91
A2	11	62.2 (6.72)	-7.61	34	-4.19
B1	33	62.2 (6.72)	-4.34	34	-4.19
B2	25	62.2 (6.72)	-5.53	37	-3.75

Chart 3: Pre and Post NDW by participant



Chapter 5: Discussion and Conclusions

The results of this study did not generate clear evidence for or against the efficacy of

therapeutic horseback riding for toddlers who present with language delays. Specifically, participants in both the treatment and control group made gains. The significance of these gains could not be measured due to sample size.

Change from pre to post treatment was evaluated by measurement of MLU, NTW and NDW. One of the two participants in the treatment group made gains in the area of MLU while both participants in the control group had increases in MLU. Both participants in the treatment group and both participants in the control group had increases in NTW and NDW.

Initially, all four children were at least one SD below the norm in each of the three areas, indicating a delay. Although each participant made gains overall, the participants in the treatment group remained in the below average range in all three areas at the end of treatment. In the control group, both the participants went from the below average range to the average range in the area of MLU, but remained in the below average range for NTW and NDW.

Overall, the gains of the participants in the control group were greater than those of the treatment group. Specifically, in the area of MLU, the treatment group made an average increase of 0.03 SD while the control group made an average increase of 1 SD. As MLU has been found a reliable measure of general language development (Rice, Redmond & Hoffman, 2006; Rondal, Ghiotto, Bredar & Bachelet, 1987), the difference in these gains is of interest. For example, Yoder, Molfese & Gardner (2011) found a different pattern. They used MLU to measure the efficacy of two grammatical treatment approaches, broad target recasts (BTR) and milieu language teaching (MLT). It was found that MLT resulted in greater increases in MLU for children who initially had a lower MLU (Yoder, Molfese & Gardner, 2011). On the contrary, findings of the present study found the opposite; children who began with a lower MLU made less gains than those who initially had a higher MLU. Possible explanations for this difference

may include the difference in sample size. Yoder, Molfese & Gardner (2011) had a sample size of 57 preschoolers whereas the present study had only 4. As such, the comparison study (Yoder, Molfese & Gardner, 2011) may have had participants, and therefore results, more representative of the population. In addition, it is unclear what constituted a "low" or "high" MLU, meaning that the participants in the present control group who had a "high" MLU in relation to the present treatment group, may have still been in the "low" MLU group had they been in the comparison study.

In the measure of NTW, the treatment group made an average increase of -0.085 SD and the control group made an average increase of 0.87 SD. In the area of NDW, the treatment group made an average increase of 0.55 SD while the control group made an average increase of 0.88 SD. The significance of these difference could not be measured due to sample size. Therefore, it is unknown if the difference between the gains made by the control group were significantly more than those made by the treatment group.

As determined by calculation of MLU, NTW and NDW, the participants in the treatment group were initially lower linguistically than those in the control group. On average, A1 and A2 had MLUs 0.97 SD below those of B1 and B2; NTW 0.96 SD lower than B1 and B2; and NDW 0.33 SD below that of B1 and B2. It may be hypothesized that the lower numbers representative of the the participants in the treatment group at the beginning of treatment were indicative of an unidentified disorder resulting in delayed language. Further assessment and research would need to be done to determine the affect this may have had on the gains made.

Previous literature suggests that therapeutic horseback riding is a beneficial therapy for individuals with special needs. The present study was designed to add to the existing evidence. Macauly & Gutierrez (2004) showed that parents and participants noted gains made by children

with language-learning difficulties. The present study added to these findings by identifying potential areas in which gains may be seen. The results of the present research indicated gains in the areas of MLU, NTW and NDW. In addition, Smith (2011) found that a different alternative therapy, music therapy, resulted in an increase in expressive language and vocabulary. The present study found similar results when using therapeutic horseback riding. Further research could indicate other areas of speech and language that may benefit from therapeutic horseback riding as well as other alternative therapies which may benefit speech and language.

In addition to the quantitative data gained from this study and previous literature, informal measures, including observation and parent report, also demonstrate increases in language as a result of riding. The researcher noted an increase in the treatment group's motivation and ability to imitate simple sounds and words. This was also reported by the participants' parents. A2's mother reported that her child does not get frustrated as easily when trying to communicate and has had fewer breakdowns since she began riding. The mother of participant B2, who did not receive therapeutic horseback riding but did receive speech and language services reported that she saw an increase in her child's imitation and vocabulary as he was no longer using non-words to label items. The mother of participant B1, who did not receive any treatment, reported that she did not see any changes in her child's speech and language.

Follow up with the mother of participant A1, who continued to receive both therapeutic horseback riding lessons and speech therapy, showed a continuation of gains. Seven months following the study, A1's mother reported that she was putting two words together, imitating often, and using language spontaneously.

Limitations

The short time frame in which this study took place creates a limitation for the results crediting therapeutic horseback riding. It may be hypothesized that given therapeutic horseback riding lessons for a great length of time would result in continued and greater gains. As parent and staff testimonials at PoVa Therapeutic Riding Center suggest that greater gains are often achieved over a longer period of time, further research could document these claims.

In addition, the current study has low external validity as the small sample size may not be representative of the population of children with delayed speech and language. As such, general conclusions made from this study may not be applicable to all children with delayed speech and language.

The presence of and severity of the participants' delays were not measured by a standardized assessment prior to the study. Rather, the participants were chosen based on informal measures. Three of the four participants were reported to be delayed by the parent, and the fourth participant was judged to be delayed through observation of a speech-language pathologist. All four participants displayed below average performances in the areas of MLU, NTW, and NDW when the initial language sample was collected. As a formal assessment was not used to determine the child's level of functioning prior to research, the participants in the control group may not have been a proper match to the children in the treatment group.

A factor that could not be accounted for was the length, frequency, and type of speech therapy that A2 and B2 received. As a result, the effect of the outside speech therapy on the participants' gains and it's correspondence with therapeutic horseback riding could not be measured.

Lastly, the current researcher is a graduate student. Her limited knowledge and experience conducting research may have influenced the findings.

Conclusions

In therapeutic riding lessons, the rider is challenged to communicate (either verbally or nonverbally) with the instructor, volunteers and horses. As the instructor responds when the rider has communicated (for example, the instructor will not open the gate until the rider has communicated the request) and the leader does not guide the horse until the rider has communicated to it (for example, the leader will not ask the horse to walk on until the rider requests it to do so), the rider learns that their communication has an effect. It may be expected that as the rider learns to communicate during their lessons, this would cross over to other aspects of life, resulting in an overall increase in language.

Additional research needs to be done to provide further quantitative evidence regarding the efficacy of therapeutic horseback riding for the increase of expressive language. Results from the present study should be considered with caution and on a case by case basis.

Appendix A

7/13 Sunday afternoon to 7/14 Monday morning

Vocabulary Inventory

meaning	vocalization	whole word	gesture	
up	uh ✓✓✓		✓✓✓✓✓	
bug	by ✓			
ant	ah ✓			
book			✓✓✓✓✓✓	
bye			✓✓✓✓	spontaneous ✓
eat			✓✓✓✓	
I love you			✓	
milk			✓	
brush teeth			✓	
good morning	guh			
Dada	dah			
more	muh ✓✓		✓✓✓✓✓	
mama	mama ✓✓			
pant like a dog		✓✓		
roar like a lion		✓		
kitty	kiyee ✓✓✓✓			
meow	eeow ✓✓			
help			✓	
egg	~~g~~	✓		
girl	gu			
bunny			✓✓	
brocolli	boc ✓✓			
dada		✓		

Child: Dates: 8/7/14 - 8/13/14

Intent/Meaning	Complete Word	Vocalization	Gesture
Mine		"me me"	
Hi	Hi		
Kitty	Kitty		
Isaac	Isaac		
Mommy	Mama/mommy		
yes			✓
no			✓
eat			✓
drink			✓
more			✓
stop			✓
go			✓
up	✓		✓
spider			✓
bug	buh →		
baa (sheep noise)	bah →		
dog	duh →		
book			✓
choo-choo			✓
hop	hoh →		✓
meow	(meow)		
horse noise	(vashemy noise)		
bear noise	(growl)		
dog noise	(pants)		
owie (when hurt)	owie		
Daddy	Dada		
Nana		Nono/Noni	
28 good job			claps
That		dat	
outside			✓
more eat (together)			✓
more book (together)			✓
~~Mine~~		~~me me~~	

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Vocabulary Repertoire

added to prior list

Child: A2

8/12 - 8/13

Intent / Meaning	Word	Vocalization	Sign / Gesture
Blueberry		Ba Ba	
Blue Bell			
Help		Ha	Fist on palm
Up		Ah	Point up
Bath		Baba	
Her name		Ah	points to self
Letter O		O	
Letter A		Ah	
Go		"oh"	(with visual prompt)
counting		"dah"	vocalizes while pointing
five		"dah"	shows 5 fingers
Book		"B"	+ does sign
Letters of alphabet		names by sound: B, T, D, F, P, M	

Child: Dates: 7/20 -

Intent/Meaning	Complete Word	Vocalization	Gesture
NO	✓	✓	Also signs
YES			NODS
Mama	✓	✓	
~~DaDa~~ Daddy	✓	Dah-Dah	
Bear			scrakhos shoulders
milk			grasping hand
cracker			hand in elbow
sandwich			hands clasped
zoo / elephants			arm up like trunk
frog			2 fingers under chin
eat			fingers to mouth
juice			bent arm
Banana		nana	
potty			wave T & closed fist
Horse			index finger on forehead
spider		~~ah da~~	flutter fingertips together
All done (vocalization is NEW)		ah da	wave hand
Go		grunt +	point finger
Thank you			sign
please			sign
Sorry			sign
cow		mmm +	point to object
pig			point to nose
hi + bye			waves
one			one finger
two			holds 2 fingers together
four			shows four fingers
five			" five
more		"mo-e"	
play			waves both hands
owl		owa	
lion		ahhh	
uh-oh		oh no	
help			grasp one hand & other
clock		t-t-t	

Child: Dates: _____ - _____

Intent/Meaning	Complete Word	Vocalization	Gesture
man fixed the wall			
I run in the rain			
I try that			
mommy brush my hair			
waffles		faffles	
mommy's eating strawberry yogurt			
I pooped			
I go downstairs			
pink shopping cart			
Abby Cadabby			
brother needs a haircut			
Charlie needs milk			
hummus and quesadilla			
I go play with my friends			
That's a big doggy			
it's good			
I want a piece of watermelon			
a big watermelon			
black cat is gone			
Daddy's ~~sup sups~~ Dip Dops are on		sup sups	

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Child. ...tes: _____ - _____

Intent/Meaning	Complete Word	Vocalization	Gesture
	Play	Pay	
	moon	moon	
	yucky	yuty	
	Potty	potty	
	Poopy	poopy	
	Night Night	night night	
	Bye Bye	" "	
	more	moo	
	were home		
	help me		
	yes, no		
	ok		
	battery		
	moo moo		
	I did it		
	mine		
	me		
	mommy, daddy		
	baby, ouch		
	eat		
	Play with me		
	watch choochoo		
	~~[illegible]~~ my seat		
	~~[illegible]~~ bath time		
	turtle		
	No turtle daddy		
	Elmo		
	where?		
	me hide		
	hot		
	phone		
	your phone		
	~~[illegible]~~ bed room		
	clean-up		
	bannana		
	yummy		
	apple/apple juice		
	water-~~[illegible]~~		
	outside		
	Bee, fly, bat		
	up please		

...reen means go
...ed means stop

yummy toothpaste
baby, puppy, meow meow
big, car, jump
...a rando...

down please
excuse me
Thank you
I love you

Fax
858-486-7887

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