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## The Effectiveness of Naturalistic Sign Language Training for Nonspeaking Individuals on the Autism Spectrum

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**The Effectiveness of Naturalistic Sign Language Training for Nonspeaking Individuals on  
the Autism Spectrum**

Elizabeth Michael

Bowling Green State University

HNRS 4990: Honors Project

Advisors: Mrs. Megan Thompson and Dr. Tim Brackenbury

April 21, 2023

## **ABSTRACT**

This study examined the impacts of sign language training on the communication of two adult brothers with level 3 autism spectrum disorder (ASD). A single-subject, multiple-baseline design was used. Sign language targets were selected based on a parent survey and the participants' predicted motivation towards the target items. The baseline and intervention were conducted naturalistically in the home. Results indicated that the individual, environment, target signs, reinforcement, and motivation are all factors that play into sign language acquisition for nonspeaking individuals with ASD.

## INTRODUCTION

Individuals diagnosed with autism spectrum disorder (ASD) may experience difficulties in communication, social interactions, learning, and have restricted and repetitive behaviors (APA, 2013). The communication methods and modalities for people with ASD have been a topic of research, since up to 28% of people with ASD may not develop functional speech (Lord et al., 2004). ASD presents itself with varying degrees of severity. The *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; DSM-5; American Psychiatric Association [APA], 2013), otherwise known as the DSM-5, is the nomenclature most accepted for classifying mental disorders, and is the diagnostic criteria used by clinicians to diagnose ASD. According to the DSM-5, there are three levels of autism, ranging from level 1 “requiring support”, to level 2 “requiring substantial support”, to level 3 “requiring very substantial support.” Regarding language and communication, people with level 3 ASD usually have severe deficits in communication skills, including both verbal and nonverbal communication. They also tend to have deficits in observing social cues and initiating interactions with others (APA, 2013). Although labeling the levels of ASD is helpful for practitioners and researchers to have the same understanding when communicating about a disorder, there is currently a disagreement about preferred terms of labeling ASD. Labeling levels 1-3 of ASD is considered by many to be a form of ableist language, and advocates are encouraging terms such as “nonspeaking” instead of “nonverbal” or “level 3 ASD” (Kenny et al., 2016). While acknowledging this, the DSM-5 is the most up-to-date diagnostic criteria for ASD, so this paper will reflect the current terms for ASD, which includes the labeling of levels 1-3.

Sign language is a manual form of communication that is used by various populations, including people who are deaf, hard of hearing, people with developmental disabilities, and

more. Sign language is a form of alternative and augmentative communication (AAC). AAC constitutes any form of graphic symbols, manual signs, and/or gestures that help facilitate communication via symbols, which is shown to be especially effective for people with ASD (Wendt, 2009). Research by Hodges and Schwethelm (1984) shows that manual signing is especially successful for individuals with ASD who have difficulties acquiring verbal expressive language skills.

Previous research has demonstrated positive effects of teaching sign language to individuals with developmental disabilities. Since people with ASD tend to have cross-modal difficulties regarding speech and the perception of speech, sign language is a strictly manual language that avoids this difficulty. Tactile stimulation has also been found to generate responses from people with ASD, so sign language is an effective way to provide these individuals with visual and tactile stimulation (Fulwiler & Fouts, 1976). Research by Seal and Bonvillian (1997) shows that children with autism have the ability to retain sign communication skills for a long period of time, and these skills also seem to improve attention, social behavior, and motivation.

In a study by Tincani (2004), sign language training was found to be a functional way for some individuals with autism to request items. The procedures included granting brief access to the preferred items to ensure they are reinforcing, assessing imitation skills as a baseline test, then teaching the simplest form of sign language for the preferred items. In conjunction with the simplest form being taught, Manwaring et al., (2017) also studied how motor development is important in language development, since individuals with delayed language often have difficulties with some motor tasks, especially fine motor skills. The study found that fine motor skills are an underlying construct of using gestures, which impacts nonverbal communication strategies for people with ASD. Because of this, it is important to consider adjusting manual

signs to better fit the individual's fine motor abilities. In addition to conducting sign language with manual signing, Tan et al., (2004) found that simultaneously providing signing and speech when training children with ASD is more beneficial than sign-only or speech-only intervention. This combination of speaking and signing resulted in the children effectively using the signs, while generalizing some signs across other activities.

In addition to sign language, naturalistic interventions have been widely researched for people with ASD. The fundamental components of naturalistic intervention include providing semi- to un-structured treatment, in a natural environment, with responsive communication partners (Christensen-Sandfort & Whinnery, 2013). It is meant to provide more client-directed experiences than traditional therapy, while taking advantage of a client's interests. Research by Christensen-Sandfort and Whinnery (2013) found naturalistic intervention to be effective in increasing speech and communication for children with autism spectrum disorder, as well as finding a correlational relationship between naturalistic intervention and generalization of communication targets. According to Harjusola-Webb and Robbins (2012), naturalistic intervention is best conducted when it is an extension of activities that are already normally occurring for the clinician-client pair. This can be incorporated into sign language training by ensuring the target signs used in a study are the signs of objects the individual uses in daily life. In turn, this gives the ability to increase time spent in natural intervention and less time in isolated intervention. Research by Wright et al., (2013) concluded that not only is naturalistic intervention an appropriate way to teach sign language, but it also increases the individual's engagement in communication. Wright et al., (2013) incorporated coding the participants' responses as spontaneous, imitated, prompted, or aided, which helped the researcher track progress, finding each participant to demonstrate an increased signing rate.

### *Present Study*

There is a plethora of research involving communication interventions for individuals with ASD. However, most of this research involves participants with ASD level 1 or level 2. There is minimal current research involving the enhancement of communication for individuals with autism spectrum disorder level 3. Due to this, the research question for the present study seeks to determine whether naturalistic sign language training is effective for level 3 nonspeaking individuals on the autism spectrum.

(Per request by the project's faculty advisor, the literature review was combined into the introduction for the sake of organization and formatting. The separated literature review can be found in Appendix E., as it is an Honor's College requirement.)

## METHOD

This study was approved by Bowling Green State University's Institutional Review Board (see Appendix A).

### *Participants*

Two male brothers with level 3 autism spectrum disorder, who will be referred to as P1 and P2, participated in this study. The participants were ages 20 and 24 at the start of the study. The experimenter has already built a strong positive relationship with both of the adults while providing services for them about 8 hours per week for the past 2 years. Consent for this study (see Appendix B) was obtained by the biological father of P1 and P2, who is the court appointed legal guardian for both adults. A written parental permission form was signed by the father.

P1 and P2 communicate primarily using vocalizations, eye gaze, pointing, and leading a person by the hand. P1 and P2 can both produce the vocal utterances "mamama" to mean "mom", and "bababa" to mean "bye-bye." P1 already uses American Sign Language signs for please, more, all done, and music, mostly when prompted. P2 already uses American Sign Language signs for please and all done, mostly when prompted. Both P1 and P2 shake their heads "no" to express objection and occasionally wave good-bye.

### *Design*

A single-subject, multiple-baseline design was implemented. Working 1:1 with each participant, the aim of the study was to increase each participants' production of the new target signs. This increase would be based on the participant's baseline results, which was conducted to ensure the participants had no production of the target signs prior to intervention. The treatment sessions would then expose the target signs for the participants to begin producing. A withdrawal



phase, which occurs after intervention and repeats the activities of the baseline period, was not carried out in this study.

### ***Setting***

Baseline and intervention sessions were conducted in P1 and P2's shared home. The baseline and intervention for signs that involved food and mealtime took place at the dining room table. The dining room consists of a table and 6 chairs and is connected to the kitchen and living room. The experimenter, P1, P2, and another caregiver were seated at the table. The other caregiver helped during mealtime but did not directly assist with the study. The baseline and intervention for signs that involved play took place in P1 or P2's bedroom, while sitting on the floor. Both P1 and P2's bedrooms are nearly identical, consisting of a bed, a window, 2 dressers, and room on the floor to sit and play. The environment was arranged to elicit target behavior.

### ***Materials***

Edibles and toys were used as naturally occurring reinforcers for the participants during their mealtime routine and play activities. A video recorder with no internet access was used to record all baseline and intervention sessions for later data collection.

### ***Parent Survey***

A parent survey was conducted with the parents of the participants to determine which signs would be beneficial additions to the participants' sign language vocabulary. Four signs were selected to be targeted for each of the participants, and the simplest variation of the signs were taught:

P1: Candy, Water, Sticky Toy, Block

P2: Candy, Water, Sticky Toy, Tape

These signs were chosen based on what the parents of the participants thought would be beneficial additions to the participants' language, improving social validity. The parents and experimenter also took into consideration the participants' anticipated motivation towards the objects the signs represent. Questions used in the parent survey can be found in Appendix C.

### ***Baseline***

The procedures for baseline and sign language intervention were partially adapted from Tincani's (2004) *Comparing the Picture Exchange Communication System and Sign Language Training for Children with Autism*. Specific aspects from this study adapted for the present study include using a verbal prompt and model followed by a physical prompt, granting brief access to preferred items to ensure they are reinforcing, assessing imitation skills as a baseline test, and teaching the simplest forms of sign language. However, the design of the present study added natural intervention elements throughout the procedures and baseline. The purpose of baseline in this study is to ensure the participants do not already have the ability to request the selected items by using its correct sign language label. Baseline occurred for approximately 10 minutes two times a week, for a two-week period. The baseline was conducted 1:1 with the experimenter and one of the participants at a time. The participant received 10-20 seconds of access to each of the toy and food items, presented to the participants one at a time in a random order. The toy and food items were removed, then represented within view with two choices at a time, both out of arm's reach. If the participant reached for an item, the experimenter prompted the participant by asking, "which one do you want?" If the participant signed the name of one of the items, they would be given access to it. If not, one of the items would be removed and exchanged for the next item on the list. The process continued until all items on the list were presented.

### *Sign Language Intervention*

Intervention sessions occurred two times per week for six weeks. Sessions occurred during mealtime for approximately 10 minutes and playtime for approximately 10 minutes, depending on the continued engagement by the participants in the interaction. The experimenter was the only individual engaging in intervention with the participants and the majority of intervention was done 1:1 with each participant. It is important to note that occasionally, the experimenter interacted with both participants within the same time frame, shifting to a 1:2 ratio (i.e., with both participants). These occasional incidences were due to both participants desiring the attention of the experimenter instead of the other caregiver during intervention, as well as both participants being in the same room at the time of intervention. Since the study was conducted naturalistically, these events were to be expected, and the experimenter attempted to give full attention to one participant at a time when 1:2 ratios occurred. A simplistic version of the signs “water” and “blocks” were modeled. Iconic signs that resembled the action of the items were taught for “tape” and “sticky toy.” The American Sign Language sign for “candy” was modeled.

The naturalistic intervention evidence-based practices of modeling and prompting were used. Toys and edibles that elicited the target sign were placed in sight of the participant during intervention and presented in pairs. If the participant reached for one of the items, the experimenter presented the participant with a verbal prompt, such as, “Which one do you want?” or “What is this?” If the participant signed the correct response, verbal praise and access to the preferred object or activity would be given. An incorrect or lack of response would be countered in one of two ways: a second verbal prompt would be given if the participant’s attention was high, or a model of the correct sign would be given if the participant’s interest was waning. The

name of the target item would be spoken by the experimenter during the second verbal prompt, such as, “show me water,” as well as spoken while modeling the correct sign. If the participant failed to respond appropriately after the second model or mand, the experimenter would use a full physical prompt to help the participant use the correct sign. Then, verbal praise and access to the desired object or activity would be given to the participant. If the desired object was a food or drink item, the participant would be given a small portion of the item. If the desired object was a toy, the participant would be given access to the item for approximately 10-20 seconds. This intervention follows a prompting hierarchy, where the experimenter gradually decreases prompting until the participants reach independence. The hierarchy starts with a full physical prompt, fades to a partial physical prompt (i.e., participants having the correct handshape but requiring assistance moving hand to correct location), then moves to a visual model, then a verbal prompt, and finally a natural cue (i.e., the participant seeing a water bottle and signing “water”).

### ***Data Collection***

Each of the sessions were videotaped in order for the experimenter and faculty advisors to later analyze the sessions to ensure fidelity and determine inter-rater reliability. Each video segment was coded by the experimenter. An “aided sign” would be coded if the experimenter had to physically mold the participant’s hand into the correct sign. An “imitated sign” would be coded if the participant used a sign within 10 seconds of the experimenter’s visual model. A “prompted sign” would be coded if the participant used a sign within 10 seconds of the experimenter’s verbal prompt or question. A “spontaneous sign” would be coded if the participant used a recognizable sign independent of a model or prompt.

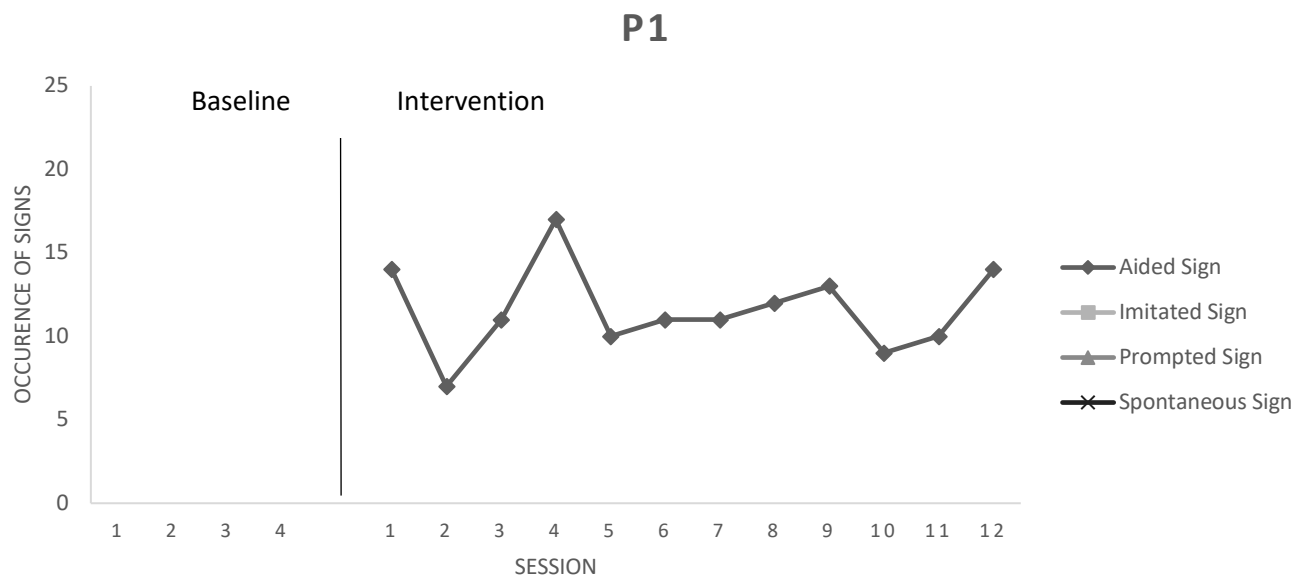
## RESULTS

During baseline, both participants expressed zero signs as responses. Regarding exposure of the chosen signs during intervention, P1 had an average of 12 aided signs (full physical prompt) per day for the first five intervention sessions, while P2 had an average of 14 aided signs per day for the first five sessions. No imitated or prompted signs were recorded for the first five days for either participant. Interrater reliability was recorded as 100% for the baseline and intervention data between the experimenter and the primary faculty advisor of the project (Mrs. Thompson).

### Participant 1

As shown in Figure 1, P1 consistently produced aided signs, without production of imitated or prompted signs. Based on his initiation of reaching for an object that would elicit a prompt for a sign, he had a total of 33 aided signs for “candy”, 25 for “water”, 28 for “sticky toy”, and 53 for “blocks”. The individual session-by-session can be found in Appendix D.

Figure 1: Occurrence of Aided, Prompted, and Imitated Signs for Participant 1

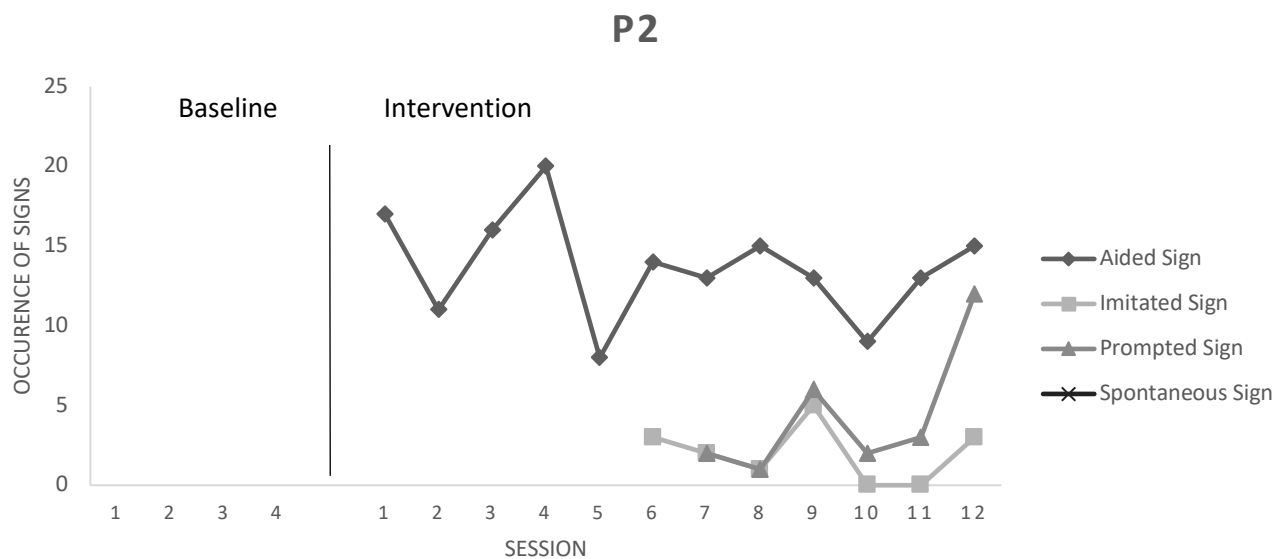


After the first few sessions of intervention, it was evident that P1 was not extremely interested or motivated by candy or water. In response to this, the experimenter incorporated a toy puppet to “drink” and “eat” the water and candy, which was then used to expose the participant to the signs. It was important to do this because without motivation or interest in the object, the participant would not likely acquire exposure to the sign in the first place. As intervention sessions went on, P1 was making strides in making the correct or almost-correct handshape for the objects he was signing for. However, the experimenter still had to physically move his hands to the correct location for the sign, resulting in an “aided” sign produced by the participant.

## **Participant 2**

As shown in figure 2, P2 consistently produced aided signs throughout intervention sessions, while beginning to produce imitated signs during intervention six and prompted signs during intervention seven. Prompted signs continued to increase in number throughout intervention sessions, while imitated signs varied for the remainder of sessions. Based on his initiation of reaching for an object that would elicit a prompt for a sign, P2 produced a total of 37 aided signs for “candy”, 39 for “water”, 44 for “sticky toy”, and 44 for “tape”. Only signs for “candy”, “water”, and “tape” were expressed using an imitated or prompted sign. “Water” was produced as an imitated sign a total of 10 times and a prompted sign a total of 8 times. “Candy” was used as an imitated sign a total of 3 times and a prompted sign a total of 18 times. “Tape” was produced as an imitated sign 1 time during day 12 of intervention. The results from individual intervention sessions can be found in Appendix D.

Figure 2: Occurrence of Aided, Prompted, and Imitated Signs for Participant 2



During the intervention sessions, it was evident that P2 was greatly motivated by verbal praise given by his mother and the experimenter. Although his mother did not aid in any intervention, she would occasionally be in the room when intervention was conducted and praised P2 when he produced the correct signs. It was evident by the observation of his disposition as well as the recorded number of imitated and prompted signs that this praise was a strong motivator. It was also observed that P2 sometimes made overgeneralizations of the signs. On some occurrences, he used the sign “candy” for “water” and “sticky toy.” These interchanged signs happened occasionally throughout the intervention sessions and were not recorded as correct productions. On the day of the 12th intervention session, P2 spontaneously produced “water” four times and candy one time. However, these productions occurred outside of intervention and were not on video, which is why they were not officially recorded in the data.

## DISCUSSION

This study focused on introducing two adults with level 3 autism to new sign language signs. The signs were introduced naturalistically when the participant reached for the target item that would elicit the sign. While both P1 and P2 are brothers with a very similar expressive communication skills, they responded to intervention somewhat differently. In just eight days of intervention, P2 produced half of the signs following a verbal prompt, whereas P1 was only able to produce the signs when physically prompted by the experimenter. Despite the similar exposure, starting on intervention day six, imitated signs were used by P2 but not P1. P2 continued to produce imitated and prompted signs for the remainder of the intervention sessions, while P1 continued to only produce aided signs. No spontaneous signs were coded during intervention for either participant. P2's production of imitated signs decreased as his production of prompted signs increased. This showcased his advancement in learning and understanding the signs because he was gradually able to produce the signs following only a verbal prompt (prompted), instead of following a model (imitated).

It is interesting to note that P2's aided sign exposure to the sign "tape" was higher than that for "water" or "candy", yet he did not produce an imitated sign for "tape" until the 12<sup>th</sup> intervention session. This could be due to the object itself, which may be less motivating to him. Despite P1 not producing imitated or prompted signs, he still made progress that should not be disregarded. Given different circumstances, such as different target signs or more time or increased exposure, he may have made larger gains

Anecdotally, by the 12<sup>th</sup> intervention session P2 appeared to take pride in his accomplishments and enjoyed producing the target signs, most likely because he was receiving praise after producing them. Whatever the reason, he made great progress which led to producing



spontaneous signs after the recorded session. This shows his accomplishment in generalizing signs even without a verbal prompt or model, which is the goal for the participants to utilize the new signs to use as communication outside of intervention.

In comparing the results of this study to previous research, the results in the present study support the work of Tincani (2004). When comparing different modalities of communication for students with autism spectrum disorder, Tincani (2004) found that the most efficient modality may depend on the individual's specific characteristics, including motor imitation skills. This supports the findings in the present study because even with nearly identical treatment, the efficiency of the two participants' acquisition of signs differed. While sign language training may be best for some individuals, it does not appear to enhance communication for all people on the autism spectrum.

### **Limitations**

Certain challenges were present in this study that were attributed to the naturalistic approach to intervention. Although the naturalistic approach was ideal for this study, it limited the ability to provide the participants with frequent exposure to the signs. Not only was the intervention conducted only for 10 minutes twice a week, but the participants were only exposed to the signs as many times as they naturally reached for the target items. This naturalistic approach was great for generalization, yet difficult for research because the participants may have had better exposure if either the treatment time was increased, or the treatment was conducted in a different way that allowed for more exposure in the beginning. In addition, another limitation to the study was not including a withdrawal phase, where activities of the baseline would repeat following the conclusion of intervention sessions. Not including a withdrawal phase eliminates the chance of comparing the baseline results directly with the

withdrawal phase results. So, in this study, the baseline was compared to the results of the intervention sessions.

Some challenges were present that attributed to the basic limitations of human participants, including both participants in the study being susceptible to seizures. Both participants occasionally had seizures before or during intervention. When it occurred, the experimenter ended intervention right away. These natural limitations either abruptly halted intervention or decreased the participants' attentiveness to participate in intervention.

Another limitation to the study was that not all target items were motivating for the participants. It seemed that P1 lacked motivation for candy and water, and P2 was not as motivated for tape and sticky toy. Since this study relied on motivation for these items in order for the participants to gain exposure to the sign and produce it themselves, this is an important limitation.

### **Future Research**

The results from this study show that nonspeaking individuals on the autism spectrum can learn and produce some sign language when taught through naturalistic intervention. Given this success, future research may want to focus on individual differences, since this study shows the variety of results based on two brothers with level 3 autism. It could also be useful to look into increasing the exposure of signs. This study was limited to 10 minutes a day since each session was recorded on video. However, a future study could look into longer sessions, while having a second person in the room to record results during the sessions. Future studies may also want to focus on target signs more important for activities of daily living. However, this becomes a challenge when converting into more abstract than concrete ideas.

Regarding clinical intervention, a speech-language pathologist who has a client with level 3 autism could implement some aspects of this study into therapy. This may include choosing signs of objects that the individual uses on a daily basis, as well as signs that will be motivating to the individual. Additionally, it is recommended that the speech-language pathologist routinely expose the individual to the target signs, stick to the prompting hierarchy of gradually decreasing prompting, and conduct therapy in a setting as naturalistic as possible.

### **Conclusions**

Findings from this study show that the effectiveness of naturalistic sign language training may be dependent on the individual and the environment. Regarding the individual, their personality, learning style, motivation, and interest in intervention all play a role in the effectiveness of the intervention. The effectiveness of sign language training may also be due to the target signs themselves. Some signs are easier to produce than others, and the production difficulty may depend on each individual's physical or cognitive abilities. Some signs also represent concepts that are more abstract or concrete, which could affect the acquisition of the sign. The length of time it takes for sign acquisition can also depend on the individual. Even though the methodology was the same for both participants, they had different time frames of acquiring the signs.

Reinforcement and motivation were also shown to play a large role in sign language acquisition, as seen by edibles initiating more imitated and prompted signs compared to the non-edibles. The edibles included built-in reinforcement based on taste. Reinforcement in the form of verbal praise was also seen to increase motivation. Each of these findings are interrelated when considering how the individual, environment, target signs, reinforcement, and motivation are all pieces of sign language acquisition. Since the methodology was the same for both participants,

the results point to each of these factors as being the cause of different rates of acquisition for both participants.

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## APPENDIX A. INSTITUTIONAL REVIEW BOARD (IRB) APPROVAL LETTER



BOWLING GREEN STATE UNIVERSITY

Office of Research Compliance

Institutional Review Board

DATE: November 2, 2022

TO: Elizabeth Michael

FROM: Bowling Green State University Institutional Review Board

PROJECT TITLE: [1944662-3] Sign Language Training for Individuals with ASD Level 3

SUBMISSION TYPE: Revision

ACTION: APPROVED

APPROVAL DATE: November 1, 2022

EXPIRATION DATE: September 6, 2023

REVIEW TYPE: Expedited Review

REVIEW CATEGORY: Full Board

Thank you for your submission of Revision materials for this project. The Bowling Green State University Institutional Review Board has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a project design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

The final approved version of the consent document(s) is available as a published Board Document in the Review Details page. You must use the approved version of the consent document when obtaining consent from participants. Informed consent must continue throughout the project via a dialogue between the researcher and research participant. Federal regulations require that each participant receives a copy of the consent document.

Please note that you are responsible to conduct the study as approved by the IRB. If you seek to make any changes in your project activities or procedures, those modifications must be approved by this committee prior to initiation. Please use the modification request form for this procedure.

All UNANTICIPATED PROBLEMS involving risks to subjects or others and SERIOUS and UNEXPECTED adverse events must be reported promptly to this office. All NON-COMPLIANCE issues or COMPLAINTS regarding this project must also be reported promptly to this office.

This approval expires on September 6, 2023. You will receive a continuing review notice before your project expires. If you wish to continue your work after the expiration date, your documentation for continuing review must be received with sufficient time for review and continued approval before the expiration date.

If you have any questions, please contact the Institutional Review Board at 419-372-7716 or [irb@bgsu.edu](mailto:irb@bgsu.edu). Please include your project title and reference number in all correspondence with this committee.

## APPENDIX B. INVITATION AND CONSENT



Department of Communication Sciences and Disorders  
Speech & Hearing Clinic

### Informed Consent

#### The effectiveness of sign language training for individuals with autism spectrum disorder level 3

I, Elizabeth Michael, am an undergraduate Honors student at Bowling Green State University majoring in Communication Sciences and Disorders. I am conducting a study to analyze the effectiveness of sign language training for individuals with Autism Spectrum Disorder Level 3. The purpose of the study is to offer more insight about how non-verbal individuals with autism spectrum disorder acquire and use sign language to communicate more effectively.

The purposes of this letter are to tell you about the study and request your approval for the individuals under your legal guardianship to participate. Your consent and their participation in the study is voluntary. The participants are free to withdraw from the study at any time. Deciding to allow them to participate in this study or not will not impact any relationship you or the participants may have with me or BGSU. I will always be open and honest when addressing any questions or concerns. I will also keep my behavior, temperament, and emotions consistent before, during, and after the study. I will also have an unchanging attitude about my job and services if you choose to not partake in the study.

#### What happens in the study?

During my normal work times as an independent provider, I will conduct baseline and intervention sessions with the participants. These sessions will last approximately 10 minutes per day for each participant and will be in a natural setting such as during mealtime or playing with toys. Baseline sessions will occur two times a week over a two-week period, and intervention sessions will occur two times a week over a six-week period. I will be the only person engaging in intervention other than the participants, who will each be seen individually.

Each of the participants will communicate their interest in participating based on their vocalizations, facial expressions, and movements. If a participant becomes upset when participating in the study, such as showing signs of disagreement such as shaking their head no, pushing/walking away, or showing any other form of disagreement/discomfort, I will assist the participants with de-escalation. My de-escalation strategy includes ending any kind of training I am currently delivering, moving back to give them more personal space, and allowing them to move about and/or access anything they want, such as a certain toy.

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### **What are the benefits and costs?**

Since there is a lack of research regarding sign language training for individuals with autism spectrum disorder level 3, this study is very important to gain knowledge in this area. As you know, the participants already have a small inventory of signs that they use to communicate expressively, and those signs have proved to be a great way for others to understand their wants and needs. This study aims to expand their sign language vocabulary so that they can communicate in a more effective manner.

The risks involved in participation are no greater than those experienced in daily life.

### **How will the participants' information be protected?**

While discussing and writing about the study, the identity of the participants will be kept confidential by being referred to them only as Participant 1 and Participant 2. Each of the sessions will be videotaped for the experimenter and faculty advisors to later analyze. The sessions will be recorded on a video recorder with no access to the internet. At the conclusion of the session, the recording will be transferred to a specified private OneDrive folder for this experiment and deleted off the video recorder. Only myself and my two faculty advisors from Bowling Green State University will have access to the OneDrive.

Once this study is complete, I may share the results through conference presentations and/or written publication(s); however, the identity of the participants will be kept confidential.

If you have any questions about this study or participant rights, please contact:

Elizabeth Michael	Megan Wilson	Institutional Review Board
Undergraduate Student	Project Advisor	Bowling Green State University
Honors College	Counseling and Special Education	(419) 372-7716
BGSU	BGSU	irb@bgsu.edu
(937) 726-4825	(419) 265-3114	
ejmicha@bgsu.edu	mrwilso@bgsu.edu	

Thank you for your consideration.

Please read and sign the next page if you are interested in participating in this study.

**Informed Consent****The effectiveness of sign language training for individuals  
with autism spectrum disorder level 3**

Please sign below to indicate that you give consent for the individuals under your legal guardianship to participate in this study.

Your signature acknowledges that you have

- read the entire document that explains the research study, including information about what is expected of you and the participants
- been informed of your rights and the participants' rights
- been told about any risks and inconveniences that the participants might experience by participating in this study
- been notified of the right to withdraw from the study at any time without penalty to yourself or the participants
- had all of your questions about the study answered

\_\_\_\_\_  
Printed Name

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

## APPENDIX C. PARENT SURVEY

## Parent Survey (to be conducted verbally)

1. What signs would you like your sons to learn?
2. Do you know of any signs that your sons are currently being taught?
3. Do you have any other questions, comments, or suggestions?

## APPENDIX D. SPECIFIC BASELINE AND INTERVENTION DATA

**Baseline: P1**

Date: 11/9/22				
Baseline 1	<b>Aided Sign</b>	<b>Prompted Sign</b>	<b>Imitated Sign</b>	<b>Spontaneous Sign</b>
<b>Water</b>	0	0	0	0
<b>Candy</b>	0	0	0	0
<b>Sticky Toy</b>	0	0	0	0
<b>Blocks</b>	0	0	0	0

Date: 11/14/22				
Baseline 2	<b>Aided Sign</b>	<b>Prompted Sign</b>	<b>Imitated Sign</b>	<b>Spontaneous Sign</b>
<b>Water</b>	0	0	0	0
<b>Candy</b>	0	0	0	0
<b>Sticky Toy</b>	0	0	0	0
<b>Blocks</b>	0	0	0	0

Date: 11/16/22				
Baseline 3	<b>Aided Sign</b>	<b>Prompted Sign</b>	<b>Imitated Sign</b>	<b>Spontaneous Sign</b>
<b>Water</b>	0	0	0	0
<b>Candy</b>	0	0	0	0
<b>Sticky Toy</b>	0	0	0	0
<b>Blocks</b>	0	0	0	0

Date: 11/21/22				
Baseline 4	<b>Aided Sign</b>	<b>Prompted Sign</b>	<b>Imitated Sign</b>	<b>Spontaneous Sign</b>
<b>Water</b>	0	0	0	0
<b>Candy</b>	0	0	0	0
<b>Sticky Toy</b>	0	0	0	0
<b>Blocks</b>	0	0	0	0

## Intervention: P1

Date: 1/9/23				
Intervention 1	Aided Sign	Prompted Sign	Imitated Sign	Spontaneous Sign
<b>Water</b>	2	0	0	0
<b>Candy</b>	3	0	0	0
<b>Sticky Toy</b>	3	0	0	0
<b>Blocks</b>	6	0	0	0

Date: 1/11/23				
Intervention 2	Aided Sign	Prompted Sign	Imitated Sign	Spontaneous Sign
<b>Water</b>	0	0	0	0
<b>Candy</b>	1	0	0	0
<b>Sticky Toy</b>	3	0	0	0
<b>Blocks</b>	3	0	0	0

Date: 1/17/23				
Intervention 3	Aided Sign	Prompted Sign	Imitated Sign	Spontaneous Sign
<b>Water</b>	1	0	0	0
<b>Candy</b>	3	0	0	0
<b>Sticky Toy</b>	1	0	0	0
<b>Blocks</b>	6	0	0	0

Date: 1/18/23				
Intervention 4	Aided Sign	Prompted Sign	Imitated Sign	Spontaneous Sign
<b>Water</b>	3	0	0	0
<b>Candy</b>	5	0	0	0
<b>Sticky Toy</b>	3	0	0	0
<b>Blocks</b>	6	0	0	0

Date: 1/23/23				
Intervention 5	Aided Sign	Prompted Sign	Imitated Sign	Spontaneous Sign
<b>Water</b>	3	0	0	0
<b>Candy</b>	3	0	0	0
<b>Sticky Toy</b>	1	0	0	0
<b>Blocks</b>	3	0	0	0

Date: 1/30/23				
Intervention 6	<b>Aided Sign</b>	<b>Prompted Sign</b>	<b>Imitated Sign</b>	<b>Spontaneous Sign</b>
<b>Water</b>	2	0	0	0
<b>Candy</b>	3	0	0	0
<b>Sticky Toy</b>	4	0	0	0
<b>Blocks</b>	2	0	0	0

Date: 2/1/23				
Intervention 7	<b>Aided Sign</b>	<b>Prompted Sign</b>	<b>Imitated Sign</b>	<b>Spontaneous Sign</b>
<b>Water</b>	3	0	0	0
<b>Candy</b>	2	0	0	0
<b>Sticky Toy</b>	2	0	0	0
<b>Blocks</b>	4	0	0	0

Date: 2/6/23				
Intervention 8	<b>Aided Sign</b>	<b>Prompted Sign</b>	<b>Imitated Sign</b>	<b>Spontaneous Sign</b>
<b>Water</b>	3	0	0	0
<b>Candy</b>	2	0	0	0
<b>Sticky Toy</b>	2	0	0	0
<b>Blocks</b>	5	0	0	0

Date: 2/8/23				
Intervention 9	<b>Aided Sign</b>	<b>Prompted Sign</b>	<b>Imitated Sign</b>	<b>Spontaneous Sign</b>
<b>Water</b>	4	0	0	0
<b>Candy</b>	3	0	0	0
<b>Sticky Toy</b>	1	0	0	0
<b>Blocks</b>	5	0	0	0

Date: 2/13/23				
Intervention 10	<b>Aided Sign</b>	<b>Prompted Sign</b>	<b>Imitated Sign</b>	<b>Spontaneous Sign</b>
<b>Water</b>	0	0	0	0
<b>Candy</b>	3	0	0	0
<b>Sticky Toy</b>	2	0	0	0
<b>Blocks</b>	4	0	0	0

Date: 2/15/23				
Intervention 11	<b>Aided Sign</b>	<b>Prompted Sign</b>	<b>Imitated Sign</b>	<b>Spontaneous Sign</b>
<b>Water</b>	1	0	0	0
<b>Candy</b>	3	0	0	0
<b>Sticky Toy</b>	2	0	0	0
<b>Blocks</b>	4	0	0	0

Date: 2/20/23				
Intervention 12	<b>Aided Sign</b>	<b>Prompted Sign</b>	<b>Imitated Sign</b>	<b>Spontaneous Sign</b>
<b>Water</b>	3	0	0	0
<b>Candy</b>	2	0	0	0
<b>Sticky Toy</b>	4	0	0	0
<b>Blocks</b>	5	0	0	0

**Baseline: P2**

Date: 11/9/22				
Baseline 1	<b>Aided Sign</b>	<b>Prompted Sign</b>	<b>Imitated Sign</b>	<b>Spontaneous Sign</b>
<b>Water</b>	0	0	0	0
<b>Candy</b>	0	0	0	0
<b>Sticky Toy</b>	0	0	0	0
<b>Tape</b>	0	0	0	0

Date: 11/14/22				
Baseline 2	<b>Aided Sign</b>	<b>Prompted Sign</b>	<b>Imitated Sign</b>	<b>Spontaneous Sign</b>
<b>Water</b>	0	0	0	0
<b>Candy</b>	0	0	0	0
<b>Sticky Toy</b>	0	0	0	0
<b>Tape</b>	0	0	0	0

Date: 11/16/22				
Baseline 3	<b>Aided Sign</b>	<b>Prompted Sign</b>	<b>Imitated Sign</b>	<b>Spontaneous Sign</b>
<b>Water</b>	0	0	0	0
<b>Candy</b>	0	0	0	0
<b>Sticky Toy</b>	0	0	0	0
<b>Tape</b>	0	0	0	0

Date: 11/21/22				
Baseline 4	<b>Aided Sign</b>	<b>Prompted Sign</b>	<b>Imitated Sign</b>	<b>Spontaneous Sign</b>
<b>Water</b>	0	0	0	0
<b>Candy</b>	0	0	0	0
<b>Sticky Toy</b>	0	0	0	0
<b>Tape</b>	0	0	0	0



## Intervention: P2

Date: 1/9/23				
Intervention 1	<b>Aided Sign</b>	<b>Prompted Sign</b>	<b>Imitated Sign</b>	<b>Spontaneous Sign</b>
<b>Water</b>	2	0	0	0
<b>Candy</b>	4	0	0	0
<b>Sticky Toy</b>	6	0	0	0
<b>Tape</b>	5	0	0	0

Date: 1/11/23				
Intervention 2	<b>Aided Sign</b>	<b>Prompted Sign</b>	<b>Imitated Sign</b>	<b>Spontaneous Sign</b>
<b>Water</b>	3	0	0	0
<b>Candy</b>	4	0	0	0
<b>Sticky Toy</b>	2	0	0	0
<b>Tape</b>	2	0	0	0

Date: 1/17/23				
Intervention 3	<b>Aided Sign</b>	<b>Prompted Sign</b>	<b>Imitated Sign</b>	<b>Spontaneous Sign</b>
<b>Water</b>	4	0	0	0
<b>Candy</b>	4	0	0	0
<b>Sticky Toy</b>	4	0	0	0
<b>Tape</b>	4	0	0	0

Date: 1/18/23				
Intervention 4	<b>Aided Sign</b>	<b>Prompted Sign</b>	<b>Imitated Sign</b>	<b>Spontaneous Sign</b>
<b>Water</b>	3	0	0	0
<b>Candy</b>	6	0	0	0
<b>Sticky Toy</b>	5	0	0	0
<b>Tape</b>	6	0	0	0

Date: 1/23/23				
Intervention 5	<b>Aided Sign</b>	<b>Prompted Sign</b>	<b>Imitated Sign</b>	<b>Spontaneous Sign</b>
<b>Water</b>	1	0	0	0
<b>Candy</b>	0	0	0	0
<b>Sticky Toy</b>	4	0	0	0
<b>Tape</b>	3	0	0	0

Date: 1/30/23				
Intervention 6	<b>Aided Sign</b>	<b>Prompted Sign</b>	<b>Imitated Sign</b>	<b>Spontaneous Sign</b>
<b>Water</b>	5	0	3	0
<b>Candy</b>	3	0	0	0
<b>Sticky Toy</b>	3	0	0	0
<b>Tape</b>	3	0	0	0

Date: 2/1/23				
Intervention 7	<b>Aided Sign</b>	<b>Prompted Sign</b>	<b>Imitated Sign</b>	<b>Spontaneous Sign</b>
<b>Water</b>	2	0	2	0
<b>Candy</b>	6	2	0	0
<b>Sticky Toy</b>	3	0	0	0
<b>Tape</b>	2	0	0	0

Date: 2/6/23				
Intervention 8	<b>Aided Sign</b>	<b>Prompted Sign</b>	<b>Imitated Sign</b>	<b>Spontaneous Sign</b>
<b>Water</b>	3	1	1	0
<b>Candy</b>	3	0	0	0
<b>Sticky Toy</b>	3	0	0	0
<b>Tape</b>	6	0	0	0

Date: 2/8/23				
Intervention 9	<b>Aided Sign</b>	<b>Prompted Sign</b>	<b>Imitated Sign</b>	<b>Spontaneous Sign</b>
<b>Water</b>	4	3	4	0
<b>Candy</b>	4	3	1	0
<b>Sticky Toy</b>	3	0	0	0
<b>Tape</b>	2	0	0	0

Date: 2/13/23				
Intervention 10	<b>Aided Sign</b>	<b>Prompted Sign</b>	<b>Imitated Sign</b>	<b>Spontaneous Sign</b>
<b>Water</b>	3	1	0	0
<b>Candy</b>	1	1	0	0
<b>Sticky Toy</b>	3	0	0	0
<b>Tape</b>	2	0	0	0

Date: 2/15/23				
Intervention 11	<b>Aided Sign</b>	<b>Prompted Sign</b>	<b>Imitated Sign</b>	<b>Spontaneous Sign</b>
<b>Water</b>	3	1	0	0
<b>Candy</b>	2	2	0	0
<b>Sticky Toy</b>	3	0	0	0
<b>Tape</b>	5	0	0	0

Date: 2/20/23				
Intervention 12	<b>Aided Sign</b>	<b>Prompted Sign</b>	<b>Imitated Sign</b>	<b>Spontaneous Sign</b>
<b>Water</b>	6	2	0	0
<b>Candy</b>	0	10	2	0
<b>Sticky Toy</b>	5	0	0	0
<b>Tape</b>	4	0	1	0

## APPENDIX E. LITERATURE REVIEW

A multitude of prior research was compiled to build the structure of the present research study. In a study by Tincani (2004), sign language training was found to be a functional way for some individuals with autism to request items. The procedures included granting brief access to the preferred items to ensure they are reinforcing, assessing imitation skills as a baseline test, then teaching the simplest form of sign language for the preferred items. In conjunction with the simplest form being taught, Manwaring et al., (2017) also studied how motor development is important in language development, since individuals with delayed language often have difficulties with some motor tasks, especially fine motor skills. The study found that fine motor skills are an underlying construct of using gestures, which impacts nonverbal communication strategies for people with ASD. Because of this, it is important to consider adjusting manual signs to better fit the individual's fine motor abilities.

In addition to conducting sign language with manual signing, Tan et al., (2004) found that simultaneously providing signing and speech when training children with ASD is more beneficial than sign-only or speech-only intervention. This combination of speaking and signing resulted in the children effectively using the signs, while generalizing some signs across other activities. According to Harjusola-Webb and Robbins (2012), naturalistic intervention is best conducted when it is an extension of activities that are already normally occurring for the clinician-client pair. In turn, this gives the ability to increase time spent in natural intervention and less time in isolated intervention. Research by Wright et al., (2013) concluded that not only is naturalistic intervention an appropriate way to teach sign language, but it also increases the individual's engagement in communication. Wright et al., (2013) incorporated coding the

participants' responses as spontaneous, imitated, prompted, or aided, which helped the researcher track progress, finding each participant to demonstrate an increased signing rate.