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E-Hearsay



Special Fall Edition



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Ohio Speech-Language- Hearing Association (OSLHA)

MISSION:

Empowering our members by providing opportunities for professional development, advocacy, and leadership development necessary to foster excellence in the services provided to individuals with communication and related disorders.

HISTORY:

Founded in 1945, the Ohio Speech-Language-Hearing Association (OSLHA) is a professional association representing speech-language pathologists and audiologists throughout Ohio. OSLHA is recognized by the national American Speech-Language-Hearing Association (ASHA) as the official professional organization for Ohio. OSLHA members provide services for the evaluation and rehabilitation of communicative disorders. Members work in a variety of settings including: clinics, health care facilities, hospitals, private practice, schools, and universities. Members must abide by the OSLHA Code of Ethics.



eHearsay: Statement of Purpose

eHEARSAY, the electronic journal of the Ohio Speech- Language- Hearing Association, is designed to address the professional development needs of the state association.

Issues may be developed around specific themes and can include invited papers, research articles, review, tutorial, research forum, letter to the editor, clinical focus/forum or viewpoints.

eHEARSAY is published as a web journal annually. Continuing education credits will be available for each issue.

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In This Issue

On behalf of OSLHA, I'd like to welcome you to the second *eHearsay* issue of 2013, the on-line journal of the Ohio Speech-Language-Hearing Association. I received a lot of positive feedback from readers after the first issue and I'm hoping to see more after you get a chance to look at all the interesting information provided in this second issue.

This issue doesn't really have a theme per se. My goal as Journal Editor was to encourage as many of you as possible to submit a manuscript to OSLHA. You may have even seen some of these ideas/topics if you attended the OSLHA 2013 Convention. But, I think this issue has a little bit of something for everyone. Please share it with your colleagues.

If you are interested in pediatrics, this issue has five articles to keep you engrossed. There are three excellent meta-analyses from Case Western University on autism. The first article explores peer mediated therapy for increasing social interaction. The second article investigates effectiveness of treatment of food selectivity. The third article examines the role of joint attention and language acquisition.



Pediatric Speech-Language Pathologists (SLPs) that treat children with articulation disorders know that there are certain phonemes that are challenging to remediate. Gordy Rogers introduces *eHearsay* readers to a tactile biofeedback tool that appears to cue the retroflexion necessary to produce American English /r/. School SLPs face challenges working with children whose primary language is not English. Jean Rivera-Perez and Sandra Combs investigated vocabulary strategies in preschoolers who are learning English as a second language to determine if the native language can be used to enhance vocabulary growth faster than vocabulary strategies in English-only.

This issue also has 5 articles on adult neurogenic topics including Aphasia (confrontation naming, reading practices), Moyamoya, Dementia and Traumatic Brain Injury as well as an article on voice therapy. Last but not least, this issue has the results of a survey on therapeutic use of personal electronic devices that reaches across work environments and generations.

Each of these papers was reviewed by a team of editorial consultants, and I would like to thank each of them for their time and effort in assuring that each of these papers are ready for publication. I especially wish to thank my editing/punctuation "specialists" Laura Schrock and Sandi Grether for their keen "eye".



I hope you enjoy reading this issue. Feel free to contact me at laurie.sheehy@utoledo.edu

Sincerely

Laurie M. Sheehy M.Ed. CCC-SLP

eHearsay Journal Editor

Clinical Benefits of PED Use

The existing evidence supports the use of both high- and low-technology aids to support memory retention in individuals with cognitive and memory impairments (Turkstra & Kennedy, 2008). High-tech electronic devices, in particular, have been noted to support or improve the functional abilities of individuals with TBI, including increased orientation and short-term memory (Gentry et al., 2007). A crucial downfall of relatively unsophisticated aids like paper calendars and notebooks is that their effectiveness depends upon the client being able to remember to use them (DePompei, Gillette, Goetz, Xenopoulos-Oddsson, Bryen, & Dowds, 2008). More sophisticated electronic devices, on the other hand, can be programmed to alert TBI clients to significant events in a timely manner (O'Neil-Pirozzi, Kendrick, Goldstein & Glenss, 2004). The rapid pace of technological advancement has provided SLPs increased opportunities to appropriately match a client's expectations and requirements to an appropriate electronic device. TBI clients may also be willing to use electronic devices because they are perceived as socially acceptable and may be indistinguishable from the electronic devices that are used in mainstream society (Gentry et al., 2007).

Limitations of PED Use

Avery and Kennedy (2002) note that high tech personal electronic devices are not appropriate for all clients with TBI and do come with some cautions. First, some PEDs require the user to have adequate vision, reading, writing, and fine motor skills, and even intact language formulation in order to use the device properly. While there are many PEDs from which to choose, clinicians must take into consideration the client's situation, personality, strengths, and limitations when choosing an appropriate device. Ideally the client will master operation of the device; however, the clinician may be required to work with caregivers to help implement the strategies in addition to teaching the client how to respond appropriately when the aid is triggered. Some clients may have a very difficult time learning how to use the device, and generalization to every day usage is not guaranteed. High tech instrument operation may exceed a client's cognitive abilities, and, even if someone else assumes responsibility for programming, significant training may be required to teach appropriate responses to its activation. Finally, clinicians and clients must come to an agreement on the

amount of effort the client is willing to put forth in the use of an external aid, and the cost of the device may be prohibitive (Avery & Kennedy, 2002).

Training the Trainers: SLPS and PED Use

Cognitive orthotics and electronic devices are meant to enhance the clinical experience, not to replace the therapist (Tsaousides & Gordon, 2009). This means that clinicians must be adept at providing education and support to clients and their caregivers to ensure that compensatory devices are being utilized to their fullest potential (O'Neil-Pirozzi et al., 2004). A small number of research studies have investigated the extent to which clinicians themselves use high-tech electronic devices and are equally comfortable training clients to use them. Hart, Buchhofer, & Vaccaro (2003) noted that (a) many clinicians are much more comfortable using low tech tools like sticky notes and calendars, and they are not educated about and do not use high-tech tools in therapy, and (b) clinician attitudes affect the acceptance and use of devices by clients. Thus, Hart et al. (2003) examined clinicians' attitudes and expectations for selecting, training, and supporting the use of PEDs for clients with TBI. Data collected via focus groups found that 90% of clinicians reported that they used full sized computers as a therapeutic aid, but only 17% used PEDs, despite feeling that PEDs would be most useful to assist individuals with learning and memory skills. Those clinicians who did not personally use PEDs reported low levels of confidence in their abilities to teach clients with TBI to use the technology. This low level of confidence indicates the importance of continuing education for clinicians in their learning and use of electronic devices (Hart et al., 2003).

Similarly, O'Neil-Pirozzi et al. (2004) surveyed clinicians from various therapeutic settings to discover if there is any correlation between SLPs' personal use of electronic devices and use of similar devices with their TBI clients. Of the 81 respondents, 22% reported that they themselves use PEDs to augment memory and 36% responded that they have worked with clients using PEDs. Also noteworthy is that only 16% reported that they had received training in the use of PEDs while the overwhelming majority of clinicians (88%) said that improved instruction would lead them to use PEDs more in therapy. The authors concluded that 95% of surveyed clinicians believed PEDs are useful but only 36% had actually utilized the technology. These

findings suggest that SLPs see the advantages of using such equipment and are only hindered from doing so by their own lack of training (O'Neil-Pirozzi et al., 2004). The study further indicates that increased educational and training opportunities (e.g., workshops, vendor demonstrations, accessibility of PEDs at work, conferences, research publications) relating to use of electronic technology for rehabilitation purposes are necessary to increase the use of such devices.

Rationale

While the research literature has documented positive outcomes for PED use with clients who have poor memory and organizational skills, there is rather limited research pertaining to the beliefs, knowledge, and skills of SLPs related to PED use. The existing studies in this area are now about a decade old, and the rapidly developing pace of technology may mean that SLPs' use of PEDs both personally and professionally has increased. Thus, the purpose of this study was threefold: (1) to increase the body of knowledge regarding perceptions of PEDs and their use by SLPs, (2) to obtain an updated perspective on SLPs' use of PEDs, and (3) to establish whether there are personal, professional, or clinical barriers that might account for underutilization of PEDs, if such underutilization continues to exist.

Methods

Participants

Invitations to participate in an online survey were emailed to 476 SLPs. The email addresses were obtained via random sampling of the American Speech-Language-Hearing Association (ASHA) member database. A response rate of 22.3% (106 participants) was obtained; however, 12 respondents did not complete the survey completely and their results were eliminated from the data set for a total of 94 participants.

All participants were ASHA-certified SLPs or were currently pursuing ASHA certification. The participants consisted of 92 women and 2 men with an average age of 41.6 years. Most participants (47.8%) had 6-10 years of professional experience, followed by more than 15 years of experience (41.6%) and between 1-5 years of experience (10.6%). Participants had work experience in a variety of settings, including schools, hospitals, skilled nursing or rehabilitation facilities, and private

practice. The vast majority of participants (97.9%) reported that they are currently working or have worked in the past with clients who have memory and/or organizational impairments. On average, participants estimated that 25% of their current caseloads consisted of clients with these types of impairments. The majority of such clients were reported to be age 21 or younger.

Survey Instrument

A questionnaire was developed to assess SLPs' perceptions and use of PEDs. Questionnaire items were developed based on a review of the literature and feedback obtained during pilot testing from three SLPs who had extensive clinical experience working with clients with cognitive impairments. Pilot testing was conducted in order to refine questionnaire items and enhance content validity. The questionnaire included a description of PEDs (i.e., electronic organizers, laptop computers, digital watches, etc.) and asked participants to describe the extent to which they (a) used these types of devices in their personal lives, (b) felt comfortable using such devices in therapy, (c) agreed that PEDs are effective therapeutically, and (d) received training in the use of PEDs which were used or could be used in their clinical practice. Participants were also asked to indicate the types of PEDs they used in therapy, if any, and factors that would influence whether they chose to use PEDs with their clients. The questionnaire also asked participants to respond to demographic items such as years of professional experience, nature of their caseload, and type of employment setting.

Procedures

After the questionnaire was piloted and refined, a link to an electronic version of the questionnaire was then sent to a national, randomly selected sample of SLPs in an email that explained the nature of the research and invited participation in the study. Two reminder notices were sent and all follow-up procedures were conducted electronically as per Dillman, Smyth, and Melani Christian (2009). In addition, participants had the option of completing an identical paper copy of the questionnaire, as opposed to an electronic one, if they requested to do so. No request for a paper copy was received. Data analysis began after the 30-day response period expired.

Data Analysis

The items on the questionnaire were primarily Likert-type questions or questions with categorical variables. As such, parametric statistics were avoided in favor of calculating descriptive and non-parametric statistics. Chi-square tests of independence were conducted to examine the association between factors such as personal and therapeutic PEDS use, comfort level with PEDs use and therapeutic PEDs use, and personal PEDs use and beliefs about the therapeutic effectiveness of PEDs. A significance level of .05 was assigned a priori to allow for determination of whether these categorical variables were significantly associated.

Results

The majority of participants (79.8%) agreed or strongly agreed that PEDs are successful in helping clients cope with memory or organizational deficits. While a similar number of participants (81.9%) reported that they used PEDs personally, somewhat fewer participants reported the use of PEDs in therapy (70.7%). Chi-square analysis indicated that personal use of PEDs was significantly associated with participants' beliefs that PEDs are therapeutically beneficial, $\chi^2(1, N = 94) = 8.27, p = .004$, but personal use of PEDs was not significantly associated with therapeutic use, $\chi^2(1, N = 94) = 3.40, p = .065$. Programmable watches were used the least in clinical practice (12%), whereas laptop computers were used the most (42%). Figure 1 provides a list of PEDs used by SLPs in their clinical practice.

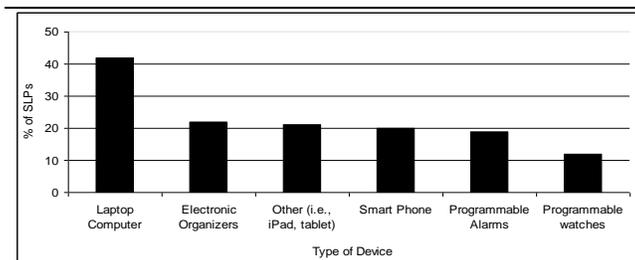


Figure 1. Percentage of SLPs who reported therapeutic use of various types of personal electronic devices.

Note that 29% of SLPs reported that they had never used a PED before in clinical practice.

The training received by participants in PED use seems to be minimal, as 83% of participants reported receiving little or no training. Only 14% of participants, however, agreed or strongly agreed that professional training (or lack thereof) has influenced their decision to use PEDs in therapy. Reported comfort level with using PEDs in

therapy was significantly associated with personal use of PEDs, $\chi^2(2, N = 92) = 6.90, p = .032$. Approximately 41% of participants were comfortable or very comfortable using PEDs therapeutically, 25% felt uncomfortable or very uncomfortable, and 34% reported neutral comfort levels. Respondents indicated that several factors may influence their use of PEDs, including cost, clients' cognitive and/or physical limitations, amount of time needed to train clients and caregivers, and the preferences of some clients to not use PEDs (see Figure 2).

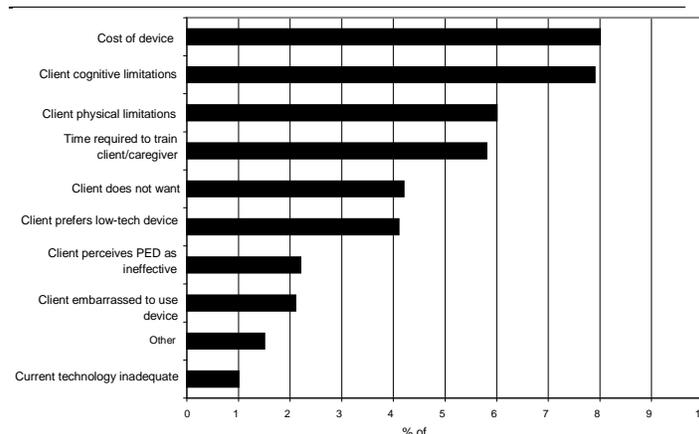


Figure 2. Perceived barriers to therapeutic use of personal electronic devices by SLPs.

Discussion

The review of the literature indicated that SLPs underutilize PEDs in therapy due to lack of training (O'Neil-Pirozzi et al., 2004). The results of this study, however, indicate that the majority of SLPs are using PEDs in personal and therapeutic contexts, and that to some extent personal use may mitigate a lack of formal training in the use of PEDs for therapeutic purposes. Of note, however, is that a minority of SLPs, albeit a large minority at 42%, reported feeling comfortable using PEDs in therapy. There seems little evidence to suggest that SLPs feel confident or comfortable using PEDs therapeutically solely on the basis of personal use. Thus, Hart et al.'s (2003) finding that SLPs lack confidence in the therapeutic application of PEDs seems relatively unchanged even after a decade of increasingly innovative and available electronic devices. These findings may suggest that employers see little reason to provide training on therapeutic use of PEDs because these devices are often used personally by SLPs on a

daily basis. Likewise, SLPs may feel that they should not need training in PEDs use and place a higher priority on receiving other types of therapeutic training. It is possible that formal training in PEDs use specifically for clients with TBIs and other communication disorders may increase SLPs' willingness to use these devices with their clients.

The rather small discrepancy between the numbers of SLPs who believe PEDs are effective therapeutically (80%) and who actually use PEDs in clinical practice (70%) can be explained by such factors as cost, clients' physical and cognitive abilities, amount of time required to train clients and caregivers, and client preferences. These results seem to suggest that use of PEDs for clients with cognitive impairments has increased in the past decade, and it is reasonable to assume that PEDs use will continue to grow as technologies such as personal tablets become more affordable and user-friendly. As devices become smaller, however, clients with physical limitations may not find PEDs particularly accessible and may be at a disadvantage.

These results of this study should be interpreted cautiously due to a relatively low response rate and the high numbers of clients on participants' caseloads with memory or organizational deficits who were under the age of 21. Younger clients may be more comfortable and willing to utilize high-tech electronic devices in therapy. This study utilized a randomized sampling of SLPs, though it is possible that a purposive survey of SLPs who primarily have older clients on their caseloads would yield different results. Those SLPs who treat clients with cognitive impairments exclusively may also view the use of PEDs in therapy differently than the SLPs in this study, who generally estimated that only 25% of clients on their current caseload had memory or organizational deficits. Thus, future research may target SLPs who treat a wider age span of clients and survey a larger and more specific sample of SLPs who primarily work with clients who have memory and/or organizational deficits. In addition, it may also be illuminating to survey clients with cognitive impairments to determine if their perceptions correlate with the views expressed by SLPs in this and other studies. ♦

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"Around here, however, we don't look backwards for very long. We keep moving forward, opening up new doors and doing new things...and curiosity keeps leading us down new paths."

- WALT DISNEY



step involves organizing the visual stimuli perceptually to interpret the image and give it semantic meaning with a lexical name (Harnish, 2008). Visual processing deficits may impair how visual information is organized and interpreted in the lexical centers of the brain, leading one to have difficulties perceiving objects as different from their environment, which is necessary for the recognition and naming of objects (NCLD, 2011). Vision is deemed to be key to the construction of language, world experiences and semantic memories (Mishra & Marmolejo-Ramos, 2010). Therefore, when impaired, semantic and phonemic naming errors may occur like those typically observed in the language production of people with aphasia (Hallowell & Chapey, 2008).

Of late, research has investigated how different types of visual supports can facilitate the communication of people with aphasia. Studies have introduced the concept of pictures conveying high- and low-contexts (Dietz, McKelvey & Beukelman, 2006; McKelvey et al., 2010). High-context pictures are defined as rich in color, depicting people interacting in a scene; the people are caught in action, or interacting with the environment; that is high-context pictures show a relationship between the subject of the picture and the objects in the picture. In contrast, low-context pictures are defined as black and white and depicting simple objects in order to identify an object or person (Dietz et al., 2009). See Figure 1 for examples of high- and low-context pictures. It is further hypothesized that high-context pictures may more effectively activate bilateral semantic memory and the recognition of life events for people with aphasia by creating more activation in the right brain hemisphere. Imaging studies have documented bilateral brain involvement and reorganization for naming tasks after stroke (Obler et al., 2010). Therefore, high-context pictures may compensate for the typically damaged left-brain hemisphere of people with aphasia when compared to low-context pictures. Thus, high-context pictures could ease the visual processing task by activating semantic word networks more efficiently through richer contexts and bolster the organization of visual stimuli allowing individuals to interpret images for meaning and naming with more ease.

A recent investigation on the effects of picture contextualization and naming compared the Boston Naming Test (Goodglass, Kaplan & Barresi, 2000) to a

color and texture enriched picture-naming task and found that the speed of naming for older adults was



Figure 1. Examples of low- and high-context pictures with the same oral confrontational naming target

slower but more accurate in both conditions when compared to younger adults (Rogalski, Peelle & Reilly, 2011). Although this study included older and younger normal adults without brain injury, the results of this study suggests that persons with aphasia may experience an increase in naming accuracy when provided contextualized pictures and extra time (Rogalski et al., 2011).

Many treatments for people with aphasia have been developed that specifically address verbal expression and anomia. Treatment approaches traditionally center around clinician-provided cues and prompts that facilitate word retrieval and oral naming (Coelho, Sinotte & Duffy, 2008) in an effort to restore their linguistic systems. Some specific therapeutic approaches include phonemic cueing (Thompson, Raymer & le Grand, 1991), semantic feature analysis (Boyle & Coelho, 1995), and the personalized cueing method often referred to as self-cueing (Freed & Marshall, 1995; Marshall & Freed, 2006). Phonemic cueing treatment programs provide rhyming and first

phoneme cues to elicit target word responses and has been shown to improve oral naming (Thompson et al., 1991). Semantic feature analysis is a therapeutic approach that improves naming through the creation of semantic cues related to a target word (Boyle & Coelho, 1995). For example, if a target word is “coffee” a person with aphasia would be asked to answer questions semantically related to coffee, (e.g., where do you find it, what do you do with it, etc.). Lastly, the personalized cueing method for anomia promotes naming through the creation of associative cues and has been shown to have a lasting impact on the naming accuracy of people with aphasia (Freed, Marshall & Nippold, 1995; Marshall & Freed, 2006). These therapeutic approaches and others aim to improve the verbal production of people with aphasia and require a sound assessment of an individual’s naming ability to guide and enhance the therapeutic process.

In light of current literature and the visual and naming deficits experienced by people with aphasia, the purpose of this study was threefold: to investigate 1) the effect of time post-stroke, 2) the effects of phonemic, semantic and self-cues and 3) the impact of two types of pictorial representations on the naming accuracy of people with aphasia.

Method

Research Questions

In an effort to investigate the influences of time post-stroke, cueing and the impact of two types of pictorial representations on the naming accuracy of people with aphasia, the following research questions were explored.

- 1) Is the confrontation naming accuracy of people with aphasia affected by time post-stroke?
- 2) What type of cueing is most helpful for people with aphasia to elicit accurate confrontational naming responses, phonemic, semantic or self-cues?
- 3) Will high-context pictures result in fewer naming errors by people with aphasia during a confrontational naming task when compared to low-context pictures?

Research Design

This investigation employed a quasi-experimental repeated measures design. Also, a randomized block procedure was utilized in an attempt to counterbalance and control any possible sequencing effects of the investigational assessments given.

Participants

Fourteen people with aphasia were recruited from the greater Cincinnati, Ohio area. All the participants gave consent to take part in this investigation according to the protocol set forth by the Institutional Review Board of the University of Cincinnati. Furthermore, all participants displayed the following characteristics: right handed, adequate visual acuity, native English speaker, at least a high school education, no history of visual or ocular problems including, but not limited to, artificial lens implants, color blindness or macular degeneration and medically stable after a minimum of six months post- left hemisphere stroke resulting in acquired aphasia. The participants included seven females and seven males whose ages ranged from 35-78 years ($M = 57$ years). Also, seven of the participants exhibited motor-speech disorders in addition to expressive aphasia, six presented with apraxia of speech and one with unilateral upper motor neuron dysarthria. Considering the participants’ time post-stroke, five were less than two years post-stroke, five participants were between 2-6 years post-stroke and four experienced their stroke more than six years from the time of the study. The participants’ time post-stroke ranged from 6-264 months ($M = 70$ months). Table 1 presents the demographic and linguistic assessment data of the participants.

Materials

Equipment and software. Each research assessment session was digitally audio recorded with a Marantz PMD 660 recorder. The high-context visual stimuli were 4 in. x 6 in. color images and printed using a Lexmark Pro200-S500 Series printer. The statistical analyses were run using Statistical Package for the Social Sciences (SPSS)®.

Experimental stimuli development. The researchers developed a high-context naming assessment for the purposes of this investigation. The target words to be named during the high-context naming task were based on the Boston Naming Test from the Boston Diagnostic Aphasia Examination-Third Edition (BDAE-3), (Goodglass et al., 2000). The researchers collected images from a variety of Internet search engines that depicted the target words in a contextualized manner. Contextualized images were defined as photographs that represent objects in their natural state or environment (McKelvey et al., 2010).

Table 1
Participant Demographic and Linguistic Assessment Data

Participant	Male/ Female	Age	Months Post Onset	Motor Speech Disorder	WAB-R AQ ^a	WAB-R ^a Aphasia type	Pyramids and Palms ^b	Boston Naming Test ^c	High- Context Naming Test
1	Female	56	116	na	92	Anomic	50	45	42
2	Female	57	114	Apraxia of Speech	66	Anomic	43	27	34
3	Female	56	20	na	90	Anomic	50	39	38
4	Male	64	149	Dysarthria	91	Anomic	52	54	45
5	Male	58	61	Apraxia of Speech	61.8	Broca's	50	31	39
6	Male	63	10	Apraxia of Speech	25.1	Global	42	0	0
7	Female	78	26	na	75.6	Anomic	48	56	54
8	Male	35	6	na	97	Anomic	50	57	52
9	Male	58	71	Apraxia of Speech	70.8	Conduction	49	46	51
10	Male	65	26	na	56.3	Conduction	44	7	6
11	Female	37	13	na	89.8	Anomic	50	50	53
12	Female	37	21	Apraxia of Speech	77.5	Anomic	44	39	31
13	Female	74	264	Apraxia of Speech	61.1	Broca's	39	25	29
14	Male	56	48	na	60.9	Anomic	47	12	9

Note: ^a Western Aphasia Battery – Revised Aphasia Quotient (Kertesz, 2007), possible score 100, ^b The Pyramids and Palm Trees Test (Howard & Patterson, 1992), possible score 52, ^c Boston Naming Test from the Boston Diagnostic Aphasia Examination-Third Edition (BDAE-3), (Goodglass et al., 2000), possible score 60, High-Context Naming Test, possible score 60.

A panel of three judges verified the level of context depicted by each image on a 5 point Likert scale (1= no context; 5 = high-context). To be incorporated into the high-context naming assessment the judges had to assign an average rating to the images of 3.5 or higher.

Operational definitions of cueing types. This investigation sought to explore the impact of phonemic, semantic and self-cues on naming accuracy. Consequently, operational definitions of each type of cue were developed. The operational definitions for each cue type are as follows: 1) phonemic cues: presenting the initial phoneme or blend of a target word, 2) semantic cues: providing a category or characteristic associated with the target response and 3) self-cues: consisted of any spontaneously generated cue by the participant that could be phonemic or semantic in nature. All cues were recorded and tallied online during the assessment session. Later, when the researchers scored the assessments, the number and types of cues provided as well as whether the cue elicited a correct response were calculated.

Experimental Session

The participants met with the researchers for one session during which they completed four linguistic assessments in a randomized order: Western Aphasia Battery-Revised (WAB-R) (Kertesz, 2007), The Pyramids and Palm Trees Test (Howard & Patterson, 1992), Boston Naming Test (Goodglass et al., 2000), and a high-context naming test. The participants were provided frequent breaks to minimize any fatigue.

Reliability

The first author observed 80% of the assessment sessions to ensure adherence to the assessment procedures to substantiate procedural integrity. The researchers confirmed that the assessments were scored reliably and accurately by employing the following procedures. The assessments were first scored independently by a member of the research team. When the accuracy of a participant's response to a stimulus was questioned, two members of the research team listened to the audio-recorded response of the participant to reach an agreement on the accuracy of the item named. Furthermore, when the type of cue utilized to elicit a correct or incorrect response was unclear the same procedure was employed.

Statistical Analysis

Each research question presented with its own set of independent and dependent variables. Therefore, various statistical analyses were utilized within SPSS® to determine significant differences between the variables. To explore the first research question the researchers employed a multivariate analysis of variance (MANOVA). A MANOVA and post-hoc pairwise comparisons were also utilized to answer the second research question. Lastly, an analysis of variance (ANOVA) was engaged to investigate the final research question.

Results

Linguistic Assessments

Each participant completed four experimental linguistic assessments. The group results are presented below and the individual performances of the participants can be found in Table 1.

Western Aphasia Battery-Revised. The Western Aphasia Battery-Revised (WAB-R) (Kertesz, 2007) was completed to determine the type and severity of aphasia that each participant exhibited. Of the fourteen participants, nine demonstrated Anomic aphasia, two had Broca's aphasia, two had Conduction aphasia and one displayed Global aphasia. A wide range of aphasia severity was revealed on the WAB-R (Kertesz, 2007), ($M = 72.5$, $R = 25.1-97$, possible score 100). One participant exhibited Global aphasia with a score of 25.1 of a possible 100, while another participant received a score of 97 of a possible 100, which is not indicative of aphasia. However, the participant with a WAB-R (Kertesz, 2007) score of 97 displayed clear anomia during the naming assessments and the research team consciously chose to include the participant in the study.

Pyramids and Palm Trees Test. The Pyramids and Palm Trees Test (Howard & Patterson, 1992) is a non-verbal assessment of semantic knowledge and functioning and is frequently used with people with aphasia to examine semantic access (Klein & Buchanan, 2009). Therefore, this assessment was utilized to yield information regarding the semantic functioning of the participants and provide insight into the potential usefulness of semantic cues to facilitate naming. That is, if an individual displays deficits in semantic access then clinician provided semantic cues may prove to be

beneficial. The participants performed similarly on The Pyramids and Palm Trees Test (Howard & Patterson, 1992), ($M = 47$, $R = 39-52$, possible score 52), and showed relatively intact semantic knowledge and functioning.

Boston Naming Test. Each participant's oral confrontational naming skills were examined with the Boston Naming Test (Goodglass et al., 2000) to provide a measure of spontaneous and cued word retrieval. A wide range of scores ($M = 34.8$, $R = 0-56$, possible score 60) was evidenced and reflected the range of aphasia severity experienced by the participants.

High-context naming test. The developed high-context naming test was also administered to reveal the spontaneous and cued oral confrontational naming ability of the participants. The participants' performance was similar to the Boston Naming Test (Goodglass et al., 2000), as the assessment yielded a wide range of scores ($M = 34.5$, $R = 0-54$, possible score 60).

Statistical Analysis of Research Questions

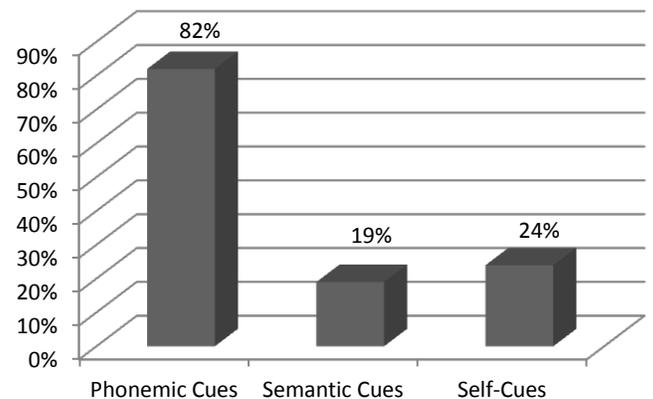
The participants' time post-stroke, scores on the four linguistic assessments, as well as the number and types of cues provided to elicit correct responses, were used to generate the necessary data sets required to investigate the research questions statistically. Each question and its accompanying statistical analyses are presented below.

Research Question 1: Is the confrontation naming accuracy of people with aphasia affected by time post-stroke? The first data set was comprised of the independent variable of time post-stroke which had three levels, less than two years post-stroke, between 2-6 years post-stroke and more than six years post-stroke from the time of the study. The dependent variables included the confrontational naming accuracy scores of the Boston Naming Test (Goodglass et al., 2000) and the high-context naming test. First, Cook's distance analysis did not reveal outliers and so the assumption of homogeneity was met and further analysis could be employed. A MANOVA did not reveal a significant main effect for time-post stroke, Wilk's $\lambda = (.891)$, $F(4, 20) = .297$, $p > .05$. Thus, time post-stroke did not influence the confrontational naming ability of the people with aphasia who took part in this study.

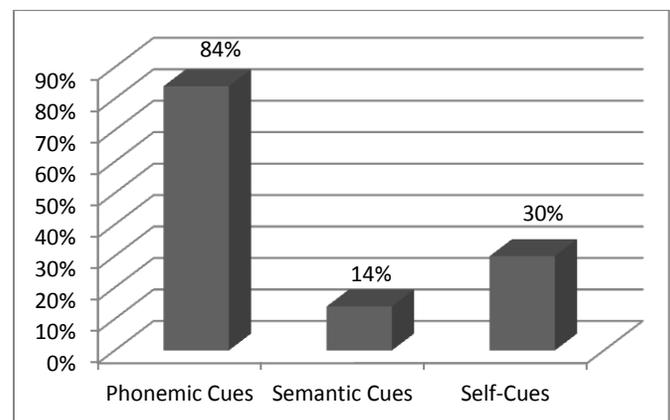
Research Question 2: What type of cueing is most helpful for people with aphasia to elicit accurate confrontational naming responses; phonemic, semantic or self-cues? In order to answer this research question, the following independent variables: phonemic, semantic and self-cues; and dependent variables: percent of correct responses after a provided cue, were statistically analyzed. An overall model MANOVA revealed a significant main effect for cueing, Wilk's $\lambda = (.443)$, $F(4, 160) = 20.07$, $p < .0001$. In order to further investigate the significance for each type of cueing, a post-hoc pairwise comparison was completed. No significant difference between semantic cueing and self-cueing was revealed, $F(2, 26) = (.240)$, $p > .05$. An analysis of phonemic cues compared to semantic and self-cues revealed a significant effect, $F(2, 26) = 28.94$, $p < .0001$ for semantic cues comparison and $F(2, 26) = 27.59$, $p < .0001$ for self-cues comparison. Thus, phonemic cues proved to be highly effective in eliciting correct target responses during both the Boston Naming Test (Goodglass et al., 2000) and the high-context naming task. Graph 1 depicts the mean of the cue types provided by the researchers that prompted correct target responses during the Boston Naming Test (Goodglass et al., 2000) and Graph 2 displays the mean of the types of cues provided by the researchers that prompted correct target responses during the high-context naming test. The participants benefited from phonemic cues similarly during both naming tasks, 82% and 84%, respectively. However, the participants showed a trend of requiring less semantic cues (19% Boston Naming Test, 14% high-context naming test) and producing more self-cues (24% Boston Naming Test and 30% high-context naming test) that generated accurate responses during the high-context naming test.

Research Question 3: Will high-context pictures result in fewer naming errors by people with aphasia during a confrontational naming task when compared to low-context pictures? The two independent variables consisted of the low-context stimuli, Boston Naming Test (Goodglass et al., 2000), and high-context stimuli, high-context naming test, while the dependent variable was the spontaneous naming accuracy score produced by the two assessments. A one-way ANOVA was calculated to detect an influence of contextualization on naming accuracy and the analysis was not significant, $F(1, 26) = .003$, $p > .05$. Therefore, the naming accuracy of

the participants in this study was not affected by the contextualization of pictures.



Graph 1. Mean cue types utilized to elicit correct target responses during *The Boston Naming Test* (Goodglass et al., 2000).



Graph 2. Mean cue types utilized to elicit correct target responses during high-context naming test.

Limitations

Although these findings provide information to direct clinicians in their use of contextualized pictures for the assessment and treatment of people with aphasia, it is necessary to discuss factors that may reduce the generalizability of the results. The small sample size may have contributed to a less than ideal statistical power and therefore a higher probability of a type II error. Perhaps, a replication study with more participants would reveal a statistical difference in the naming accuracy of people with aphasia when presented with low- or high-context stimuli as well as increased naming accuracy as time post-stroke increases. Furthermore, the participants in this

investigation displayed a wide range of aphasia types and severity because it is believed that anomia is characteristic of all individuals with aphasia. Future studies could build upon this investigation by narrowing the participation criterion to truly reveal the possible influences of time post-stroke, cueing and picture contextualization on naming accuracy of individuals with one type of aphasia.

Conclusion and Discussion

This investigation sought to examine the effect of time post-stroke, cueing and picture contextualization on the naming accuracy of people with aphasia. The researchers hypothesized that a positive relationship between time post-stroke and naming accuracy would be evidenced to document aphasia recovery over time. Regrettably, the data showed no significant effect of time post-stroke on the naming accuracy of the participants in this study. However, the researchers did observe the participants with longer periods post-stroke utilizing many strategies for self-cueing (e.g. finger spelling, alphabet supplementation and categorization) that most likely the participants developed over time. Perhaps future investigations could more closely examine the relationship between time post-stroke, self-cueing and naming accuracy to document aphasia recovery.

Furthermore, when exploring the influence of cueing on naming accuracy these data revealed that the participants utilized self-cues more frequently and with greater accuracy to produce targeted words during the high-context naming test than during the low-context counterpart. In fact, semantic cues appeared to frustrate and even offend many of the participants, which may have adversely affected their ability to produce the target responses. Moreover, The Pyramids and Palm Trees Test (Howard, & Patterson, 1992) revealed that as a whole, the participants had relatively intact semantic functioning, which may have led to the adverse reactions of the participants to the clinician who provided semantic cues. On the other hand, phonemic cues proved to be the most effective cue type when prompting oral naming. Therefore, phonemic cues may be a helpful first step strategy during therapeutic treatments aimed at the remediation of oral naming before the implementation of semantic and self-cueing strategies for some people with aphasia.

Lastly, while it is hypothesized that high-context pictures may more effectively activate semantic memory and bolster the visual processing necessary for naming, no significant effect of contextualization on the naming accuracy of people with aphasia was evidenced in this study. The presence of low- or high-context pictures did not change the participants' performance outcome on the naming tasks. Therefore, it can be concluded that clinicians may utilize treatment and assessment materials that depict either level of contextualized photographs while working with people with aphasia. However, future research endeavors that investigate the role of high-context pictures when training the use of self-cueing strategies for the treatment of anomia would advance the field of aphasiology. Moreover, this research would provide much needed guidance to clinicians for the development of assessment and treatment stimuli that could further enhance the language recovery and training of independent self-cueing strategies for people with aphasia. ♦

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As previously stated, one of the major impairments in autism is a lack of social skills including verbal and nonverbal communication with others as well as social pragmatics (Autism Speaks Inc., 2013). The social communication skills targeted in the studies included in this meta-analysis were initiations, responses, imitation, social behaviors and nonsocial behaviors. For the purpose of this meta-analysis and the studies included in it, these social skills are defined as follows:

- **Initiations.** Any verbal or nonverbal communication behavior directed toward another child or group of children. This includes requests, play organizers (a statement such as “Let’s build a tower with the blocks”), sharing, compliments, attention getters (a statement such as “Look at me”), and affection. All of these social interactions could be positive or negative in nature.
- **Responses.** Any verbal or nonverbal response to another child or group of children. This includes simple yes/no answers or larger utterances. These social interactions could be positive or negative as well.
- **Imitation.** Any verbal or nonverbal imitation of another child’s spoken language, such as repeating an utterance; or an imitation of a physical action, such as copying what another child is doing with a toy.
- **Social Behaviors.** Any other social behaviors not otherwise specified, such as verbal or nonverbal turn-taking or waiting one’s turn in conversation or while playing. This also includes any utterance stated that is not related to the task at hand; for example, “Yesterday, I went to the doctor,” when playing with a toy farm set. These behaviors could also be positive or negative.
- **Nonverbal Social Behaviors.** Any other behaviors not directly involving another child, such as joint attention or an utterance directed towards an aide in the room while playing with the other children. This also includes any utterance said only to oneself.

Though the effectiveness of using peer-mediated therapy for increasing social skills in preschoolers with autism is the focus of this meta-analysis, there are other types of social skills interventions available. One type of intervention focuses on the parent-child interaction for increasing social skills as opposed to child-peer interactions. Interventions of this type have proven

successful in improving the social interactions of preschoolers with autism, specifically in improving social play and social initiations and a decreasing negative behaviors in response to social initiations from others (Rogers, 2000). In 2007, Solomon and colleagues found that by training the parents of children with autism using the PLAY model, which focuses on a social-pragmatic approach, the target children showed significant improvement in their social and pragmatic behaviors, including self-regulation, forming relationships, and two-way purposeful communication. Though this intervention required intense training of the parent by trained specialists, positive results as well as high parental satisfaction supported further trials with a larger sample size and a control group. This study, as well as others with the same purpose, demonstrates that having the child with autism work with a familiar person, such as a parent or caregiver, social skills can be increased because the child is more likely to interact with these persons on a regular basis (Rogers, 2000).

Another type of social skills intervention that has proven successful utilizes non-parent adults, such as speech-language pathologists or teachers. Interventions using these adults have improved social interactions among preschoolers with autism as well as sparked improvements in symbolic play skills and positive social responses to adults (Rogers, 2000). In a study conducted in 1998 by Krantz and McClannahan, three preschool-aged boys were trained using a script-fading approach to attend to their teacher. A stimulus word was embedded within the boys’ play routines that would prompt the child to gain the teacher’s attention. Over time, the word was faded from the boys’ normal play routine; however, the children maintained their social initiations with the teacher and even generalized the behaviors to other adults and activities.

Though there is not just one type of intervention technique or strategy implemented in the studies using parents and non-parent adults as therapists, the ultimate goal was an increase in social skills of preschoolers with autism and generalization of these skills. Increases in social interactions have been documented using these adults, but the main problem with using these intervention agents is that generalization of skills did not generalize to other peers (Rogers, 2002). In order for these children to learn to

interact socially with their peers, it would be reasonable to assume that the intervention must involve peers. In addition, because children with autism are becoming more prominent in inclusive preschool settings, the importance of peer-mediated interventions for social skills cannot be understated.

Numerous studies, some of which will be included in this meta-analysis, have documented that using peer-mediated interventions to increase social skills of children with autism is effective in small sample sizes, and in most cases, carryover is maintained and generalization is highly probable. In fact, peer-mediated interventions are now at the forefront of best practice for this particular population (Prendeville et al., 2006) and therefore continue to be a popular area of research. In 2012, the Centers for Disease Control and Prevention estimated that 1 in 88 children were diagnosed with autism spectrum disorder. Due to the large number of children diagnosed with autism, an intervention considered to be “best practice” for establishing and maintaining social skills in children with autism, deserves to be examined to identify whether or not it is effective for this population as a whole. Therefore, this meta-analysis aims to calculate the average effect size and confidence interval for peer-directed therapy on social interactions in preschoolers with autism.

Autism and resulting communication impairments continue to be a growing issue as more and more children are diagnosed with this developmental delay each year. Of crucial importance when working to improve this population’s communication skills are the social interactions between these children and their typical peers. Multiple models of peer-mediated therapy exist in the research literature, yet they all seek to improve the socialization of children with ASD using their typical peers as models (Prendeville et al., 2006). Therefore, it is necessary to not only look at the quantitative results of the study, but also the qualitative factors of each intervention strategy. By including both effect size and qualitative information in an analysis of peer-mediated interventions, the clinician can be sure this type of intervention is the best practice for the individual client. This meta-analysis serves to determine whether these different peer-mediated interventions are in fact effective in increasing the social

interactions of preschoolers with autism by calculating average effect size and taking into account internal and external validity of the studies examined. Ultimately, the goal of this analysis is to answer the question: In preschoolers with autism, is peer-directed therapy effective in increasing social interactions?

Methods

Search Procedures and Inclusion/Exclusion Criteria

Studies involving peer-mediated therapy and children with autism were located through searches of electronic databases as well as by examining the references of relevant articles, literature reviews, and meta-analyses. Articles were also found by looking at the “related articles” the electronic database found related to an article of interest. See Figure 1 for a detailed view of the literature search procedures.

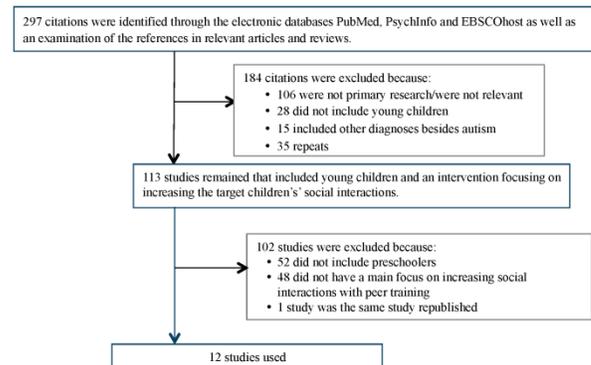


Figure 1. Process for Identifying Studies

In all, 297 studies were identified using the search terms “Autism AND peer social intervention” in the databases PubMed and EBSCOhost and “Autism AND social intervention AND peers” in PsychInfo as well as a hand search of the references in relevant articles and reviews. A total of 184 studies were excluded because they were not primary research or were not relevant to this meta-analysis, did not include young children, included other diagnoses besides autism criteria. Only 113 studies remained from the electronic and hand searches. These studies were further narrowed to include only preschoolers with autism with the main focus in the study being the effects of the peer tutors in increasing social skills of the target children with

Table 1 Sources of the identified Studies

Electronic Database	Total Hits	Not Studies/ irrelevant	Not Young Children	Dx not only Autism	Repeats	Not Pre-schoolers	Purpose differed	Studies Used
PubMed	108	33	14	6	14	19	18	3
EBSCOhost	132	53	11	1	20	20	25	2
PsychInfo	16	12	0	1	1	1	1	0
Hand Search	41	8	3	7	0	12	5	7
Total	297	106	28	15	35	52	49	12

*One (1) study was excluded because it was a republication with the same data as Kohler, et al (1995)

autism. After eliminating the studies that had exclusion criteria, twelve studies were found relevant in determining the effectiveness of peer-mediated therapy in increasing social interactions in preschoolers only.

For the purpose of this meta-analysis, preschoolers are identified as children enrolled in a preschool program during the course of the study. In the studies reviewed, the ages of these preschoolers ranged from 4 to 6 years. The target children in the study also had to have a formal diagnosis of autism spectrum disorder.

Though all the included studies implemented an intervention that aimed to improve the social skills of the target child, they did not all use the same strategies and techniques. All of the studies were done in preschool classrooms, though one intervention and peer training were done after school (Kalvya & Avramidis, 2005) versus during class time during the school day. Many of the studies examined used dyads or triads of students with the target peer during the intervention (Carr & Darcy 1990; Goldstein & Cisar, 1992; Goldstein et al., 1992; Kohler et al., 2007; Kohler et al., 1995; Kohler et al., 1990; Lefebvre & Strain, 1989; McGee et al., 1992; Sainato et al., 1992) whereas others included the entire classroom or a small group of students that included the target child (Garfinkle & Schwartz, 2002; Kalvya & Avramidis, 2005). One study, Zanolli et al., 1996, utilized both a dyad and whole classroom training group.

Description of the Studies Included

In terms of training during the intervention, some studies trained only the typical peers (Carr & Darcy, 1990; Goldstein et al., 1992; Kalvya & Avramidis, 2005; Sainato et al., 1992; Zanolli et al; 1996) whereas others included the target child in the training sessions (Garfinkle & Schwartz, 2002; Goldstein & Cisar, 1992;

Kohler et al., 2007; Kohler et al., 1995; Kohler et al., 1990; Lefebvre & Strain, 1989; McGee, et al., 1992). The context of the intervention also varied between the studies. One of the studies assessed the efficacy of the intervention solely during free play sessions (Zanolli et al., 1996) in an attempt to also assess generalizability, whereas the remainder of the studies observed the target child and their interactions with typical peers during structured small group activities or preselected socio-dramatic play activities infused within free play. The amount of training time varied (5-40 minutes) among the included studies, as well as presence of adult cueing (no cueing to cueing during all parts of the study); all the studies did include both of these variables.

The study designs included in this meta-analysis are one reversal design (Goldstein & Cisar, 1992), one longitudinal study with a control group (Kalvya & Avramidis, 2005), three withdraw designs (Kohler et al., 1995, 1990; Lefebvre & Strain, 1989), and seven multiple-baseline designs (Carr & Darcy, 1990; Garfinkle & Schwartz, 2002; Goldstein et al., 1992; Kohler et al., 2007; McGee et al., 1992; Sainato et al., 1992; Zanolli et al., 1996). All systematic reviews and meta-analyses were excluded, but referenced for relevant articles and information regarding social skills interventions for children with autism.

Another thing that must be considered in these types of observational studies is inter-rater reliability. Internal validity was a strength in all the studies examined with an inter-rater reliability of 75% or greater when identifying target social interactions among the children with autism and their typical peers. This suggests that every included study trained their data collectors to properly identify the behaviors examined in the study.

Table 2. Included studies

Study	Level of Evidence	Sample size	Groupings	# of Training Sessions	Inter-rater Reliability	Study Design
Carr & Darcy, 1990	IV	4	dyad	1-4	> 80%	Multiple baseline
Garfinkle & Schwartz, 2002	IV	4	small group	1-4	>80%	Multiple baseline
Goldstein et al., 1992	IV	3	triad	5-10	> 80%	Multiple baseline
Goldstein & Cisar, 1992	IV	5	triad	11-10	> 80%	Reversal
Kalvya & Avramidis, 2005	III	5	small group	Not specified	> 80%	Longitudinal
Kohler et al., 2007	IV	1	triad	5-10	> 80%	Multiple baseline
Kohler et al., 1990	IV	3	triad	11-10	> 75%	Withdraw
Kohler et al., 1995	IV	2	triad	11-10	> 75%	Withdraw
Lefebvre & Strain, 1989	IV	3	triad	5-10	> 80%	Withdraw
McGee et al., 1992	IV	3	dyad	Not specified	> 80%	Multiple baseline
Sainato et al., 1992	IV	3	small group	11-10	> 80%	Multiple baseline
Zanolli et al., 1996	IV	2	dyad & whole class	3	> 80%	Multiple baseline

Level of evidence was determined using Robey's (2004) six levels of evidence concerning research and evidence-based practice, in which Level I is the highest quality of evidence represented by a meta-analysis with multiple controlled trials with randomization, Level Ib represented by a well-designed randomized control trial, Level II represented by quasi-experiments, or well-designed experiments with control trials but no randomization, Level III represented by observational studies with controls, Level IV represented by observational studies without controls, and Level V represented by the expert opinions of authorities in the field. Due to the nature of the studies in the communication sciences field and the legality issues surrounding withholding treatment for disorders known to have beneficial interventions available, only one study incorporated a control group consisting of two children with autism (Kalvya & Avramidis, 2005), therefore increasing the level of evidence from Level IV like all the other studies included in this meta-analysis, to Level III.

Variability

The studies included in this meta-analysis were similar based on the age group, diagnosis, and broad intervention type (peer-mediated) used in the research studies. However, much variability did exist concerning the type of training used in the study, who was trained, and in what environment the target social behaviors

were assessed. Five of the studies trained just the typical peers how to better interact with the target child (Carr & Darcy, 1990; Goldstein et al., 1992; Kalvya & Avramidis, 2005; Sainato et al., 1992; Zanolli et al., 1996), whereas the remaining seven studies trained both the peers and the target children for the intervention (Garfinkle & Schwartz, 2002; Goldstein & Cisar, 1992; Kohler et al., 2007; Kohler et al., 1995; Kohler et al., 1990; Lefebvre & Strain, 1989; McGee, et al., 1992). Seven of the studies had an adult both model and give verbal instructions for the training period (Kohler et al., 2007, 1995, 1990; Lefebvre & Strain, 1989; McGee et al., 1992; Sainato et al., 1992; Zanolli et al., 1996) while the remaining five only used verbal instructions to train the typical peer and/or target child (Carr & Darcy, 1990; Garfinkle & Schwartz, 2002; Goldstein & Cisar, 1992; Goldstein et al., 1992; Kalvya & Avramidis, 2005). As for the environment in which the target social interactions between the target child and the typical peers were recorded, all of the included studies utilized a free play setting to assess generalization except Carr and Darcy (1990), who used a one-on-one gym setting to assess motor imitation and Kalvya and Aramidis, (2005) who used a small group setting called "circle time," an activity facilitated by the teacher of the classroom.

External and Internal Validity Quality Markers

All the reviewed studies for this meta-analysis were examined for markers of external and internal validity using questions based on Dollaghan’s 2007 book *The Handbook for Evidence-Based Practice in Communication Disorders*. Further details of the questions used can be found in Table 3. Internal validity was assessed by taking into account inter-rater reliability, randomization of groups, blinding, etc. External validity was assessed by recruitment process of participants, adequate description of methods and procedures in order for replication of the study, attrition, etc.

Table 3. Questions used to determine external and internal validity

Quality Markers	Questions
Participant selection	Were the participants in preschool and diagnosed with autism?
Attrition	Did any of the children leave the study?
Replicability	Were the procedures adequately described for replication?
Design	Was a non-treatment control group utilized?
Design	Was randomization of groups used?
Outcome Measures	Was blinding used?
Outcome Measures	Was inter-rater reliability assessed >80%?

Effect Size, Adjustments, and Confidence Intervals

Because we strive to achieve what is considered “best practice” in our field to treat our patients, a quantitative summary of the current body of evidence holds greater weight than that of expert opinion (ASHA, 2005) or single study results. A meta-analysis seeks to summarize the results of multiple studies on a specific topic in a quantitative manner in order to help clinicians determine “best practice” for their patients (Dollaghan, 2007). By quantifying the magnitude of the effects of a particular treatment using a meta-analysis, the credibility of a specific intervention type can easily be understood (ASHA, 2005).

A meta-analysis uses effect size along with confidence intervals to measure the magnitude of a treatment effect. Though a study may result in a positive effect for the treatment intervention, it is important to know the size of the effect to determine its utility (Dollaghan, 2007). Confidence intervals are also calculated in conjunction with effect size. These intervals identify a

range in which the true effect size should fall and serve the purpose of precision in calculating the true effectiveness of a treatment. A narrow confidence interval therefore indicates a more precise calculation of effect size, whereas a wider confidence interval suggests more uncertainty in the estimate of the effect size. For a confidence interval to be narrow, a large sample size as well as little room for measurement error must be present in the studies used in the meta-analysis (ASHA, 2004). Once effect sizes are calculated for each individual study, an overall, weighted effect size and 95% confidence interval is calculated to summarize the results of all of the studies, combined.

In order to determine what statistical procedures were required to calculate the overall effect size, a statistical model had to be chosen. Due to the nature of the studies included in this meta-analysis, a random effects model was chosen because it takes into account that data may be affected not only by residual error, but also by the differences between participants in the study. This model eliminates the need to separate the participants into different groups, therefore allowing a calculated effect size representative of all the groups/participants in the included studies (Cleophas & Zwinderman, 2008).

Based on the data given for each study, a nonparametric approach called percentage of non-overlapping data (PND; Scruggs, Mastropieri & Casto, 1987) was used to calculate effect size for all included studies except one (Kalvya & Avramidis, 2005), each of which used a single-subject experimental design. Figure 2, adapted from Sainato et al (1992), shows a typical outcome graph from the studies. Graphs from each study were used to calculate PND by calculating the percentage of points during the intervention phase (circled in blue) that did not overlap with the highest point in the baseline phase (circled in red). When multiple participants were administered the intervention in a single study, the individual PND scores were aggregated across participants to obtain an overall treatment effect (Xin & Jittendra, 1999). Confidence intervals (95%) were calculated using methods described by Wilson (1927) and a continuity correction as described by Newcombe (1998) using an online calculator (<http://www.vassarstats.net/prop1.html>).

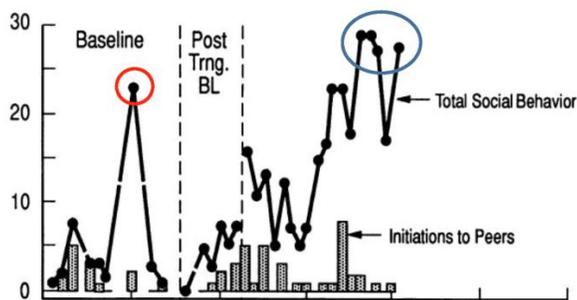


Figure 2. Example calculation of Percentage Non-overlapping Data (PND).

The red circle indicates highest baseline point and the blue circle indicates post-treatment points that were non-overlapping with the highest baseline point. Adapted from Sainato et al., 1992.

Kalvya and Avramidis (2005) measured differences between an intervention and control group and PND would not be an appropriate calculation of effect size. The Kalvya and Avramidis effect size was calculated using Cohen's *d* (i.e., the difference in means divided by the pooled standard deviation) and will be reported separate from the other studies.

Using the aggregated effect sizes from the PND for the included studies, forest plots were created to graphically depict the individual effect size of each treatment, as well as the overall effect size of this particular intervention type, with 95% confidence intervals. Studies with an effect size of 50% or below marks a treatment with no positive effect. Studies with an effect size of 50.1%-70% mark low effectiveness, while studies with an effect size between 70.1% and 90% mark a moderate effect, and studies 90.1% and above mark a large effect size (Rogers & Graham, 2008).

Results

Quality Assessment

Table 4 summarizes the quality markers used to determine internal and external validity of the included studies described in Table 2. All studies were published between 1989 and 2007. The biggest threats to internal validity were (a) control groups were not used; (b) blinding was not used; and (c) randomization of groups was not used. Due to the nature of these studies however, these internal validity quality markers were unable to be utilized to support the validity of these studies

As previously stated, control groups who receive no treatment are not commonly seen in this field, because it would be unethical to withhold treatment when there are interventions supported by evidence-based practice. Blinding and randomization were also unable to be used because these children were specifically chosen due to their medical diagnosis to receive these interventions. A strength of internal validity was inter-rater reliability great than eighty percent in nine of the eleven analyzed studies. The two that did not meet this criteria (Kohler, 1990; Kohler 1995) had an inter-rater reliability of seventy-five percent or greater. All participants had either a formal or informal diagnosis of autism, which contributes to the external validity of the study. The specificity in which study procedures were described defines the replicability of the included studies, all of which documented their procedures explicitly.

Forest Plots

The forest plot shown in Figure 3 contains the effect sizes for all included studies, as well as the overall weighted effect size for this meta-analysis (represented by the diamond). Table 5 summarizes the included studies and their individual effect sizes. Confidence intervals are set at 95% and are indicated by the horizontal lines accompanying the effect size for each studied denoted by a square. The diamond at the bottom of the forest plot signifies the overall effect size for this type of intervention.

Figure 3. Forest plot of weighted overall effect size and individual study effect sizes with 95% confidence intervals.

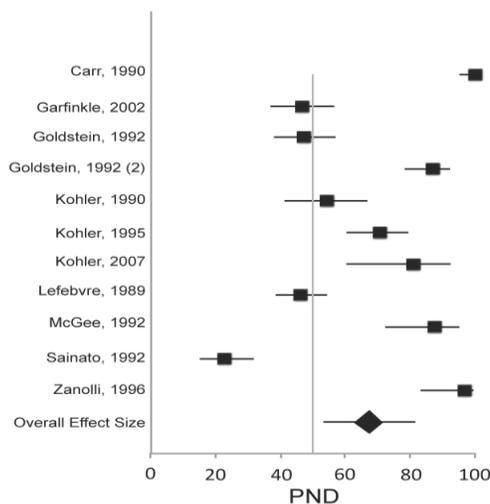


Table 4. Internal and external validity quality markers

Quality Markers	Participant Selection	Attrition < 50%	Replicability	Control Group	Randomized	Blinding	Inter-rater reliability < 80%
Carr, 1990	Yes	Yes	Yes	No	No	No	Yes
Garfinkle, 2002	Yes	Yes	Yes	No	No	No	Yes
Goldstein, 1992	Yes	Yes	Yes	No	No	No	Yes
Goldstein, 1992 (2)	Yes	Yes	Yes	No	No	No	Yes
Kohler, 1990	Yes	Yes	Yes	No	No	No	No
Kohler, 1995	Yes	Yes	Yes	No	No	No	No
Kohler, 2007	Yes	Yes	Yes	No	No	No	Yes
Lefebvre, 1989	Yes	Yes	Yes	No	No	No	Yes
McGee, 1992	Yes	Yes	Yes	No	No	No	Yes
Sainato, 1992	Yes	Yes	Yes	No	No	No	Yes
Zanolli, 1996	Yes	Yes	Yes	No	No	No	Yes

Summary of Results

The overall effect size of peer-mediated therapy in increasing social behaviors of children with autism based on the combined data of the eleven studies in Table 5 was 0.67, indicating a small effect size, with a 95% Confidence Interval (CI) of 0.53-0.82, within which the true effect size falls. Standard error was calculated to be 0.07. Due to the variable range of effect sizes for the included studies summarized in Table 5, the overall effect size only showed a small effect, bordering on a medium effect for this particular intervention type.

Table 5. Effect sizes of studies

Study	Effect Size	95% Confidence Interval
Carr, 1990	1	0.95-1
Garfinkle, 2002	0.47	0.37-0.57
Goldstein, 1992	0.47	0.38-0.57
Goldstein, 1992 (2)	0.87	0.79-0.92
Kohler, 1990	0.54	0.41-0.66
Kohler, 1995	0.71	0.60-0.79
Kohler, 2007	0.81	0.60-0.93
Lefebvre, 1989	0.46	0.38-0.54
McGee, 1992	0.88	0.72-0.95
Sainato, 1992	0.22	0.15-0.31
Zanolli, 1996	0.97	0.83-1
Overall Effect Size	0.67	0.53-0.82

Individual Study Effect Sizes

The effect sizes for all included studies were calculated in order to determine the magnitude of effect each study’s intervention had on increasing the social behaviors of preschoolers with autism overall. The effect sizes ranged from no effect to a large effect (see Table 5). Though many different activities (e.g., follow the leader, trained scripts, free play activities,

structured activities) were used to assess the social behaviors of the target children, all data was collected via observation of the social behaviors defined in the introduction. Data in all studies was displayed graphically, making PND a valid effect size model for this meta-analysis.

A brief summary of the included studies and their treatment effect follows:

- **Carr & Darcy, 1990.** This study aimed to determine the ability of a child with ASD to imitate motor tasks during follow the leader. A multiple-baseline design was used to evaluate imitative behaviors of the target children post-training across different settings. The effect size for this study was 1, indicating a large effect. The results of this study suggest that children with ASD can increase motor imitations of their typical peers with one-on-one training from these peers.
- **Garfinkle & Schwartz, 2002.** This study used a multiple-baseline design to analyze the target children’s social behaviors, including initiations and imitation of peers’ behaviors post small group sessions using follow-the-leader and during free play. The effect size for this study was 0.47, indicating no effect for this intervention. This result shows that social behaviors learned in a small group setting did not generalize to more naturalistic settings, such as free play.
- **Goldstein et al., 1992.** An ABCB reversal design was used in this study to assess the social behaviors of the target children with and without peer encouragement and conversation facilitation. The effect size for this study was 0.47, indicating no effect for this treatment approach. This result

suggests that social behaviors in the target children were not maintained when the actions of peer tutors were removed from the environment.

- **Goldstein & Cisar, 1992.** This study used a multiple-baseline design to evaluate the presence of social behaviors related and unrelated to trained scripts and role play during free play that had first been practiced with typical peers. The effect size of this intervention was 0.87, indicating a large effect using this treatment approach. This result suggests that training of social scripts with typical peers generalizes to a free play setting post-training.
- **Kohler et al., 1990.** This study utilized a withdraw design to determine whether an individual typical peer and/or typical peers in a group setting influenced the social behaviors of the target child. The effect size for this study was 0.54, indicating a small effect size. This result proposes that trained peers can modestly increase the social behaviors of preschoolers with autism.
- **Kohler et al., 1995.** This study also used a withdraw design to investigate whether typical peers in a group setting alone (as opposed to individual peers in the above study) could increase the social behaviors of the target children. The effect size for this study was 0.71, indicating a medium effect. The results suggest that a group-contingency with typical peers is an effective intervention for increasing social behaviors of preschoolers with autism.
- **Kohler et al., 2007.** This study used a withdraw design to determine whether the social skills of a preschooler with autism would increase with her typical peers when a “Buddy Skills” package consisting of strategies to play, stay, and talk, was implemented. The effect size for this study was 0.81, indicating a large effect. This result suggests that the buddy skills package used by typical peers can increase the social behaviors of preschoolers with autism. However, it is important to note that there was only one subject in this study.
- **Lefebvre & Strain, 1989.** The purpose of this study was to examine the effects of group reinforcement to increase the social interactions of the target children using a withdraw design. The effect size for this intervention was 0.46, indicating no effect. This suggests that the group design used in this study was not significant in increasing the social interactions of the preschoolers with autism.
- **McGee et al., 1992.** The purpose of this study was to evaluate the effects of peer incidental teaching on increasing reciprocal peer interactions among the target children and their typical peers during free play using the strategies of wait, label, turn-taking and praise. A multiple baseline design was used to collect data. The effect size for this study was 0.88, indicating a large effect. The results of this study therefore indicate that incidental teaching of communication strategies to typical peers facilitates an increase in social behaviors in preschoolers with autism.
- **Sainato et al., 1992.** The purpose of this multiple baseline design study was to determine whether training peers with communication strategies would increase the social behaviors of the target children. It also sought to identify whether or not having the typical peer self-evaluate after a free play session would further increase the use of communication strategies and therefore further increase the social behaviors of the target children. The effect size for this intervention was 0.22, indicating no effect. This suggests that neither the communication strategies taught, nor the self-evaluation of the typical peer significantly increased the social behaviors of preschoolers with autism.
- **Zanoli et al., 1996.** The purpose of this multiple baseline design study was to examine whether priming typical peers with strategies to increase spontaneity of social interactions would increase these skills and social interactions in general in the target children. The effect size for this study was 0.97, indicating a large effect and suggesting that teaching typical peers communication strategies to use with the target children during planned activities also generalized to free play in the target children.
- **Kalvya & Avramidis, 2005.** The purpose of this study was to determine whether using an intervention called “Circle of Friends” would improve the social interactions of preschoolers with autism with their typical peers. The effect size for this study was very large (3.73) suggesting a strong positive effect of peer-mediated treatment on the social interactions of children with autism. This study had the highest level of evidence due to the presence of a control group, suggesting that future work with similar rigor may show similarly large effect sizes.

Discussion

Due to the numerous differences across the studies, it is hard to determine what individual intervention differences improved the results of one study compared to another. One particular issue with many studies in the field of communication sciences is the small sample sizes utilized. None of the studies reviewed in this meta-analysis included more than five target children. This makes the results hard to generalize to the larger population.

There is also a lack of a control group in all included studies, except Kalvya and Avramidis (2005), which ultimately delivered intervention to the control group. Because it is considered harmful to a child with autism or any communication impairments to withhold all treatment, the use of control groups who receive no treatment is rare in this field. This poses a problem in whether or not the improvement in social interactions is due to confounding variables, such as maturation or simply exposure to typical children.

An examination of the features of the studies with a large effect (Carr & Darcy, 1990; Goldstein et al., 1992; Kohler et al., 2007; McGee et al., 1992; Zanolli et al., 1996; Kalvya & Avramidis, 2005) shows great variability among these studies. The number of treated children ranged from one to five. Two of the studies trained both peers and the target children together (Kohler, et al 2007; McGee et al., 1992) and the remaining four trained only the peers. Training consisted of only verbal instructions in Carr and Darcy (1990), Goldstein, et al (1992), and Kalvya and Avramidis (2005) but consisted of verbal instructions and modeling in Kohler et al., 2007, McGee et al., 1992, and Zanolli et al., 1996. The number of training sessions ranged from three to sixteen in these studies. The presence of adult cueing varied in all studies; present during training only in Carr and Darcy (1990), present during intervention only in Goldstein et al., 1992 and Zanolli et al., 1996, and present during both training and intervention in Kohler et al., 2007 and McGee et al., 1992. Kalvya and Avramidis (2005) did not use cueing at all. All studies with a large effect size observed the changes in social behaviors (described in the introduction) of the target children, except Carr and Darcy (1990) which assessed only the target child's ability to imitate their peer's motor actions.

None of the studies showing a large effect was structured exactly the same. The great variance among these studies proposes that the differences among the target children, the typical peer tutors, the adults providing cueing and facilitating training, as well as the individual activities chosen for training and intervention have a great effect on the outcome of the study. Because of sample variance, even a replicable peer-mediated study may show different results when redone with different participants. Therefore, it is important to consider the individual personality and deficits of a preschooler with autism when determining whether or not peer-mediated therapy would be a useful intervention.

It is also important to note that four of the six studies with large effect sizes (Zanolli et al., 1996; McGee et al., 1992; Kohler et al., 2007; Goldstein & Cisar, 1992) likely had an inflated PND due to baseline measures of zero social interactions for the target children. This causes a 100% ceiling effect, meaning that the target child will appear to improve in their use of social interactions, even if they only increase by a single documented interaction.

Though external validity is hard to achieve with the small sample sizes in the included studies as well as a lack of formal assessment to measure change, a calculation of effect size to measure the magnitude of the change in social interactions across the studies is what makes this meta-analysis beneficial to clinicians in determining whether peer-mediated therapy is appropriate for their client. Peer-mediated intervention to increase the social behaviors of preschoolers with autism showed a small, bordering on medium, overall weighted effect size, suggesting that it does hold some significance in treating children with ASD. ♦

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though this is increasing as accuracy of diagnosis improves (Baaj, Agazzi, Sayed, Toledo, Spetzler, & van Loveren, 2009). The exact mechanism that results in Moyamoya remains unknown (Houkin, Ito, Sugiyama, Shichinohe, Nakayam, Kazumata, & Kuroda, 2012), but many hypotheses of the pathogenesis have been proposed, including infection, autoimmune dysfunction, protein abnormality, and genetic abnormality. The most promising hypothesis is genetic abnormality, though it is likely that there is a complex mechanism at work and several factors, including genetics, may be the best explanation for formation of Moyamoya (Houkin et al., 2012).

Moyamoya is usually first identified when an individual is in childhood and they begin experiencing recurrent TIAs or CVAs, both hemorrhagic and ischemic (Burke et al., 2009); headaches and seizures are also a common presentation (Parray, Martin, & Saddiqui, 2011). There is evidence of heritability of Moyamoya, as there is an increased incidence in first degree relatives (Guzman, Lee, Achrol, Bell-Stephens, Kelly, Do, Marks, & Steinberg, 2009). The development of Moyamoya is also correlated with conditions such as sickle cell disease, Down syndrome, or Neurofibromatosis type I (Guzman et al., 2009) though the cause of Moyamoya is often unknown (Burke et al., 2009).

The diagnosis of Moyamoya is most often made at an average age of 5 (when a child begins experiencing ischemic events) or at an average age of 40 (adults most often experience CVA due to recurring blood clots in the affected brain vessels; Burke et al., 2009). The diagnosis is made on basis of clinical and radiographic exams (most importantly the magnetic resonance arteriography [MRA] scan), in which the characteristic “puff of smoke”-appearing blood vessels are best viewed (Tarasow, et al., 2011). Women are more than twice as likely as men to have Moyamoya (Scott & Smith, 2009).

Overall prognosis depends on how rapidly vascular blockage occurs, and to what extent. Moyamoya can progress slowly with occasional TIAs or CVAs, or it can involve rapid decline. Prognosis is also determined by ability to develop effective collateral circulation, the age at onset of symptoms, and the severity of disability resulting from a CVA. The individual’s neurologic condition at the time of treatment is more important in

determining long-term outcome than the individual’s age (Scott & Smith, 2009). There is no typical presentation of cognitive deficits for an individual with Moyamoya, as the deficits depend on the area of brain involvement (localization of the lesion).

Treatment of Moyamoya

Surgical interventions are the gold standard of treatment for Moyamoya. Interventions can be characterized as either *direct* or *indirect* vascularization procedures.

Direct vascularization. Direct vascularization involves an arterial bypass; that is, connecting a blood vessel from outside the brain to a vessel inside the brain to reroute blood flow around an artery that is narrowed, blocked, or damaged. The most common bypass procedure is the superficial temporal artery to middle cerebral artery procedure, which may achieve instant improvement in blood flow (Scott & Smith, 2009). Direct vascularization procedures are less commonly done than indirect, because the risk to the individual of serious complication (CVA or death) is increased. More common are *indirect* vascularization procedures.

Indirect vascularization. Indirect vascularization procedures do not involve connecting an artery to an artery. Rather, they all involve exposing the brain parenchyma to a procedure or structure that will help increase proliferation of arteries.

- **Omental transposition procedure.** The omentum (the lining surrounding the abdominal organs) is placed on the surface of the brain, with the expectation that vessels will eventually grow into the brain and improve blood supply.
- **Multiple burr holes procedure.** Several small holes are drilled in the skull, which causes proliferation of new vessels into the brain from the scalp.
- **EDAS (encephalo-duro-arterio-synangiosis) procedure.** The superficial temporal artery is placed in contact with the brain surface.
- **EMS (encephalo-myo-synangiosis) procedure.** The temporalis muscle on the side of the head is dissected and, through an opening in the skull, is placed onto the surface of the brain.
- **EDAMS (encephalo-duro-arterio-myo-synangiosis) procedure.** This procedure combines the technique of EDAS and EMS. This was the procedure that MD underwent.

Prognosis

For surgically treated pediatric individuals with Moyamoya, disease progression was found in about 2.5% of the sample. If an individual with Moyamoya is surgically treated prior to a disabling CVA, even if the condition is severe, the prognosis tends to be excellent. Untreated individuals who had no symptoms were found to experience an annual CVA rate of 3.2% and disease progression in 80%. Even in individuals with Moyamoya without symptoms, surgical treatment has been reported to protect against CVA (Burke, et al., 2009). If left untreated, the disease will invariably progress, producing clinical deterioration and potentially irreversible neurological deficits over time (Kuroda & Houkin, 2008).

Increased perfusion success rates are high following surgical treatments. In a longitudinal study (Guzman, et al., 2009) of 450 individuals who underwent an indirect vascularization that involved synangiosis, 102 had follow-up arteriograms 1 year after surgery (195 hemispheres were viewed). The increased perfusion was measured and "graded." *Grade A* was used to denote that the synangiosis procedure induced filling of greater than two-thirds of the middle cerebral artery (MCA) circulation, which was found in 65% of the hemispheres viewed. *Grade B* denoted that the synangiosis induced filling of between one-third and two-thirds of the MCA circulation, which was found in 25% of the hemispheres. Finally, *grade C* denoted that the synangiosis induced filling of less than one-third of the MCA circulation, which was found in 10% of the hemispheres.

As with any surgical procedure, complications may occur. The authors found that within one month of surgical intervention, 11 CVAs occurred (7% of individuals with Moyamoya, 4% of treated hemispheres) and three TIAs occurred (Guzman, et al., 2009).

Why Refer for a Neuropsychological Evaluation?

A neuropsychologist has a doctorate degree (Ph.D. or Psy.D.), usually in clinical or counseling psychology, has completed a one-year internship with an emphasis in neuropsychology, and has completed a two-year fellowship in clinical neuropsychology. It is becoming more common for neuropsychologists to pursue board certification, to prove their competence in the field.

Neuropsychology is an applied science concerned with the behavioral expression of brain dysfunction. Neuropsychology as a distinct profession began about 1967 and currently, there are roughly 8000 neuropsychologists in the United States.

There are several main reasons that prompt a neuropsychological evaluation: diagnosis (though this is often less of a need in a rehabilitation setting where the diagnosis is most often already known), patient care (questions about management and planning), treatment (assisting with individualized treatment programs and monitoring patients' changing treatment requirements), evaluating treatment efficacy, research, and forensic questions (Lezak, Howieson, & Loring, 2004). Of course, when there is a team approach, the first four are the most critical.

Neuropsychological evaluations can include assessments of all of these cognitive domains: orientation, speech and language, attention, visual perception, memory, intellectual functioning, executive functioning, academic functioning, and affective/emotional functioning.

Common referral questions include the following:

- Capability of making informed medical decisions.
- Level of supervision needed.
- Insight into deficits and ability to self-correct.
- Cognitive stamina and endurance.
- Description of cognitive deficits.
- What level of employment/schooling is most feasible?
- Level of motivation to work.
- What kind of work/school adaptations would be helpful?
- Extent of social problems.
- Medications that might assist cognitive or emotional functioning.

Speech-Language Pathology (SLP) and Neuropsychology evaluations often overlap in the domains that are tested. Frequently, my SLP colleagues use my evaluations as a starting point for treatment, to monitor the progress of their patients, to help determine when a plateau may have been reached, and, as a result, when therapy may be coming to an end. Because of its training emphasis on cognition, brain-behavior relations, and standardized

testing, the specialty of neuropsychology offers a useful common taxonomy, which SLPs use, of cognitive abilities necessary to evaluate in neurologically compromised individuals (Johnstone & Stonnington, 2009). However, the education in the *remediation* of cognitive deficits is more robust for SLPs.

Case Presentation

MD was a 36 year old, right-handed Caucasian woman who was referred for a neuropsychological evaluation almost two years after being diagnosed with a CVA. MD was also diagnosed with Moyamoya disease and a seizure disorder post EDAMS procedure.

Her medical/surgical history was significant for depression (being treated by a psychiatrist monthly and counselor every other week), hypothyroidism, acid reflux, stage III kidney disease, hypertension, hypercholesterolemia, diabetes mellitus, osteoarthritis and tubal ligation. Family history in first order relatives was unremarkable for any medical, neurological or psychiatric disorders.

MD was married with two children (6-year-old son and an 18-month-old daughter). MD's daughter was born *after* the CVA, which reportedly occurred via surrogacy due to history of kidney disease.

MD reported that she earned two Masters Degrees with no history of special education services or learning disabilities and excellent grades throughout her school career.

At the time of the CVA, MD had been working as a school psychologist for about 1.5 years. Prior to that, she had worked as a teacher and prior to that as an admissions counselor for a university.

MD's Self-Report of Current Functioning

Cognitive. MD reported the only cognitive difficulties that she was experiencing were with expressive language. However, her husband indicated that she could be easily distracted, had "patchy" memory abilities, and believed that at times her auditory comprehension "may be down."

Physical. MD reported that her right arm has been significantly weak and painful since the CVA. She noted

her right leg has some weakness, though the arm is worse than the leg. She also noted that she has "frozen" shoulders bilaterally. She noted no difficulties with her vision, though her husband indicates that she has had to get glasses recently. She reported no difficulties with hearing.

Activities of daily living. MD indicated that she requires minimal assistance with dressing (buttons, zippers). She noted that her husband had taken over most of the cooking for the household. She reported that she was able to do some cleaning around the house. Her husband indicated that she was showering independently. MD indicated that her mother was assisting her with medication management and her husband had taken over the money management since the CVA. Also of note, MD indicated that she has been experiencing bladder incontinence since the CVA. She noted that lately it had been occurring on about a weekly basis. She noted that there had been no pattern to this (e.g., not at a particular time of day or when she was doing a particular activity).

Findings (See Figure 1)

Behavior. MD's ambulation was notable for right-sided weakness. Her level of activity through the examination was mildly fidgety in that she had a tendency to rock side-to-side. Sensory and motor functions were notable for significantly weak/flaccid right upper extremity. MD was a very friendly woman although she did become tearful at times during the clinical interview and examination.

Speech was coherent and goal-directed, though telegraphic in nature; she stopped frequently during free conversation, in an obvious attempt to think of/attempt to say the word she wanted to use. She was able to understand all directions provided to her. She remained cooperative through testing and therefore results appeared valid.

Of note, MD has an insulin pump, which beeped several times through the exam; when asked what that meant, she stated, "I need to check my blood sugar." However, until strongly urged her to do so, she was not going to check it.

Figure 1. MD's testing results

VISION	Visual Acuity (near)	20/25								
		Within Normal Limits				I M P A I R E D				
		Superior	Hi Avg.	Avg.	Low Avg.	Borderline	Mildly	Moderately	Severely	Profoundly
PREMORBID IQ Est.	Reading Aloud		111							
INTELLECTUAL FUNCTIONING	Full Scale IQ				74					
	Verbal Comprehension Index				78					
	Perceptual Reasoning Index			90						
	Working Memory Index				71					
	Processing Speed Index				71					
VISUAL PERCEPTION	Visuoconstruction			x						
	Visual analysis and synthesis			x						
	Visual integration					x				
	Perceptual Reasoning Index			90						
SPEECH AND LANGUAGE	Verbal abstract reasoning								x	
	Oral Vocabulary				x					
	General Fund of information			x						
	Verbal Comprehension Index				78					
	Confrontation Naming						x			
	Verbal Fluency								x	
	Animal Fluency									x
ATTENTION	Immediate auditory attention								x	
	Sustained Attention (mental Math)				x					
	Working Memory Index				71					
MEMORY	Story Memory			x(1,2)						1=immediate
	List Learning					x(3)		x(1,2)		2=delay
	Visual Memory				x(2)	x(1)				3=recognition
	Immediate Memory Index				85					
	Delayed Memory Index				88					
HIGHER COGNITIVE FUNCTIONING	Speed of Processing					cod	ss	SDMT oral		
	Processing Speed Index				71					
	Nonverbal Abstract Reasoning				solutions				persev. Errors	
AFFECTIVE	Emotional distress (self-report)	minimal depression and anxiety								

Vision. Near-visual acuity was estimated to be within functional limits. There was no evidence of right or left neglect.

Intellectual functioning. MD was administered a reading recognition task (the Wechsler Test of Adult Reading; Holdnak, 2001) designed to yield an estimate of "premorbid" IQ. Her score was a 111 (high average). She was then administered the Wechsler Adult Intelligence Scale, 4th Edition (WAIS-IV; Wechsler, 2008), earning a Full Scale IQ score of 74 (borderline). Her significantly attenuated score was secondary to changes in expressive language, working memory, and processing speed. Her index scores were as follows: Verbal Comprehension = 78 (borderline); Perceptual Reasoning = 90 (average); Working Memory = 71

(borderline/mildly impaired); and Processing Speed = 71(borderline/mildly impaired).

Visual perception. This was an area of relative strength for MD. Her performance on a task of visual construction (Block Design from the WAIS-IV) in which she had to put red and white blocks together to make them look like a pictured design was average. She performed similarly on a task of visual analysis and synthesis of information (Matrix Reasoning from the WAIS-IV). She had most difficulty with the task of visual integration in which she had to mentally put together pieces of a geometric shape, scoring in the borderline range. These scores combined to yield an overall Perceptual Reasoning index of 90 (average).

Speech and Language. This domain is the most significantly affected domain for MD. Verbal abstract reasoning (Similarities from the WAIS-IV; stating how two seemingly different objects are alike or similar) was severely impaired. Oral vocabulary skills (Vocabulary from the WAIS-IV) were borderline. General fund of information (Information from the WAIS-IV) was average. These scores combined to yield an overall Verbal Comprehension index of 78 (borderline). She was also administered tasks of speech fluency (FAS; Bolla, Lindgren, Bonnaccorsy, & Bleecker, 1990; and Animal Fluency; Spreen & Strauss, 1998) and confrontation naming (Boston Naming Test; Kaplan, Goodglass, & Weintraub, 1983). Confrontation naming was moderately impaired. Speech fluency tasks were profoundly impaired. MD had been seeing a speech-language pathologist on and off since early 2011, who diagnosed MD with Broca's aphasia.

Attention. Immediate auditory attention (Digit Span from the WAIS-IV) was severely impaired. However, she did better with a task of mental math (Arithmetic from the WAIS-IV), performing in the low average range. These scores combined to yield a Working Memory index on a WAIS-IV of 71 (borderline).

Memory. This domain was quite variable. Memory for stories (Logical Memory from the Wechsler Memory Scale, 4th edition; WMS-IV; Wechsler, 2009) was average both initially and after a delay. Memory for a list of words (California Verbal Learning Test, 2nd edition; Delis, Kaplan, Kramer, & Ober, 2000) was severely impaired initially and after a delay, though she benefitted from recognition cuing, performing in the mildly impaired range on that aspect of the task. It is likely that her expressive language deficits contributed to her lower score. However, on a task of visual memory (Visual Reproduction from the WMS-IV), her score was also reduced from premorbid status. She performed in the mildly impaired range initially and low average after a delay. This is an indication that she required extra processing time in order to encode the information. Overall on the WMS-IV, her Immediate Memory index was an 85 (low average) and Delayed Memory index was 88 (low average). These are compared to predicted scores (derived from the WTAR) of 107 and 109 respectively.

Executive Functioning. This domain was impaired. MD was administered tasks designed to assess speed of information processing (Symbol Search and Coding from the WAIS-IV). Two of these tasks require a motor component and since she had to use her non-dominant left hand to complete the tasks, this may have influenced her scores to some degree. However, it was interesting to note that she scored better on the more motorically involved task (Coding) than on the less motorically involved task (Symbol Search). In addition, on a motor-free task of speed of processing (Symbol Digit Modalities Test, Oral; Smith 1968) her performance was severely impaired. MD presented with speed of information processing deficits for an overall Processing Speed index on the WAIS-IV of 71 (borderline/mildly impaired). On a task of nonverbal abstract reasoning (Wisconsin Card Sorting Test, Heaton, Chelune, Talley, Kay, & Curtiss, 1993), MD had difficulty formulating solutions to this complex card-sorting task, for a score in the low average range. However, what was more notable was that she had a very significant tendency toward perseverative errors, with this score being in the profoundly impaired range.

Affective functioning. MD was administered two self-report questionnaires of current psychological symptomatology (Beck Depression Inventory, 2nd edition; Beck, Steer, & Brown, 1996; Beck Anxiety Inventory; Beck & Steer, 1993). Her responses indicated she was endorsing a minimal level of depressive and anxiety symptoms.

Summary of MD's performance

The results of the neuropsychological evaluation (2 years post CVA as the result of moyamoya syndrome) indicated MD exhibited significant expressive language deficits consistent with Broca's aphasia. In addition, she exhibited reduced speed of information processing, reduced memory, and executive dysfunction (e.g., perseveration). She met criteria for cognitive deficits as late effect of cerebrovascular disease.

She did well in the following areas: visual perception, general fund of information, reading aloud, and memory for stories.

No behavioral issues were exhibited during testing. She was pleasant, cooperative, and quite hard working.

Emotionally, she exhibited tearfulness at times. She reported no significant depression or anxiety and her responses on two questionnaires were consistent with this. The tearfulness appeared to be more related to emotional lability, a common sequela of CVA.

It was also the professional opinion of the neuropsychologist that further cognitive gains will be slow and gradual, prognosis for independence in complex activities of daily living (e.g., driving) was guarded.

Recommendations from Neuropsychological Evaluation

Some of the referral questions that MD's physician wanted addressed included MD's ability to make informed medical decisions, level of supervision, description of cognitive deficits, her ability to complete advanced activities of daily living (e.g., driving), medications that might assist cognitive functioning, and if future employment was feasible.

Results of the evaluation appeared to suggest that MD is able to make informed medical decisions (no power of attorney or guardianship was recommended). MD will likely continue to require the assistance from her husband and mother, not only to complete her own advanced activities of daily living, but also to assist in the care of her two very young children.

Given the cognitive deficits noted (e.g., speed of processing, memory and executive dysfunction) at two years post-onset, any further gains are likely to be slow and gradual; therefore prognosis was guarded. The neuropsychologist suggested that MD continue to focus on pre-driving skills with occupational therapy and be re-evaluated via a driving simulation evaluation in 1 year. The findings also suggest that MD was not able to participate in paid, competitive employment.

MD may also benefit from a neurostimulant medication to improve speed of processing.

The neuropsychologist also encouraged MD to continue participation in CVA support group, engaging in cognitive activities (e.g., puzzles, board games, card games, etc) and to be physically active, as there is evidence of improvements in cognition following

acquired brain injury with physical activity (Devine & Zafonte, 2009).

Discussion

Moyamoya disease is a cerebrovascular disease that can be successfully surgically treated. However, the risk for CVA before, during, or after treatment is significant. Depending on the severity of the CVA, an individual's prognosis will vary. The case presented describes a woman with CVA as the result of Moyamoya that was quite devastating. At the time of the evaluation, which was two years post, she was unable to live independently, drive, or return to work. Prognosis for future ability to participate in these activities is guarded. A neuropsychological evaluation was important in this situation to clarify what her continued needs and supports are. ♦

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differences in the timing of the necessary articulatory gestures for both vocalic and consonantal /r/. This would suggest that both versions of American English /r/ need to be separately considered and targeted in treatment. In the current study, both consonantal and vocalic /r/ were targeted in separate blocks in each study treatment session.

More recently, researchers have begun to test a variety of novel treatment approaches to provide treatment alternatives for treatment-resistant children. Many of these approaches to treatment generally fall under the term sensory biofeedback. Sensory biofeedback utilizes specialized instrumentation to facilitate increased awareness of the target behavior in the client (McAllister, Byun, & Hitchcock, 2012). Sensory biofeedback works by providing an alternate visual representation of the target behavior (i.e., visual biofeedback) or by presenting a physical target for the participant to touch (i.e., tactile biofeedback) to achieve the target behavior (Shuster, Ruscello, & Toth, 1995). Examples of these approaches, which target the client's visual perceptual system, are electropalatography (EPG) and ultrasound. Sensory biofeedback provides an external focus of directed attention to the task of remediating misarticulated speech. This external focus is said to aid the retention of a newly acquired motor skill such as speech (Wulf, 2007).

The theoretical underpinnings of specifically tactile biofeedback have become the focus of recent studies. These studies have highlighted the strong connection between auditory and tactile or somatosensory feedback in speech perception and production (Tremblay, Shiller, & Ostry, 2003; Gick & Derrick, 2009; Champoux, Shiller, & Zatorre, 2011). Indeed, leading psycholinguistic models of the speech production mechanism, such as Guenther's DIVA model (Guenther & Vladusich, 2012) necessarily include an active somatosensory feedback control subsystem. This subsystem is thought to include specific, distinct somatosensory goals during speech production. These researchers have posited that aberrant speech production may be the result of an underlying impairment in the development of this somatosensory feedback control subsystem, and, by extension, fine-tuning a speaker's somatosensory acuity during speech production may be one of the principal underlying goals

of speech intervention (Ghosh, Matthies, Maas, Hanson, Tiede, Menard, Guenther, Lane, & Perkell, 2010).

As a methodology, tactile biofeedback provides the participant with a lingual target inside the oral cavity that indicates, by feeling this target, where the tongue should be placed and how it should move in order to achieve correct production of misarticulated /r/. There has been a long history of tactile feedback devices in therapy for speech sound disorders (Ruscello, 1995). A notable study testing the effectiveness of such a device was reported by Clark, Schwarz, and Blakeley (1993). Their investigation focused on a specially fitted dental mold with an attached lingual target that was shown to be effective in treating misarticulated /r/, as compared to traditional approaches of articulation therapy.

Although sensory biofeedback approaches have shown clear clinical promise, particularly with treatment-resistant /r/ errors, the widespread applicability currently appears limited. For example, Adler-Bock, Bernhardt, Gick, and Bacsfalvi (2007) noted the relatively high cost of ultrasound instrumentation despite the promising clinical implications of the data they obtained supporting its use in remediating residual /r/ in adolescents. The tactile biofeedback device described in Clark et al. (1993) required individual fitting, was noted to have impeded saliva swallowing, and was generally uncomfortable to study participants over extended use. The current study aims to provide preliminary evidence for a unique embodiment of tactile biofeedback that does not require specialized fitting, is generally well tolerated by clients, and would be available to clinicians at a fraction of the cost of other biofeedback tools.

Hypothesis

This study aims to examine the effectiveness of a specially designed tactile biofeedback tool that directly cues the retroflexion necessary to produce American English /r/. Specifically, the author hypothesizes that the use of tactile biofeedback as the primary cuing mechanism for remediating /r/ will result in decreased time to achieve remediation as compared to industry norms. The tactile biofeedback device will be used as the primary cuing mechanism within a traditional articulation therapy framework, as described in Van Riper & Emerick (1984). Industry norm used for comparison are data gathered by Jacoby et al (2002),

which describe the average treatment time for speech sound disorders for pre-school and early school-age children. These norms are based on data gathered from 149 children aged 3 to 6 who received treatment to address speech sound disorders; to the author's knowledge, no other set of data of a comparable sample size exists for the study participant's age group. Based on these data reported by Jacoby et al (2002), the average time to achieve one level of functional communication improvement, which corresponds to the study participant's misarticulation of /r/, was 14 hours of direct therapy. These normative data will be compared with the data gathered during this investigation at two separate time points: 1) at the conclusion of treatment; and, 2) at ten weeks following the conclusion of treatment. Should the study participant show maintenance of accuracy levels ten weeks post-treatment, this would suggest gains were generalized to the participant's everyday life. Remediation is defined as greater than 70% accuracy in words and words-in-sentences on a 50-item picture naming test, as per performance standards stipulated in Van Riper and Emerick (1984).

Methodology

In order to test the hypotheses listed above, a single, treatment-naïve male participant, A.R., age 8 years, 10 months, received eight therapy sessions of approximately 30 minutes each. During treatment, the primary means of eliciting correct American English /r/ was tactile biofeedback. The participant's baseline accuracy at producing /r/ was assessed pre-treatment and compared to accuracy immediately following the conclusion of treatment as well as ten weeks post-treatment, to assess generalization. The principal investigator (PI), who acted both as the study evaluator and therapist, obtained informed consent from A.R.'s mother as well as assent from A.R. himself, using IRB-approved forms.

Participant

At the time of enrollment, the study participant was 8 years, 10 months old and presented with misarticulated American English /r/ and /s/, as measured by 20% accuracy or less on picture naming tests focused on these phonemes. He was a monolingual native speaker of Standard American English. As per the results of the Comprehensive Evaluation of Language Fundamentals-4 Screening Test (CELF-4 Screening Test), A.R. was not at

risk for a receptive or expressive language delay or disorder. As per an audiological screening using a recently calibrated Earscan 3[®] brand audiometer, A.R. presented with hearing function within normal limits at 500 Hz, 1000 Hz, and 5000 Hz, bilaterally. He had no consistent prior speech therapy targeting his misarticulated /r/ but underwent a brief therapy regimen of approximately four hours focused on production of /s/. The participant's mother reported no measureable improvement on accuracy of /s/ production as a result of this treatment and therapy to target /s/ was discontinued.

Test Article

The principal function of the test article is to aid the participant in achieving correct lingual placement and movement for the /r/sound, the primary task of the speaker (McAllister, Byun, & Hitchcock, 2012). Acoustically correct production of /r/ requires three distinct oral cavity constrictions as well as posterior lateral tongue bracing (Alwan, Narayana, & Haker, 1997; Gick, Iskarous, Whalen, & Goldstein, 2003). The first, most anterior constriction is commonly referred to as lip rounding and is particularly evident in word-initial, pre-vocalic /r/ (Bernhardt & Stemberger, 1998). The second constriction involves the tongue moving posteriorly to approximate the shape of the palate. This is generally accomplished by two means in the majority of speakers of American English: tongue retroflexion or tongue retraction. The third, most posterior constriction involves the tongue moving toward the pharyngeal wall (Alwan et al., 1997). As described below, a combined visual and verbal cue was used to aid the client in achieving lip rounding for /r/. The test article targets the second of these constrictions, where the tongue moves to approximate the shape of the oral cavity.

The test article is a tactile biofeedback device and is commercially known as the Speech Buddy[®] R device. The test article was designed by Articulate Technologies, Inc., a private company based in San Francisco, California. The device is hand-held, minimally invasive and sized to fit a wide range of sizes of the oral cavity. The hand-held embodiment allows it to be maximally controllable by the clinician while providing a direct tactile target for 1) the correct initial placement of the tongue tip via the positioning ridges described above; and 2) the correct tongue movement during

production. The device was designed to minimally impede coarticulation, thus allowing the participant to correctly produce /r/ up to the word level in most phonetic contexts, with the device in place. Figure 1 depicts the key components of the test article as well as its placement and use within the oral cavity. The ridges between the end of the device neck and the body of the device coil provide tactile cue for the correct starting position of the tongue. The device coil itself represents the tactile cue for the movement phase of production. During feasibility testing conducted by the device manufacturer with over 50 children presenting with misarticulated /r/, the test article was able to elicit correct productions of both consonantal /r/ (as in “rack”) and vocalic /r/ (“as in car”).

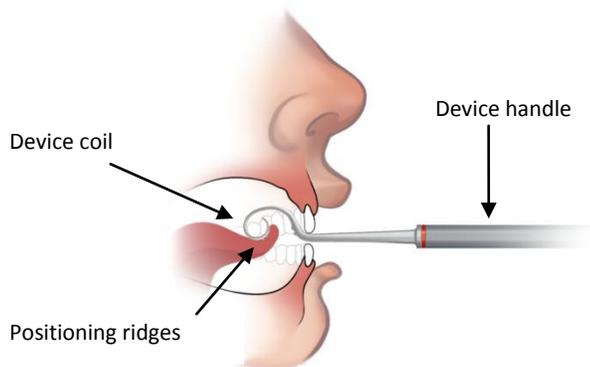


Figure 1. The key components, placement and use of the test article within the oral cavity

Eliciting correct production of /r/ with the test article requires two distinct phases: 1) the positioning phase, and 2) the movement phase. For the positioning phase, the speech-language pathologist (SLP) places the device directly behind the participant’s upper dentition and holds it in this position. The SLP then instructs the participant to feel the positioning ridges with his tongue and hold his tongue in this correct starting position. The SLP would then have the participant confirm that he feels these ridges with a simple question (e.g. “can you feel those bumps?”) that the participant would answer with a nod. Once the tongue is correctly placed for the positioning phase, the SLP instructs the participant to roll his tongue back by uncoiling the device coil while saying an extended /a/ low, back vowel. This low back vowel is thought to cue posterior

vocal tract constriction (Kent & Read, 2002), the third of the vocal tract constrictions. The participant should feel the coil fully unroll to confirm the necessary retroflexion of the tongue. The SLP would then cue, via a simple visual cue and one-step verbal directive, a slightly rounded and protruded lip posture (e.g. “Look at my lips and try to make an ‘O’ with your lips like I am doing.”). This rounded lip posture represents the most anterior of the three vocal tract constrictions described in this section above.

The tip of the device, which provides the tactile biofeedback, is made of a soft thermoplastic elastomer that has passed appropriate biocompatibility and toxicity testing required by International Organization for Standardization (ISO) standards and U.S. Food and Drug Administration (FDA) guidance. The material is soft enough to prevent deformation or pain when bitten down upon, yet is sturdy enough to retain its shape when manipulated by the tongue.

Therapy

A.R. received eight individual treatment sessions over a period of seven weeks. The study PI attempted to schedule two weekly sessions over four weeks. However, taking into account scheduling conflicts (e.g. vacation and illness), seven weeks was allotted to complete all eight sessions.

Therapy featured tactile biofeedback delivered via the test article as the primary cuing mechanism. This primary tactile biofeedback cue was supported by verbal instructions to correctly manipulate the tool with the tongue as well as auditory cues to aid the participant to auditorily perceive correct vs. incorrect production of /r/. In addition, since lip rounding represents a secondary, necessary vocal tract constriction in American English /r/ (Bernhardt & Stemberger, 1998), a separate and combined visual and verbal cue was used to elicit this lip rounding. This cue involved a visual demonstration of this lip configuration, supported by the verbal instruction, “watch my lips make an “O” shape and try to do the same thing when you say /r/.” No external cues, in the form of another device or other instrumentation (e.g., a mirror) were used during the study. Each of the eight treatment sessions consisted of exactly 55 stimulus items, taking approximately 25 minutes to complete. The first six items trained were “warm-up” items with /r/ presented

in isolation and in CV and VC syllables (e.g. “ra” and “ar”). After completing the “warm-up” items, the remaining 49 items trained consonantal, pre-vocalic /r/ in words in initial position (22 items), vocalic /r/ in medial position (seven items), and vocalic /r/ final position (20 items). For all study sessions, stimulus items were trained in blocks according to word position, with the 22 word-initial items trained first, followed by the seven items in medial position, and the 20 word-final items. Stimulus words featured both vocalic and consonantal /r/ only in singletons (i.e. not in clusters) and generally in stressed syllables when stimulus items were polysyllabic.

Items were chosen to generally feature /r/ in stressed syllables and only as a singleton, not in consonant clusters. Items were chosen to represent a wide range of vocalic and consonantal contexts. All “warm-up” items with /r/ in isolation and in CV and VC syllables used the intra-oral tactile biofeedback device. In addition, every other item was trained with the intra-oral tactile biofeedback device, with 25 of the 49 total items trained with the device. Appendix A provides a sample therapy session, including randomly selected stimulus items. Given the random nature of the stimulus item selection, certain items appeared in duplicate in a given session.

A.R.’s therapy regimen was tracked by the PI using a dedicated trial binder consisting of all relevant study information. Each binder consisted of executed parent and student consent forms; all pre-treatment, during-treatment, and post-treatment assessments; and, all therapy session logs.

Assessments and Measures

A.R.’s speech was qualitatively assessed to be highly intelligible, despite his misarticulation of /s/ and /r/. Due to this, the PI made the judgment that standardized assessments such as the Goldman-Fristoe Test of Articulation or percentage consonants correct (PCC) that would assess A.R.’s whole speech sound system would not be sufficiently specific measures for the purposes of this investigation. Therefore, to assess A.R.’s pre-treatment vs. post-treatment accuracy in producing /r/, the PI developed a 50-item picture-naming test consisting of words and words-in-sentences containing only the /r/ phoneme in various word positions and phonetic contexts used. This test was

constructed to contain vocabulary items expected to be found in the lexicon of a school-age child without expressive lexical deficits. In order to mitigate any learning effect for the assessment items, no assessment item was used as a stimulus item during therapy. The same 50-item picture-naming test was used for the pre-treatment assessment, the post-treatment assessment, and the generalization assessment. The generalization assessment was administered ten weeks after the post-treatment assessment. A list of assessment battery stimulus items and results of each of the study’s three evaluations (pre-treatment, post-treatment, and ten weeks post-treatment) can be found in Appendix B.

All data were recorded by the primary investigator (PI), a New York State-licensed, ASHA-certified clinical speech-language pathologist. The PI also acted as the sole study clinician. Accuracy judgments made by the PI when acting as the study evaluator are reported in the Results section below. Assessments were audio and video recorded. Audio and video recordings were captured using a JVC Everio GZ-MS120BU brand digital camcorder. The camcorder microphone had an audio sampling rate of 40 kHz, considered adequate for recording the entire acoustic signal of human speech, and particularly for capturing the acoustic signal of both consonantal and vocalic /r/ (Kent & Read, 2002).

In order to establish the inter-rater reliability of the study evaluator, the recorded post-treatment data were converted to a digital format and electronically mailed to a leading researcher in the field of speech sound disorders with over 30 years of clinical and research experience (please see Acknowledgements section below). Under his supervision, three graduate student clinicians took part in a dedicated training session led by this supervising researcher to distinguish between correct versus incorrect consonantal and vocalic /r/ using 30 token items via a Marantz Digital Recorder Model PMD 671 free field in a quiet room. These 30 token items differed from the study stimulus items. After this training session, the three graduate student clinicians made independent judgments of the sample of the recorded items spoken by the study participant. Results of this inter-rater reliability testing are reported below.

Results

A.R. demonstrated little difficulty in using the test article to effect the retroflex tongue movement necessary to produce correct consonantal and vocalic /r/. In addition, he easily incorporated the secondary, combined visual and verbal cue to achieve correct lip rounding during production. With these cues, A.R. showed correct productions of both consonantal and vocalic /r/ in all word positions during the first therapy session. Based on the baseline assessment data reported below, A.R.'s production of consonantal /r/ in initial position and vocalic /r/ in medial position of words was emerging at the beginning of therapy. He had begun to manifest correct production of both classes of /r/ in limited contexts, suggesting that he was likely stimulable for producing correct consonantal and vocalic /r/. Figure 2 summarizes the change in accuracy of both consonantal and vocalic /r/ across all positions, combining words and words-in-sentences. Figure 3 illustrates the change in accuracy according to word position, aggregating words and words-in-sentences.

Figure 2. Pre-treatment vs. post-treatment change in accuracy: all items

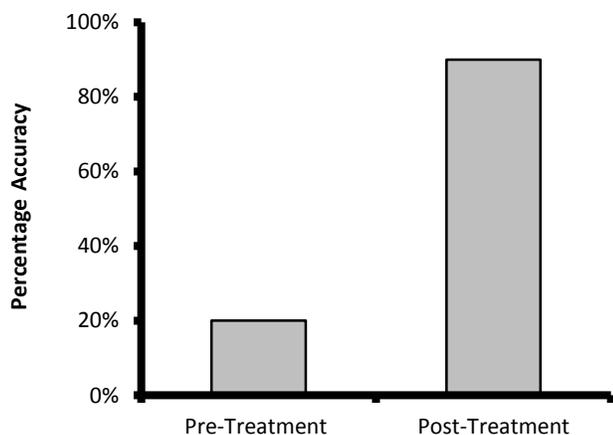
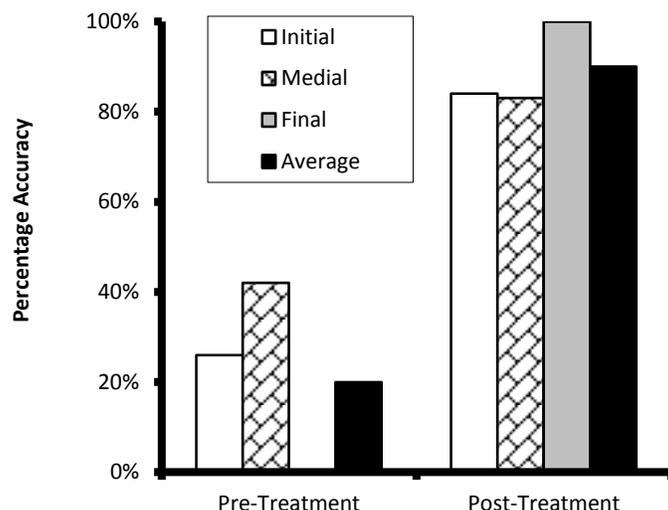


Figure 3 – Pre-treatment vs. post-treatment change in accuracy by word position.



Pre-Treatment vs. Post-Treatment

Pre-treatment data suggest that A.R.'s consonantal (initial) and medial vocalic /r/ were emerging at the time of assessment. Final, vocalic /r/ was not accurate in any context and was not stimulable at the outset of treatment. Post-treatment, A.R. was 90% accurate in all positions in both words and words-in-sentences, above the generally accepted 70-80% accuracy range for remediation (Van Riper & Emerick, 1984). Table 1 and Table 2 below summarize the participant's pre-treatment vs. post-treatment accuracy of /r/ for words (Table 1) and words-in-sentences (Table 2) for all assessment items.

Table 1. Pre-treatment vs. post-treatment accuracy: Words

	Initial	Medial	Final	Total
Pre-Treatment	27% (4/15)	45% (5/11)	0% 0/14	23% (9/40)
Post-Treatment	80% (12/15)	91% (10/11)	100% (14/14)	90% (36/40)

Table 2. Pre-treatment vs. post-treatment accuracy: Words-in-Sentences

	Initial	Medial	Final	Total
Pre-Treatment	25% (1/4)	0% (0/2)	0% (0/4)	10% (1/10)
Post-Treatment	100% (4/4)	50% (1/2)	100% (4/4)	90% (9/10)

Pre-Treatment vs. Ten Weeks Post-Treatment

Table 3 summarizes A.R.'s accuracy in producing /r/ ten weeks after the conclusion of treatment, as compared to pre-treatment accuracy. These data show that A.R. generalized correct consonantal /r/ in initial position and vocalic /r/ in medial position beyond the treatment period in both words and words-in-sentences. That he was able to generalize production accuracy in these word positions suggests that this short-duration therapy regimen was sufficient for contexts in which he had begun to show emerging competence. However, generalization did not occur for vocalic /r/ in final position in either words (57% accuracy) or words-in-sentences (25% accuracy). This suggests that in contexts in which A.R. showed no baseline competence or stimulability, this short-duration was sufficient to achieve a remediation response, as assessed immediately post-treatment, but that additional therapy was likely required to yield a generalization response for word-final vocalic /r/. Considering all positions of words, A.R. generalized correct production of consonantal and vocalic /r/ according to the 70-80% accuracy range for remediation only for words (75% accuracy) but not for words-in-sentences (60% accuracy), as per Van Riper and Emerick, (1984). Table 3 and Table 4 below summarize the participant's pre-treatment vs. ten weeks post-treatment accuracy of /r/ for words (Table 3) and words-in-sentences (Table 4) for all assessment items.

Table 3. Post-treatment vs. ten weeks post-treatment accuracy: Words

	Initial	Medial	Final	Total
Post-Treatment	80% (12/15)	91% (10/11)	100% (14/14)	90% (45/40)
10 weeks Post-treatment	80% (12/15)	91% (10/11)	57% (8/14)	75% (30/40)
Change in Accuracy	0%	0%	-43%	-15%

Table 4. Post-treatment vs. ten weeks post-treatment accuracy: Words-in-sentences

	Initial	Medial	Final	Total
Post-Treatment	100% (4/4)	50% (1/2)	100% (4/4)	90% (9/10)
10 Weeks Post-Treatment	100% (4/4)	50% (1/2)	25% (1/4)	60% (6/10)
Change in Accuracy	0%	0%	-75%	-30%

Post-Treatment vs. Ten-Weeks Post-Treatment

In the ten-week period between the conclusion of treatment and the generalization assessment (i.e. "ten weeks post-treatment" assessment), the data above show that A.R. was able to maintain improvements in accuracy achieved during the therapy period for initial, consonantal /r/ and for medial, vocalic /r/ in words and words-in-sentences. However, accuracy in A.R.'s production of vocalic /r/ in final position of words did show a decay of 15 percentage points to 75% accuracy; and, a decay of 30 percentage points to 60% accuracy in word-final vocalic /r/ in words-in-sentences. Table 5 and Table 6 below summarize the participant's post-treatment vs. ten weeks post-treatment accuracy, as well as any observed decay in accuracy, of /r/ for words (Table 5) and words-in-sentences (Table 6) for all assessment items.

Table 5. Pre-treatment vs. ten weeks post-treatment accuracy: words

	Initial	Medial	Final	Total
Pre-Treatment	27% (4/15)	45% (5/11)	0% (0/14)	23% (9/40)
10 weeks Post-treatment	80% (12/15)	91% (10/11)	57% (8/14)	75% (30/40)

Table 6. Post-treatment vs. ten weeks post-treatment accuracy: Words-in-Sentence

	Initial	Medial	Final	Total
Post-Treatment	25% (1/4)	0% (0/2)	0% (0/4)	10% (1/10)
10 weeks Post-treatment	100% (4/4)	50% (1/2)	25% (1/4)	60% (6/10)

In summary, Figure 4 depicts A.R.'s change in accuracy over all time points, from pre-treatment, through post-treatment to ten weeks post-treatment. Figure 5 depicts these data according to word position. In both depictions, data for words and words-in-sentences are aggregated.

Figure 4. Pre-treatment, post-treatment vs. ten weeks post-treatment change in accuracy: all items

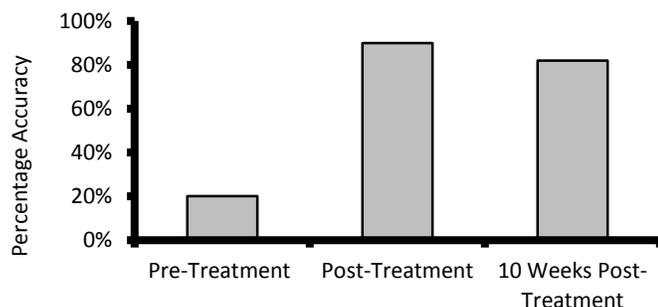
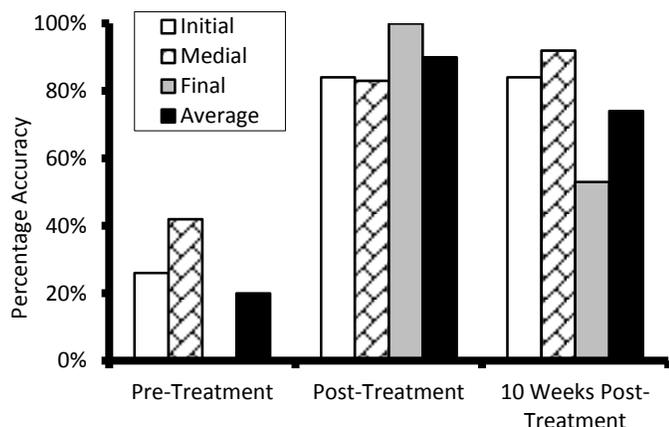


Figure 5. Pre-treatment, post-treatment vs. ten weeks post-treatment change in accuracy by word position: all items



Inter-Rater Reliability

As described above, three separate, supervised graduate student clinicians acted as judges, who made independent judgments of A.R.’s accuracy of production based on audio recordings of the data. These judges’ responses were tabulated and compared to accuracy judgments made by the study evaluator. Table 7 below summarizes the judgments of accuracy made by these judges, as compared to those of the study evaluator. Analysis revealed 83% correspondence with the study evaluator among the judges for all items. This inter-rater correspondence is considered sufficient to consider the study evaluator a reliable judge of /r/ accuracy, as per the standards presented in McCauley and Swisher (1984).

Table 7. Summary of Evaluator and Reliability Judges’ Accuracy: Post-Treatment and 10 Weeks Post-Treatment Data

	Study Evaluator	Judge #1	Judge #2	Judge #3
Post-Treatment	90% (45/50)	94% (47/50)	96% (48/50)	88% (44/50)
10 weeks Post-treatment	74% (37/50)	62% (31/50)	82% (41/50)	58% (29/50)

Discussion

The results above suggest that the therapy regimen described above enabled the test participant to remediate his misarticulated /r/ during a short-duration therapy regimen of four hours. Based on the performance standards outlined in Van Riper and Emerick (1984), the accuracy achieved by A.R. would suggest an overall remediation response for combined words and words-in-sentences at both of the study’s separate time points: upon final assessment immediately following the conclusion of treatment, as well as ten weeks following the conclusion of treatment. The author concludes that the study’s hypothesis was met at both time points. It is important to note however that word-final vocalic /r/ in words decayed to overall 57% accuracy, and word-final vocalic /r/ in words-in-sentences decayed to 25% accuracy ten weeks post-treatment, both below the 70-80% accuracy threshold as per Van Riper and Emerick (1984). This would indicate that some additional therapy may have been necessary to generalize treatment gains to these two specific contexts. As will be discussed in more detail below, the four hours required to achieve overall remediation was measurably better than the mean time to achieve a similar level of functional improvement, as reported in Jacoby et al. (2002).

As a case study design clinical investigation, this study did not use a concurrent control. Jacoby et al. (2002) have provided a comprehensive description of the mean treatment units required to achieve functional change in communication. These authors used the functional communication measures (FCMs) rubric from the ASHA National Outcomes Measurement System (NOMS), which was designed to systematically describe and track communicative functioning and its change over time (NOMS, 1997; NOMS, 1999). This rubric uses seven levels of functioning to describe a child’s communication effectiveness; level one represents the

lowest level of functioning and seven the highest. Descriptions of the FCM levels from the ASHA NOMS are listed in Appendix C.

Before treatment, A.R. was classified by the study PI as FCM level six. For articulation and intelligibility, FCM level six is described as “compared to chronological peers, child’s connected speech is consistently intelligible to unfamiliar listeners. Child’s speech occasionally calls attention to itself more than would be expected of chronological peers, and this rarely affects participation in adult-child, peer, and directed group activities” (p. 380). A.R.’s mother reported to the study PI that this description accurately reflects her son’s communicative functioning; she reported no adverse social consequences of his speech sound disorder. After treatment and at the assessment conducted ten weeks post treatment, A.R. was classified as FCM level seven, described as “child’s connected speech rarely calls attention to itself more than would be expected of chronological peers, and participation in adult-child, peer, and directed group activities is not limited by speech intelligibility” (p. 380). A.R.’s mother again reported agreement with this description.

For all participants in their articulation/intelligibility data set, Jacoby et al. (2002) reported a mean of 55.4 treatment units (SD 2.1) required to achieve one level of FCM improvement (n=149). A treatment unit is defined as fifteen minutes of direct intervention. For six year olds, the age group that most closely matches A.R., Jacoby et al. reported a mean of 56.9 treatment units (SD 2.2) to achieve one level of FCM improvement (n=17). With tactile biofeedback via the test article as the primary cuing mechanism, A.R. required 16 treatment units to achieve one level of FCM improvement. As per Jacoby et al. (2002), this would equate to 37.4 fewer treatment units, or approximately nine fewer hours of therapy, to achieve comparable treatment gains.

As the generalization assessment revealed, administered ten weeks after the conclusion of treatment, A.R. showed some decay producing word-final vocalic /r/. Although he scored 100% accuracy in producing word-final vocalic /r/ in the post-treatment assessment administered immediately following the conclusion of therapy, it appears that a limited amount of additional therapy was likely necessary. One

noteworthy finding is the stability of consonantal word-initial as well as vocalic word-medial /r/ in the generalization assessment. For these word positions, A.R. had shown emerging stimulability. This observation would support the findings of Miccio, Elbert, and Forrest (1999), who concluded that stimutable phonetic contexts undergo the most change in accuracy and may be the most resistant to decay after treatment. Conversely, at the outset of treatment, A.R. was not stimutable for word-final vocalic /r/. While he experienced a treatment response in therapy via the test article, particularly as measured by the post-treatment assessment, the initial non-stimulability of this phonetic context would justify extended treatment, specifically focused on vocalic /r/ in word-final position. This would lend further support to recent evidence (e.g. Preston, Brick & Landi, 2013) that the generalization process is more protracted among less stimutable phonetic contexts and may be limited between vocalic and consonantal /r/.

As noted above, previous investigations into the clinical utility of sensory biofeedback have shown this methodology’s potential for treating treatment-resistant speech sound errors. The current study provides preliminary evidence of the utility of sensory biofeedback in a single, treatment-naïve participant. The experimental use of treatment-naïve participants has the advantage of eliminating the effect of prior treatment on observed results (He, Deng, Li, Chen, Jiang, Wang, Huang, Collier, Gong, Ma, Zhang, & Li, 2012). Since A.R. was naïve to therapy to treat /r/, the improvement observed in A.R.’s /r/ accuracy was likely a direct consequence of therapy he received. In addition, that A.R. was a treatment-naïve participant for /r/ would suggest that the treatment program used here could be indicated at the outset of therapy.

An additional advantage of the test article used in this study is that its simple design and fabrication process enable it to be comparatively low cost compared to other sensory biofeedback instrumentation. Despite the growing body of evidence in support of ultrasound as an effective treatment tool, Adler-Bock et al. (2007) noted the high cost of ultrasound equipment as the primary factor inhibiting its more widespread application in the field; Clark et al. (1993) noted that their dental retainer embodiment for tactile biofeedback necessarily required costly individual fitting

by an orthodontist. The test article used here was a single extruded piece of thermoplastic elastomer that through extensive feasibility testing was sized to fit a wide range of oral cavity sizes, thus preventing the need for individual fitting. This would allow clinical practitioners to provide the benefit of tactile biofeedback to a variety of clients in a comparatively cost-effective manner.

Despite the results reported above, caution is indicated. The single-participant, case study design would limit the wider applicability of results. The pre-treatment assessment showed that A.R.'s production of word-initial and word-medial /r/ was emerging at the onset of therapy. Given this and his apparent initial stimulability for producing correct /r/, we cannot rule out a similar treatment response would have been achieved had a traditional, phonetic-based approach or phonological approach been used. In addition, A.R. presented as a neurotypical, hearing child, who was reported to excel academically and was not reported to be socially or emotionally affected by his misarticulation of /r/. Additional studies incorporating larger participant samples would further validate this approach to treating misarticulated /r/. Further research also is required to determine the extent to which these results may apply to other treatment populations, such as those presenting with hearing impairment or cognitive deficits. ◆

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Appendix A. Sample Therapy Session

One of eight sessions lasting approximately 25 to 30 minutes. Total therapy was 4 hours.

Therapy Items 1 – 6. “Warm-up” in isolation and syllables

Instruct the participant: “I am going to say the /r/ sound in isolation or in a syllable. Please repeat each sound after me.”

	Stimulus Item	Position	Consonantal (C) or Vocalic (V)	Correct (v) or Incorrect (/)
1	Rrr	Isolation	V	
2	Rrr	Isolation	V	
3	Rah	Initial	C	
4	Rah	Initial	C	
5	Arr	Final	V	
6	Arr	Final	V	

Therapy Items 7 – 55. Words and words in sentences

Instruct the participant: “I am going to say a word or a word in a sentence that has the /r/ sound in them. Please repeat what I say.”

	Stimulus Item	Position	Consonantal (C) or Vocalic (V)	Correct (v) or Incorrect (/)
7	Race	Initial	C	
8	Rook	Initial	C	
9	Rail	Initial	C	
10	Raid	Initial	C	
11	Rob	Initial	C	
12	Wrist	Initial	C	
13	Roll	Initial	C	
14	Rig	Initial	C	
15	Rod	Initial	C	
16	Riddle	Initial	C	
17	Rack	Initial	C	
18	Rum	Initial	C	
19	Rust	Initial	C	
20	Wrestle	Initial	C	
21	Rid	Initial	C	
22	Ref	Initial	C	
23	Riddle	Initial	C	
24	Risk	Initial	C	
25	Rum	Initial	C	
26	Ref	Initial	C	
27	Wreck	Initial	C	
28	Rind	Initial	C	
29	Furry	Medial	V	
30	Bury	Medial	V	

31	Very	Medial	V
32	Referee	Medial	V
33	Carry	Medial	V
34	Very	Medial	V
35	Ferry	Medial	V
36	Core	Final	V
37	Jar	Final	V
38	Clear	Final	V
39	Fire	Final	V
40	Tire	Final	V
41	Store	Final	V
42	Pier	Final	V
43	Fire	Final	V
44	Core	Final	V
45	Steer	Final	V
46	Shore	Final	V
47	Fire	Final	V
48	Shore	Final	V
49	Mare	Final	V
50	Wear	Final	V
51	Score	Final	V
52	Blur	Final	V
53	Jar	Final	V
54	Tar	Final	V
55	Core	Final	V

Appendix B. Assessment Battery Stimulus Items with Results

Assessment Items 1 – 40. /r/ in Words

Instruct the participant: "I am going to show you some pictures of words that have the /r/ sound in them. Please just name what's in the picture. If you don't know what something is, just tell me and I will give you a hint."

Indicate whether the participant's response was correct or incorrect

Item	Position	Pre-Treatment	Correct (✓) or Incorrect (/)		10 Weeks Post-Treatment
			Pre-Treatment	Post-Treatment	
1	Rat	Initial	/	/	✓
2	Rake	Initial	/	/	/
3	Red	Initial	/	/	/
4	Rainbow	Initial	✓	✓	✓
5	Radish	Initial	/	✓	✓
6	Rice	Initial	✓	✓	✓
7	Raccoon	Initial	✓	✓	✓
8	Rooster	Initial	✓	✓	✓
9	Robot	Initial	/	✓	/
10	Ruler	Initial	/	✓	✓
11	Rug	Initial	/	✓	✓
12	Road	Initial	/	✓	✓
13	Robe	Initial	/	✓	✓
14	Rope	Initial	/	✓	✓
15	Roof	Initial	/	✓	✓
16	Factory	Medial	/	✓	✓
17	Barrel	Medial	✓	✓	✓
18	Blueberries	Medial	/	✓	✓
19	Celery	Medial	✓	✓	✓
20	Parrot	Medial	✓	✓	✓
21	Arrow	Medial	✓	✓	✓
22	Cherry	Medial	/	/	/
23	Carriage	Medial	/	✓	✓
24	Camera	Medial	/	✓	✓
25	Siren	Medial	✓	✓	✓
26	Carrot	Medial	/	✓	✓
27	Ear	Final	/	✓	✓
28	Door	Final	/	✓	✓
29	Bear	Final	/	✓	✓
30	Pear	Final	/	✓	✓
31	Guitar	Final	/	✓	/
32	Hair	Final	/	✓	✓
33	Floor	Final	/	✓	/
34	Car	Final	/	✓	/

35	Deer	Final	/	√	/
36	Star	Final	/	√	/
37	Square	Final	/	√	√
38	Four	Final	/	√	/
39	Tear	Final	/	√	√
40	Flower	Final	/	√	√

Assessment Items 41 – 50. /r/ in words in sentences

Instruct the participant: *“I am going to show you some pictures of words that have the /r/ sound in them. I am also going to say a sentence that has that word in it. Please repeat the whole sentence and make sure you do your best to say that word that has the /r/ in it.”*

Indicate whether the participant’s response was correct or incorrect.

Item	Position	Pre-Treatment	Post-Treatment	10 Weeks Post-Treatment	
				Correct (√) or Incorrect (/)	
41	Someone who has lots of money is rich .	Initial	/	√	√
42	A tool that helps you loosen or tighten things is a wrench .	Initial	/	√	√
43	A vessel that floats on water is called a raft .	Initial	√	√	√
44	Something pretty you tie around a present is a ribbon .	Initial	/	√	√
45	The food group that contains milk and cheese is dairy .	Medial	/	√	√
46	Something that shows your reflection is a mirror .	Medial	/	/	/
47	Someone who keeps people healthy is a doctor .	Final	/	√	√
48	Twelve months make up a year .	Final	/	√	/
49	This person is a skier .	Final	/	√	/
50	The house isn’t near, it’s very far .	Final	/	√	/

Appendix C. Functional Communication Measures (FCM) rating scale for articulation/intelligibility.

This measure was developed by and is the property of the American Speech-Language and Hearing Association (ASHA).

LEVEL	Description of Rating
Level 1	Speech cannot be understood even by familiar listeners.
Level 2	Child's production of simple words and short phrases is rarely intelligible to familiar listeners. Child's speech is unintelligible to unfamiliar listeners.
Level 3	Child is occasionally intelligible in connected speech to familiar listeners. Child's production of simple words and phrases is rarely intelligible to unfamiliar listeners.
Level 4	Child's connected speech is usually intelligible to familiar listeners but only occasionally intelligible to unfamiliar listeners.
Level 5	Compared to chronological peers, child's connected speech is consistently intelligible to familiar listeners and is usually intelligible to unfamiliar listeners. Child's speech usually calls attention to itself more than would be expected of chronological peers, and this occasionally affects participation in adult-child, peer, and directed group activities.
Level 6	Compared to chronological peers, child's connected speech is consistently intelligible to unfamiliar listeners. Child's speech occasionally calls attention to itself more than would be expected of chronological peers, and this rarely affects participation in adult-child, peer, and directed group activities.
Level 7	Child's connected speech rarely calls attention to itself more than would be expected of chronological peers, and participation in adult-child, peer, and directed group activities is not limited by speech intelligibility.

Nuts & Bolts of Semi-Occluded Vocal Tract Exercises in Voice Therapy: The Why, When and How

Marci D. Rosenberg

Abstract

Voice therapy includes numerous techniques to reduce harmful vocal behaviors, modify manner of voice production and augment vocal fold tissue healing following injury. Traditional voice therapy exercises use a multitude of semi-occluded vocal tract exercises to enhance voice production. This article will provide a brief overview of these exercises.

The article author Marci D. Rosenberg works for the University of Michigan and has no relevant financial or nonfinancial relationships to disclose.



Learning Objectives

- 1) Define semi-occluded vocal tract
- 2) List several uses of semi-occluded exercises in voice therapy
- 3) Describe at least three variations of a semi-occluded vocal tract exercise



What is a Semi-Occluded Vocal Tract?

Semi-Occluded Vocal Tract exercises (SOVTs) have long been used in both the area of speech pathology, vocal pedagogy and vocal coaching. Described by Titze in 2006, a SOVT introduces some sort of narrowing somewhere along the vocal tract. This narrowing can occur at any supraglottic point along the vocal tract and allows for the redirection of some of the acoustic output back down toward the vocal folds creating a backpressure and actually facilitating a small amount of abduction during phonation. The result, if done correctly, is an un-pressing of the vocal folds during phonation. Many speech pathologists use variations of SOVTs regularly in voice therapy even if they don't identify these exercises as a SOVT exercise. Some examples of the many varieties of SOVTs include (1) lip trills, (2) resonant hum, (3) phonation through a straw (4) finger kazoo, (5) resonant Voice Therapy, and (6) Stemple's Vocal Function Exercises. Further descriptions of many of these and other SOVT exercises can be found in Behrman and Haskell's Exercises for Voice Therapy (2013).

Why are SOVTs useful for voice therapy?

Use of a SOVT exercise improves vocal economy by creating an environment in which the resonances of the vocal tract interact productively with the airstream as it is valved by vocal fold vibration. The result is a neutralized level of adduction (not too pressed, not too breathy). Executions of these types of exercises engage all of the subsystems of voicing (power, source, filter, articulators). One of the benefits of SOVTs is that there is a multitude of ways to do them, and they can be easily modified and adapted to meet the needs of different patients. Additionally, they provide kinesthetic feedback to the patient who can tune in to these forward, resonant sensations. This is useful for carryover for connected speech, which does not inherently allow for semi-occlusions.

How do SOVTs improve vocal economy?

When done correctly, SOVTs maximize the interaction between the sound source (vocal fold vibration) and the filter (vocal tract) resulting in more efficient, less pressed phonation. More in depth explanations of the science behind how this happens are found in the resources provided in the reference section of this article (Behrman & Haskell, 2013; Titze, 2006; Titze & Verdolini Abbot, 2012). Several of these articles give more scientific detail as to the physiology behind SOVTs. Very simplified, the column of air above the vocal folds can be entrained to actually improve vibration of the vocal folds. This happens when the semi-occlusion creates increased acoustic pressure near the occlusion causing a backpressure of acoustic energy within the vocal tract, which is then re-directed back down to the vibrating vocal folds helping them to

generate more aerodynamic power. For example, with a resonant hum, the point of occlusion or narrowing is the nasal passage. In a lip trill, the lips become the point of constriction, or narrowing. When SOVTs are done in a productive manner, the result is sensation of vibration in the front of the face and an efficient, resonant voice production. However, when the sound source (aerodynamic energy) is not efficiently converted into acoustic energy, the result is sensation of vibration in the laryngeal region with a non-resonant quality. The latter scenario is often a primary target goal of voice therapy.

When are SOVTs useful in voice therapy?

Efficacy of SOVT exercises have been demonstrated in speech pathology literature (Stemple et al, 1994, Titze & Verdolini, 2012, Verdolini-Marston et al. 1995, 1998). Additionally, several have demonstrated efficacy of SOVTs increasing vocal efficiency in both normal, and vocally trained subjects (Gaskill & Quinney, 2011; Guzman et al, 2013; Laukkanen, Titze, Hoffman & Finnegan, 2008; Verdolini-Marston, K., Burke, M.K., Lessac, A., Glaze, L., & Caldwell, E., 1995; Verdolini-Marston, K., Drucker, D.G., Palmer, P.M., & Samawi, H., 1998).

When done correctly, the result of SOVTs is more efficient vocal fold vibration. The vocal folds become “unpressed” and therefore, function more efficiently (Titze & Verdolini, 2012). Because SOVTs facilitate easy phonation, and are executed at relatively low volumes they can be modified and used for many types of voice patients:

- 1) SOVTs are very user friendly for patients with vocal fold lesions
- 2) Many variations of SOVTs are gentle enough to be used during post-operative re-introduction of voicing (once cleared by otolaryngologist to initiate therapy)
- 3) SOVTs are very useful throughout the day as a voice calibrator
- 4) SOVTs can be used after very active voice use as a cool down exercise to reduce fatigue
- 5) SOVTs can be helpful for the non-intuitive voice patient as a means of facilitating resonant voicing

What are examples of SOVTs?

As stated earlier, there are many variations of SOVT exercises. Below is a brief description of some of the more commonly used SOVT exercises:

- 1) **Lip Trill/Raspberry-** The patient is instructed to generate a lip trill first without voicing. Sometimes it is helpful for the patient to use his/her fingers to hold the sides of the cheek to facilitate this sound. Once this is established, have the patient add voicing in the gently gliding, siren-like manner. Start in a comfortable range and move up and down in pitch if comfortable. This exercise is also effective to improve breathing and airflow.
- 2) **Resonant Voice Therapy-** Made popular in the field of Speech Pathology by Dr. Katharine Verdolini (Verdolini-Marston et al. 1995, 1998), Resonance Voice Therapy (RVT) was designed to increase efficiency of vocal fold vibration by using a hierarchical approach stemming from a forward hum and progressing to connected speech over a series of sessions. The patient is encouraged to sustain a /m/ noting sensations of vibration in the front of the face with little effort in the throat. The patient is encouraged to note how these sounds “feel.” Dr. Verdolini continues to teach seminars on this method, which also now has a program for pediatric voice called “Adventures in Voice.”
- 3) **Straw Phonation-** This is one of the simplest variations of the SOVT exercises. The clinician can use varied diameters of straws depending on patient response. A drinking straw or smoothie straw is often a good choice to begin with. The straw is placed in the mouth with no air leaking around the lips. The patient is encouraged to sustain gently, easy phonation in the form of glides and sirens through the straw. The patient should be encouraged to generate sound as if the straw weren’t present allowing for adequate airflow and volume. It may take several minutes of practice before the patient settles into easy phonation through the straw. At this point, patient can be encouraged to expand pitch range. Patients will often notice a nice calibration effect of their voice after these exercises.

In general, the above exercises can be completed for several minutes at a time multiple times during the day. The clinician should ensure correct execution of these exercises in therapy to avoid the patient perfecting errors at home with incorrect practice. This can be best achieved by having the patient provide frequent self-feedback as to what they are feeling, hearing and experiencing during and after these exercises during the voice therapy session. Additionally, having the patient review with the clinician each session how they are practicing at home will allow the clinician to adapt and modify as needed. Making audio and video recording with the patient's smart phone (if he/she has one) is another way to increase likelihood of correct practice at home.

SOVTs are an easy and efficient way to improve vocal economy by improving the mechanics of vocal fold vibration. They are relatively easy to teach and execute making them a very useful tool in a voice therapy setting. Additionally, there are multiple variations of exercises that can be adapted to accommodate most patient needs. Clinicians seeking further information are encouraged to read the resources and references listed. Additionally, there are several opportunities for speech pathologists to attend workshops for direct hands-on learning of some of these techniques. ♦

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Effectiveness of Treatment of Food Selectivity in Children with Autism

Jessica Massa, Angela H. Cicca, and Jennell Vick

Abstract

Feeding problems have been well documented within the population of autism spectrum disorders (Ahearn, Castine, Nault, & Green, 2001; Ledford & Gast, 2006; Schreck, Williams, & Smith, 2004.) Research has shown that these feeding issues are the result of sensory integration difficulties. Unfortunately, food selectivity has not been well defined within this research. Also, food selectivity has only been recently described in research, and thus, the available research for treatment of food selectivity is fairly limited. The role of a speech pathologist in feeding treatment has been defined by the American Speech-Language-Hearing Association (2002); the role as defined by research has been deficient. Points of the research studies included in this meta-analysis may provide information for speech pathologists to use when co-treating patients with food selectivity or when evaluating swallowing, which requires consumption of foods and liquids (Merkel-Piccini & Rosenfeld-Johnson, 2004). The purpose of this meta-analysis is to analyze the effectiveness of treatments for food selectivity across studies. Another purpose is to determine future directions of research that will be valuable for practicing clinicians

The article author(s), Jessica Massa, a student at Case Western Reserve University and Angela H Cicca and Jennell Vick, both of whom are employed at Case Western Reserve University have no financial or nonfinancial relationships to disclose.



Learning Objectives

- 1) Identify the characteristics of food selectivity
- 2) Describe the impact of food selectivity on individuals with autism
- 3) Quantify the effectiveness of published treatments for food selectivity in children with autism



Food selectivity has not been consistently defined, but has been used to describe picky eating, limited food groups, frequent food refusals, and selective intake of certain food categories. Treatment of food selectivity is a fairly new concept in research. Research regarding food selectivity began in the 1950's and the main purpose was to describe the concept and why it occurs. The first article published was in 1951 and it indirectly approached food selectivity. The authors hypothesized that food selectivity was impacted by the motivational factors important to the individual and the emotions of the individual (Postman & Leytham, 1951.) The next research studies that were available began in 1980 and concentrated on behavioral treatment and the nutritional aspects of food selectivity in disordered children but not specifically in individuals with autism spectrum disorders (Luiselli, Evans, & Boyce, 1985; Riordan, Iwata, Wohl, & Finney, 1980.)

Feeding problems have been well documented within the population of autism spectrum disorders (Ahearn, Castine, Nault, & Green, 2001; Ledford & Gast, 2006; Schreck, Williams, & Smith, 2004.) Various subjective reports and autobiographies of individuals with autism spectrum disorders suggest that sensory factors, such as smell, texture, color, and temperature can contribute to food selectivity (Cermak, Curtin, & Bandini, 2010.) According to statistics from 2008, approximately 1 in 88 individuals will be diagnosed with an autism spectrum disorder (Baio, 2012.) Autism spectrum disorders include: autistic disorder; pervasive developmental disorder—not otherwise specified (PDD-NOS, including atypical autism); or asperger disorder (Baio, 2012.) With such a high prevalence of autism spectrum disorders and a reportedly high incidence of feeding issues in the autism spectrum disorder population, it is apparent that there is an immense need for treatment options for food selectivity.

The current literature on food selectivity in autism spectrum disorders is comprised primarily of reviews and narrative descriptions. Little research has been done to look into the treatment of food selectivity, and the majority of the treatment studies available are performed on individual subjects or on small groups of

Table 1. Levels of evidence adapted from Dollaghan (2007.) Originally from Phillips *et al.* (2001)

Level	Description
1a	Systematic review of two or more high-quality randomized controlled clinical trials (RCTs) showing similar direction and magnitude of results
1b	Individual high-quality RCT with results surrounded by a narrow confidence interval
2a	Systematic review of two or more high-quality cohort studies showing similar direction and magnitude of results
2b	Individual high-quality cohort study or low-quality RCT
2c	Outcomes research; ecological studies
3a	Systematic review of case-control studies showing similar direction and magnitude of results
3b	Individual high-quality case-control study
4	Case series or poor quality cohort or case-control studies
5	Expert opinion without explicit critical appraisal, evidence from physiology, bench research, or first principles(i.e., axiomatic)

people, with less than ten participants. Case studies do not represent a very high level of evidence.

Case studies rank between the fifth and sixth lowest levels of evidence, out of seven, depending on whether or not controls were used (Johnston, 2006.) Another evaluation of evidence places case studies as a level three or four, out of five, as seen in Table 1 (Dollaghan, 2007.)

The level of the evidence and procedures used in the research is important to those evaluating studies, because they look to use research with a high level of evidence to support the use of their current practices. According to Dollaghan (2007), practicing professionals should incorporate evidence-based practice. Evidence-based practice includes the best available external evidence from systematic research, the best available evidence internal to clinical practice, and the best available evidence concerning the preferences of a fully informed patient. By incorporating all three aspects of evidence-based practice, a clinician will be best informed for making clinical decisions.

Within the research regarding treatments for food selectivity, several types of treatment are utilized. The key components of these treatments involve sequential presentation, simultaneous presentation, escape extinction, and/or a type of reinforcement. Sequential presentation involves the presentation of food in a sequence. During this type of presentation, a non-preferred food is presented first and once that food is accepted a preferred food is provided (Kern and Marder, 1996). Simultaneous presentation comprises of delivering food that is preferred and not preferred at

the same time on a single plate or tray (Piazza *et al.*, 2002). Escape extinction during these treatments include concepts of non-removal of spoon or cup, re-presentation of the bite, and physical guidance. Non-removal of spoon or cup describes the clinician’s efforts to decrease avoidance from the individual by keeping the food or drink presented within a certain distance to the mouth until it is accepted (Ahearn, 2002). Re-presentation of the bite is utilized when the individual expels the presented bite in order to escape from having to accept the bite (Ahearn, 2002). Physical guidance is used by the clinician to direct an individual’s hand to the mouth for acceptance of a non-preferred or preferred food (Ahearn, 2002). Several studies used a combination of these treatment components or a single component along with details that were specific to their intervention. Positive reinforcement was the most commonly used type of reinforcement. In some studies, the use of preferred foods act as positive reinforcements, whereas in other studies, preferred items like toys, books, or the end of the treatment served as positive reinforcement (Gale, Eikseth, & Rudrud, 2011).

Treatment of feeding problems is within the scope of practice for speech-language pathologists set by the American Speech-Language-Hearing Association. Speech-language pathologist involvement in the treatment of food selectivity is defined by serving as an integral part of a multi-disciplinary team, developing a treatment plan, performing treatment for feeding and swallowing problems, making recommendations, and educating families and other professionals about the swallowing and feeding characteristics that are disordered (American Speech-Language-Hearing

Association [ASHA], 2002.) Speech pathologists often work in unison with occupational therapists to treat feeding problems. When it comes to food selectivity, speech pathologists would aid in oral-motor movements, swallowing, and oral structure and function (ASHA, 2002). The speech pathologist helps with increasing the efficiency of chewing and swallowing by improving the coordination of the oral motor musculature. By gaining the knowledge of which treatments are most successful in improving food selectivity, a speech pathologist will better be able to provide treatments. By knowing how to present the food, what type of reinforcements to use, and whether to use escape extinction strategies, a speech pathologist can approach therapy in the most successful way possible (Merkel-Piccini & Rosenfeld-Johnson, 2004). The speech pathologist will also be able to better understand their role in the relationship with the occupational therapist during treatment. In a professional setting, it is not always possible to directly co-treat. The speech pathologist performing a swallow study will need to know how to present varieties of food to individuals with food selectivity in order to determine the complete swallowing ability of the individual with several food consistencies. They may also need to work with the occupational therapist by explaining which food consistencies must be tested in a swallow study or were found to be safest in a swallow study (Clark, 2007; Merkel-Piccini & Rosenfeld-Johnson, 2004). Then the speech pathologist can begin working with the occupational therapist on choosing a treatment that will work on acceptance of those needed consistencies.

Feeding problems, such as food selectivity can be from causes such as: attentiveness to detail, perseveration, impulsivity, avoidance of new stimuli, sensory defensiveness or deficiencies, social skill discrepancies, and food intolerance (Cumine, Leach, & Stevenson, 2000; Ledford & Gast, 2006). The causes stated above and limited research have shown that even individuals with no diagnoses or diagnoses of other developmental disabilities experience food selectivity, thus making the findings of this meta-analysis valuable for children with autism spectrum disorders and children experiencing food selectivity due to other developmental disorders or unexplained reasons (Najdwoski *et al.*, 2010).

This meta-analysis began once a foreground question was drafted. The purpose of drafting a foreground question is to help structure the searches for external evidence (Sackett *et al.*, 2000). The foreground question includes four elements that can be summarized using the acronym PICO. 'P' stands for problem, the 'I' for intervention, the 'C' for comparison, and the 'O' for outcome (Sackett *et al.*, 2000). Following the PICO guidelines, the following foreground question was developed: What effect do treatments for food selectivity have on children with autism spectrum disorders? The purpose of this meta-analysis is to analyze the effectiveness of treatments for food selectivity across studies and to define the effectiveness of treatments for food selectivity specifically for children with autism spectrum disorders.

Methods

The search for articles related to food selectivity used the databases Academic Search Complete within the PubMed search engine, Medline, and PsychInfo to locate relevant research. The search terms used varied by each database due to the differing requirements of each database. A description of the search methods follows.

For this meta-analysis, food selectivity was defined to include picky-eaters, selective intake of various foods, and limited food portfolios. Studies were considered if they were originally published in the English language between the time of January 1995 and January 2012. The language criterion was chosen, because when reading translated works, the information that is complex to begin with, gets even more intricate when trying to determine what was intended to be said. The dates for inclusion were chosen to contain the most recent research available with a high level of evidence. Articles prior to 1992 were found to include information that is no longer relevant or has been proved to be incorrect. Other inclusion criteria for the research comprised of studies that were published in a journal or book, children with a diagnosis within autism spectrum disorders, and children between 3 and 18 years of age. The publication types were chosen to maintain the highest levels of evidence, as compared to unpublished theses. The diagnosis was critical for the external research based on the foreground question that was established.

Table 2. Description of Search Methods (* = non-duplicates)

Search Terms	Database	# Results	# Related	# Used
(autis* OR asperger*) and (therapy OR treatment OR intervention OR diet OR consistency) and (eating OR feeding) AND 1992-2012	PsychInfo	239	25	8
(autis* OR asperger*) and (therapy OR treatment OR intervention OR diet OR consistency) and (eating OR feeding) and (humans) and (English) AND 1992-2012	PubMed	98	29	6 3*
(autis* OR asperger*) and (therapy OR treatment OR intervention OR diet OR consistency) and (eating OR feeding) AND 1992-2012 AND (English)	Medline	91	29	6 1*
Hand Search: William Ahearn	PsychInfo	46	6	5 1*
Hand Search: Becky Penrod	PsychInfo	10	4	2 1*
Hand Search: Sharp AND feeding	Medline	32	6	1
TOTAL:		516	99	15

Figure 1. Process for Identifying Studies

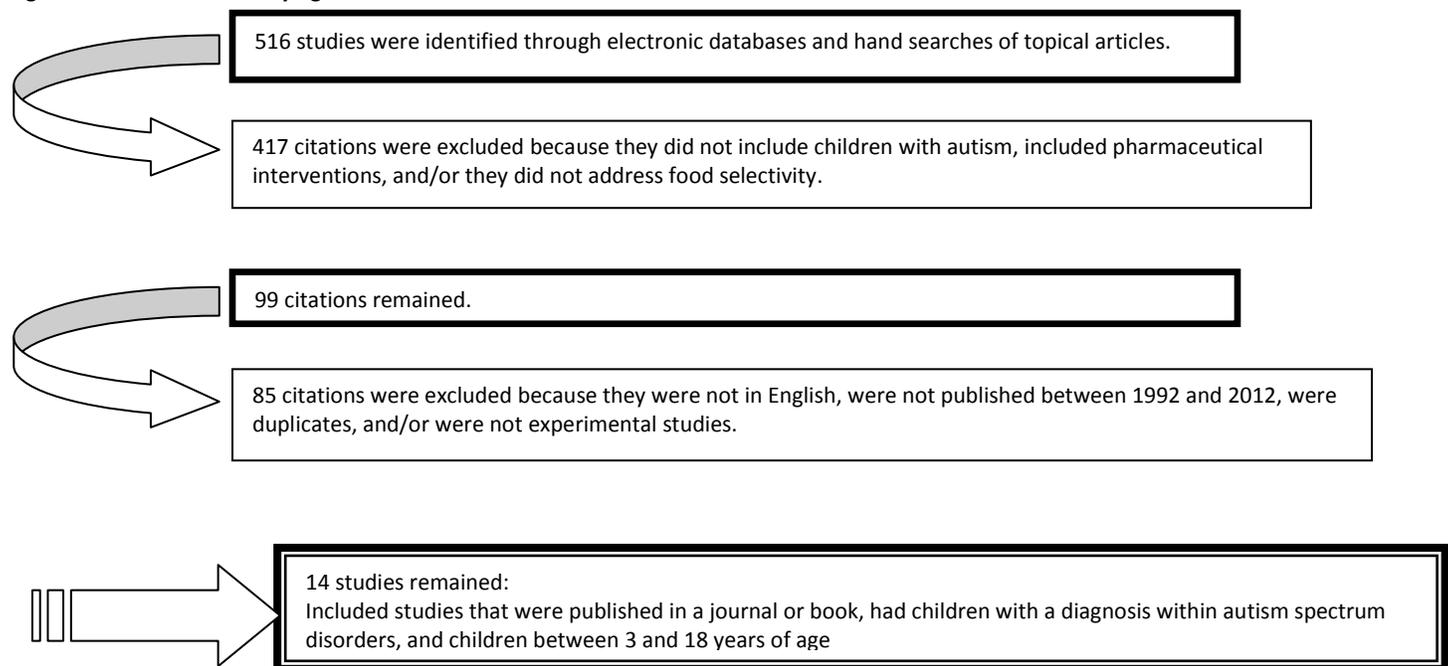


Table 3. Description of Studies

Study	N	Average Age of Participants (months)	Use of Escape Extinction Methods	Use of Reinforcement	Administrator	Controlled	Randomized
Ahearn, 2002	6	90	Yes	Yes	Therapist	Yes	Yes
Ahearn, 2003	1	168	Yes	Yes	Therapist	Yes	No
Gale <i>et al.</i> , 2011	3	42.7	Yes	Yes	Group	Yes	No
Hagopian & Farrell, 1996	1	144	No	Yes	Therapist	Yes	No
Kozlowski <i>et al.</i> , 2011	1	108	Yes	Yes	Therapist	Yes	No
Laud <i>et al.</i> , 2009	46	69	No	No	Group	No	No
Levin & Carr, 2001	4	73.2	Yes	Yes	Group	Yes	No
Najdowski <i>et al.</i> , 2010	3	39.6	Yes	Yes	Parent/ Caregiver	Yes	No
Paul <i>et al.</i> , 2007	2	51	Yes	Yes	Group	Yes	No
Piazza <i>et al.</i> , 2002	3	116	Yes	Yes	Therapist	Yes	Yes
Roth <i>et al.</i> , 2010	1	192	Yes	Yes	Subjects	Yes	No
Sharp <i>et al.</i> , 2011	13	56.1	Yes	Yes	Therapist	Yes	No
Tarbox <i>et al.</i> (2010)	1	36	Yes	Yes	Parent/ Caregiver	Yes	No
VanDalen & Penrod, 2010	2	54	Yes	Yes	Therapist	Yes	No

The age range was chosen because research on children younger focused more on the sucking behavior than feeding, and research for individuals over 18 years old focused more on long-term nutritional options, such as percutaneous endoscopic gastrostomy procedures.

Articles were excluded from the search results if they were a dissertation or thesis, not originally printed in English, did not focus on food selectivity, focused on feeding behaviors like sucking, concentrated on outcome measures that were consequences of food selectivity (like hydration or malnutrition), was not directed toward children with autism spectrum disorders, or were descriptive and did not describe treatment or intervention. Dissertation and thesis papers were excluded because the author wished to include research with the highest level of evidence. Articles that were not printed in English were excluded because the results were not always clear once they were translated.

A total of 14 studies were included within this meta-analysis due to containment of the inclusion criteria and nonexistence of the exclusion criteria. A total of 87 participants contributed to the results of those studies. The youngest of the 87 participants was 2 years, 11 months and the oldest was 16 years old. The participant that was 2 years, 11 months was included because while participating in treatment, the individual reached three years of age. Twelve of the 14 articles included

the use of escape extinction methods, and 13 of the 14 articles utilized a type of reinforcement within their treatment method. The therapist, researcher, parent or caregiver, participants, or a group of two or more of those were utilized to administer the treatment. Thirteen of the 14 studies were controlled. The majority of the controlled articles were controlled through comparison to baseline. Only two of the research studies that were included within the external research needed for the meta-analysis were randomized. A description of the studies that met the inclusion criteria is located in Table 3. The organized information from all of the external research can be helpful when trying to determine if patterns exist for creating a better effect size for improving food selectivity in children with autism. The column headings also coincide with the coding themes determined by the author for the articles.

Reliability was measured by developing a coding scheme for the studies. Each study was coded by year, number of participants, age of participants, diagnosis, treatment or intervention, use of escape extinction, use of reinforcements, who administered the treatment or intervention, the outcome measure, randomization, and if a control was used for comparison. The author coded each study and then provided an individual, blinded to the results, the list of studies and a coding book with a description of each code. The individual then coded each of the studies, and the results were compared with

the author’s results. The comparison found 93% agreement between the two coding arrangements. The

Table 4. Coding Agreement Results

Coding Agreement	Percentage Of Agreement
Year	100
# of Participants	100
Age of Participants	100
Diagnosis	87
Intervention	93
Use of Escape Extinction	87
Use of Reinforcement	87
Administrator	100
Outcome Measures	100
Randomized	80
Controlled	93

External validity refers to how the results of the study would generalize once it was replicated outside of the restrictions of the study (Dollaghan, 2007.) External validity is important to consider when evaluating evidence for clinical practice, because if the results of the study would not translate to real-world situations, they would not prove to be a respected plan for treatment. Internal validity states how well the evidence compares to the true conditions present for the participants during the study and in clinical practice (Dollaghan, 2007.) When looking to use the protocols from the research study, it is important to consider all of the possible threats to internal validity to make sure the results will translate to clinical practice.

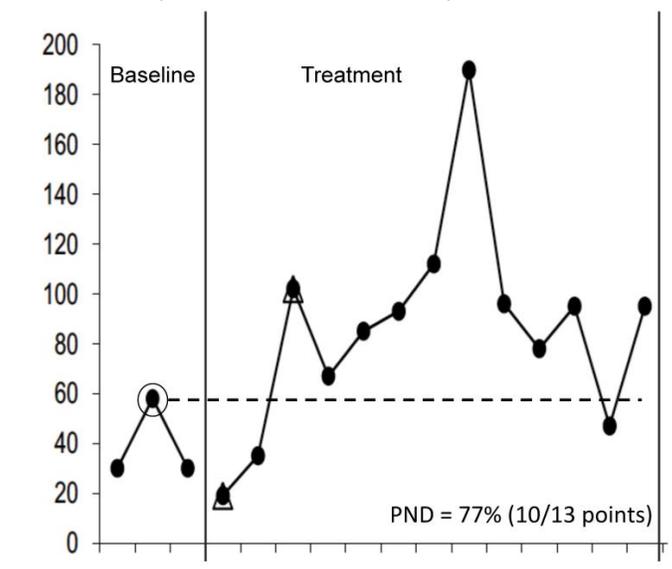
Results

A meta-analysis is a collection of studies that is used to quantitatively summarize a topic’s outcome measures (Dollaghan, 2007). The studies included in the meta-analysis are compared by their effect size and confidence intervals. The effect size measures the magnitude of a treatment effect. The effect size can be calculated using a variety of factors, such as the design of the study, the statistic used within the study to find significance, and the type of data (van Kleeck, Schwarz, Fey, Kaiser, Miller, & Weitzman, 2010).

Percentage of nonoverlapping data (PND); (Scruggs, Mastropieri & Casto, 1987) was used to calculate effect size for nine of the ten studies that were included, each of which used a single-subject experimental design. Figure 2 illustrates an example PND calculation. PND was calculated by counting the number of points during

breakdown of the coding agreement (Table 4) and can be simplified as follows: the treatment phase that did not overlap with the highest point in the baseline phase.

Figure 2. Example calculation of PND. The percentage of treatment data points above the highest baseline data point (circled) is calculated. Adapted from Tarbox, Schiff & Najdowski, 2010.

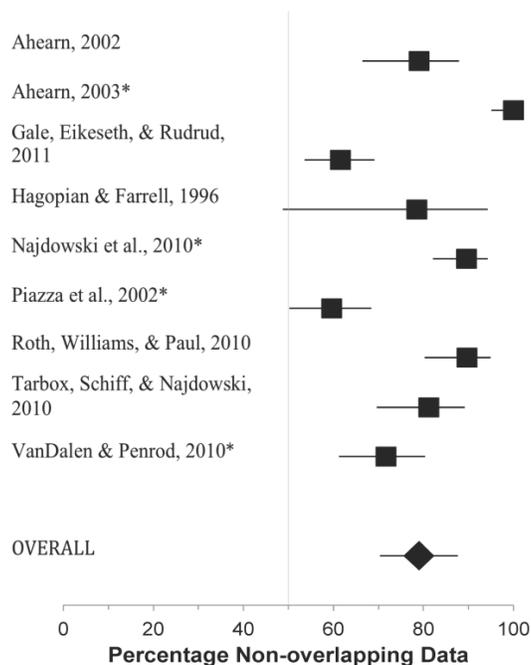


For the single remaining study, a Cohen’s *d* measurement was used to compare the means of two or more groups (Dollaghan, 2007). “The Cohen’s *d* measurement provides a way to standardize the size of the difference between group means, translating the difference into standard deviation units that are interpretable regardless of the nature of the original scores,” (Dollaghan, 2007, p. 49). The means and standard deviations of an outcome measure are necessary in order to calculate a Cohen’s *d*. When calculating the measure, the means are subtracted from each other and then divided by the standard deviation (Dollaghan, 2007). Cohen’s *d* measurements can be given a value by their effect size in a study. Cohen (1988) explained that a *d* value of 0.20-0.49 is a small effect, a *d* value of 0.50-0.79 is a medium effect, and a *d* value of 0.80-1.00 is a large effect.

Because the baseline performance for the participants in several of the studies was zero (e.g., zero bites consumed), the PND values are markedly biased toward a ceiling of 100%. Those studies with all zeros in baseline performance are marked with a (*) in Figure 3. When multiple cases were presented in a single

study, the individual PND scores were aggregated across participants to obtain an overall treatment effect (Xin & Jittendra, 1999). Confidence intervals (95%) were calculated using methods described by Wilson (1927) and a continuity correction as described by Newcombe (1998) using an online calculator (<http://www.vassarstats.net/prop1.html>?). Figure 3 is a forest plot representing the effect sizes and confidence intervals found in the individual studies as well as the overall effect size of nine of the ten studies combined. Each of the studies is represented by a diamond and horizontal line. The diamond signifies the effect size, whereas, the horizontal line indicates the 95% confidence interval. The shorter the confidence interval line on a forest plot, the smaller chance of variability of the duplicated results (Dollaghan, 2007). The diamond and horizontal line located at the bottom of the forest plot represents the overall effect size for all of the nine studies combined.

Figure 3. Forest plot of PND for each study and an overall, weighted PND across all studies



Overall Effect Size

The percentage of non-overlapping data was calculated using the mean, median and range of non-overlapping data for increased acceptance across the studies. “PND greater than 90% is a large effect, PND between 70.1% and 90% is a moderate effect, PND between 50.1% and

70% is a low or small effect, and PND 50% or below is classified as not effective,” (Rogers & Graham, 2008, p. 885). Numerous outcome measures were used by the researchers within each study, but for the purpose of this meta-analysis, one measure or a combination of the measures were selected per study for the calculation of treatment effectiveness. Most of the outcome measures used for calculating effect size centered on the acceptance of food and the increase in food or liquid consumption. As seen in Figure 3, the overall effect size was found to be 78.99%. The total effect size of the studies is considered to have a moderate effect according to the Rogers & Graham (2008) article. The confidence interval represents the percentage of confidence one can have in duplicating a study and finding similar results. Each of the studies will be described and then evaluated to determine if there are patterns or important components contributing to the moderate effect size. As a collection, nine of the fifteen studies had effect sizes that ranged from 59.6% to 100% or from a questionable effect to a very high effect.

Individual Effect Sizes

To begin discussing the individual effect sizes, it is important to make note that four of the fourteen original studies were not used in the final effect size calculation due to a variety of circumstances. Kozlowski, Matson, Fodstad, and Moree (2011) was not included because the researchers did not present any data for their results. Another article that was not included in the final analysis was the research described by Levin and Carr (2001), which did not provide the baseline data necessary to perform an effect size analysis. Because the researchers did not provide any standard deviations used for their analysis, the Laud, Girolami, Boscoe, and Gulotta (2009) study needed to be excluded. The last study to be excluded from the final results discussed the use of taste exposure and escape prevention in increasing food acceptance and consumption. The research, performed by Paul, Williams, Riegel, and Gibbons (2007) was excluded because of the way the data was presented in the study. The data for the study was presented in a bar graph that did not allow for the percentage of non-overlapping data to be calculated.

The first PND determined was for Ahearn (2002). This article, written by Ahearn, looked into using simultaneous or sequential presentation of various types of food and escape extinction techniques to

increase the acceptance and consumption of food in children with autism that had food aversions. The PND was calculated based on the non-removal of the spoon or physical guidance needed for food acceptance. The percentage was collected from an aggregated group of children and number of items presented. The overall effect size for Ahearn (2002) was found to be 79% (95% CI= 66.5-87.9). The effect size of this study is considered moderate because it falls between 70.1% and 90%. The confidence interval indicates that one can be 95% confident that if the research were to be duplicated, the overall effect size would fall between 66.5 and 87.9. The results of this study suggest that using simultaneous or sequential presentation with escape extinction can be effective in improving the consumption of food in children with autism.

Ahearn (2003) was the next study to be evaluated. This study used simultaneous presentation of vegetables in conjunction with the addition of condiments, in an attempt to impact vegetable consumption in children with autism. The effect size, as measured by the percentage of non-overlapping data, regarding acceptance of vegetables after the addition of condiments, was 100% (95% CI= 95.1-100). The effect size of the Ahearn (2003) study is considered to be large. These results imply that adding condiments to vegetables can be very effective in increasing vegetable consumption in children with autism. It is important to consider that the large effect size found in this study may be due to compounding factors that will be debated further in the discussion section.

Another study evaluated for this meta-analysis described the use of functional assessment interview (FAI) and functional assessment observation (FAO) to see how positive and negative reinforcement impacted whether children with autism accepted a variety of foods or not (Gale *et al.*, 2011). The Gale *et al.* (2011) study was found to have an effect size of 61.6% (95% CI= 53.6-69.1). This effect size is considered low or small. The effect size was calculated using data regarding acceptance of food collected from all of the participants and number of items presented combined. The results of this study suggest that using positive or negative reinforcement will have a questionable impact on the consumption of a variety of foods in children with autism.

Hagopian and Farrell (1996) described their research regarding the use of backward chaining and fading to increase liquid consumption. The research was performed on a child with autism that had complete liquid refusal. The percentage of non-overlapping data was calculated to be 78.57% (95% CI= 48.8-94.3). The effect size was considered using the outcome measures related to cup trials only. The effect size would be classified as a moderate effect. These results suggest that using backward chaining and fading can increase the amount of liquid consumed by a single individual with autism.

Najdowski *et al.* (2010) used a combination of differential reinforcement of alternative behavior (DRA), non-removal of spoon, and demand fading to try to decrease behavioral problems impacting the amount of food consumed by children with autism. Another key component of this study is that the parents of the children were trained to provide the treatment (Najdowski *et al.*, 2010). The computed effect size of this study reflected a moderate effect size based on the percentage of non-overlapping data reaching 89.6% (95% CI= 82.1-94.3). The effect size was calculated using the data collected from all of the participants combined. The results imply that differential reinforcement of alternative behavior, non-removal of spoon, and demand fading can be effective, or borderline very effective, for increasing the amount of food consumed by children with autism.

The next study to be evaluated for effect size considered how simultaneous presentation and sequential presentation of food impacted acceptance in children with food selectivity (Piazza *et al.*, 2002). This study was written by Piazza *et al.* (2002) and when calculating effect size, all of the outcome data from either form of food presentation was grouped together. The overall effect size of the study was 59.6% (95% CI= 50.2-68.4). This effect size indicates that the treatment used had a low or small effect size. The results suggest that using simultaneous and sequential presentation types as treatment can have a questionable effect on increasing the acceptance of food in children with autism. This study had the lowest effect size out of the ten studies evaluated.

Roth, Williams, and Paul (2010) described using token economy and fading procedures for increasing acceptance of solid food in children with autism. A fading procedure paired with escape prevention was used by the researchers to attempt to increase consumption of liquids (Roth *et al.*, 2010). When evaluating this study, it is important to consider that the researchers used a multi-component treatment in an attempt to increase acceptance of food and liquid. The effect size was calculated using the outcome measure of accepted bites. After calculation, the Roth *et al.* (2010) study had a moderate effect size of 89.7% (95% CI= 80.3-94.9). The results of this study imply that using a combination of token economy, escape extinction, and fading procedures can be effective, or borderline very effective, for increasing the consumption of liquids.

The use of non-removal of a meal was used by Tarbox *et al.* (2010) in an effort to reduce the food selectivity of a child with autism. The outcome measures of grams consumed, percentage of meals consumed, and meal duration were aggregated for the effect size to be calculated (Tarbox *et al.*, 2010). Once combined and calculated for effect size, the outcome measures indicated that the treatment had a moderate effect size of 81.2% (95% CI= 69.6-89.2). The results of this study suggest that a treatment of not removing the meal from the child can be effective for increasing the amount of food consumed by a child with autism.

VanDalen and Penrod (2010) compared the use of simultaneous and sequential presentation of non-preferred foods in children with autism. The authors paired the presentation options with escape extinction to positively impact the amount of non-preferred foods consumed (VanDalen & Penrod, 2010). The percentage of non-overlapping data was calculated using the data regarding preferred and non-preferred food acceptance from a combination of all of the participants and presentation types. The effect size of this study was determined to be 71.7% (95% CI= 61.2-80.4), which is considered a moderate effect. The results from this VanDalen and Penrod (2010) study, suggests that simultaneous and sequential presentation paired with escape extinction can be effective in increasing the amount of non-preferred food consumed in children with autism.

The Sharp, Jaquess, Morton, and Miles (2011) study required the use of the Cohen's *d* calculation. The study included the use of escape extinction, reinforcement, and stimulus fading, as a parent provided intervention, in order to increase food consumption in children with autism (Sharp *et al.*, 2011). The effect size was calculated by combining the outcome measures regarding acceptance, swallowing, and disruptive mealtime behaviors before and after parent training. Statistical analysis of these combined measures produced a positive effect of 15.28 (95% CI: 10.78-18.89). This effect size is considered very large. The results indicate that the use of escape extinction, reinforcement, and stimulus fading can be very effective for increasing acceptance and swallowing, and decreasing disruptive mealtime behavior.

Discussion

When viewing the forest plot analysis, utilizing a percentage of non-overlapping data, one would assume that most of the studies have effect sizes that are considered positive because they are located to the right of midline. However, each of the studies included within this meta-analysis varied in effect size. The studies ranged from having a questionable effect to a very large effect. Confounding variables need to be evaluated to determine what could impact the effectiveness of the various treatments both positively and negatively.

The studies can be separated by groups regarding the calculated effect size found for each of them. Sharp *et al.* (2011) and Ahearn (2003) both had large effect sizes. Gale *et al.* (2011) and Piazza *et al.* (2002) represent studies that had low or small effect sizes. The rest of the articles included within this meta-analysis had moderate calculated effect sizes (Ahearn, 2002; Hagopian & Farrell, 1996; Najdowski *et al.*, 2010; Roth *et al.*, 2010; Tarbox *et al.*, 2010; VanDalen & Penrod, 2010). The sections that follow will distinguish factors that have the ability to impact effectiveness.

Number of Participants

Five of the original fourteen studies contained a single subject for analysis. Of those five, four of the studies were used toward the final analysis of effectiveness. The Koslowski, Matson, Fodstad, and Moree (2011) study was not used for further analysis due to the lack of any data being presented in the study. Hagopian and Farrell (1996), Roth *et al.* (2010), and Tarbox *et al.* (2010) all had single subjects and had calculated effect sizes at the moderate effect level. The only exception to this is the Ahearn (2003) study, which had a large effect.

Two of the original studies had two participants they used for their research, but only one of the studies was able to be used for calculating percentage of non-overlapping data. Paul *et al.* (2007) was not included because the data was presented in bar graph form, which did not allow for calculating the percentage of non-overlapping data. VanDalen and Penrod (2010) were able to be included in the final analysis and were found to have a moderate effect size.

Three of the original fifteen studies used three participants to complete their research, and all of them were used for the final analysis. Gale *et al.* (2011) and Piazza *et al.* (2002) were found to have a low or small effect size after calculating the percentage of non-overlapping data. After calculating the effect size, Najdowski *et al.* (2010) had a moderate effect size.

The study described by Levin and Carr (2001) was the only study to contain four participants, but was not included in the final analysis because the authors did not provide any baseline data. Another study that was left out of the final analysis was the Laud, Girolami, Boscoe, and Gulotta (2009) study. This study had the largest participant group of forty-six children. The study had to be excluded because there were not any standard deviations provided for the data. This study would have had a higher level of evidence due to the larger effect size.

The next study to be included in the final analysis of effect size was the Ahearn (2002) study that contained six participants. This study had a moderate effect size. The final study to be included had the highest number of participants of the studies included in the final analysis. The Sharp *et al.* (2011) study contained

thirteen children and had a calculated effect size that was considered very large using Cohen's *d*.

Age of Participants

When breaking down the participant's ages, each of the studies will be described in groups by their effect size. The Sharp *et al.* (2011) study had a very large effect size and the participants ages ranged from 2 years, 11 months to 7 years, 8 months, with a mean age of 4 years, 5 months. The Ahearn (2003) study used a single participant that was 14 years-old.

The studies with moderate effect sizes will be described further according to their number of participants. The Ahearn (2002) study's participants ranged in age from 4 years to 11 years. Hagopian and Farrell (1996) used a participant that was 12 years old. The next study used three participants, one of which was 2 years old, and two others were 4 years old (Najdowski *et al.*, 2010). The Roth *et al.* (2010) study used a 16 year old for their research. Tarbox *et al.* (2010) used a 3 year old for their research. The VanDalen and Penrod (2010) study included two children, one that was 4 years old and one that was 5 years old.

The two studies with low or small effect sizes differ by ages just as the other levels of effect sizes. Gale *et al.* (2011) had three participants aged 3 years, 10 months, 2 years, 6 months, and 4 years, 4 months. The Piazza *et al.* (2002) study used three participants aged 8 years, 10 years, and 11 years.

Diagnosis

All of the studies used for this meta-analysis included children with the diagnosis of autism, or an autism spectrum disorder. Only two of the ten included studies also used children with other diagnoses. Najdowski *et al.* (2010) used two children with autism diagnoses, but also included a child that was typically developing that was experiencing severe food selectivity. Because the participants were combined for effect size calculation, the role of the typical child is unclear. The other study to include other diagnoses was Piazza *et al.* (2002), which used only one child with autism and two children with pervasive developmental disorder. Because autism was the minority diagnosis, the results should be evaluated prior to using as a basis for treatment.

The Najdowski *et al.* (2010) article had a moderate effect size and the Piazza *et al.* (2002) study had a low or small effect size, so there appears to be no clear correlation between other diagnoses being present and the level of effectiveness.

Intervention

At each of the levels of effect size, there was variability between interventions used by the researchers. At the large effect size level, Ahearn (2003) used simultaneous presentation alone, whereas, Sharp *et al.* (2011) used a combination of escape extinction, reinforcement, and stimulus fading procedure during a day-treatment program.

At the moderate level of effect size, Ahearn (2002) used simultaneous presentation, sequential presentation, and escape extinction in his study. Hagopian and Farrell (1996) used backward chaining and fading. The next study used non-removal of spoon, simultaneous presentation, reinforcement, and demand fading (Najdowski *et al.*, 2010). The Roth *et al.* (2010) study used token economy and fading procedure for solid food and a fading procedure plus escape prevention for liquids. Tarbox *et al.* (2010) used non-removal of a meal. The VanDalen and Penrod (2010) study used simultaneous presentation, sequential presentation, and escape extinction.

At the low or small level of effect size, Gale *et al.* (2011) utilized escape extinction and positive and negative reinforcement. The Piazza *et al.* (2002) study used simultaneous and sequential presentation.

Administrator

Sorting the studies by level of effect size again, patterns may develop when looking at the administrator. At the large effect size level, Ahearn (2003) and Sharp *et al.* (2011) used the therapist as the provider of the intervention. The Sharp *et al.* (2011) study also used the parent for providing the intervention, but it was noted that the success rate of the intervention diminished after the parent took over the intervention.

At the moderate level of effect size, Ahearn (2002), Hagopian and Farrell (1996), and VanDalen and Penrod (2010) used the therapist to provide intervention for the study. The next studies used the parent or caregiver to perform the intervention (Najdowski *et al.*, 2010;

Tarbox *et al.*, 2010). The Roth *et al.* (2010) study was unique in that it used the participant of the study to provide the intervention. The subject of this study was a teenager and did not have any physical impairment that could limit his ability to feed himself.

At the low or small level of effect size, Gale *et al.* (2011) utilized a group of people, including the therapist and parent, just as the Sharp *et al.* (2011) study. The Gale *et al.* (2011) did not use the therapist and parent in two different contexts. In this article, the therapist and parent provided the intervention together. The Piazza *et al.* (2002) study used the therapist for providing the intervention.

Randomized/Controlled

All of the researchers used a control. Most often the control was considered because of a comparison to baseline that occurred. As for randomization, only two studies used randomization. Ahearn (2002) had a moderate effect size and Piazza *et al.* (2002) had a low or small effect size, indicating that the use of randomization does not increase the level of the effect size.

Conclusions

When evaluating the results according to each of the individual factors, some patterns emerged, whereas, others appeared to be less useful for predicting effect size. There was no clear relationship between the level of the effect size and the age of the participants used in the studies or the presence of diagnoses other than autism. The studies with participants that had a single diagnosis of autism also varied by the level of effect size associated with the studies, indicating no correlation.

Even though the interventions in the studies varied considerably, some interventions or intervention components were consistent over a few studies. The practice of simultaneous presentation, sequential presentation, and escape extinction were used in Ahearn (2002) and VanDalen and Penrod (2010) which both had a moderate effect size. This could suggest that using those three components together can be moderately effective in children with autism.

Escape extinction techniques were also utilized in all of the studies, except for the Hagopian and Farrell (1996) study. Unfortunately, due to the variability in effect size

levels; there is no indication of any pattern for using escape extinction to obtain a higher effect level. The same can be said for reinforcement. All studies used a source of reinforcement, either direct or indirect, which does not make it useful for determining if reinforcement can increase food consumption. Direct reinforcement included the use of positive verbal praise or a reward of getting to play with desired objects. Indirect reinforcement included the practice of providing a preferred food after a non-preferred food was accepted. Indirect reinforcement is seen when utilizing the sequential presentation of food.

Another pattern that emerged from the research was the use of fading during intervention. Hagopian and Farrell (1996), Najdowski et al. (2010), Roth et al. (2010), and Sharp et al. (2011) all utilized fading procedures during the various interventions, and all the studies were found to have a moderate effect size. This pattern can indicate that using fading during a feeding intervention for food selectivity in children with autism can have a moderate effect on improving the acceptance of food.

Overall, these studies have shown that intervention for food selectivity can be effective in increasing the amount of food consumed by a child with autism, but the distinct relationship cannot be considered until further research is performed.

Future Directions

As seen, there is little consistency between studies to indicate why some were more successful than others. When proceeding, it is important to perform research with a higher level of evidence. This would include increasing the number of participants, randomizing, and controlling the treatment.

Another component that is necessary for further research is a consistency between studies. Several studies used varieties of reinforcement or varieties of escape extinction. Future researchers should define each of the components, so that they may be used consistently across various studies. The studies that were chosen for this meta-analysis also determined small patterns within the research regarding intervention components. It is recommended that more research is done exploring the roles that simultaneous presentations, sequential presentation, and escape

extinction can play in the effectiveness of food selectivity treatment in children with autism. The role of fading should also be evaluated further in the research that is performed in the future.

The information regarding effectiveness of treatment can also be valuable in the present. This research can provide valuable information to practicing speech pathologists. As stated previously, speech pathologists can use this information directly when performing swallowing evaluations or treatments. During swallowing evaluations, the speech pathologist is determining which consistencies of food a person can consume without a risk of aspiration. If a speech pathologist is evaluating a child with autism that is exhibiting food selectivity, the speech pathologist can use the results of this meta-analysis when attempting to get a child to accept an un-preferred food or consistency. The use of simultaneous or sequential food presentation in conjunction with escape extinction could be utilized during the evaluation. The same techniques could be used in treatment when conditioning a swallow in a controlled environment. The use of fading could also be considered useful during treatment. A speech pathologist may evaluate the use of fading prompts or techniques to increase the acceptance of foods when performing swallowing treatment.

The use of these intervention techniques should be used on a trial basis. This meta-analysis is a beginning evaluation of treatment for food selectivity, so it must be kept in mind that the results are not definitive. If the findings will be used in practice, the clinician should explore further the research studies used in this meta-analysis and research that has been performed recently. The clinician should also track the progress of the client to determine if the techniques are valuable for that specific individual.

This meta-analysis found that the treatment of food selectivity in children with autism has the potential to be valuable for increasing the acceptance of various foods. However, before determining a definitive relationship between treatment techniques and increased acceptance, the concept must be explored further in research. ◆

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approaches include Multiple Oral Reading, (Cherney, 1995; Lacey, Lott, Snider, Sperling, & Friedman, 2010) Modified Multiple Oral Reading (Mayer & Murray, 2002; Orjada & Beeson, 2005) and Oral Reading for Language in Aphasia (Cherney, 1995; 2004; 2010; Cherney, Merbitz, & Grip, 1986), all of which promote the recovery of word- or passage-level reading. At least one study documents the effectiveness of computerized reading programs on improving the reading comprehension of PWAs (Katz & Wertz, 1997). Although more data are necessary to understand how to best use these tools, reading software packages, such as *Bungalow*® and *Parrot*® may provide an attractive alternative for PWAs to rebuild their reading skills outside of traditional therapy.

In contrast to the traditional restorative approaches, the functional approach to reading intervention provides PWAs support to comprehend text through modification of written materials. For example, aphasia-friendly formatting of text includes strategies such as making text larger, incorporating white space and visuographic supports (e.g., Brennan, Worrall, & McKenna, 2005; Dietz, Hux, McKelvey, Beukelman, & Weissling, 2009; Rose, Worrall, & McKenna, 2003). Another strategy PWAs may use to bolster their reading comprehension of a variety of materials is participation in aphasia-friendly book clubs (Bernstein-Ellis & Elman, 2003; Elman, 2007). These book clubs provide reading materials to PWAs that enhance comprehension using aphasia-friendly approaches, while fostering motivation to read through social collaboration.

Despite the documented success of the aforementioned treatments, the extent to which PWAs benefit from them is not clear. In fact, PWAs have limited additional resources to help them remediate their reading challenges (Cameron & Wright, 2009; Wallace, 2010). A prime example of this is the often-limiting insurance restrictions for speech and language therapy services; sometimes patients are only allowed 20 visits per year. In a sense, limited numbers of treatment sessions force aphasia rehabilitation programs to focus intervention on ameliorating basic communication challenges, leaving little or no time to address the other residual linguistic challenges that aphasia leaves behind (Holland, Fromm, DeRuyter, & Stein, 1996). As such, rehabilitation of reading challenges is somewhat of a luxury for most PWAs; leaving them and their caregivers

(CGs) to independently discover strategies to recover and support their lingering reading deficits (Cameron & Wright, 2009).

The aforementioned challenges of integrating reading interventions into the rehabilitation framework may make it difficult for PWAs to return to a sense of normalcy, especially for those who were once avid readers. As a result, this group of PWAs may feel isolated from family and friends because they can no longer enjoy leisure reading activities, such as perusing novels and magazines, or participating in book clubs that foster discussion and camaraderie around select books. Furthermore, PWAs also experience limited use of electronic communication because their reading challenges hamper their ability to correspond via text messaging, e-mail, Twitter®, Facebook®, and other forms of social networking (Davidson et al., 2003; Dietz, Ball, & Griffith, 2011). For all of these reasons, it is important for PWAs to have knowledge of reading interventions and strategies that support their comprehension; otherwise their sense of autonomy and social well-being may diminish over time.

In summary, PWAs experience reading difficulties well into the chronic stages of their recovery (e.g., Worrall et al., 2011), which can exacerbate the reduced autonomy, social isolation, unemployment, and a loss of self-identity associated with the communication challenges of aphasia (Shadden, 2005). A number of efficacious restorative and functional reading interventions are available to help ameliorate reading challenges; however, the immediate needs of PWAs necessitate the focus of the initial rehabilitative efforts toward establishing functional communication (Holland et al., 1996). This approach to rehabilitation compounds the reading challenges that often contribute to PWAs' inability to resume their pre-stroke work or leisure activities (Worrall et al., 2011). Currently, it is unclear how PWAs manage the reading challenges they encounter following their stroke and subsequent discharge from rehabilitation. Therefore, the purpose of this study was to explore the reading practices of PWAs in the chronic stages of their stroke recovery.

Method

Qualitative design is a valuable research approach that fosters, "... a better understanding of the communicative contexts our clients experience..."

(Hammer, 2011, p.161). Historically, aphasiologists have used both qualitative and quantitative methodologies to achieve a “holistic and verifiable picture of aphasia” (Damico, Simmons-Mackie, Oelschlaegers, Elman, & Armstrong, 1999, p.651). Therefore, for this study, the researchers employed a questionnaire to understand the impact of newly acquired reading deficits on the lives of PWAs. The researchers used semi-structured interviews and inductive analysis to unveil the reading practices of PWAs in the chronic stages of their stroke recovery. The research team was comprised of three graduate and two undergraduate students in Communication Sciences and Disorders and their faculty adviser.

Participants

The participants included two groups, PWAs ($n = 8$) and their CGs ($n = 8$) who were recruited from a data bank of former research participants at the University of Cincinnati (UC) Augmentative and Alternative Communication (AAC) and Aphasia Lab and patients at a rehabilitation hospital. All volunteers who met the criteria listed below were included. To protect their anonymity, pseudonyms were used to refer to the participants in this paper. Each participant group is described in detail below.

People with aphasia. All PWAs were: (a) diagnosed with aphasia secondary to a left cerebral vascular accident, (b) right-handed prior to the stroke, (c) at least 12 months post-stroke and medically stable according to participant/CG report, (d) native speakers of American English, (e) had at least a high school education, and (f) had mild-moderate aphasia according to the complete *Western Aphasia Battery-Revised Aphasia Quotient (WAB-R: AQ)* (Kertesz, 2007) administered by the first and second authors within one year of this investigation. All participants had received post stroke aphasia therapy; however only one was enrolled in treatment at the time of this study (Paul). In addition, all participants passed a standard hearing screening and visual acuity and field cut screening (symbol cancellation) conducted by the first and second authors. A convenience sample was formed from the aforementioned data bank based on the above criteria and yielded a participant pool of seven people with moderate aphasia, and one participant classified with mild aphasia. The PWAs ranged in age between 37 and 72 years ($M = 55$, $SD = 14.5$) and included five males and

three females. Table 1 displays the demographic and linguistic testing information of the PWAs.

Caregivers. Following a major medical event, such as a stroke, CGs possess intimate knowledge regarding the daily experiences and rehabilitative journey of PWAs. As such, the first author, a Master’s/PhD student in Communication Sciences and Disorders, used information gathered from the CGs to set the stage for the interviews with the PWAs and so interviewed them independently prior to the meetings with the PWAs. Although this procedure may have influenced the interview of the PWA, it provided background information to help guide and repair communication breakdowns during the interviews for those with more communication challenges. For the purposes of this study, CGs were defined as the primary persons responsible for, or collaborating with, the PWAs in making their general medical and financial decisions, as well as assisting with their day-to-day functioning. The CGs group (5 female and 3 male) was comprised primarily of spouses ($n = 6$), but also included one significant other, and one sibling ($n = 1$). The CGs were native speakers of English, reported vision and hearing within functional limits, and had at least a high school education (see Table 1). Finally, all CGs reported no history of cognitive-linguistic challenges and/or brain damage due to acquired or traumatic events.

Materials

Assessment. The PWAs completed two standardized measures: the *Western Aphasia Battery-Revised (WAB-R)* (Kertesz, 2007) and the *Reading Comprehension Battery for Aphasia-2 (RCBA-2)* (LaPointe & Horner, 1998). The *WAB-R* provided information regarding the severity and type of aphasia, and the *RCBA-2* provided documentation of the reading proficiency of the PWAs.

Guiding questions. The first author, a former special education teacher and graduate student in speech-language pathology, conducted the face-to-face interviews with the CGs and the PWAs. As a novice clinician, she had no prior association with the participants or preconceptions of their experiences with reading materials since their stroke. The interviews took place at a rehabilitation hospital and/or the UC AAC & Aphasia Lab, with one exception, which occurred in the participant’s home (Dan).

Table 1 Demographic Data for Participants with Aphasia

PWA	Age	Ethnicity	Level of Education	Former Vocation	Months post-Onset	WAB-R: AQ ^e	Aphasia Type	RCBA-2 ^g Total Score	Caregiver Relation	Ethnicity
John	40	Caucasian	BA ^a	Finance	21	63.3	Broca's ^f	84	Wife	Caucasian
Curt	55	Caucasian	MA ^b	Chief Financial Officer	23	60.7	Transcortical Sensory	67	Sister	Caucasian
Sarah	65	Caucasian	MA	Elementary Teacher	120	52.1	Broca's ^f	88	Husband	Caucasian
Matt	57	Caucasian	BS ^c	Engineer	48	72.4	Transcortical Motor	92	Wife	Caucasian
Bob	37	African-American	BA	Finance	60	76.6	Anomic	75	Girlfriend	African-American
Pam	72	Caucasian	AS ^d	Office Manager	252	61.1	Broca's ^f	81	Husband	Caucasian
Jane	56	Caucasian	AS	Administrative Assistant	132	66.0	Anomic	75	Husband	Caucasian
Dan	57	Caucasian	BA	Entrepreneur	48	61.8	Broca's ^f	68	Wife	Caucasian

^a = Bachelor of Arts. ^b = Master of Arts. ^c = Bachelor of Science. ^d = Associate of Science. ^e = *Western Aphasia Battery-Revised: Aphasia Quotient* (Kertesz, 2007). ^f = Concomitant apraxia of speech. ^g = *Reading Comprehension Battery for Aphasia-Second Edition* (LaPointe & Horner, 1998).

The interviewer used guiding questions/probes that focused on the pre- and post-stroke reading practices of the PWAs (see Appendices A and B) and used clarifying questions and probes as needed. To accommodate the flexibility of natural interactions and to encourage the free-flow of thoughts from the participants, the wording of questions and the question order varied but all topics from the guiding questions (see appendix A) were addressed.

Artifacts. Prior to their interview session, the first author encouraged the CGs and the PWAs to bring reading artifacts such as books, magazines, or other related reading materials to reference during the interviews.

Equipment. The researchers video recorded the assessment session and interviews with the PWAs using a Cannon digital recorder (FS200). The interviews with the CGs were audio-recorded using Marantz professional solid-state digital recorder (PMD660).

Procedure

Assessment. The second author, a licensed speech-language pathologist, administered the *WAB-R* (Kertesz, 2007) and the *RCBA-2* (LaPointe & Horner, 1998) to each participant prior to the interview session (see Table 1 for a summary of the assessment results). The

PWAs were provided at least one day of rest between the assessment and interview sessions.

Semi-structured interviews. Each interview was video/audio-recorded (PWAs) or audio-recorded (CGs) and orthographically transcribed. The interviews with the PWAs included notation of gestures and other non-verbal language that was pertinent to understanding the context or intent of the messages. The interviews lasted roughly 90 minutes for both the PWAs (*M* = 91, *Range* = 77-111) and the CGs (*M* = 96, *Range* = 51-103). In an effort to respect the fatigue PWAs often experience during linguistic tasks, frequent breaks were offered throughout the interview session. The first author maintained a log of field notes written immediately following the interview. The field notes included impressions following the interviews regarding emergent themes. The presence of emerging themes was cross-checked with members of the research team.

The lead author conducted the semi-structured, in-depth interviews with the CGs prior to the interviews with the PWAs. The CGs' perspectives were important for gathering preliminary information and gaining insights into the pre- and post-stroke reading practices of the PWAs (see Appendix A for guiding questions and probes). Next, the PWAs were interviewed separately, on a different day; however, several of the PWAs invited their CGs (John, Sarah, Dan, and Pam) to join the

interview toward the end of the discussion to assist them in clarifying information. During the interviews with the PWAs, the first author began the session with the same guiding questions/probes used with the CGs (Appendix A). The interviewer provided visual supports with key words (Garrett & Lasker, 2013) to increase comprehension during the conversation. In essence, the interviewer presented the information using multiple modalities (e.g., providing visual supports such as Google™ images and gestures to supplement the verbal presentation of questions). When necessary, the interviewer verified communicative intent using the “speaking for” strategy (Simmons-Mackie, Kingston, & Schultz, 2004) to confirm the message of the PWAs. This was accomplished by offering guesses, in the form of questions, to reduce spoken demands with the presentation of a written choice format (see appendix B for example of the written choice format), which allowed the PWAs to confirm or reject the information. This strategy served to enhance the ability of the PWAs to endorse, restate, or elaborate on the provided topic. In addition, most of the PWAs referenced the books or magazines that they brought to the interview. This provided the researchers the opportunity to observe the PWAs interacting with preferred written materials. When the PWAs indicated the desire to elaborate on ideas, but were limited by their verbal ability, the interviewer employed several strategies to facilitate expression and comprehension of follow-up questions. Appendix B provides an excerpt of sample questions from Appendix A presented in an aphasia-friendly format, as well as questions developed on the basis of the CG interviews to present to the PWAs whenever they experienced significant challenges conveying their thoughts. The authors recognize that this procedure limited the type and perhaps the amount of input that the PWAs provided during their interviews because the strategies utilized to repair breakdowns centered on key-words and verification and not response elaboration. However, this approach allowed the researchers to focus the interviews, and, thus, reduce the length of time required to complete each interview with the PWAs. The limitations of this approach are reviewed in the discussion section of this paper.

Data analysis. The interviews were transcribed verbatim from the recordings. Next, all the transcripts were read and cross-checked for accuracy to ensure that the entire typed transcript matched the

audio/video recordings by at least one other member of the research team. Then 20% of the PWAs and CGs transcripts were further checked for accuracy by a third member of the research team to determine agreement. A minimum of 90% accuracy was obtained by dividing agreed upon words by total words. Upon completion of the transcription process, the researchers employed an inductive coding analysis to identify the categories and, later, the overarching themes that emerged from the data. The field notes collected after each interview were used as a measure of reflexivity or self-disclosure and helped to illuminate the biases of the researcher and inform emerging categories in the data that may potentially shape the standpoints on this topic. The authors rigorously studied the transcripts for emergent patterns, which described the experience of managing written material in the face of chronic aphasia.

Inductive analysis was carried out using the following procedures. First, the primary and secondary authors read the transcripts independently to identify possible themes and categories. Then emergent patterns and themes were discussed and agreed upon (Patton, 2002). Next, the two authors re-read the transcripts together in order to determine ideas or concepts and develop a color-coding scheme. Finally, each interview was coded by the two authors in this manner and then tested for convergence. In other words, the first and second authors together established operational definitions (i.e., agreed upon descriptions for each category) to identify recurring patterns in the data. Then they determined what categories could be collapsed based on those working definitions. Each coded category included a brief content description, which was cross-referenced to the full passage in the complete interview to keep quotations in context (Patton, 2002). After careful analysis the coded categories were then conceptualized into broad themes through discussion between the first and second author (Jain & Ogden, 1999; Marshall, 1999). Two undergraduate student researchers independently sampled 20% of the transcripts to determine reliability of the category coding and provide consensual validation of the patterns (Patton, 2002). The inter-rater reliability for category coding was 95% for the PWAs transcripts and 90% for the caregiver transcripts. This was calculated by tallying discrepancies in category assignment between the coded transcripts of the two authors and one student and dividing them by the total category

assignments. All discrepancies were discussed and recoded based on mutual agreement between the first and second author. Finally, representative quotes that illustrate each theme were selected from each participant group.

Results

The researchers discovered three major themes that encompass various subcategories depicting the reading practices of PWAs. These themes included: (a) the PWAs' growing recognition of reading problems in the chronic stages, (b) the perspective of PWAs and their support network during the recovery of reading abilities and (c) receptivity to technology as a functional support. In the following sections, a description of each theme is provided along with representative quotes—from the viewpoint of both the PWAs and their CGs.

Growing Recognition of Reading Problems in the Chronic Stages

As PWAs in this study entered the chronic stages of their illness, they realized the emotional and physical barriers (i.e., mounting frustration and fatigue) that hindered the restoration of their reading; these are summarized below.

Frustration with loss of identity and social roles. The PWAs in this study reported frustration with their inability to overcome the obstacles that impeded their ability to return to certain social roles, self-identity, employment, and relationships with family members, because of the associated reading demands. In particular, they noted challenges returning to work due to lingering reading comprehension deficits. John's CG noted, *"He gets frustrated because he knows without his reading he can't return to work."*

Bob described his disappointment at not realizing familial expectations and at the process of learning to read again with limited success. More importantly, Bob was frustrated with his reading challenges because his mother taught him at an early age the importance of being a competent reader:

Researcher: *"As an adult you're having to go back and learn something [to read] and it's not so easy the second time around."*

Bob: *"(nodding) What can I say? I'm just mad...I'm mad now...you know, because my*

mom instilled for me lessons...you know at one...books, books, books, books."

In the case of Janet, the complex task of reading continues to elude her eleven years after her stroke. Janet's CG elaborated on this point, *"The biggest problem is her inability to read. That's the biggest thing that holds her back...The reading is probably the one thing that frustrates her more than anything."* Janet, admitted how she hides, even from family members, the extent of her reading deficit, *"I wouldn't let them know that I can't read...People think I'm dumb...because I can't read...but I don't tell them that I can't."* Janet's CG further illuminated the family secret, *"Her mom and dad both knew before they died...they knew she couldn't read...very well. I think her brothers and sisters probably aren't aware of it."*

Matt's CG shared the importance of the family perception: *"I'm sure he would be really upset if he thought his mom didn't think he could read anymore, or if he was having trouble. Cause it's always been their intellect is the most important thing there is."*

In an effort to quantify how Matt perceived his comprehension, the researcher asked the following question:

Researcher: *"Now would you say that you read as well as you did before the stroke?"*

Matt: *"No!"*

Researcher: *"You think that you've regained it by 70 percent?"*

Matt: *"50 percent"*

Residual deficits such as Fatigue. All CGs in the study reported that the PWAs actively attempt to read novels to a certain degree, either independently or with assistive technology (e.g., audio books, Kindle™, Text to Speech software, etc.). The interviews revealed that the PWAs often experienced fatigue and subsequently a reduced reading rate in their effort to independently read novels.

Sarah was a more proficient reader than the other PWAs in the study (i.e., RCBA-2 total score = 88); however, she was still limited by fatigue when attempting to read novels. Her CG noted, *"She'll read a few pages at a time and that's probably a pretty good description."*

Sarah describes her limited stamina when reading the novel *The Shack* (Young, 2007):

Researcher: *"Do you read a half a page (at a time)?"*

Sarah: *"Zoo"* (holds up three fingers)

Researcher: *"Maybe three pages at a time?"*

Sarah: *"Ya ya"* (nods)

Matt also described the persistence necessary to continue reading a novel at a slow but deliberate pace, as he emphasized his independent accomplishment:

Researcher: *"But that [reading] has got to take you some time."*

Matt: *"Slowly, slowly... but I read it."*

Matt, further described his self-imposed strategy of rereading familiar novels to boost his success when reading:

Matt: *"Glen Beck read fiction no problem ...*

Non-fiction very hard."

Researcher: *"So are you still rereading novels or have you moved so that you are attempting to read new material?"*

Matt: *"Half and half"*

John, a PWA, on the other hand, tried to elaborate on his experience of using several different types of technology to help him advance through a novel and overcome fatigue:

John: *"I bought the "Open" CD....reading the"*

Researcher: *"Text-to-speech."*

John: *"Yes..."*

Researcher: *"Do you like your Kindle™?"*

John: *"Yes yes."*

Researcher: *"What kind of books did you download?"*

John: *"Tennis"*

Researcher: *"Oh Andre Agassi."*

John's CG described a commonly reported challenge faced by the CGs in this study, which is providing an atmosphere that mirrors the reading autonomy once experienced by the PWAs, *"If I say, 'What's up? Why aren't you reading the book?' That's like a put-down, so I try to let him have his independence so he doesn't feel like a child."*

The Perspective of PWAs and their Support Network during the Recovery of Reading Abilities

As PWAs adjust to reading challenges post-stroke, they often struggle to find equilibrium in their relationships with CGs and other family members. Finding motivating reading materials and therapy solutions is part of the puzzle.

Balance of caregiver support and independence. CGs reported that it was difficult to balance their role as CG with that of therapist. Their roles had to be renegotiated because the PWAs experience less reading autonomy than they were accustomed to pre-stroke. In fact, the analyses revealed that the CGs emerged as the main source of support for PWAs when they attempted to read a variety of materials on a day-to-day basis.

John, a PWA, described the following scenario, in which he seeks support from his wife:

John: *"Brenda come here...reading, reading."*

Researcher: *"So if you find something is hard to read you ask Brenda?"*

John: *"Yes."*

Janet also expressed how she uses her husband to help her decipher difficult reading content:

Janet: *"I don't have to worry about it because of Ted. He can read it."*

Researcher: *"Ok so he will fill you in."*

Janet: *"Right, right."*

While the analyses revealed that CGs routinely support the PWAs by reading text for them, the CGs' role of "reading instructor" is harder for both parties to navigate. Janet expressed her reluctance to engage with her husband as a reading tutor:

Janet: *"But see Ted is a teacher."*

Researcher: *"Right."*

Janet: *"So I just (gestures with hand) don't."*

Researcher: *"Okay so you have to find what works with your relationship...how you can work it out."*

Janet: *"Okay."*

Caregivers also reported difficulty balancing their role as an advocate with that of an instructor. Sarah's CG explained his internal conflict with this issue and the potential for dissonance while assisting Sarah with e-mail: *"I've tried to work with her a little bit...there's only*

so much, and so far husband-spouse kind of things go, [she needs] somebody working with her...like a speech pathologist...it seems to resonate a little easier or gets her going a little more."

Reliance on extended family members. The analyses revealed that the PWAs in this study often turned to extended family members at some point after discharge to help them regain their reading skills. Kurt, a participant with aphasia, shared how his family played an integral part in his reading rehabilitation; he described it in the following manner:

Researcher: *"Who helped you learn how to read again?"*

Kurt: *"Mom and dad."*

Kurt's CG corroborated the explanation of his parents involvement, *"They [parents] would work with him several days a week and taught him the letters, the sounds, and how they fit together."* Janet also confirmed the supportive role of the family as she explained her reliance on her mother during the initial stages of reading rehabilitation, *"Well, I couldn't read them when I di...first did this (points to arm) I couldn't, no. But I have all them books that my mother did and work."*

Purview of the speech-language pathologist (SLP). In contrast to the other PWAs in this study, Matt expressed the importance of the SLP during the chronic stages of his reading rehabilitation. Furthermore, he demonstrated unusual fortitude in striving to improve his reading skills independently while partnering with a therapist:

Researcher: *"Was the therapist helping you with reading or did your wife step in?"*

Matt: *"(laughing) No."*

Researcher: *"Did you pretty much work yourself?"*

Matt: *"Therapy and self."*

Researcher: *"It sounds like you were pretty self-motivated"*

Matt: *"Yes."*

Matt's CG confirmed that the SLP played a primary role in his recovery of reading skills: *"She did a lot of things where ya know? He had to bring in books that he was reading. Or magazines."*

Challenge of finding motivating reading materials.

According to the study, family members often absorbed responsibility for reading routines of the PWAs and, given their diminished reading levels, struggled to provide age-appropriate reading materials. Pam's CG shared this harsh reality, *"She's got to be interested in it or she won't read it."* In their quest to provide suitable and engaging material for the PWAs, CGs seemed to turn to magazines as a viable solution. In the current study, both the CGs and the PWAs shared their motivation to return to reading magazines and newspapers in the chronic stages of their aphasia and reported an elevated degree of autonomy with this type of texts. Matt's CG commented that, *"Once he started picking up things better [reading], he started to order magazines again."* Matt's enthusiasm for sharing the extent of his magazine subscriptions illustrates this point:

Matt: *"News...geogwific."*

Researcher: *"National Geographic."*

Matt: *"Yes...and um I don't (laughs) lots of subscriptions..."*

Researcher: *"You are getting magazine subscriptions and reading your magazines now?"*

Matt: *"Yes."*

Although Matt enthusiastically described how he enjoyed his magazine subscriptions, his CG shared the challenges posed by reading a magazine he once enjoyed, *"What really aggravated him was ...his (inability to read the) American Scientific [sic]. He just couldn't grasp it anymore...so he started reading less intense magazines."* Dan's CG tried to capture how magazines can capitalize on a specific area of interest, *"He reads watch magazines still from cover to cover and can tell you anything you want to know about watches."* The notion of using magazines as a viable way to return to some level of reading in their post-stroke recovery was repeated across most PWAs and their CGs.

Receptiveness to Technology as a Functional Support

The advent of computer technology, including therapeutic software programs and text-to-speech features on personal devices, has opened-up new possibilities for PWAs as they search for strategies to augment their rehabilitative efforts.

Bolstering independence through technology and home practice programs. Computerized aphasia software treatment programs were cited as another popular reading support by the PWAs and their CGs. Most of the participants indicated that they learned about this software (e.g., *Bungalow*[®], *Parrot*[®]) from their SLP at the time of discharge from formal outpatient rehabilitation and found it helpful for developing a home practice program to improve all four modalities of language function. The PWAs and their CGs reported that they used this software to practice reading at the word, sentence, and paragraph levels. All of the participants were familiar with this type of software and reported using it as a part of a home treatment approach at some point in the chronic stages of recovery. As Bob's CG testified, "*He used it [computerized software] a little bit at therapy; he's used it a little bit at home.*" John's CG described the benefit of the reading support offered by the computerized software in building a sense of ownership during the remedial reading practice, "*It's interesting to see how he...he's teaching himself in his own way [using Parrot[®]].*"

One participant with aphasia depicted her experience using reading treatment software:

Pam: "*I did that stuff [computerized software]...I still read. I do that but...Nine years ago...but they kind of got easy...but it was hard nine years ago...*"
 Researcher: "*Do you still use it?*"
 Pam: "*No, but I should.*"

Sarah's CG attempted to explain the advantages and disadvantages of this approach:

"She likes doing things on the computer...because it's self-paced and she feels like she's in control...the independent part coming out...but at some point there isn't the feedback ...you get to where you're kind of redoing the same thing...How do you get to another level?...Most of those things seem to only go so far....so much of it is individualized, you know what the individual's particular needs are..."

Dan's CG also pointed out the limitation of this type of reading support for Dan, "*He's a very social person, so what I consider isolated activities [Bungalow[®]] is not*

something he is going to gravitate toward." In response to these sentiments, the researcher probed interest into other reading strategies that offer social camaraderie while supporting reading efforts such as book clubs. Most of the PWAs and CGs indicated that they would be open to this format; unfortunately the participants were not aware of any local aphasia-friendly book clubs.

Reading with aphasia in a digital world. Because of our computer-driven society, both the PWAs and their CGs viewed the ability to read written material via the Internet, including e-mail correspondence, as necessary to return to previous employment or to connect with family and friends. The analyses also revealed that although computer literacy permeates our everyday lives, PWAs face challenges independently reading this form of media. Janet, a PWA, tried to elaborate on this point, "*He (CG) reads them [e-mails] to me because I don't sometimes they don't (shaking head and hand) no. I do if they have real small letter.*" In most cases, the PWAs reported that they rely on their CGs to help them read and respond to e-mail correspondence. However, one participant, in his pursuit of reading autonomy, described how he employed text-to-speech technology to assist him with reading email:

Researcher: "*I sent you an e-mail, so you are reading e-mail?*"
 John: "*Eah...eah...Sometimes...speaking.*"
 Researcher: "*[You're using] the text-to-speech [feature] you have on your computer.*"
 John: "*Yes yes.*"

John's CG noted that, "*He does have Natural Reader [software]. He can highlight things [in emails] and it will read it to him.*" However, even sometimes when John is using this technology, John's CG still questions the degree of John's comprehension during Internet reading activities, "*You can tell he is not comprehending it because he will repeat it a couple of times.*" Although John's CG sensed that this strategy may have limitations, it seemed to be bolstering John's sense of autonomy while reading.

Dan, another PWA, shares his enthusiasm for using technology to facilitate independence during these reading tasks:

Dan: "*The other thing is the...not the Kindle[™] ...the other one... Mac[®].*"
 Researcher: "*The iPad[®]?*"

Dan: "Get that soon...reading and email and slide presentations."

Researcher: "On the iPad[®]? Okay."

Dan: "Yeah."

Dan eloquently portrayed the hope that drives the reading rehabilitation process well into the chronic stages of the illness. "Reading, um, very good . . . but still. . . now but because of aphasia and everything ...bad ...a little bit ...because now, um (reaches for book off shelf and opens it as though to read), maybe a little bit...but otherwise, no...really YET [emphasis added]."

Discussion

In summary, the results of this study unveiled three overarching themes: (1) the PWAs' growing recognition of reading problems in the chronic stages, (2) the perspective of PWAs and their support network during the recovery of reading abilities, and (3) receptivity to technology as a functional support. These themes revealed that the PWAs experienced a lack of reading routines following their stroke, which adversely compounded the effect the aphasia has on their social roles, identity, and employment opportunities (Parr, 2007; Shadden, 2005). However, the impact of these challenges is often not realized until the chronic stages of the illness. Out of necessity, early intervention efforts by SLPs tend to focus primarily on immediate communication needs, leaving PWAs with limited support when reading deficits become more apparent in the chronic stages. In turn, PWAs become frustrated with the lingering impact of deficits and often experience reduced motivation to engage in reading tasks, a vital component of reading success (Lynch, Damico, Damico, Tetnowski, & Tetnowski, 2009; Toboada, Tonks, Wigfield, & Guthrie, 2009).

The results of this study highlight the CGs' quest to support the reading independence of PWAs, which required them to balance their roles as a caregiver and a therapist. Three strategies emerged from the findings that could be implemented to support PWAs and CGs in redefining their roles while building independence and enhancing reading therapy approaches; a) computerized software, b) text-to-speech, c) aphasia book clubs.

First, computerized reading software provided an attractive alternative and viable support, especially

when traditional therapy services may not be offered to address reading challenges due to insurance restrictions (Wallace, 2010). A portion of the participants in this study had a similar rehabilitation experience, and received recommendations for home practice, such as computerized reading software, upon discharge from formal therapy. Although the CGs and PWAs acknowledged the benefits of computerized reading software, they also reported a desire for a supervised regimen to advance through the reading levels provided by the software (Katz & Wertz, 1997).

Secondly, recent technological advances such as text-to-speech offer PWAs another therapeutic strategy to address reading deficits. When engaged appropriately, text-to-speech may foster the independence of PWAs (Griffiths & Biancarosa, 2012), while decreasing their reliance on CGs for reading support during the chronic stages of the illness. The PWAs and their CGs reported that they read a variety of written materials including electronic media (e.g., e-mail and Web-based information), magazine subscriptions, and novels all of which can be accessed with personal technology (e.g. tablet, Kindle[™], iPad[®]) offering a text-to-speech feature. Magazine subscriptions in particular seem to provide a motivating reading task because they offer articles on topics of interest that are brief in nature. In addition, magazine articles are frequently accompanied by visuographic supports, which may facilitate comprehension (Brennan et al., 2005; Dietz et al., 2009). This may explain why the participants commonly reported that they resumed their magazine subscriptions during the chronic phases of their aphasia. Magazines may also offer clinicians a valuable tool for introducing and practicing reading strategies in conjunction with text-to-speech supports.

However, the use of text-to-speech software to facilitate comprehension of written material was reported by the participants to have mixed results. Perhaps fatigue and other factors, such as attention deficits, limited the participants' success in using text-to-speech for reading passages of longer length (e.g., novels). This strategy may be more beneficial for reading shorter texts, such as e-mail, web pages and magazines. However, with direct intervention, this technique may yield results that are more positive across a variety of reading tasks (Hodapp & Rachow, 2010).

Thirdly, aphasia book clubs offer PWAs the means to monitor reading comprehension through “reading ramps” (Elman & Bernstein-Ellis, 2006, pp. 33). These “reading ramps” scaffold the content of novels by providing chapter reviews and comprehension questions in an aphasia friendly manner (Bernstein-Ellis & Elman, 2003; Elman, 2007) within the context of a socially motivating environment. Given the struggle for autonomy in their reading rehabilitation, aphasia book clubs offer an interesting juxtaposition of reading intervention approaches for PWAs. In particular, aphasia book clubs may provide a beneficial alternative to reading alone or relying on CGs to translate written material for them. In essence, book clubs offer PWAs a venue to establish new reading routines and strategies (i.e., text-to-speech), while simultaneously promoting social connections that cultivate reading success.

Limitations

The results of this study may have been limited by four factors. First, the small sample size may not represent the diversity of ethnic and educational backgrounds of PWAs in the general population. Second, the researcher did not observe all the participants engage in reading activities beyond a standardized measure. Inclusion of these data across participants would have provided an authentic assessment of day-to-day functioning with reading tasks and strengthened the reliability of the emergent findings. Third, the researchers did not conduct member checks or allow the participants to comment on the accuracy of the derived themes. Member checking would have enhanced the authenticity of the interpreted themes.

Clinical Implications and Future Directions

The findings of this study indicate that PWAs experience reading challenges that have an adverse impact on work and leisure activities well into the chronic stages of the illness. This result should motivate clinicians and researchers to understand how individual factors related to reading success help PWAs comprehend various reading materials. An appreciation of this phenomenon may reveal novel solutions that will enhance the recovery process and thus facilitate reading autonomy and, ultimately, the quality of life of PWAs.

Speech-language pathologists play a vital role in educating PWAs and CGs about available reading rehabilitation options. Specifically, SLPs can provide PWAs with reading treatments and access to resources such as local support groups or aphasia book clubs. However, since reading deficits are typically addressed later in the recovery process, PWAs often struggle silently with their challenges for years. The results of this study suggest that PWAs remain hopeful regarding their reading prognosis and realize that technology may facilitate reading independence while simultaneously boosting motivation to establish reading routines. By striving to provide relevant reading therapies, clinicians anticipate improvement in the reading skills of PWAs, thereby helping them regain a sense of their former selves and reclaim social roles once defined by their ability to proficiently navigate the literary world. ♦

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Appendix A

Guiding Questions for CG Interviews

Icebreaker Questions¹

1. So I can get to know you a little better, tell me about life with _____ before the stroke.
2. How has your life and the life of _____ changed since the stroke?
3. What are some of the challenges that you and _____ face in your daily life?

Probe Questions¹

4. Describe _____'s leisure activities before the stroke.
5. Describe _____'s leisure activities now.
6. Tell me about _____'s reading habits before the stroke.
7. Describe _____'s reading habits now.
8. Has _____'s current reading ability had an impact on your life? _____'s life? Describe what that looks like.
9. Describe how you think _____ feels about his/her current reading level. Can you think of any examples or quotes?
10. What types of reading support strategies has _____ tried?
11. How and to what extent do you support _____ in his/her reading efforts?
12. Have you had a therapist or other professional work with you on reading strategies? If so, describe that experience.
13. Describe _____'s use of technology and reading (e.g., email, Facebook, Kindle or other programs).
14. Which is harder for _____? Do you think it is reading the words or understanding what is read?
15. Does _____ feel more successful reading a particular type of genre (e.g., fantasy, fictional narrative, expository, newspapers, magazines, comics etc.)?
16. Has the preference in genre changed since the stroke?
17. What text length does _____ typically read (e.g., page, paragraph, or chapter)?
18. Describe _____'s exposure to Aphasia friendly text. How often is this available in daily life? Has _____ been an advocate for these materials?
19. What types of printed material does _____ encounter daily? Which materials are easiest or hardest to read?
20. Would _____ be open to reading intervention strategies in an attempt to help improve his/her reading ability, including book clubs?
21. Do you have any recommendations or advice for people with aphasia or their caregivers in regard to reading?

¹ Questions 1-3 were used as "ice breakers" to increase the comfort level of the participants at the outset of the interview process. Questions 4-15 targeted the reading practices of PWAs following the stroke.

Appendix B

Example: Aphasia-friendly Guiding Questions and Probes for PWAs

Example of aphasia-friendly supplemental questions and probes derived from Appendix A. The interviewer used these supports whenever the PWAs demonstrated difficulty expressing their ideas following the probes listed in Appendix A. All questions and augmented input for the PWAs was formatted in 18-point bold-faced font and appeared on a separate page. The numbering of these questions reflects the correlating question in Appendix A. Also, when appropriate, the questions were paired with relevant pictures to augment comprehension. Due to copyright limitations, the images are not available for reproduction.

12. Have you had a therapist or other professional work with you on reading strategies?

YES NO

13. Do you use technology such as iPad, Kindle or other electronic readers?

YES NO

14. Do you email?

YES NO

17. How much do you read at one time?

-PARAGRAPH

-PAGE

-CHAPTER

-OTHER

18. What types of materials do you read?

- BOOK/NOVEL

-NEWSPAPER

-MAGAZINE

-OTHER

Socialization Matters: Effectiveness of Group Intervention on Social Interactions of Patients with Dementia or Dementia-like symptoms

Marika Roll, Colleen F. Visconti and Christie A. Needham

Abstract

Background Information. In order to maintain physical health, it is recommended that individuals stay physically active. The same is true for social health; individuals need to remain socially active. Research has shown that “people with regular social ties are significantly less likely to demonstrate cognitive decline when compared to those who are lonely or isolated” (Ristau, 2011, p. 70). Therefore, participation in activities that are socially stimulating may postpone the onset of dementia (Wierenga & Bondi, 2011). It has been shown that for individuals with dementia, their cognitive deficits impact not only executive functions and language, but also can severely impact behavior and social functioning (American Psychiatric Association, 2000). Therefore, individuals with dementia have been found to be less likely to stay socially active.

Purpose. The purpose of the pilot study was to examine whether group intervention based on aspects of cognitive stimulation therapy (CST) with adults with dementia or dementia-like symptoms lead to changes in communication and socialization within the group intervention setting, and/or outside of the group intervention setting (i.e., in the retirement community setting).

Methods. The pilot study examined the changes in social engagement and communication of residents with dementia or dementia-like symptoms following participation in a group intervention program. Three female adults with dementia or dementia-like symptoms participated in an intervention program 1 time per week for 6 months. The participants completed one partner and one group activity per session. Therapy was planned and implemented by three undergraduate student clinicians under the supervision of a licensed and certified speech-language pathologist. The student clinicians and the clinical supervisor completed an observation checklist regarding each participant’s communication and social skills both during the intervention and following the activities while observing the participants at lunch. A similar checklist was also completed by a trained staff member at the retirement community while observing the participants during daily activities. Both the observation checklists were completed monthly.

Results. The data was analyzed to examine changes in the participants’ social interaction and communication over time. Improvements were found in the initiation of topics within the intervention session, and socialization within and outside of the therapy session. Clinical implications and future research directions will be discussed.

The article author(s), Marika Roll, a student at Baldwin Wallace University, Colleen Visconti and Christie Needham who work at Baldwin Wallace University have no relevant financial or nonfinancial relationships to disclose



Learning Objectives

- 1) Identify two types of activities that foster socialization with adults with dementia or dementia-like symptoms
- 2) State at least two characteristics of Cognitive Stimulation Therapy (CST).
- 3) Identify two significant changes that resulted from the intervention provided in the study



Physical fitness is important to a person’s well-being and overall health. However, social interaction and relationships are important aspects of overall health as well. Dementia does more than affect a person’s

cognitive skills. Language and communication skills of a person with dementia can also be affected (Ristau, 2011). Dementia can be a vicious cycle: an individual with dementia may begin to experience cognitive decline, he or she may begin to demonstrate deficits in language and communication abilities, and then become socially disengaged. Changes in socialization may be due to early deficits in communication, depression, or embarrassment related to their communication difficulties. By disengaging with others, an individual becomes socially isolated which can contribute to further cognitive decline. Speech-language pathologists have an opportunity to assist individuals with dementia or dementia-like symptoms by planning and implementing non-medical group

intervention that focuses on increasing socialization and cognitive functioning with patients with dementia.

In the United States more than 80% of elderly residents in specialized care have dementia (Potkins, Myint, Bannister, Tadros, Chithramohan, Swann, & O'Brien, 2003). Dementia is "a pattern of cognitive deficits characterized by impairment in memory and at least one other cognitive domain" (Wierenga & Bondi, 2011, p. 37) such as language, executive functions, or visuospatial abilities. Furthermore, dementia impacts behavior and interferes with social or occupational functioning (American Psychiatric Association, 2000). Dementia is caused by various neuropathologies which lead to gradual progression of cognitive impairment. The most common causes of dementia include the presence of beta-amyloid plaques, neurofibrillary tangles, infarctions, ischemic injury, hemorrhagic lesions, cell loss and deposition of Lewy Bodies in the sub-cortical, limbic, and neocortical regions, and frontal and temporal lobar atrophy (Wierenga & Bondi, 2011). Dementia can also occur in individuals with Parkinson's disease, Huntington's disease, or human immunodeficiency virus (Wierenga & Bondi, 2011). Unfortunately, at this point in time a definitive diagnosis is only possible at autopsy, which makes diagnosing individuals during their lifetime difficult. Therefore, the diagnosis is based on symptoms and patterns of cognitive deficit (Wierenga & Bondi, 2011).

Cognitive deficits such as forgetfulness and memory loss are the most common and well-known clinical symptoms of dementia. There are several other possible predictors of dementia. One such predictor of cognitive decline is depression. Specifically, the rate of cognitive decline has been found to be correlated with depression with the greatest cognitive decline being found in individuals with persistent depression symptoms (Kohler, Van Boxtel, Van Os, Thomas, O'Brien, Jolles, & Verhey, 2010). Thus, the presence of depression may be a precursor to dementia (Kohler, et al., 2010). In addition, changes in socialization patterns (Wang, Karp, Winblad, & Fratiglioni, 2002) and progressive deficits in receptive and expressive language abilities (Wilson, Rochon, Mihailidis, & Leonard, 2012) have also been found to be predictive of early dementia.

The term "use it or lose it" does not only apply to physical strength or muscle memory, but applies to social engagement and can help maintain cognitive health. Good relationships are correlated to physical, psychological, and cognitive well-being (Ristau, 2011). Researchers believe that socialization contributes to increased brain reserve, or the ability of the brain to function despite physical damage or trauma (Ristau, 2011). The impact of socialization on dementia was examined by Crooks, Lubben, Petitti, Little, & Chiu (2008). The study examined over 2200 female participants over the age of 78, and found that women with the larger social networks were 26% less likely to develop dementia than those with smaller social networks, and women who had daily contact with friends cut their risk of developing dementia in half (Crooks et al, 2008). In addition, involvement in daily or weekly engagement in mental, social, or productive activities has been found to lower the incidence of dementia (Wang et al., 2002). However, in order to maintain involvement in social activities individuals must be able to effectively communicate.

Individuals with dementia have been found to demonstrate deficits in communication. Specifically, individuals with dementia have been found to demonstrate deficits in verbal fluency, semantic categorization anomia, reduction in phrase length, and difficulty with repetition tasks (Wierenga & Bondi, 2011). Furthermore, Carlomagno and colleagues (2005) found that during dyadic communication interactions individuals with dementia frequently misunderstood the examiner, provided poor responses to feedback from the examiner, demonstrated paraphasic errors, and had difficulties providing crucial information. Communication deficits have also been found in the area of pragmatics. Specifically, individuals with dementia have shown deficits in selecting and maintaining a topic, changing a topic, turn taking in a structured environment, and contributing new information to the conversation (Mentis, Briggs-Whittaker, & Gramigna, 1995; Moss, Polignano, White, Minichiello, & Sunderland, 2002). These deficits in communication can affect the overall level of functioning of the individual with dementia, which can lead to frustration and disruptive behaviors (Potkins et al., 2003), which in turn can negatively impact overall socialization.

It is difficult to determine whether the communication deficits lead to social isolation or if social disengagement leads to an increase in communication deficits; therefore, intervention should aim to improve communication skills in a socially engaging and focused group environment. When a person participates in a social or productive activity, he or she feels useful and competent which may be linked to an increased sense of self-esteem and self-concept (Wang et al., 2002). If an individual has high self-esteem and confidence, he or she may be more likely to continue to engage in more social activities. In addition, social engagement provides the individual with the opportunity to continue to utilize communication.

Cognitive Stimulation Therapy

One of the most popular alternative treatment techniques and the only non-drug intervention recommended by government guidelines for the treatment of cognitive symptoms in dementia is Cognitive Stimulation Therapy (CST) (National Institute for Health and Clinical Excellence, 2007). CST is a brief, group intervention that involves 14 sessions, each 45 minutes in length, and targets cognitive and social functions such as word association, object categorization, discussions of current affairs, and orientation (Orrell, Spector, Thorgrimsen, & Woods, 2005). Implicit learning is favored over explicit learning tasks, and the therapy focuses on opinion rather than fact. The effectiveness of CST was examined using a random control trial study that included 201 people with dementia from 23 residential homes and day centers in London (Orrell, et al., 2005). The study found that the individuals who received CST showed significant benefits in cognitive function and quality of life when compared to the control group who did not receive the treatment. A more recent study examined the use of CST on specific areas of cognitive functioning in individuals with dementia (Spector, Orrell & Woods, 2010). The study found that the cognitive skill that showed the most improvement was language. Improvements in spoken language, word-finding, naming, and comprehension positively impacted conversation and communication, and lead to increased well-being among participants (Spector, et al., 2010).

The group dynamic of the therapy is one of the most important aspects. Individuals with dementia have reported positive experiences of being in a group

(Mason, Clare, & Pistrang, 2005). Specifically, individuals with dementia enjoyed having a facilitated opportunity to talk with other people with dementia. Participants stated that they felt more understood by their peers and felt more confident in their communication skills in a group setting (Mason et al., 2005). By increasing a person's language abilities, an individual will be more likely to communicate and socialize with others. Improvements of quality of life may be the result of increased cognitive functioning after participation in CST as well (Spector et al., 2010).

Purpose

The purpose of the pilot study was to examine whether group intervention based on aspects of cognitive stimulation therapy (CST) with adults with dementia or dementia-like symptoms lead to changes in communication and socialization within the group intervention setting, and/or outside of the group intervention setting (i.e., in the retirement community setting).

Method

Participants

The participants in the study included three Caucasian female residents at Crystal Waters Retirement Community. Eleven participants with dementia or dementia-like symptoms were initially recommended to participate in the study by the Director of the facility. Eight out of the eleven participants agreed to participate in the evaluation portion of the study, and from there four participants agreed to participate in the study and attended the sessions on a regular basis. However, only three participants completed the six months of intervention. The three participants were from the middle to upper class socioeconomic status, and English was their primary language. The ages of participants ranged from 81 years and eight months to 96 years and zero months of age, with a mean age of 87 years and seven months (see Table 1). The level of service provided by the staff of the assisted living facility for the residents varied depending on the request of the resident and/or their family/caregivers. There were four service packages available to residents. Service Package 1 included two-chef prepared meals served in the dining room per day. Service Package 2 included three-chef prepared meals served in the dining room per day and weekly laundry service. Service Package 3 included three-chef prepared meals served in the dining

room per day, medication management, personal care services with minimal assistance, bathing or shower assistance once per week, and weekly laundry service. Finally, Service Package 4 included three-chef prepared meals served in the dining room per day, medication management, personal care services with maximum assistance, bathing or shower assistance two times per week, and weekly laundry service.

Table 1. Participant Descriptions

Participant	D	J	G
Age	83.8	83.5	96.0
Diagnosis	Possible dementia	Dementia	Dementia with behavioral disturbances
Possible Related Medications	None	Lexapro (anti-depressant)	Aricept (memory medication)
Level of Service	3	3	1
Length of Residency	2 years 4 months	4 years 4 months	1 years 8 months

Procedure

Under the supervision of the licensed and certified speech-language pathologist, the participants were assessed individually by one of the three undergraduate student clinicians. All three of the undergraduate student clinicians had completed at least 25 hours of clinical observation and obtained at least one semester of individual clinical intervention experience. Prior to the study, the participants were evaluated using the *Executive Functioning Skills Assessment Score Sheet* and *Test Booklet* (Needham, 2012).

The three participants participated in one group intervention session for 30-45 minutes once a week for 2 months, then 1 month break due to the semester break followed by another 3 months of intervention. Each session included a partner and group activity focusing on improving cognition and/or socialization (i.e., word retrieval, categorization, sequential expression, description activities, etc.) in a socially engaging environment.

Partner Activities

One of the student clinicians was responsible for creating the partner activity lesson plan each week. The partner activity lasted approximately 15-20 minutes. All of the participants and student clinicians sat at one

large table, yet worked in assigned pairs. Each student clinician was paired with one to two participants for the partner activity. The student clinician began by providing simple directions for the activity, with additional directions provided if needed.

Group Activities

Following the partner activity, all of the participants and student clinicians created one large group for the group activity. One of the student clinicians then explained the directions for the group activity. The group activity lasted approximately 15-20 minutes and focused on word retrieval, categorization, sequential exercises, and descriptions; however, the primary goal for these activities was to encourage communication and socialization among the group members. Examples of group activities implemented in the study included modified versions of *Taboo* and *Scattergories*.

Assessment and Data Collection

Once a month the student clinicians and clinical supervisor completed the *Clinician Observation Checklist* (Appendix A) twice for each participant, once immediately after therapy and once while observing the participants during lunch. The lunch observations were completed by observing the participants eating lunch from a room with windows that overlooked the dining area. A staff member at the facility completed the *Staff Observation Checklist* (Appendix B) while observing the participants at various activities throughout the day on the same days as the supervisor and student clinician’s observation

Results and Discussion

The data collected from the *Student Observation Checklist* and *Staff Observation Checklist* were entered into SPSS (SPSS, 2010) for data management and analysis purposes. An ANOVA by observer was run to determine if there were any significant differences between the student clinicians, clinical supervisor and the staff member. No significant differences were found. A second ANOVA was run to examine changes in the participant’s communication and socialization across time. Significant differences ($p \leq 0.05$) were found for approximate number of times the participants initiated a topic within the intervention setting, and the approximate number of times the participant was observed communicating with others from the group outside of the intervention setting (Table 2).

Specifically with regards to initiating a topic within the intervention setting, at the beginning of the intervention the participants initiated an average of 1.75 (S.D. = 0.463) topics per session, which increased to 3.67 (S.D. = 2.082) topics per session. Anecdotal evidence also noted an increase in the number of initiations made per conversation. At the beginning of the study the student clinicians noticed that the participants preferred to initiate conversation with the student clinician sitting nearest to them. The participants were found to ask follow up questions during the conversations with the student clinicians. By the end of the intervention, the participants were initiating more conversations with the other participants, and were addressing each other by name and greeting each other at the beginning of the sessions. The increase in the number of topics initiated during intervention could be due to an increased comfort level felt among participants.

As previously noted, significant differences were also found in the participant's communication with others outside of the intervention setting. The participants were found to have increased their social interaction with others. Initially the participants were found to have very little to no interaction with others ($X = 0.13$; S.D. = 0.345); however, by Time 4 ($X = 1.00$; S.D. = 0.000) all of the participants were observed interacting with other individuals outside of the intervention setting. In addition, one of the participants began checking the daily activities schedule and wondered why the student's group was not listed.

Changes over time were also noted in the medication use across participants over the course of the study. The participant who was not taking any anti-depressant medication or memory enhancement medication made the most improvement over time in all areas. This could have important clinical implications, in that it could support the use of non-medical treatment regimens for individuals with early dementia or dementia-like symptoms. Non-medical interventions aimed at decreasing depressive symptoms or behavioral symptoms related to dementia could also prove to be beneficial. Cognitive activities involving word retrieval, categorization, sequential expression, or description activities could be implemented into other retirement community settings. Future studies should further investigate whether non-medical treatment of

dementia leads to significant improvements in communication and socialization as compared to the use of prescription medications.

As is common in most pilot studies, there were limitations in the experimental design. Population size proved to be a limitation in the study. The present study contained only three participants who participated for the full 6 months of the study. A larger population size could yield more reliable results. The participant population also lacked diversity. All participants were Caucasian females from middle to upper middle class with dementia or dementia-like symptoms. Future studies should include male participants to investigate any effect gender has on dementia. In the present study, intervention was only implemented once a week. Increasing the frequency of treatment should be examined to determine if more frequent intervention leads to more significant changes in socialization and communication. The researchers also had no control over the medications taken by the participants. If possible, future researchers could create a study comparing how group intervention affects communication and socialization of both participants currently taking anti-depressant medications or memory enhancing medications and participants who are not.

The present study provided preliminary results showing that group intervention could be beneficial for individuals with dementia or dementia-like symptoms. Both communication and socialization within and outside of the group setting were observed. As the baby boomer generation ages, more individuals could be diagnosed with dementia or dementia-like symptoms. Recent research suggests that speech-language pathologists have an opportunity to provide non-medical treatment to assist this population. Preliminary findings such as the ones presented in the current study could be the base for larger studies examining effective non-medical treatment approaches for individuals with dementia. ♦

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Appendix A

Baldwin Wallace Communication/Socialization Research

Clinician Observation Checklist

Patient's Initials: _____ Date: _____ Time: _____ am/pm

Clinician Name: _____

Observation	Yes/No		Notes
1) What activity is the patient participating in?			
a) If the patient attends an event, are they sitting with others?	Yes	No	
b) If the patient attends an event are they speaking with others?	Yes	No	
c) Is the topic appropriate for the activity?	Yes	No	
	N/A		
d) Is the patient noted to be talking about their scripted topics?	Yes	No	
	N/A		
e) Does the patient initiate conversation? Approximately how many times?	Yes	No	
	1 2 3 4 5 <5		
f) Approximately how many turns does the patient take in the conversation?	1 2 3 4 5 <5		
2) Does the patient seem agitated?	Yes	No	
3) Is the patient observed communicating with other patients from the group?	Yes	No	
4) Overall awareness/ orientation? (1 being very unaware, 5 being very aware)	1 2 3 4 5		
5) Is the patient involved in any disruptive behavior or issue?	Yes	No	

Appendix B

Baldwin Wallace Communication/Socialization Research

Staff Observation Checklist

Patient's Initials: _____ Date: _____ Time: _____ am/pm

Staff Member Name: _____

Observation	Yes/No	Notes
1) Is the patient observed attending social activities (i.e. Bingo, etc)	Yes No	
a) If the patient attends an event, are they sitting with others?	Yes No	
b) If the patient attends an event are they speaking with others?	Yes No	
c) Is the topic appropriate for the activity?	Yes No	
d) Approximately how many times a week did you note the patient engaged in social activities?	1 2 3 4 5	
2) Does the patient seem agitated?	Yes No	
3) Overall awareness/ orientation? (1 being very unaware, 5 being very aware)	1 2 3 4 5	
4) Is the patient involved in any disruptive behavior or issue?	Yes No	

that typically developing children spent engaging in joint attention with their mothers. The researchers found that the amount of time spent in joint attention was positively associated with vocabulary size later on (Tomasello & Todd, 1983). A replication and expansion on this study was conducted by Markus et al., who found that the amount of time spent in joint attention at 12 months was related to language skill at 18 months (2000). Numerous other studies have looked at various types of joint attention, and have found similar results in terms of association with and/or prediction of language outcome in typically developing children (Bruinsma, Koegel, & Koegel, 2004).

Due to the sizable amount of evidence supporting joint attention as a predictor of language outcome in typically-developing children, one might expect that joint attention might also be useful in predicting language outcome in children with developmental disorders – specifically, children with disorders who experience language delays. One such disorder is autism spectrum disorder (ASD), a neurologically based disorder that causes social interaction and communication deficits. ASD is, as its name suggests, a spectrum disorder, and includes (but is not limited to) autistic disorder (or “classic” autism) and pervasive developmental disorder, not otherwise specified (PDD-NOS, or “atypical” autism).² In addition to social and communication deficits, these children often experience deficits in joint attention as well. Numerous researchers have considered the serious implications that these deficits could have on language development, and have therefore attempted to examine joint attention as a predictor of language outcome in children with ASD. However, the results of these studies appear to be somewhat contradictory of one another and/or inconclusive. In other words, some studies found that joint attention appeared to have an effect on language outcome; some studies found that it did not; and others did not come to a definite conclusion either way.

²As of May 2013, PDD-NOS will no longer be a diagnosis within autism spectrum disorders, according to the DSM-V. However, studies using participants diagnosed with PDD-NOS were still included in this meta-analysis for two reasons: (1) there are not enough existing studies that used solely children diagnosed with autism; and (2) children previously diagnosed with PDD-NOS will simply have a changed diagnosis; in the author’s opinion, this does not change their joint attention or language skills.

One explanation for these contradictory findings is the fact that several types of joint attention exist, and studies do not always examine the same types. The types of joint attention can be divided into two categories: (1) initiation of joint attention (IJA) and response to joint attention (RJA) and (2) declarative and imperative. IJA and RJA simply refer to the establishment of or response to joint attention – e.g., pointing or following someone’s pointing – respectively. Declarative joint attention refers to joint attention that is used to share awareness of an object or event, while imperative is joint attention that is used to make a request. Other types of joint attention exist as well, but these are the most common types analyzed in the literature.

Due to the wide variance in how these studies were conducted, the question of whether joint attention acts as a predictor of language outcome in children with ASD might seem intimidating, even to a seasoned clinician. However, Evidence-Based Practice (EBP) can be a useful tool for answering this question. EBP is defined by Christine A. Dollaghan (2007) to be the sensible and conscientious integration of three types of evidence when making clinical decisions: (1) external evidence from systematic research, (2) internal evidence from clinical practice, and (3) evidence deriving from the preferences of the patient (*The Handbook for Evidence-Based Practice in Communication Disorders*, 2007). The present study aims to tackle the question of if, and how, joint attention acts as a predictor of language outcome in children with ASD by carefully reviewing evidence of the first type – external from systematic research.

Dollaghan (2007) also states that analyzing the level of evidence that we find is extremely useful for deciding how significant the results of a study are. *Level 1* refers to studies with the highest quality of evidence, and includes systematic reviews of high-quality randomized controlled trials (RCTs) and RCTs themselves. *Level 2* refers to the systematic review of high-quality cohort studies or lower-quality RCTs, or simply these studies themselves. *Level 3, 4, and 5* refer to the systematic review of high quality case-control studies or these studies themselves; case series, poorer-quality cohort studies, or case control studies; and expert opinion, respectively. All of the studies included in this meta-analysis qualify as Level 2 cohort studies (RCTs are not

necessarily possible to conduct when examining joint attention as a predictor of language outcome).

As previously stated, this meta-analysis aims to answer the question of whether joint attention acts as a predictor of both expressive and receptive language outcome in children with ASD, using the first type of evidence in EBP – external from systematic research. The primary population examined in these studies was young children (average age 30.01 months) with ASD. Each study examined the effect of at least one of the aforementioned types of joint attention on expressive and/or receptive language outcome in these children.

The current literature on this topic is certainly diverse. However, through conducting a careful meta-analysis of the evidence that these studies offer, we will acquire a more explicit idea of exactly how joint attention affects language development in children with ASD – and the implications that has on how we approach language intervention in these children.

Method

Search Procedures and Inclusion Criteria

Potential studies were identified through the use of electronic databases, as well as by manually searching through the references of relevant articles. Please refer to Figure 1 and details on the identification process, and Table 1 for a list of sources of the identified studies and exclusionary criteria.

A total of 643 studies were identified using the methods outlined in Figure 1 and Table 1. Seven electronic databases were used: Education Full Text, Education Research Complete, ERIC, ISI Citation Databases, PsycINFO, PubMed, and SocINDEX. Studies found at these databases (including systematic reviews – although not included in meta-analyses, these frequently offer pertinent citations) were then searched for relevant citations.

580 studies were excluded from the original 643 on the basis of having irrelevant titles and keywords (i.e., not related to joint attention, language outcome, and/or children with autism). Out of the 63 studies remaining, 50 were excluded based on six criteria: (1) did not look at joint attention as a predictor of language outcome, (2) duplicate studies, (3) not longitudinal, (4) did not use children with ASD or had a sample size of children with

ASD that was too small, (5) did not report effect sizes and/or any information that could be used to calculate effect sizes, and (6) not research studies. Some studies examined preverbal skills – but not joint attention – as predictors of language outcome, and were therefore excluded. Duplicate studies were those already identified in previous searches. Some studies met all of this criteria, but were not *longitudinal*, or at least 12 months long (i.e., they analyzed joint attention in relation to current language skill) – therefore, these were also excluded. Studies using only participants that did not have ASD, that were older than the age of four at the beginning of the study, or that had a sample size of children with autism that was too small (i.e., less than five) were excluded. Some studies met all other inclusion criteria, but did not report any effect sizes and/or any information that could be used to calculate effect sizes, and therefore had to be excluded. Finally, citations classified as “not research studies” – including book chapters and reviews – were also excluded.

Figure 1

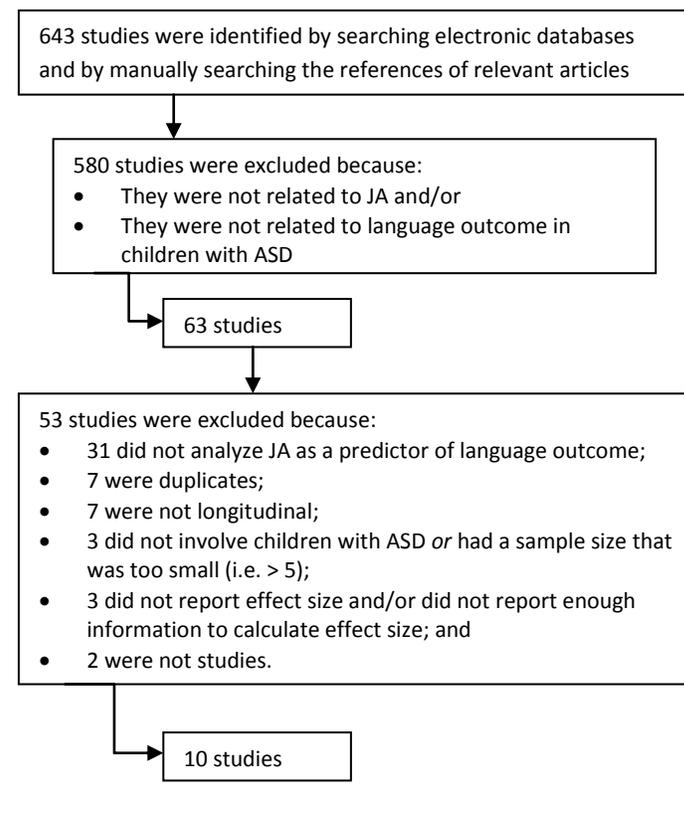


Table 1. Sources of Identified Studies and Exclusionary Criteria

Electronic Databases Searched	Total Hits	Not Related to JA or LO in children with ASD	Did not analyze JA as a Predictor of LO	Duplicates	Not Longitudinal	Inefficient Sample Size	No Effect Size/No Information to calculate	Not Studies	On Topic Articles
Education Full Text	250	249	0	0	0	1	0	0	0
Education Research Complete	182	178	2	0	5	0	0	1	0
ERIC	27	25	0	0	1	0	0	0	1
ISI Citation Databases	76	58	10	1	0	2	0	0	2
PSYCHinfo	24	15	3	2	1	0	1	1	1
PubMed	79	54	16	4	0	0	1	0	3
SocINDEX	1	1	0	0	0	0	0	0	0
Manual Search of Relevant Article References	4	0	0	0	0	0	1	0	3
Total Hits	643	580	31	7	7	3	3	2	10

Note: JA = Joint Attention; LO = Language Outcome. Several combinations of the following search terms were used at each database: (children OR toddlers); (autism spectrum disorder OR Asperger’s syndrome OR PDD-NOS OR autism); joint attention OR joint engagement OR attention OR predictors); (language acquisition OR language outcome OR language development OR language OR communication outcome OR communication development OR communication); NOT (treatment or intervention).

Description of the Studies

Table 2 displays the studies and their corresponding identification numbers. Table 3 provides a list of factors used to characterize each study (e.g. total number, age, and diagnosis of participants; length of study; how joint attention and language were measured, etc.). Table 4 provides a list of all ten studies coded by these characteristics.

The number of participants in each study ranged from 18 to 206, while the number of participants with ASD within those samples ranged from 9 to 98. In the studies that did report number of male and female participants with ASD, the majority was male (Adamson et al, 2009; Bono et al., 2004; Smith et al., 2007; Stone & Yoder, 2001; Thurm et al., 2007). All studies included participants on the autism spectrum disorder; some with autism, and some with PDD-NOS. Some studies included participants with other diagnoses for comparison (e.g. Down syndrome), but the results of these groups were not included in this meta-analysis (Adamson et al., 2009; Anderson et al., 2007; Mundy et al., 1990; Thurm et al., 2007). How participants were diagnosed with ASD was included in order to gain an understanding of the consistency of diagnosis methods currently being used.

How language outcome was measured, the type of joint attention examined, and protocols used to measure joint attention were also included as variables; these varied widely from study to study.

All included studies were longitudinal, or at least 12 months in length. Overall, length of study ranged from one to seven years. Participants were aged, on average, at the beginning of the study between 20.6 and 46.7 months old (overall average age 30.01 months). All participants had their language and joint attention skills assessed at least twice.

Internal and External Validity Quality Markers

The internal and external validity of each study was determined using questions adapted from Dollaghan (2007). A list of these questions can be found in Table 5.

Assessing the internal and external validity is essential in order to determine whether one can draw conclusions based on the results of a study. A study is considered to have *internal validity* if its evidence accurately represents the patients, procedures, and settings that were originally observed. Specific factors affecting internal validity that were examined in this

meta-analysis were blinding, quality of measurements used (validity and reliability), administrator qualifications, inter-rater reliability, method of statistical analysis, and data such as statistical significance, effect size, and confidence intervals (Dollaghan, 2007).

Table 2. Studies and Identification Numbers

Identification Number	Study
1	Adamson et al., 2009
2	Anderson et al., 2007
3	Bono et al., 2004
4	Charman, 2003
5	Charman et al., 2003
6	Mundy et al., 1990
7	Smith et al., 2007
8	Stone & Yoder, 2001
9	Thurm et al., 2007
10	Toth et al., 2006

A study is considered to have *external validity* if its evidence is generalizable to patients, procedures, and settings outside of the study; in other words, external validity describes the extent to which professionals can apply the results of a study to their own practice. Factors affecting external validity that were analyzed in this meta-analysis were participant selection and having an attrition less than 20% (i.e. at least 80% of the children who started the study finished it) (Dollaghan, 2007).

Please refer to Table 6 for an analysis of the validity of the included studies with regard to these factors (elaborated upon in “Results”).

Effect Size, Adjustments, and Confidence Intervals

A meta-analysis can be described as a systematic review, which also includes the use of statistical analysis “to quantify the weight of the evidence across studies,” (Dollaghan, 2007, p. 22). Two pieces of information specifically used in this statistical analysis are *effect sizes* and *confidence intervals*. *Effect sizes* essentially provide information regarding the magnitude of observed results in a study. In these particular studies, effect size describes to what degree joint attention influenced language development in the sample population (children with ASD). *Confidence intervals* provide an estimation of how reliable an effect size is, or how much “room for error” surrounds an effect size. Naturally, effect sizes with smaller or more narrow

confidence intervals are seen as more reliable than effect sizes with larger or broader confidence intervals (Dollaghan, 2007).

There are several ways to calculate effect size. In this meta-analysis, we decided to use two types of effect size calculation: Cohen’s *d* and *r*-squared (abbreviated as R^2). We chose these types of calculations based largely on the types of statistics used to calculate significance in each study, as well as the type of data reported that could be used to calculate effect size. For example, Smith et al. (2007) reported standard deviations; because these are used to calculate Cohen’s *d*, this type of calculation was naturally chosen to compute effect size for this study. Effect sizes for seven studies (Adamson et al. [2009], Anderson et al. [2007], Bono et al. [2004], Charman et al [2003], Mundy et al. [1990], Stone and Yoder. [2001], and Toth et al. [2006]) were calculated using *r*-squared, and effect sizes for the remaining three studies (Charman et al. [2003], Thurm et al. [2007], and Smith et al. [2007]) were calculated using Cohen’s *d*.

In order to understand R^2 , one first needs to understand Pearson’s *r* – a type of statistic that describes the correlation between two variables. *R* values can range between 0 and 1; 0 indicating that no relationship exists between two variables, and 1 indicating that a strong, predictable relationship exists between them. When the *r* value is squared, we are left with a value (R^2) that explains how much of the variation in one variable can be explained by a second variable (Dollaghan, 2007). In the studies by Adamson et al., Anderson et al., Bono et al., Charman, Mundy et al., Stone and Yoder., and Toth et al., R^2 was calculated using the *R*-values from each study. Simply put, this value represents how much of the variation in the children’s language at the end of the study could be explained by their joint attention skills at the beginning of the study.

Dollaghan describes Cohen’s *d* as a “simple, accessible, and reasonably robust measure of effect size” that is used to compare two or more groups (2007, p. 49). In the studies conducted by Charman et al., Thurm et al., and Smith et al., the two groups being compared were (1) children who made language gains at the end of the study, and (2) children that did not make such gains. Joint attention skill was then analyzed in relation to the language skills of each group of children. We calculated

Table 3. Selected Variables and their codes

Variable	Types & Respective Codes
Total Number of Participants	Numeric
Number of Participants with ASD	Numeric
Diagnosis of Participants	1 = autism 2 = Pervasive Developmental Disorder - Not Otherwise Specified (PDD-NOS) 3 = Down syndrome 4 = mentally retarded 5 = nonspectrum developmental disabilities (language delayed; ADHD)
How Participants with ASD were Diagnosed	1 = Autism Diagnostic Interview-Revised (ADI-R) 2 = Autism Diagnostic Observation Schedule (ADOS) 3 = Childhood Autism Rating Scale (CARS) 4 = Pre-Linguistic Autism Diagnostic Observation Schedule (PL-ADOS) 5 = Clinical diagnosis by experienced clinician(s) not involved in study 6 = American Psychiatric Association criteria (1980) 7 = DSM-III diagnostic criteria (1987) 8 = DSM-IV diagnostic criteria (1984) 9 = ICD-10 diagnostic criteria (1993) 10 = Checklist for Autism in Toddlers (CHAT)
Percentage of Male Participants with ASD	Numeric
Length of Study	Numeric (Years)
Average Number of Times Participants were Evaluated	Numeric
Average Chronological Age of ASD Participants at Onset of Study	Numeric (Months)
How Language was Measured	1 = Clinical Evaluation of Language Fundamentals-Revised (CELF-R) 2 = Differential Ability Scales (DAS) 3 = Expressive Vocabulary Test (EVT) 4 = MacArthur-Bates Communicative Development Inventory (MCDI) 5 = Mullen Scales of Early Learning (MSEL) 6 = Peabody Picture Vocabulary Test-III (PPVT-III) 7 = Preschool Language Scale-3 (PLS-3) 8 = Reynell Developmental Language Scales 9 = Sequenced Inventory of Communication Development-Revised (SICD) 10 = Vineland Adaptive Behavior Scales (VABS) 11 = Wechsler Intelligence Scale for Children-III (WISC)
Type of Joint Attention Analyzed	0 = no specific type 1 = initiation of joint attention (IJA) 2 = response to joint attention (RJA) 3 = declarative 4 = imperative 5 = coordinated 6 = supported 7 = symbol-infused 8 = non-symbol-infused 9 = gestural
How Joint Attention was Measured	1 = activated toy task (Butterworth & Adamson-Macedo, 1987) 2 = Autism Diagnostic Observation Schedule (ADOS) 3 = coded by authors 4 = Early Social Communication Scales (ESCS) 5 = MacArthur-Bates Communicative Development Inventory (MCDI) 6 = Parent Interview for Autism (PIA) 7 = Pre-Linguistic Autism Diagnostic Observation Schedule (PL-ADOS)

Cohen's d for these studies by taking the difference in the means of groups 1 and 2, and dividing it by the two groups' combined standard deviation. Cohen himself suggested that d values of 0.20, 0.50, and 0.80 could be designated as small, medium, and large effect sizes, respectively (which equate to r values of 0.10, 0.30, and 0.50) (Dollaghan, 2007; Durlak, 2009). However, it should be noted that many researchers have pointed out that Cohen offered these interpretations only as a general rule of thumb, and that interpretations of d values should be made within the context of several factors. These factors include (1) the quality of research that the effect size was produced from; (2) making comparisons between similar research conditions, rather than between completely different ones; and (3) considering the clinical and/or practical significance of the effect size (Durlak, 2009). These factors were taken into account when interpreting not only d values, but R^2 values as well (elaborated upon in the "Results" section of this meta-analysis).

Confidence intervals for the studies were computed using an online statistics calculator (Soper, 2006). Calculation of most of the confidence intervals required the number of predictors used in the statistics model, the value of R^2 , and the sample size. It should be noted that confidence intervals were largely weighted by sample size, which is evident in the forest plot (see "Results"). For instance, the study by Charman et al. (2003) had a sample size of 9, and therefore a much larger confidence interval than the study conducted by Thurm et al., which had a sample size of 118 and consequently a much more narrow confidence interval. This is logical, as the larger the sample size, the more likely it is that a researcher can be confident in the reliability of their calculated effect sizes (Dollaghan, 2007). For all studies, we chose to use a 95% confidence interval.

Moderator Variables

Baron and Kenny (1986) describe moderator variables as any qualitative or quantitative variable that affects the relationship between an independent variable and dependent variable. This relationship can be affected by either being strengthened, weakened, or changing in direction (i.e., positive to negative). There are several moderator variables that could have affected the relationship between joint attention at the beginning of each study and language outcome at the end; some of

these include: age of participants, length of study, how participants were diagnosed with ASD, how language and joint attention were measured, and the type of joint attention being analyzed.

Referring to Table 4, it is clear to see that there is a large amount of variation between studies in these particular factors. The average chronological age of participants at the beginning of the study ranged between 21 months and nearly 47 months. While early intervention services can begin any time after a child is born, it is very possible that many of the children in these studies were not receiving any services when they participated in these studies. It is also more likely that a child who is older may have been receiving intervention services for a longer period of time than a child who is younger. All of this is important because joint attention skills, along with receptive and expressive language skills, are certainly things that would be targeted in therapy. If any children had or had not already been receiving intervention when the study began, their language and joint attention skills would most likely be affected (i.e. children in therapy might experience a more significant language and/or joint attention growth than children who were not in therapy). Therefore, the age of the children when they began the study – and the likelihood that they were already receiving therapy services as a result of their age – could certainly affect the results in these studies.

The length of time that the studies were conducted also varied somewhat significantly, between one and seven years. This has a similar affect that age does – the longer that a study was conducted, the more likely it was that the children participating in it were receiving intervention services at some point in time, if not for the entire length of the study. It could reasonably be assumed that the longer a child is in therapy, the more they would progress in developing language and perhaps joint attention skills – and this would have an effect on their performance at the end of the study. For example, suppose that a child performs very poorly on a test of joint attention at the beginning of a study that will be conducted for two years. His parents recognize this, and place him in therapy for most of the two years that the study is conducted. At the end of the study, the child is evaluated again, and shows great gains in receptive and expressive language that he might not have achieved without therapy. This child's performance could skew the results of the study, as one

Table 4. Coded Studies

Study Number:	1	2	3	4	5	6	7	8	9	10
Total Number of Participants	52	206	29	18	18	45	35	35	118	60
Number of Participants with ASD	23	98	29	18	9	15	35	35	118	60
Diagnosis of Participants	1, 3	1, 2, 5	1	1, 2	1, 2	1, 4	1	1, 2	1, 2, 5	1, 2
How Participants with ASD were Diagnosed	1, 5	1, 2, 4, 5, 8	1, 2, 5, 8	9, 10	1, 9, 10	5, 6	3, 5, 8	3, 5, 7, 8	1, 4	1, 2, 5, 8
Percentage of Male Participants with ASD	87%	N/A	76%	N/A	N/A	N/A	80%	77%	88%	N/A
Length of Study (Years)	1	7	1	~2	~2	~1	2	~2	3	~2.5
Average Number of Times Participants were Evaluated	3	4	2	2	2	2	4	2	3	at least 3
Average Chronological Age of ASD Participants at Onset of Study (Months)	30.8	29	46.7	20.6	20.6	45	45.59	30.9	29.98	43.6
How Language was Measured	3, 4, 6	2, 5, 10, 11	1, 8	8	8	8	4, 5	4, 7, 9	2, 5, 9, 10	5, 10
Type of Joint Attention Analyzed	5, 6, 7, 8	0	1, 2	3, 4	0	9	1	0	1, 2	1, 2, 3, 4
How Joint Attention was Measured	3	2	4	1	1	4	5	6	7	4

TABLE 5: Questions Used to Determine Internal and External Validity.

Factor	Question
1. Participant Selection	Were participants randomly selected from a population of qualified children (i.e., children that were diagnosed with ASD)?
2. Attrition <20%	Did at least 80% of the children who started the study complete it?
3. Blinding	A. Were the people measuring joint attention and language skill at <i>baseline</i> blinded to the participants' diagnosis (if participants had more than one diagnosis)? B. Were the people measuring joint attention and language <i>outcome</i> blinded to the participants' previous scores, and, if possible, diagnosis (if participants had more than one diagnosis)?
4. Quality of Measurement	A. Does it appear that the joint attention measures used could provide a valid and reliable reflection of joint attention skill? B. Does it appear that the language measures used could provide a valid and reliable reflection of language skill?
5. Administrator Qualifications	Were the people administering the joint attention and language assessments properly trained and qualified to do so?
6. Inter-Rater Reliability	Was there a sufficient amount of inter-rater reliability between people assessing the participants' joint attention and language skills?
7. Statistical Analysis	What type of statistical analysis was used to interpret results?
8. Statistical Significance, Effect Size, & Confidence Intervals	Did the researchers report this information or provide enough data so that they could be calculated?

might interpret that there really is not a relationship between joint attention and language skill at a later age, when in reality, there might have been if time (and therapy) were not involved. The way that joint attention and language were measured, as well as the type of joint attention being analyzed, could affect the relationship between joint attention and later language as well. Table 4 shows the large amount of variation in measurement tools for joint attention and language. Although some measures are more common than others (e.g. the Reynell Developmental Language Scales were used to measure language in four studies, and the Early Social Communication Scales was most commonly used to measure joint attention), a good deal of variability still exists. This variability might have an effect on the studies' results, as well as the overall

effect size of this meta-analysis. It is more difficult to determine the actual effect of joint attention on language outcome when such a wide variety of tools are used to measure these two things and this variety between studies would surely affect overall effect size to some degree. In addition, it is possible that some of the measures that were used by the researchers were simply outdated – which could affect the language and joint attention skill measurements of these children. The type of joint attention skill that was measured could also affect results of the individual studies, as well as overall effect size (i.e., it is possible that one type of joint attention is much more predictive of language outcome than another type).

Table 6. Internal and External Validity Quality Markers of Studies.

Study Number: Factor	1	2	3	4	5	6	7	8	9	10
1) Participant Selection	No ¹	No ¹	N/A ²	N/A ²	N/A ²	No ¹	No ¹	No ¹	No ¹	N/A ²
2) Attrition <20%	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3) Blinding	A. N/A ² B. N/A ²	A. N/A ² B. N/A ²	N/A ⁵	N/A ⁵	N/A ⁵	A. Yes B. Yes	N/A ⁵	N/A ⁵	A. N/A ² B. N/A ²	N/A ⁵
4) Quality of Measurement	A. N/A ³ B. Yes	A. Yes B. Yes	A. Yes B. Yes	A. Yes B. Yes	A. Yes B. Yes	A. Yes B. Yes	A. Yes B. Yes	A. Yes B. Yes	A. Yes B. Yes	A. Yes B. Yes
5) Administrator Qualifications	N/A ²	N/A ²	N/A ²	N/A ²	N/A ²	N/A ²	Yes	Yes	Yes	N/A ²
6) Inter-Rater Reliability	Yes ⁴	Yes ⁴	Yes ⁴	N/A ²	N/A ²	Yes ⁴	N/A ²	N/A ²	Yes ⁴	Yes ⁴
7) Statistical Analysis	Correlation; Regression Analysis	Growth Curve Analysis	Correlation; Regression Analysis	Correlation Analysis	Cross- Sectional, Longitudinal Analysis	ANOVA	ANOVA	Correlation Analysis	ANOVA	Correlation Analysis
8) Statistical Significance, Effect Size, & Confidence Intervals	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: ¹Participants were referred by professionals in the area, or selected based on certain characteristics (e.g. language level) which this author did not consider to be "randomly selected." ²Not explicitly listed in study. ³Unknown whether a standardized measurement was used (i.e. coded by authors) ⁴Inter-rater reliability was good to excellent. ⁵All participants were diagnosed with autism or PDD-NOS, therefore making blinding to diagnosis unnecessary.

Results

Quality Assessment

Table 6 depicts the validity of the ten research studies according to the quality markers explained in Table 5. All ten studies had an attrition rate of less than 20%; and either reported statistical significance, effect size, and confidence intervals, or provided enough data that this information could be calculated. In addition, all of the studies appeared to use valid and reliable measures of joint attention and language skill (apart from Adamson et al. – it was unclear whether a valid and reliable measure of joint attention skill was used in this study), and nearly all of the studies did not utilize blinding to participant diagnosis (which was unnecessary, as almost all participants in the studies were diagnosed with ASD).

According to our analysis, the biggest threats to internal validity were administrator qualifications and inter-rater reliability. Because qualifications of the individuals administering the joint attention and language measures were not explicitly stated in most of the studies, it is impossible to conclude that these individuals were actually qualified to do so. Only three studies (Smith et al [2007], Stone and Yoder [2001], and Thurm et al. [2007]) explicitly stated who administered the measures in their studies (i.e. psychologist, speech-language pathologist, etc.). The remaining seven studies only referred to an “experimenter” or something similar. While it could perhaps be assumed that the experimenter was one or more of the authors – who are often psychologists or speech-language pathologists themselves – it is still unknown for sure who administered measures to the children in these studies. Inter-rater reliability was rated as “good to excellent” in 60% of the studies; however, information on this was not listed in the remaining 40%, which is somewhat problematic. If this type of reliability was poor in any of the studies, this could very well have an impact on the ratings the children received.

Two factors affecting external validity were analyzed: participant selection and having attrition less than 20%. As previously stated, attrition was excellent among all ten studies. However, all ten studies either did not utilize random selection of participants (e.g. participants were referred by professionals in the area), or did not offer any information on this subject. Recruiting participants based on the referral of others is

somewhat risky, as professionals might be more likely to refer children with more severe deficits, rather than any of their clients that would qualify for a study. However, because children diagnosed with ASD at this age are much less likely to be found in easily-accessible groups (i.e., older children might go to a school specifically for ASD, making random selection within the school more feasible), referral from professionals may have been necessary in these studies.

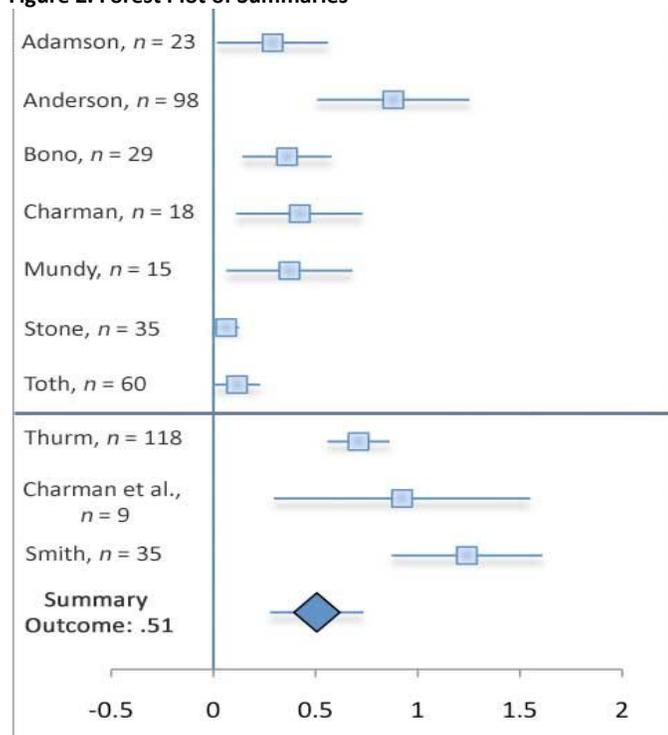
Overall, internal and external validity of the studies was good; only three quality markers out of eight were found to be inadequate in most of the studies. A couple of these quality markers could even be argued as negligible (i.e. random selection and administrator qualifications) due to the nature of the population being studied, as well as the likely possibility that although not explicitly stated, the authors of the studies may have been the test administrators.

Forest Plots

Figure 2 is a forest plot summarizing the results of this meta-analysis. The vertical blue line represents 0, or no observed effect. The horizontal blue line divides the studies into those that were calculated using R^2 (seven studies, above the line) and those that were calculated using Cohen’s d (three studies, below the line). The studies are listed along the left side, along with the number of participants with ASD in that study (n). The effect sizes for each study are represented by blue squares, and a larger blue diamond represents the overall effect size. The horizontal line extending through each of the effect sizes represents the confidence interval; the longer the line, the broader the confidence interval.

Table 7 lists more of the qualitative data, including outcome (measured in R^2 or Cohen’s d), standard errors (SE), confidence intervals (CI), and number of participants with ASD (n). The type of joint attention that was analyzed in each study is also listed in order to allow for easier comparison of effect sizes between studies with similar goals.

Figure 2. Forest Plot of Summaries



Note: Studies listed above the horizontal dividing line were calculated using R^2 . Studies listed below the line were calculated using Cohen's d .

Summary of Results

The overall effect size for all studies was .51, which is considered to be of medium clinical importance. The confidence interval was between 0.277 and 0.734; this is a wider confidence interval and indicates that there is a decent amount of uncertainty regarding the precision of the effect size. Individual effect sizes – as well as their respective confidence intervals – varied substantially. In Adamson et al. (2009), 23 children with ASD were observed interacting with a parent, on average, three times in one year. These observations were taped and organized into six “scenes,” each five minutes in length, which were later analyzed regarding joint attention skill. Several types of JA were coded, but the two primary types were coordinated (attending to both parent and object) and supported (attending to object only). Two standardized tests, as well as an inventory filled out by the parent(s), were used to measure language at the beginning and end of the study. The combined effect size for coordinated and supported JA with regard to language outcome was 0.29 (a small effect size) with a confidence interval of 0.017-0.562 (a wider confidence interval, due to the relatively small sample size).

In the study by Anderson et al. (2007), 98 children with ASD were evaluated four times (at the ages of two, three, five, and nine) over the course of seven years. Language and joint attention skill were measured using standardized tests. The authors did not target a particular type of JA, but their descriptions most closely resembled those of RJA and IJA. The effect size for this study was large (.88), but with a wider confidence interval (0.508-1.252).

Table 7. Outcome of Studies

Study	Type of Joint Attention Analyzed	Number of Participants with ASD	Outcome	Standard Error	Confidence Interval
Adamson et al., 2009	Multiple	23	0.29 ^A	0.11	0.017, 0.562
Anderson et al., 2007	No specific type	98	0.88 ^A	0.19	0.508, 1.252
Bono et al., 2004	IJA, RJA	29	0.36 ^A	0.11	0.142, 0.578
Charman, 2003	Declarative, Imperative	18	0.42 ^A	0.15	0.110, 0.730
Mundy et al., 1990	Gestural	15	0.37 ^A	0.16	0.063, 0.680
Stone et al., 2001	No specific type	35	0.12 ^A	0.06	0.003, 0.228
Toth et al., 2006	IJA, RJA, Declarative, Imperative	60	0.06 ^A	0.03	-0.000, 0.126
Thurm et al., 2007	IJA, RJA	118	0.71 ^B	0.08	0.558, 0.862
Charman et al., 2003	No specific type	9	0.92 ^B	0.32	0.295, 1.550
Smith et al., 2007	IJA	35	1.24 ^B	0.19	0.871, 1.609
Summary			0.51	0.12	0.277, 0.734

Note: ^ACalculated using R^2 . ^BCalculated using Cohen's d .

In Bono et al. (2004), 29 children with ASD were evaluated twice at a medical center, with about a year in between visits. JA (specifically, IJA and RJA) and language skills were evaluated using standardized assessments. The aggregated effect size for RJA and IJA was 0.36 (small-medium), with a confidence interval of 0.142-0.578 (medium). Individual effect sizes for RJA and IJA were 0.49 (medium) and 0.23 (small), respectively, suggesting that RJA had a larger impact on later language than IJA.

Charman (2003) analyzed declarative (sharing awareness of an object/event) and imperative (requesting) joint attention in 18 children with ASD two times over about two years. Language was measured using a standardized assessment, and JA was measured using a toy task designed by the researcher. The aggregated effect size for JA with receptive and expressive language came out to 0.42 (medium), with a wide confidence interval of 0.110-0.730. The effect size for JA and expressive language was 0.29 (small), and the effect size for JA and receptive language was 0.42 (medium), suggesting that JA had a larger impact on receptive language.

In another study by Charman (et al., 2003), nine children with ASD were also seen twice over a period of about two years. Language was measured using a standardized test, and JA (no specific type) was measured using three toy tasks designed by the researchers. The aggregated effect size for JA with receptive and expressive language was 0.92 (large) with a very wide confidence interval of 0.295-1.550 (primarily due to the very small sample size). Charman noted that the effect of JA appeared to be greater on receptive language than on expressive (Charman et al., 2003).

The study by Mundy et al. (1990) looked at gestural JA with regard to language skill in 15 children with ASD. The children were observed twice over the period of about a year, and their skills were measured using developmental scales. The calculated effect size was 0.37 (small-medium) with a very wide confidence interval of 0.063-0.680 (again, due to the small sample size used in this study).

In Smith et al. (2007), 35 children with ASD were observed four times in their home communities over

the course of two years. This was one of the few studies where participants were reported to receive 15-20 hours per week of speech and language therapy. The researchers measured IJA and language using standardized assessments. IJA was found to have a strong impact on language, with an effect size of 1.24 and a narrower confidence interval of 0.871-1.609.

In the study by Stone and Yoder (2001), language skill and JA (no specific type) were analyzed in 35 children with ASD two times over two years. Standardized assessments, as well as parent questionnaires, were used to measure language skill and JA. Parents also reported hours of speech and language therapy that their children received over the two years. The calculated effect size for this study was small, coming out to 0.12, with a significantly wide confidence interval of 0.003-0.228.

Thurm et al. (2007) analyzed IJA and RJA with regard to language outcome in 118 children with ASD. The children were seen three times over three years, and completed standardized assessments to measure their JA and language skills. The aggregated effect size for IJA and RJA was 0.71 (large) with a medium confidence interval of 0.558-0.862.

Finally, in the study by Toth et al. (2006), 60 children with ASD were seen at least three times over the course of two and a half years. Their language and JA skills (mainly, IJA and RJA) were measured using standardized assessments and developmental scales. The aggregated effect size for IJA and RJA with regard to language outcome was 0.06 (small), with a narrow confidence interval of -0.000-0.126.

Overall, a small majority of the calculated effect sizes were small to medium, with wide or very wide confidence intervals. Four studies (Anderson, Charman, Smith, and Thurm) did yield large effect sizes, but their confidence intervals varied from narrow to wide. The studies by Smith and Thurm yielded the most clinically significant results, with large effect sizes and narrow or medium confidence intervals – however, while Smith concluded that IJA had a significant effect on language outcome, Thurm concluded that RJA had a significant effect. Out of all of the studies – regardless of effect size – RJA was most often found to have an impact on language outcome. In addition, joint attention in

general was found to affect receptive language more often than expressive language.

Discussion

A recurring theme throughout this meta-analysis has been the significant amount of variation between studies – especially in the type of joint attention analyzed and how JA and language were measured, among other factors. This variation indubitably had an effect on the results that were calculated in each study, and how generalizable these results are to other settings and children with autism. The author hopes that, with the previous discussions of moderator variables, interpretation of effect sizes and confidence intervals, and of the general variation of all included studies, that readers will be able to interpret the results of this meta-analysis appropriately. While this might appear to be a modest interpretation of the results, there are several benefits to be gained and lessons to be learned from this meta-analysis.

First, it is apparent that some type of relationship between joint attention and language outcome in children with autism exists, although some light still needs to be shed on the exact nature of that relationship. Some studies in this meta-analysis indicated that RJA appears to have a greater impact on language outcome than other types, and that joint attention in general seems to affect receptive language to a greater degree than it does expressive language. This is important, because it could be argued that in some cases, a lack of receptive language is even more detrimental than a lack of expressive language. For example, if a child with autism is unable to respond to his name or to engage at all when an adult or peer tries to interact with him (receptive language skills); the chance of him communicating expressively is much smaller. In other words, receptive language can be viewed as an important – and perhaps necessary – precursor to developing expressive language. Therefore, if joint attention does have a greater effect on receptive language (as some studies suggested), then it is crucial that joint attention be targeted in therapy with children with autism. If these children are able to develop stronger joint attention skills, their receptive skills might follow suit – which could in turn pave the way for the development of stronger expressive language skills.

Second, this meta-analysis suggests that more robust studies need to be done on this particular subject, and reinforces the need for more research in general within the field of speech-language pathology. Joint attention and how it relates to language growth in children with autism is certainly a very specific subject matter, but given the fact that so many candidate articles were identified for this meta-analysis, it seems quite probable that more studies on this subject will be conducted in the future. This means, however, that future researchers also need to take care to perform research that has more internal and external validity. It would also be beneficial for future researchers to focus on one or two more common types of joint attention, rather than a more obscure one. (Recommendations for future researchers are elaborated upon in the final section of this article.) This meta-analysis also reinforces the constant need for more research within the field of speech-language pathology in general. When one considers how many graduate programs are beginning to emphasize evidence-based practice, the need for new research in our field becomes even more critical. In order to gain a better understanding of this subject matter (and others), and consequently deliver more effective and appropriate therapy to clients, more and higher-quality studies need to be completed.

Finally, analyzing the effect sizes of some of the better-conducted studies in this meta-analysis can lend some insight into joint attention, as well as provide guidance for future research. While we still have a lot to understand about exactly how joint attention affects language outcome in children with autism, a couple of the more robust studies definitely contribute to our understanding. For instance, the study by Thurm et al. (2007) was performed on a larger sample size ($n = 118$), had relatively strong internal and external validity, and used valid and reliable measurements of joint attention and language skill. Because of this, it is reasonable to conclude that the results of this study – a large effect size of 0.71 with a medium confidence interval – are statistically significant, and can lend some insight into how we approach receptive language treatment with children with autism. Future researchers could also benefit from striving to produce a study of this quality when analyzing joint attention and language outcome.

Comparison to Expected Results

These results were certainly not unexpected, given the large amount of variation in many parts of the studies. Referring back to Table 4 shows this very clearly: there was a substantial amount of variation especially in the number of participants, how participants were diagnosed with ASD, length of the study, average age of participants, how language and JA were measured, and what type of JA was analyzed. While variation within one or two of these areas might cause *some* discrepancy between study results, variation within seven areas is bound to have more significant effects – and this was certainly observed in the results that we calculated from these studies. In addition, research on autism – and especially, joint attention skill in children with autism – is still relatively new within the field of speech-language pathology. In fact, it could even be stated that research in general is much newer to the field of speech-language pathology than it is to other fields, such as psychology and medicine. Therefore, given the facts that (1) the studies varied considerably; (2) a limited amount of studies on this topic exist, and (3) we as a profession are still developing our research skills, the results of this meta-analysis were surely to be expected.

Limitations

Several limitations affected the conduction of this meta-analysis. First, although many combinations of search terms – as well as a variety of databases – were used when looking for research articles online, it is certainly possible that some relevant articles could have been overlooked. Second, as stated several times, the large amount of variability between the studies limited our ability to obtain a clearer picture of exactly how joint attention affects language outcome in children with autism, or how certain types of joint attention might affect it. Finally, the small sample sizes in most of the studies had a significant effect on confidence intervals, and our ability to generalize results to other settings and children with ASD.

Recommendations

The findings of this meta-analysis have provided two major recommendations for future research within this field. First and foremost, more, higher-quality research needs to be conducted on the subject of joint attention and its effect on language outcome in children with autism. It will be impossible to continue to learn about

this phenomenon if no further research is conducted on the subject. The research conducted also needs to be of higher quality – i.e., randomly selecting participants, rather than relying on referrals; using much larger sample sizes; and ensuring that valid and reliable measures are used *and* are administered by qualified individuals. The second major recommendation for future research (although perhaps a bit optimistic) is that there is more agreement between researchers on tests, scales, and questionnaires used to measure joint attention and language in this population; as well as an agreement of what types of joint attention to focus on. Future researchers could benefit from communicating with one another (as much as possible) about which measures are the most appropriate to use with young children with autism, as it seems unlikely that each of the several different types used here would all be the best choice. In addition, it might be beneficial for researchers to focus on one or two types of joint attention in future research. Since several studies in this meta-analysis analyzed IJA and RJA, and because some results suggest that RJA has an effect on later language outcome, these two types of joint attention might be worth looking into. ♦

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connections. Cell connectivity is strengthened with repeated activation of neurons. Participation in specific interventions can increase cell production and recruitment of neurons and has been shown to improve functional outcomes in persons with BI. Neurons and networks can be protected through participation in a variety of interventions that are novel. Learning new skills and developing healthy habits and routines can offset decline in persons with BI (Nussbaum, P., 2003). The use of performance strategies can allow persons with BI to perform skills necessary for function. Feedback and subsequent modifications to performance can stimulate the reorganization of the brain to allow for continued improvement in performance. Interventions targeted to improve specific motor skills increase the excitability and expand the representation of neurons in the primary motor cortex. Interventions that require skilled movements in combination with cognitive challenges can enhance cortical excitability.

Interventions that target a specific brain function lead to an enhancement of that function. The nature of the intervention dictates the nature of the plasticity, a principle referred to as *specificity* (Kleim, J. & Jones, T., 2008). The production of site-specific neurons is dependent upon the type of intervention. A specific intervention targets and changes a specific subset of neural circuitry. Interventions designed to target specific skills enhance the plasticity of the corresponding region of the brain. Neurons are organized into circuits that process specific kinds of information. The arrangement of neural circuits varies according to their intended function. The synaptic connections that increase neuronal activity correlate with skill acquisition.

Induction of plasticity requires sufficient *repetition*. NP is influenced by the efficiency of neural circuits and is enhanced by repeated use. Repetition of newly learned skills is required to induce lasting neural changes. Plasticity requires continued performance of skills over time. The plasticity brought about through repetition makes the skill resistant to decline. Repetition of newly learned skills is critical to the stimulation of brain plasticity required for retention of newly skills. Practice stimulates the reorganization of the brain to allow persons with BI to continue to improve their performance.

Induction of plasticity requires sufficiently *intense* interventions (Kleim, J. & Jones, T., 2008). Neurons that form new synaptic connections vary in their sensitivity for receiving signals that determine degree of responsiveness to specific interventions. Environments rich in multi-sensory experiences and that are novel can sustain brain capacity across the lifespan for persons with BI, a concept referred to as *enriched environments* (Passineau, M.J., Green E.J. & Dietrich, W.D., 2001). Interventions that provide multi-modes of stimulation increase the intensity and can reverse the effects of decline and improve function (Wagner, A. K. et al., 2005). The sensory systems that have the most dramatic impact on performance are the primary vestibular, tactile and proprioceptive systems. Interventions that require more intense skills increase the number of synapses over a longer length of time. Environments rich in opportunities for participation in interventions that require new learning of new skills that have a physical and/or social component can have a dramatic impact on brain plasticity (Gauike, L.J., Horner, P.J. Fink, A.J., McNamara, C.L. & Hicks, R. R., 2005). Factors that increase the NP value include variety, novelty and activation of a primary sensory system(s). Interventions that require novel learning of more intense skills that include a motor component are highly effective in inducing plasticity.

Different forms of plasticity occur at different times during intervention. The alteration in excitability of neurons provides an opportunity for plasticity. New neurons are more dependent upon learning than mature neurons. The ability to maintain change is negatively impacted by the lapse in time between participation in a newly learned task. *Time* is critical, given the dynamic changes in the neural environment that occur with BI (Kleim, J. & Jones, T., 2008). Major cascades of neuronal reactions occur as BI progresses. There is a critical period for survival that occurs immediately following the formation of new neurons in persons with BI. Enhanced synaptic responses are more susceptible during early phases of recovery than later stages. The timing of the intervention determines whether it is protective by sparing neurons and loss of neural connections or whether it stimulates reorganization of remaining connections. Interventions typically have a greater impact during the early stages of recovery however improvements in function can continue throughout the lifespan.

Interventions must be *salient* (or relevant) to induce plasticity (Kleim, J. & Jones, T., 2008). The relevance of a task correlates with the motivation to engage in a task (Reed, K. L. & Sanderson, S. N., 1999). Synaptic responses that stimulate the reward pathway provide reinforcement for sustaining participation in a task. The ventral tegmental area and nucleus accumbens transmit dopamine, a neurotransmitter responsible for the sensation of pleasure. Engagement in specific interventions that are perceived as meaningful are correlated with the production of increased levels of norepinephrine. Engaging in interventions that are meaningful and purposeful stimulate dopamine that binds to and activates receptor sites in the reward center of the brain to create the sensation of pleasure. When feelings of pleasure are associated with the task, the behavior is repeated and becomes reinforced. The personal relevance of the task influences the ability to learn and recall it. The relevance of a task correlates with the motivation to engage in the task. Motivation to participate in environments rich in significance is a critical factor in promoting and maintaining a healthy brain. It is beneficial for the therapist to work collaboratively with the person and the family/caregivers to ensure that the goals and interventions are personally meaningful to each individual person (Melville, L. L., & Nelson, D. L., 1996, 2001).

Persons with BI often experience a lack of awareness of their deficits and may not appreciate the benefit from participation in specific interventions. Helping persons with BI recognize the need for participation in specific interventions can be challenging. Participation in specific interventions can help persons with BI gain awareness of their priorities and challenges, with these reflections resulting in the establishment of relevant goals (Melville, L. L., Baltic, T. A., Bettcher, T., & Nelson, D. L., 2002). Involving the person in the decision-making process by asking them to reflect on their performance can be helpful in establishing goals that are realistic and meaningful.

Interventions that address environmental barriers can improve the safety and independence in persons with BI within the home and community (Veloza, C. A., & Peterson, E. W., 2001). When feasible, interventions should take place in both the person's home and community (Barnard, S., Dunn, S., Reddie, E., Rhodes,

K., Russell, J., Tuitt, T.S., et al., 2004). Collaborative problem-solving is effective when followed by practice, feedback, self-evaluation, modification and more practice. The person gradually learns that recovery is an ongoing process that results from participation in everyday tasks and is not limited to participation in therapy.

Intervention-induced plasticity occurs more slowly in the aging brain of a person with a neurological condition. Neurological injury influences the health and productivity of the brain with age. Synaptic potential, neural connections and cortical map reorganization can all decrease with age in persons with BI. Aging in persons with BI is associated with neuronal and synaptic atrophy and physiological decline. Cognitive decline reflects the progressive failure of plasticity in compensating for impairments with age in persons with BI. Brain reserve is not limited or fixed at any given age. Neural plasticity has the potential to continue with aging in persons with BI. The aging brain continues to be responsive to participation in intervention, although the changes are less profound and occur more slowly. The process of aging is minimized in persons with BI who engage in interventions that require newly learned skills that include a cognitive and/or motor component.

Plasticity in response to one intervention can enhance the acquisition of similar behaviors. Learning to perform a new skill induces brain changes that are specific to the corresponding region(s) of the brain. *Transference* refers to the ability of plasticity within one set of neural circuits to promote simultaneous plasticity (Kleim, J. & Jones, T., 2008). Repeated practice stimulates the reorganization of the brain to allow persons with BI to generalize their newly learned skills. Plasticity enhances the acquisition of skills necessary for engaging in interventions that vary in task parameters. As plasticity continues, the brain has the potential to transfer learning to new tasks, a process referred to as "graded learning." Interventions can be graded in complexity by changing the task parameters slightly, significantly, or completely as the individual's skill level improves.

Plasticity in response to one intervention can interfere with the acquisition of other behaviors. *Interference* refers to the prevention of the induction of new or expression of existing plasticity (Kleim, J. & Jones, T., 2008). Persons with BI can develop and utilize strategies

that prevent brain plasticity through the use of compensations that make it easier to perform tasks but that interfere with the acquisition of new skills. If the brain learns to cope with the damage or decline with compensation, the potential for the generation of new networks may be reduced. When the compensations are adopted early, they become reinforced with repetition.

Complexity is an important parameter for driving NP and has a potential lasting effect on both brain and behavior (Kleim, J. & Jones, T., 2008). Interventions that require complex movements have been shown to promote greater plasticity and efficacy than interventions that require simple movements. Neurogenesis is enhanced through the processing of varied sensory information. Persons with BI can benefit from participation in specific interventions that are meaningful and that require the integration of motor, sensory, perceptual and cognitive skills. Interventions that target cognitive and physical health produce change patterns in neural connectivity.

Persons with Parkinson's disease (PD) who have decreased endurance and fatigue can benefit from participation in interventions using effortful and repetitive movements, with a focus on increasing deliberate movements through their complete range of motion (Deane, K. H. O., Ellis-Hill, C., Dekker, K., Davies, P., & Clarke, C. E., 2006). *Intensive*, high effort interventions can be difficult for persons with PD due to sensory deficits, fatigue and depression (Kleim, J. & Jones, T., 2008). Intensive practice is influential in maximizing and sustaining neural plasticity. Intensity can be increased through frequency, duration, repetition, difficulty (effort and accuracy), complexity and amplitude (Gaudet, P., 2002).

A significant principle to guide intervention for persons with PD is to design participation in interventions with the focus on *amplitude* in movement patterns that increase the speed of upper limb movements for reaching and lower extremity movements for walking (Kleim, J. & Jones, T., 2008). Cues that help focus attention on movements and attention that promote conscious effort can improve walking, reduce freezing (sudden stopping) and enhance task performance (Taba, P., & Asser, T., 2005). Persons diagnosed with PD have been shown to be more responsive to specific

principles of NP (Dixon, L., Duncan, D. C., Johnson, P., Kirkby, L., O'Connell, H., Taylor, H. J., & Deane, K., 2007). Dopamine regulates the level of neural activity required to start or end a movement. Muscle activation becomes inadequate when dopamine levels drop, resulting in movements that are slow or incomplete. Lower dopamine levels interfere with the ability to maintain upright posture required for the initiation of movement and responding to changes in the environment (Farley, B. G., & Koshland, G. F., 2005). Interventions designed to activate the extensor muscles of the trunk can improve upright posture and balance reactions of persons with PD, thereby reducing the risk of falls and decreasing the pain associated with musculoskeletal deformities (Ashburn, A., Fazakarley, L., Ballinger, C., Pickering, R., McLellan, L. D., & Fitton, C., 2007). Interventions designed to increase the mobility of the trunk reduces the rigidity of the muscles common to those with PD (Guttman, M., Kish, S. J., & Furukawa, Y., 2003). Persons with PD may perceive normal movements as "too big or too fast" (Rao, A. K., 2010). This misperception is resultant of the discrepancy between how people move and how movements feel. Interventions that encourage this population to perform large and fast movements using a more conscious effort increase the activation of the muscles (Movement Disorder Society Task Force on Rating Scales for Parkinson's Disease, 2003). Teaching persons with PD to "think big" increases muscle activation. As PD progresses, complex, adaptive, everyday movements are reduced (Jenkinson, C., Fitzpatrick, R., Norquist, J., Findley, L., & Hughes, K., 2003). This loss in automaticity requires conscious attention to task performance.

Given that persons with BI are at higher risk for falls, practitioners would benefit from inquiring as to not only the frequency of person's past falls but also to the circumstances of those falls (Balash, Y., Peretz, C., Leibovich, G., Herman, T., Hausdorff, J. M., & Giladi, N., 2005). Consideration of a person's physical and cognitive level of function is beneficial when selecting interventions in collaboration with persons with BI. When feasible, interventions should be varied and take place in both the subject's home and community (Clark, P., Azen, S.P., Zemke, R., Jackson, J., Carlson, M., Mandel, D., et al., 1997). Falls can be decreased through the collaborative analysis of the discrepancies between a person's abilities and the challenges they experience within their home and community environments

(Gillespie, L.D., Gillespie, W.J., Robertson, M.C., Lamb, S.E., Cumming, R.G., & Rowe, B.H., 2003). Practicing performance strategies, the use of adaptive aids and modifications to the environment within the naturalistic context can maximize safety and independence (Matuska, K., Giles-Heinz, A., Flinn, N., Neighbor, M., & Bass-Haugen, J., 2003). A home and community-based approach to intervention may result in the reduction or cessation of falls for persons with BI. Participation in specific interventions can promote the performance skills required for safe and independent mobility within the home environment by negotiating unpredictable environments.

It is beneficial for the practitioner to work collaboratively with the person with BI to insure that the goals and interventions used are personally meaningful to each person. Inclusion of the family and/or significant other(s) in the therapeutic process can be beneficial. Persons with BI have identified interests in specific interventions that include reading, writing, participating in games and playing musical instruments (Verghese, J., Lipton, R. B., Katz, M. J., Hall, C. B., Derby, C.A A., Kuslansky, G., et al., 2003).

Collaborative problem solving is effective when followed by practice, feedback on performance and more practice implementing the suggestions made. Falls can be reduced through the collaborative analysis of the discrepancies between the person's abilities and challenges within the home and community environment, the implementation of performance strategies, the use of assistive devices and modifications to the home. Practicing the use of performance strategies, devices and equipment within the context of the modified home and community will enhance functional independence and safety during interventions and thereby the quality of life (Farias, S. T., Mungas, D., Reed, B.R., Harvey, D., Cahn-Weiner, D., & DeCarli, C., 2006). Using this approach to intervention, persons may become successful in achieving self-identified goals by reducing the risk of falls.

Aerobic activity has been correlated with an alleviation of the negative effects of BI on brain structure. Regular participation in interventions designed to improve cardiovascular conditioning, strength, flexibility and balance have been identified in the literature as being

effective in delaying the symptoms associated with BI. Persons with BI have identified interests that include playing tennis and golf, swimming, bicycling, dancing, participating in group exercise classes, playing team games including bowling, walking and doing housework. Interventions that include aerobic conditioning, stretching and strengthening have been proven to be beneficial. Participation in interventions for 30 minutes per day, five times weekly is correlated with delayed symptoms associated with BI. These include walking, riding a stationary bicycle, swimming and aerobic classes. Strengthening has been shown to improve balance and reduce falls. Stretching decreases rigidity and improves posture through the lengthening of muscles. Interventions that require trunk rotation can improve functional mobility and functional performance. Persons with BI can benefit from participation in yoga to improve their awareness of posture and movement with an emphasis on relaxation and breathing. Tai chi provides whole-body, large-scale and purposeful movements that are associated with reduced falls in persons with BI.

Mental and physical fatigue is common among persons with brain injury. Specific interventions that provide education and application of practical strategies designed to conserve energy that include pacing have been effective in increasing overall endurance.

Persons with BI often report depression related to feelings of helplessness resultant of the physical and social limitations associated with their condition (Beck, A.T., Steer, R.A., & Brown, G.K., 1996). Participation in interventions can be helpful in coping with an emotionally painful decline by living as fully as possible (Miyasaki, J. M., Shannon, K., Voon, V., Ravina, B., Kleiner-Fisman, G., Anderson, K., Weiner, W. J., 2006). A home and community-based approach to intervention can result in greater health-related quality of life (Starkstein, S. E., Mayberg, H. S., Preziosi, T. J., Andrezejewski, P., Leiguarda, R., & Robinson, R. G., 1992). Participation in spiritually-based practices has shown to improve life satisfaction in persons with BI (Veazey, C., Aki, S. O. E., Cook, K. F., Lai, E. C., & Kunik, M. E., 2005). Participation in productive occupations that include volunteering, participation in the planning and preparation of meals and maintaining social contacts with friends have been associated with improved quality of life by persons with BI.

A search of the literature revealed minimal case descriptions of experience-dependent therapeutic approaches designed to improve the neural plasticity in persons with BI. As a result of the lack of evidence-based practice approaches, the following research questions may provide important insights into the most effective intervention approaches for persons with BI:

1. Does failure to activate specific brain functions lead to a decline in functional performance?
2. Do interventions that target specific brain function improve that function?
3. Does the nature of the intervention determine the nature of the recovery?
4. Does repetition improve functional recovery?
5. Does the intensity of intervention improve functional recovery?
6. Do different functions occur at different times throughout intervention?
7. Do interventions that are meaningful and purposeful enhance functional outcomes?
8. Is recovery following brain injury influenced by age?
9. Does recovery of function in one area of performance improve recovery of function in similar areas?
10. Can recovery in one area of performance interfere with recovery of performance in other areas?

Now that practitioners have a better understanding of principles that guide experience-dependent neural plasticity, practitioners have an opportunity to design applied research studies with the goal of answering these questions. An understanding of these principles as they apply to persons with BI can improve functional outcomes. Designing specific interventions based upon these principles have the potential to develop evidence-based practice with the goal of enhancing functional outcomes for this population. ♦

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Piglet: "Pooh?"
Pooh: "Yes, Piglet?"
Piglet: "I've been thinking"
Pooh: "That's a very good habit to get into Piglet!"



Research has emphasized the economic, social, and cognitive advantages available to maintain the native language (García & Ñañez, 2011; Li & Edwards, 2010; Pease-Alvarez, 1993; Shatz & Wilkinson, 2010). The first language (L1) of a child is part of their personal, social and cultural identity. For some students, developing and maintaining their L1 is easy because their instruction is in their L1. However, the vast majority of ELL students in U.S. receive instruction in English only (Shatz & Wilkinson, 2010). The English only education puts these children at risk of losing their native language, and limiting their linguistic opportunities (Portes & Rumbaut, 2001; Shatz & Wilkinson, 2010). Bilingual families have reported changes in their communicative behaviors due to a loss of the child's native language (Wong-Fillmore, 1991). Nevertheless, some studies have suggested various strategies to support dual language acquisition in preschoolers (Winsler, Espinoza, Rodriguez, 1999; Ryan 2005; 2007). The use of the child's L1 can become a tool for helping the child build a bridge between their vocabulary in their L1 and the acquisition of new vocabulary in the second language (L2). This vocabulary will impact the child later on in their learning abilities for listening, speaking, reading, and writing by increasing their language, vocabulary and literacy skills (National Reading Panel, 2000; Shatz & Wilkinson, 2010; Vandergrift 2006;). Researchers state that children who come from special populations need more opportunities to learn new words and intensive instruction for their academic success (Wasik, Bond, & Hindman, 2006). To ameliorate the impact of academic difficulties, due to an inadequate amount of expressive English vocabulary, the vocabulary growth and the use of the child's first language (L1) should be considered. Because of the increasing number of ELL students and increasing demands for academic accountability there is an urgent call to the research community to contribute in the area of vocabulary and literacy development for ELL (Hammer, Jia, Uchikoshi, 2011; Shatz & Wilkinson, 2010; Lugo-Neris, Wood Jackson, Goldstein, 2010; Vandergrift 2006).

L2 Vocabulary Acquisition

Successful strategies have been developed where the use of the child's L1 has been used as a tool to promote language growth in both L1 and L2. The current study was framed on the linguistic interdependence model (Cummins, 1979) that proposes a two way transfer

model where literacy in both languages is facilitated. In the linguistic interdependence model a conceptual mechanism permits that linguistic and literacy related knowledge learned in the L1 of the person can be exercised on the learning of academic skills and knowledge into the person's L2. The new knowledge in the L2 then feeds back into the L1. Based on this concept, the ELL will not re-learn in English, but he or she will recode using already learned knowledge of his or her L1. During the initial stages of learning the new language, the ELL children use mastery of their L1 as a "scaffold" for learning their L2 (Cárdenas-Hagan & Carlson, 2007). This facilitates acquisition of the English word.

Researchers have explored techniques and strategies that support lexical acquisition in school and at home. It is easier to acquire vocabulary words through translation than it is through explanation (Gunning, 2010). Vocabulary is a key to later language and academic skills and vocabulary size has been found as a predictor for reading comprehension (Kame'enui, & Baumann, 2012) and literacy skills (August & Shanahan, 2006). Two models of bilingual representation describe the process of how people process vocabulary when learning a new language; Word Association and Concept Mediation models (Potter, Eckardt, & Feldman, 1984). In Word Association, children gain access associating concepts in their L2 through their L1 lexicon (vocabulary). In the Concept Mediation Model it is theorized that children who are learning two languages will eventually be able to independently develop direct links in each language rather than having interdependent conceptual links to vocabulary items and concepts (Potter et al, 1984). In other words, children will stop requiring making "bridges" between their L1 and L2 to acquire vocabulary.

Researchers have widely recommended storybook reading for promoting early literacy skills and language in children. Dialogic Book Reading is one of the most effective early literacy, language and vocabulary interventions for acquiring literacy skills and vocabulary development (Biemiller & Boote, 2006; Justice, Meier, & Walpole, 2005) because it permits the children to participate actively in the book reading experience (McVicker, 2007). Although much of the research focuses on K-12 instruction, two recent studies have reported the use of reading techniques to enhance

vocabulary in students who are learning English as a second language with positive effects in the acquisition of vocabulary in their L2. By incorporating the child's L1 to promote English development for 2 weeks, Lugo-Neris, Jackson, & Goldstein, (2010) found a significant improvement in naming, receptive knowledge, and expressive definition skills in children that received Spanish as a bridging tool for learning English. On the other hand--in the same study--children that were identified as having limited Spanish and English, showed significantly less vocabulary growth than those with strong skills in Spanish. This study recommends that future research examine the effect of bilingual language techniques for children with limited skills in both languages with alternatives like tangible manipulatives and additional instruction. Collins (2010) investigated the effects of rich explanation, base vocabulary and home reading practice on children who are learning English as their second language with native Portuguese language. After a 3 week period, it was found a significant acquisition of story book vocabulary that was considered "sophisticated."

From these studies we can thus conclude the following; First, there is a limited amount of research related to the effect of vocabulary acquisition in children with limited proficiency in L1 (Spanish) and L2 (English) in preschool (Castro et al. 2011). Second, more studies of the role of L1 and L2 vocabulary growth are warranted. Third, none of the aforementioned studies compared a non-stimulated group with their experimental groups. Fourth, although evidence suggests positive effects in the acquisition of vocabulary, the intervention time was between 3-4 weeks which may not yield sufficiently strong data related to vocabulary growth.

The present study used vocabulary strategies in Spanish and English in preschoolers who are learning English as a second language to test the hypothesis that the native language can be used to enhance vocabulary growth faster than vocabulary strategies in English-only. The purpose of the present study is to determine the effectiveness of using L1, specifically Spanish, to enhance vocabulary growth in both the L1 and L2 of children who are ELL. This study addresses the following question: Is there a difference in vocabulary growth between the groups of children who are learning English as a second language with limited English proficiency when they receive vocabulary

enrichment in English and Spanish or English only when compared to the control group?

Methods

Participants

Parents and children were recruited from a large urban Head Start program with a considerable Hispanic population. Head Start promotes school readiness for children in low-income families by offering education and other essential services for the community (Love, Chazan-Cohen, Raikes, & Brooks-Gunn, 2013). The instruction in this Head Start is primarily English-only.

The participants were included in this research study if the family reported Spanish as the first language at home. In addition, the children were tested during the treatment for language proficiency in Spanish and also in English. Three primarily English-speaking classrooms that provide services to Spanish speaking children were selected. The principal investigator has had extensive contact with this site as a service provider for bilingual children during the last two years. Twenty Spanish speaking pre-school children (3-5 yrs old) and their parents agreed to participate and provided consent. Of the 20 children, sixteen (12 boys and 4 girls) completed all the tests and activities. Children ranged in age from 41 to 64 months, with a mean age of 55 months (SD= 6.61). No child was identified or reported with any disability, cognitive, sensory or physical impairment. All 16 children were able to communicate in Spanish fluently.

Measures and Tests

Standardized Assessment

Two batteries of tests were given to the children. The Preschool Language Assessment Scales – Spanish, (PreLAS - S; De Avila & Duncan, 2002) and The Preschool Language Assessment Scales – English (PreLAS, 2000; Duncan & De Avila, 2002) were administered to examine the children's proficiency in each language respectively. The mean standard score obtained on the PreLAS-S (Spanish Proficiency Test) was 89.3 (SD= 12.4). The mean standard on the Pre-LAS (English Proficiency Test) was 63.5 (SD= 9.5).

Target Vocabulary measures

The target Vocabulary test was created with the objective to identify the child's receptive and expressive vocabulary gain after the intervention period in both

Spanish and English languages. The target vocabulary tests were developed by the principal investigator. The target vocabulary words were taken from the text of the storybook. Names, verbs and adjectives were chosen with diverse complexity and frequency of use. Receptive and expressive target vocabulary tests were given to the children before the intervention began with a computer. The same target vocabulary with different images was given to the children when the intervention finalized in a computer. For the receptive test the examiner presented four vocabulary pictures in the computer monitor to each participant. The four vocabulary words for the test were selected in the same semantic category. All pictures presented to the children were color photos. The examiner stated the vocabulary word that referred to one of the pictures. The child then pointed to the image on the computer monitor of the computer. The naming or expressive test consisted of presenting an image on the computer monitor and requiring the child to name the verb, concept or object presented. The total score was 43 target vocabulary words and was calculated on a form made by the principal investigator. Pre intervention test scores and post intervention test scores were subtracted respectively to obtain the vocabulary gain during the 6 weeks of intervention.

Group Assignment

Children were assigned to one of three groups (Figure 1) using simple randomization. In the Spanish-English-Group (SEG), the children were stimulated first in English and then a translation in Spanish followed. Five children participated in the (SEG) (3 boys, 2 girls). In the English only Group (EG), the same books and activities were used with the children, but in English only. Five children participated in this group (4 boys, 1 girl). The third group, the Control Group (CG), did not receive intervention. The CG consisted of five children (5 boys).

Figure 1

Randomized Group	Spanish-English Group (SEG)	English Only Group (EG)	Control Group (CG)
# of Participants	5	5	5
Gender	3 boys 2 girls	4 boys 1 girl	5 boys

Intervention

Target vocabulary in 6 story books for children were selected in English and translated into Spanish for the group stimulated in both languages. One book reading and follow-up activity were repeated two times in a week with the same book and vocabulary each week, continuing for 6 weeks of intervention. The intervention groups (SEG and EG) received vocabulary stimulation which included a 15-20 minute book reading session followed by a target vocabulary activity. The target vocabulary activity consisted of identifying images on a computer.

The interventions were organized as follows:

- a) The researcher invited the children to participate in a space prepared for the book reading in the Head Start. This place was in a quiet separate room from the classroom
- b) The researcher introduced and read the book. The researcher used techniques like repetition of vocabulary words, open ended questions, expansions and extensions (Justice, et al.2005; Biemiller & Boote, 2006) to promote vocabulary learning.
- c) Once the book was finished, the children did an activity that included the target words by orally identifying images on a computer. This activity was carried out as a group activity; all children were exposed at the same time to the target words. After 6 weeks of intervention, the CG received the Spanish and English intervention.

Strategies

Unlike the SEG, the EG received the intervention noted above, but without the translation in Spanish. The following strategies were used during the group reading: First, the target vocabulary words were pre-selected and sentences were translated in the L1 language for SEG. During the readings, simple definitions of the target vocabulary words were offered in L1 and L2 for SEG and L2 for EG. The clinician asked the students to repeat words in both languages L1 and L2 for SEG and in L2 for EG. The use of gestures and actions for verbs and pointing to pictures are motivational strategies used to help learners to understand the meanings that words carry. Finally, for the SEG, students were asked to translate the target vocabulary word in L1 or L2 during the reading of the

story and during the naming of the pictures after the story was read.

Results

Four dependent variables were used to measure the children’s vocabulary growth of the target words: (1) Spanish receptive vocabulary, (2) English receptive vocabulary (3) Spanish expressive vocabulary (naming), and (4) English expressive vocabulary (naming) in all three groups.

The analysis addressed the following (a) Time: Pre-intervention vocabulary baseline compared to post-intervention vocabulary. (b) Language intervention: Target vocabulary acquisition in groups SEG, EG and CG was being compared.

A repeated-measure ANOVA was computed to find the differences among SEG, EG and CG and the gain in vocabulary over time at an alpha level of 0.05. All the scores were analyzed in a data analysis web program Stat Crunch™. A descriptive summary of each language proficiency group’s scores was conducted to determine the effect of language vocabulary (Table I).

Vocabulary growth in ELL among groups

Receptive Outcome Measure

There was no significant difference among either experimental groups or the control group for use of targeted vocabulary in the receptive Spanish and receptive English vocabulary gain.

Expressive Outcome Measure

Repeated measures ANOVAs with a Tukey adjustment were computed to examine the differences over time for all three groups. The SEG groups showed a significant increase in both Spanish (Mean Diff 7.6, Std. Error=1.93, p=0.04) and English (Mean diff= 7.4, Std. Error=1.50, p=0.04). The EG group showed a significant increase in English vocabulary use only (Mean Diff=7, Std. Error = 1.63, p=0.04).

Discussion

The purpose of the present study was to determine the effectiveness of using L1, specifically Spanish, to enhance vocabulary growth in both the L1 and L2 (English). This study intended to answer the following questions: Is there a difference in vocabulary growth in ELL with limited English proficiency who received

Table I. Vocabulary differences over time (N=16).

Dependent Variable	Receptive Spanish	Receptive English	Expressive Spanish	Expressive English
	Difference	Difference	Difference	Difference
Group	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
SEG N=5	11 (2.88)	10.4 (4.36)	7.6* (1.93)	7.4* (1.50)
EG N=6	5 (2.32)	7.33 (3.1)	5.33 (1.90)	7.0* (1.63)
CG N=5	2.6 (3.07)	0.8 (0.48)	1.0 (0.83)	1.8 (0.73)

*Significant at 0.05 level

vocabulary enrichment in both English and Spanish, English only or no intervention?

Discussion

The purpose of the present study was to determine the effectiveness of using L1, specifically Spanish, to enhance vocabulary growth in both the L1 and L2 (English). This study intended to answer the following questions: Is there a difference in vocabulary growth in ELL with limited English proficiency who received vocabulary enrichment in both English and Spanish, English only or no intervention?

This research study revealed that both Spanish and English and English only intervention groups obtained more naming-expressive vocabulary words than the control group. These findings support that vocabulary strategies and shared reading in the classroom might have facilitated lexical acquisition (Justice, Meier, & Walpole, 2005; Boote & Biemiller, 2006) in both L1 and L2.

Although, both intervention groups benefited with an increase in expressive vocabulary in comparison with the control group, it must be noted that the English followed by Spanish translation intervention had a significant effect in vocabulary growth in both English and Spanish for children in SEG. The overall target vocabulary gained in English and Spanish was greater for the SEG group than the EG group. These findings support the linguistic interdependence model (Cummins, 1979) that suggests that there is a common underlying proficiency that makes possible the transfer of proficiency from one language to another. This study supports the interchange between those languages resulting in a gain in vocabulary in both languages.

These findings further support techniques which target vocabulary in both L1 and L2 for Hispanic children who are learning English as a second language (Lugo-Neris et al., 2010; Collins, 2010; Tsybina & Eriks-Brophy, 2010). If the Speech-Language Pathologist uses a child's native language in interventions that are known to support language acquisition, the child's L1 and L2 acquisition are both supported. This allows the child's own culture and language to be valued in school and offers greater gains in vocabulary development in the new language. As Cummins (2007) states "L1 is not the enemy in promoting high levels of L2 proficiency; rather, when students' L1 is invoked as a cognitive and linguistic resource through bilingual instructional strategies, it can function as a stepping stone to scaffold more accomplished performance in the L2." (p. 238).

The use of bilingual strategies promotes acquisition of vocabulary in both languages in children who speak English as a second language. Although it was found that children who received English only had vocabulary gains in English it is important to take into consideration that this strategy, if used for prolonged periods of time, can deter the development of the native language of the child. It is important that children who speak English as a second language develop both languages in order to maintain their identity and social communication with their families and cultural peers. Children who are not able to adequately develop the language spoken at home can create changes in the family's interactions that may have a detrimental effect on the communication with the family (Pease-Alvarez, 1993). Children can benefit from bilingual strategies to acquire a skill set to function adequately in environments that use English or Spanish. An English only approach of education may create a gradual loss of their native language (Wong-Fillmore, 1991)

These findings further support the use of dialogic book reading techniques during intervention to support lexical acquisition in English and/or Spanish. Strategies used in this research can be transferred to diverse scenarios in school or clinical settings. The SLP does not need to be bilingual to facilitate biliteracy acquisition. The use of the following strategies can help the acquisition of expressive vocabulary in both English and Spanish. 1. Pre-select the target vocabulary words or sentences and translate in the L1 language. The use of a simple definition of the vocabulary word in both

languages can be shared with the children. 2. Ask the students to repeat words in both L1 and L2. 3. The use of gestures and actions for verbs and pointing to pictures are motivational strategies that help learners to understand the meanings that words carry. Finally, ask students to translate the target vocabulary word in L1 or L2 during readings. Monolingual SLPs can facilitate the acquisition of two languages including L1 vocabulary words in readings and writing materials; L1 phrases, and give instruction in both languages. If the SLP does not know the language of the child, technology can help to integrate biliteracy techniques.

Limitations

One limitation to note is the variance in the period of exposure to English for the children. Some children had been enrolled for less than one year in the Head Start and were timid and seemed to show stress due to adjustment in a non-native language school. Others had been in preschool for one full year and were more familiar with English, as well as the routine of the school day. Other issues to consider when examining these results are that pictures in the storybook and vocabulary tests were different in order to reduce memorization of the picture and promote better learning of the vocabulary word. Some children might have had difficulties generalizing the target vocabulary from the book to other pictures from the receptive and expressive vocabulary test. It is possible that the duration of the intervention provided was not sufficient to promote generalizations of receptive and expressive vocabulary from the pictures presented in the vocabulary tests.

Further Research

Further research is needed to examine information related to maintenance and generalization of the new acquired vocabulary words and examine the impact of this vocabulary in the child interactions or in academic coursework. It is also recommended that future research explore the aforementioned techniques with a monolingual teacher as the promoter of vocabulary in both languages. It is interesting to explore the acquisition of vocabulary in ELL with language impairments or limited skills in both languages.

Conclusion

This study supports that biliteracy strategies using L1 and L2 strategies might enhance naming-expressive

lexical acquisition in both languages of the child. It also provides additional evidence that book reading strategies can support child language. Additionally our data supports the claim that the dual translation of some words in a storybook might support the native language and help ELL students to assimilate the new language with less effort. ◆

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HELLO

Hola	你好	Hej	Kumusta
Bonjour	γεια σας alo	שלום	
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Therapeutic Use of Personal Electronic Devices: An Updated Survey of Speech-Language Pathologists

- 1) Which is another term for the use of personal electronic devices to assist with memory and language deficits?
 - a) Cognitive assistive technology
 - b) Cognitive orthotics
 - c) Memory lapse technology
 - d) All of the above

- 2) What is true about the use of personal electronic devices of SLPs based on the results of this study?
 - a) Most SLPs do not use personal electronic devices in therapy
 - b) Most SLPs use personal electronic devices personally
 - c) Most SLPs use personal electronic devices therapeutically
 - d) Both B and C

- 3) Which of the following factors was not discussed as a barrier to therapeutic PED use by SLPs in therapy?
 - a) Large, bulky devices
 - b) Client preferences
 - c) Time required for training in device use
 - d) Device may exceed client's cognitive abilities

- 4) Which of the following is true of the training SLPs receive in the therapeutic use of personal electronic devices?
 - a) Most SLPs receive clinically-relevant training in personal electronic device use
 - b) Most SLPs do not receive clinically-relevant training
 - c) SLPs who use personal electronic devices personally do not feel the need for professional training
 - d) None of the above

Confrontational naming and aphasia: The influences of time post-stroke, cueing, and picture contextualization

- 5) A high-context image
 - a) Depicts objects with high-contrast colors
 - b) Depicts objects with color interacting with an environment
 - c) Depicts objects in black and white
 - d) All of the above

- 6) Self-cues
 - a) Are spontaneously generated cues by people with aphasia that may be phonemic or semantic in nature
 - b) Are cues provided by clinicians to people with aphasia to increase self-awareness
 - c) Are cues generated by people with aphasia by tapping fingers or gesturing
 - d) All of the above

- 7) High-context images facilitate
 - a) Memory
 - b) Naming accuracy
 - c) Ability to self-cue
 - d) All of the above

- 8) Semantic cues _____ while phonemic cues _____.
- a) Appeared to increase frustration, proved to be the most effective when eliciting accurate naming responses
 - b) Proved to be the most effective when eliciting accurate naming responses, appeared to increase frustration
 - c) Appeared to be ineffective when eliciting accurate naming responses, proved to have little influence on naming accuracy
 - d) Proved to have little influence on naming accuracy, appeared to be ineffective when eliciting accurate naming responses

Peer-Mediated Therapy for Increasing Social Interactions in Preschoolers with Autism: A Meta-analysis

- 9) How many studies were ultimately included in this meta-analysis?
- a) 7
 - b) 12
 - c) 11
 - d) 9
- 10) What was the overall effect size of peer-mediated therapy in increasing social behaviors of children with autism based on the combined data of the studies in Table 5?
- a) 0.67
 - b) 0.85
 - c) 0.23
 - d) 0.56
- 11) What does the overall effect size mentioned in question 2 indicate?
- a) No effect
 - b) Small effect
 - c) Moderate effect
 - d) Large effect
- 12) What was the most common grouping used in the studies according to Table 2?
- a) Dyad
 - b) Whole classroom
 - c) Small group
 - d) Triad

Moyamoya: A case presentation

- 13) What is Moyamoya?
- a) A narrowing of the internal carotids leading to compensatory development of collateral vasculature of small vessels
 - b) The body's inability to clear copper, causing a toxic buildup
 - c) A progressive, degenerative disorder of the CNS caused by a protein called a prion
 - d) A progressive, degenerative disease of the CNS resulting from the practice of cannibalism
- 14) Moyamoya is a Japanese word that means
- a) "more more"
 - b) "puff of smoke"
 - c) "on Mount Fujiyama"
 - d) "carotid stenosis"
- 15) Dimensions typically assessed in a Neuropsychological evaluation include all BUT
- a) Attention
 - b) Speech and language
 - c) Visual perception
 - d) Gait

- 16) Common surgical interventions for Moyamoya include all BUT
- Placing vasculature from the abdominal organ lining on the surface of the brain
 - Placing muscle tissue from the temporalis muscle on the surface of the brain
 - Carotid endarterectomy
 - Direct anastomosis of a superficial scalp artery with the middle cerebral artery

Hand-Held Tactile Biofeedback as a Cuing Mechanism

- 17) All of the following are examples of sensory biofeedback in the treatment of articulation disorders EXCEPT
- Electropalatography (EPG) for misarticulated /s/
 - The use of a mirror to illustrate the protruded and rounded lip configuration associated with correct production of /r/
 - The use of ultrasound of remediate /r/ in a 14 year old male
 - The use of a dental appliance specially fitted to the client's palate to cue correct placement of the tongue for /r/
- 18) The approximate mean number of **hours** required to improve one level in functional communication related to articulation/intelligibility, according to the Functional Communication Measurement (FCM) rubric described by the ASHA National Outcomes Measurement System (NOMS), is:
- 4
 - 24
 - 14
 - 94
- 19) Despite the strong gains made by the subject in this study, the decay in accuracy of word-final /r/, as measured ten weeks post-treatment, would suggest which of the following:
- Additional therapy, focused on word-final /r/, was indicated
 - No additional therapy was indicated and the child was able to be discharged
 - Additional therapy, focused on all positions of /r/, was indicated
 - Additional therapy, focused on only word-medial /r/, was indicated
- 20) In order for a speaker to produce an acoustically correct /r/, the North American English speaker must effect vocal tract constrictions in all of the following vocal regions EXCEPT
- The pharynx
 - The velum
 - The lips
 - The coronal region

Nuts & Bolts of Semi-Occluded Vocal Tract Exercises in Voice Therapy

- 21) What is a Semi-Occluded Vocal Tract (SOVT)?
- An area of opening along the supraglottic vocal tract
 - A voice therapy technique used to increase prosody
 - An area of narrowing anywhere along the supraglottic vocal tract
 - A voice therapy technique emphasizing opened space in the back of the throat
- 22) Why do SOVTs improve vocal economy?
- They strengthen the vocal folds
 - They allow for better articulation
 - They reduce vocal fold adduction allowing for efficient vocal fold vibration
 - They are done at low volumes

- 23) Why are SOVTs useful in voice therapy?
- a) They are easy to teach
 - b) There are so many varieties of SOVTs to adapt to patient need
 - c) They provide kinesthetic feedback for patient monitoring
 - d) All of the above
- 24) When can SOVTs be used in therapy?
- a) Various vocal fold lesion
 - b) Post-operative voice therapy
 - c) After a cerebrovascular accident (CVA)
 - d) A and B

Effectiveness of Treatment of Food Selectivity in Children with Autism

- 25) Within the available research, what is the level of evidence for the majority of the studies?
- a) High, because the majority were reviews of two or more randomized controlled clinical trials (rcts)
 - b) Moderate, because the majority were individual rcts
 - c) Low, because it contained case-control studies
 - d) No level was assigned
- 26) Which intervention components were discovered to possibly generate a larger effect on the participants?
- a) Age of participants
 - b) Simultaneous presentation
 - c) Escape extinction
 - d) Simultaneous and sequential presentation with escape extinction
- 27) What are the possible benefits of this research for speech-language pathologists?
- a) Useful when co-treating with an occupational therapist
 - b) Useful when performing swallow studies
 - c) Useful when performing articulation therapy
 - d) Both A and B
- 28) Have treatments for food selectivity been successful in improving food selectivity in individuals with autism?
- a) Yes, all of the studies were shown to have a positive effect on food selectivity
 - b) Yes, but only in a portion of the studies
 - c) No, the studies were shown to have a negative effect on food selectivity
 - d) No, the interventions were shown to not have an effect on food selectivity

Exploring the Reading Practices of People with Chronic Aphasia

- 29) The impact of poor reading skills for people with aphasia is multi-faceted and may include:
- a) Social isolation
 - b) Unemployment
 - c) Reduced autonomy
 - d) All of the above
- 30) As people with aphasia progress into the chronic stages of the illness, they often deal with residual deficits such as _____ that may hinder reading recovery.
- a) Impulsivity
 - b) Lack of safety awareness
 - c) Fatigue
 - d) Hypolipodemia

- 31) People with aphasia and their caregivers often find it difficult to navigate their perspective roles while balancing support and _____ during the reading recovery process.
- a) Revenue
 - b) Independence
 - c) Healthy lifestyles
 - d) Employment responsibilities
- 32) Reading strategies that can bolster independence and/or social needs while fostering reading recovery include:
- a) Text-to-speech technology
 - b) Computer software
 - c) Aphasia book clubs
 - d) All of the above

Socialization Matters: Effectiveness of Group Intervention on Social Interactions of Patients

- 33) Group activities that focus on socialization include:
- a) Word retrieval exercises
 - b) Sequential exercises
 - c) Categorization exercises
 - d) All of the above
- 34) Cognitive Stimulation Therapy focuses on:
- a) Implicit learning tasks
 - b) Explicit learning tasks
 - c) Communication tasks
 - d) None of the above
- 35) Significant differences were found in the following areas:
- a) The number of times the participants initiated a topic outside of the group setting
 - b) The number of times the participants communicated with others from the group outside of the intervention setting
 - c) The number of adjectives used by the participants during intervention
 - d) None of the above
- 36) Limitations of the study include:
- a) Population size, lack of diversity, lack of supervision
 - b) Poor participation
 - c) Lack of medication control and lack of treatment tools
 - d) Population size, low frequency of treatment, lack of gender and ethnic diversity, no medication control

Joint Attention as a Predictor of Language Outcome in Children with Autism

- 37) What is NOT considered a type of joint attention?
- a) Looking at something that another person is looking at
 - b) Playing with a toy alone, while sitting next to someone
 - c) Pointing at a picture so someone else looks at it
 - d) Staring at ice cream to suggest to another person that you want it
- 38) Research has shown that typically developing children:
- a) Display more language skills later in life when they display more joint attention skills earlier in life
 - b) Always display more joint attention skills than children with autism
 - c) Never experience deficits in joint attention
 - d) Develop language in a way that is never related to joint attention

- 39) The results of this meta-analysis suggested:
- That response to joint attention (RJA) has a greater effect on language outcome than any other type of joint attention
 - That a large effect size exists
 - That joint attention has a larger impact on receptive language than expressive language
 - A and C
- 40) The authors suggested that to improve our understanding:
- Sample sizes should be larger in future studies
 - Assessment tools for language and joint attention should be less varied between studies if possible
 - More research needs to be done
 - All of the above

Clinical Application of Experience-Dependent Neural Plasticity in Persons Living with Brain Injury

- 41) Define brain reserve.
- The supply of brain function not needed for immediate use but available if required
 - Brain size
 - The number of neurons
 - The density of the connections
- 42) Why does re-learning after brain injury matter?
- Learning reorganizes the damaged brain & brain damage changes the way the brain responds to learning
 - Minimizes loss of function
 - Restores function
 - Compensates for function
- 43) Which of the following are principles of experience-dependent neural plasticity?
- The brain is adaptive
 - Brain cells possess the ability to alter their structure and function in response to a variety of internal and external pressures
 - Behavioral training
 - Use it or lose it; use it and improve it; specificity; repetition; intensity; time; salience; age; transference; and, interference
- 44) Why is it important for clinicians to understand the basic science principles of experience-dependent neural plasticity?
- To understand how the brain encodes experience and learns new behavior
 - To design clinically effective practice interventions based on evidence-based research
 - To understand how the damaged brain relearns lost skills in response to intervention
 - To identify what drives recovery

Supporting English and Spanish Vocabulary in English Language Learners

- 45) Which of the following objectives best describes a strategy that supports vocabulary acquisition for preschoolers in first language (L1) and second language (L2)?
- The student will identify and state the purpose for reading a selection prior to reading in English
 - The student will identify the verbs in both languages once the storybook has been read
 - The student will recall familiar objects when removed in English
 - The student will identify an object from its verbal description in L1
- 46) What strategies have been shown to be beneficial to acquire English vocabulary in ELL?
- Pre-select the target vocabulary words or sentences and translate in the L1 language
 - Use a simple definition of the vocabulary word in both languages and translate the target vocabulary word in L1 or L2 during readings
 - Use gestures and actions for verbs and pointing to pictures
 - All of the above

- 47) What are the benefits of maintaining the L1 of ELL?
- Economical
 - Socio-cultural identity
 - Cognitive advantages
 - All of the above
- 48) What can a monolingual clinician do to facilitate vocabulary for ELL preschoolers?
- Learn the native language of the students
 - Facilitate the acquisition of two languages including L1 vocabulary words in readings and writing, L1 phrases, give instruction in both languages, etc.
 - Do not allow the use of the native language during the intervention.
 - All of the above



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Reviewers will be sent manuscripts on an as needed basis throughout the year. Guidelines for reviewers and review forms will be provided at the time of each review. Reviewers should be able to judge an article's significance, timeliness, relevance, research base, methodological soundness, and clarity. Reviewers need not edit papers for form and style. Reviews are double blinded.

Interested applicants should send an email to the *eHearsay* Editor (laurie.sheehy@utoledo.edu). Please attach a CV or resume listing relevant professional publications and employment history.

eHearsay welcomes reviewer applications on an ongoing basis. There is no deadline to apply. Please forward this email to any of your colleagues who may be interested.



Guidelines for Submission to eHearsay

eHEARSAY, the electronic journal of the Ohio Speech- Language- Hearing Association, is designed to address the professional development needs of the members of the state association.

OSLHA publishes manuscripts relevant to the fields of speech-language pathology and audiology and adheres to American Speech-Language-Hearing Association (ASHA) Guidelines for the Responsible Conduct of Research: Ethics and the Publication Process <http://www.asha.org/docs/html/GL2009-00308.html>

Types of Manuscripts

Contributed manuscripts may take any of the following forms:

- **Research Article:** Full-length articles presenting important new research results. Research articles include an abstract, introduction, methods and results sections, discussion, and relevant citations. These are typically limited to 40 manuscript pages including citations, tables, and figures. Large data sets and other supplementary materials are welcome for inclusion in the online publication.
- **Review:** A comprehensive overview of an area of speech, language, or hearing sciences and/or disorders (i.e., systematic review or meta-analysis). Reviews should be accessible to knowledgeable readers not expert in the subject area. They should be prepared with the same rigor as a research article reporting specific results. These are typically limited to 40 manuscript pages including citations, tables, and figures.
- **Tutorial:** Educational expositions covering recent literature on topics of interest to clinicians and other scholars. These are typically limited to 40 manuscript pages including citations, tables, and figures.
- **Research Forum:** The purpose of a research forum (RF) is to provide a concentrated focus on a special topic deemed to be of high interest to the readership. An RF contains a series of empirical studies centering on a key aspect of speech, language, hearing, or swallowing science and/or disorders. RFs may also comprise a set of scholarly papers presented at a scientific conference.
 - A proposal for an RF must be approved for consideration by the journal editor prior to forum development. Pre-approval by an editor does not guarantee that any or all manuscripts submitted will be accepted for publication. The proposal should (1) provide a forum summary, (2) outline the probable manuscript titles and author lists, (3) state whether a prologue and/or epilogue is planned, and (4) designate one person, a forum coordinator, as the point of contact and coordinator of communications with forum authors.
- **Letter to the Editor:** Opinions about material previously published in the journal or views on topics of current relevance. A letter relating to work published in the journal will ordinarily be referred to the author(s) of the original item for a response, which may be published along with the letter. Letters are typically limited to 15 manuscript pages, including citations, tables, and figures.
- **Clinical Focus:** Articles that may be of primary clinical interest but may not have a traditional research format. Case studies, descriptions of clinical programs, and innovative clinical services and activities are among the possibilities.
- **Viewpoint:** Scholarly based opinion(s) on an issue of clinical relevance that currently may be neglected, controversial, related to future legislation, or could serve to update the readership on current thinking in an area.

Manuscript Style and Requirements

Style Manual

Authors are expected to follow the style specified in the *Publication Manual of the American Psychological Association* (6th edition).

Language Policies

OSLHA policy requires the use of nonsexist and person-first language in preparing manuscripts.

Page Limit

A guideline of 40 pages (including title page, abstract, text, acknowledgments, references, appendices, tables, and figures) is suggested as an upper limit for manuscript length. Longer manuscripts, particularly for critical reviews and extended data-based reports, will not be excluded from review, but the author(s) should be prepared to justify the length of the manuscript if requested to do so.

Peer Review

All manuscripts are peer reviewed, typically by at least two reviewers with relevant expertise, an issue editor (if applicable), and the journal editor. Correspondence between authors and editors is expected to be professional in tone. If correspondence is not conducted in a professional manner, an editor has the option to bring the matter before the OSLHA Directory of Technology and Publications and/or OSLHA's Executive Council. After consultation with the Directory of Technology and Publications, the editor may terminate the peer review process for that submission. The author has the right to appeal to the OSLHA Directory of Technology and Publications and/or OSLHA's Executive Council.

Authorship & Author Disclosures

During manuscript submission, answers to a number of disclosures will be required. The corresponding author:

- Affirms that all of the authors listed in the byline have made contributions appropriate for assumption of authorship, have consented to the byline order, and have agreed to submission of the manuscript in its current form
- Affirms that all applicable research adheres to basic ethical considerations for the protection of human or animal participants in research
- Affirms that there is no copyrighted material in the manuscript or includes a copy of the permission granted to reproduce or adapt any copyrighted material in the paper
- Affirms that the manuscript has not been previously published in the same, or essentially the same, form
- Affirms that the manuscript is not currently under review elsewhere. OSLHA prefers to publish previously unpublished material
- Discloses information about any previous public presentation of the data reported in the submitted manuscript, including at a scientific meeting or in conference proceedings, book chapters, websites, or related media
- Discloses any real or potential conflicts of interest that could be seen as having an influence on the research (e.g., financial interests in a test or procedure, funding by an equipment or materials manufacturer for efficacy research)

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In The Next Issue: *eHearsay* 2014

I hope you have enjoyed the articles in this issue. This journal is for you, the OSLHA member. I want to hear from you – what do you want to know more about? What kinds of information would be helpful to you in your area of practice?

We have two exciting issues lined up for 2014. The first issue of 2014 will focus on **Supervision**. Supervision is “the action or process of watching and directing what someone does or how something is done; the action or process of supervising someone or something.” We have all been “supervised” during our lifetimes, whether it was at your first job at a fast food restaurant while you were going to school, while you were obtaining your clinical clock hours during graduate school or during your career as a speech-language pathologist. Effective supervision and how to be a good clinical educator is a hot topic but tends to get pushed to the side when presented with other continuing education courses. This is why our first issue of 2014 will be focusing on Supervision.

Effective supervision starts with an awareness of the ethical bases of clinical practice, as well as of the competencies and expectations for supervisors.
ASHA (2013)

Aphasia is an impairment of language, affecting the production or comprehension of speech and the ability to read or write.

I’m also pleased to announce that Glorijean Wallace (Fellow of ASHA and a tenured Professor at the University of Cincinnati) will be guest editor of the second issue of 2014 focusing on **Aphasia**, an acquired language impairment that occurs suddenly after damage to the brain. OSLHA has many members who work with persons with aphasia in all levels of care (acute care, rehabilitation units, outpatient centers, home health providers and skilled nursing facilities).

I’d also like to encourage **YOU** to submit articles to eHearsay. It’s an easy way to get your feet wet in the publishing world. If you presented a poster or gave a lecture at OSLHA, ASHA, or another convention –you could turn it into an informative article for the membership. If you are faculty and have your students complete a review of a specific topic (e.g., child language, dysphagia, voice) emphasizing evidence based reviews, consider submitting them as a clinical forum. If you have conducted a survey and want to share the results, submit a manuscript.

Lastly, don’t forget OSLHA members can earn **FREE CEUs** just by reading the articles, answering the multiple choice questions and submitting your answers on-line.

Sincerely,

Laurie M. Sheehy M.Ed. CCC-SLP

eHearsay Journal Editor