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Effects of Imitation Therapy for Non-Verbal Children with Autism in Zambia

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Abstract

As infants develop, the skill of imitation typically emerges. This skill serves an important cognitive and social function in a child's development (Ingersoll, 2011) and is essential for the development of language. Unfortunately, many children with autism (CA) have demonstrated deficits in imitation skills, and they show a general failure to understand relationships and communicate (Heinmann et al., 2006). Some initial studies have suggested that teaching the skill of imitation to CA leads to improvements in their social functioning, language, joint attention, and spontaneous gesture use (Ingersoll, 2008; Ingersoll & Schreibman, 2006). A specific imitation therapy intervention developed by Zedler (1972) resulted in increased verbalizations for non-verbal children who did not imitate (Gill et al., 2011). Unfortunately, there is no data to demonstrate that this technique has been used with children in Zambia, and, in fact, there is very little data or research on treatment of non-verbal CA in Zambia (Kabali et al, 2019; Nyoni & Serpell, 2012). This study attempted to ascertain preliminary data on the treatment of CA in Zambia. It involved utilization of imitation therapy with three young children with suspected autism who were non-verbal. Effectiveness of the intervention was measured by counting the changes in the number of different phonemes, the total utterances, the number of non-verbal imitations, and the number of reciprocal verbal imitations produced by the children. For these three children, the intervention resulted in significant changes in all areas. This preliminary study suggests that imitation therapy may be an effective intervention for non-verbal CA in Zambia.

Keywords:

Imitation, autism, joint attention, verbalizations, language development.

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Introduction

Imitation, a skill that emerges at a very young age, is vital for learning to communicate and for the development of many other skills (Meltzoff & Moore, 1977; Stern, 1985; Uzgiris, 1981). However, many studies have shown that the ability to imitate others is lacking in children with autism (CA) and that this is correlated with a lack of language development (Penney & Schwartz, 2019; Radhakrishna, 2010;Rogers, 1999; Rogers & Pennington, 1991; Sigman & Ungerer, 1984; Williams et al. 2004). The role of imitation, an essential one for language and social functions, appears to be significantly impaired in many children with autism.

Study Significance

Research suggests that early interventions that target increasing social communication skills for children lead to enhanced use of language and improved communication outcomes (Fuller & Kaiser, 2020). Further, the high incidence of autism, the fastest-growing developmental disorder (National Autism Association, 2020), demands that early and effective intervention be available for CA with significant deficits in imitation. In Zambia, while the incidence of autism is not specifically known (Wonani&Muzata, 2019), the children who have been diagnosed or are suspected of having autism, have received little to no social-communicative interventions because of few speech-language pathologists (SLPs) in the country (Peele, et al, 2020). An intervention pioneered in the United States called Zedler's Imitation Therapy (ITZ) has been used for non-verbal children who did not imitate, and the results showed that imitation skills for the children improved, and verbalizations increased (Gill et al., 2011). Unfortunately, there is no evidence to demonstrate that this technique has been used in Zambia. Considering the scarcity of SLPs and the suspected rise of cases of autism, it may be beneficial to determine if ITZ will improve imitation skills and increase utterances in non-verbal children with autism in Zambia.

Imitation Therapy

Contaldo et al. (2016) noted that behavioral studies that were done earlier suggest that adult's imitation of children's actions could be an efficacious tool to enhance social gaze orientation, play skills, and adjacent social behaviors. Researchers concluded that the "being imitated" strategy encouraged social engagement in CA. This offers a possible early intervention for social skills development. Other clinical studies have shown that adults imitating children and vise-versa during play improves imitation skills, awareness of being imitated and non-verbal communication in CA (Field, 2017).

A specific imitation therapy protocol, developed by Zedler (ITZ, 1972) promoted increased imitation skills when the children were imitated by others, and the children eventually recognized that their actions and vocalizations were powerful (Gill et al., 2011). ITZ for non-verbal children who did not imitate was based on the premise that this treatment created an awareness in the child of his ability to impact others, provided a positive way for the child to direct other people's actions, and provided (via verbal imitation) a reinforcement

of the child's verbalizations. Gill et al. (2011) utilized the ITZ with five children, ages 18-19 months, who were non-verbal and who did not imitate, in a clinical setting with speech-language pathologists. Following 8 weeks of bi-weekly treatment, all of the children exhibited increases in the number of sounds produced and number of spontaneous verbal imitations. In addition, they found that several spontaneous word-forms emerged.

The ITZ has several stages, which overlap during the intervention. Initially, the therapist is the imitator of all movements and sounds the child makes. Once the child has begun to notice that he is being imitated, the therapist reduces the imitation of large movements and imitates the child's voice, mouth and hands. Finally, reciprocal imitations are explored, whereby, the therapist initiates a word or sound previously produced by the child, then if the child imitates it, the therapist imitates him back. ITZ can be broken into three general steps that can overlap.

ITZ Initial Step

The therapist sets the room with pairs of identical toys to begin with. The selection of toys varies from session to session so that the child remains interested. Mirrors are posted on the walls of the room within the child's line of sight. The goals at this stage are that a child should be able to realize that he isin control and can deliberately manipulate the therapist's behavior. The therapist imitates everything that the child does—gross motor movements and any sounds or vocalizations produced by the child. If the child picks a blue car, the therapist picks the matching blue car and plays with it exactly the way the child plays with it. If the child decides to take the toy from the therapist, the therapist also reaches out to take the other toy from the child to institute a toy exchange. If the child decides to sit on the carpet, the therapist follows and sits the same way. This imitation excludes all negative behaviors like banging the head, crying, hitting, biting, or scratching. At this stage, the child takes the lead, and the therapist follows.The goal of stage one has been reached when the child demonstrates the realization that he isbeing imitated and that he can manipulate the therapist's behavior by his actions. Then stage 2 begins.

ITZ Second Step

The goal of this stage is that the child should imitate the therapist's movement of articulators or vocalizations and facial movements, and reciprocal imitation should begin. Imitation in this stage is limited to vocalizations, hand movements, and the child's articulators only. The therapist does not imitate gross motor movements like walking around, jumping, or lying on the floor. The therapist remains more stationary and sits in front of a mirror. The therapist imitates movements of the child's articulators and verbalizations, and then occasionally inserts a sound the child has previously made. If the child comes to join the therapist and imitates either or both of the articulatory movements and vocalizations, the therapist immediately goes back to imitating the child's hands, articulators, and vocalizations. The therapist tries to tempt the child's attention to the mirror, and face-to-face positions are attempted frequently. Occasional lip popping sounds, clapping, or "uh" sounds are produced and if the child attempts to imitate those, the therapist imitates the child and then continues to

imitate the child's hand movements, sounds, and articulators. Any additional sounds that the child produces are imitated by the therapist, and this serves as reinforcement of the sounds. If the child imitates the sound back, this is considered reciprocal imitation. Leadership roles are exchanged in this stage: the child takes the lead, the therapist imitates, the therapist takes the lead, the child imitates, and vice versa. This stage ends when reciprocal imitation of gesture and/or sound is established, or when leadership roles are transferred between the two.

ITZ Final Steps

The goal of this stage is to increase the number of times a sound is produced and increase the different phonemes the child will produce. The therapist limits the imitation to vocalizations only and attention is drawn to the mirror. Pictures of animals or family members are taped on the mirror and the child's attention is drawn to them while the therapist occasionally produces compatible syllables to the picture matched with an action or a toy. If the child imitates the syllable, the therapist reciprocates (restates the same sound), and if not, then the therapist goes back to imitating the child. The therapist takes the lead to occasionally initiate different types of sounds and phonemes so that the child can imitate them. If the child does imitate, reciprocal imitation is commenced, and the focus is on sound-concept pairings, such as dropping a toy and saying "uh-oh". No pressure is placed on the child to imitate if he does not. If the child imitates the therapist, he is rewarded by the therapist resuming imitation of him. ITZ ceases when the child easily and regularly imitates the therapist's vocalizations.

Methods and Materials

Intervention took place in a clinical setting and the study utilized an ABA design. The clinical setting included a room with minimal distractions other than the mirrors and toys. Twenty pairs of identical toys were used during the intervention, starting with four pairs, then they were changed depending on the child's response and interests. Six 12 by 12-inch mirrors were placed on the walls around the room at the child's eye level.

Study Design

This study used a single case design. Participants were assessed on the changes in their individual skills and were not compared to each other. The study consisted of three phases and data was collected for each: pre-intervention baselines (two times), intervention (20 sessions), and maintenance (two times after intervention). Visual inspection of the data was used to determine the direction and amount of change, and Cohen's modified *d*-statistic was employed to determine the effect size of the changes.

For three children with suspected autism in Zambia, the specific objectives were:

1. To determine the change in the number of utterances produced by the child.
2. To ascertain the change in the number of non-verbal imitations enacted by the child.
3. To determine the change in the number of reciprocal verbal imitations produced by the child.

4. To calculate the change in the types of phonemes produced by the child.

Participants

Three children between two and fouryears of age who were at risk for autism were recruited for the study from a special needs school in the Lusaka district. At risk for autism in this study was determined by screening the child using the Autism Behavior Checklist Form of the Autism Screening Instrument for Educational Planning – Third Edition (ASIEP-3) (Krug et al., 2008), parental response to interview questions, and observance of language, play, and interactions between the child and the parent. The children's hearing was adequate for speech reception, as determined by an informal hearing screening.The participating children were minimally verbal, meaning that they produced less than two word-forms, such as "uh" to mean "up". All the children came from families who spoke English astheir first language. The parents of all the children confirmed the absence of any known comorbidity and the children had not received any form of intervention before the study. Table 1 shows the participants' demographic information and ASIEP scores.

Table 1

Participant Demographic and ASIEP-3 Scores

Participant	Sex	Age	ASIEP-3
E.C.	M	2.4	Very Likely
J. R.	M	3.3	Very Likely
N.K.	M	4.3	Very Likely

Note. Age = Years. Months; ASIEP-3 = Autism Screening Instrument for Educational Planning – Third Edition

Procedures

After explaining the procedures and obtaining informed consent, the parents were asked questions from the Autism Behavior Checklist Form which was part of the ASIEP-3. The characteristics identified by the parents were further confirmed by the therapist by observation of interactions during informal play sessions.

After stable baselines had been established, the intervention took place for 20 sessions in total, 30 minutes per session, three times per week. After the ITZ sessions were concluded, the therapist recorded two sessions to determine if newly learned skills were maintained in the absence of treatment one and two weeks after the conclusion of the intervention phase.

Results

Positive changes were noted in all areas investigated for each of the children. The number of utterances was calculated by counting the total number of speech sounds that occurred throughout the entire session. For example, if the child said "mama go get me," that was counted as 11 total verbal sounds produced. Non-verbal imitations were tallied when the child copied hand or body movements, such as standing up or putting the hands together. The changes in reciprocal verbal imitation occurred when the therapist imitated something the child had said and the child said it again after the therapist. The fourth measure addressed the number of different phonemes that the child could produce. Thus if the child said "mama go get me," this was counted as seven different phonemes: /m/, /a/, /g/, /o/, /e/, /t/, /i/.

Summary of Participants

E. C.

At the beginning of the intervention, E.C. was 2 years, and 4 months old. He displayed

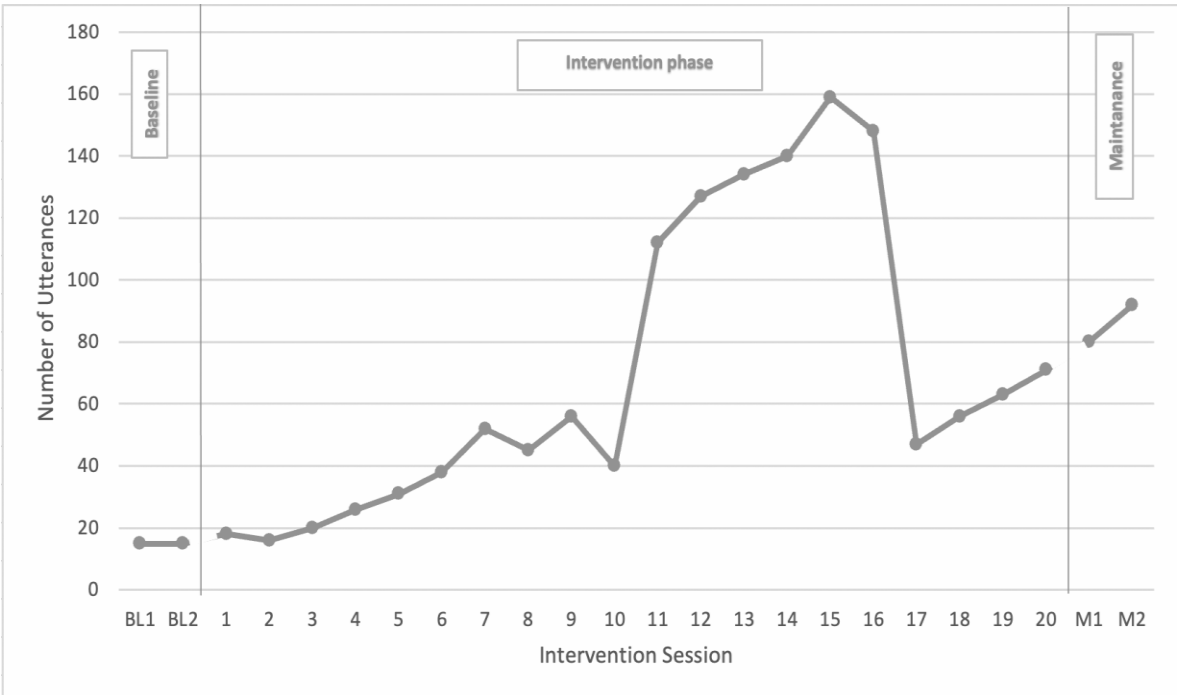
characteristics consistent with autism including lack of eye contact, lack of awareness that someone was there with him, wanting to keep toys to himself and not share, lack of attention, lack of intelligible words, lack of imitation and verbal or non-verbal communication, and hyperactivity.

Changes in the Number of Utterances. During the baseline sessions, E.C. was very quiet and frequently hummed to himself. He did not interact with his mother or respond to her calls. He cried the moment she tried to take or share any toys with him. He produced occasional jargon sounds and none of those were intelligible. As the intervention progressed, E. C. became more verbal, andut terances and different phonemes started increasing. After the 16th session, E.C. was absent for a full week, after which the parents reported that they had taken him for a surgical repair of his "tongue-tie." Following this, there was a drastic drop in performance in most areas with E. C. He did not seem to be in pain, but he was not as verbal as he had become before the tongue-tie surgery. Despite the dramatic drop in productions after the surgery, E.C. began to again increase utterance production. His final score of 92 utterances ended up far above his baseline score of zero. Cohen's modified *d*-statistic demonstrated a large effect size in utterance production. Cohen's modified *d* or *d*-statistic is used to measure the effect size between pre-intervention means and post-intervention means. The equation normally would be: $(M_{\text{post-intervention}} - M_{\text{baseline}}) / SD$ of baseline phase. In this case, a *SD* of the baseline phase for the participants was not possible because both values for baseline measures 1 and 2 had the same values. Instead, the *SD* for the intervention phase was used as a pseudo-effect size: $(M_{\text{post-intervention}} - M_{\text{baseline}}) / SD$ of intervention phase. Effect sizes greater than 1 indicates that the difference between the post-intervention and baseline means were greater than 1 *SD* (a large effect size). For E.C.'s changes in the number of utterances, effect size calculated with Cohen's modified *d*-statistic was 1.484962499. This indicates that the intervention was correlated with an extremely large

improvement of E.C.'s frequency of sound productions across the sessions. See Figure 1 for graphing of utterances.

Figure 1

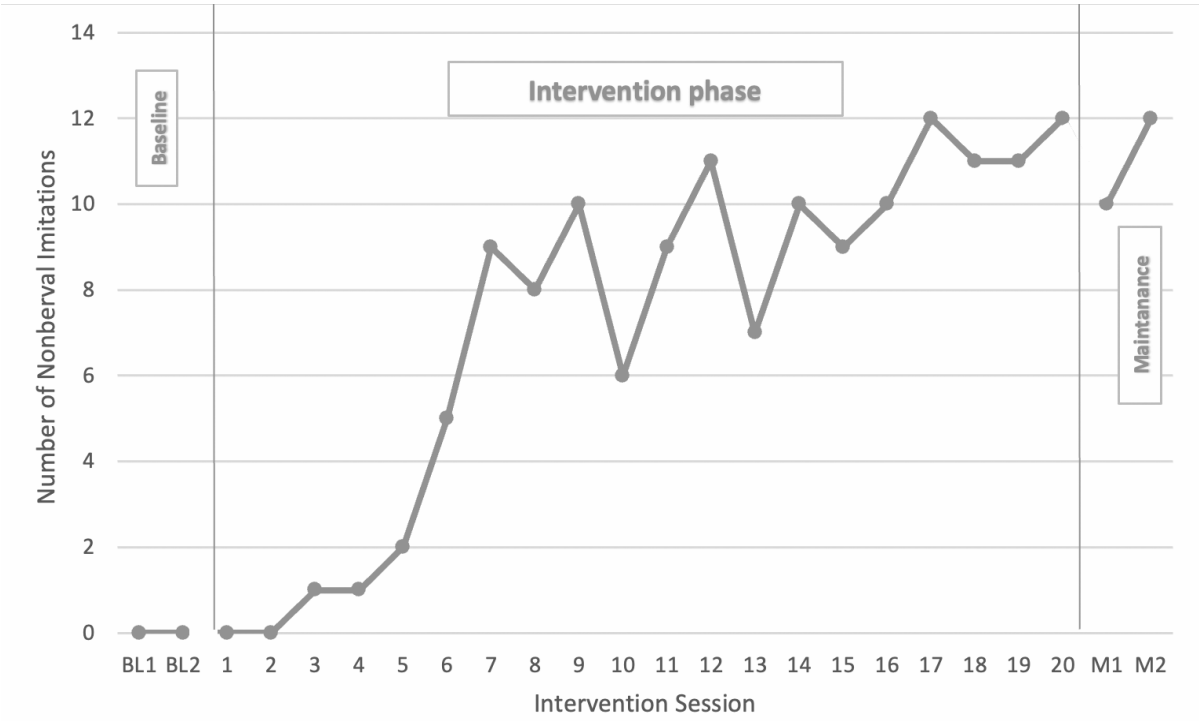
Number of Utterances Produced by E.C.



Changes in the Number of Non-Verbal Imitations. E. C. was hyperactive and he did not show concern that there was someone with him in the room. He preferred to play alone, but he showed particular interest in the mirror and he frequently gazed at it to look at himself as he produced sounds and hummed to himself. With the use of the mirror mainly, he began to notice and imitate gestures of the hands and the face. He gradually noticed that his motions were being imitated, and he began to occasionally imitate the therapist's motions. E.C. changed from zero imitations at the beginning to 12 at the end of treatment. Effect size calculated by Cohen's modified *d*-statistic ($M_{post\text{-}intervention} - M_{baseline}$)/ *SD* of intervention phase for the non-verbal imitations was 2.611113214. See Figure 2 for the data on non-verbal imitations.

Figure 2

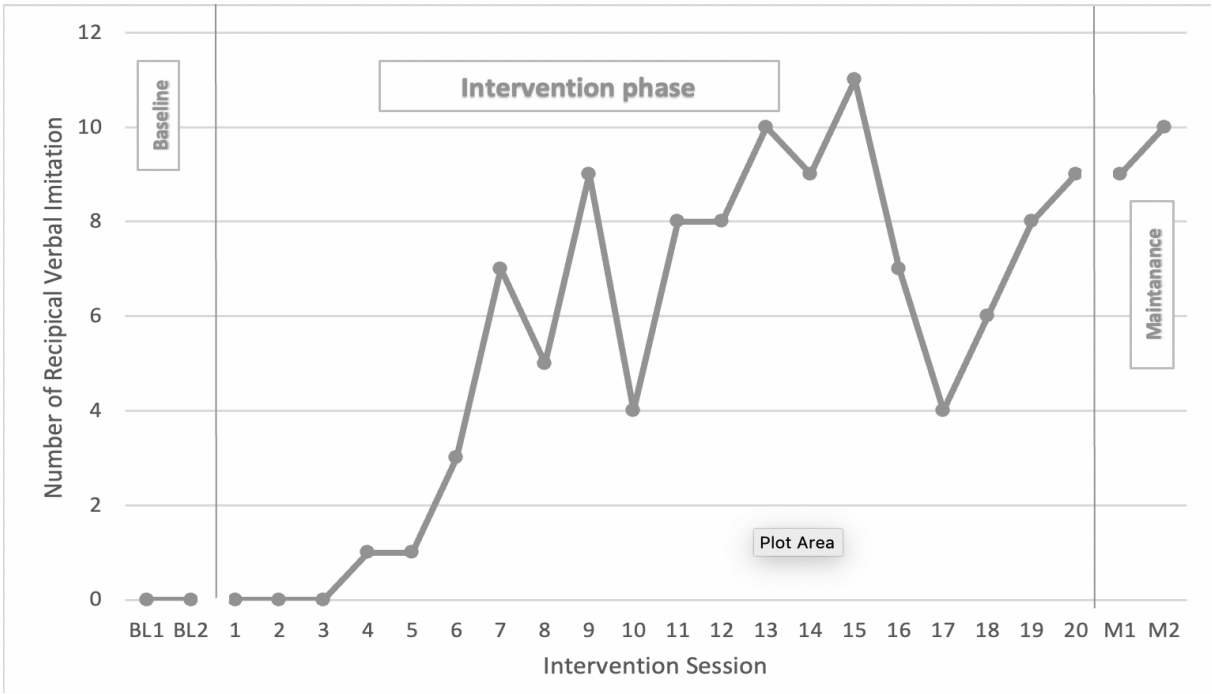
Number of Non-Verbal Imitations Enacted by E.C.



Changes in the Number of Reciprocal Verbal Imitations. Imitation of verbalizations is essential to language production. From the baseline, E. C. did not seem to pay attention to what his mother said or did. He did not imitate any sound or word that was said to him. During the intervention, there was a rise in his ability to imitate sounds and words from 0 at the beginning to 9 at the end of the intervention, with an increase up to 10 in the maintenance period. The drastic drop of utterances that was noticed during the 17th session was similar to that seen in his utterance and phoneme decreases. Following the drop, his imitations almost returned to his highest production, which was 11. The drop might be attributed to the tongue surgery that he had as well as the discontinuation of intervention for a week. However, non-verbal imitation was not affected because he continued to copy what he saw through the mirror and on the table. This suggests that perhaps there was some residual pain or reluctance to use his articulators. Cohen's *d*-statistic indicates a large effect size. Effect size for reciprocal verbal imitations was 2.603395472. See Figure 3 for a graphing of the reciprocal verbal imitations.

Figure 3

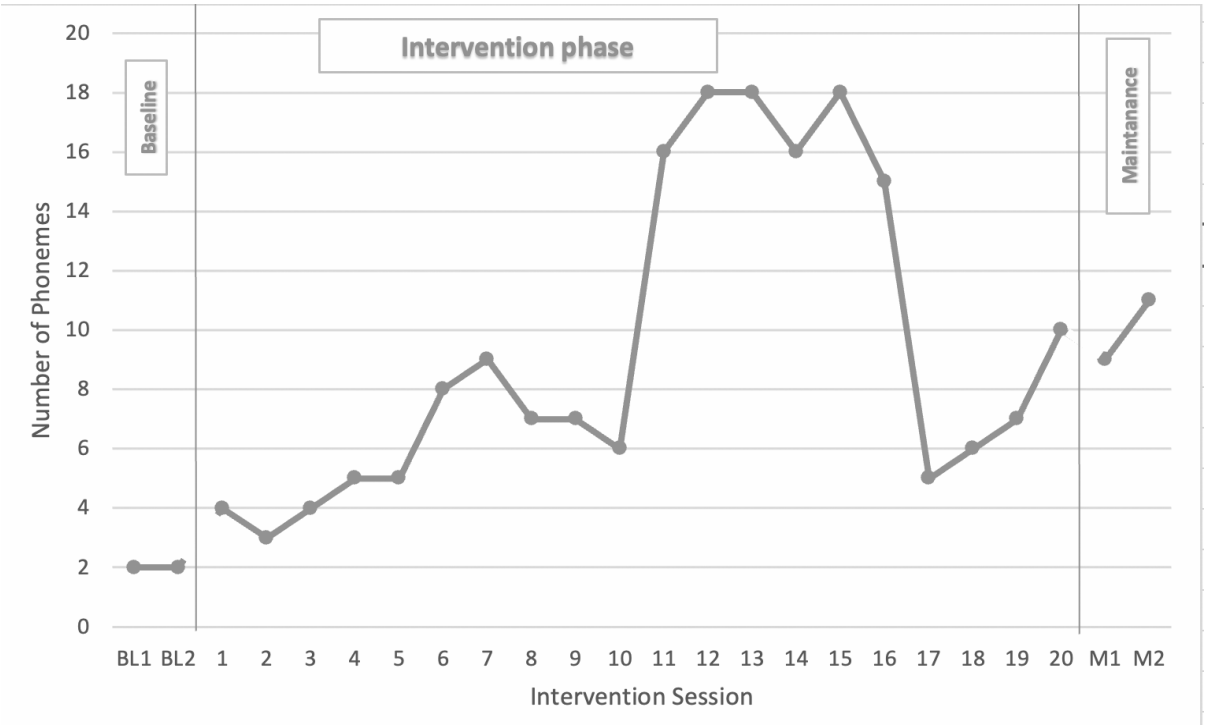
Number of Reciprocal Verbal Imitations Produced by E.C.



Changes in the Number of Different Phonemes. There was an improvement in the types of phonemes E. C. was able to produce. As he became more verbal, he was able to produce many different speech sounds. He could produce two different phonemes at the beginning and increased that to 18 in Session 12. The number of different phonemes produced dropped to five after the tongue surgery but he was able to return to production of 10 phonemes by the end. Cohen's *d*-statistic demonstrates a large effect size (1.499854), in this area also.See Figure 4 for a graphing of the number of phonemes produced throughout the intervention.

Figure 4

Number of Different Phonemes Produced by E.C.



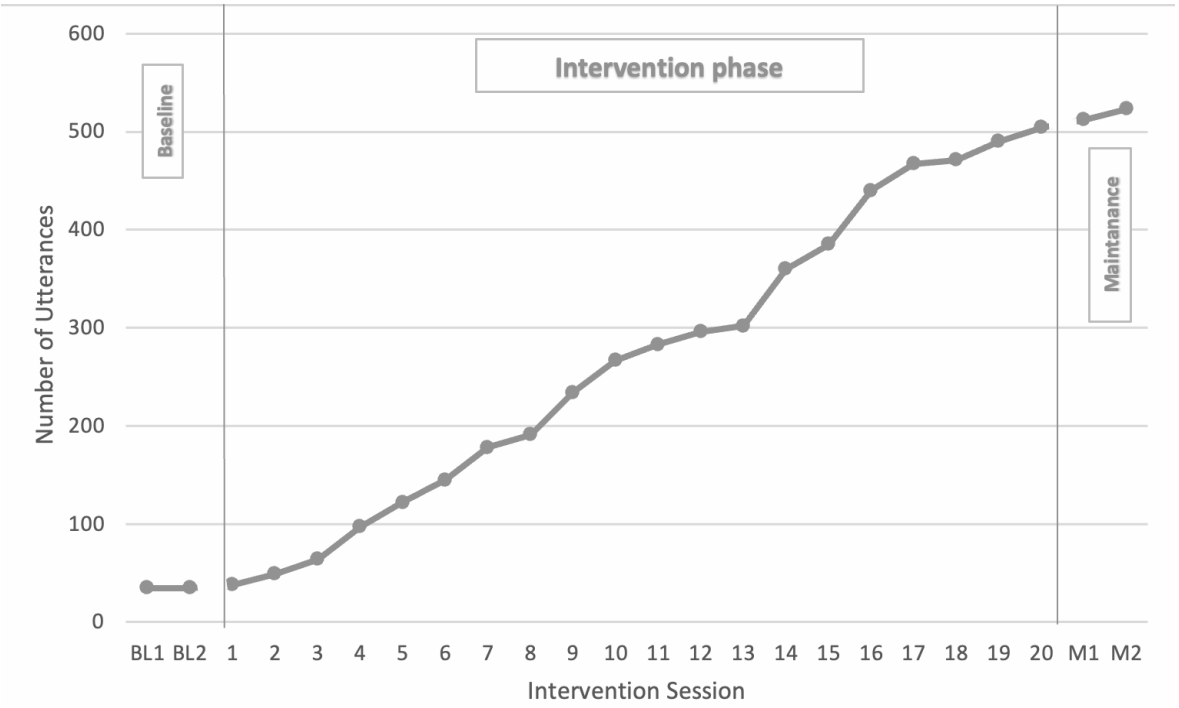
J.R.

J.R., a boy who was 3 years, and 3 months old at the beginning of the intervention displayed characteristics consistent with autism. Initially he was very hyperactive, did not play with any other toys apart from farm animal toys which he played with the same way over and over by getting them from his mother and lining them up in a particular order. He had no eye contact, made no attempts to communicate, did not turn when his name was called, scattered toys, and tore books. He did not sit down and he continuously ran from one end of the room to the other keeping his head leaning forward most of the time. He walked on tip-toe and he would bite unexpectedly. He preferred to play alone, and he would abruptly produce one utterance such as "uh" while playing, though it was not used to communicate.

Changes in the Number of Utterances. Initially, J. R. did not verbalize frequently with sounds that were not recognizable words nor were they used to communicate. He uttered single sounds and strings of soundsthat did not seem to be associated with any object or meaning. Initially, he produced 35 utterances and by the end of the intervention, he produced 512. As the sessions progressed, his utterances contained some jargon and occasional words and phrases. He gave communicative eye contact as he appeared to ask for toys in jargon and occasionally intelligible words. As utterances increased, his hyperactivity reduced. Cohen's

modified *d*-statistic was used to measure the effect size between pre-intervention means and post-intervention means. The effect size was very large (3.090841956) for J.R.'s number of utterances. See Figure 5 for a graph of utterances produced throughout the intervention.

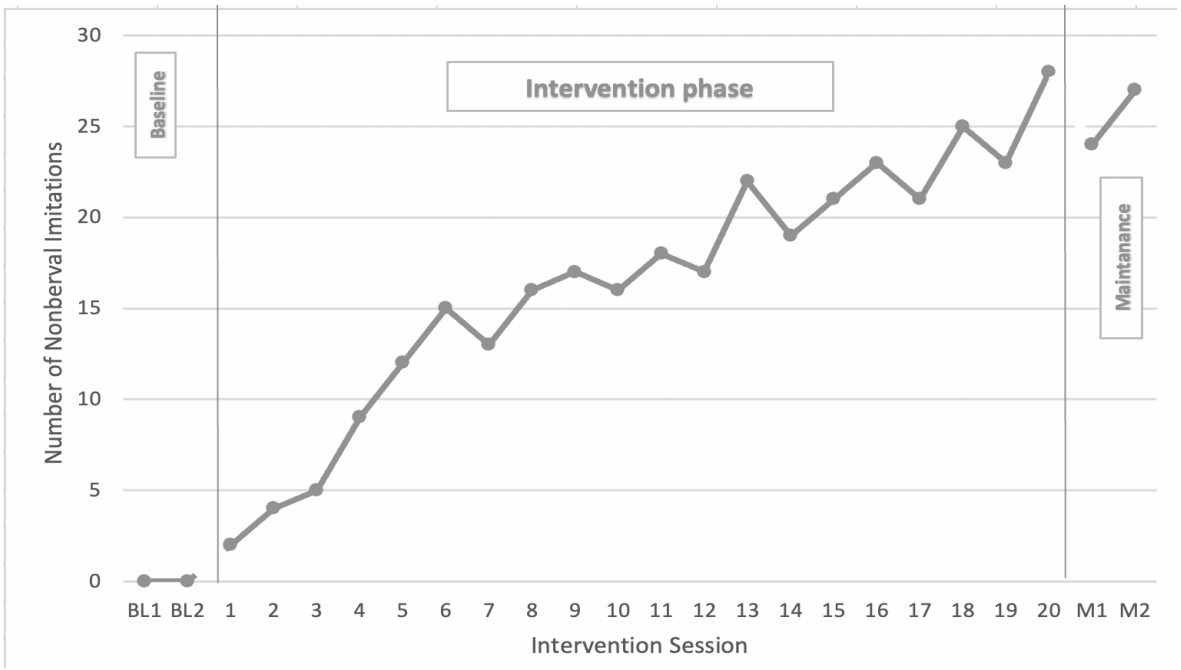
Figure 5 *Number of Utterances Produced by J.R.*



Changes in the Number of Non-Verbal Imitations. During the baseline sessions, J. R. was very hyperactive and this distracted him from imitating both verbal and non-verbal actions. He only wanted to line up farm animal toys on the floor the same wayover and over. During the intervention, the specific animals that he preferred were not used during the early sessions of the therapy. He gradually began to notice that thetherapist was imitating his movements and began to imitate her with increasing frequency. His ability to imitate gestures and facial expressions increased from 0 to 27 as the intervention progressed. Cohen's modified *d*-statistic was used to calculate the effect size, which was 3.590780827 for the number of non-verbal imitations. See Figure 6 for a graph of his non-verbal imitations.

Figure 6

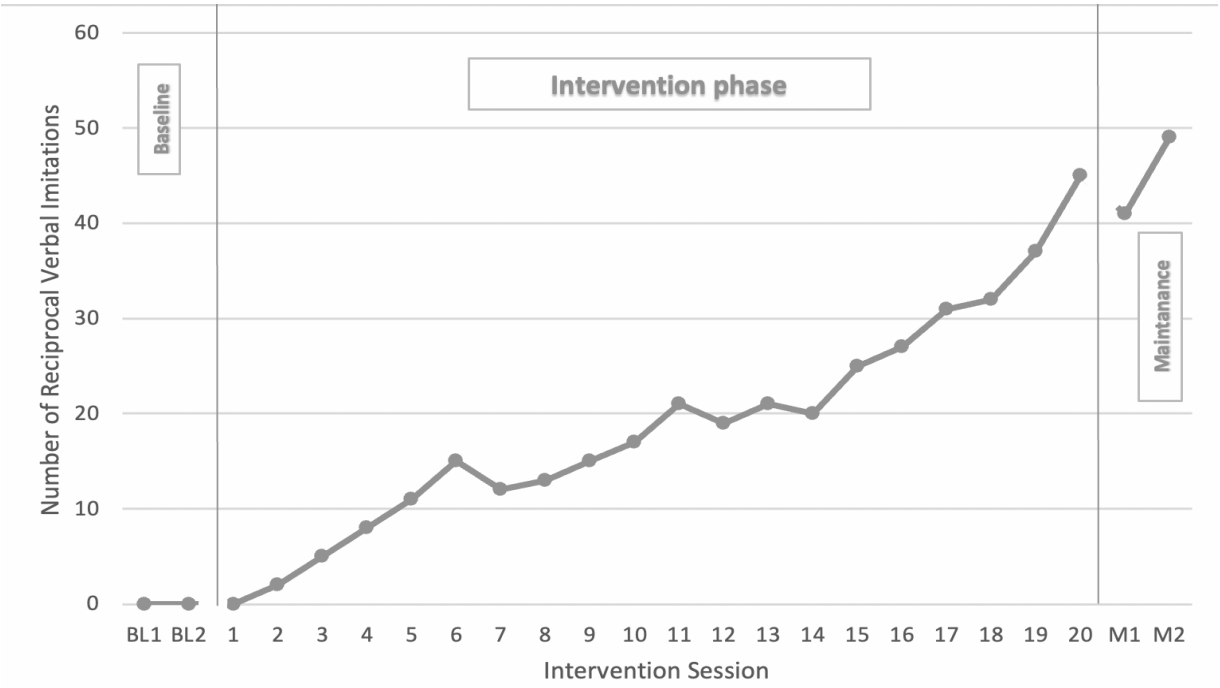
Number of Non-Verbal Imitations Enacted by J.R.



Changes in the Number of Reciprocal Verbal Imitations. J. R. did not imitate anything that his mother did or said and he demonstrated no instances of reciprocal verbal imitation at the beginning of the intervention. The verbal imitations increased gradually during the intervention. As hyperactivity reduced and the intervention progressed, J. R. was able to sit down to look at pictures in a book, point to them, and try to name them. The instances of reciprocal verbal imitation expanded from 0 to 45. Cohen's modified *d*-statistic for reciprocal verbal imitations was 3.866807416. See Figure 7 for a graph of the number of reciprocal imitations.

Figure 7

Reciprocal Verbal Imitations Produced by J.R.

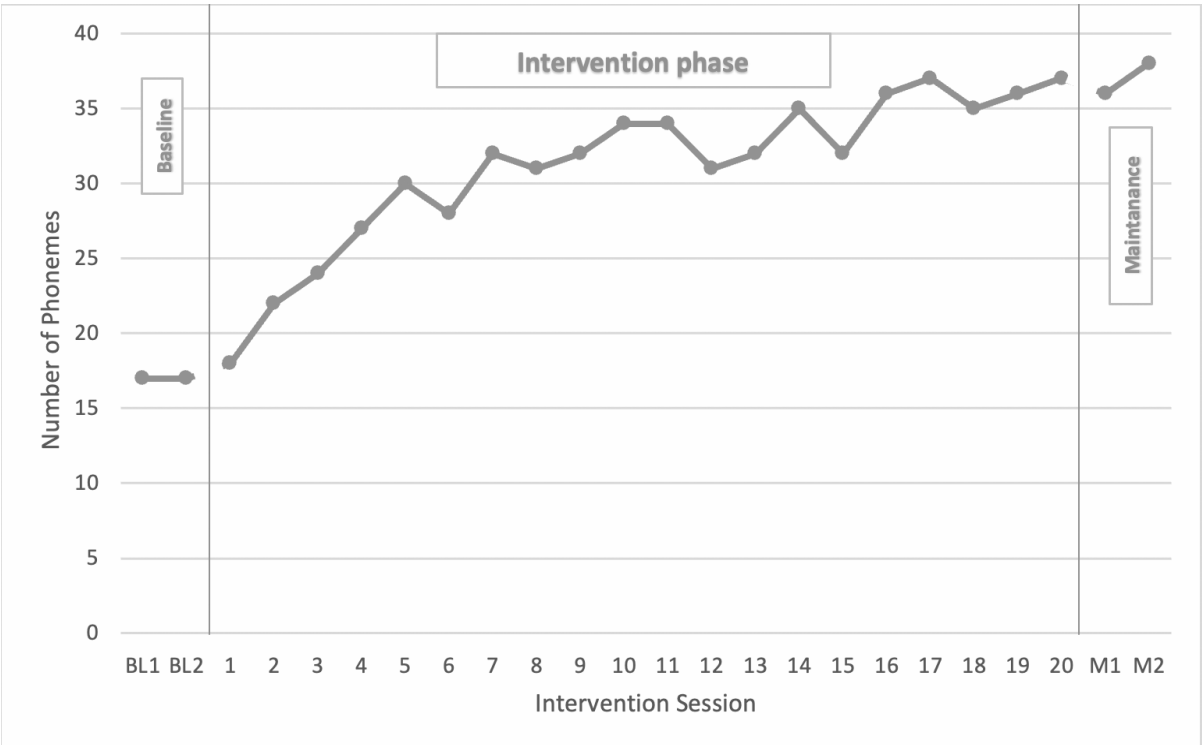


Changes in the Types of Phonemes. As J. R.'s utterances increased, there was also an increase in the types of phonemes produced. There are approximately 44 phonemes in English, and J. R. produced 17 at the beginning and reached a maximum of 37 phonemes by the end of the intervention. This represents 84% of the phonemes in the English language. Effect size, calculated by Cohen's modified *d*-statistic, for different phonemes produced, was 3.896575. See

Figure 8 for a graphing of the number of different phonemes produced.

Figure 8

Number of Different Phonemes Produced by J.R.



N. K.

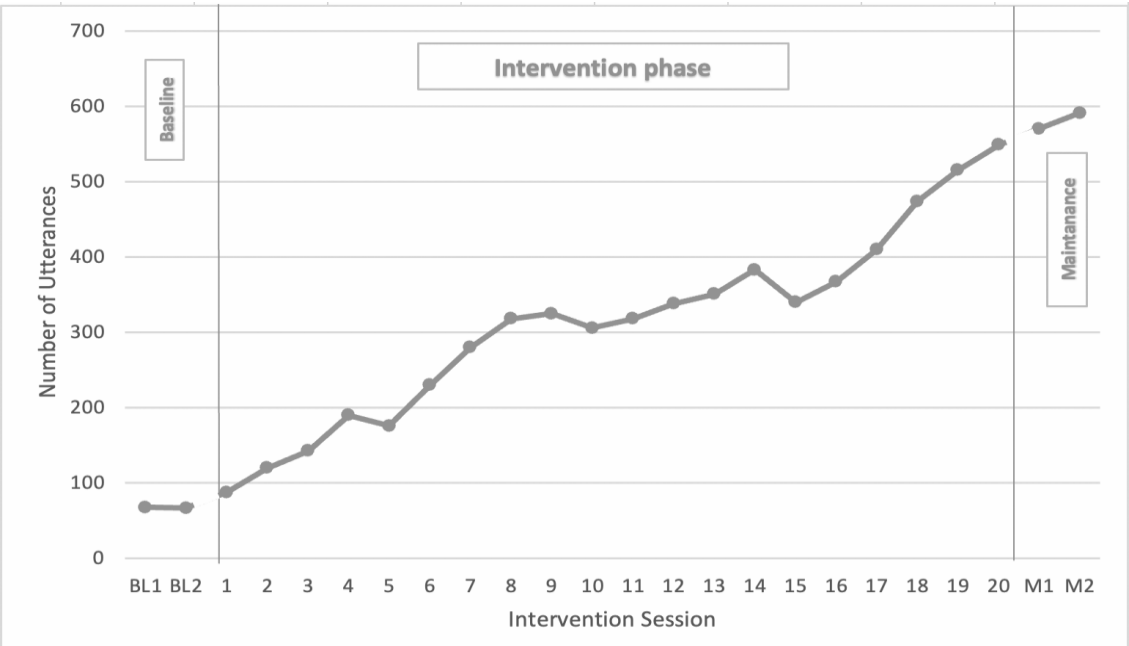
N.K. was 4 years, and 3 months old at the beginning of the intervention. He displayed characteristics consistent with autism including lack of communication, and lack of non-verbal and verbal imitation skills. He was hyperactive and frequently hummed quietly. He often ground his teeth and did not make eye-contact. He gave no response when his name was called and he did not demonstrate differential play. That is, he preferred to hold things that had the same shape and he played with them the same way over and over. He did not want to share toys and he preferred to play alone. He did not sit down and he did not point to pictures in a book when asked to. He cried and laid on the floor when he did not get what he wanted. He often climbed on the chairs and the table, then jumped off of them.

Changes in the Number of Utterances. N. K. was hyperactive during the baseline sessions and he completely ignored his mother as she tried to play with him. He verbalized by constantly humming and making non-communicative noises as he held picture cards in his hands without looking at the pictures. He walked away the moment his mother got close to play with him. Throughout the baseline sessions, he did not sit down to perform any activity and he constantly kept something in his hands to flip around. He uttered sounds frequently and some sequences of phonemes that were not intelligible. There was an increase in utterances from 88 to almost 600 over the course of the intervention. Cohen's modified *d*-

statistic was used to calculate effect size for the number of utterances. This was extremely large, at 4.074016138. See Figure 9 for a graph of the utterances produced.

Figure 9

Number of Utterances Produced by N.K.

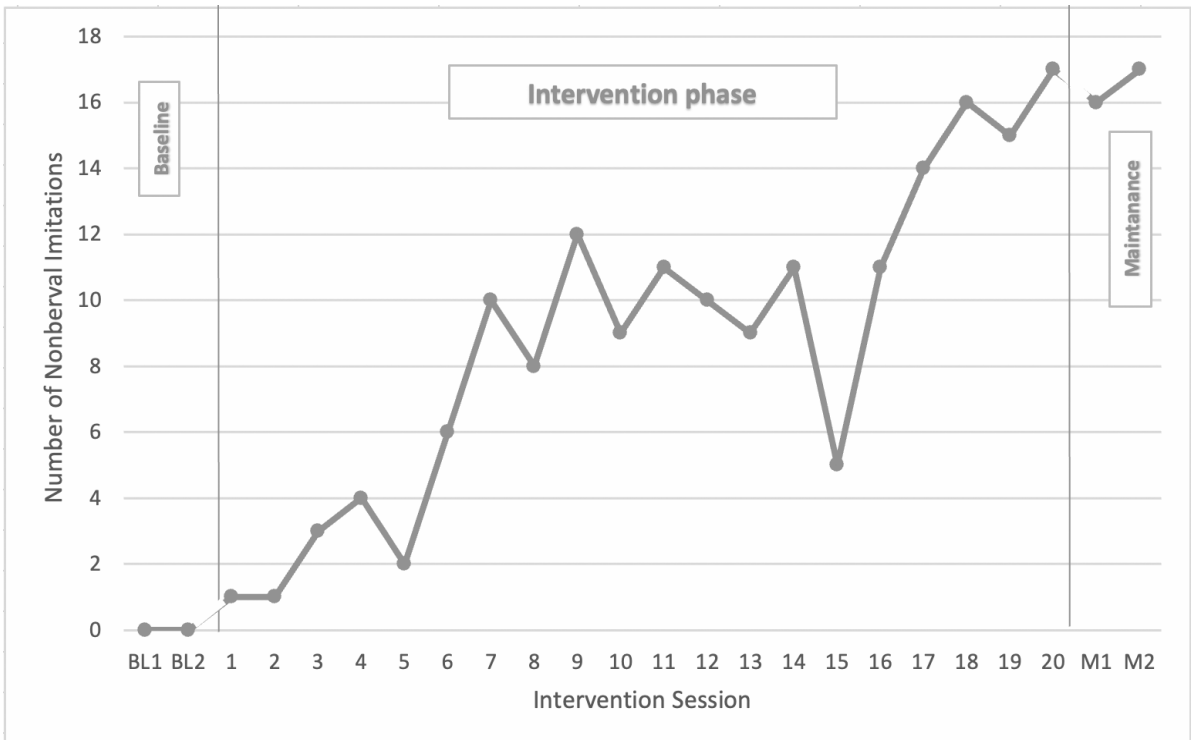


Changes in the Number of Non-Verbal Imitations. During the baseline sessions, N. K. did not imitate anything his mother did. He ignored her, and when she called his name to show him some pictures in a book, he paid no attention to her. She tried to sing a song as she played with the xylophone to get his attention, but he ignored her and kept humming and murmuring to himself. He only wanted to play with the picture cards that he opted to hold and roll in his hands. During the baseline sessions, N. K. did not imitate any of his mother's gestures. As the intervention progressed, there was a continuous increase in instances of non-verbal imitation. By the end of the intervention, non-verbal imitation had increased from 0 times per session to 17 times per session. Cohen's modified *d*-statistic indicated an effect size of 3.354284349. Skills were maintained throughout the maintenance period.

See Figure 10 for the non-verbal imitations enacted.

Figure 10

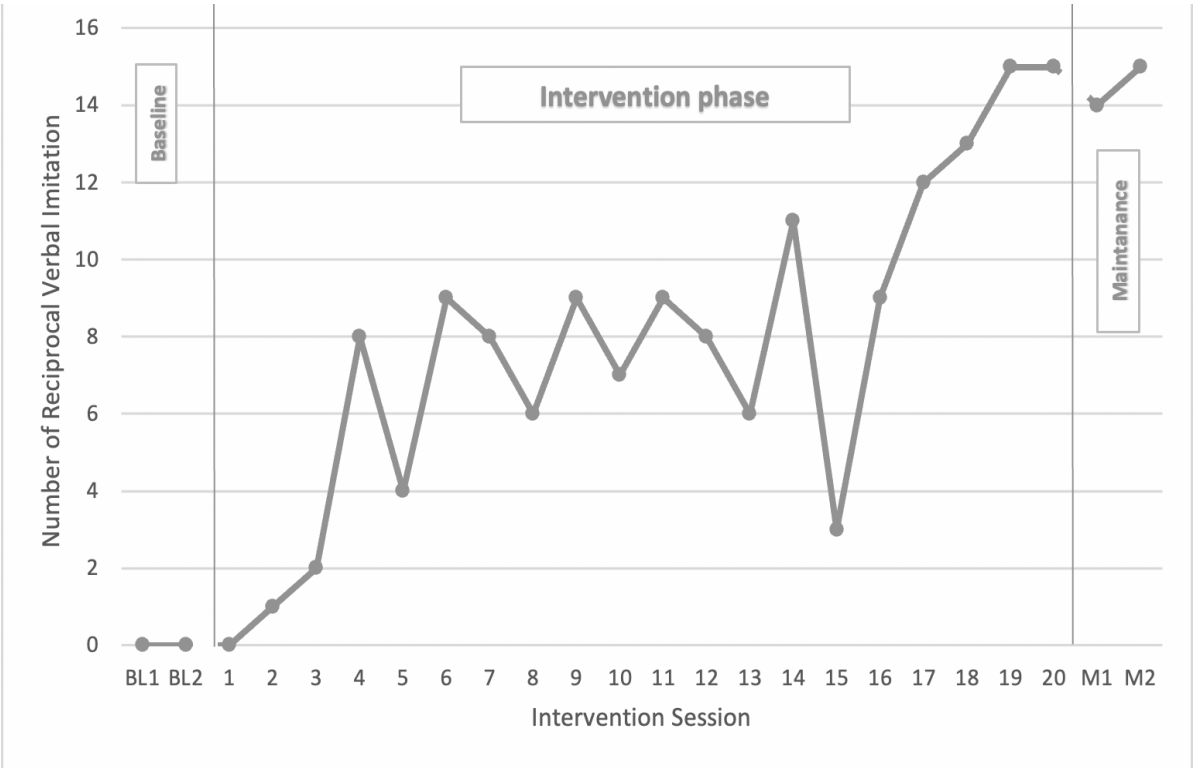
Number of Non-Verbal Imitations Enacted by N.K.



Changes in the Number of Reciprocal Verbal Imitations. N.K. was not able to demonstrate reciprocal verbal imitation initially, and he totally ignored his mother's verbalizations. She tried to get his attention by singing songs, but he did not attend or react to the singing. N.K. increased his ability to imitate as he gradually noticed the imitations of thetherapist during the sessions. From the initial intervention to the completion of it, his ability to mutually imitate verbal words and sounds increased from 0 to 15. At the maintenance sessions, N.K. was noted to engage in reciprocal imitations with his mother 14 and 15 times. Effect size, as calculated by Cohen's modified *d*-statistic was 3.379604978. See Figure 11 for the graph of his verbal imitations.

Figure 11

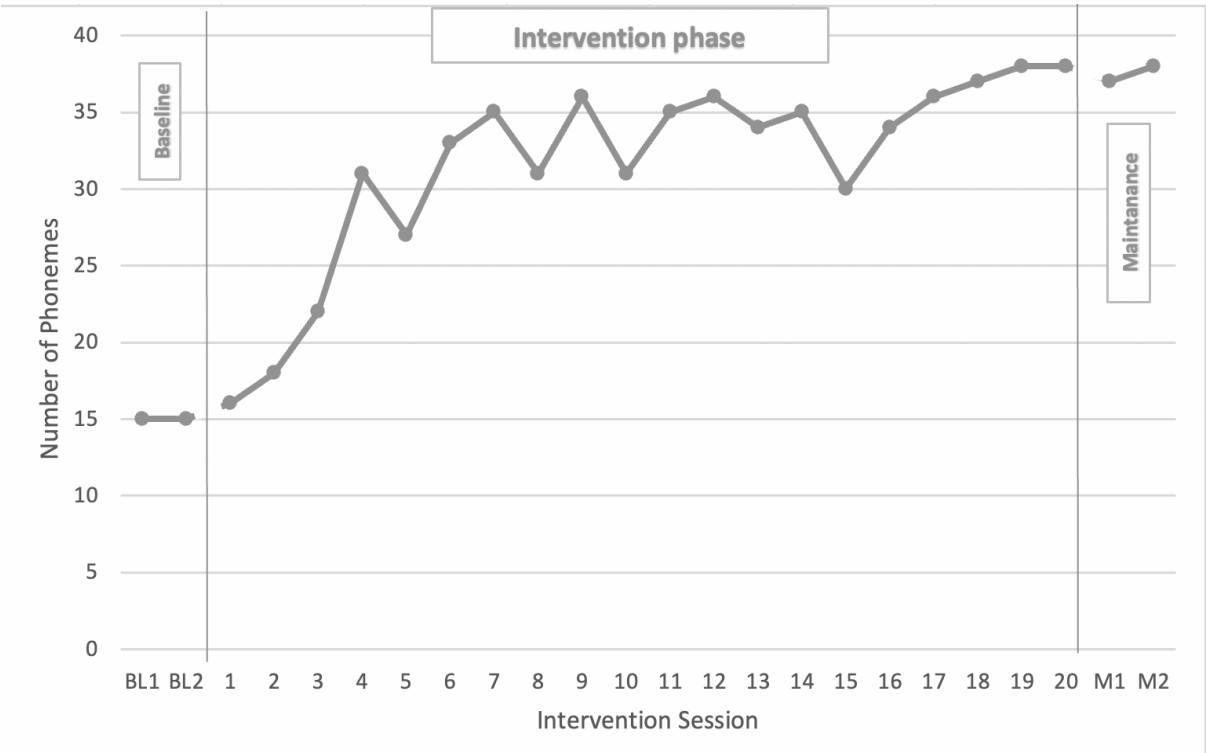
Number of Reciprocal Verbal Imitations Produced by N.K.



Changes in Types of Phonemes. As utterances increased, N. K.'s production of different types of phonemes increased as well. His movements around the room slightly decreasedas he was able to look and point to pictures in a book and imitate the names. He once flipped and looked at all the pages in a 10-page book. This increase in phoneme production was initially very large, then somewhat inconsistent, but a drop in utterances, types of phonemes, and verbal and non-verbal imitations occurred during intervention session number 15. This was accompanied by flat affect and decreased movement which the mother reported was due to the loss of his caregiver. She said that his behavior had changed even at home when his daily caregiver, whom he was very close to, discontinued her job there.Despite this, he resumed progress and by the end of the intervention had increased his phoneme repertoire from 15 to 38. Effect size as calculated by Cohen's modified *d*-statistic was 3.551609. See Figure 12 for a graph of different phonemes produced.

Figure 12

Number of Different Phonemes Produced by N.K.



Conclusions

All three children, ages 2, 3, and 4 years of age, made significant increases in speech and language skills over the course of the 20 therapy sessions. The parents did not indicate that their children's language and communication had reached expectancy for their age, but they verified dramatic improvements. In addition, all of the parents reported improvements in their child's speech and language, as well as in their ability to imitate. All parents reported that they felt that the intervention was very effective and greatly helped their child. During maintenance weeks, skills generally remained as they were at the end of intervention or continued to increase.

The purpose of this study was to determine the effects of ITZ on three non-verbal children with suspected autism in Zambia. The variables that were measured were changes in the child's production of the type of phonemes, the number of speech sounds produced, and the number of both verbal and non-verbal imitations.Very high effect sizes were found for each of the three children on all variables. Statistical measurement of changes using Cohen's modified *d*-statistic indicated that all three children exhibited extremely large improvements in the four variables measured. In addition, visual inspection of the data showed stable baselines and consistent progress throughout the intervention. This improvement was

maintainedfor at least two weeks after treatment was discontinued. The percentage of non-overlapping data (PND), or the number of treatment data points that did not overlap with baseline data points, was calculated at 100%. That is, all measures taken during treatment remained above baseline levels. This exceeded the PND of between 70 and 90% that Meline (2010) suggested indicates moderate support for treatment effectiveness. In addition, interviews with parents following the final maintenance phase indicated dramatic improvements in their children's verbalizations and imitation skills at home.

All the children increased their number of utterances, different types of phonemes, and verbal and non-verbal imitations by the end of the intervention as compared to the baseline. There was also good maintenance of the acquired skills with all the children 7and 14 days post-intervention. The results of this study overall indicate that ITZ is effective in teaching CA in Zambia to increase imitation skills and increase verbalizations. This is consistent with findings of previous studies (Field, 2017; Gill et al., 2011; Heimann et al., 2006; Ingersoll et al., 2007; Ingersoll &Lalonde, 2010) carried out in the United States.

There are many factors that could influence children's response to ITZ intervention. Medical issues, emotional issues, consistency of attendance, and social situations could alter a child's response to therapy. These factors suggest that the potential to improve at every session is limited, so that progress may be erratic. In the current study, one of the children was consistent in participation, and one attended at least weekly and sometimes twice a week. For these two, improvement in all variables was notedin almostevery session. For the other child, there was a significant drop in phonemes, utterances, and word approximations during Session 17 following the tongue-tie surgery that was performed on him a few days before this particular session. Despite these medical, consistency, and emotional factors, by the end of the intervention, all the variables being measured had increased for all three children, suggesting that the intervention was effective.

Such strong results heighten the urgency for additional study with a larger sample size.

In addition, future studies might compare daily to weekly intervention or other treatment intervals. Studies might also consider carrying out this intervention in the participants' home environment to reduce the irregular timing of intervention. Finally, future efforts might address these constraints by including the schools in utilization of some aspects of imitation therapy or in training parents in this methodology.

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