THE EFFECTIVENESS OF AUDITORY ELECTRONIC PROMPTING
FOR CHILDREN WITH AUTISM IN PEER PLAY SETTINGS

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By
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CERTIFICATION OF APPROVAL

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ABSTRACT

This study examines the effectiveness of utilizing an electronic device, or bug-in-ear (BIE) as a prompting tool for children diagnosed with Autism during peer-play sessions. BIE prompts were compared to prompts presented in person. Three 5-year-old male participants were utilized in the study. Results indicated that prompts presented via the BIE device, were not as successful as prompts presented in person.
INTRODUCTION

Autism is a developmental disorder that includes “persistent deficits in social communication and social interaction across multiple contexts” such as deficits in: “social-emotional reciprocity”, “nonverbal communicative behaviors”, and “developing, maintaining, and understanding relationships” as well as a limited repertoire of activities and interests (American Psychiatric Association, 2013). With the rate of autism seeming to be increasing from 4 out of 10,000 in 1966, to one out of 68 (Christiansen, et al., 2016), many intervention strategies have been implemented to help incorporate this population into typically developing settings (e.g. classroom and work).

Stereotypic behaviors are defined as “involuntary, patterned, repetitive, coordinated rhythmic” behaviors (Freeman, Soltanifar, & Baer, 2010) that can be suppressed by other outside stimuli or distractions. Examples of stereotypy include: hand-flapping, rocking of the body, manipulation of objects by the hand or in the mouth, and vocal repetitions, where the child may repeat words or sounds (Lee, Odom & Loftin, 2007) that are incoherent or inappropriate given the context and their environment.

Children with autism seem to lack the ability to connect themselves with other individuals and situations from the beginning of life (Kanner, 1943). Kanner also noted that children with autism have a tendency to disregard any outside stimulation, whether it is from noises, people, or other external events. When they come into
contact with these stimuli, they tend to act as if it never happened, or resist it in a severe distressing manner. The children that were noted in Kanner’s (1943) study seemed to look at other children in the room, however, would disregard their presence and be content to play on their own with no interest in cooperative or interactive play.

Because of limited social-interaction among children with autism, there has been an increase in parent requests, as well as legislative mandates to incorporate this population into general education classrooms (Kasari, Freeman, Bauminger, & Alkin, 1999). However, merely placing children diagnosed with Autism Spectrum Disorder (ASD) in close proximity with typically developing peers may not increase social skills as much as previously thought. Chamberlin, Kasari, and Rotheram-Fuller (2007) found that children with autism incorporated in a regular education classroom had less reciprocated friendship nominations from their typical peers than among the typically developing children. The children in this study who had higher rates of reciprocated friendships, also included parental collaboration and teacher involvement which helped set the stage for the typically developing peers to incorporate their classmate.

In order to help increase age-appropriate social skills and every day functioning, intervention is frequently used to help teach these skills (Schopler & Mesibov, 1986). Teaching social skills is a common intervention used for school-age children with autism (Weiss & Harris, 2001). There have been three categories of social skills training identified (DiSalvo & Oswald, 2002). The first category includes forming interpersonal situations to promote interactions such as peer play groups
(Wolfberg & Schuler, 1993). The second category includes utilizing typically developing peers to help initiate social interactions (Odom & Strain, 1986) as well as building school-based peer networks (Garrison-Harrell, Kamps, & Kravitz, 1997). And lastly, the use of prompting is implemented to help children with autism initiate social interactions (Brady, McEvoy, Wehby, & Ellis, 1987).

Prompting has been shown to be an effective tool in helping teach children with autism. There are several different types of prompts that are used, which include, but are not limited to: physical, visual/gestural, tactile, physical, model, and auditory prompts. The most common type of prompt used is the auditory or verbal prompt. This type of prompt is used due to its ease of implementation. Giving the child an immediate verbal prompt helps reduce the chance of the child producing an incorrect response to target stimuli. However, auditory prompts can be intrusive and distracting depending on the situation where they are used (e.g., teaching appropriate peer interactions). Visual prompts are less intrusive, however, they must be taught prior to use, and the child must reference the individual giving the prompt.

A tactile prompt is also less intrusive than an auditory prompt, and more beneficial than a visual prompt, since the child does not need to be looking at any specific individual in order to receive the appropriate prompt (Taylor & Levin, 1998). Just as the visual prompt, a tactile prompt must be taught to the child before its use. Physical prompting involves physically touching the child, to help guide them through the target behavior. This is most beneficial if used when the child has never performed the target behavior and does not perform it with a model prompt. This type
of prompting is very intrusive, as it requires the teacher to be physically moving the child, or touching the child in some way in order to help promote or act out the behavior. Model prompting is similar to physical prompting, but requires no touching from the teacher to the child; instead it is used to demonstrate to the child how the target behavior should look, if it is not previously in their repertoire.

In regards to teaching children appropriate social skills, tactile prompts have been shown to increase verbal initiations more so than the use of verbal- and no-prompting. Shabani et al. (2002) used tactile prompting in the form of a vibrating pager, in order to prompt the child to initiate verbal responses with his peer. When the tactile prompt was implemented, verbal initiations increase from 0% to an average of 77% for the three children in the study. The use of the tactile device was to provide a less obtrusive prompt for verbal initiations (Shabani et al.). However, a disadvantage with using the tactile prompt is not being able to provide a variety of verbal initiations. A less obtrusive form of verbal prompting could help aid in producing a variety of verbal responses from the children, by either providing partial verbal prompts, or suggestive verbal prompts (e.g. “Ask him/her about their favorite things to do,” “Talk about school”) for the children.

One form of a less obtrusive, verbal prompting system that has been utilized with various populations is a radio transmitter ear/microphone, also known as a “bug-in-the-ear” (BIE) (Goodman et al., 2008). The use of this device gives the instructor the ability to provide immediate prompts, directives, cues, or feedback to behaviors
while the person who is wearing the ear piece is interacting with others such as clients, or teaching a class (Gallant & Thyer, 1989; Goodman & Duffy, 2007).

Goodman and Duffy (2007) utilized a bug-in-the-ear prompting system to increase positive self-statements and to help the individual with autism participate in his own Individualized Education Program (IEP) meeting. With the use of BIE during the IEP meeting the level of anxiety decreased, and provided the individual with an unobtrusive coach to help guide him through his IEP meeting by providing verbal prompts. With the use of the BIE, the number of positive statements increased in comparison to baseline (increase from one to six positive statements). BIE has also been utilized in providing effective and time-efficient feedback for teachers. Goodman, Brady, Duffy, Scott and Pollard (2008) also noted that delaying feedback increased the likelihood that individuals would learn and practice errors. This delay in appropriate feedback may strengthen the inappropriate or incorrect behavior (Goodman, et al., 2008). The use of BIE has been proven effective in delivering immediate feedback and prompts in order to increase or change behavior. This has been indicated by Goodman et al. (2008), who utilized BIE in order to shape the delivery of learning units (antecedent, student behavior, consequence given by teacher) from a student/novice teacher given by a supervising teacher. In this study, the rate of correct delivery of learning units increased for all three participants through the use of BIE technology.

More recent research from Gilson and Carter (2016) evaluated the effectiveness of reducing proximity by using a walkie-talkie device and providing
them with a coaching package while providing feedback on social interaction and task engagement. The individuals assessed in this study were three participants (ages 18-26) with a diagnosis of Intellectual Disabilities (ID) or ASD at their current place of internship. In this study, Gilson and Carter (2016) found that providing both a job coach package, as well as reducing the proximity of the coach from the participant, which at this point prompts were provided through a BIE device, social interactions increased 22-27% from baseline levels across the participants.

Utilizing BIE to provide immediate prompts and feedback has been shown to increase the rate and accuracy of a target behavior. The purpose of this study was to examine the effectiveness of bug-in-the-ear technology as a less intrusive means of increasing social interaction among children with autism. The use of BIE could also increase a variation of verbal responses that tactile prompts did not produce. This could be done by fully or partially prompting statements, questions or responses through the BIE system.
METHODS

Participants

Three children participated in this study. All participants had a diagnosis of autism spectrum disorder (ASD) and were receiving up to 35 hours per week of comprehensive, early intensive behavioral treatment (EIBT) from a center in Riverbank, California. Each participant had previously received a diagnosis with an autism spectrum disorder by an agency independent of the treatment center using “best practice” assessment and diagnostic procedures. Upon verbal agreement from the parents, a packet describing the study, which also included informed consent and assent forms, was sent home to the parents of the children (see Appendix A).

Participant 1 was a 5-year 11-month-old boy in a regular education kindergarten classroom with aides from the agency. Participant 2 was a 5-year 9-month-old boy in a regular education kindergarten classroom. Participant 3 was a 5-year 9-month old boy in a regular education kindergarten classroom. It should be noted that Participant 2 and 3 are fraternal twins.

Before training or collection of baseline data occurred, informed consent from the parents (see Appendix A) was obtained. After informed consent was obtained, assent from the participant was obtained before each baseline and training session that occurred. Assent was obtained whenever the child was asked to participate. The experimenter asked the child “Do you want to participate in my study today?” or “Would you like to play today?” If the participant indicated they did not wish to
participate in the study that day, then the participant skipped that day of intervention. The researcher then tried again the next day or at a later time to recruit the participant who refused.

Once parents agreed to have their child participate in the study, language prerequisites were assessed. Language prerequisites for participation were as follows: the child must have been able to produce at least two-word utterances, with close pronunciation of the words or phrases which they intended to speak. They were required to be able to respond to simple questions and statements, be able to reciprocate or independently produce questions, as well as reciprocate or independently generate general statements that were appropriate to the activity they were engaging in.

Utilizing the child’s learning programs, the researcher was able to assess the number of words per sentence the child was able to speak with clarity. The researcher then prompted simple echoic phrases (e.g., “How are you?”, “What is your name?”, “I like that one.”). Once the child demonstrated that he was able to repeat simple phrases, the researcher then assessed whether or not the child was able to appropriately answer simple questions (e.g., “Do you like the yellow one?”, “What game would you like to play?”, “What is the car doing?”). Participants were reminded of the preferred reinforcement they would receive at the end of the session, while obtaining assent by asking, “Would you like to work for [preferred reinforcement] by playing with your friend [name] today?” An informal preference assessment was
completed by asking the participant which items he would like to work for (e.g. iPad®, extra play time, edible treat).

Once language capabilities were determined, the child was assessed for tolerance of the BIE device. Initial tolerance of wearing the BIE device was determined by placing the earpiece in the child’s ear and clipping the walkie-talkie to their belt area. If the child was able to wear the device without aversive reactions, they moved onto the next phase of assessment of tolerance. Once the child demonstrated they were able to wear the device successfully, the researcher turned the device on and spoke to the child through the child’s earpiece. If the child demonstrated tolerance to the device without displaying behaviors associated with anxiety/stress, then the child continued in the study and moved onto baseline phase. If the child displayed increases in anxiety/stress behaviors, they were not required to continue in the study, and the parents were provided a verbal or written explanation of the discomfort that the device caused their child. During this study, no participants were excluded due to aversive reactions from wearing the device.

Baseline measures of tolerance were assessed by having the child wear the device, turned off, until the child displayed dislike towards the device (e.g., removing/attempting to remove the device). Once the baseline time frame was determined, the time was increased by 30 second intervals until the child was comfortable wearing it for at least 15 minutes. Upon successful increases in time wearing the device, the child was then given access to a highly preferred reinforcer that was determined using a preference assessment prior to the placement of the
device. Once the child was capable of keeping the headset on for 15 minutes, the child then wore the device for 15 minute intervals during normal program instruction: discrete trials, down times, and during the child’s break outside or in the indoor playroom.

Materials

The radio transmission system used was the Motorola FV300 FRS/GMRS 10-Mile 2-Way Radios along with compatible headsets. The researcher used an ear bud with a built-in microphone while the children wore the ear bud without a microphone attached. Extra AAA batteries were supplied for the radio transmitters.

In addition to the Motorola devices and parts, data sheets for training and treatment fidelity were utilized (see Appendix B).

Setting

Intervention took place in a 10x10 1:1 intervention room located at the center where the children were receiving services. The room included materials such as board games, car play (tracks, cars), blocks, arts and crafts, puzzles, child size table and chairs, and books. The intervention occurred during normal intervention hours (between the hours of 8:30 am and 6:00 pm). The individuals in the room included two adults (the researcher and the child’s typical tutor), a typically-developing peer who was present for peer sessions, and the participant.

The type of setting for the participants was a peer-play setting, in which a similar-age, typically-developing peer was brought into the center to interact with the children receiving services in the center. Both the participant and the typically...
developing peer were brought into the room set up for the peer play with appropriate toys and materials.

The peers present for the study consisted of two children: a 5-year-old boy in a typically developing kindergarten classroom, and a 4-year-old girl in a typically developing preschool classroom. Each participant engaged in the peer play sessions with both peers depending on peer availability. The peer who was present for the day completed a session with each participant.

**Procedures**

A multiple baseline design across participants was utilized to evaluate effectiveness of prompts provided through a BIE device. Each peer play session lasted for 10-20 minutes. While the baseline phase was being implemented, each participant’s tolerance to wear the BIE device was increased systematically from baseline levels. This was conducted periodically throughout the week, until the participants were comfortable wearing the device for at least 15 minutes. After at least two baseline sessions were conducted and baseline stability was shown, training to respond to the BIE device was introduced. The participants were trained using discrete trial training until they demonstrated responding to the prompts provided through the BIE system at least 90% of the time. Once the participants were successful at responding to prompts via the BIE device intervention was then introduced.

The BIE device was checked prior to each session to ensure that they were operational before use.
Baseline

During baseline sessions the observer and researcher were located in the room. The researcher recorded the baseline data while the tutor prompted the interactions with the children. The researcher was located near the back of the room during the entirety of the baseline sessions. Language prompts were provided to the participant as they normally would have been, during peer-play sessions, to facilitate appropriate language during play.

Baseline data were recorded prior to the introduction of the intervention phase. A minimum of two sessions of baseline data without the BIE device on the child were recorded, and a second baseline condition was conducted with the BIE device on the child (but not turned on) were recorded. Baseline sessions were conducted one to two times per week over the course of three weeks and lasted approximately 10-20 minutes each. The researcher provided prompts throughout the session to facilitate appropriate language as was typical in the students programming.

Treatment

Before the treatment phase began, but after baseline conditions, training to respond to the BIE system was introduced to each of the participants within the same week of completing baseline. Once the participants demonstrated success with wearing the earpiece comfortably without experiencing distress then training continued. Step one of training consisted of teaching the child the mechanics of the ear piece system (volume control and putting the earpiece back on if it falls off).
The next step was to begin to teach the participants to respond to the auditory prompts provided through the BIE system. This consisted of the trainer initially providing prompts through the BIE system to the child while in close proximity. The close proximity was to provide reinforcement immediately after the correct behavior. Once the participant produced correct responses on two separate occasions, which were separated by no less than 1 minute and no more than 3 minutes, the trainer then increased the distance between him/herself and the participant by three feet. Upon responding to prompts provided through BIE two times at three feet, the distance was then be increased by three more feet. This was continued until the distance between the child and the trainer was the length of the treatment room and the child responded to all auditory prompts being provided through the BIE system.

Maintenance sessions were conducted during different times of the day, over the course of a day or two. If the participant failed to respond correctly in any of the steps, proximity between the child and the trainer was decreased to the previous successful distance.

Once training was completed for each participant and they responded to the BIE prompts 90% or better, the treatment phase was introduced. The first participant who completed training and demonstrated baseline stability was placed in the treatment phase. Each participant was subsequently added each week, or when training was completed, which-ever came later and after baseline stability was demonstrated. Collection of baseline data continued to be recorded for the other participants who were not in the treatment phase.
During the treatment phase, the participant and peer were brought into the same room as the baseline phase to control for extraneous variables. The room was set up as identically as possible for every session regarding the location, number of individuals present, as well and location of the furniture, and games. During treatment the second observer remained in the room, but was as far to the back of the room as possible, near the researcher who was recording data. The researcher provided prompts through the BIE system as prompts would normally be provided to facilitate natural verbal interactions during peer-play sessions. The role of the second observer was to be present to keep conditions the same as baseline. The treatment sessions lasted approximately 10-20 minutes.

Once the session began, the researcher began to verbally prompt the participant. If more than 20 seconds elapsed without the participant initiating a question or statement to the peer, the participant was off topic related to the activity being played or the conversation being discussed, or was engaged in a different activity than that performed by the peer, a prompt would be provided.

The prompts included: statements such as “Say, ‘I like dogs’, say, ‘Green is my favorite color’, say, ‘I have a red shirt’, say, ‘my name is (x)’ say, ‘Yes, I have two cats’”; or questions such as “Ask your friend: ‘What is your favorite movie?’, Ask your friend: ‘What is your teacher’s name?’, Ask your friend: ‘What game do you like to play?’ Ask your friend: ‘What is your favorite color?’” etc. If the participant was not engaging with the peer for more than 20 seconds, one of the above type prompts were given. Being engaged with the peer required the participant to be
verbally engaging by responding (providing a statement or question within 5 seconds of the peer’s statement or question) to or initiating statements and/or questions with the peer. Statements were defined as any declarative sentence, while questions were defined as any sentence to elicit information.

Fading of the BIE was going to be conducted after the participants demonstrated successful responding to prompts with the peer present, however, due to the drastic decrease in successful responding (see results), fading sessions were unnecessary.
RESULTS

The participant data indicated that responding to prompts provided via the BIE device was not as successful as responding to prompts given in person. Figure 1 shows the percentage which the participants responded to the corresponding prompts delivered. Prompts during both baseline phases were given in person. Phase two of baseline was conducted with the BIE device placed in the participant’s ear, but was not turned on. This was to assess if any change in the percentage of prompting occurs with the device present. During the treatment phase, all prompts were given via the device. During the peer sessions, two peers were utilized—one male and one female—which are labeled M and F on Figure 1. Prompts were provided when the participant was not responsive to the peer’s questions or statements, or there was a lapse of conversation between the peer and participant that lasted greater than 20 seconds.

During both baseline conditions, prompts were given in person. During the treatment conditions, prompts were given via the BIE device. During initial baseline conditions, Participant 1 responded to all prompts delivered in person. During the introduction of treatment, responses to prompts delivered via the BIE device did not initially vary from baseline levels. However, as shown in Figure 1a, after session 2, responses to prompts decreased significantly. As shown in Figure 1b Participant 1’s responding decreased from 100% during both baseline levels, to an average of 82% during treatment phase. Participant 2’s responses to prompts maintained similar levels
of responding across baseline conditions, 94% on average during the initial baseline condition, and 95% on average during the second baseline condition. When treatment was introduced, responses to prompts delivered decreased significantly to an average of 80%. Participant 3’s responses to the prompts varied across phases. Once the BIE device was introduced during the second phase of baseline, response to prompts decreased from an average of 89% responsive, to an average of 80% responsive. At the end of the second baseline phase, response to prompts did increase to initial baseline levels. Once treatment was introduced, responses to prompts delivered via the BIE device decreased significantly to an average of 48%. During the final session, data collection was discontinued due to the participant refusing to respond to prompts delivered.
Figure 1a. Percentage of participants response to prompts delivered.
Figure 1b. Average compliance to prompts provided traditionally or via BIE device.

Figure 2 shows the total percentage of language prompts delivered vs total language opportunities during the peer play sessions—each client had 40 opportunities for independent or prompted language. The baseline phase of the study was compared to the BIE prompt treatment phase of the study. As shown from Figure 2, Participant 1’s total session prompts varied minimally from baseline phases to treatment phase. Participant 2’s total session prompts varied minimally during baseline phase. Though, during the treatment phase, the second participant’s total sessions prompts had a higher rate of variance from baseline. Participant 3’s total session prompts began to increase after introduction of the BIE device during the second phase of baseline. Prompts required for the third participant remained higher
during the treatment phase. During the last session of treatment phase Participant 3 began to protest responses to the prompts delivered via the device. At this point, data collection was discontinued.
Figure 2. Total percentage of prompts delivered during peer sessions.
DISCUSSION

These findings seem to indicate that language prompts presented through a BIE device are not as effective as language prompts presented in a typical fashion utilizing 5-year old children on the Autism spectrum. These results are not similar to what was found when Goodman and Duffy (2007) utilized a BIE device to assist a 10th grade individual with autism to participate in his IEP meeting. In that study, the individual was able to respond to the BIE prompts which helped reduce anxiety during the IEP meeting, as well as increase positive statements. Goodman et al. (2008) also reported success in utilizing a BIE device to provide immediate prompts to increase or change behavior from a supervising teacher to a novice teacher. Gilson and Carter (2016) also found that utilizing a BIE device helped increase social interactions 22-27%, in three 18-26 year old participants at their internship.

When looking at the data presented, at the onset of the treatment phase, all participant responsiveness to prompts decreased. The decrease in responsiveness, could be attributed to the participants vocalizing statements that were not what was prompted, when prompts were presented via the BIE device. This could be due to the noise level in the treatment room. It was possible the participants were unable to hear the prompts being given. During this instance, the participant would occasionally vocalize “What?” or “Huh” and the prompt would be represented. During baseline conditions, prompts were presented to the participants at a close proximity, with varying levels of volume respective to the noise level in the room. During treatment
conditions, prompts were presented in the participants’ ear; however, if the device was not turned up high enough, prompts would not have been heard correctly, if at all, when conditions had higher levels of noise. Goodman et al. (2008) utilized a similar BIE device in a special education classroom setting with a typical population of college graduate novice teachers. The teachers in this setting were able to adjust their ear piece when the volume was too low. One solution could be to teach the participants to respond appropriately when the volume is too low, and to adjust it themselves.

Another possible cause for decrease in responsiveness, could be due to the participants’ age. Goodman and Duffy (2007) utilized a 10th grade participant, while Goodman et al. (2008) utilized typically developing post-college participants, and Gilson and Carter (2016) utilized individuals 18-26 years old. Utilizing 5-year-old participants may not be an ideal population for this type of technology. Additional research should consider utilizing various age groups to determine the effectiveness among other ages.

At the onset of introduction to the BIE system for Participant 3, responding to prompts initially decreased even during baseline phase, where prompts were not given through the BIE system. During the treatment phase, Participant 3’s responding to prompts through the BIE system decreased significantly compared to baseline levels. In session 10, data collection was discontinued after the onset of the session due to the client protesting all prompts given. His protests were in the form of shaking
his head ‘no’ upon the onset of all prompts delivered. He would then begin to remove the ear piece and vocalized that he did not want it on any more.

Limitations to the study include the cost effectiveness of using a walkie-talkie with a headset/earpiece and extra batteries. During the treatment phase, there were also instances where the bug would fall out of the participants’ ear. The participants were taught how to re-insert the bug, should it fall out. Though, there were instances where the researcher would need to step in and insert the bug due to the participants not replacing the bug correctly, taking an extended amount of time to re-insert the bug—which would hinder the play activity—or the participant was unable to untangle the cord to replace the device correctly. One solution to could be the use of a smaller cordless blue tooth device. Goodman and Duffy (2007) utilized a similar prompting system; however, prompts were provided in a meeting format, which indicates a less active environment. More research is needed in this area regarding different types of devices that could be utilized. To get a better understanding if this type of device was distracting, it could be beneficial to obtain information regarding whether the device was interruptive during the session by asking the peers as well as the participants.

During this study, inter-observer agreement (IOA) data were not taken during the study due to inconsistent peers as well as limited time when peers present. Lack of camera availability during peer presence was a contributing factor as well. Future research should look at utilizing a system to collect IOA data, this could be purchasing and utilizing a camera system specifically for recording sessions, or training an additional observer to record data while the session occurs.
Another limitation includes the varying peers presented to the participants. It is unclear if the participants responded differently to the treatment condition due to the introduction of a female peer, or if it was due to the change of the treatment conditions. Participant 1’s responses began to decrease when the male peer was presented, and continued to decrease until the female peer was brought back at the end of treatment. Participant 2’s responses to BIE prompts was on an inconsistent trend among the male and female. While Participant 3’s responses to BIE prompts dropped significantly once the female peer was present. A solution to ensure the responsiveness to prompts was not due to the peers present could be to utilize a single typical peer, or alternate typically developing peers throughout baseline and treatment to determine if there are consistent trends of responsiveness depending on the peers.

Location of the treatment room should be considered to rule out extraneous factors such as noise. Fading procedures to include fading from a quiet space, to a noisier environment should be looked at.

Currently, there are limited studies focusing specifically on using a BIE system in peer play settings. More research would be needed to rule out if this is not a form of prompting that is as effective as prompts provided traditionally. An important aspect to this study is that the use of a less intrusive way of prompting could be effective given the correct devices, settings, and participants.

This study demonstrates that some implementations of BIE may not be as successful as traditional prompting with younger children diagnosed with ASD, though it could have benefits, such as allowing the participant to be more
independent, by increasing the distance between the prompter and children in the peer setting. This benefit allows for a more natural flow of conversation. This increase in distance, could also be beneficial to use in school settings, where it may be difficult to provide prompts in close proximity. It also could serve as a more discrete method of prompting in community/school based settings, which is desirable among parents of children with Autism Spectrum Disorders.
REFERENCES


DiSalvo, C. A., & Oswald, D. P. (2002). Peer-mediated interventions to increase the
social interaction of children with autism: Consideration of peer expectancies.


doi:10.1177/10883576020170040201


doi:10.1177/108835769701200406


Freeman, R. D., Soltanifar, A., & Baer, S. (2010). Stereotypic movement disorder:

doi: 10.1111/j.1469-8749.2010.03627.x


doi:10.1023/A:1022159302571


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APPENDIX A

INFORMED CONSENT FORMS

To the Parents:

This thesis study is designed to study the effectiveness of a radio electronic device, or a bug-in-ear (BIE), as an auditory prompting system for children who have been diagnosed with Autism or Pervasive Developmental Disorder (PDD). A BIE system includes: two walkie-talkies (one for the individual giving the prompts, and the other for the child receiving the prompts), two headsets: one with a microphone and earpiece and one with an earpiece only. The walkie-talkie will be clipped onto the child’s belt area where the shirt can lay over the device, and the wire can be placed under the shirt up to the child’s ear. This is to keep the wire from being tangled up in activities the child may be engaging in, as well as an attempt to keep confidentiality.

Generally auditory prompts include the prompter (tutor, teacher, parent) giving the child a prompt within close proximity to each other. This type of prompting system will assess an increase in the proximity between the tutor and the child while the child is engaging in peer plays with children around or at their own age. This study is to determine whether or not the children will respond appropriately to auditory prompts from the tutor through the BIE system. This is also assessing whether or not this type of prompting system is less distracting to the children than normal auditory prompts within close proximity to the child.

If you chose to have your child participate, they will be assessed for tolerance of the BIE system. If the child exhibits any anxiety or stress related to any part of the system, their participation will be stopped. This is to ensure that the child is not harmed in any way during the course of the study. The data collection as well as videos for the study will be kept confidential. Only the individuals on the research team will have access to these files.

Your decision to have your child participate, or not participate will not affect the services your child receives from CVAP inc.

The intervention will take place during normal CVAP inc. operating hours. The initial training sessions will occur in your child’s normal intervention room. Once your child has learned to respond to prompts given through the BIE system, they will then be moved to a larger room located in the center for peer play. At this point, they will be instructed to play with their friend. The peer play will occur normally, with the only difference being how the prompts to your child are delivered. The tutor will be distanced from your child, but in the same room, and prompts will be given remotely using the BIE system.

If you agree to have your child participate, please review the Informed Consent located on the next page. If you have any questions feel free to contact me at the number listed below. If you have any questions about your rights as a research
participant, you may contact the Chair of the Psychology Institutional Review Board of California State University Stanislaus, Dr. Kelly Cotter, at kcotter@csustan.edu.

Sincerely,
Kari Petersen
(707) 845-4435

Debriefing Form

During the course of the study, you will be able to be updated on your child’s general progress at any point during the intervention. At the end of the study, you will also be provided with the results of your child’s participation after the data has been compiled. Information regarding when the end of the study is will be provided on further notice. A letter will be sent home to you estimating the end date as it approaches, as well as information regarding when the results will be available. If you wish to obtain information on your child’s progress during the intervention process, feel free to contact your child’s Supervisor or me at the number below.

Thank you,
Kari Petersen
(707) 845-4435

Informed Consent for Study on Bug-in-the-Ear Prompting

I hereby give consent for my child ______________________________ to participate in a graduate thesis study that will examine the effectiveness of a radio communication system. The purpose of this study is to evaluate the effectiveness of a radio communication system (Bug-in-ear; BIE) as a less intrusive prompting system during peer play.

I understand that this study is being conducted as a graduate thesis through California State University Stanislaus Psychology program. My decision to or to not participate or withdraw early will not affect the services that are provided to my child at Central Valley Autism Project. My child’s participant in this study is voluntary and that I may stop my child’s participation at any time during the study. I also understand that my child’s real name will not be used in the published report.

Participation does not guarantee that there will be any benefits to me or my child. However, possible benefits may include the ability to continue to research less intrusive measures of prompting during peer play including generalizing the radio system to more naturally occurring settings (i.e., school settings).
This study will be conducted during normal intervention hours and will require 15-20 minutes each session. Sessions will be conducted 3 times per week for 4 weeks.

Data that are collected during this study will be kept confidential and only accessible to those conducting the research (i.e., the researcher, those on your child’s team or other qualified employees at the center) and the thesis advisor, Dr. Potter. Any video footage of your child will be kept on a separate external USB drive, and kept at the CVAP center. Access to the video footage will be limited to those on my child’s data collection team.

The present study is designed to reduce the amount of negative experiences my child may encounter during his/her participation. Potential risk factors may include: my child’s discomfort or agitation with the BIE system. However, if any discomfort or agitation is displayed by my child, the session will be stopped immediately. If your child’s participation causes you any concern, anxiety, or distress, feel free to contact the Stanislaus County Behavioral Health and Recovery Services at 1-888-376-6246, or the supervisor of your child’s team.

I understand that being a graduate thesis, if I have any questions or concerns regarding the research, I can contact Kari Petersen at (707) 845-4435 or Dr. Potter at (209) 667-3518. At the end of the study, I will be provided with results of the research, and the findings will be discussed with me. If you have any questions about your rights as a research participant, you may contact the Chair of the Psychology Institutional Review Board of California State University Stanislaus, Dr. Kelly Cotter, at kcotter@csustan.edu.

By signing below, I indicate that I am this child's guardian and that I give permission for him/her to participate in the study. I acknowledge that I have read and understand the information provided above and allow my child to be video-taped in the study described above. I will also be provided with an unsigned copy of this form to keep.

_________________________________________  __________________
Parent Signature                  Date
APPENDIX B

TRAINING AND TREATMENT FIDELITY

Observer________________ Start Time ________
Date ___________________ Stop Time_________
Participant ID ________

Training Fidelity

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<tr>
<th></th>
<th>Yes (tally)</th>
<th>No (tally)</th>
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<tbody>
<tr>
<td>Does the trainer provide the prompt through the BIE system?</td>
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<td>Does the trainer provide immediate reinforcement when the child responds correctly to the prompt?</td>
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<td>Does the trainer provide the appropriate correction procedure if the child does not respond correctly?</td>
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<td>Does the trainer increase the proximity to the child by three feet after 2 correct sittings (100% responding for each trial in the 2 sittings)</td>
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Observer ________________  Start Time __________
Date ______________________  Stop Time__________  
Participant ID ______

*Treatment Fidelity: Researcher*

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<th>Question</th>
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<td>If the peer asks a question, does the researcher give the child 5 seconds to respond before prompting a response?</td>
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<td>Does the researcher wait 15 seconds, but not longer than 20 seconds, after the child has made an independent statement or response before prompting a new response or question</td>
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<td>Does the researcher provide a positional prompt if the child is more than 3 feet away from the peer for 20 seconds?</td>
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<td>Does the researcher initially provide the prompt via the BIE system before prompting in close proximity without the BIE system?</td>
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APPENDIX C

DATA COLLECTION FORM

Participant ID ____

EFFECTIVENESS OF BUG-IN-EAR PROMPTING (Baseline/Treatment)*circle one

<table>
<thead>
<tr>
<th>Observer:</th>
<th>Date:</th>
<th>Start Time:</th>
<th>Stop Time:</th>
<th>Prompted</th>
<th>Participant Initiated</th>
<th>Participant Responded</th>
<th>Non-response</th>
<th>Inappropriate Bx</th>
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Prompted Key:
- B: BIE prompted S/Q (tx)
- A: Auditory prompted answer

Initiated Key:
- S: participant statement
- Q: participant question

Responded Key:
- S: responded to statement
- Q: responded to question

Non-response Key:
- 1: Child NR to peer
- 2: Off topic response
- 3: Child NR to tutor

*keep track of vocal behavior only. Each instance of vocal behavior is on its own line.