THE ESTABLISHMENT OF A SPEECH OUTPUT COMMUNICATION SYSTEM FOR A NON-VERBAL CHILD WITH SEVERE BEHAVIOURAL AND COGNITIVE DISABILITIES: A CASE STUDY

By

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ABSTRACT

This study investigates the ability of a seven year old non-verbal girl (Mary), who has multiple physical and cognitive disabilities, to learn to make requests using an electronic augmentative communication device (Apple IIGS computer with Unicorn Expanded Keyboard). This study will show how Mary learned to use symbols combined with speech output to request food in a natural setting, and in the absence of suggested communication intervention pre-requisites.

Data were collected during forty-three sessions, each 15 minutes long. Verbal and physical prompts were used to teach Mary to touch a photograph symbol resulting in the activation of the synthesized speech. The number of both prompted and unprompted activations were recorded. Data were collected to determine if Mary generalized this skill to a play situation. The results indicate that Mary was able to learn to make food selections using the communication device. Her instances of unprompted selections increased over the duration of the study.

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CHAPTER 1

INTRODUCTION

This study investigates the ability of a severely physically and cognitively disabled non-verbal seven year old girl to learn to make food and activity requests using a speech output communication device. Her success using photographs as symbols, in addition to synthesized speech to make choices will demonstrate the ability of a seriously disabled child to learn functional communication skills in the absence of suggested pre-requisite language abilities. It is the belief of this author that speech output communication devices are powerful tools for the acquisition and application of communication skills by children with multiple disabilities.

For children with significant developmental disabilities, the acquisition of language and functional communication skills is a challenge, and one that must be faced early in a child's development. Using a language system to indicate preferences is a language skill that is established early in life.

Children with cognitive, physical, and/or sensory impairments often possess limited means of receiving information from their environment, and may possess limited response systems. Such children must be helped to develop interaction and communication skills in order to prevent the onset of "learned helplessness", and over dependence on caregivers. "Learned helplessness" refers to circumstances which serve to prevent disabled children from developing a sense of independence and self-reliance on their own abilities. This often results if few expectations are placed on the child, and when needs are anticipated and met by caregivers without initiation from the child. Under such circumstances disabled children often become overdependent on their caregivers and fail to learn that their actions and abilities can effect change in their environment (Musselwhite, 1986).

It was suggested by Foss and Peterson (1981) that the most significant barrier to successful integration of developmentally delayed adults into a work setting were poorly developed communication and interaction skills, rather than cognitive, physical, or sensory

limitations.

In order to facilitate the acquisition of communication skills, children must be taught to develop responses and signals that are understood by other people to promote interaction within their environment. Interaction should occur in naturally structured situations when possible (Musselwhite, 1986). Intervention designed to enable children to communicate is an important goal of special education programs. Augmentative communication systems - eg. communication boards and computer assisted devices, can enable children who are non-verbal to communicate. Successful use of augmentative communication devices permit inclusion in normal education environments, and opportunities for interaction and participation with their peers (Reichle & Keogh, 1986).

Tremendous gains have been made in the field of augmentative and alternative communication technology in the past decade. Individuals who cannot meet their communication needs using speech, sign language, or writing, have at their disposal a wide variety of

electronic devices designed to enhance and augment existing skills. Augmentative communication systems include both unaided and aided systems. Unaided techniques rely on the skills of the communicator to use gestures, body language, and facial expressions to convey meaning. American Sign Language and other signed languages are examples of unaided communication methods.

Aided communication systems employ the use of an external device capable of providing a means of communication. These peripherals range from simple devices to complex computer based devices. Picture boards, laptop computers, and dedicated speech computers are examples of aided systems. These devices often produce some form of visual or auditory output including synthesized speech, visual display, or printed words (Montgomery, 1986; Russel, 1984).

The selection and purposes of augmentative communication depend on several factors including: the age and abilities of the user; the limitations of the communication method being utilized; and the range of

situations in which the augmentative communication user is required to function. Shane (1986), suggested that the primary goal of augmentative intervention is to enable the disabled person to function as independently and effectively as possible in his/her community. Augmentative communication technology plays an important role in the educational programs of students with severe communication disabilities.

Until recently, the population of children and adults with severe physical disabilities and developmental problems has not had access to augmentative communication technology. This population is comprised in large part of non-speaking individuals who are considered to have severe mental retardation, and other associated disabilities (physical, sensory, emotional, and behavioural). Locke & Mirenda (1988) observed that although manual signing has been a communication method of choice for teachers and clinicians for several years, manual signing is not be the most appropriate system for this population. Children with physical and sensory disabilities may not have the motor dexterity required for signing - and many cannot see the signs.

Romski and Sevcik (1988) noted the paucity of research addressing the communicative needs of severely disabled children and adults. They suggested that the requirement of pre-requisite skills, combined with poorly defined teaching strategies for this population also prevented them from having access to the needed communication technology. Fortunately, this situation is changing and more severely disabled individuals are being taught to work with complex communication devices.

Longitudinal studies of students with severe disabilities can help to establish guidelines for the selection and use of augmentative communication systems. With experience in working with these individuals, several issues and concerns become important. An individual's ability to apply augmentative communication strategies beyond the immediate control of instruction has emerged as an important issue. Generalization is the ability to use what has been learned in non-training situations in the presence of other stimuli and different responses (Odle, Wethered, and Selph, 1982). It has long been

observed that generalization is helped when the training situations resemble the natural context for which the training has been designed. The goal of many communication programs is the establishment of spontaneous communication skills that can be applied in natural situations. Halle (1987) proposed that a hierarchy of levels be considered in order to bridge the gap between instructional and natural environments. Natural environments have been defined as community and home settings in which communication is necessary. Since natural environments vary from one individual to another, it is important to explore how generalization occurs and can be facilitated.

This study investigated how one student with severe and multiple disabilities learned to use an Apple IIGS computer with a Unicorn Expanded Keyboard. This study provides both a description of an instructional design and an analysis of the outcome.

Two main questions provided the focus for this study:

1. Does the use of an augmentative and alternative

communication aid facilitate making choices and/or requests?

2. Will learning to make requests in one situation generalize to another situation?

The main premise of the study was that children with severe developmental problems can learn to operate an augmentative communication device to make choices and requests, and to generalize choice making to other situations. A case study was used because it allowed for an in-depth exploration of both the instructional and generalization process.

DEFINITION OF TERMS

AUGMENTATIVE COMMUNICATION - A communication system used by an individual who is unable to use speech to meet daily needs. It can be aided (using a device separate from the body) or unaided (using arms, hands, facial expression). It can range from simple to complex and usually displays the communicator's message in any combination of visual symbols, print, video screen, or synthesized speech (Montgomery, 1986).

DIRECT SELECTION - The fastest way to access a communication device, the user points with a hand or finger to the choice he/she wishes to make. Typing on a computer keyboard, or directing a beam of light on a display are examples of direct selection techniques (Montgomery, 1986).

ADAPTIVE FIRMWARE CARD - Consisting of an internal circuit board and external input/output box, this device allows alternate input methods to be used on the APPLE computer series, when persons cannot access the standard keyboard. (Distributed by Adaptive Peripherals, Seattle WA)

UNICORN EXPANDED KEYBOARD - This 128 key, multi-level, programmable membrane keyboard functions as an enlarged and/or simplified keyboard for persons who lack the skills required to access a standard keyboard. In addition the UNICORN board can be programmed to function as a talking communication board, with a variety of customized overlays. (Distributed by Unicorn Engineering Co. Oakland, CA.)

ECHO IIB SPEECH SYNTHESIZER - This device consists of of an internal circuit card and external speaker, and when used in conjunction with selected software produces synthesized speech. (Distributed by Street Electronics Corporation, Carpinteria, CA).

REQUESTING - For the purposes of this study requesting was demonstrated as the use of visual searching, and/or touching a photographic symbol to indicate choice of a food or play activity. The photo was located on a customized overlay on the Unicorn Expanded Keyboard which activated the synthesized speech mechanism.

GENERALIZATION - Generalization was demonstrated as the use of visual searching and/or touching a photographic symbol representing a play activity in a setting different from the instructional situation.

CHAPTER 2

REVIEW OF THE LITERATURE

The topics reviewed in this examination of the literature include:

1. Discussion of case study methodology
2. Augmentative communication and its use with severely disabled students.
3. Generalization of a learned skill and/or concept to other situations with special reference to students with severe disabilities.

CASE STUDY RESEARCH

Research on the use of case studies demonstrates their important role in the development of the field of augmentative and alternative communication. McEwen and Karlan (1990) noted that case studies have served a role in the development of many fields. Physicians, educators, anthropologists etc. keep detailed records regarding the course of treatment and responses of their patients, students, and subjects. Crystal (1986) argued for increased case study research to

strengthen the development of the augmentative communication field. Many professionals working with augmentative and alternative communication users can make a valuable contribution to the field of communication technology with properly presented case studies (Crystal, 1987). McEwen and Karlan (1990) forcefully argued for case study research and suggested that case studies should be made readily available in professional journals.

A great advantage of case study research is that it is a medium for sharing the experiences of practitioners with researchers in the field of augmentative and alternative communication (McEwen & Karlan, 1990). According to Yin (1984), case study methods are useful when the subjects are too few and too heterogeneous to choose them at random, and/or when the behaviour of the individual is the primary unit of analysis.

McEwen & Karlan (1990) argued that case studies can make several important contributions to the field of augmentative and alternative communication. They

contribute to the development of hypotheses for further research (Barlow & Hersen, 1984). Case study methodology yields a significant number of variables, and these, if carefully detailed can provide avenues for systematic investigation. Locke & Mirenda (1988) used a case study approach to describe an intervention strategy designed to help a multi-disabled child to use a computer. This study illustrated that severely disabled learners could be taught to use a complicated communication device.

McEwen and Karlan (1990) also suggested that case studies could prove to be a valuable resource for educators in the development of educational programs and selection of materials. The newness of the field, combined with the specialized technical knowledge required and the high cost of equipment has limited educators' knowledge of augmentative and alternative communication devices (Goossens', 1989).

There is a need for "well-defined, empirically validated theory" (McEwen & Karlan, 1990 p. 71) in augmentative and alternative communication research.

As outlined by Yin (1984), case studies are helpful when they represent the testing of an existing theory, or establish conditions that can result in the development of a theoretical perspective. Kazdin (1980) suggested that case studies serve to persuade and motivate practitioners to implement new strategies and techniques.

Case study reporting is often more descriptive and less theoretical than quantitative studies, which makes it easier to derive information about methods and materials. Readers become more familiar with subjects than is possible in multiple subject/control group designs. This information is of practical usefulness to clinicians and educators. Kazdin (1980) noted that "concrete and dramatic case studies serve to stimulate the interest of researchers and motivate them to test and critically evaluate the claims." (p.71).

AUGMENTATIVE COMMUNICATION

When choosing and implementing a communication system for a non-verbal learner it is important to

consider the characteristics of both the communication system, and the skills of the student. Pre-requisite skills, symbol selection, and instructional techniques all require careful examination.

It is helpful when one is able to identify a potential augmentative communicator's level of cognitive functioning prior to the implementation of an intervention program (Goossens', 1989). Multiple disabilities restrict and curtail physical, sensory and communicative functioning, making it difficult to make realistic assessments of the child's cognitive functioning (Musselwhite, 1986; Reichle & Keogh, 1986; Rice & Kemper, 1984). It is important to be aware that non-verbal does not mean non-language, and that there are many individuals who are unable to speak, but who comprehend language. As augmentative systems which facilitate communication are made more readily available, more realistic assessments of skills can be conducted (Mirenda and Iacono, 1990).

Nevertheless, the belief persists among several authors that there are pre-requisite skills that

students must demonstrate before being considered candidates for alternative communication system use. Several authors (Bates, Benigni, Bretherton, Camaioni, and Volterra, 1977; Slobin, 1973; Cromer, 1974) suggested a link between cognitive pre-requisites such as object permanence, establishment of an understanding of causality, and the ability to imitate actions and vocal patterns, as indicators of cognitive competence. Reichle & Keogh (1986) cited the identification of cognitive development in language literature according to the Piagetian stages of sensorimotor development. Chapman and Miller (1980) and Carrier (1976) suggested that pre-requisite skills needed to be taught prior to commencement of an intervention.

In an investigation of symbol transparency (the degree to which a chosen symbol resembles the object it is meant to represent) in non-speaking, intellectually disabled people, Mirenda and Locke (1989) selected candidates based on screening criterion that included such pre-requisite skills as being able to point and, provide a consistent yes/no response, maintain eye gaze, and attention to task.

Subjects were classified as mild to moderately mentally handicapped.

Kangas and Lloyd (1988), Rice and Kemper (1984), Romski and Sevcik (1988), and Mirenda & Iacono (1990) questioned the validity of the assumption that there are indeed any strict cognitive pre-requisites for the use of aided or augmentative communication. Kangas & Lloyd (1988) reviewed the literature related to cognitive pre-requisites and communication development for individuals with disabilities. While outlining the weaknesses in the cognitive hypothesis, Kangas & Lloyd (1988) expressed their concern that the assumption of pre-requisite skills has denied children with severe disabilities access to augmentative communication. Despite the recent research that challenged the validity of cognitive pre-requisites for the development of symbolic communication, the belief that pre-requisites are required continues to impact many treatment programs and influence assessment outcomes. Furthermore, the findings of Kangas & Lloyd (1988) suggested that there are no significant reasons to delay communication programs

for severely disabled children, and noted that "there are some compelling reasons for beginning communication intervention at a young age even if certain cognitive skills have not yet been attained" (Kangas & Lloyd, 1988, p219). These include the need to develop the physical and cognitive skills that will assist the child to access a communication system, facilitation of interaction between the disabled child and his/her peers and family, and the acquisition of functional interpersonal skills. Reichle & Karlan (1985), Steckol and Leonard (1981), and Romski & Sevcik (1988) challenged the notion that cognitive competence is an indicator of language ability. These authors also questioned the validity that there are pre-requisites to be considered before aided or augmentative communication can be introduced.

In addition to the matter of pre-requisite skills for aiding the communication of non-verbal learners, there is the need to consider the symbol system to be utilized. The criterion for which mode to employ, ie. manual signs, object or pictorial symbol systems, and/or speech output devices include a number of

factors such as the age of the student, the iconicity of the symbol, the physical skills of the student, and the communication needs. Authors differ about the procedures that could be applied in symbol selection (Hamre-Nietupski, Nietupski, and Rathe, 1985; Reichle, Williams, and Ryan, 1981; Mirenda & Locke, 1989). In a 1985 article, Hamre-Nietupski, Nietupski, & Rathe proposed a list of factors for choosing between manual signing as an alternative communication method and the use of communication boards. Their list included considering the motor skill requirements of the system. Many systems, particularly speech output devices, require extremely minimal motor ability.

Portability of the system is important. The use of a communication board by an ambulatory child presents some difficulty, especially if the user is expected to generalize his/her communication skills to a variety of settings (Calculator, 1988). Another factor is the training and/or knowledge required by the communicator's audience. Manual signing requires significant training, and many abstract symbol systems

ie. Blissymbolics (Mirenda & Locke, 1989) are not readily understood by communication partners. In addition, the speech quality of some speech output devices (particularly the early versions) may be difficult for the untrained ear to comprehend. Some communication systems require a constant visual display. Signs and/or picture boards can be used together with speech output devices as long as the listener is within hearing range. A communication system must be versatile, and applicable to a range of settings in order to meet the communication needs of the non-verbal person. The pragmatic functions of communication such as requesting, initiating, commenting, questioning, and protesting need to be possible through the communication device.

Iconicity and the transparency factor is of importance in the choice of visual symbol(s) to be used, either with a speech output system, or as a dedicated symbol board. The dimension of transparency is the degree to which the symbol resembles the object or action that it is intended to represent (Mirenda & Locke, 1989). Bellugi and Klima (1976) and Mizuko,

(1987) suggested a continuum of intelligibility of symbols from transparent to opaque. Mirenda and Locke (1989) examined eleven different symbols types representing objects, with 40 non-verbal persons. The symbols included non-identical objects, miniature objects, identical coloured photographs, non-identical coloured photos, black and white photographs, Picture Communication Symbols, Picsyms, Rebus, Self-Talk, Blissymbols, and written words. These studies indicated that real objects were most easily recognized by subjects, while Blissymbols and written words were the most difficult. Keogh and Reichle (1985) used a visual match-to-sample protocol in which subjects were asked to match a sample with the object it most closely represented in a visual array of two or three objects. Results from this protocol were compared with an auditory matching task in which subjects were asked to match the sample with the most closely representative visual cue. Keogh & Reichle (1985) concluded that the more closely the symbols matches the objects the easier the task of associating the two. Many match-to-sample procedures have been used to examine this topic (Dixon, 1981; Sevcik &

Romski 1986; Romski, Sevcik, and Pate, 1988) and have yielded similar results.

In 1989, Rotholz, Berkowitz, and Burberry examined the functionality of sign language and communication book symbols in community settings with two autistic youths, The symbols used were black and white Picture Communication Symbols from Mayer Johnson Co. Both students used manual signs as their method of communication, but many of the signs were poorly formed, and were only used in the presence of school staff or family members. Baseline data were collected at a local fast food restaurant. The students used their signs to communicate with the restaurant staff. The degree of assistance required by the investigator was noted. During this phase the investigator was required to prompt the students to use their signs at the counter, and often had to interpret the signs for the counterperson. Communication book training used a match-to-sample procedure, and the application of the pictures in both requesting and responding situations. The final phase of the investigation was the application of the communication books in the fast

food restaurant. Rotholz et al. (1989) concluded that the use of the communication book was easily trained (with these particular subjects), and was more easily generalized to a new situation than were manual signs because of the transparent nature of the symbols. The authors advocate for the use of a variety of communication alternatives in the quest for the establishment of functional communication for the non-verbal student.

Blackstone (1992) also discussed the application of various symbol systems with individuals with Downs Syndrome. She suggested that sign language and the use of graphic symbols on communication boards and electronic devices may facilitate social interaction for those with language deficits and may encourage oral language development.

Murray-Branch, Udavari-Solner, and Bailey (1991) developed textured communication symbols for use with students with severe cognitive disabilities and sensory impairments. Tactile materials were used to represent objects and activities. The use of the

symbols to make choices and requests was investigated. The authors concluded that the textured symbols resulted in expanded vocabularies for the students, and an increase in their abilities to communicate effectively. This "low-tech" system was easily constructed, inexpensive, and portable (Murray-Branch et al. 1991).

As previously stated, studies of communication intervention programs for children with significant cognitive impairments have focussed largely on "low-tech", symbol or sign systems, and the degree with which the acquisition of these communication skills influenced expressive behaviours (Clark, 1981; Dennis, Reichle, Williams, and Vogelsberg, 1982; Harris-Vanderheiden, Brown, MacKenzie, Reinen, and Scheibel, 1975).

The application of synthetic speech output systems as a viable alternative for the establishment of communicative competence with severely intellectually impaired individuals has not been well documented in the literature. There are many

advantages that such systems have that would serve the communication needs of the more disabled communicator (Romski & Sevcik, 1988; King, 1991). The most obvious advantage is the provision of an interface between the listener and the speaker. Locke and Mirenda (1988) suggested that because synthesized speech is consistent, severely disabled learners will benefit from the frequent, unchanging repetition of the device. The speech synthesizer is a powerful reinforcer for a severely disabled learner who may require the continual reinforcement of the speech sounds for communication behaviour to emerge. Because of the transparency of speech output devices, even young and/or non-reading communication partners can interact with the technology user (Romski & Sevcik, 1988).

Rather than delaying that onset of speech (as some researchers believed in the past), electronic communication aids have been shown to encourage the development of speech abilities (Fishman 1987). Fishman acknowledged that technical devices can actually increase the intelligibility of potential

speech because they remove the pressure on the speech impaired individual to speak. As the individual is able to relax, he/she is better able to develop functional speech. Meyers (1987) supported this view and suggested that the use of a device with synthesized speech output allows the child to generate as many repetitions of exactly the same words or sounds as are needed for mastery. Speech output, according to Meyers (1988), allows the speaker to function more effectively in a wider variety of integrated environments (home, school, recreation, and work). Meyers (1987), King (1991), and Fishman (1987), described speech output devices as having a dual role; they serve as a functional communication method, and a way to increase the credibility of the learner in the eyes of his/her peers. The use of electronic "high-tech" devices empowers the disabled child, who functions in a society where sophisticated technology is commonplace.

Blockberger (1986), listed seven advantages of technical aids with speech output.

1. The user can communicate with those not familiar

with their system.

2. Reduces or eliminates the need for an "interpreter".
3. User can communicate with non-readers.
4. User can communicate with other disabled people.
5. Increases ease of initiating communication.
6. Allows communication in a more conventional pattern.
7. Through the uses of technology, allowing for pre-stored messages, the speed of communication is increased.

GENERALIZATION

Generalization of a skill refers to the ability of a learner to appropriately apply the skill in a context other than the one in which it was learned. An important part of a communication instruction program is the need to plan for generalization beyond the instructional setting (Odle, Wethered, and Selph, 1982; Kaczmarek, 1991). Calculator (1988) observed that generalization of communication skills may be particularly difficult, yet it is the goal of all

educators. Guess, Keogh, and Sailor, (1978. p.375) indicated that "it appears to be easier to establish a rudimentary language repertoire in language deficient children than it is to teach spontaneous use of the skills in non-training situations." Kaczmarek (1990) stated that many instructional strategies have successfully taught severely disabled persons to communicate. Their success, however, is limited because the newly acquired language skills are not used in natural environments. Often language is taught in isolated settings, and efforts must be made to provide opportunities for these new skills to be used in other settings. Hamre-Nietupski and Nietupski (1992) examined the values parents placed on educational priorities for their severely disabled children. In comparison to academic and life skill development, parents placed a greater value on the acquisition of functional communication skills. The parents surveyed believed that sufficient communication abilities would help their children to form friendships and other successful social relationships.

Odle et al. (1982) suggested there are two types of generalizations. 1. Stimulus generalization is the use of an acquired language skill in a different setting when the same stimulus is present. For example requesting a drink at home, in a restaurant, and/or at school. 2. Response generalization suggests that a similar language behaviour will be applied in the same setting under different stimuli. They gave the example of utilizing the rule of noun pluralization.

Haring and Liberty (1990) defined skill generalization as responding appropriately to new settings. Educators must apply strategies that facilitate all aspects necessary for generalization. These include: recognition that the setting is appropriate for the skill; identification of the antecedent stimuli; and finally responding with the skill. Haring & Liberty (1990) identified three assumptions which provided the foundation for their research. The first assumption was that generalization must be a target of instruction and should be included in a student's IEP. Secondly, only

25% of the skills which are taught to severely handicapped students will generalize without specific intervention. The third assumption was that assessments of student performance in generalization situations are necessary to make decisions about the effectiveness of instructional techniques.

Stokes and Baer (1977), in their discussion of generalization strategies, suggested that generalization is more likely to occur if training has taken place with different trainers in different settings. Other investigators (Calculator, 1988; Brown, Nietupski, and Hamre-Nietupski, 1976; Guess and Helmstetter, 1986) emphasized the need for teaching communication behaviours in the setting in which they will be used. Stokes & Baer (1977) even suggested that presenting different instructional materials, responses and reinforcers for the desired behaviour will help to facilitate generalization. Espousing this approach however, is difficult when research demands a degree of control on the majority of variables in an investigation or intervention.

Hunt, Alwell, Goetz, and Sailor (1990) analyzed

the generalized effect of communication training for each of three severely cognitively disabled students. The conversation skills of initiation and turn-taking were probed at regular intervals. The students used both verbal and symbol communication (picture books). Verbal and physical prompts were used as instructional strategies for conversation training. Peer partners were used as conversation partners during the instructional phase and the independence (generalization) phase. Hunt et al. (1990) concluded that children with severe disabilities can be successfully taught to engage in meaningful conversation and that their three subjects were able to converse independently with new peer partners in new settings after proper skill training. The authors indicated that over the course of the investigation the range of topics that occurred during generalization probes were typical of high school students and that a decrease in socially inappropriate behaviours was observed. They suggested that further investigation of the complexity of topics, quality of the interactions, and the extension into the students' homes would be a suitable follow-up of their study.

In 1989, Alwell, Hunt, Goetz, and Sailor used an interrupted behaviour chain strategy to teach three severely disabled elementary school students to request objects in a variety of contexts. In this procedure an instructional session was inserted within an individual's routine or activity. The student was required to request resumption of the activity using responses they had been taught. During the course of this investigation, the settings, materials, and instructors were varied to promote generalization. This supports the findings of Stokes & Baer (1977) who emphasized the need for a variety of materials, responses, and settings to help facilitate generalization. The students used a variety of responses including signs, gestures, and photo cards. Communicative requests measured included "drink", "out", "hug", "toy", and "eat". During each instructional session, the investigator interrupted a routine by failing to provide a necessary article required in the routine, or by placing a needed item just out of reach. No prompts were used and the investigators waited five seconds to see if the child would use previously taught responses to request the

item. If no response occurred, then verbal and physical prompts were used to model the desired behaviour. These prompts were faded as the investigation progressed. The results demonstrated that the interrupted chain strategy was effective in establishing simple request behaviours with severely disabled students (Alwell et al. 1989). The authors suggested that communication behaviours are only useful to the learner if he or she is able to apply them with a variety of people and in a variety of settings on a daily basis.

In his investigation of factors which contribute to generalization failure, Calculator (1988) discussed the following five variables: instructional problems; lack of environmental response; replacing one idiosyncratic system with another; mistaken focus; and mode devaluation. Instructional problems are of course limitless but referred to by Calculator (1988) as the way in which the skill is taught. A skill taught for labelling objects must not be assumed to generalize to requesting and responding behaviours in another setting unless this use of the skill is

specifically taught. Further evidence is supplied by Reichle and Yoder (1985). In their study, four preschool children were taught to label objects using pictorial communication. The subjects failed to generalize this skill to requesting preferred objects at play time.

Lack of environmental response refers to the fact that often adult responses to children's communication attempts, present in an instructional setting, are not present in other environments. Vicker (1985) recommended facilitator training for persons interacting with alternative communication users. Calculator and d'Altilio Luchko (1983) investigated the effects conversational partners have on the use of an augmentative communication devices. Although the subject of this study was a competent communication board user, her attempts to communicate with others on her job site were not successful. Her fellow workers failed to respond to her attempts and as a result, she then made fewer attempts to initiate conversation. A program of listener instruction was provided to the employees, and once strategies for encouraging and

responding to the subject's communication attempts were implemented, her efforts at initiation increased.

The idiosyncratic nature of many alternative communication systems can also result in generalization difficulties. These can include the degree of iconicity of the symbol system utilized, and the quality of the speech output system. Both these factors contribute to the intelligibility of the system for partners who are not familiar with the communication device.

Calculator (1988) suggested that sometimes communication behaviours that are taught have little relevance to the learner's needs, or to educational goals. He recommended that the focus be the model of instruction rather than the communication goal.

Another factor which may limit the generalization of communication skills is referred to as mode devaluation. An individual may employ two or more different systems. For example, the communication user may prefer to use eye gaze to answer yes/no

questions because it is faster and more easily understood by familiar partners, in addition to a voice output device or communication board. If the preferred method is devalued by the instructor, than frustration may be the result and communication attempts may decrease. Reichle and Karlan, (1985) suggested that the most successful communicators are those that use combined methods appropriately and who have received instruction as to the appropriate use of contextual cues to determine the circumstances in which to access a particular method. Calculator (1988) concluded that instructional strategies that increase the likelihood of generalization behaviour should be taught in naturally occurring situations in appropriate environments, and that multiple forms of communication should be attempted and encouraged.

CHAPTER 3

METHODOLOGY

PURPOSE OF THE STUDY

The purpose of this study was to explore how one child with severe learning problems, who is non-verbal, learned to make requests using an electronic augmentative communication device (Apple IIGS computer with Unicorn Expanded Keyboard).

This device employs both speech output and pictures and was selected because it is easy to manage and activate, provides immediate speech feedback, and is able to be customized for specific vocabularies.

The main hypotheses of this study was -

1. The child would learn to make food choices using the communication device.
2. The child would generalize this skill to making activity choices.

THE SUBJECT

The subject of this study is a seven year old

named Mary (fictitious name) who is enrolled in a full-time special education program for children with multiple disabilities. Mary is one of nine children in a class staffed by one teacher and five special education assistants. Mary is the oldest of three children. She lives at home with her family. Mary's medical history indicates a diagnosis of spastic quadriplegia, epilepsy, and severe retardation associated with Dandy Walker Syndrome. This rare genetic condition is characterized by the presence of internal cystic growths which can interfere with the development and functioning of numerous organs. Prior to the age of two years Mary had extensive surgeries to remove cysts from her kidney, and various locations in her brain, including the optic nerve. There has been no further growth of remaining cysts to this date. As a pre-schooler, Mary experienced frequent and severe seizures. She was reported to be heavily medicated, lethargic, and inactive. Mary has been seizure free for over two years and her medication levels have been significantly reduced. An overall improvement in functioning has been reported and is described below.

Mary does not speak, and requires assistance for personal care, including dressing, toileting, bathing etc. Mary uses a wheelchair for distance mobility, however she can pull herself to a standing position using furniture, etc. for support. She has learned to walk using a posterior walker. Poor protective reflexes necessitate that she wear a soft top helmet for protection should she fall when walking outdoors. Mary's hearing was assessed when she was in pre-school and is reported to be within normal limits. A functional visual assessment has not been included given that Mary had complications involving her optic nerve in early childhood. Intact visual abilities are assumed.

Mary's communication skills have been assessed with observational checklists and discussions with her parents and school staff. It is not clear how much language Mary understands. She turns her head towards interesting sounds and visually locates the source of a voice or sound. She recognizes her mother and other family members from their voices and actively looks for them when she hears them. Mary does not respond

to simple commands such as "come", "sit down", or "walk" , nor does she look up, or move towards a speaker when her name is called. Mary uses a few gestures, vocalizations, and facial expressions to communicate her pleasure/displeasure, comfort/discomfort, and to request food and objects. Mary is able to vocalize several consonant-vowel-consonant combinations, including "guh", "maa", "aah", and "duh". Mary makes a low guttural sound to express displeasure. She pulls away from adults or children if she is not interested in participating in an activity with them and signals rejection by turning her head or pushing objects away. Pleasure is expressed by hand clapping and laughter. Mary is interested in her environment and propels herself to reach those objects and activities in which she is interested. Often she reaches and grabs for the things she wants, and removes obstacles by pushing, pulling, and lifting if her path is blocked.

Mary prefers brightly coloured toys and objects, frequently picking them up to examine them. She can

find her preferred toys and take them out of drawers and off of shelves. She is familiar with the closet where her walker and bike are kept and will open the door to gain access to these items. Mary is gentle with most objects and does not intentionally damage toys, but she does enjoy tearing pages from books, and will pull paper displays off walls if left unsupervised. Her family reports that she will remove video tapes from their designated spot in a cabinet and attempts to take toys from her younger siblings. Mary is able to open doors and will leave the classroom if she is able. Her favourite destinations include the nearby water fountain, the library, and the Primary 2 classroom where she spends most of each afternoon. Mary plays alone for short periods but prefers to be with other children. She sometimes teases them by walking away, and vocalizing, in an effort to involve them in a chasing game. Mary can ride a tricycle and knows where her bicycle is stored in the classroom. Mary knows that she needs her walker and keeps it in sight in the classroom. It should be noted that Mary walks better with the walker than by holding an adult's hand. With more confidence

and skill it is hoped that Mary will be able to walk independently.

Mary feeds herself finger foods and can eat soft foods with a spoon. A Tupperware cup with a lid and straw insert are her drinking implement at school. Mary has food preferences, and helps herself to food. She will not eat from her own plate if she can see something she likes better on the table. She eats at a low cut-out table and sits on a primary chair.

Mary has been participating in a language stimulation program (The Hanen Early Communication Program -It Takes Two To Talk) in which Mary's parents and teachers were encouraged to imitate her vocalizations, establish turn-taking routines using her sounds and behaviours, and establish functional communication behaviours. Improvement has been noted, particularly in her ability to imitate her own sounds after an adult has initiated them. She is encouraged to vocalize a greeting when she arrives, and at home Mary is not given additional servings of food, such as milk, yogurt, or pizza until she produces an "mmm"

sound which is expanded by her parents to "more". Mary is interested in playing in front of a full length mirror, and will vocalize, pat her reflection with her hand, and turn her head from side to side while watching her reflection. Mary is helped to use gestures such as waving, and pointing but resists prolonged hand-over-hand assistance by pulling away.

Mary has also been working with a microswitch on a series of activities designed to develop her interest in cause and effect using the Apple IIGS computer. Progressing from battery-operated toys, Mary can use her switch to access music or animation on the computer using specially designed software. Mary finds the visual display of the computer attractive and her attention span with this activity is longer that in other situations. Mary requires intervention to prevent her from making excessive activations of the switch, or from pushing it off her table when she is finished. Mary has not yet begun to use computer programs with features such verbal directions for activating the switch, nor has she been successful with interaction software, in which two

switch users interact co-operatively, or competitively. In these situations Mary does not stop touching her switch after her turn has expired.

In preparation for training in the use of an augmentative system, Mary was shown how to communicate using 4" x 6" photographs of her favourite foods and activities. The aim of this instruction is to enable Mary to request by pointing to photographs. Examples of Mary's photographs include: bathroom, radio, computer, milk, sandwich, and yogurt. The photos are mounted on construction paper to add strength, and are laminated to increase longevity. Several photos are mounted directly to objects or locations. For example, the photo of Mary using the commode is attached to the wall in the washroom, and the photo of Mary brushing her teeth is secured to the counter in the bathroom. A photo of her walker is positioned on the door of the closet in which it is stored. This ensures that all staff are able to reinforce Mary's use of her photos. Mary's lunch-time photos are mounted directly on her table with transparent contact paper. Mary demonstrated the most consistent use of

her photograph cards in the lunch setting. Pictures which represent activities outside the classroom, such as going to the water fountain, gym, library, school bus, and the Primary 2 classroom, are single hole punched and attached together with a loose leaf ring. Mary's teaching assistant carries these symbols when she is outside the classroom and initiates their use appropriately.

Mary requires both verbal and physical prompts to access her photos. Verbal prompts include labeling the object or activity and saying "look at the _____", or "here is the _____", or "show me the_____". Her hand is placed on the photo, and Mary pats it. She sometimes uses her finger to point but this is not consistent. The need for physical prompts is decreasing as Mary makes contact with the photos independently.

Mary uses photos to make choices. No more than two photos of activities are presented at one time. Mary is shown the objects or activities and is prompted to make her selection, using similar prompts

as described above. The photos are placed side by side on her table and are removed once she has made her selection in order for her to receive reinforcement. Activities/objects include the radio, bubble blowing, playing with a balloon, or using the flashlight. Recently Mary has been introduced to a series of sequence photos which represent the steps involved in an activity. For example; using a flashlight involves photo cards for opening the flashlight, inserting the batteries, turning off the lights, and shining the flashlight. After selecting the photo, Mary is helped to complete each step in the activity.

Because Mary needs a communication device that will allow her to make food or activity choices in a variety of situations -another system has been introduced. The next section includes a description of how Mary is being instructed, and discusses her progress in the use of a voice output augmentative communication device. Since Mary has the necessary motor skills, the communication system selected for her consists of a Unicorn Expanded Keyboard connected

to an Apple IIGS computer. External speech is provided by an Echo IIB speech synthesizer, and an Adaptive Firmware Card permits Mary to utilize the Talking Word Board software program. When the Unicorn board is activated, text appears on the screen and synthesized speech reinforces the text. This configuration was present in Mary's classroom prior to the initiation of this study. The new system is more durable and portable than a communication board.

INTRODUCTION OF THE COMMUNICATION SYSTEM

Based on Mary's recent success using identical colour photos to represent food and toy choices, it was decided to use these symbols with the augmentative communication system. The meaning of such symbols are transparent. Mary was familiar with all the food items selected and had previously been exposed to colour photos of the same items. Eating is a very motivating activity for Mary, thus lunch-time was chosen as the appropriate time to introduce the augmentative system. An overlay for the Unicorn Expanded Keyboard was prepared, and 4 squares

measuring 4" x 4" were drawn on the overlay. The food items selected for the study were a sandwich, milk, yogurt, and cookie. Each food picture was glued on a square and the overlay was placed on the keyboard. The photo representing MILK consisted of Mary's white Tupperware cup filled with milk, positioned on a contrasting yellow background. The SANDWICH photo showed a "Cheeze Whiz" sandwich, broken into bite size portions positioned on Mary's plate. Similarly the COOKIE photo showed a fruit-filled oatmeal cookie broken into bite size pieces. Her YOGURT was represented by a photo of blueberry yogurt in her bowl, with her spoon and the empty yogurt contained placed beside it. Figure 1 shows the configuration of the Unicorn Keyboard.

The Talking Word Board program was used to program the computer to name the food item when Mary pressed the square. The phrase "more _____" was programmed for each photograph. The Unicorn board was presented to Mary at a slightly angled position, approximately 45 degrees to her lunch table. This position was selected because it took up less space

Figure 1

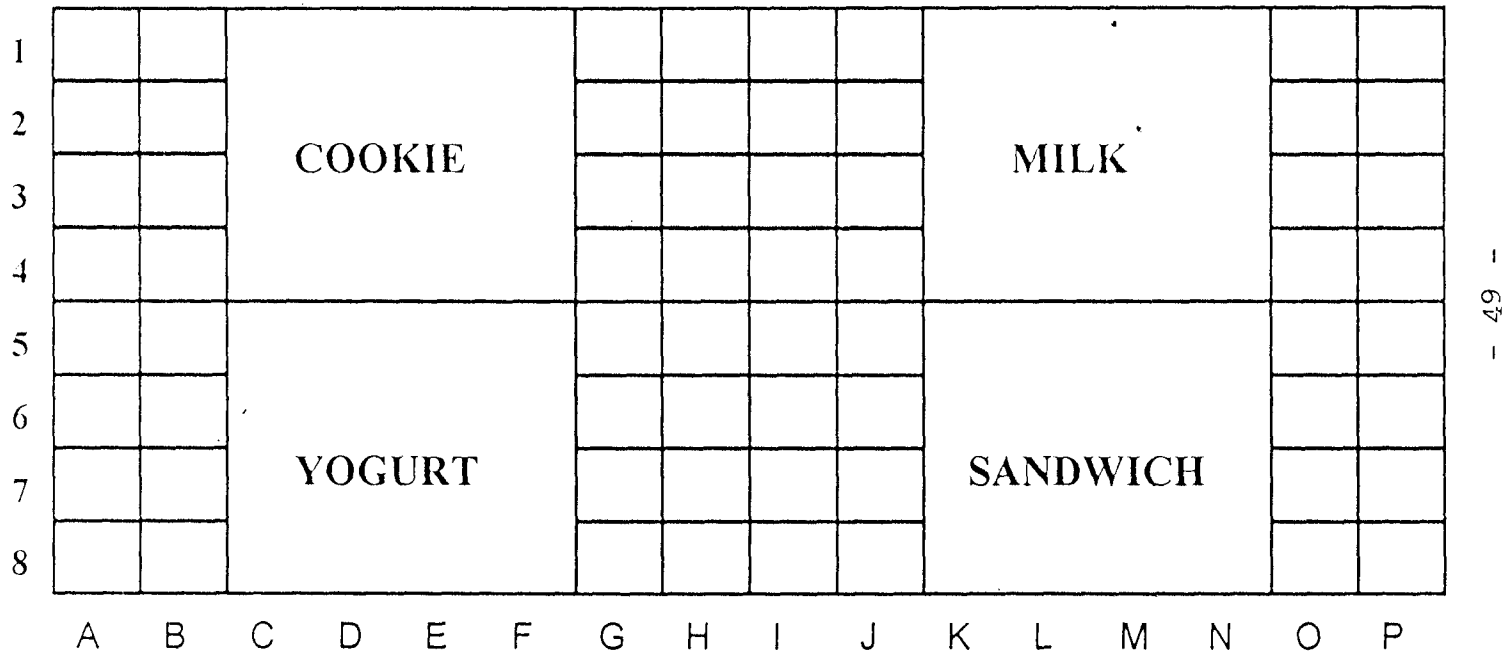


Figure 1 - Reproduction of the Unicorn Expanded Keyboard Overlay

* text represents placement of photographs

and permitted better visual display. The angle also made it easier for Mary to reach for her photographs.

MEASURES

The procedure used was an A-B design, described by Yin (1989). In this design a specified behaviour (in this case selection of food using an expanded keyboard) is measured throughout two phases. The first phase (A), or baseline, measures the natural frequency of occurrence of the behaviour (Barlow & Hersen, 1984). During the B Phase a treatment is introduced and changes in the behaviour are recorded. The dependent variable was the number of times Mary selected a food item using the Unicorn Keyboard. Instruction took place at the table where Mary eats her lunch in the classroom. It was felt communication taught in a natural setting is more likely to generalize to other settings. All instruction was carried out by the investigator

Baseline data were gathered by measuring the frequency of occurrence of the dependent variable -

unprompted activation of the Unicorn Keyboard to request food. Baseline data were obtained when Mary was introduced to the four food items, and the Unicorn board with the picture symbols she would be using. The food items were shown to Mary and she was allowed to taste each one. All attempts to touch the photos, resulting in the activation of the Unicorn board were recorded. Instructional sessions were fifteen minutes long. This phase continued for five sessions, when a reliable pattern of measurements was established.

Intervention consisted of thirty-three sessions, each fifteen minutes long. The intervention took place at Mary's regular lunch table positioned near the Apple IIGS computer in the classroom. Because of Mary's previous experience with two photograph choices for lunch-time, it was decided that two photographs would be offered to Mary initially. The first overlay provided a milk and sandwich photo. Physical guidance in the form of lifting Mary's hand to touch the photographs was performed at the beginning of each teaching session during the intervention phase. Mary was accustomed to eating one food before making a

second choice. Usually she enjoyed beginning with a drink of her milk. Milk requests took place at the beginning of instructional sessions. In order to assess Mary's ability to make yogurt and cookie selections from the Unicorn board, data were collected after she was finished her sandwich. New photographs were added to those already in place, until a series of three overlays were used. The position of the symbols on the overlay remained constant for the duration of the intervention.

The verbal prompt "What would you like Mary?" was used and her choice was reinforced with the presentation of the food item saying "Good girl Mary here is a _____ ." A new food photograph was added once Mary had selected a food item four times during each of three consecutive sessions. The number of prompted and unprompted touches resulting in synthetic speech activation of the Unicorn board were recorded.

Yogurt was introduced as a photo choice during session twenty-two. Mary particularly enjoyed eating

yogurt and did not want to make another food choice. Data collection for activation of the yogurt photo location began when she had eaten most of the sandwich. The yogurt photo was located in the lower left corner of the overlay. The yogurt was given to her in her bowl and after two of three spoonfuls, the bowl was removed and verbal prompts of "What would you like Mary?" were provided for making a request for yogurt.

During session thirty-one, the final photo, that representing a cookie, was introduced.

Generalization was explored by presenting Mary with a new overlay of two 4" x 4" colour photographs of two favourite play activities; bubble blowing and listening to the tape recorder. These were mounted on the Unicorn Keyboard in a similar manner as her food symbols, and any attempts to touch the Unicorn board resulting in synthetic speech output were recorded for five sessions.

RELIABILITY

The following procedures were undertaken to ensure reliability. All procedures were documented and reported by the investigator at the conclusion of the study. This was done to allow for replication of the case study. In addition interobserver reliability was calculated by training a classroom teaching assistant to record prompted and unprompted activations of the keyboard by the subject, using videotapes of randomly selected sessions of all phases. The reliability coefficient was determined by dividing the number of agreements by the sum of the agreements and disagreements and multiplying by 100.

During the baseline phase, three sessions were videotaped and the mean interobserver reliability was 100%. During the intervention phase, ten sessions were videotaped and the mean interobserver reliability was 92%. Similarly, during the generalization phase the mean interobserver reliability was 90% for five videotaped sessions.

VALIDITY

In order to ensure appropriate construct validity, information regarding the subject of the case study was obtained from multiple sources (Yin, 1989), including reports contained in classroom files, interviews with Mary's parents, and direct observation by the investigator.

The generalization phase of the case study helps establish credible external validity. Because it is difficult to determine whether the results of a single case study can generalize to other situations, accurate reporting must occur to facilitate ease of replication.

CHAPTER 4

RESULTS AND DISCUSSION

RESULTS

Over the course of this study, Mary's ability to select a preferred food item using the Unicorn Keyboard increased. Reliance on verbal and physical prompts was reduced, as Mary made independent use of the Unicorn Keyboard.

During the initial introduction of the keyboard, Mary was observed to activate the Unicorn Keyboard without prompts on only two occasions. It is possible that this was incidental, although she looked at the food placed nearby on the counter. She also initiated eye contact with the author and generally behaved in a cheerful manner. She made happy sounds and clapped her hands in anticipation of eating. Mary connected her use of the keyboard with receiving food. She touched the keyboard several times, patted it with her left hand, and reached out to fiddle with the plastic protector between bites of food. When she activated

the voice mechanism she turned to look at the computer. When the monitor was turned off to minimize distraction, Mary did not appear to look at the photos, and she activated the voice mechanism without apparent visual contact with her photos.

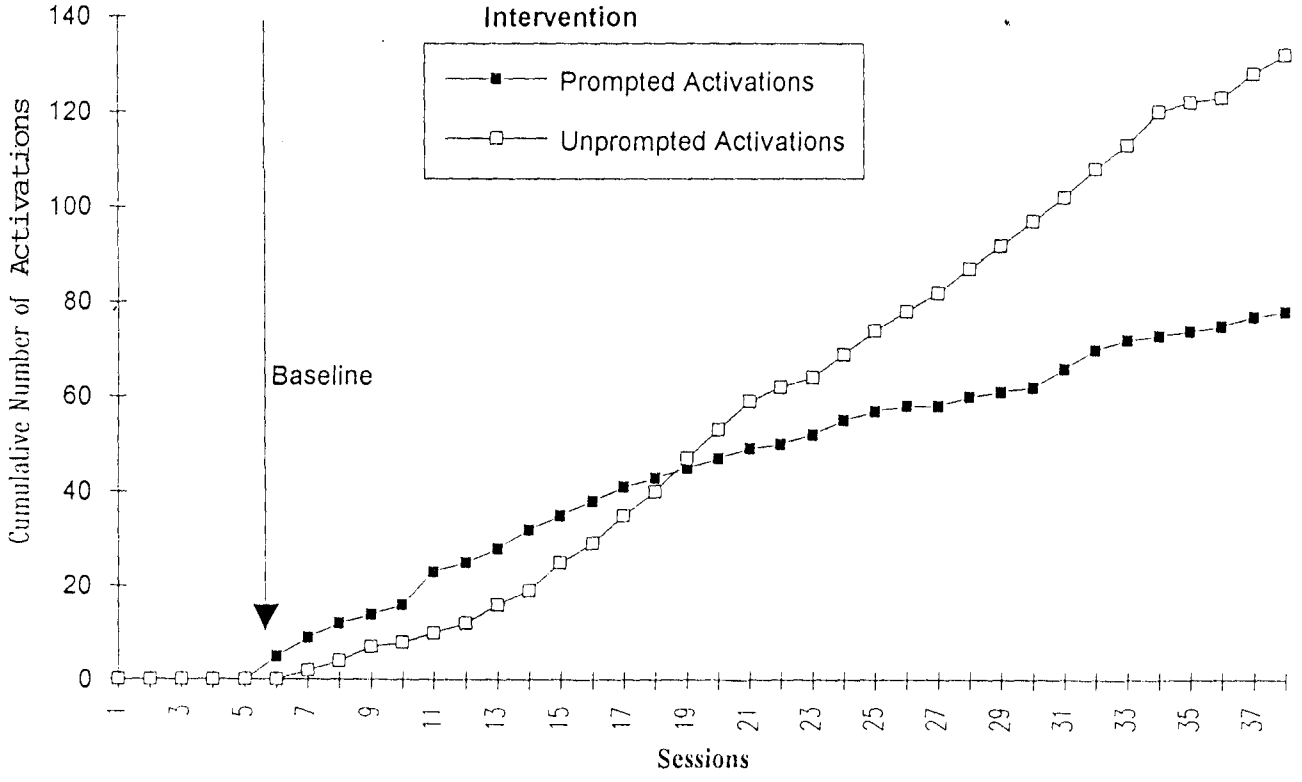
The results of the intervention phase demonstrated an increase in Mary's ability to associate her photos, and voice activation of the Unicorn Keyboard with the food items. At the beginning of the intervention phase, Mary required many verbal and physical prompts to use the Unicorn Keyboard to request. When Mary made unprompted milk requests, sandwich selection was included. After several sessions, Mary began to make unprompted requests. During the intervention phase, when Mary was eating and not involved with making food requests, she made numerous attempts to handle, push, and otherwise try to manipulate the Unicorn Keyboard. Close supervision was necessary to prevent damage to the communication device. Sandwich requesting was frequent, probably because she was hungry when given instruction on the keyboard. Mary made several

unprompted requests for milk and/or sandwich and her next photograph was added after session twenty-one.

Mary learned to access the proper location of the yogurt photograph which was at the lower left corner of the overlay. At first, Mary made several requests for milk and/or sandwich and did not touch the yogurt photograph. She was often pleased to have milk in between yogurt but was not pleased when given a sandwich instead of yogurt.

Activation of the cookie photograph was inconsistent, due in part to the fact that Mary preferred to eat a cookie after the yogurt and on occasion was not hungry enough to want the cookie. At this stage of the intervention phase, Mary made several unprompted requests for sandwich but did not eat it after the request was made. During the intervention phase, Mary began to show an interest in the photos on the expanded keyboard and made fewer incidental touches. On several occasions, Mary demonstrated a pointing response when selecting her food choice. Figure 2 shows the increase in Mary's

Figure 2: Cumulative Activations of the Unicorn Keyboard to Make Food Choices



use of the Unicorn Keyboard to select food items.

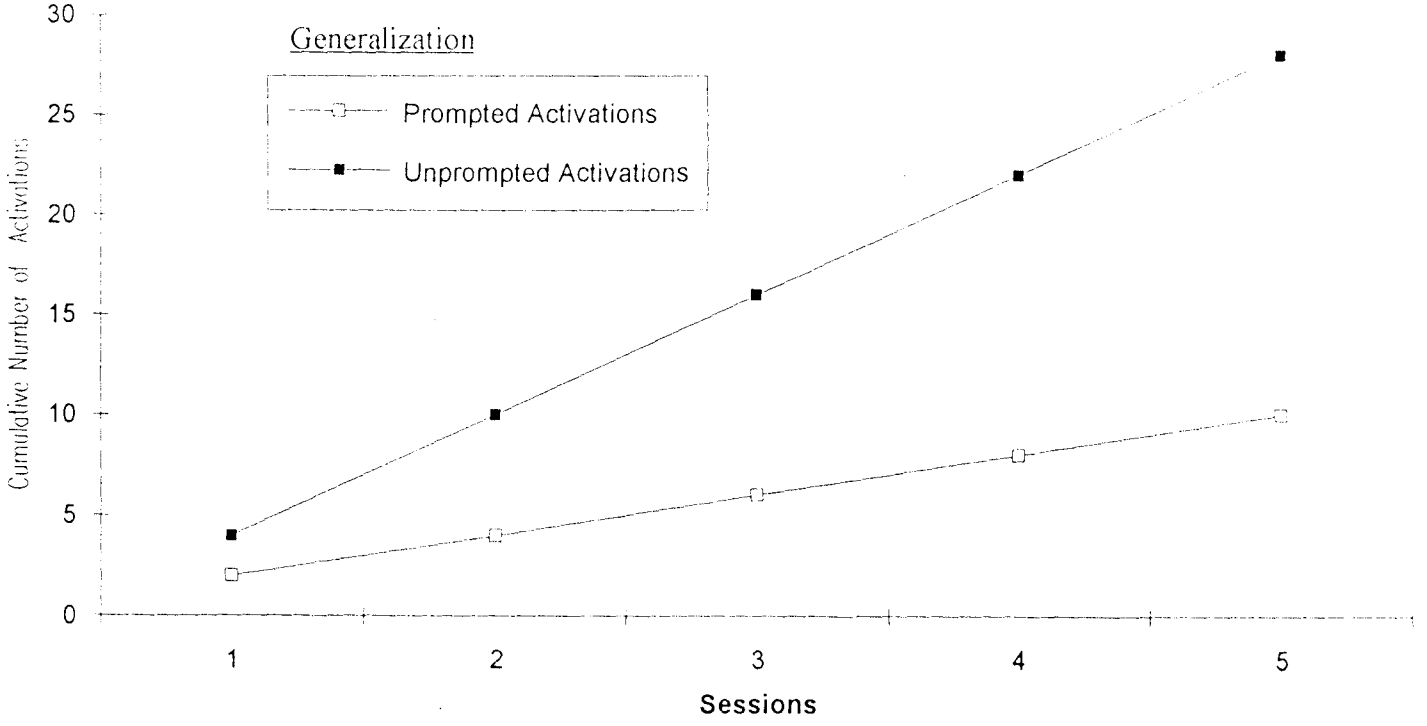
In each of the five generalization sessions, Mary showed a growing ability to indicate activity preference using the Unicorn Keyboard. At the start of each session, Mary was shown the bubble and tape recorder equipment positioned on the table next to her, and attempted to reach for her choice. She was redirected with a physical prompt to the photograph on the expanded keyboard and assisted to activate the synthesized speech. This type of prompting was required for each of the two activities. Mary demonstrated unprompted activation of the keyboard to request music (fifteen times) and bubbles (fourteen times) during the five generalization sessions. The cumulative number of requests is shown in Figure 3.

DISCUSSION OF RESULTS

AUGMENTATIVE COMMUNICATION

As a result of the intervention described in this study, Mary learned to request food and drink using

Figure 3: Cumulative Activations of the Unicorn Keyboard to Make Activity Choices



the Unicorn Keyboard in combination with colour photographs. Reinforcement consisting of speech output and the provision of requested food was found to be a successful combination for Mary. She also learned to generalize this skill to a play setting, requesting activity choices using the Unicorn board.

The instructional procedure using verbal and physical prompts was important for Mary. As her ability to make unprompted choices increased, her reliance on verbal prompts decreased. Mary occasionally required physical prompts, especially at the beginning of each session. This reliance will need to be reduced in order for her to initiate functional communication.

It was apparent early in the study that the speech output was important to Mary. She would look towards the Echo speaker when the speech was activated, and on several occasions, if Mary's touch did not activate the speech, she would look towards the investigator and then make another attempt to activate the Unicorn board. Mary did not however,

make attempts to correct herself if she selected a symbol that was incorrect. Instead, she refused the food item offered and would receive prompts for selecting the desired food. This suggests that perhaps Mary is able to associate the photos with the production of speech feedback and the provision of food, but is not yet able to associate only the speech output with her food choices. The speech synthesizer provided an interface between Mary and the investigator, resulting in immediate reinforcement for Mary's requests. On one occasion Mary's siblings were visiting in the classroom and her four year old sister became interested in the voice output of the communication system. Mary's sister was able to echo the voice appropriately and was prompting Mary to "ask for a drink", and "touch the sandwich". This interest in, and comprehension of the synthesized speech by a young child with no history of developmental problems reinforces the argument that non-reading children can interact effectively with an augmentative communication user (Romski & Sevcik, 1988). The introduction of speech output as part of Mary's communication skills provides her with an opportunity

to control her environment, initiating communication with her peers and teachers.

SYMBOL SELECTION

Because Mary displayed a preference for eating her lunch items one at a time and did not select another item until she was finished eating the previous one, it may be questioned as to whether Mary was able to associate the food with the photograph symbol. The generalization procedure was important evidence to suggest that this was not the case. During this phase Mary made selections for bubbles and music in a random order and was pleased with the reinforcement for her selections. In addition, when Mary was eating her yogurt and her cookie, she made several unprompted requests for milk. This suggests that she was able to discriminate among her photo symbols. Mary's ability to associate the photographs with the food and play objects they represent supports the conclusion that in match-to-sample situations, the more closely the symbol represents the object, the easier the task of learning to associate the two

becomes (Keogh & Reichle, 1985; Sevcik & Romski, 1986; Romski, Sevcik, & Pare, 1988).

PRE-REQUISITE SKILLS

Mary's successful acquisition of requesting behaviours using an augmentative communication system supports the argument that the presence of strict cognitive pre-requisites such as a consistent yes/no response, understanding of object permanence, or the ability to respond to verbal commands, are not indicators of the development of communication abilities (Kangas & Lloyd, 1988; Rice & Kemper, 1984; and Romski & Sevcik, 1988). Mary's success strengthens the need for further consideration of instructional strategies for use with severely disabled children and validates the application of augmentative communication devices.

GENERALIZATION

Mary learned to generalize requesting behaviour

to a setting other than the instructional setting. She also used objects different from those used during the instructional sessions. Her successful application of a previously learned behaviour supports Stokes & Baer's (1977) suggestion that the use of different materials and settings for reinforcing a response will facilitate generalization of the desired behaviour. Mary used the familiar combination of colour photographs and speech output to request play activities . Factors identified by Calculator (1988) as being important to successful generalization of a learned behaviour which were present in this study, include the use of a highly transparent symbol system (colour photographs), consistent responses to Mary's communication attempts, and the use of highly motivating, appropriate objects and activities (food, and play items) relevant to the learner's needs. Mary is a young child and play is the primary avenue of exploration and learning for her. Generalization of food requesting to the play situation, will facilitate further development of social and communication skills. Mary was taught to use an augmentative communication device in the environment in which

she naturally participates in eating, and in play. This supports Calculator's (1988) conclusion that generalization behaviour should be taught in appropriate environments.

FUTURE NEEDS FOR MARY

Mary continues to use the Unicorn Expanded Keyboard to request food choices during lunch-time. Her use of this device to select leisure activities has been expanded to include activities such as bike riding and playing with a balloon. Instruction has been carried out in a manner similar to that used in this study. Overlays have been created to allow Mary to participate in group games such as Simon Says, and Bingo. She is helped to "direct" her classmates by making selections on the Unicorn board. In this situation, black and white drawing coloured with pencil crayons are used as the symbol system.

In order for an augmentative communication system to be functional for an active child like Mary, it

must be readily available for her use in a variety of settings, and during a range of activities. Reliance on the Apple IIGS computer for operation of a communication device limits the portability of the system, and is very expensive for provision in Mary's home or Primary 2 classroom. Mary needs to have access to a portable speech output device such as an ALLTALK or a TOUCH TALKER. A portable device chosen for Mary must allow for expanding symbol vocabulary, offer flexibility with regard to programming, and allow for the provision of several levels or overlays for use in a range of situations. It must be portable and durable. A funding source for this equipment will need to be solicited. A referral to the Communication Disorders department at Sunny Hill Hospital is being considered in order for Mary to have the opportunity to access the possibilities for a suitable communication system.

In order to support Mary's use of photographs to make requests at school, a visit to Mary's home was made by the author and Mary's speech pathologist. After a discussion with Mary's parents about the

results of the study, they expressed an interest in using the photograph system with Mary at home. Mary's father took photographs of Mary's favourite home activities. These were the swimming pool, her tricycle, the television, preparing for a ride in the family car, and story time with her two younger siblings. Grooming activities such as teeth brushing, toileting, and dressing were also represented by photographs. These photographs were attached with clear contact paper to the walls and/or locations where they occur, and Mary's parents were instructed to give verbal and physical prompts appropriately prior to initiating the activities. They were also asked to consistently reinforce unprompted requests made by Mary whenever possible.

In anticipation of the acquisition of a new system for Mary, the introduction of smaller symbols on the Unicorn Keyboard is scheduled to begin. Instead of a 4" X 4" square, Mary's photos will be reduced in size to 2" X 2". In order to further reduce this size, Mary will need to develop her ability to point to, rather than simply touch the symbols.

FUTURE DIRECTIONS FOR RESEARCH

Mary's family has begun to use her photograph communication system at home. It will be appropriate for the author to monitor Mary's ability to generalize her skills to a different setting. The skill of requesting a drink at home using the same symbol Mary uses at school will demonstrate stimulus generalization as described by Odle et al.(1982).

In order to provide further evidence supporting the abilities of children with severe developmental disabilities to benefit from augmentative communication, additional case studies such as this must be completed and published. Case studies contribute to the development of further research hypotheses, and provide opportunities for in-depth discussion and reporting of the subject and procedures. Educators and researchers involved with children with multiple disabilities can be motivated to apply new instructional strategies.

Additional research topics can include the investigation of appropriate instructional techniques to promote generalization, the role of speech output in the development of both receptive and expressive communication abilities in disabled learners, the effect of facilitator training on the development of communication skills, and the effective evaluation of communication competence in augmentative communication users. Mirenda & Iacono (1990) believe that educators face a "communication imperative" for the 1990's. Persons with severe disabilities must have access to functional communication training.

Recently, in British Columbia, the Ministry of Education established the Special Education Technology - British Columbia (SET-BC) initiative, whose role is to provide necessary educational technology to non-speaking students in the province. Assessment, training, and provision of technology, including microcomputers, software, and electronic communication devices is provided along with the related services such as seating/positioning, speech therapy, psychological assessment, medical consultation, and educational planning.

SUMMARY

This case study examined the ability of a multi-disabled child to learn to use a Unicorn Expanded Keyboard in combination with photographic symbols to request food.

The initial application of augmentative communication technology has been with individuals who possess normal or near normal cognitive functioning. These augmentative communication devices have improved the abilities of persons with disabilities such as cerebral palsy, multiple sclerosis, and/or spinal cord injury to function as productive, contributing members of an economic community. Reports of successful application of augmentative technology with severe cognitive impairments are limited, but the results of this study suggest that these learners can also benefit from sophisticated technology and increase functional exchanges with their families and peers.

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