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Article

Training Educational Assistants to Facilitate Grammatical Development of Adolescents Who Use AAC

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Abstract: *AAC can enhance communication, improve academic achievement, and increase societal participation for individuals with complex communication needs. Unfortunately, many students lack access to effective interventions due to a lack of experienced professionals and stakeholders. Research suggests educational assistants can be trained to support the communication of these children, but there is a notable gap regarding adolescent students. This investigation used a single-subject, multiple-baseline design to examine the effects of an educational-assistant-delivered intervention on the morpho-syntactical productions of adolescents who require AAC. Analyses indicated that an effective communication partner-delivered intervention program can lead to gains for adolescents who use aided communication.*

Keywords: Augmentative and alternative communication, educational assistant training, grammatical morphology

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Training Educational Assistants to Facilitate Grammatical Development of Adolescents Who Use AAC

It is estimated that 1.3% of people are unable to communicate via speech to accomplish their daily communicative needs (Beukelman & Miranda, 2005 & Beukelman & Mirenda, 2013). Many students with severe communication difficulties, who require augmentative and alternative communication (AAC) interventions, enter school without a solid foundation on which to build the communication and literacy skills needed for academic and social success. According to the principles of naturalistic instruction, children learn to communicate by communicating, and children need communication partners communicating within their zone of proximal development (ZPD) for language learning to occur (Tomasello, 2003). Therefore, ensuring that communication partners are trained to communicate effectively with children with complex communication needs, who require AAC, is essential.

It can be challenging for professionals to provide effective services to individuals who require AAC (Light et al., 2019). A possible solution is to expand service delivery options by including communication partners. A communication partner can be defined as anyone who communicates with a child who uses AAC including parents, peers, teachers, and other professionals who interact with the child. According to the American Speech-Language Hearing Association's (ASHA; 2016) position statement on AAC service delivery, speech-language pathologists (SLPs) should consider using communication partners to facilitate communication for individuals with complex communication needs within natural settings. Research suggests that communication partner instruction programs can help facilitate expressive communication in young children with complex communication needs (Solomon-Rice & Soto, 2014) although there is less evidence for older adolescent children.

Literature Review

Aided Language Production

Most children will develop speech as their primary means of communication (Light, 1997); however, many children with developmental disabilities will not acquire spoken language sufficiently to meet their daily communicative needs (Light & Drager, 2007) and will require support to increase their communication. While there is a preponderance of research examining the spoken language development of children (e.g., Brown, 1973), there is less research examining the language development of children who use aided communication. Central to this inquiry regarding language acquisition is the need to determine the impact that decreased production has on language learning. People who require AAC have been shown to experience decreased communication opportunities (Kent-Walsh & McNaughton, 2005; Light, 2003), limited partner responses (Botting, 2002), and decreased partner responsivity. During typical development, communication partners routinely provide scaffolding in the forms of recasts or expansions that stimulate language growth, which in turn accelerates language learning (Saxton, 2005; Smith, 2015). Language learners who use aided communication may not fully benefit from communication partner responsivity due to: (a) infrequent initiation of communication which provides negative evidence to the communication partner, (b) shortened utterance length, (c) use of symbol displays with static vocabulary that inhibits the ability to express spontaneous novel

utterances, (d) use of symbol displays that lack representation of various grammatical categories, and/or (e) lack of familiarity with a symbol or symbol location (Reichle et al., 2002). There are a number of other challenges that impact language development for children with complex communication needs. For example, the child must overcome the linguistic input-output asymmetry which exists in their communication environment (Blockberger & Sutton, 2003; Smith & Grove, 2003; Sutton et al., 2002). This asymmetry exists due to the AAC user having to convert language from the spoken language models they hear into the visual, symbolic language they are expected to produce using aided communication. This impacts several aspects of language development, including lexical knowledge, semantics, morphology, and syntax.

These factors can lead to ineffective communication between the child and their communication partners. Additionally, adolescent language learners who have experienced this ineffective style of communication for a long duration, may require more intense interventions to increase overall language usage. In order to reduce the impacts of these communicative pitfalls, communication partners should be educated regarding the manner in which their communication should be altered to provide the greatest support for those with complex communication needs.

Education of communication partners can be embedded in AAC intervention with the ultimate outcome of increasing communicative competence for the individual with complex communication needs. Communicative competence provides the AAC user with "the ability to communicate functionally in the natural environment and to adequately meet daily communication needs" (Light, 1989, p. 143). However, successful AAC interventions require more than the provision of an AAC system. A person's ability to use language at a level that allows them to create spontaneous novel utterances across settings leads to communicative competence (Beukelman & Mirenda, 2013). In 2004, ASHA endorsed the use of Beukelman and Mirenda's (1988) Participation Model as the guiding framework for diagnosis and treatment in AAC. Using this framework, the AAC team first identifies instances where communication, or lack thereof interferes with participation for the AAC user. The identified barriers then become the focus of the intervention. The authors classify barriers as either access barriers, or opportunity barriers. Access barriers are related to the limitations of the individual's current communication system or current capabilities (e.g. motor, cognitive, linguistic). For example, an access barrier to providing a grammatically correct personal narrative might occur if a student lacks access to grammatical morphology on their AAC system. On the other hand, opportunity barriers are limitations that are imposed by partners without disabilities. These barriers are related to the attitudes, knowledge, and skills of the communication partner. For example, a student may have access to grammatical morphology on their aided system, however, their communication partners may lack the skills to support the development and use of such skills.

Communication Partner Instruction

It is thought that the use of intentional communication in children is directly linked to the responsiveness of the communication partner (Yoder & Warren, 1998). It is then necessary to create a partner instruction model of intervention to support AAC stakeholders, so that the quality of communication is such that language learning and communication can take place. Possible candidates for a communication partner instruction program include educational assistants (EAs), teachers, caregivers, and peers. For the purposes of the current article, EAs will

refer to special education paraprofessionals. Shire and Jones (2015) conducted a systematic review to determine the efficacy of communication partner instructional programs. Out of the 13 studies reviewed, 10 studies selected parents (87 mothers, 8 fathers) as the adult participants, and the remaining studies selected EAs who had a range of experience with AAC. Large effects were noted for outcomes that measured the communication partners' fidelity of intervention implementation (Shire & Jones, 2015). Positive gains were noted with child outcomes, specifically in semantics, turn-taking, and AAC use (Shire & Jones, 2015).

Douglas et al. (2012) taught EAs to increase the communication opportunities of children with complex communication needs by teaching them two interaction strategies (IPLAN [Identify activities for communication, Provide means for communication, Locate and provide vocabulary, Arrange environment, use iNteraction strategies] and MORE [Model AAC, Offer opportunities for communication, Respond to communication, Extend communication]). Large effects were noted for adult and student outcomes during the intervention and maintenance phases. Evidence suggests that communication partners can facilitate language acquisition by providing opportunities for communication paired with 5-10 seconds wait-time for the child to process and respond (Binger et al., 2010). Other skills taught during partner instruction programs include shared book reading, picture exchange communication system (PECS), natural aided language stimulation, environmental arrangement, and milieu (Shire & Jones, 2015).

Overall, research suggests that communication partner instruction used within an AAC intervention program may result in improved communication outcomes for the individual who uses AAC (Kent-Walsh et al., 2015; Shire & Jones, 2015). Specifically, partner instruction has been shown to reduce the opportunity barriers of facilitator knowledge and skills (Beukelman & Mirenda, 2013) resulting in improved communicative interactions between the AAC user and their respective communication partner. Additionally, there are recognized frameworks (e.g., ImPAACT program) that clinicians can use, within the suggested practice of "role release" (ASHA, 2002) in order to expand the service delivery to include key stakeholders.

The ImPAACT program is based on Kent-Walsh and McNaughton's (2005) 8-step instructional approach for teaching communication partners how to facilitate language outcomes for individuals who require aided communication. Multiple studies have been published that examine the use of the ImPAACT program to teach communication partners to increase turn-taking rates and multi-symbol message productions of young children who require AAC (see Kent-Walsh et al., 2015). The results provide support for the use of a structured partner intervention program that utilizes five main instructional techniques: (a) video review, (b) modeling, (c) role play, (d) verbal rehearsal, and (e) coached practice. One interactive reading strategy that has been successfully implemented using the ImPAACT program is the Read-Ask-Answer-Prompt (RAAP!) interaction strategy (Binger et al., 2010). This strategy was initially designed to assist communication partners in facilitating multi-symbol aided AAC productions and is outlined in more detail in Table 1. Although current research provides evidence of the benefits of communication partner training, there are overt gaps in the literature. There is limited research on preparing EAs to interact with adolescent students with complex communication needs in a school setting, and even less on providing communication interactions that support grammatical development (Kent-Walsh et al., 2015).

There is a paucity of adolescent participants in the extant literature related to communication partner training. In fact, only one adolescent participant was noted in a recent descriptive analysis of participant characteristics in communication partner research (Kent-Walsh et al., 2015). Additionally, most educational assistant training programs have focused on non-academic tasks (e.g., play) using activity-based communication displays, which are not functional for adolescent students who need access to curricular material and symbolic language to provide for spontaneous novel utterance generation. The production of grammatical errors is common in children who use aided communication (see Binger & Light, 2008 for review); yet, much research is still needed regarding grammatical language interventions for older children with complex communication needs.

Table 1

Comparison of the original RAAP! interaction strategy to the adapted RAAP! interaction strategy

Strategy	Original RAAP! Strategy	Adapted RAAP!
R	Read + Model 2 words	Read + Model grammar inflection
A	Ask wh question (wait at least 5 seconds)	Ask wh question (wait at least 5 seconds)
A	Answer with a recast (wait at least 5 seconds)	Answer with a recast (wait at least 5 seconds)
P	Verbal Prompt (“show me two”) + aided language model (wait at least 5 seconds)	Verbal Prompt (“hold”) + aided language model of grammar inflection (wait at least 5 seconds)

This study sought to expand the research base regarding communication partner interventions to evaluate the viability for an adolescent population of people who require AAC in the context of a curriculum-based reading activity. Moreover, communication partner intervention programs have historically targeted limited child language outcomes (e.g., turn taking, semantics, multi-word utterances). This study expanded the outcomes to include an additional area: grammatical morphology. Research suggests that communication partner-delivered interventions can lead to an increase in expressive and receptive language skills for children with complex communication needs (Binger et al., 2010; Douglas et al., 2012; Kent-Walsh et al., 2015). Furthermore, an increase in expressive communication should also increase the student’s ability to engage in autonomous communication, which increases their ability to establish and maintain social connectedness.

With these purposes in mind, the current study sought to address the following experimental question: What is the impact of a communication partner training program on the grammatical morphology use of adolescent students who use AAC? It was hypothesized that there would be an increase in the students’ expressive use of grammatical morphology during the shared reading activities. Research suggests that training communication partners leads to an increase in

expressive and receptive language skills for children with complex communication needs (Binger et al., 2008; Binger et al., 2010; Douglas et al., 2012; Kent-Walsh et al., 2015).

Methods

All methods and procedures were approved by the Institutional Review Board (IRB) of Valdosta State University. Informed consent was obtained from the educational assistants and from the participants with complex communication needs and their parents.

The study used a single subject, non-concurrent multiple baseline probe design (Holcombe et al., 1994) across three dyads to measure the dependent variable. Each communication dyad included one EA and one student with complex communication needs. The primary dependent variable was the percentage of grammatical morphemes produced during the reading activities by the student with complex communication needs.

The study was implemented in three phases: baseline, instruction and intervention, and maintenance. To provide for greater experimental control, the timing of the phases was staggered across the communication dyads by at least one week to reduce threats to validity (Harvey et al., 2004). Finally, a social validity measure was included to determine the perceived effectiveness of the training by the EA and classroom teacher.

Participants

Three students who required AAC and their EAs participated in the study. All participants resided in a rural southeast Georgia community. Dyads were formed with each educational assistant providing instruction to the student that they typically assisted in the classroom.

EA participants

The researcher recruited EAs based on selection criteria, which was adapted from the criteria set forth in ImPAACT studies (see Kent-Walsh et al., 2015 for a review). Criteria for EA selection included the following: the EA participants (a) worked in a special education classroom containing at least one adolescent student who used AAC; (b) worked with the AAC user for at least one month; (c) had at least a high school diploma or equivalent; and (d) implemented the adapted RAAP! interaction strategy in less than 25% of opportunities during reading interactions using a News-2-You article with their students prior to the beginning of the investigation. The investigator invited EAs who met the above criteria to participate in the study.

Student Participants

Once consent was obtained by the EA, the researcher selected student participants within the EA's classroom based on the following criteria adapted from Bedrosian's (1999) selection criteria for AAC interactive storybook reading research. The participants (a) were enrolled in a public elementary, middle, or high school; (b) were between the ages of 12-17; (c) presented with a severe, congenital motor speech impairment (i.e., less than 50% comprehensible speech given no contextual cues on Dowden's (1997) Index of Augmented Speech Comprehensibility in

Children (I-ASCC); (d) had a receptive vocabulary age of at least 24 months as measured by the Peabody Picture Vocabulary Test - Fourth Edition (PPVT-4; Dunn & Dunn, 2007); (e) listened to a News-2-You article and answered simple wh-questions based on the article with at least 70% accuracy (e.g., "Who?" "What?"); and (f) had hearing and vision within (or corrected to be within) functional limits as recorded on their most recent school screening. Student special education files were reviewed to gather background information on present levels of performance and applicable testing results.

Screening of Student Skills

I-ASCC

Stimuli from the I-ASCC (Dowden, 1997) were used to measure students' speech intelligibility. This non-standardized measure identifies single-word speech comprehensibility in children. To administer this probe, the examiner presents stimulus cards to the examinee who is required to verbalize the name of the object given as few cues as possible while being audio-recorded. Unfamiliar and familiar communicative partners listen to the recordings and identify the word that is produced.

DAGG-2

The Dynamic AAC Goals Grid-2 (DAGG-2; Dowden, 1997; Tobii-DynaVox, 2015) was administered as a skills checklist to describe the students' observable communication behaviors. The ability level continuum provided insights into how the students were communicating prior to intervention, while also highlighting strengths and potential linguistic targets.

PPVT-4

The PPVT-4 (Dunn & Dunn, 2007) was used as primary assessment measures for receptive vocabulary. This assessment does not require the student to expressively communicate their responses.

CELF-5

The Word Structure (WS) subtest of the Clinical Evaluation of Language Fundamentals - Fifth Edition (CELF-5; Wiig et al., 2013) was administered to each participant to identify potential linguistic targets for the grammar intervention and to assess the students' ability to apply word structure rules (i.e., morphology) to denote inflections. This assessment required expressive responses; therefore, the students had the option to respond through various communication modalities (e.g., augmentative communication, natural speech). Two stimulus items from the CELF-5 were administered for each grammatical morpheme to identify potential linguistic targets for intervention. Summary results for all measures are included in Table 2.

Dyad Profiles

Dyad 1 (Anita and Alex)

Anita, age 52, had earned an associate's degree. She had seven years of experience working with students in a special education classroom. For the last four years, she worked with students who used various types of communication devices. At the beginning of the study, she had been working with Alex for almost two months and possessed baseline knowledge of how to operate his communication device.

Alex, a freshman in high school, was 17 at the start of the study. A psychologist diagnosed him with autism when he was three years of age. School records indicated that his hearing and vision were within normal limits. Intellectual testing using the Kaufman Brief Intelligence Test-2 (KBIT-2; Kaufman & Kaufman, 2004) resulted in the following scores:
Verbal Intelligence Quotient (IQ) 58; Nonverbal IQ: 78. Alex had used aided communication since he was nine years old. For the previous three years, he used the communication application Proloquo2Go on his personal iPad and classroom iPad. Though Alex preferred to use AAC to communicate in small settings with familiar communication partners, he frequently used gestures and a handful of words to communicate with his peers. He received speech therapy services in the school setting to increase language and communication skills.

Dyad 2 (Brooke and Brianna)

Brooke, age 36, held a bachelor's degree. She possessed 12 years of experience supporting students with disabilities, including those who required AAC.
Brooke worked with Brianna for approximately five months before the start of the study and demonstrated baseline knowledge of her communication system. She assisted in an English/Language Arts classroom.

Table 2

Participant Screening Results

Name, ethnicity	I-ASCC context unknown	PPVT-4 (AE)	DAGG-2© Ability Level	Communication modes	Target vocabulary
Alex, Caucasian	10%	7;4	Transitional-independent	Natural speech, Proloquo2Go, gestures	Plural –s, -es Irregular Plural Possessive –'s Auxiliary –ing Regular Past Tense Irregular Past Tense
Brianna, African-American	33%	6;9	Context-dependent	Natural speech, Proloquo2Go, gestures	Plural –s, -es Irregular Plural Possessive –'s Auxiliary –ing Regular Past Tense Irregular Past Tense Third Person Singular
Cole, Latino	0%	7;6	Context-dependent	Natural speech, Proloquo2Go, gestures	Plural –s, -es Irregular Plural Possessive –'s Auxiliary –ing Regular Past Tense Irregular Past Tense

Note. AE = age equivalent

Brianna, age 13, was a seventh-grade student in a self-contained, life skills classroom at the beginning of the study. A review of educational records revealed that she had medical diagnoses of Prader-Willi syndrome and childhood apraxia of speech (CAS). Hearing and vision were noted to be within normal limits. Results from the KBIT-2 (Kaufman & Kaufman, 2004) indicated that Brianna's overall nonverbal IQ was 51. Brianna first began using AAC (e.g., DynaVox Maestro) around 9 years of age to supplement speech, however, she began using an iPad with the communication application Proloquo2Go around the age of 12. The iPad was a preferred device for Brianna based on portability and social acceptability by her peers. Brianna received speech and language therapy services to increase overall communicative competence.

Dyad 3 (Cassie and Cole)

Cassie, age 55, had recently completed her bachelor's degree in Interdisciplinary Studies with a major in English as a Second Language (ESOL). She possessed 11 years of experience supporting students with disabilities; however, she reported limited experience with students

using AAC. For the previous year, Cassie worked in a self-contained, life skills classroom with a health and social studies teacher. While Cassie provided academic support for Cole prior to intervention, she rarely used his device and demonstrated limited operational knowledge. Moreover, she received little prior training in the area of AAC.

Cole, age 17, was a freshman in high school at the start of the study. He was a Hispanic male whose bilingual family spoke Spanish and English. Cole spoke primarily English, but used Spanish words sparingly (e.g., “agua”). He had a medical diagnosis of Down syndrome. A student records review revealed hearing and vision to be within normal limits. Full scale IQ using the Universal Nonverbal Intelligence Test - Second Edition (UNIT; Bracken & McCallum, 1998) was reported to be 59. Cole began using an iPad with the communication app Proloquo2Go at the age of 14 to supplement his speech. Cole received speech therapy services to increase language and communication skills.

Setting

The study was conducted in two different public schools located in the southern region of the United States. All three schools used the Unique Curriculum and associated News-2-You reading articles. The instruction and intervention sessions were conducted within the primary school for each communication dyad. Research sessions occurred in a quiet, dedicated meeting room with only the EA and student present. The secluded space was carefully chosen to minimize external distractions, ensuring a calm and conducive environment for the dyad to engage in the shared reading activities.

Instrumentation/Materials

The reading material used in the study was the weekly News-2-You newspapers. These texts were selected based on their familiarity to the EAs and students, and their shared symbol-set (SymbolStix) with the students’ communication app, Proloquo2Go. News-2-You is a weekly newspaper that is used in special education classrooms to teach and expand communication and literacy skills. Furthermore, the weekly papers provided an engaging, age-appropriate platform that followed grade level educational standards in the areas of reading, writing, listening, and speaking. Participants in the study utilized the symbol-supported, regular version of the newspaper to decrease the overall cognitive load required for the reading interaction. Each News-2-You paper includes an activity-based communication board; however, these boards do not offer grammar support, or the opportunity for communication partners to model morphology. These boards were used as a guide to determine the necessary fringe vocabulary that was programmed into the student’s speech output technologies for each newspaper.

The participants used Prolquo2Go on an iPad with a core word vocabulary grid size of 7 x 11. Proloquo2Go uses the Crescendo vocabulary layout, which offers easy access to core vocabulary words to increase communication efficiency. The core vocabulary buttons appeared in the same format on each fringe, or template page, thus increasing language acquisition through motor planning. Research suggests that grammar instruction in AAC is not appropriate during activities with a high cognitive load (Binger & Light, 2008). In an attempt to decrease the required cognitive load, the researcher used an existing reading template in Proloquo2Go, while adding

the needed fringe vocabulary for each article. In doing so, the students didn't have to navigate away from the reading page set, thus decreasing cognitive demand.

Prior to the start of the study, the researcher created one vocabulary display for each newspaper using the reading template in the Proloquo2Go. Each vocabulary display was then saved as the title of the newspaper and stored in the school reading folder on the AAC device for easy retrieval during the study. Each communication dyad was then able to select the appropriate page set to accompany the selected newspaper, while having access to the entire AAC app.

Grammar support for verbs, nouns, pronouns, and adjectives were provided to further support the language development of the AAC user. Access to automatic inflections was utilized by holding down the desired button until the inflections appeared. The user then selected the desired linguistic form. For example, if an individual wanted to access the past tense form of "run," he would touch and hold "run" to bring up the inflection popup, and then select "ran."

Procedures

The investigation was conducted in three phases: baseline, instruction and intervention, and maintenance. All three dyads participated in all phases of the investigation. A Flip video camera was used to record probe data in all phases of the study.

Baseline

During baseline, the EA and student participants were observed in three News-2-You article reading interactions. The EAs were instructed to interact with their student as they normally would during each reading activity. Shared reading interactions were video-recorded and analyzed for the dependent variable. The researcher also used a checklist to identify the EAs' use of AAC language facilitation strategies prior to instruction. Each communication dyad remained in baseline for a minimum of three probe sessions, or until there was stability in the primary dependent variable with no indication of an increasing trend (McReynolds & Kearns, 1983). Feedback was not given during baseline sessions.

Instruction and Intervention

This phase was twofold: (a) instruction consisted of teaching the EA participants to use the adapted RAAP! interaction strategy and (b) intervention consisted of examining the impacts of the communication partner instruction on the expressive language outcomes of the student participants (Binger et al., 2010; Douglas et al., 2012). News-2-You articles were used during both components of this phase.

Instruction content. During EA instruction, the researcher provided one-on-one coaching for the EAs on the adapted RAAP! strategy (Binger et al., 2010) and hands-on practice with the students' AAC systems. The adapted RAAP! interaction strategy included: *Read* and provide aided AAC models of grammatical morphemes, *Ask* a wh-question to provide the student with an opportunity to use the inflection, *Answer* the wh-question with a recast, and *Prompt* using an operational cue. During the prompting component step of the interaction strategy, the

EA provided operational support by verbalizing the "*hold*" action required to elicit the inflection popups. In doing so, the EA was not only addressing linguistic skills required for effective and efficient communication, but also operational skills that are required for AAC system use (Light, 1989). The EA was instructed to use the interaction strategies on each page of the news article. Additionally, the target vocabulary was highlighted on each page of the newspaper to remind the EA to provide the aided AAC model. Questions designed to elicit grammatical morphemes were written at the bottom of each page.

As previously noted, aided AAC models and recasts demonstrating the use of grammatical inflections have been suggested to facilitate the production of bound morpheme use in young children (Binger et al., 2010). Using an adapted protocol, the EAs were required to first read text and provide aided AAC models using the grammar support function of the AAC system (i.e., provide a grammatically complete spoken model, and use a grammatical morpheme on the student's AAC system). Then, the EAs were instructed to ask a wh-question that should elicit the target grammatical morpheme production, and provide at least 5 seconds of wait time for the student to respond. If the student produced an incorrect answer or language form (e.g., "*dog* for *dogs"*), the EA was instructed to answer the wh-question with a recast using an aided AAC model (e.g., *yes there are two dogs*) and provide at least 5 seconds of wait time for the student to comprehend and respond. Finally, if the child was unable to respond with the correct grammatical morpheme, the EA would prompt the student using an operational cue (e.g., *there are two hold...dogs*) while using an aided AAC model, and provide at least 5 seconds of wait time.

Instruction format. The framework for teaching the EAs to use the interaction strategy was modeled after Kent-Walsh and McNaughton's (2005) 8-step ImPAACT program for communication partner instruction. The teaching protocol consisted of a modified version of the procedures described in Kent-Walsh and McNaughton (2005). Specifically, the procedures consisted of the following steps: (1) conducted pretest (i.e., baseline data probes), provided a general overview of AAC, and obtained EA commitment to training and strategy use, (2) administered an AAC operational competency checklist to EAs, and described the adapted RAAP! strategy, (3) demonstrated the strategy, (4) provided verbal practice for the steps in the interaction strategy, (5) controlled practice with feedback using role-play, (6) controlled practice without feedback using role-play, (7) advanced practice with their student, (8) completed a posttest, and (9) demonstrated the maintenance of the strategy (Kent-Walsh & McNaughton, 2005). Based on the recommendations for future research in a study completed by Binger and colleagues (2010), the study also included a brief overview of the students' speech output technologies to include a mini lesson on vocabulary arrangement, navigation, and programming. This additional information was introduced during the first coaching session, and readdressed as needed in subsequent training sessions.

Steps 1-5 were completed during a single coaching session, lasting approximately 90 minutes. Training included a PowerPoint presentation with video examples, visual aids, and hands-on instruction with the student's AAC system. During the second coaching session, the researcher facilitated an additional controlled practice opportunity (i.e., step 6) during which the EA participated in a mock reading session while jointly planning for strategy use with the student. Once the EA demonstrated independent implementation of the interaction strategy with at least

90% accuracy throughout the duration of the news article, they progressed to the intervention phase with their student (steps 7-8).

Intervention. The intervention phase, during which data was collected on the dependent measure, mirrored those procedures used in baseline, with the addition of the interaction strategy. Each communication dyad participated in a reading activity using a News-2-You article. Sessions occurred twice weekly. During the first session of the week, the researcher provided the EA with a novel News-2-You article that contained the selected linguistic targets for their student. The same article was used during both weekly sessions to decrease the cognitive load of the reading task. The EAs were instructed to use the adapted RAAP! strategy while providing grammar support using the students' speech output technologies.

After the first dyad completed one week of intervention, the EA in the second dyad began the training protocol. Intervention sessions continued for the duration of the study (i.e., 8 weeks). The phases of the study continued to be staggered in this manner.

Maintenance

During the maintenance phase, the communication dyads participated in a reading activity using a novel, current News-2-You article that was selected by the researcher. Data was collected on the dependent variable in the same manner as in the intervention phase. Maintenance probes were obtained approximately two weeks after the intervention phase.

Data Analysis/Measures and Collection

The dependent variable (DV) was the percentage of grammatical morphemes produced by the student during the reading activity. Data collected on the dependent variable was graphed and visually inspected for level, trend, and variability (Byiers et al., 2012).

The data were obtained by calculating the percentage of spontaneous, grammatically correct target morphemes produced by the student during each reading session. As operationally defined by Binger and colleagues (2010), all grammatically correct target morphemes produced by the student before the prompt component of the interaction strategy were counted as successful attempts (i.e., "P" step of RAAP).

Visual Analysis of Data

Visual analysis of the data was used to examine the causal relationship between the independent and dependent variables. A treatment effect and the magnitude of the relationship can be determined by visual inspection of data across all phases of the study for at least three standards (Kratochwill et al., 2010). Researchers describe these standards as: (1) level, (2) trend, (3) variability, (4) immediacy of the effect, (5) overlap, and (6) consistency of the data patterns across similar phases. This study focused on examination of level, trend, and variability as recommended by Byiers et al. (2012). Level, which represents the mean score of the data, was calculated by adding the values of all the data points in each phase (i.e., baseline, intervention, maintenance) and dividing the sum by the total number of data points. Trend was determined by obtaining slope values for each phase to inspect for significant upward or downward trends.

Finally, variability was calculated using the range of data in each phase. Comparisons were made between conditions (i.e., baseline, intervention, and maintenance). To further examine the clinical significance of the changes that occurred following the EA training, effect sizes were calculated based on standard mean difference (Cohen's *d*) by calculating the difference between the average baseline and the average intervention and then dividing by the standard deviation (Busk & Serlin, 1992).

Inter-rater Reliability

Inter-rater reliability was calculated on 20% of randomly selected sessions. The second rater was a graduate research assistant in a speech-language pathology graduate program. The rater was trained by the primary researcher to identify and quantify the dependent variable. Cohen's κ was utilized to examine agreement. Agreement was found to be strong according to the standards recommended by McHugh (2012) $\kappa = .893$, $p < .001$. There was also a statistically significant positive Pearson correlation between the measures of each observer, $r = .990$, $p = < .001$. Both of these values indicate high levels of inter-rater reliability.

Procedural Fidelity

Procedural fidelity of EA instruction was assessed to ensure the researcher's adherence to the adapted ImPAACT communication partner instruction program (Kent-Walsh & McNaughton, 2005). The evaluator who completed the fidelity checklist was a licensed and credentialed SLP with more than ten years' experience serving individuals with complex communication needs. The evaluator watched the complete instruction sequence (i.e., steps 1-6) for dyads 1 and 3 and completed the evaluation form. Procedural reliability was 100%.

Social Validity

A measure of social validity was obtained to determine the perceived impact of the intervention by classroom teachers. The classroom teacher for each student watched two randomly selected video clips, one from baseline, and one from intervention. The teacher was then asked to complete a questionnaire, which in part asked them to choose a preferred video and to explain why they selected that video.

Results

Visual and effect size analyses were conducted on the grammatical morphemes produced by the student during the reading activity. Visual inspection focused on level, trend, and variability (Byiers et al., 2012) (see Figure 1). In regards to effect size analyses, effect sizes of 1.0 were established as the minimum d_2 that could be considered clinically relevant (Maas & Farinella, 2012). In other words, the change in accuracy from pretreatment to posttreatment had to exceed the pooled standard deviation to satisfy this requirement.

Visual analysis of the participant data revealed differences in level between the baseline and both the treatment and maintenance phases. The participants obtained a mean accuracy proportion of 1.67% during the baseline sessions whereas they obtained a mean accuracy proportion of 84.79% during the treatment phases and 86% during the maintenance phase. No differences were

observed between the treatment and maintenance phase. Visual inspection indicated that the change occurred immediately after implementing the intervention phase and there is no overlap between the phases, meaning that the data point representing the lowest accuracy proportion in the treatment phase is still higher than the data point representing the highest accuracy proportion during the baseline phase.

Visual inspection revealed no significant differences in terms of trend between the baseline and treatment phases (See Figure 1). Statistical analysis concurred and revealed no significant difference between the slope values obtained during the baseline phase (m = -.333) or the treatment phase (m = .46); t (2) = .44, p = .67. Inspection of the maintenance phase revealed a

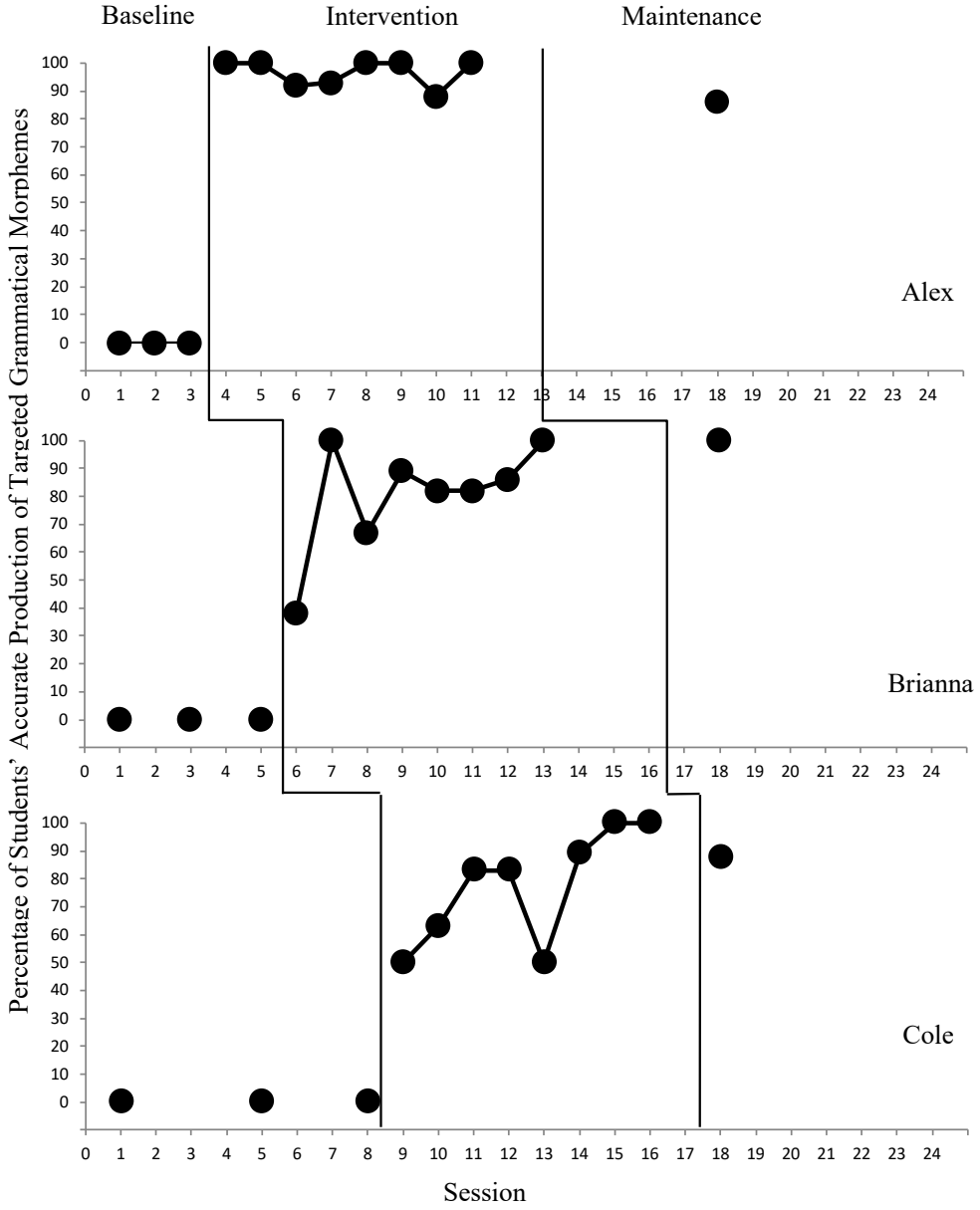

Figure 1. Percentage of students' accurate production of targeted grammatical morphemes.

possible change in trend, with a 13.33% mean decrease in performance occurring immediately after the treatment phase.

Finally, visual inspection revealed changes in variability. The baseline condition was associated with minimal variability (range = 9 percentage points) whereas more variability was observed during the treatment conditions (range = 62 percentage points).

Effect sizes based on standard mean difference were calculated to assess differences in baseline to posttreatment performance for each participant (Busk & Serlin, 1992). The effect sizes (d^2) for Alex, Brianna, and Cole were respectively 96.63, 43.06, and 20.29. Effect sizes for each participant exceeded 1 and were thus, determined to be clinically significant (Maas & Farinella, 2012).

Social Validation

Teacher Questionnaire

As a measure of social validity, the classroom teachers that worked with each EA reviewed the randomly assigned video from pre- and post-instruction. Two of the three teachers selected the post-instruction video for both questions. When asked what they liked or valued about the student's communication behaviors in the selected video clip the responses included: (1) the student appeared to take pride in having more of an opportunity to participate and communicate, (2) the student was able to add more to the conversation, (3) the student was more engaged and used her device more for communication, and (4) I like how the student was able to practice grammatical skills with the device which were modeled for her by the EA. One teacher chose the pre-training video. When asked to discuss the reasons why she selected the video clip she noted that she felt the student used his communication skills (e.g. talking to the EA) more when he was not relying on the device.

Discussion

The purpose of this study was to determine what effects a communication partner training program would have on the grammatical morphology skills of adolescent students who require AAC. Results indicate that the intervention was effective at increasing the students' use of grammatical morphemes. This provides initial evidence that an intervention inclusive of communication partner instruction, aided AAC modeling, contingent responsivity, and operational cues can be an effective and socially valid AAC intervention for children with complex communication needs.

Effectiveness of Instructional Program to Increase Strategy Use

Previous communication partner research has found large effects for outcomes that measured communication partners' (e.g., parents, peers, EAs) fidelity of strategy instruction implementation (Shire & Jones, 2015). A meta-analysis of communication partner research conducted by Kent-Walsh and colleagues in 2015 identified very large overall effect sizes for all identified age categories, except adolescents (e.g., 12-17 years of age), which yielded no effect.

Communication partner instruction has consistently resulted in positive gains for young children across language domains including semantics (e.g., vocabulary), pragmatics (e.g., turn-taking), syntax (e.g., multi-symbol utterance), and morphology (e.g., bound morphemes; Kent-Walsh et al., 2015). The current study supported these findings, but also added vital information regarding these findings with an adolescent population. The results of the current study provide initial evidence that training communication partners for an adolescent population of individuals can produce large effects and should continue to be viewed as an integral part of AAC interventions.

There is ample evidence to support the impact of adult speech, specifically contingent responsivity, on language learning (Marcus, 1993). To expand further, this current investigation targeted the language domain of morphology in the form of increased productions of grammatical morphemes during an academic based reading activity. Study results support the hypothesis that the EAs' use of a targeted interaction strategy (e.g., RAAP!) would lead to an increase in the expressive use of grammatical morphology. Implications of these findings are consistent with past research, which examined the effects of using AAC modeling, recasting, and contrastive targets on the grammar skills of young children who used AAC (Binger et al., 2011).

Strategy Instruction Model

In the current investigation, immediate gains in expressive language outcomes were noted once the EAs' began using the language facilitation strategies. For example, during the first intervention session, Brianna produced targeted grammatical morphemes with 38% accuracy and Cole demonstrated 50% accuracy. Interestingly, Alex correctly produced all of the grammatical morphemes in the first intervention session. The significant gains made by Alex may have been due to his literacy skills, or as a result of having the opportunity (open-ended question + expectant delay) to demonstrate his expressive language abilities. Since Brianna and Cole cannot read, they had to learn the motor plan (e.g., position) for each grammar inflection symbol on their device before they could correctly express the grammar target, whereas Alex had the capability to read each grammar form. Future research is needed to fully understand the impact that literacy skills have on the acquisition of morphology for individuals who use AAC.

Overall, the training taught the EAs to use evidence-based language facilitation strategies, which increased the quality of communication, so that language learning could occur. Specifically, the EAs were taught to utilize wh-question asking, expectant delay, contingent responding, aided AAC modeling, and verbal prompting, all of which have previously resulted in positive child language gains (Binger et al., 2008; Binger et al., 2010).

Aided AAC Modeling

The core skill of the interaction strategy was aided AAC modeling, which developed out of the social learning theory (Tomasello, 2003). According to this hypothesis, children acquire early language skills as a result of the linguistic input they receive from their communication environment. Research indicates that the language learning process for individuals who use AAC may differ significantly. For example, individuals who use AAC typically receive language input in the form of speech, and not in the symbolic form of their communication system. This is a challenge for people who require AAC because they are expected to use a mode of

communication that is not modeled for them. Smith and Grove (2003) refer to this opportunity barrier as an "asymmetry between the modalities of input to output" (p. 163). AAC modeling based interventions were developed as a possible solution to this asymmetry (Binger & Light, 2007). The results of the present study indicate that the EAs' provision of aided AAC models led to student gains in the areas of linguistic (e.g., production of grammatical morphemes) and operational (e.g., ability to access grammar inflections) competence.

The frequency at which the EAs provided the aided models in this study ranged from 21-28 models per news article. Therefore, the students received at least two aided AAC models per minute. Previous research in the area of aided AAC modeling reported similar doses of input, providing around 30 AAC models in 15 minutes (Binger & Light, 2007). However, this remains a stark contrast to the quantity of linguistic input that children without disabilities receive which ranges from 620-2,150 words per hour (Hart & Risely, 1995). Despite the relatively low doses of quality input, the students made meaningful communication gains.

It is important to note that this intervention took place in the context of an academic-based literacy activity, which provided multiple communication opportunities at the students' current level of development. Additionally, the communication displays that were created for each news article provided easy access for the EA to provide aided modeling, and for the student to communicate. Research has found that contingent responses are most effective at increasing language and communication outcomes when they are matched to the developmental level of the child (Yoder & Warren, 1998). Therefore, the researcher administered the PPVT-4 (Dunn & Dunn, 2007) as a measure of receptive vocabulary prior to intervention in order to identify developmentally appropriate language targets. Each student's resulting age equivalency was then matched to a developmentally appropriate stage of grammatical development using Brown's order of grammatical acquisition (1973). Consequently, student gains following an increase in the EAs' use of the interaction strategy may be a result of the grammatical morphemes targets being in the students' ideal language learning zone.
When discussing grammar interventions for individuals who use AAC, it is critical to consider the intrinsic and extrinsic factors that may affect the results. Intrinsic factors include a student's cognition, receptive language abilities, memory and attention skills, whereas extrinsic factors are related to issues with the communication partner or AAC system. Previous findings to this effect (Binger et al., 2008; Binger et al., 2011, Binger & Light, 2007) may help explain the varying rate of acquisition of the target grammar structures for the three student participants. While the EA training was designed to decrease the impact of the extrinsic factors related to the communication partners and grammar accessibility of the student's AAC system, the heterogeneity of the student profiles may still contribute to the expressive grammar challenges.

Implications

Current findings have both clinical and educational implications. A significant increase in strategy use by the EAs was found to result in significant expressive grammar gains in their students who require AAC. This study provides preliminary evidence that a training program that follows the ImPAACT framework for partner instruction can lead to effective interventions provided by EAs during an academic-based reading activity. Although previous studies have demonstrated the positive effects of training EAs who support young children with complex

communication needs (Binger et al., 2010; Binger et al, 2011), the current results indicate that training appears to be as effective with an adolescent population of students. Furthermore, the prolonged duration that the adolescent participants have potentially been experiencing the ineffective, reduced reciprocity style of communication did not appear to influence the need for a longer or more intense intervention. In other words, the dosage of the intervention of the present investigation was consistent with the dosage of previous research that has been completed with younger individuals (see Kent-Walsh et al., 2015). Given the potential for well-trained EAs to positively impact the expressive grammar and communication skills of students who require AAC, local educational agencies should consider making systematic training a high priority.

The demonstrated positive effects on student grammatical morphology use is also consistent with prior research with students who use aided communication (Binger et al., 2011). The students exhibited communication gains when the EAs began to provide language input (e.g. AAC modeling) in a way that matched their expressive communication. Additionally, results of this study provide support for selecting expressive grammar interventions that incorporate the use of contrastive targets (e.g., past tense verbs and present progressive tense verbs), recasts, and AAC modeling. This study also provides support for the integration of skills and instruction across the domains of communication and literacy for an adolescent population of students. The goal of a shared reading activity in AAC is not to assess comprehension of reading material, but to promote opportunities for communication that facilitate language development in a natural setting. In summary, SLPs should continue to incorporate recognized frameworks (e.g., ImPAACT program, strategy instruction) into AAC intervention protocols in order to expand service delivery to include key stakeholders.

Limitations

Although this investigation provides evidence to support the effectiveness of a communication partner training program, several limitations should be considered and possibly accounted for in future research. First, although typical of similar research, the current sample size was small (i.e., 3-dyads) and based on a structured convenience sample procedure. The student participant profiles are limited in relation to age, disability category, language and literacy ability levels. Therefore, like most single-subject designs, the external validity of the results cannot be determined without replication. Additionally, the utilization of time-based transitions instead of a criterion-based entry into the maintenance phase presents a limitation in the research design. While a predetermined timeline helped to manage the logistical considerations of this study, a criterion-based entry could have offered clearer evidence of the lasting effects of the instruction program. In summary, careful consideration was given to a priori selection of intervention start points while weighing practical constraints.

A final limitation of this study relates to the context and setting of the intervention. Since the present study examined the effects of an interaction strategy during the context of a one-on-one reading activity outside of the classroom, the degree to which the effects would be maintained in other contexts (e.g., leisure, vocational) or settings (e.g., classroom, community) are unknown. While past studies using the ImPAACT framework for communication partner instruction (Binger et al., 2008; Binger et al., 2010; Kent-Walsh et al., 2010) included a generalization phase to examine the communication partners abilities to implement the target strategy in a novel

context or setting, the time allotted in the present study did not allow for this phase. Taken collectively, the limitations of this study provide avenues for future research.

Recommendations for Future Research

Although the results of this study are in alignment with prior research in the area of communication partner instruction in AAC, modifications specific to an adolescent population of students continue to be a critical need. When considering the adolescent participants and the important role that peers play during this stage of development, future research should expand to include a variety of communication partners including peers. Furthermore, carryover of communicative competencies into the community is the ultimate goal of AAC interventions for adolescent and adult populations. Therefore, research should examine the impact of communication partner and strategy instruction frameworks across a range of settings (e.g., jobs, leisure activities with peers).

Conclusion

While future research is needed to examine the effects of providing communication partner instruction to key stakeholders for an adolescent population of students, this research begins to fill a gap with a previously underrepresented population of individuals who use AAC. Many adolescent students who require AAC have experienced limited achievement regarding language and literacy skills (Smith, 2015). However, the results of this study support the notion that limited attainment should not lead to abandonment of these goals. It is encouraging to note that this study provides preliminary evidence that supports the provision of AAC interventions to increase communication partner skills that facilitate the grammatical morphology skills of adolescents who use aided communication.

Compliance with Ethical Standards

The current authors have no potential conflicts of interest to disclose. In addition, all procedures, including the procedures for obtaining informed consent, were approved by the authors' University Institutional Review Board.

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