5-2022

Using the RAAP Strategy to Promote Communication Skills for Students with Multiple Disabilities

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Using the RAAP Strategy to Promote Communication Skills for

Students with Multiple Disabilities

A thesis

presented to

the faculty of the Department of Educational Foundations and Special Education

East Tennessee State University

In partial fulfillment

of the requirements for the degree

Master of Education in Special Education,

Advanced Studies in Special Education concentration

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May 2022

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ABSTRACT

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The purpose of this study was to examine the effects of the RAAP strategy on students with

multiple disabilities and their ability to produce multi-symbol messages. Using a single-case,

multiple probes across participants design, 4 students with multiple disabilities participated in

this study. They were taught how to answer reading comprehension questions through the

RAAP strategy and access to a communication/core board.

Results indicated a functional relation between the RAAP strategy and the student's

multisymbol messages. Three of 4 students increased their multi-symbol messages and made

progress with the intervention as it was planned. One student needed the intervention to be

adapted before showing progress. All 4 students were able to increase their multi-symbol

productions through the RAAP strategy. Future research needs to be carried out across multiple

subjects and areas in the students' natural environment. Implications for practice and limitations

will also be highlighted.

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Chapter 1. Introduction

Students with multiple disabilities acquire additional supports to communicate through augmentative and alternative communication (AAC). Having multiple disabilities refers to having two or more areas of significant impairment. Specifically, one of these disabilities must be an intellectual disability (IDEA Sec. 300.8 (c) (7)). Other areas of impairment are autism spectrum disorder (ASD), hearing impairments, (HI) orthopedic (OI) impairments, speech/language impairments (SI/LI), traumatic brain injuries (TBI), etc.

According to Volkmar et al. (2004) around twenty-five percent of individuals with autism spectrum disorder remain without practical verbal communication. Behavioral interventions have been used for the purpose of increasing speech intelligibility, but more than 50% of children diagnosed with ASD are predominantly nonverbal (Charlop & Haymes 1994). Many people work with students with significant disabilities, including general education teachers, special educators, related service providers, paraprofessionals and many more. Yet, the general problem is that not all these professionals necessarily know how to effectively communicate with or teach a student with multiple disabilities to communicate. Johnston et al. (2004) stated the need to train educators on how to encourage use of AAC in a classroom is crucial. Students have AAC devices but do not use them alongside their communication partners (Johnston et al., 2004). While paraeducators could be a viable option for increasing the purposeful use of AAC, few studies have examined this option.

One study that focused on training for paraeducators related to teaching AAC use showed promise. Using a multiple baseline design with probe measurement Bingham, Spooner, and Browder (2007) studied the training of paraeducators to promote use of AAC for students with significant disabilities. The paraeducators were trained on 1) the importance of

communication, 2) the relationship between communication and behavior, 3) the use of AAC, 4) how to prompt students to use AAC, and 5) how to self-evaluate their behavior. Results indicated two of the students in this study increased the number of attempts they made to use their AAC devices. It also indicated all three students' problem behaviors decreased when teaching functional communication as a replacement behavior. The research indicated when training was provided to the paraeducators, they were able to effect a change in communicative and challenging behaviors in a short period time.

To effect change in a student's ability to use their AAC device, one must allow students who use AAC chances to develop their language skills (Binger et al., 2005). To do this, however, the instructional components of AAC must be readily available for caregivers to increase the instructional opportunities the student has to communicate throughout the day. For example, Binger et al. (2005), taught Latino parents to support the production of multi-symbol messages in children with ASD. They used a multiple baseline with probe measures design across three participants (i.e., Latino children) and their guardians to investigate the effects of the Read, Ask, Answer (RAA strategy. The RAA! strategy was taught to the guardians for the purpose of implementation. The guardians were taught an 8-step instructional protocol and as soon as the guardians mastered the strategy, reading sessions with their child began. The guardians used this strategy during reading sessions that were approximately 10 minutes long to increase their child's use of multi-symbol messages. Results showed positive outcomes for all three children in the study, with an increase in multi-symbol messages.

Further research by Binger et al. (2010) examined teaching communication systems to communication partners. This research extended the study by Binger et al. (2005) wherein this study, the *Read-Ask-Answer Prompt* (RAAP!) strategy was used to teach educational

assistants to facilitate multi-symbol message productions for those children who needed augmentative and alternative forms of communication. This study used a single subject multiple-probe-across participants design with 3educational assistants and three pre-school or elementary students with disabilities. In the instruction and intervention phase, there were two components: 1) instructing educational assistants to use the interaction strategy, and, 2) evaluating the impact of the instruction on the educational assistant's use of the interaction strategy and the production rates the students had using multiple symbols. The RAAP! strategy led to functional relation and both parents and educational assistants noticed progress.

While the research by Binger et al. (2010) produced positive results, it only focused on teaching 3 educational assistants (EAs) and 3 students, and the generalizability of the findings were limited. Additionally, Binger et al. (2010) did not educate any other personnel on a student's IEP team. Future research should address this generalizability issue by systematic replication and including other members of the IEP such as related service providers/parents/therapists. Overall, there is limited generalizability in some of these studies due to the lack of replication and small number of participants.

Therefore, the purpose of this study was to implement a Read-Ask-Answer Prompt (RAAP) strategy to facilitate communication to students with significant/multiple disabilities who use AAC. The following research questions were addressed in the current study:

1. What is the effect of the RAAP strategy on students with multiple disabilities multisymbol message production?

2. Does the RAAP strategy generalize across different domains? (needs/wants/desires) and environments (speech therapy room, general education classroom, etc).

Chapter 2. Literature Review

The term *multiple disabilities* is defined under IDEA, Part B as simultaneous impairments (IDEA, 2004). It is a broad term because not all multiple disabilities are the same. The term does not include deaf blindness as a multiple disability but can include all other combinations of disabilities. For example, if a student has an intellectual disability and an orthopedic impairment, they would be considered under IDEA, a student with multiple disabilities (MD). However, this is just one example and there are many MDs. Every state has their own definition for MD. The state of Tennessee's definition as written in the Standards and Special Education Evaluation and Eligibility document states that a MD is a combination of impairments that cause educational needs severe enough that a student cannot be accommodated for by only addressing one of the impairments (tn.gov, pg 1).

Students with MD will most likely need accommodations, modifications, and supports to best support their needs in a school setting. The purpose of an accommodation is to allow a student with a disability equal access and opportunity to show what they know and can do. A modification is a change to the content that is being taught or a way to a change how a student could complete an assignment/task. Some examples of accommodations are using a communication device, using adapted materials, speech-to-text, etc. Modifications can include alternative assessments, extended time, breaking up test/assignments over several days, etc. (jjasso3.weebly.com, pg 1). These are just some of the supports that are offered to students with multiple disabilities. In their Individualized Education Plans (IEPs), they have many supports and team members such as speech language pathologist, occupational therapists, physical therapist to support their academic and physical needs.

What does the eligibility of MD mean for a student's educational needs? According to the Center for Parent Information and Resources, they may need support in major life activities such as caring for themselves, eating, walking, standing, breathing, reading, and communicating (parentcenterhub.org, pg. 1). Access to the general education curriculum looks different for those learners with a primary eligibility of MD. Some students with these impairments may not use spoken or written language. While communication is a key factor to learning in school and everyday life. Verbal and written speech are not the only way to communicate. According to Schlosser and Sigafoos (2006), effective communication is a high need area for children with MD. Communication is defined as expressing ones needs, wants, developing relationships, and social skills (Schlosser et al., 2006). For the population of students with multiple disabilities communication may come in the form of augmentative and alternative communication, sign language, symbol systems, and communication boards (familyconnect.org, pg.1).

AAC Systems

Augmentative and alternative communication (AAC) is defined by Lloyd et al. (1997), as a clinical and educational practice that has a set of strategies and approaches to help or replace a person's speech or handwriting. There are two types of AAC: aided and unaided. According to Lloyd et al. aided AAC involves an external aide such as a communication board or a speech generated device (SGD). Unaided approaches involve the student/person only using their body parts to communicate such as gestures, or manual sign language (Lloyd et al., 1997).

Symbol systems can also be used to help students with multiple disabilities exchange communication. One communication system was one developed by Lori Frost and Andy Bondy in 1985, was the Picture Exchange Communication System (PECS). PECS is an alternative format to AAC systems for students with autism and/or other disabilities. PECS is designed for

early nonverbal communication training and is meant to occur within typical daily activities and in the natural setting of the classroom. It is typically used for students who are non-verbal but could also be used for students who are echolalic, have unintelligible speech, and those who have minimal meaningful words in their vocabulary. There are multiple phases to effectively teach PECS, and if implemented correctly, students in this population could become more effective communicators.

Another way for students with multiple disabilities to communicate is through communication boards. Communication boards are picture symbol boards that can be used to support a student with a disability communicate in an activity through interaction (citation). It displays photos, symbols, or pictures on a board. The learner than can gesture, point, or eye gaze at the images to communicate with others. Some communication boards are used in classrooms for daily routines, emotions, and some schools are starting to place communication boards in different places in their schools so that students with disabilities can access them during inclusive interaction such as on the playground or in the lunchroom.

Studies Highlighting Strategies to Teach Communication

An individual's inability to communicate effectively can have long lasting negative effects on their success across multiple areas. Students in this population, students with extensive support needs, face challenges learning communication that is sufficient for their education and quality of life (Carter et al., 2012). Students with extensive support needs and fewer communication skills can have less access to the general education content that their nondisabled peers, therefore, they may be missing out on high-quality instruction (Kearns et al., 2011). Because of this, these students are more likely to receive their academics in more restricted settings, engage in challenging behaviors to gain or escape items/activities and social

interactions (Lauderdale-Litten et al., 2013). Interventions and strategies are critical to a student's success with communication. Without knowledgeable and willing team members of a student with extensive support needs, communication skills cannot be fully maximized to have the best quality of life. Some strategies to be highlighted below are the use of a VOCA device, mands/tacts, modeling, and PECS.

In a study completed by Youngmee et al. (2013), five children with multiple disabilities who received cochlear implants were chosen for this study. They were all diagnosed with an intellectual disability and cerebral palsy by both psychologists and psychiatrists. The purpose of the study was to determine the effect of AAC using a voice output communication aid (VOCA) to improve speech perception, production, receptive vocabulary skills, and other communicative behaviors in children with multiple disabilities (Youngmee et al., 2013). The five children with the cochlear implants were matched with a control group. The children attended AAC interventions with their parents for six months each week. Intervention was given through 24 sessions, which focused on direct teaching for children and parent training to help with the children's communication skills. They used the KidsVoice device for intervention. This device holds 3200 images and is designed to meet the needs of children with multiple disabilities (Youngmee et al., 2013). The students learned symbols by requesting a preferred object by pointing to pictures that were on the VOCA. Sessions were designed to be as similar as possible to the daily activities that the student encounters at home and at school. Overall, this study showed a positive effect for interventions using a VOCA for deaf children with multiple disabilities through mands. It was proved that all five students made improvements in speech production, repetitive vocabulary skills, and communicative behavior.

Mands/requests are important for a student with a disability to communicate (Cooper et al. 2007). This communication strategy is taught through applied behavioral analysis (ABA). A mand is a type of verbal operant where the speaker (student) asks for what they need or want (Cooper et al., 2007). This request could be done verbally, as a demand, implied, as a gesture, etc. A mand is a behavior that directly states what the speaker (student) wishes to gain, allowing the speaker to gain direct reinforcement for requesting both appropriately or inappropriately. An appropriate response could be the speaker (student) using words, signs, PECS, etc. to request what it is that are trying to gain. An inappropriate response would be screaming, throwing, etc. Yet, in both situations the student is receiving reinforcement. Therefore, it is important to teach the speaker (student) to mand in an appropriate way so that those positive requests are the ones being reinforced.

On the other hand, a tact or label is the way a person labels items, actions, events, or feelings that they experience in everyday life (Cooper et al., 2007). According to Cooper et al. the speaker (student) uses a tact to name things and actions that they have direct contact with using any of the sense modes (Cooper et al., 2007). A learner can tact both observable things and non-observable concepts. The observable things can be gained through any of the senses (sight, hear, taste, smell, touch). The non-observable things can be gained through concepts such as emotions (sad, happy, physical pain) (Cooper et al., 2007). When mands and tacts are reinforced correctly and consistently, the speaker (learner) will then learn what is appropriate communication within their natural environment.

Modeling is also an effective strategy to teach AAC to students with MD because they need to learn in alternative formats to best access their environment. Yet, they are not just going to learn naturally how to use an AAC device. In a study conducted by Sennot et al. (2015), one

student and one educational assistant (EA) participated. A simple A-B design was used. The student's performance was being measured on how well the EA could execute their coaching in the MODELER for Read and Talk strategy. MODELER consists of modeling AAC use as you speak, encouraging communication (through time delay), and responding to children's communication attempts. The Read and Talk component is referring to reading a book and talking about it by making comments or asking questions. During baseline, five sessions were conducted that included share storybook readings sessions for the Biscuit series books by Alyssa Satin Capucili, an iPad with AAC software (Sennot et al., 2015). Intervention consisted of a 90minute training for the EA that was conducted in one setting. After the training, they used the MODELER for Read and Talk strategy across intervention sessions with the student. It contained the same components as baseline did. A 5s delay was used to teach the student turn taking skills within the natural flow of communicating. Interventions showed that the student increased his total number of communications turns taken. This was due to the fact the EA was modeling the words she was modeling, encouraging, and responding to the student through AAC.

The picture exchange communication system (PECS) is an effective evidence-based practice to teach a student with a disability a communication exchange. There are six phases to teach PECS to a learner with a communication need. These protocols, according to PECSUSA, include systematic error correction procedures to aid in learning when errors occur. Verbal prompts are not used. Phase one out of six teaches the learner how to communicate. They learn to exchange single pictures for items or activities they desire (pecsusa.com pg.1). In phase two out of six, the learner learns distance and persistence. The learner is still using pictures in this phase, but is instead, using them in a variety of setting with different people and across

distances (pg.1) In phase three out of six, the learner is discriminating between pictures. This phase is where they learn how to select two or more pictures to ask for something they want (pg.1) these are on placed on a PECS communication book that is made by a teacher, service provider, parent, etc. It is a 3ringed binder with Velcro, where the pictures are stored and easily removed so that the learner can communicate (pg. 1) phase four out of six, the learner is learning how to use sentence structures to communicate what it is they want. The learner is to place on a Velcro sentence strip the phrase "I want" and then request what it is that they want (pg. 1) the learner will then learn to expand their sentences by adding verbs, prepositions, and adjectives. In phase five of six, the learner will use PECS to answer questions such as "what do you want?". Lastly, in the final phase, the learners are taught to comment in response to a question such as, "what do you hear", "what is it?" (pg.1). All six of these phases are taught to learners so that they can exchange in a conversation regardless of their verbal abilities.

In a study conducted by Lund and Troha (2008), they observed young people with multiple disabilities make requests using a variation on the picture exchange communication system with tactile symbols. The study featured three students ages 12-17 that had autism and were blind. There were three-sub phases: symbol exchange, distance and persistence and discrimination (Lund and Troha, 2008). All of which are the first three phases of PECS. In this study they used strategies such as hand over hand and least-to-most prompting for the three students to accurately use these three sub-phases of PECS to communicate. As a result, all students made progress in this study, while only one finished all three phases, all three gained new skills to exchange communication. Research has also shown learners using PECS also develop speech once they have successfully gone through all 6 phases. Some learners also

transition to speech generated devices to further their communication needs (pecsusa pg.1)

Core Boards/Communication Boards to Teach Literacy Skills to Students with Multiple

Disabilities

According to Spooner (2003), evidence-based practices are used for teaching literacy to students with multiple disabilities because it makes sure that the instruction, they are receiving is both efficient and effective compared to the required skills their non-disabled peers know. For example, constant time delay (CTD) is an evidence-based strategy to teach literacy to students.

In a study by Binger et al. (2011), they evaluated the effects of using AAC modeling and recasting on the morphemes with children who use AAC. This study was a single-subject, multiple probes across targets design (Binger et al., 2011). Three participants participated in this study and had all been using their speech-generated device (SGD) for at least one year prior to intervention. A storybook series was used as a context for intervention and each student chose their own book. All the books and texts were appropriate for the student's individual age. On each of the student's SGD device, the morphemes were pre-programed for example, "ING" and "ED" (Binger et al., 2011). During baseline, the researchers administered 10 probes for each participant at the beginning of each session. Each participant completed a minimum of 3 baseline sessions. During intervention sessions, a 15-minute story reading was read. While reading the story, the researcher provided the students with aided AAC models that targeted the key morphemes. The grammatical morphemes were used correctly during intervention and not one student took more than seven sessions to make use their AAC devices correctly with the programmed grapheme. Overall, teaching morphemes through storybook reading and AAC

preprogrammed communication boards, was proved to be effective for all participants (Binger et al., 2011).

When teaching vocabulary to a student with a communication need on a core board, it is important that both fringe words and core words are taught because people do not speak using just fringe words. A fringe word is defined as a word that is more specific to a situation or topic (mostly nouns). One cannot form a sentence from only using fringe words. However, fringe words, when on a core board, are easy to visualize because they can easily be explained in different pictures. For example: "apple", "dog, "house", "teacher", etc. (fluentaac, pg 1). Core vocabulary is defined as common, general words that can be used in more than one context and with several communication partners (pg. 1). One cannot build a sentence without these words but could build some sentences using only core words. Core words are more difficult to visualize for this population because they are harder to be explained. Core words often involve pronouns, verbs, prepositions, and articles (pg.1) When building a core board, one should make sure that a consistent set of core vocabulary would be on the left side of the board and a set of fringe vocabulary would be on the right side of the board. The core vocabulary is intended to stay constant, but the fringe words would change based on what is being taught (pg.1) Teaching both fringe and vocabulary words to students with communication needs allows them to hold a more valuable exchange, understand content presented to them and gain better access to everyday language acquisition.

Teaching Reading Comprehension Using the RAAP Strategy

Reading comprehension skills for students with multiple disabilities are just as important as their non-disabled peers. As stated by Bos and Anders (1990), the failure to teach students with learning disabilities how to comprehend what it is they are reading, ends up

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ravaging in the end. Without the explicit instruction to promote reading comprehension, this population of students may struggle with recognizing words, understanding a sentence meaning, or recognizing the larger text (Bos & Anders, 1990). The need to teach reading comprehension skills to students with multiple disabilities is crucial. One evidence-based practice that address the needs of both the learner and the skill is a strategy called Read, Ask, Answer, Prompt (RAAP). It focuses not only on communication skills, but also uses literacy experiences from story book reading to build them (Binger & Kent-Walsh, 2010). RAAP has been primarily used in two studies with students who have severe/multiple disabilities. RAAP includes specific dialogical reading strategies. As stated by Quinn et al., RAAP encourages students to responds through question, evaluate, and expand the student's response and prompts for model responses. RAAP has been shown to improve young children's multi-symbol message productions (Binger et al., 2008).

One of the studies was conducted by Quinn et al. (2020), on teaching preschoolers with down syndrome how to use AAC during small group dialogic reading, four children with down syndrome and five typically developing peers participated. They used a multiple probe across behaviors research design. The study included three phases: baseline, intervention, and maintenance. In this study completed by Quinn et al. 2020, they used dialogical reading to teach vocabulary words and increase their number of multiple word combinations using their AAC devices. Dialogical reading is an approach where the adult and the student exchange roles. The student learns to discuss the story with the assistance of the adult, all while the adult is scaffolding the child's storytelling through listening and questioning (U.S Department of Education, Institute of Education Sciences, What Works Clearinghouse, 2010). In the study conducted with the four children with down syndrome and the five typical peers, the baseline

session and intervention session included two activities: a vocabulary probe and dialogic

reading) During baseline, the interventionist (speech language pathologist) conducted a

vocabulary probe by instructing the participant to show them a label for the picture. After this

probe, a typically developing peer was invited to join the participant. The interventionist began

reading a story using the RAAP strategy. The steps they followed were: (a). read a page that

contained a target vocabulary word, (b) pause to ask a question, (c) pause and wait for the child

to response, and (d) if the child did not respond, prompt the child to respond. The

interventionist used the RAAP strategy 12 times and embedded six opportunities for each of the

participants to respond to the RAAP strategy. During intervention, the interventionist was

working on the same two activities: vocabulary probe and dialogical reading. The intervention

sessions were like those during baseline, but during intervention there was accessed to AAC-

MOD during dialogical reading. The AAC-MOD included three components: target vocabulary,

AAC expansions, and AAC input during RAAP steps. The interventionist used RAAP

combined with AAC-MOD 23 times with each child having six opportunities to respond to

RAAP strategies steps. Generalization sessions were five minutes and conducted in pairs.

Maintenance phases occurred every 2–16week post-intervention and followed the same probe

procedures as baseline and intervention. The results of this study showed that an AAC-MOD

intervention, including RAAP, a systematic dialogic reading strategy, was effective for teaching

vocabulary, symbol identification, increasing the rate of symbolic communication, increase in

symbol comprehension after maintenance phases for young students with down syndrome.

Some limitations to this study were if AAC-MOD could be implemented without support of

research personnel, typical educators, or speech pathologists. Another limitation to this study

was the fact that it took place in an inclusive classroom, therefore, there is no proof that that AAC-MOD would work in a more restrictive classroom.

Another study that addressed the effectiveness of RAAP strategy was one that was completed in 2010 by Binger et al. It was a study on teaching educational assistants to facilitate the multi-symbol message productions of young students who require AAC. Kent Walsh and Light noted that educational assistants have a high amount of responsibility when it comes to teaching students who use AAC but have little to no training on how to do so. (Kent-Walsh & Light, 2003). This study was a single-subject multiple probe across participants design to determine the how effective the Improving Partner Applications of Augmentative Communication Techniques (ImPACCT) program was. This program is an eight-step model for teaching partners of students who use AAC to provide instruction. In this study there were three educational assistant and student dyads. Storybooks were used as a material but had to meet the following requirements: a. has illustrations, b. text/story line is appropriate to each child's receptive language level, cultural background, and interests; and c. includes at least six doublepage spreads. These books were then used to facilitate each of the student's multi-symbol message production. Each book had their own display on the student's speech generated device where each page contained 30-35 symbols. The study measured the percentage of strategy steps that were correctly implemented by the educational assistant on each page of the story book. The study also measured the frequency of multi-messages produced by each of the students during their 10-minute story reading session using their speech generated device.

A set of books were randomly assigned for each dyad before the start of baseline. One set of story books was used to instruct the EAs and to take intervention data, and the second set

of books were used for generalization measures. During baseline, no feedback on performance was given to the educational assistants. They were instructed to read to their student as they would normally do. The educational assistants were then worked with on how to use a modified version of the interaction strategy that consisted of three main steps: read, ask, answer (RAA RAA!). However, an additional step was added for this current investigation, a verbal prompt (RAAP RAAP RAAP!) Each time the educational assistant turned the page, they were instructed to follow these steps until their student took a multi symbol turn on his/her speech generated device:

1. Read text + provide two-symbol aided AAC model (Binger & Light, 2007);

2. Ask a wh-question + provide a two-symbol aided AAC model;

3. Answer the wh-question + provide a two-symbol aided AAC model;

4. Provide a brief verbal prompt (e.g., "Your Turn")

Between each step, educational assistants were taught to have a 5s delay providing the student an opportunity to respond (Binger & Kint-Walsh et al., 2008). The RAAP RAAP RAAP! strategy was not used during the baseline phase, but all the educational assistants used it consistently during their intervention phase and after completing the instructional program. The students all learned to produce combinations on their speech generated devices within a short period of time. Therefore, the RAAP strategy was proven to be successful for both the educational assistants and the students as well. Some limitations to this study were that only three students and educational assistants were included in this study. Also, the students had to use AAC to participate. This study is also limited to the fact that it only looks at story book reading for language intervention, further research needs to be made on language interventions as they relate to daily living skills (Binger et al., 2010).

In conclusion, both studies showed promising results for students with multiple disabilities, regardless of their limitations. The RAAP strategy can be effective in teaching both literacy skills and communication skills to this population of learners. To date, there is yet a study using RAAP strategy with communication boards/core boards to students with multiple disabilities. This current study will prove if RAAP is effective in not only this population, but also without the use of an SGD device. Therefore, the purpose of the current study was to see if students with multiple disabilities could increase their multisymbol productions through RAAP.

Chapter 3. Methods

Participants

The students in the study met the following criteria: (a) enrolled in an elementary school special education program; (b) present with severe, non-functional speech; (c) communicated through compact messages; (d) could listen to stories and then answer open-ended questions that were simplified on that story; and (e) had hearing and vision within practical limits. All these students had prior exposer to AAC before the onset of this study. The participants also were all exposed to core boards before the start of the study. They used them in the classroom to express their wants/needs and emotions as well as their AAC devices. All four participants were Caucasian males with ages ranging from 6-11.

Cody was a six-year-old boy who had developmental delays and language impairments. He had an outside diagnosis from a doctor for Kleefstra Syndrome. Kleefstra Syndrome involves many parts of the body. Some features of this syndrome can include developmental delays, intellectual disabilities, severely limited speech and hypotonia (weak muscle tone). Cody had limited speech and could produce no more than 25 words verbally at the time of the study but was able to use PECS (Frost et al., 1994) and picture cards to communicate what he wanted as well as to access his environment and people in the building. Cody used PECS to answer questions that are were asked to him. Cody spent his school day in two different self-contained classrooms. He lived at home with his two parents.

Cody had exposure prior to this study with Go Talk Pro and accessed it during school, home, and ABA therapy. He also accessed the PECS through the same environments. He was familiar with single picture requests but had yet to consistently use multi symbol messages prior to this study.

Fred was a six-year-old boy who had a primary diagnosis of autism and a diagnosis of attention deficit hyperactivity disorder (ADHD) from a doctor. Fred had limited speech and was unable to form sentences to communicate his wants and needs. He had an expressive vocabulary of about 30 words. Many of the words that Fred produced were echolalic. Echolalia is meaningless repetition of another person's spoken words. Fred attended a self-contained classroom and accessed his Kindergarten general education curriculum and non-disabled peers throughout the day. He lived at home with his four older brothers and two parents.

Fred had exposure to core boards in speech language therapy as well as in the classroom using the "basic needs" core board. Fred had only been able to touch one to two symbols prior to this study that related to a topic. For example: "sick, tired" but it was not consistent, and they did not always relate to one another. For example: "hungry, Buzz Light Year"

Harold was a seven-year-old boy with a developmental delay and language impairment. He also had a diagnosis of Down syndrome as well as ADHD. Harold had limited functional speech. He had more than 25 functional words that he was able to say, but he was unable to make intelligible sentences to communicate his wants and needs. Harold attended a self-contained classroom and accessed the general education curriculum and non-disabled peers throughout the day. He lived at home with his maternal grandmother and older brother.

Harold also had access to the Language Acquisition through Motor Planning (LAMP) program prior to this study as well as core boards that were accessible in the classroom. According to the Center for AAC and Autism, the Lamp Program is defined as a therapeutic approach based on neurological and motor planning principles. Its goal was to give learners who are nonverbal or have limited speech a method to express themselves and gain independence (aacandautism.com pg.1) Due to his limited understanding of syntax, he was

unable to make it past the 1-hit system on the LAMP program prior to this study. The 1-hit system is 84 early words that speak immediately when selected.

Sam was an 11-year-old boy who had a diagnosis of multiple disabilities. He was also considered non-verbal and relied on an alternative way to communicate. He had access to AAC for three years at the time of this study. He used a Tobii Dynavox machine, but just recently started to learn AAC through the LAMP program on the I-pad. He also is still learning the 1-hit version of this program. Sam had limited motion in his right arm due to spastic cerebral palsy and hypotonia. He primarily spent his day in a self-contained classroom but had access to his general education curriculum and non-disabled peers at different opportunities throughout the day. He lived at home with his mother who adopted him and had a nighttime nurse.

Sam had access to LAMP and PECS prior to this study but was unable to make consistent multi-symbol messages. He did know many single words on the 1-hit version of LAMP such as: sleep, stop, finished, eat, drink, yes, no, help, etc.

Setting

The study took place in an elementary school in a rural area in the southern United States. The school had around 500 students, kindergarten-fifth grade. In the school, there were three special education programs ranging from most intensive supports to inclusion supports.

All sessions took place in the participants classroom, where no other participants were exposed to the study at the same time. The class was a self-contained classroom that was made up of 9 students. Those 9 students were exposed to another 10 students who were certified as a student with a disability but were included in the general education classroom apart from pullout services The classroom was made up of centers that focused on math, reading and writing. This was the same classroom that three out of the four participants spent most of their

school day. Sam was the only student who did not access this environment daily because he attended a self-contained classroom for most of the day. For this study, however, he completed baseline and intervention in the other participants' classroom. Intervention took place when the other students were at related arts which allotted 30 minutes for intervention. The average intervention time was 15 minutes long. The study called for 10-minute story book readings, but two participants (Sam and Cody) needed flexible time limits due to physical needs and shortened attention to task.

Materials and Instrumentation

The story books that were used for the investigation were chosen under the same criteria as the Binger et al., (2010) study: (a) had illustrations; (b), used literature that was appropriate to each child's receptive language level, cultural background, and interests; and (c) included at least six double-page spreads (Binger et al., 2010). The story books were selected using the following criteria: (a). books were age and grade appropriate, (b) books were similar in complexity, and (c) books were validated by the school Speech/Language Pathologist (SLP). The books that were chosen were *If You Give a Mouse a Cookie* and *If You Give a Pig a Pancake* by Laura Numeroff. This author has a series of books that are similar in complexity. The Lexile levels range from 410L-570L, meaning that the age group was the same for both books (3-8). Books were randomized by drawing a name out of a hat. Baseline books were drawn first and the book the participant did not access during baseline, they accessed during intervention sessions. These were the two books that the teacher and SLP agreed upon for intervention due to the amount of wh- questions that could be produced during story book reading. Each book in this series had a multitude of nouns and verbs. To aid the student's production of multi-symbol messages, appropriate symbols were available on each of the story

core boards. The core boards were 2, 22 X 28-inch poster boards, one for each book. Picture

cards were printed using the software Board Maker and were glued down on the poster board

appropriately to reflect a core board. See Figure 1 for the example of *If You Give a Pig a*

Pancake.

Figure 1

If You Give a Pig a Pancake Core Board
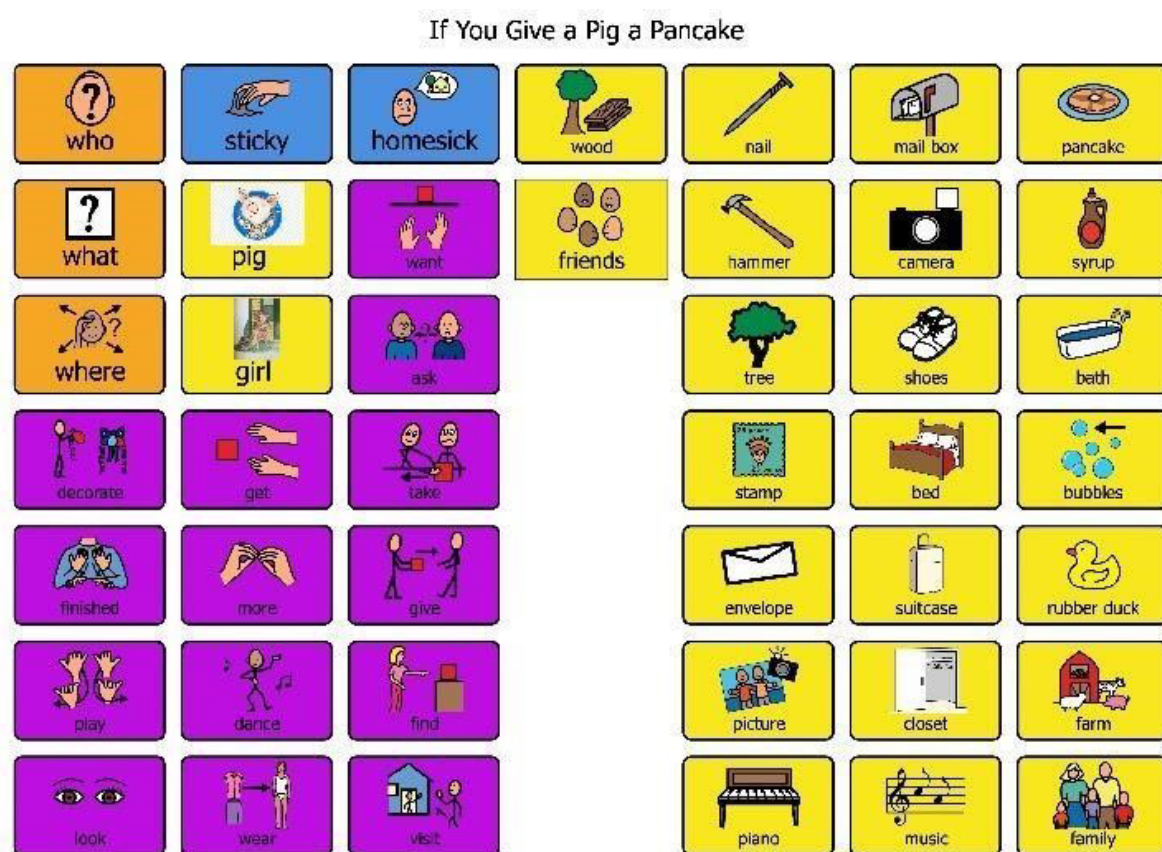
Each core board included main characters, actions, descriptions, and miscellaneous

items in the story. Symbols were organized by category and each category was color coded.

Each board contained 35-45 symbols during baseline and intervention. The categories were:

purple (verbs), blue (descriptors), orange (interrogative words) and yellow (nouns). These

instructional materials were based on Goossens et al.'s (1992) model for aided language stimulation for AAC.

The intervention had to be adapted for Cody due to lack of participation. A visual schedule was made using Lesson Pix showing the steps of the activity in order. It was able to be referenced throughout intervention and baseline to encourage participation. See Figure 2 for a picture of the visual support used for Cody.

Figure 2

Cody's Visual Support

Cody's Work Time
Rules

6	All Done	
5	Work	
4	Focus	
3	Listen	
2	Look	
1	Sit	

Experimenter

The author of this study served as the interventionist (classroom teacher). Before baseline and intervention, the experimenter taught one of her classroom EA's the steps of the RAAP strategy and the steps to look for as an inter-observer for agreement data. The teacher collected the data throughout the study. She had a bachelor's degree and a K-12 Special

Education Certification. She had been teaching for four years in the same classroom with one of the participants; Harold. She has taught two years with Sam and both Cody and Fred were new to her classroom. At the time of the study, she was enrolled in a Master's program for Special Education with a focus on Comprehensive licensure (i.e., low incidence disabilities) advanced studies track.

Research Design

To determine the effectiveness of the RAAP strategy, a single subject multiple baseline across participants with probe measurement design (Ledford & Gast, 2018) was implemented. Four students with multiple disabilities participated in this study. All four students were initially probed in baseline conditions for five sessions. The first student to demonstrate a low and stable trend entered intervention while the remaining three stayed in baseline conditions and measures were intermittently obtained. Once the first student showed a consistent change in level and trend (accelerating), the remaining participants were probed again in baseline conditions. The next participant who showed a low and stable trend was brought into the intervention. This same pattern continued until all students were in intervention. Once a student showed a consistent demonstration of 10 multi-symbol responses the intervention was stopped to check for maintenance.

Independent Variable

The independent variable for this study was the RAAP strategy and core boards used to access the story book readings. They were built to reflect key vocabulary in the book. The core boards highlighted some important literacy skills such as determining nouns and verbs.

Measures

Dependent Variable

The dependent variable for this study was the amount of multi-symbol messages produced using the story core board within a 10-min read aloud. Each participant was observed prior to the study on their multi-symbol message productions that occurred using their SGD devices. All students in this study had access to their own SGD device. Measures were taken on the amount of different symbol combinations the students produced in each phase of the study. Measures were also taken on the overall number of symbols produced.

Social Validity

Social validity was gathered from the parents of the participants, the EA and the school SLP. The parents/caregivers of all four students viewed pre and post instruction progress by looking at their child's data sheets. The teacher set up a meeting with the parent either by zoom or in person to show their child's progress at the conclusion of the study. The teacher reviewed with them that the goal was to produce 10 multi-symbol messages in a story book reading. Data were shared with them on only their child at the beginning and the end of the study (baseline and post intervention) so they could compare their child's progress. The parents were showed some of their child's multimessage productions.

Social validity was gathered from the EA after the completion of maintenance phases. The EA first looked the baseline data and the intervention data to see the impact of intervention. Social validity was also gathered from the SLP after the completion of maintenance phases. The SLP also looked at the baseline data and the intervention data to see the impact of intervention.

Data Analysis

The number of independent multi-symbol responses were graphed daily for both baseline and intervention sessions. The graphs were analyzed first using visual analysis to determine trend, level, and the magnitude of change. Once the study was completed, the percentage of nonoverlapping data (PND) between baseline and intervention was used to calculate effect size. For calculating PNDs for each participant, a PND calculator was used (Tarlow & Penland, 2016). PND scores range from 0%-100%. Scores 90% and above indicated that the intervention was very effective, 70%-89% indicated that the intervention was effective, 50%-69% indicated a questionable effect, and below 49% indicated an ineffective intervention (Rakap, 2015).

Procedures

Baseline

Baseline was collected to determine pre-intervention levels on the dependent variable. As with the Binger et al., (2010) study, a minimum of five baseline sessions was needed for each of the participants and was continued until data was low and stable. Before baseline probes, books were assigned randomly to each student. Each participant was read one book during baseline and one during intervention. The books that met criteria and were selected by the SLP and classroom teacher were *If You Give a Mouse a Cookie,* and *If You Give a Pig a Pancake* by Laura Lumeroff. Whichever book the participant did not access during baseline, the access during intervention. This was so the student was not exposed to the same multi-symbol productions during baseline and intervention. Each baseline session consisted of a 10-minute reading session with the teacher and student dyad. The teacher read to each of the students as she would read to anyone else their age. The students had access to the core board with the

appropriate communication display in the form of pictures. No feedback was provided to the students during these sessions of baseline data. Reinforcement was provided for participation across all participants. Reinforcement included verbal praise and tangible reinforcement.

Intervention

Baseline data with all four participants were collected for a minimum of five consecutive trails. The student with the most low and stable data started intervention first. The remaining students remained in baseline instructional conditions, and they received only intermittent assessments of their data. Once the first student in intervention showed a consistent change in trend and level, the remaining students were probed in baseline. The student with the most low and stable data moved into intervention as well. This continued until all students were in intervention. During baseline, all four participants participated in the RAAP strategy, but no instructions or feedback were given on how to respond using multi-symbol messages.

Intervention was given to evaluate the student's multi-symbol production rates. Whichever book the student did not access during baseline, they accessed during intervention sessions.

For the first component of instruction, the classroom teacher had to understand the steps of the intervention as they were intended to be taught. The classroom teacher replicated these steps of the intervention until the student was able to produce multi-symbol messages from their communication/core board independently. The steps are available in Table 1.

Table 1

Intervention Steps

Intervention Step Per 2 Page Spread	Ratings	
1. Introduce Book Title	YES	NO
2. Give student the correct core board	YES	NO
3. **Read** first 2-page spread aloud	YES	NO
4. Touch core board to reflect targeted vocabulary	YES	NO
5. Wait 5s	YES	NO
6. Ask Question	YES	NO
7. Wait 5s	YES	NO
8. **Answer** questions by touching target vocabulary	YES	NO
9. Wait 5s	YES	NO
10. **Prompt** student to respond using core board and "show me two"	YES	NO
11. Praise appropriately for correct/independent responses.	YES	NO

Total Steps Implemented: 11
11/11= 1 X 100=100%

Between each of the steps listed above that involved *Reading, Asking Answering and Prompting,* the teacher provided a 5s delay allowing the students time to learn natural turn taking skills. Lastly, the teacher responded to each multisymbol message the student produced

using an aided AAC mode containing two symbols minimum (Binger et al., 2010). Until the

students used two symbols independently, the teacher RAAPd each double page spread of the

story book. It is important to remember that if one of the participants responded to a wh-

questions using two or more symbols, that the teacher had to also respond with two or more

symbols. (See Figure 3 on page 37 for details on this interaction strategy). This happened

during intervention with both Harold and Fred. They both were able to access their core

board/communication board quickly and understood the process of answering wh- questions

using two or more multisymbol productions.

Figure 3

Interaction Strategies for Teaching Multi-Symbol Messages

Interaction Strategies **for** **Teaching Multi-Symbol Messages** **Until the student uses 2 symbols, you will <u>RAAP</u> on each double-page spread of the** **book:**	

"Elicitation" Component   "Response" Component

<u>READ</u> + MODEL 2 SYMBOLS using

AAC systems.

5s delay   **When the student uses two or more**

symbols: RESPOND by using 2

or more symbols:

<u>ASK</u> + MODEL 2 SYMBOLS using

AAC systems

5s delay

<u>PROMPT</u> using AAC system

"Show me two"

5s delay
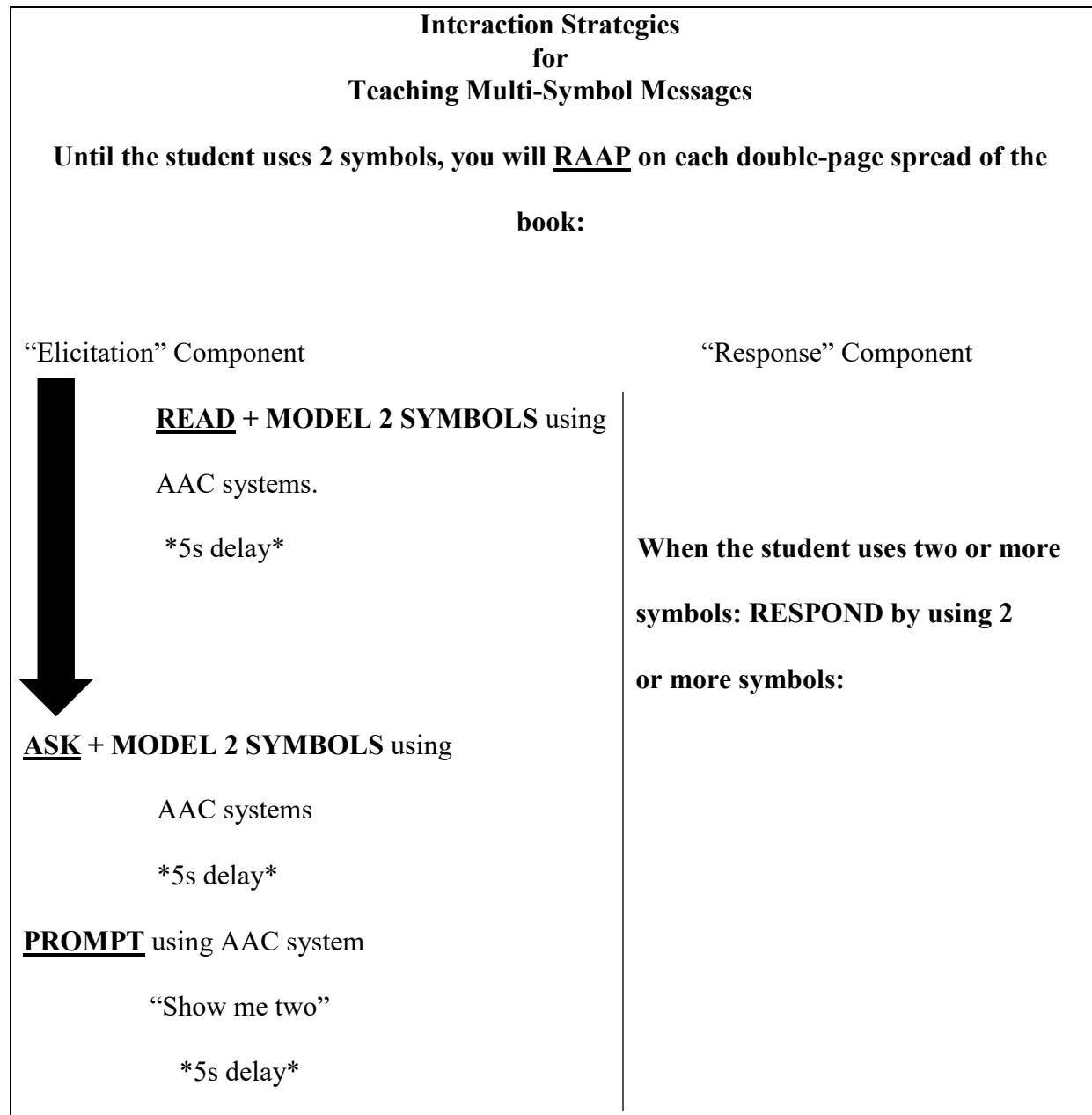
Demonstrated below is how an interaction was laid out between Harold and the

classroom teacher for the book *If You Give a Mouse a Cookie* and shows the RAAP strategy on

a double page spread.

Teacher: ("read" component) *The Mouse is sweeping the house MOUSE SWEEP* (5s delay)

Harold: MOUSE

Teacher: ("ask" component) *Who is sweeping the house?* WHO SWEEP (5s delay)

Harold: MOUSE SWEEP

Teacher: ("answer" component) *Yes, the mouse is sweeping the house* MOUSE SWEEP

(5s delay)

Harold: SWEEP

Teacher: ("prompt" component) *Show me two*

Harold: MOUSE SWEEP

Teacher: ("response component") *Yes, the mouse is sweeping the house* MOUSE

SWEEP HOUSE.

The RAAP strategy was used during intervention for all students on each double page spread until the student was able to show two symbols independently.

Maintenance Phase

For maintenance, the student was given two story books from the same author on two separate sessions. The books that were used for maintenance were *If You Give a Pig a Party* or *If You Take a Pig to School*. The student was measured on their multi-symbol productions and their ability to maintain the RAAP strategy. Student and teacher performance was compared to the performance on the books used during intervention. Maintenance was taken approximately two to seven days after the last intervention occurred. Maintenance Phase showed that all participants were able to produce at least 10 multi-symbol messages across two different books in two different sessions.

Inter-observer Agreement

A trained paraprofessional in the classroom was used as a second observer for interobserver agreement (IOA). Approximately 30% of sessions during baseline and intervention were assessed for IOA. The criterion for sufficient IOA was at least 90% or higher. If IOA was below 90%, the interventionist (classroom teacher) and paraprofessional met to review any variance in the data and come to an agreement before moving forward. Item by item IOA was used throughout the study. The number of agreements was divided by the total number of agreements plus disagreements and multiplied by 100. During both baseline and intervention, there was not a time when IOA was below 90%, however, during both baseline and intervention, Cody's IOA was at 90% accuracy. During baseline IOA for Harold, Fred, Cody, and Sam was taken for approximately 30% of sessions and averaged 96, 94, 93 and 90%. During intervention. IOA was taken for approximately 30% of sessions and averaged 97, 93, 91, and 91% agreement.

Procedural Fidelity

For procedural fidelity (PF) to be measured, a checklist of steps to implement during baseline and intervention was used during both phases. These data were collected by a trained paraprofessional for at least 30% of all sessions in baseline and intervention across the 4 participants and was set at 90% or higher. If the procedural fidelity fell below 90% then the interventionist (classroom teacher) would review these implementation procedures with the paraprofessional who collected PF data to clarify any errors or missteps or misinterpretations of the baseline and intervention procedures. Procedural fidelity for baseline sessions was collected across 36% of sessions with an average of 95% fidelity of implementation (range of 92-94%)

Procedural fidelity for intervention session was collected for 38% of the sessions with an average of 97% fidelity of implementation (range of 96-98%).

<div align="center">

Results

</div>

Independently Communicated Multi-Symbol Messages

Results for the number of independently communicated multi-symbol messages for each student during each phase of the student can be seen in Figure 4. Generally, the results indicated that during baseline probes, students multi-symbol messages were quite low. Once the RAAP strategy was implemented with a student, those messages substantially and quickly increased. This indicated a functional relation between the RAAP strategy and the student's production of multi-symbol messages. Individual student results are presented next.

Cody

During baseline, Cody did not show any independent multisymbol messages. Because of his low and steady trend in baseline, he was the first participant to enter intervention. Once he was in intervention, he showed no multisymbol messages after being exposed to intervention and the RAAP strategy. It was hypothesized that this was due to this lack of attention to the task and overall engagement with the task. Due to this, it was determined to provide a slight adaption to the intervention for Cody. Lesson Pix was used to make him a visual analysis of the task. It showed the picture for look, listen, touch, high five. Once this adaptation of the intervention was implemented, Cody started showing an increase in his multisymbol messages. He made two multisymbol messages and then four multi symbol messages consecutively in sessions 5-7. It took Cody sixteen intervention sessions to show a clear change in trend and level from baseline conditions. He made ten different multisymbol messages for the book *If You Give a Mouse a* Cookie. His data showed a slightly variable but accelerating trend for

<div align="center">

41

</div>

intervention sessions. See Table 2 for some of the multisymbol messages made. The PND for

Cody was 88% indicating an effective effect size.

Table 2

Examples of Cody's Multi-Symbol Phrases Produced

Intervention Session	Multi-Symbols Produced
4	MOUSE SWEEP
6	COOKIE MILK, MOUSE SWEEP, CLEAN FLOOR, BOX SLEEP
10	COOKIE MILK, MOUSE SWEEP, CLEAN FLOOR, BOX SLEEP, CRAYON DRAW
16	MOUSE BOY, MOUSE SWEEP, CLEAN FLOOR, MOUSE SLEEP, MOUSE DRAW, MOUSE MILK, MOUSE COOKIE, BOY COOKIE

Fred

Fred was the next student to enter intervention because his data were low and stable and

due to other participants' illness, he was one of the participants that was both ready for

intervention and present at school. During baseline, he was given the book and the core board

for the book *If You Give a Mouse a Cookie*. During initial probing for baseline, he showed one

multi symbol message by touching MOUSE COOKIE. After Cody showed a consistent positive

trend, Fred was probed again in baseline and this time, he produced no multi-symbol messages,

during intervention he had access to the book *If You Give a Pig a Pancake* and its

corresponding core board. He produced two multi symbol messages during the first intervention session. He had a total of 10 intervention sessions. Fred went through intervention as the study was intended. Board. His last three sessions all consisted of 10 multi-symbol messages across the 10-minute story book reading. Therefore, Fred had a steep and accelerating trend. The PND for Fred was 100% indicating a very effective effect size. See Table 3 for some of the multisymbol messages produced.

Table 3

Examples of Fred's Multisymbol Messages Produced

Intervention Session	Multi-Symbols Produced
1	WHO PIG, BATH BUBBLES
3	PIG PANCAKE, PANCAKE SYRUP, BED SHOES, WHO GIRL
6	PIG PANCAKE, WHO PIG, PANCAKE SYRUP, GIRL PIANO, PIG DANCE, GIRL CAMERA, PIG STAMPS, PIG TREEHOUSE
10	WHAT PANCAKE, PANCAKE SYRUP, BATH BUBBLES, BED SHOES, GIRL PIANNO, CAMERA PICTURE, STAMP MAILBOX, PIG GIRL TREEHOUSE, SYRUP PANCAKE, PIG PANCAKE

Harold

Harold was the next participant to enter intervention. He was probed three separate times for baseline conditions for a total of eleven sessions and across these sessions data showed that he was low and stable at mostly zero (only two sessions he scored 1 in baseline). During baseline, he accessed the book If You Give a Mouse a Cookie and showed no multisymbol messages.

During intervention, he was given the book and core board for *If You Give a Pig a Pancake*. During the first intervention session, he produced two multisymbol messages. He had a total of 12 intervention sessions. During the last three sessions, he was able to consistently show 10 multisymbol productions across the story book reading. Therefore, he showed a steep accelerating trend for intervention. The PND for Fred was 100% indicating a very effective effect size. See Table 4 to see some of the multisymbol messages produced

Table 4

Examples of Harold's Multisymbol Messages Produced

Intervention Session	Multi-Symbols Produced
1	PIG PANCAKE, PIG DANCE
5	WHO PIG, PIG PANCAKE, BATH BUBBLES, BED SHOES, CLOTHES PIG, PIG MAIL, WHAT GLUE
8	PIG PANCAKE SYRUP, BATH TOYS, BED SHOES, PIG MUSIC, GIRL PIANO,

	PIG DANCE, GIRL CAMERA, PIG TREEHOUSE
12	PIG PANCAKE SYRUP, BATH BUBBLES, BED SHOES CLOTHES, PIG MUSIC, GIRL PIANO, PIG DANCE, GIRL CAMERA, PIG STAMP MAILBOX, PIG TREEHOUSE, SYRUP PIG PANCAKE

Sam

Sam was the last one to intervention due to absences because of Covid-19. He was probed in baseline 14 times and every time, he was not able to produce one multisymbol message. He was given *If You Give a Pig a Pancake* and its core board for baseline sessions. Sam had 16 intervention sessions. In intervention Sam had a jump in level and accelerating trend, which continued through intervention. He accessed the book *If You Give a Mouse a Cookie* and its core board for intervention sessions. At the end of intervention, Sam was able to produce 10 different multisymbol messages. His data showed a slightly variable but accelerating trend for intervention sessions. The PND for Sam was 94.4% indicating a very effective effect size. See Table 5 for multisymbol messages produced.

Table 5

Examples of Sam's Multisymbol Messages Produced

Intervention Session	Multi-Symbols Produced
3	MOUSE COOKIE, COOKIE MILK
7	MOUSE COOKIE, COOKIE MILK, MOUSE MIRROR, MOUSE SWEEP, MOUSE PILLOW, MOUSE THIRSTY
12	MOUSE COOKIE, COOKIE MILK, MILK STRAW, MOUSE MIRROR, MOUSE PILLOW, BOY READ, PIG DRAW, MILK COOKIE
16	MOUSE COOKIE, COOKIE MILK, MILK STRAW, MILK NAPKIN, MOUSE PILLOW BLANKET, BOY READ, PIG CRAYON DRAW, WHAT TAPE, PIG FRIDGE, MILK COOKIE

All participants were able to increase their multisymbol message productions during intervention by accessing the RAAP strategy and core boards. As you can see most of the students produced two-word communications, except for a few three productions.

Maintenance

Two maintenance probes were collected to see if the student was able to maintain the RAAP strategy to a set of story books. These books were not used during baseline or intervention, but the teacher quickly used the strategy appropriately during the maintenance phase (85-100%). Henry and Fred both used more multisymbol messages during the maintenance phase. (Henry= 13 and 16 Fred=12 and 15 symbol combinations for each session of generalization). Cody and Sam produced less symbol combinations during their first maintenance phases, but this improved for both during the second maintenance phase (Cody 6 and 12, Sam= 8 and 13).

Generalization

Books in baseline, intervention, and maintenance were all different and were randomly pulled from an equivalent set of books. During maintenance, two different books were used for each probe which allowed the students to demonstrate both maintenance and generalization.

Social Validity

All four parents verbally stated that the teacher better supported their child child's language skills post instruction. They also noted their children communicated more effectively after instruction and were attempting to make more than one symbol responses. The EA that collected IOA for the study verbally stated that based off data, the intervention was successful. She stated that this strategy may not necessarily be beneficial for all types of learners. She noted that when Cody was going through intervention, he had to have the intervention adapted to him. She stated that while adaptions are needed at times for intervention, she wondered if there were other evidence-based practices that could be implemented with learners who need more physical prompting. Yet, the EA stated that from baseline data to maintenance probes, all the students were

able to maintain and produce multi-symbol messages. She would recommend this to a similar study group with similar criteria.

The SLP verbally stated that based off data, the intervention was effective. However, he would have liked to see what generalization would look like using the RAAP strategy across other subjects. He stated that it was effective for both communication building and literacy skills. He would recommend this intervention strategy with similar students and stated he was going to implement RAAP strategy with his own students who received speech/language therapy.

Figure 4

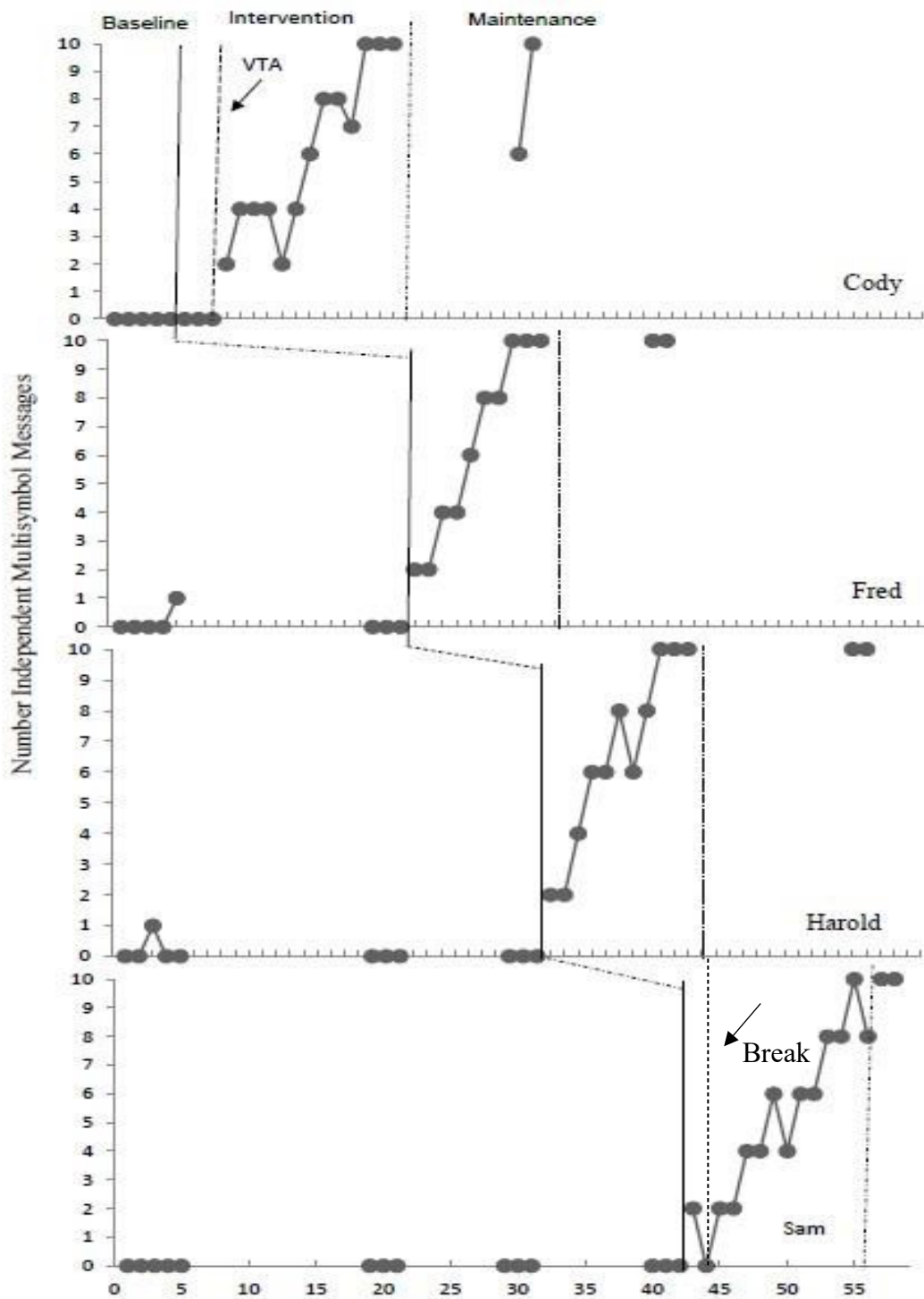*Number of Independent Multi-Symbol Messages Data Analysis*

Figure 4.
Number of independent correct multisymbol messages during storybook lesson

Discussion

The purpose of this study was to determine the effects that the RAAP strategy had on the dependent variable (multi-symbol communications through story book readings). A single subject multiple baselines with probe measurement across participant design (Ledford & Gast, 2018) was implemented. Participants were four students in an elementary school that had multiple disabilities. These four student's results showed a functional relationship.

While the study indicated a functional relation between the independent and dependent variable, there are a few points worth noting about the implementation of this study. First, a limitation for Cody was his intervention needed to be adapted after the first three probes in baseline due to the lack of progress. At this point, it was decided that adding a visual support could be beneficial for him. This was decided as he initially showed a lot of refusal during the intervention, such as swiping the core board on the ground, whining, and crying. He also showed confusing gestures that could indicate he was responding a different way such as smacking the core board and not pointing out one symbol at a time. He required a lot of verbal redirections at the beginning of intervention to remain seated and listen to the story. However, the slight adjustment to the intervention for Cody, provided an opportunity for him to be successful. Additionally, he was able to maintain and generalize the RAAP strategy during story book lessons and produce a minimum of 10 multi-symbol messages.

Moreover, Sam had numerous intervention sessions, as did Cody. Sam had 14 intervention sessions, Cody had 13, Fred 10, and Harold, 11. As data indicated, Sam and Cody needed longer in intervention to show consistent acquisition. However, Sam did not need to have intervention altered because he was able to produce multisymbol messages in intervention sessions one, three, and four. Whereas Cody was unable to do so without his visual support.

This study built upon the few studies to date that used the RAAP strategy to teach students with disabilities literacy instruction (Binger et al., 2010; Quinn et al. 2020). There are important differences in the previous and current studies, Binger et al. (2010), implemented the RAAP strategy through story book readings just as this current study did. However, in the study by Binger et al., the purpose of the study was to determine the effects of teaching the RAAP strategy to EAs and the multi-symbol productions of the students. In this current study, the RAAP strategy for story book readings was implemented by the classroom teacher and the EA was used to assess inter-observer agreement and treatment fidelity. This current study used core boards to implement the RAAP strategy, whereas the study in 2010 used SGD to implement the RAAP strategy. This current study filled the gaps for students who do not have access to SGDs but need alternative ways to communicate during literacy instruction.

The study by Quinn et al. (2020), focused on teaching preschoolers with Down Syndrome how to use AAC during small group dialogic reading. Four children with Down Syndrome and five typically developing peers participated. In contrast the current study did not focus on one disability, but instead focused on multiple disabilities. In the Quinn et al. study AAC-MOD was used as the independent variable to produce multi-symbol words whereas the current study used teacher made materials. The Quinn et al. (2020) also examined the influence of peer models, whereas the current study did not.

The two studies that were implemented prior to this current intervention all used English language arts as the subject. All three interventions, including the current, focused on teaching multi-message symbols through AAC, both aided and unaided. All three studies have been implemented across participants with disabilities. While there are similarities and differences to all the studies, each one had its own limitations and implementations for future research.

Limitations

A few limitations were present during the current study. One of the main limitations was the Covid-19 global pandemic. The pandemic caused absences, and inconsistency in students' schedules, which possibly slowed the intervention process down. Once Cody was in intervention, the classroom had to quarantine for 10 days with no virtual learning. This caused a pause in the intervention and the other three participants had to be re-probed in baseline after a change in their daily schedule.

Another limitation was the study started in November and concluded in early March of 2022. During this time frame, the classroom teacher got married and was out the last school week in December, pausing interventions. Next, the students had winter break for two weeks as well. These breaks could have been a factor in the slow progress that Cody exhibited.

Before the start of this study, the classroom teacher had planned to replicate the study as it was written by Binger et al. (2010). The initial plan was to use the EA who had worked with the three out of four of the participants for three years prior to intervention. She wanted to train that EA to implement the RAAP strategy. However, at the beginning of the school year, the classroom teachers' EA did not return to school due to personal health reasons. This caused the intervention to be adapted to the classroom teacher serving as interventionist, which slowed the start of the intervention. There had to be rapport with the students, classroom routines and procedures in place before the start of this study. There also had to be adjustments to the schedule to keep internal validity for the study. Each student during baseline, intervention, maintenance, and generalization was one to one with the classroom teacher and had no other outside distractions from students both in and out of the study.

An additional limitation for this study was the number of books that were used during baseline and intervention. There were two books used across baseline and intervention that were randomized. At the start of the study, the interventionist randomly drew out of a hat what student would use what book during both phases. Whatever book they did not use during baseline was the book that they used during intervention. This is a limitation because it is possible that the participants made progress due to repeated exposure to the same book. However, the data do not support such an interpretation since across the multiple baseline probes were either completely at or near zero levels. Also, none of the participants were prematurely exposed to intervention. The participants were unable to talk about the study to one another as all four of them showed severe; non-functional speech. The books were locked up in a cabinet so that the students did not have access to them prior to their story book reading.

One last limitation included the multiple interruptions to the daily schedule such as fire drills, staff absences due to COVID, intruder drills, therapy sessions (OT, Speech, PT) and doctors' appointments. These interruptions caused several breaks in intervention. Consistent exposure to the intervention may have resulted in faster skill acquisition, but despite these interruptions, the data still indicated quick acquisition.

Recommendations for Future Research

Based off study results and limitations, further research is needed to determine the full effects of the RAAP strategy. First, future research should be conducted on the use of multiple books across baseline and intervention and core boards for students with multiple disabilities. This would provide increased internal validity and decrease concerns of possible learning due to repeated exposure to the same text.

Future research should be conducted on generalization measures as it was a limitation in this study due to time constraints of teaching during Covid-19. The students were able to maintain the RAAP strategy, but generalization was not explored fully. Ways that this could be explored in the future could be looking at voice output devices (VOD) versus core boards. Another way that generalization could have been measured would have been to look at generalizing the strategies across different people such as the SLP. Another way it could have been explored would have been by generalizing the RAAP strategy for another subject other than literacy.

Future research should also be completed to determine the effects of the RAAP strategy across different people and subjects. Previous literature indicated that the RAAP strategy has been implemented by the classroom teacher as well as educational assistants. Other members that could implement the RAAP strategy could be the SLP and regular education teachers. The RAAP strategy has been used for students with disabilities to produce multi-symbol messages through literacy. However, further research should be conducted to determine the effects of the RAAP strategy across different subjects.

The studies conducted by Binger et al. (2010) and Quinn et al. (2020), and the current study all used the same age group for participants. Further research should be conducted to determine the effects of the RAAP strategy for participants that are not attending pre-school-fifth grade.

One more recommendation for future research could be to determine the effect of the RAAP strategy on multi-symbol productions through adapted books. All current studies have accessed non-adapted texts.

Implications for Practice

One of the main purposes for educational research is to see how effective interventions in the classroom and across multiple other environments would be. The core boards for Laura Numeroff's story books: *If You Give a Mouse a Cookie, If You Take a Mouse to School, If You Give a Pig a Pancake and If You Give a Pig a Party* proved to be effective with the intervention of the RAAP strategy on teaching multi-symbol communications to students with multiple disabilities. The students also engaged in the material and had little to no difficulty answering comprehension questions once the RAAP strategy was used.

The results from the current study showed that the questions being asked during story book readings, enable educators in the field to understand that the RAAP strategy can be an effective method for teaching multi-symbol productions and demonstrate listening comprehension skills when used with fidelity.

Conclusion

This study answered the two research questions:

1. What is the effect of the RAAP strategy on students with multiple disabilities multisymbol message production?

2) Does the taught RAAP strategy generalize across different domains? (needs/wants/desires) and environments?

Overall, the study showed a positive effect and relationship on the RAAP strategy for students with multi disabilities multisymbol message productions. The four participants increased their multi-symbol productions from the start of baseline to the end of the maintenance phase. They were able to generalize skills taught to them during intervention and generalize the RAAP strategy across multiple books.

Finally, with future research and implications for practice, the RAAP strategy could serve as a great method for teaching multi-symbol productions across subjects and environments. The RAAP strategy can allow a student with multiple disabilities independence to communicate more effectively.

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