

THE PENNSYLVANIA STATE UNIVERSITY
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DEPARTMENT OF COMMUNICATION SCIENCES AND DISORDERS

THE EFFICACY OF LOW TECHNOLOGY VISUAL SCENE DISPLAYS ON
COMMUNICATION OF A DEVELOPMENTALLY DELAYED INDIVIDUAL

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ABSTRACT

The purpose of this paper is to explore the efficacy of an intervention combining low technology visual scene displays (VSDs) and aided modeling for a preschool aged child with developmental delay. This case study focused on one participant, who will be referred to as Sam. Low technology VSDs were created using photographs of the participant engaged in different activities. Results of this study revealed that the combination of low technology VSDs and aided modeling was successful in increasing the number of communication turns and the variety of semantic concepts expressed during the intervention sessions.

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Chapter 1

Introduction

Communication allows individuals the basic right to interact with each other for the most basic purposes (Light, 1988). These purposes include expressing needs and wants, developing social closeness, exchanging information, and fulfilling social etiquette (Light 1988).

Communication allows toddlers to ask their mothers for food, teenagers to talk on the phone and exchange secrets, researchers to share new discoveries, strangers to share a polite passing, and so much more in our everyday lives. However, not everyone is able to experience the power of communication. Individuals with both developmental and acquired disabilities could experience communication impairments that often lead to being isolated from others (Harding, Lindsay, O'Brien, Dipper, & Wright, 2011). An individual with limited communication is also limited in his/her ability develop socially and cognitively (Downey & Hurtig, 2003). Augmentative and Alternative Communication (AAC) can be a suitable means of communication for many individuals with communication disorders. The American Speech and Hearing Association (ASHA) defines AAC as “an area of clinical practice that attempts to compensate (either temporarily or permanently) for the impairment and disability patterns of individuals with severe expressive communication disorders” (ASHA, 1989, p. 107)

AAC has been shown to be effective with young children with complex communication needs including those with developmental delays (Drager, Light, & McNaughton, 2010).

Children with developmental delays experience a lag in reaching development milestones

compared to their typically developing peers. Most children reach “first words” stage around 1 year of age and are able to communicate in short sentences by age 3; any child who is not speaking words or sentences by this age is considered developmentally delayed (Frey, 2011).

The goal of AAC intervention is to enable an individual with communication disabilities to communicate using any means that the person has available, not only to express needs, but to express ideas and feelings (Downey & Hurtig, 2003). Currently there are many different types of AAC. AAC can be aided or unaided. An aided AAC system involves the use of “specific pieces of equipment or other auxiliary materials” such as photographs whereas unaided AAC does not involve usage of any external devices, relying on manual signs and gestures (Sigafoos & Drasgow, 2001, p. 152). Further, aided AAC systems can be low technology systems, that include communication boards, communication notebooks, or picture symbol systems; or high technology systems that make use of electronic devices and usually provide synthesized speech patterns (Downey & Hurtig, 2003). Traditionally, AAC systems have used a grid format where AAC symbols are within separate squares organized into rows and columns (Drager, Light, Curran Speltz, Fallon, & Jeffries, 2003). These layouts may be difficult for young children because they are decontextualized and require metalinguistic abilities (Drager et al., 2003). Alternatively, visual scene displays (VSDs) are contextually rich images. Two studies by Drager et al. conducted in 2003 and 2004 found that 2.5 and 3 year olds using VSD layouts performed better on language tasks than those using grid layouts. VSDs can be a digital photograph, scanned image, or schematic line drawing of a scene with multiple concepts embedded within it (Wilkinson, Light, & Drager 2012). These concepts that are relevant to the individual are presented as “hotspots”. An individual can activate hotspots to communicate with them or about them.

The context of VSDs “allow communication partners to co-construct ‘the gist’ of important life events” and “bypass reliance on linguistic processing and need for extensive verbalizations” (Dietz, McKelvey, Weissling, Hux, and Beukelman, 2006, p. 1.) . VSDs often make use of personally relevant photographs, which incorporate familiar people, activities, and places. The use of highly personal photos uses the individuals’ visual memory skills, focusing on recognition rather than recall, which may be easier for those with disabilities (Dietz et al. 2006).

Another element of VSDs that is critical to capture and maintain attention is the incorporation of humans (Wilkinson & Light, 2011). In a study that presented a series of photographs to college students in which human figures were small and among larger, more colorful objects, they were still the earliest to draw and maintain attention (Wilkinson & Light)

Researchers have attempted to determine which type of display (grid, VSDs or a hybrid of both) has been most successful for improving communication in children. A study by Drager and colleagues (2003) indicated that VSD layouts ensured the most success with typically developing young children (below the age of three years). Although research on VSDs is still emerging, existing research indicates that these may be a promising solution for young children and beginning communicators with complex communication needs. Research incorporating VSDs with young children who had developmental disabilities indicated that all children increased their rates of turn taking, used multiples modes of communication, and rapidly acquired new vocabulary (Light and Drager, 2010). Studies such as this one used high technology VSDs, which are presented on computerized devices such as iPads and other tablet devices. One of the only studies existing on low technology VSDs was also promising. Hux et al.’s 2010 study researching the effect of a low technology VSD on the communication of an adult man with aphasia found communication sessions with a shared low technology VSD

showed the best communication outcome in terms of conversational turns, number of initiations by the participant, and conceptual complexity of responses. (Hux et al., 2010). However, no studies have investigated the use of low technology VSDs with children.

In addition to the AAC system, aided modeling is another factor that contributes to communication success of individuals who require AAC. Availability of appropriate language models is a clear factor in the development of language. Children who use AAC receive far fewer models than typically developing children (Drager, 2009). Modeling can take the form of the researcher pointing to a referent in the environment, or pointing while simultaneously vocalizing the verbal symbol for the referent (Drager et al. 2006). Modeling of AAC systems involves the communication partner using the same mode of communication that the individual uses. This shows the child how the system is used and demonstrates that AAC can be an effective mode of communication (Drager, 2009). In 2006, Drager and colleagues investigated a modeling intervention with preschoolers with Autism Spectrum Disorder, and the use of modeling with AAC devices was found to be effective in increasing symbol comprehension and symbol labeling (Drager et al, 2006).

There is currently a lack of research on low technology VSDs, without the use of tablets or computers. There are many benefits to using VSDs in a low technology form. For example, low technology devices can be easily developed and are cost efficient. Therefore, individuals that did not have access to this type of AAC in the past could have access to it in the future. This could lead to more widespread use of AAC and more individuals with complex communication needs accessing communication. It can also be a means of “trying out” AAC prior to investing in a high technology device. Low-tech VSDs are also portable and can be used in a variety of environments where high tech devices cannot be used, such as at the pool or at the playground.

Most current research using VSDs with children has been conducted with typically developing children (e.g., Drager et al., 2004). The current study looks to building upon this research base. This study looked at implementing an intervention combining low technology VSDs and aided modeling for children with communication disorders, specifically a child with a developmental delay.

Chapter 2

Method

Research Design

This project is a case study using a single subject AB design. A case study allows for in depth exploration of an individual and leads to a detailed analysis of the outcomes. In an AB design the “A” phase represents baseline (no-treatment) condition and “B” refers to the intervention phase (Zhan & Ottenbacher, 2001). The purpose of an AB design is so a participant can serve as his/her own control. The participant’s communication in the intervention phase is compared to the baseline phase. More communication turns in the intervention phase would suggest the intervention was successful in causing an increase in communication. In a case study, the participant can be observed over time and the researcher can control the treatment and outcome variables (Zha& n Ottenbacher).

This study included both independent and dependent variables. The independent variable was the AAC systems used in the baseline and intervention, specifically the low technology visual scene display combined with modeling during the intervention phase. The dependent variable of this study was the communication turns of the participant during baseline and intervention phases.

Participant

At the start of the study, the participant was a 2-year and 4-month old male who will be referred to as Sam (pseudonym). A number of assessments were done prior to the study to measure Sam's language skills and evaluate his preferences. He was classified as having a developmental delay. His gross motor skills, fine motor skills, vision ability, and hearing ability were all adequate. Sam's modes of communication included verbal (use of some words), some signs, and gestures. He attended day care.

Materials

The materials for the baseline phase grid included PCS symbols created on a Windows computer using Board Maker. These were inserted in plastic sleeves and included in a three ring binder. The intervention phase included low technology visual scene displays created using pictures of the child printed out on photo paper. Hotspots were fastened on to the VSD using transparent Velcro. During the baseline and intervention phases, plastic trucks, toy bugs, and other age appropriate toys were used. Age appropriate songs were also used during the sessions, such as "The Itsy Bitsy Spider". A video camera and tripod were used to record the sessions and a camera was used to take pictures of the child participating in activities to make into the VSDs.

Assessments

The MacArthur- Bates Communication Development Inventory was completed. Sam's inventory revealed that he had 8 words and 1 sign in his inventory prior to the study, which put him in the <5th percentile. Typically developing children should be in what known as the 50-word stage around 18 months of age, and working on transitioning into combining words. He also did not ever communicate about the past or the future, about objects not in the room, or people who are not present. This assessment demonstrated that Sam was a beginning communicator, proving that he was a good fit for this study.

A Communication Matrix was also completed. Sam was placed at a primary level IV. Level IV is conventional communication, which involves pre-symbolic behaviors to communicate, meaning there is not yet a 1:1 correspondence between the communications the child is using and the messages they wish to express. Examples of Level IV Communicative behaviors include pointing, nodding or shaking the head, waving, hugging, and looking from a person to a desired object. This stage usually takes place around 12-18 months. (See Appendix A for the results of Sam's Communication Matrix.)

A preference assessment was completed to determine which activities he would be likely to be most engaged in during the study. It was determined that he liked trucks, cars, singing songs, and animals, so those served as the basis for the activities for the sessions (Appendix B).

Procedures and Data Collection

Sessions occurred once a week. The sessions lasted 15 minutes and were videotaped. Sessions involved 1:1 engagement between the interventionist and the child in various activities of interest with Sam that were determined through the preference assessment. The interventionist, a doctoral candidate in Communication Sciences and Disorders and a Speech-Language Pathologist, allowed Sam to choose between a few options of activities to engage in each session. The interventionist and Sam sat face to face with the activity and low technology VSD in between them. The interventionist would at times pick up the AAC device to facilitate its use. Multi-modal communication was used during these sessions, including speech, signs, and use of the AAC device. The interventionist was required to provide at least eight communication opportunities for Sam. The activities included play activities and songs. The same activities were done during the baseline and intervention phases. These sessions were later viewed and coded for communication turns, which will be discussed in the data collection section.

In this study, the baseline phase involved six sessions with the interventionist using a six symbol Picture Communication Symbols (PCS) grid (See appendix C). PCS symbols provide an image relating to the activity at hand but are not provided in context. Grids were developed for each activity in the session. Once baseline was stable, meaning there were no significant increases or decreases in the number of communication turns, the study moved to the intervention phase.

The intervention phase involved five sessions with the interventionist using low technology VSDs (see appendix D) and aided modeling. The PCS grid symbols remained available. The interventionist was required to provide at least eight models within the 10 min intervention session. The low technology VSDs were set up as printed scenes of the activity in

which the interventionist and Sam were engaged. Hotspots were fixed on to the picture using transparent Velcro. Multiple VSDs were made for each activity engaged in during the session. When the child communicated about a hotspot by either pulling the hotspot or pointing to it, the interventionist would say the name of the item or person.

All the videos were viewed and coded for communication turns. For the parameters of this study, a communication turn was defined as communication initiated by the child or in response to an opportunity provided by a partner. Each turn had to be intentional, communicative, and symbolic to be counted. Intentionality means that the individual was purposefully trying to initiate or respond to communication through eye gaze, gesture, leaning toward, touching, or vocalization or verbalization. Communicative means that he was doing so using non-conventional communication forms such as gesture, sign, or speech approximation, or conventional communication such as speech. Lastly, symbolic meant that there must have been a 1:1 correspondence between the symbol and its referent. For example, Sam would have to point to the picture that represented an object, or make a sign that represented an object rather than simply pointing to the object. If all three conditions were met, the turn was counted. When coding, the turns were coded according to the mode of communication: V (vocalization, SP (speech), SPA (speech approximation), G (gesture), S (sign), or SA (sign approximation). Numbers of unique semantic concepts expressed was also noted.

Reliability

Data reliability was checked randomly on 20% of the data. The purpose of this was to ensure that the coding of communication turns was consistent. Coding was done by two different

researchers and then compared to see if each researcher coded the same turn at the same time.

The formula for consistency was $\text{Number of Turn Agreements} \div (\text{Number of Turn Agreements} + \text{Number of Turn Disagreements} + \text{Number of Omissions}) \times 100$. For Sam, the mean data reliability score was 95% (range 83.3-100). These numbers indicated high accuracy for coding of the data.

Procedural integrity was checked on the number of opportunities provided, number of models provided, and whether the researcher followed the prompting hierarchy accurately. During both phases, the interventionist worked to provide at least eight opportunities for the child to respond. Any of the following was considered an opportunity: making a choice, answering a question, making a comment, taking a turn, requesting, asking a question, and greetings. Procedural integrity was also checked throughout the study to ensure that the interventionist provided at least eight communication opportunities within a ten-minute session. This was assessed randomly in 20% of the data, and was checked one in every three sessions. The number of opportunities was consistently above the required eight opportunities.

The number of models was checked to make sure the researcher was presenting at least 8 models within a 10-min session. This was checked one of every three sessions, and this was consistently above the required eight models.

Lastly, a prompting hierarchy was used to define the amount of assistance required from the researcher to help the participant present a correct response (Fields, 2013). The prompts went from least to most. If the individual did not respond to a communication opportunity or was having difficulty, the interventionist would wait 5 sec then follow the prompting hierarchy to elicit a response. To ensure the interventionist correctly implementing the steps in the prompting hierarchy, 3 min of every session was checked for prompts. The reliability for the prompting

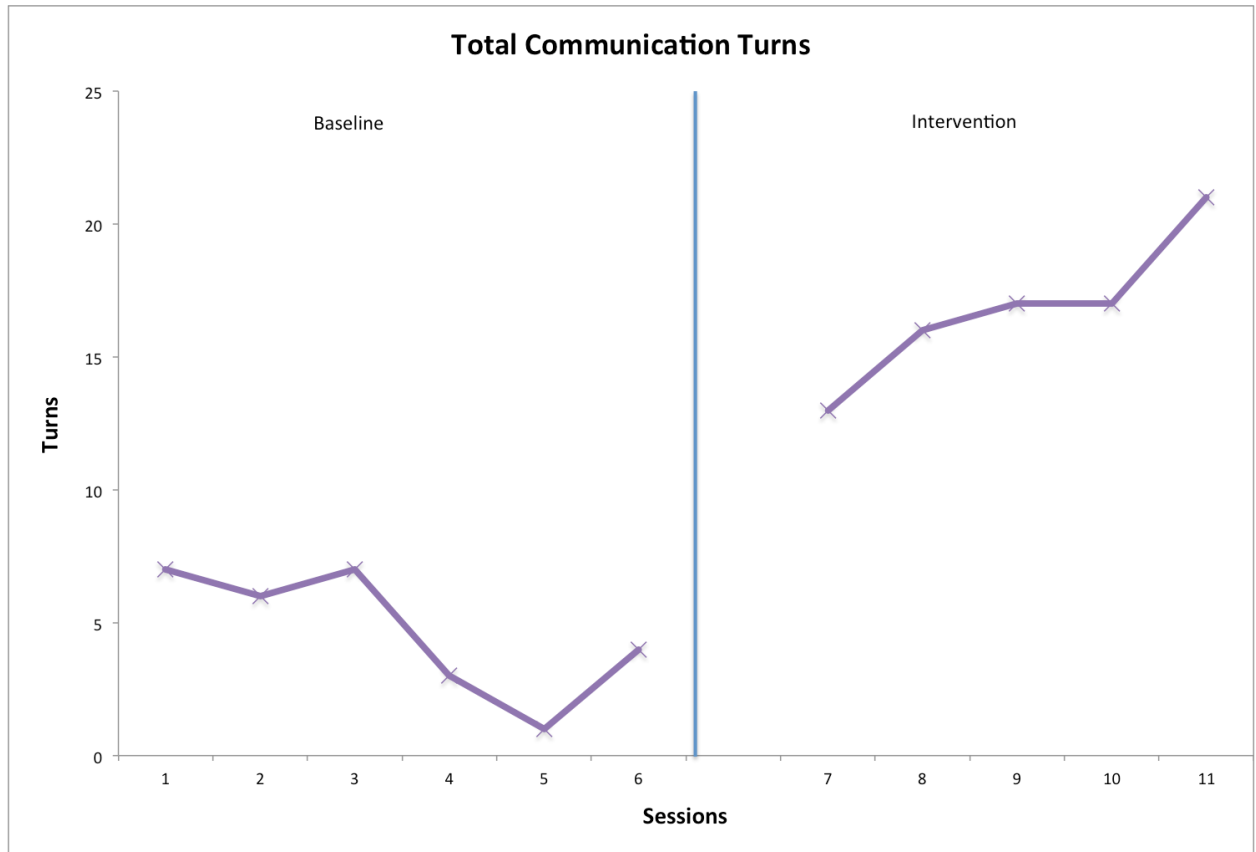
hierarchy was 100%, and this was calculated by $\text{Number of Steps Correctly followed} \div (\text{Number of Steps Correct} + \text{Number of Steps Incorrect}) \times 100$.

Chapter 3

Results

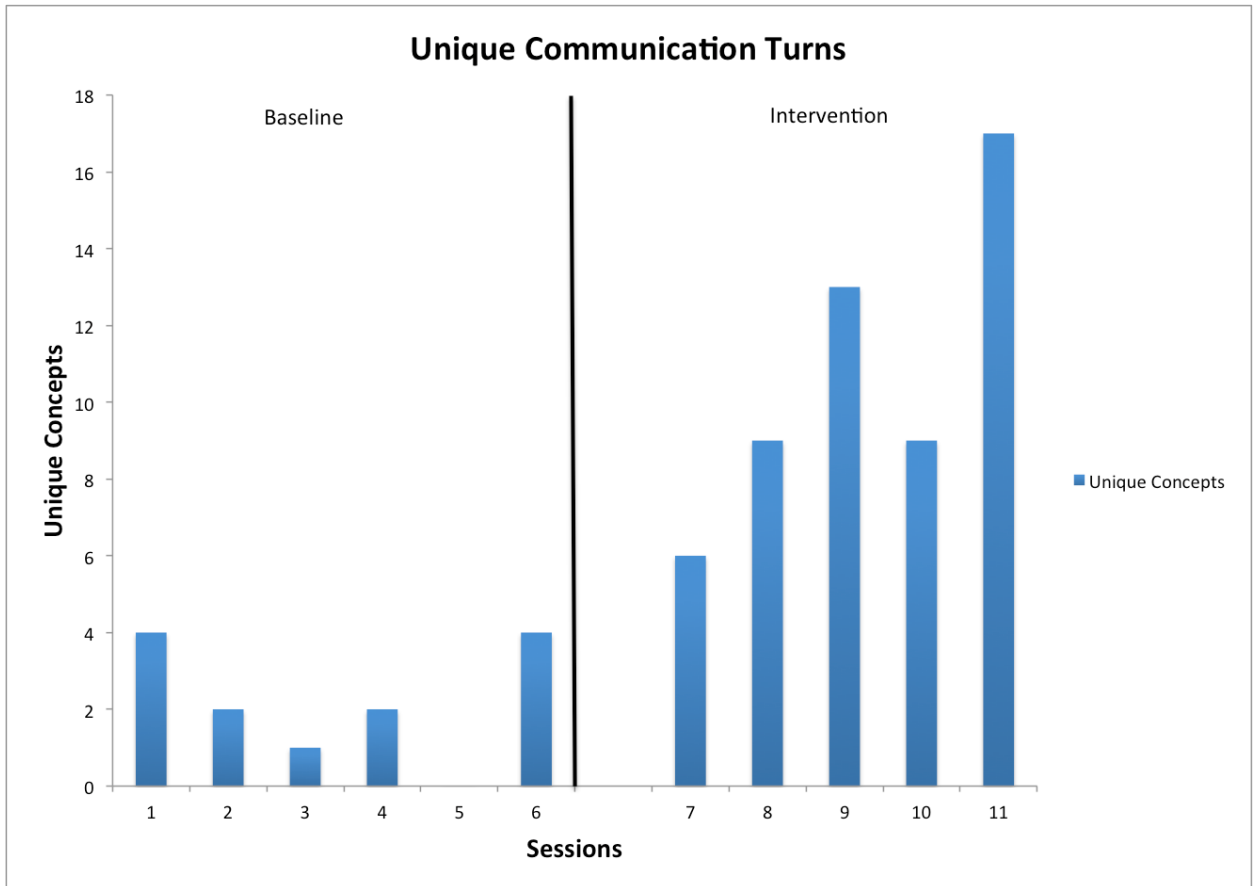
The results support the initial hypothesis that improved communication would be seen in an individual with developmental delay following an intervention combining low technology VSDs and aided modeling. As shown in Figure 1, intervention with low technology VSDs for Sam resulted in increasing his communication turns. During baseline sessions, completed between weeks 1 and 14 of the study, Sam took between 0 and 7 communication turns. The large jump in the graph represents when intervention was started at session #7. During the intervention sessions, completed between weeks 15 and 19, Sam demonstrated between 13 and 21 communication turns and shows an upward trend. This means that as compared to baseline sessions with the less contextualized AAC option, intervention sessions with the low technology VSD and aided modeling resulted in the ability for Sam to communicate more times in the same frame of 10 min.

Figure 1 Sam Communication Turns



Sam was not only able to communicate more communication turns during a 10 min session during intervention, but he was also able to communicate more variety of turns, as shown by the increase in the number of unique semantic concepts across intervention sessions. Figure 2 shows the number of unique turns in each of Sam's sessions. An upward trend of unique turns began starting from session 7 when the low technology VSDs and aided modeling intervention were introduced.

Figure 2 Sam Unique Communication Turns



Chapter 4

Discussion

The low technology VSDs and aided modeling intervention were successful in increasing the number of communication turns taken by a young child with a developmental delay. The success of this intervention could be attributed to multiple factors. Firstly, the highly contextualized nature of the VSDs could have contributed to the success of the intervention. The PCS grids used in baseline did not provide context for the concepts, so the addition of context aligns with the success of the low technology VSD intervention. These findings also align with a study by Drager et al. These researchers found that children performed significantly better with the contextual scene condition than with the grid condition (Drager et al., 2003).

The modeling of the low technology VSD by the interventionist is another factor that could have had impacted the participant's success. The participant's ability to receive input from a communication partner demonstrating how to use the VSDs could have significantly improved his ability to use it to communicate. These findings also support Drager and colleagues' (2006) study that found modeling to increase symbol comprehension and symbol labeling. Overall, low technology VSDs with aided modeling appears to be a promising communication intervention for a young child with a developmental delay

Clinical and Educational Implications

Low technology systems are easy to construct and are cost effective compared to high technology devices. This could allow many individuals and institutions that previously did not have access to AAC (due to lack of funding) to have access to it in the future. Creating low technology VSDs require limited resources, so school systems and clinical settings could develop these with ease. This ability to create new VSDs quickly is beneficial and efficient.

Low technology VSDs could also be used to “try out” this type of AAC system before investing in a high technology one. For example, in a clinical setting, clients could have sessions with a Speech-Language Pathologist using a low technology VSD to assess if they would have success with this layout. If improved communication was shown, this can be seen as an effective system for the individual. Based on this a high technology device providing access to VSDs may be trialed.

Lastly, these low technology VSDs are more portable and accessible than high technology devices. They can be laminated to prevent water damage and therefore can be used in many environments where a computerized system could not. This is especially helpful in educational setting, where children may be prone to spills, etc. There are many benefits to low technology VSDs that allow them to be conducive to educational and clinical settings.

Limitations and Directions for Future Research

Although the results of the study showed potential benefits of the intervention, limitations need to be considered as well. One problem with a single subject research design is it cannot be generalized to the whole population, so it cannot be definitely concluded that this intervention that was successful with one participant would help all individuals with a developmental delay. Threats to internal validity such as maturation and history cannot be ruled out. These shortcomings could lead to future research on low technology VSDs with a larger group of participants to have a more conclusive generalized result. The participants could include those with developmental delay as well as other disorders to determine if these are successful intervention tools across a variety of diagnoses.

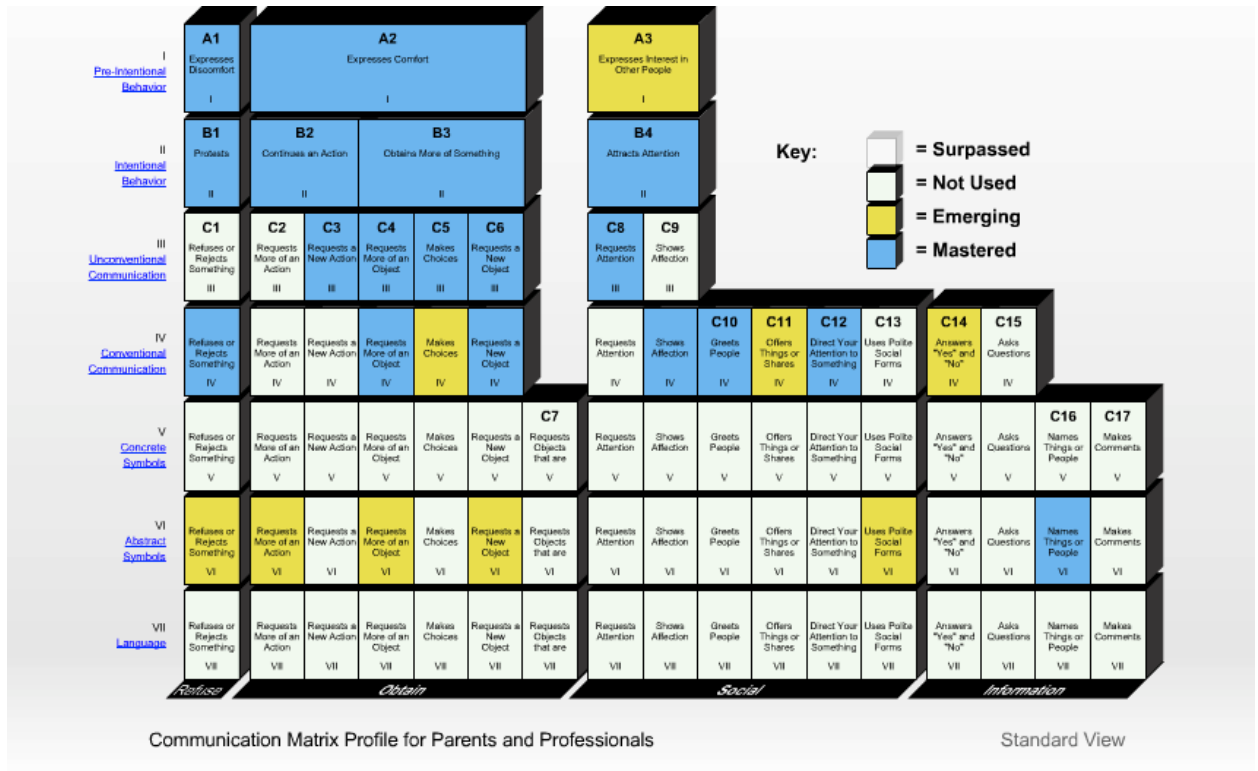
Another potential limitation was that the participant was taken out of a natural environment, such as a classroom, and had one-on-one sessions with the interventionist. This may raise the question of if a low technology VSD would provide as successful results in a real world situation. To look into this, a future study should implement the low technology VSDs around a classroom or the home with researchers observing their natural use

Conclusion

This study has demonstrated that a low technology VSD and aided modeling intervention was successful and beneficial in improving communication of a young child with developmental delay. These results indicate that low-tech VSDs can be a cost efficient AAC option for young

children. This could mean bringing AAC to individuals who previously have not had access to a variety of communication options. It is important to explore future directions related to using this innovative, new AAC tool

Appendix A Communication Matrix



Appendix B Preference Assessment

Think about what the child might like to do or say. Try to answer each question to the best of your knowledge.

- i. What are some of his/her favorite things (favorite play toys, TV shows, games, crafts)?
- ii. What are some of his/her favorite activities (play activities, activities in school, classes if in school)?
- iii. What are some of his/her favorite social activities (holiday gatherings, parties, sports gatherings)?
- iv. What are some of his/her favorite places (at home, outside, stores, at school, restaurants, movies, parks etc.)
- v. What are his/her favorite songs?
- vi. What are his/her favorite books (specific titles, topics etc.)?
- vii. What are his/her other favorite topics or special interests (TV characters, sports, dinosaurs etc.)?
- viii. What things make the participant angry or unhappy?
- ix. What makes the participant happy or laugh?
- x. At what times of the day or during what activities is the participant most likely to engage with others?
- xi. At what times of the day or during what activities is the participant least likely to engage with others?
- xii. Who are some of the participant's favorite people (peers, teachers, aides, family members)?

Appendix C Example PCS Grid



Appendix D Example Low Technology VSD



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