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Evaluation of the Effectiveness of Video-Modeling for Teaching Articulation in Verbal Children With Autism Spectrum Disorder

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Abstract

Verbal children with autism often present communication difficulties such as articulation disorders. As a result they are not able to communicate effectively and sometimes their attempts to communicate may take the form of challenging behaviors. Previous studies have demonstrated the efficacy of video-modeling in increasing the communication skills in verbal children with autism. Moreover other studies have shown that video-modeling, as a treatment package, can maintain strength and generalize all the newly learned skills. In this study, we will extend the use of video-modeling across 3 verbal children who have been diagnosed with autism and simultaneously exhibit articulation disorders in phoneme /r/ in three different positions within words. We will implement multiple baseline design across behaviors (i.e., target phoneme at the beginning, middle, and end of the words). The effectiveness will be evaluated by focusing on pre to follow-up changes of our participants' articulation.

Keywords: Video-modeling, autism spectrum disorder, articulation disorder

1. Specific Aims and Research Hypotheses/Question

Children with autism spectrum disorder (ASD) often are unable to communicate effectively and interact with others. Some of them have difficulty developing language skills, understand what others say to them, or become comprehensible by them. Other may have trouble uttering some sounds (i.e., phonemes) or words correctly. Researches suggest that children with ASD may have motor speech disorders and more specifically exhibit persistent articulation errors. Moreover these children may be nonverbal or may face difficulties in pronouncing words (Watson el al., 2013). Their speech-language problem varies depending on their social and intellectual development. Nonetheless many studies have been conducted and have shown that video-modeling is effective for verbal children with ASD across many different areas of functioning, including language (Corbett & Abdullah, 2005). Furthermore, other studies have shown that video-modeling integrate an effective learning formality for children with ASD with a well-studied intervention technique (Bellini et al., 2007). Recent studies have examined the effectiveness of video-modeling in order to improve conversation skills, more rapidly and more easily (Morlock et al., 2015). In addition, studies which have been conducted throughout the last three years, found that many children showed an increase in the complexity and frequency of their language (Scheflen et al., 2012) and improvement on their little or non-functional communication, by using video-modeling as a treatment package (Copple et al., 2014).

Although, no research exists that explores the use and the effectiveness of video-modeling technique for verbal children who haven diagnosed with ASD and simultaneously exhibit articulation disorders. The *purpose* of the present study was to extent the literature considering the effectiveness of video-modeling in communication for children on the spectrum. More specifically, this study determined the efficacy of video-modeling for teaching articulation in children with ASD who had motor speech difficulties and made speech errors (D'Ateno et al., 2003).

The *aim* of this study was to implement a single-subject research, by using multiple baseline design across behaviors in order to determine if video-modeling can improve the articulation difficulties (i.e., speech errors) of children who were verbal and had been diagnosed with ASD. In our study, the articulation that we wanted to improve was the speech error in phoneme /r/, when it was appeared in first, middle, and last syllabus of the words.

Thus, the *research question* was: "How effective is the use of video-modeling in order to improve the articulation in verbal children who have been diagnosed with ASD?".

Our *hypotheses* were:

1. After exposure to video-modeling, verbal children with ASD and speech errors in phoneme /r/ will generalize and maintain the correct articulation.
2. Verbal children with ASD and articulation difficulty in phoneme /r/ will show an increase in the correct articulation, as a response to their participation in treatment with video-modeling techniques.
3. If verbal children with ASD improve their motor speech control having been exposed to video-modeling treatment, then their articulation will also be improved.

2. Background Literature Review

Children with ASD often exhibit deficits in verbal and nonverbal communication. Furthermore, they show social, communication, and language problems. Some of them might have difficulties in understanding, talking with others, reading, or writing. Others appear to repeat phonemes, words, or whole sentences (Plumb & Wetherby, 2013). Communication is a combination of both nonverbal behavior (e.g., gestures, facial expression) and verbal behavior (e.g., spoken language). With communication we are able to tell others what we want, to share ideas, and to express our feelings. For children with ASD it is not easy process to combine all these parts together in order to communicate effectively. Children on the spectrum may present different characteristics on their communication (Sussman & Lewis, 1999).

3. Children With ASD

Autism is a group of neurodevelopmental disorders which involve deficits in three domains; in social skills/interaction, in communication, and in repetitive and stereotype patterns of behaviors. All these become apparent before 36 months of age (Hertz-Picciotto & Delwiche, 2009; Koufaris & Sismani, 2015; Kogan et al., 2009). It is important to state that parents suspect problems in their children's development before 24 months of age, and the age at which children are diagnosed with autism most of the time is after the age of 2 years (Gray & Tonge, 2001). Moreover, ASD affects boys more than girls in a ratio of approximately 4:1 (Zhou et al., 2013). It is also important to mention that the past few years there is an increase in the estimate prevalence of children with autism. More specifically, the Centers for Disease Control and Prevention estimates that 1 in 68 children, 8 years old, in multiple communities in United States have been diagnosed with ASD. There is a fundamental increase as in 2012 the estimation was 1 in 88 children (CDC, 2014). Children with ASD tend to have communication deficits (i.e., inappropriate responses in conversations, find form and letters difficult to understand, have difficulties in asking questions). Furthermore, they depend on routines, they are highly sensitive to changes in their environment, and some of them focus on inappropriate items. The early signs of autism are delayed language development, lack of or inconsistent use of eye contact, imitation, response to name, emotional expression, and interest to other people (Blenner et al., 2011). Moreover, some children exhibit poor skills in pretend play and have problems with nonverbal communication (Al Shirian & Al Dera, 2015). Some of their social deficiencies and behavioral standards might not be recognized as symptoms of ASD until children are unable to meet social, educational, or other life phase demands (CDC, 2014).

3.1.1 Communication Disorders in Children With ASD

Language, speech, and communication difficulties are of pivotal importance in ASD. All children with autism have social communication problems. Early studies showed that approximately 50% of individuals who have been diagnosed with ASD never acquire functional speech. On children with ASD the language acquisition is characterized by dramatic delay. For example, they will produce their first words around the age of 38 months, whereas the typical development children will have produced their first words by the age of 8-14 months (Eigsti et al., 2011). These children may have language disorders such as problem with grammar, reading, or vocabulary. By the first years of life, social and communication features that differentiate autism from typical development children comprise decreased frequency of orientation to social stimuli (i.e., eye contact, social interaction), complex babbling (e.g., they do not babble as much), less gesture, imitation, and word production (Landa et al., 2007). Moreover, as infants, these children present different frequency, color, and duration in their cry unlike the typical development children (Esposito & Venuti, 2010). In cases where language is present, it tends to be used for instrumental and not for social purposes. Also, content of what they say is repetitive and egocentric. Usually their conversations are one sided and their pragmatic abilities are poor (Boucher, 2003). Also they prefer to look at objects instead of faces. Children on the spectrum often appear repetitive or use rigid language. Sometimes they say things that actually do not have any meaning or, on the other hand, they repeat words or phrases that they have probably heard in the past, which is termed echolalia. Moreover some of these children speak in a high pitch tone or they use robot-like speech. It is also interesting that many children with ASD are able to develop speech and language skills, but their progress is usually uneven (e.g., they may develop strong vocabulary only in an area on which they are interested). Also they may are able to read words before the age of 5, but

they are not able to comprehend what they read (NIDCD, 2012). It is important to mention that children on the spectrum who are not able to communicate effectively with others, may feel frustrated and this can lead to behavioral outbursts (Brown & Elder, 2014). Lastly, they present poor nonverbal speech, thus they are often unable to use gestures (e.g., point to an object). As a result, without meaningful gestures and language to communicate, as previously mentioned, many of these children become frustrated in their failed attempts to express their feelings and their opinions. This frustration may appear through vocal outbursts or other inappropriate behaviors (NIDCD, 2012).

3.1.2 Treatment of Communication Disorders in Children With ASD

The positive effects of a treatment should cover a wide range of communication skills (i.e., comprehension, production, phonology, syntax, morphology, and pragmatics). Any kind of intervention should target one of these skills and try to make children to be able to communicate in order to understand, and participate effectively in their social world. One kind of intervention is to replace challenging behaviors (e.g., echolalia). This communication intervention emphasizes a view of language as a means of control over the child's environment (Goldstein, 2002). Many studies have shown that the use of innovative technology (i.e., interactive computer programs) can be effective in delivering direct intervention which will be focused on the development of communication skills of children with ASD. Other kinds of treatment packages, which can effectively improve the speech and communication skills of these children, are the computerized behavioral learning program which is focused on the improvement of vocabulary, and the *ALPHA* program, which is based on the improvement of reading, writing, and vocabulary skills. There is also the '*I can word it too*' program, which focuses on the increase of functional language and on the decrease of inappropriate language (Wainer & Ingersoll, 2011). The *Computer- aided Instructions* (CAI) is an effective treatment package for children with ASD as it has shown that children exposed to CAI exhibit better writing and communication skills (Heimann et al., 1995). The *Comprehensive Peer Network Intervention*, can strength the language and adaptive communication, and focuses on social-pragmatic use of language to interact with others. With this program children with ASD can improve their social and communication deficits and interact more effectively with their peers (Kamps et al., 2015). Moreover, the *Picture Exchange Communication System* (PECS) gives the opportunity to children with ASD who have little or no communication abilities, to communicate non-verbally, by giving to another person a picture with the desire item (Howlin et al., 2007). Lastly, the *Augmentative and Alternative Communication* (ACC) can improve the communication skills of children who are nonverbal or their natural language does not meet their needs for a functional communication. The *Speech-Generating Devices* (SGDs) provide both visual and speech feedback which can serve as an input function, especially when used during spelling instruction. For example, when a clinician models a message by using SGD, then the child hears speech and simultaneously sees the written word. Each speech feedback usually takes place after each sound, word, or sentence is typed (Blischak & Schlosser, 2003). Another treatment package which is valid and can improve the communication of a child with ASD is the *Treatment and Education of Autistic and Communication Handicapped Children* (TEACCH). By using this approach, we are able to understand the child's learning characteristics and to provide visual support in order to promote language development (Panerai et al., 2002). A treatment package which is based on a developmental model of intervention is the '*Denver model'*. This approach focuses on pragmatic communication on positive affect and on interpersonal skills. The primary aim of this program is to increase the child's motivation in an activity, subject, or individual by reactive language strategies in order to facilitate communication (Corsello, 2005).

We noted that these are not the only kind of communication interventions, but there are more, and also through research more interventions will appear and give the opportunity to these children to communicate effectively. It is important to mention that through research, new types of communication interventions can be exposed. Research studies can determine if a treatment package is effective, and if it is the most preferable depending on the communication difficulties of each child, and can also compare the effectiveness of different treatment packages, as well as finding new packages which may be better and more effective (NIDCD, 2012).

3.1.3 Video-modeling as Teaching Method for Communication Disorders in Children with ASD

Teaching children with ASD how to interact with others and communicate is substantial in helping them reach their full potential. There are many different ways in order to improve their communication skills and as always the best treatment is the one that begins as early as possible with the most effective treatment package (NIDCD, 2012). A significant goal in intervention for these children is to increase and improve their social-communication development in order to decrease the problems that arise by social avoidance. Video-modeling is a behavioral intervention which has been documented in the behavioral sciences and has been developed in order to facilitate observational learning. Moreover, video-modeling is an intervention which focuses on teaching new skills and improves the use of existing skills, in children with ASD (Wert & Neisworth, 2003). Many studies have shown that video-modeling has been successfully used to train different kind of skills in children with ASD, such as communication disorders. Basically, it involves the subject observing a videotape of a model engaging in a behavior that must be practiced and then imitated

by the child. Video-modeling appears to be effective for increasing vocalization, communication skills, and producing spontaneous verbalization. (Corbett & Abdullah, 2005). Several studies have shown that video-modeling intervention leads to increase in the conversational skills and can teach word recognition and pronunciation effectively (Morlock et al., 2015). Video-modeling can improve any poor social communication (i.e., poor social interaction, lack of eye contact, lack of response to others). Thus, by using this kind of intervention we decrease the probability that the child with ASD will be frustrated due to inability to communicate (Wert & Neisworth, 2003). Moreover video-modeling's effectiveness is based on the promotion, acquisition and generalization of any communication skill for children with ASD. Lastly it would be interesting to mention that the effectiveness of video-modeling has been evolving since 1970s and its effectiveness has been documented in the literature (Shukla-Mehta et al., 2009).

The last years many research studies have investigated various applications of technology-based interventions, in children with ASD. Research which incorporates technology, has demonstrated that the use of computers, video, mechanical prompting devices, and other technological tools, has good effects and it is very beneficial for children with ASD and communication difficulties (Goldsmith & Le Blanc, 2004).

Technology and media-based tools and strategies can strengthen and enhance the communication and social skills and they offer communication tools in the areas of reading, speaking, writing, and using augmented speech supports. Moreover technology can improve the social learning and communication with others (Cafiero & Mayer, 2008).

4. Research Gap

Many research studies and meta-analysis studies have been conducted and have shown the effectiveness of video-modeling through on different skills and in communication (e.g., sentence structure, asking questions, response to questions). The results from these studies indicated that this procedure promotes acquisition of skills that are maintained over time (Bellin et al., 2007), but further development and field testing of this kind of intervention needed. More specifically, there is no evidence of any probable disadvantages of using video-modeling as a treatment package for communication difficulties in children with ASD. Subsequently, although many experiments have been performed in order to show the effectiveness of video-modeling in general communication, however, to date none have been performed that consider articulation difficulties (e.g., speech errors) in children with ASD. Thus, through an extensive literature review that we have done, there is insufficient research on examining improvements in articulation skills of children with ASD that may develop by the use of video-modeling as a teaching package.

4.1 Significance of the Proposed Research

This study evaluated video-modeling as a teaching method for articulation in children with articulation disorders. This was carried out with a screening and then with a comprehensive assessment. Screening was conducted whenever a speech disorder was suspected. The purpose of the screening was to identify who needs further speech and communication assessment. Then children suspected of having any kind of speech/communication disorder based on screening results, were referred to a clinician for comprehensive assessment. Thus if children displayed omissions/deletions of certain sounds (e.g., 'at' for 'rat' or 'cal' for 'car') we said that these children appeared articulation disorder.

Moreover, compared with other treatment packages, video-modeling can be one of the most cost-effective methods for teaching communication/articulation skills, especially in verbal children with ASD (Sparber, 2013). Also, it is a low-cost method as it can be replayed without additional cost, and simultaneously has an entertaining appeal. Furthermore, it offers significant time saving as it is a quick method compared to others, such as traditional articulation therapy. Video-modeling is ideal for children with ASD for many reasons. One main reason is that children on the spectrum are mostly visual learners and some of them may try to avoid face to face interaction (Clifford et al., 2007). Thus, in that case, video-modeling removes the necessity of person to person interaction and by removing this interaction these children can learn with less anxiety and stress. Another reason is to maintain the strength of the target behavior (Ganz et al., 2011). Moreover, there is a probability that by using other kind of interventions (e.g., traditional articulation therapy) children with ASD may resort to inappropriate behaviors in order to escape from this kind of treatment, which may not be attractive and interesting enough for them. Nevertheless, it is important to ensure in which clinical cases the video-modeling is appropriate to be used and under what conditions. Also, video-modeling treatment package holds promise for improving the articulation of verbal children with ASD. This is based on initial research studies which show that use of video-modeling for developing and improving communication skills had positive and heartening results. Finally, another advantage of this intervention is that it is easily manageable from clinicians, compared to other complex treatment packages such as the traditional articulation therapy and the Directions into Velocities of Articulators (DIVA), which provides a monitoring feedback as you speak (Tourville & Guenther, 2011).

5. Method

5.1 Research Design

The design that we used for this study was a single- case experimental research design. More specifically, in order to evaluate the improvement in articulation by using video-modeling, we implemented a multiple baseline across behaviors. This experiment included a multiple baseline (i.e., time series) design across behaviors (i.e., the words which include the target phoneme /r/ in different syllabus) that were incorporated in words. Multiple baseline design demonstrated the effectiveness of a treatment by showing that behavior (i.e., target phoneme /r/) across more than one baseline changes as a consequence of the introduction of the treatment. We demonstrated this design because it was very useful for evaluating situations where an intervention (i.e., video-modeling) would be likely to bring enduring changes in the dependent variable (i.e., words with the target phoneme) (Case-Smith et al., 2014). In this experimental design the dependent variable was the words with the target phoneme and the independent variable was the video-modeling package. Three children with ASD were exposed to videos based on the target phoneme. Afterwards, we measured if children's articulation improves (i.e., focus on articulation improvement of the phoneme /r/). This was conducted with the follow-up intervention which took place at different period of times for each child and based on that we measured if the target behavior (i.e., phoneme /r/) was still maintained. Moreover, a pre- to follow-up design was used to determine changes in children's measure (i.e., articulation improvement from baseline to intervention).

5.1.1 Participants

We recruited three verbal children with ASD. Child 1, was 10 years old female, Child 2, was 12 years old female, and Child 3, was 13 years old male. Our participants were verbal, and after an articulation assessment we observed that all of them could not articulate the phoneme /r/, when it was appeared in the first, middle, and last syllabus of the words. They also had been diagnosed with mild Intellectual Disability based on DSM-IV.

For this study we chose two females and one male child. Males are significantly more variable in their articulation than girls. More specifically, girls have a superior mastery of speech sounds rather than words. In that case we did not want to focus on how gender was affected by this intervention and which gender was more affected. Thus, we chose a random number of males and females. In contrast to the random selection of gender, the ages of these children were not selected randomly. The typical age of acquisition of the vocalic sound /r/, is between 6 to 7 years of life. That is the reason why in this study we selected these ages, and more specifically because we know that children with ASD show speech delay and they are more vulnerable to speech disorders than typically developed children.

We selected our participants from our private local Speech Rehabilitation Institute after receiving a written permission from their parents. We asked them if they allow their children to voluntarily participate in this program evaluation.

This research study had to meet the following criteria:

1. The intervention had to be a video instruction strategy (i.e., Video-modeling) with a) baseline phase without other components (e.g., reinforcers), b) the intervention phase with other components (e.g., reinforcers).
2. Our participants had to be diagnosed with Autism Spectrum Disorder.
3. Our research design and methodology should allow us to evaluate the effectiveness of the intervention to these children.

5.1.2 Measures and Data Collection

Goaldman-Fristoe Test of Articulation 2 (GFTA-2). We implemented a standardized test, the *Goaldman-Fristoe Test of Articulation 2* (GFTA-2) in order to assess, and report each child's articulation in single words. The reason why we chose this test was because it provides a systematic assessment of the articulation of the consonant sounds, and it has a wide range of information by sampling unprompted and imitative sound production. Also, it can be used for individuals 2 years old to 21 years, as in our study our participants' ages range from 10 to 13 years old. Moreover, another reason which makes this test ideal for our study is that we need approximately 5 to 15 minutes in order to complete it. Thus, the children will not get tired from this assessment. Goaldman-Fristoe Test of Articulation 2, examines all the phones, obtain an accurate sample of children's speech production under several conditions, has colorful picture cards and is interesting to the children, and minimizes the administration time, as we can use fewer stimulus pictures in order to obtain multiple words and sound productions.

The interviewer provides pictures and verbal cues in order to elicit single-word answers from the responder that demonstrate common speech sounds. Furthermore, GFTA-2 includes 61 consonant sounds in the initial, medial, and final position (this is what we will measure) (e.g., chair, star which are represented in pictures). For example, each sound corresponds to a picture (e.g., picture with a dog). So, you point the dog and say 'What do you call this?' and the

child has to say 'Dog'. In scoring, for every correct response we point a ✓, for every incorrect response an X, and for not eliciting a response a /- (Level 1: presence of an error). Also, its error has to be noted by using the International Phonetic Alphabet (IPA) (Level 2: the presence of an error and type of error should be noted using the test manual notation). We will use a hand scoring and that scoring assists two levels (Level 1 and Level 2 above).

This test is very easy and simple to administer, covers all commonly used consonants, and the scoring tables are easy to read. Moreover GFTA-2 provides detailed information about the sound error, the type of the error (e.g., nasal, plosive, related to voicing such as/l/ used for /r/), and the position in which misarticulating occurred. So each sound has a score number, for example for sound /k/ the score in the initial syllabus is 3, in the medial is 6 and in final is 9. The median internal reliability for females is .96 and for males is .94 (for example, if the total score is 49% -30 correct responses to 61, that is a low score of articulation as we measure in 100) (Ertmer, 2010).

6. Procedure

The experimental design consists of the pre-test, the baseline, the intervention, and the follow-up sessions. All sessions were conducted in a room on the private Speech Rehabilitation Institute. The less restrictive the environment was means the greater the opportunities were for children with ASD to have an effective treatment. This is the reason why we preferred to conduct the research in a place familiar to them without any kind of distraction (e.g., at their home there is a probability of distraction in their attention because of a family member) (Guardino & Fullerton, 2010). The rooms of the Institute were special designed with soundproof in order to avoid any outside noise and did not include objects that may distract the attention of these children. The words with the target phoneme /r/ were exposed in all sessions with the following order: 1) Rhino (/r/ in the first syllabus of the word), 2) Carrot (/r/ in the middle syllabus of the word, 3) Bear (/r/ in the last syllabus of the word). All the target behaviors above were presented through screen.

6.1 Pre-test

Before the baseline, we conducted the *pre-test.* Pretesting was very important as it helped us to ensure that the materials that we used were effective and not harmful for the participants. Moreover pre-test allowed us to identify potential problems with the items that we used before initiating the study and before spending time and money on this study. We had to be absolutely sure that the items and the technology that we implemented had been assessed and that they were effective for this study. Pre-test is a kind of trial which determined if by using these items/subjects we could conduct a study effectively and if our data would have meaning.

We started the pre-test with the assessment of the articulation by using the GFTA-2, which evaluated the phoneme on which children had difficulty. Children were exposed to 61 consonant sounds. From the GFTA-2 we used the sounds-in-word section which used colorful and entertaining pictures in order to elicit articulation of the major speech sounds when the children were prompted by a visual or verbal cue. Thus, the children were exposed to pictures and the only thing that we had to do was to ask them every time "What is that?". We recorded their response by filling the sheet form of GFTA-2. This process lasted around 15 minutes. After the evaluation of the phoneme which children with ASD had difficulty we showed them pictures with objects which included the target phoneme in different positions (i.e., first, middle, last syllabus). Afterwards, we demonstrated 10 cards in total for each position respectively, and we kept the most preferable card from each category, implementing a preference assessment. This step included open-ended questions. Thus, every time we exhibited a picture, we asked the child "Do you like this one? After delivery of the picture stimulus, we presented a tangible stimulus (e.g., first a picture with a parrot and then a stuffed animal) as children with ASD sometimes prefer to touch objects (Farr et al., 2010). On this research study it was very important to use words with social validity.

Moreover on pre-test, we examined which kind of reinforcer was most effective for these three children. It was crucial significance to choose an effective reinforcer, as every time children responded correctly we rewarded them with their most preferable one. For this step, a reinforce preference assessment took place and included a rank-ordering. We presented our participants different kinds of reinforcers, such as candies, stickers, and tokens. Children had to put in order the reinforcers. The first on the row was the high preference and the last one was the low preference. Thus, the most preferable reinforce were given to them in the treatment package/intervention if their response was correct.

It was important to mention that each session in the baseline, in the treatment, and in the follow-up were lasted approximately 15 to20 minutes. Moreover, the data collection points were gathered for one to three days (only mornings) and not over the weekend. First, we targeted the behaviors for teaching, which in that case were the three words with the target phoneme (i.e., Rhino, Carrot, and Bear). Then we checked carefully that all the equipments were worked before starting any kind of intervention. The equipments that we used in all sessions were: digital cameras, TV with Digital Video Disk. On the *baseline* part, the data that we corrected were the outcome of the children's articulation by using video-modeling. The videotapes in that session presented only pictures with subjects through the screen. For example, on the screen an image of a bear was appeared. Children looked through the screen and afterwards they were

asked a question such as: “What is that?”. Then children had to say what they were looking at within 10 seconds. Children in that section did not receive any kind of intervention. And also they did not receive any kind of reinforcer. We observed and reported the number of correct and incorrect articulation responses for each child. The collection of data in baseline was important as it helped us to identify steps of the task analysis that the children could or could not without help.

6.1.1 Intervention

The intervention involved each child watching a videotape of the target behavior and then replicated that behavior. This process was exactly the same for all children. Through the video modeling, which was based on learning through observation, pictures with objects (e.g., Bear) was appeared on the screen and then a mouth pronounced the object with the specific movements of the articulators in order to show to them how exactly they had to move their modular (e.g., tongue, jaw). Immediately after, the children were asked again, “What is that?”. When our participants achieved to articulate the first word correctly, we gave them the preferable reinforcer and also we said “Well done! Great job!”. We followed exactly the same process for the next two words. For any incorrect response, there was a replay of the videotape, and we prompted them to pay more attention until they imitated the word correctly. Also for every incorrect response, children did not receive a reinforcer (i.e., stickers and “Well done! Great job”). Instead, we encouraged them by saying “Look again carefully!”. The outcomes from the intervention phase were also important in order to examine the effectiveness of video-modeling.

In case the improvement was not achieved, we adjusted or changed tactics in order to help these children acquire the target behavior. Also, we had to consider if this kind of non-improvement was because the video was too complex, or if our participants had to watch the video more times per week. Moreover, if during the intervention any of these children seemed to feel uncomfortable or started to exhibit inappropriate behaviors, then we had to stop the process immediately.

6.1.2 Follow-up

Follow-up procedure is an important component for the research. Once we finished with the intervention, we assessed the maintenance of gains for the three verbal children with ASD. We did that with a *follow up* measurement which was conducted two months after the completion of the intervention for Child 1, four months for Child 2, and six months for Child 3. The follow-up probes were exactly the same as the baseline ones (i.e., will not include the movements of the mouth). The outcomes of the follow-up were helpful in order to examine how effective video-modeling could be as an intervention package for that kind of articulation disorder. Moreover, this session was supportive in order to observe if children, after the intervention, were able to maintain and utilize the articulation skills in their normal environment. The different time gaps that the follow-up process took place were chosen in order to understand if there was maintenance after various periods of time. Basically, follow-up took part to increase the overall effectiveness of the research effort. Also, it was conducted to ascertain if the video-modeling intervention had changed in a positive manner the lives of these children who participated in our study.

6.1.3 Ethical Guidelines

This research had to take in consideration some ethical standards. Some of them were the following:

1. The children should never get harmed by their participation in study. We should try to prevent exposing these kids to any potential risk of harm.
2. Respecting the dignity of the children. We should respect children’s status, culture, and capacity.
3. Anonymity. All the data that we will select should be anonymous and we are responsible to protect the data (Graham et al., 2013).

6. Analysis of Results

Data interpretation is an important key which can prove or disprove our hypotheses. It is very important to select the proper tools to make useful analyses and interpretation of our data, otherwise, if an inappropriate data analysis method is chosen then the results may be suspect and without credibility (Pope et al., 2000). Video-modeling, as an intervention method, provides the opportunity to achieve the appropriate behavior. In this experiment, the goal was for verbal children with ASD to be able to correctly articulate three words which included the target phoneme /r/. The effectiveness of this intervention was determined with Percentage of Non-overlapping Data (PND), Percentage of Data Points Exceeding the Mean (PEM), and visual inspection. The results of video-modeling procedures were graphed as percentage of correct intervals across the observation sessions: baseline, intervention, and follow-up (see Figures 1, 2, & 3).

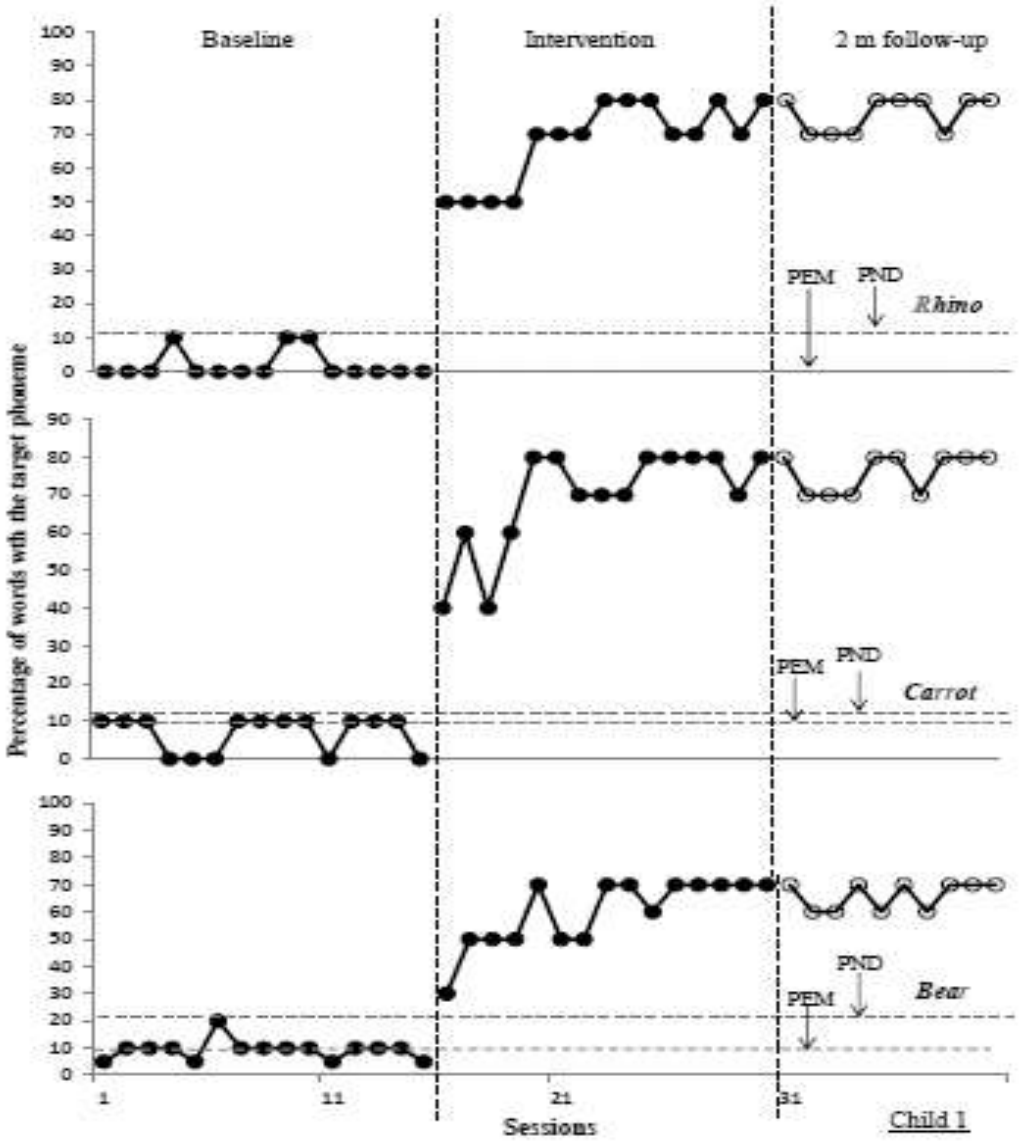

Figure 1. Results for Child 1 receiving video-modeling for the words Rhino, Carrot, & Bear where the target phoneme /r/ was appeared in the first, middle, end last syllabus. The blue horizontal line is the PND (highest data points) and the red horizontal line is the PEM (median data points)

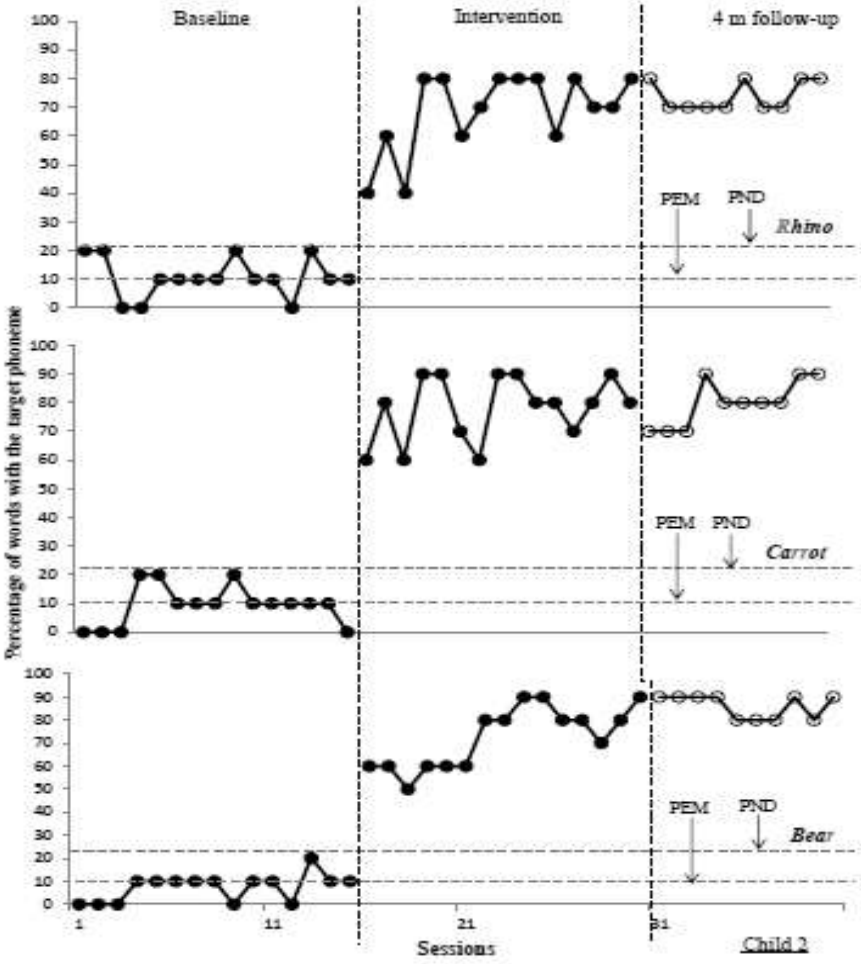

Figure 2. Results for Child 2 receiving video-modeling for the words Rhino, Carrot, & Bear where the target phoneme /r/ is appeared in the first, middle, end last syllabus. The blue horizontal line is the PND (highest data points) and the red horizontal line is the PEM (median data points)

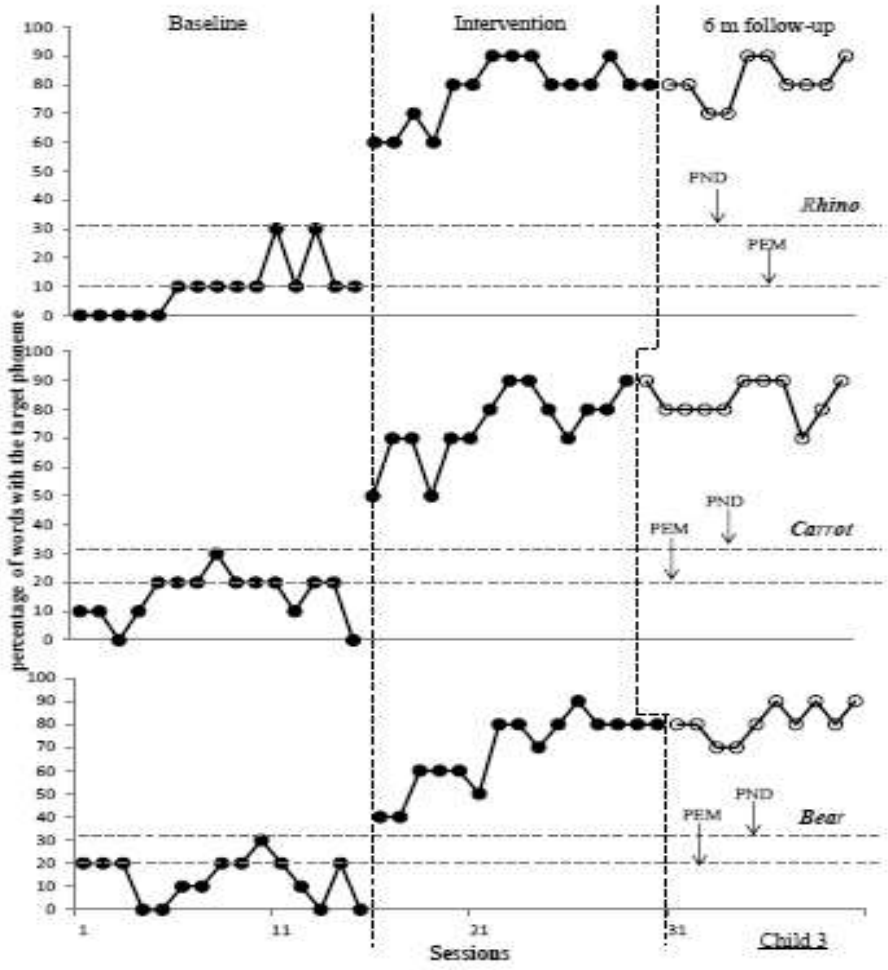

Figure 3. Results for Child 3 receiving video-modeling for the words Rhino, Carrot, & Bear where the target phoneme /r/ is appeared in the first, middle, end last syllabus. The blue horizontal line is the PND (highest data points) and the red horizontal line is the PEM (median data points)

By using all these methods, in our analysis of results, we were able to estimate the effect size of this teaching procedure. More specifically, considering the PND, we estimated the percentage of non-overlapping data points, by plotting a line on the highest data point on the baseline. For the PEM, we estimated the percentage of non-overlapping data points, by plotting through the median data points on the baseline. Thus, by using both the PND and the PEM, we were able to estimate the effect size of the interpretation, for each child separately (e.g., for Child 1 total percentage of PND for each behavior and total percentage of PEM foe each behavior respectively). The basic data unit of this analysis was the comparison between the baseline and the intervention. The visual inspection allowed us to observe any kind of phase changes and also conduct a detailed analysis of the properties of the data during the baseline session. Moreover, with the visual inspection we were able to observe any changes in the intervention.

7. Conclusion

Future research is needed in order to verify the results of this research study and also to continue to investigate the effects of video-modeling in children with ASD. Future researches can extend the time period between the intervention and follow-up phase in order to determine the maintenance of video-modeling after a prolonged period of time. Moreover, future research can include some training sessions in order to assist clinicians and teachers on how exactly to implement a video-modeling package. Lastly, it would be interesting to do further research to identify if this kind of intervention is equally effective on different culturally populations (Ortiz et al., 2012).

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