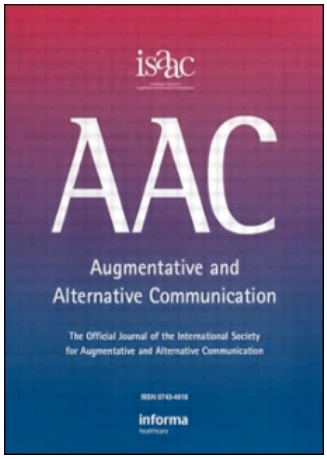

Augmentative and Alternative Communication
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713692248

"When I First Got It, I Wanted to Throw It Off a Cliff": The Challenges and Benefits of Learning AAC Technologies as Described by Adults who use AAC

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Online Publication Date: 01 September 2005

To cite this Article: Rackensperger, Tracy, Krezman, Carole, Mcnaughton, David, Williams, Michael B. and D'Silva, Karen (2005) '"When I First Got It, I Wanted to Throw It Off a Cliff": The Challenges and Benefits of Learning AAC Technologies as Described by Adults who use AAC', Augmentative and Alternative Communication, 21:3, 165 — 186

To link to this article: DOI: 10.1080/07434610500140360
URL: http://dx.doi.org/10.1080/07434610500140360

Augmentative and Alternative Communication, September 2005 VOL. 21 (3), pp. 165–186

"When I First Got It, I Wanted to Throw It Off a Cliff": The Challenges and Benefits of Learning AAC Technologies as Described by Adults who use AAC

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Seven individuals (aged 21–41 years) with cerebral palsy and who used speech generating augmentative and alternative communication (AAC) devices participated in a focus group discussion on the benefits and challenges of learning AAC technologies. The focus group was conducted on the Internet over a 9-week period. Five major themes emerged from the discussion: (a) selection of an AAC device; (b) knowledge and skills needed to use AAC technologies; (c) instruction and practice activities; (d) assessment of skill acquisition; and (e) advice to others. Participants reported that a consumer-driven assessment approach, which included the opportunity to discuss options with other individuals who used AAC, was key to the selection of an appropriate device. Participants identified a wide variety of important supports to learning how to make effective use of AAC technologies, including text and technological supports, individual exploration, learning from professionals, drill and practice, learning from peers, and opportunities for functional use in the community. For the participants, successful use of AAC technology was best assessed by functional use in the community.

Keywords: Augmentative and alternative communication; Cerebral palsy; Focus group; Internet; Learning; Instruction

INTRODUCTION

As with any technology, learning to make competent use of an augmentative and alternative communication (AAC) device imposes significant learning demands (Beukelman, 1991; Light & Lindsay, 1992). In the case of AAC, individuals must learn not only how to make use of a variety of modes of communication, including sophisticated communication technology, but also how to use these techniques to successfully participate in communicative interactions with others (Light, 1997).

Communication skills typically are learned through a series of structured and unstructured communication experiences (Hart & Risley, 1995). For individuals who use AAC, gaining access to these experiences poses special challenges. The educational programs of school-age individuals who use AAC often fail to provide the needed structured instructional experiences (Horton & Horton, 2001; Todis, 2001). Adults who use AAC face additional barriers in obtaining appropriate services, as access to and financial support for training activities is often difficult to obtain (McNaughton, Light, & Grozsyk, 2001; McNaughton, Light, & Gulla, 2003). Individuals who use AAC also face challenges in their efforts to use and develop their communication skills with a variety of partners in unstructured communicative exchanges (Simpson, Beukelman, & Sharpe, 2000). Communication partners may lack the skills needed to support successful communicative exchanges (Kent-Walsh & McNaughton,

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This paper is partially based on a presentation at the Fourth Conference of the Assistive Technology Industry Association, Orlando, Florida, January, 2002.

ISSN 0743-4618 print/ISSN 1477-3848 online © 2005 International Society for Augmentative and Alternative Communication
DOI: 10.1080/07434610500140360

in press), and may end the interaction if the exchange is not initially successful (Johnson, 2000).

While challenges to developing AAC skills are well known, there are an increasing number of individuals who are using a variety of AAC techniques to participate successfully in a wide variety of educational (Atanasoff, McNaughton, Wolfe, & Light, 1998), vocational (McNaughton & Bryen, 2002), and social activities (Dattilo, Light, St. Peter, & Sheldon, 1995). These individuals provide compelling evidence that AAC technologies can be used effectively to support participation in a wide variety of activities.

At present, we have only a limited understanding of how individuals learn to make successful use of AAC technologies to fulfill a wide range of communicative functions. Experimental investigations of learning rates have provided evidence of the challenges of learning representational and coding systems (Drager, Light, Speltz, Fallon, & Jeffries, 2003; Light & Lindsay, 1992), and of making generalized successful use of AAC systems. To date, we have only limited data on the perspectives of individuals who use AAC regarding strategies to support successful learning.

RESEARCH OBJECTIVES

Individuals who are expert users of AAC have much to contribute to our understanding of how individuals develop competence in the use of AAC. The present study was developed to gain a better understanding of the experiences of individuals who had themselves learned to effectively communicate with AAC technology. Specifically, the study investigated the perspectives of competent communicators who used AAC with respect to (a) the process of acquiring and learning to use AAC technology, and (b) recommendations for improving instruction in AAC technology for individuals who use or would benefit from the use of AAC technologies.

METHODS

This study represents a unique contribution to the field since it was designed, implemented, and evaluated by a team of individuals who use AAC, in collaboration with family members and researchers from Penn State University, as part of the Communication Enhancement Rehabilitation Engineering Research Center (AAC-RERC), which is funded by the National Institute on Disability and Rehabilitation Research of the U.S. Department of Education. This study represents the successful realization of the principle, "Nothing about us without us" (Charlton, 1998) and, in keeping with this principle, the research team included the perspectives of individuals who used AAC (TR and MW), as well as a family member of an individual who used AAC (CK), a university researcher (DM), and a graduate student in communication sciences and disorders (KD).

Research Design

A focus group methodology was chosen in order to gain a greater understanding of the AAC technology learning experiences of individuals who have cerebral palsy, have basic literacy skills, and who use AAC technology. Focus groups typically consist of six to ten participants and a moderator, and take place in one location over several hours (Vaughn, Schumm, & Sinagub, 1996). A modified approach is to conduct the focus group discussion on an Internet bulletin board system (McNaughton et al., 2001); this approach was used for the current study and allowed the seven participants to engage in discussion despite their dispersed geographic locations, and to participate in the discussions at a communication rate and time of day that was convenient and appropriate for them.

Critical to a successful focus group experience is the ability of the moderator to elicit participation and encourage the sharing of ideas. The moderator for the current study (TR) was selected for three main reasons. First, she had a demonstrated record of achievement in scholarly activities and presentations on the use of AAC. Second, as an individual who used AAC, she brought personal experience and insights to the development of the questions used in the focus group script, and to the ad-libbed questions used to obtain additional information from participants who posted to a discussion. Finally, there is evidence that some research participants may respond more openly to individuals who have had similar life experiences (De Andrade, 2000). By asking an individual who uses AAC to lead the focus group, we sought to gain a perspective different from that obtained in a traditional research project (i.e., led by a university-based researcher).

Participants

Selection Criteria

Participants were selected based on the following criteria: (a) they had cerebral palsy; (b) their

speech was inadequate to meet their daily communication needs; (c) they had demonstrated the ability to use their current AAC technology to communicate on a wide variety of topics with a range of communication partners; and (d) they had demonstrated basic literacy and Internet skills through ongoing participation in previous Internet-based activities (e.g., participation in public listservs, previous research projects).

Recruitment

Participants were recruited through postings to an email listserv, ACOLUG.[1] At the time of the study, ACOLUG had more than 300 subscribers, including individuals who used AAC, family members, and professionals. The site features discussions on a wide variety of issues (e.g., educational programs, independent living, societal barriers) considered important by individuals who use AAC.

Description of Participants

A summary of the demographic information for each participant is included in Table 1. Seven individuals participated in this study, three men and four women, ranging in age from 21 to 41 years. The highest level of education obtained by the participants ranged from completion of high school to the completion of a 4-year undergraduate degree.

The participants described making use of a number of different AAC technologies, including the Dynavox 3100,[2] the Pathfinder,[3] and the Liberator.[4] A history of past device use is provided in Table 2. All participants used a variety of means to communicate, and had experienced change over time in the types of AAC technology they used to communicate. All participants had used at least four different low tech (e.g., word boards) or high tech (e.g., speech generating devices) systems during their lives, and two participants had used as many as six.

Materials

The focus group discussions were conducted using Phorum 3.3.2,[5] a password-protected Internet bulletin board system that allows several individuals to participate in text-based discussions on a variety of topics. Phorum allowed participants to access discussion topics by selecting links listed on an index page. Participants could select to view new content posted on a topic, or review all previous comments. Participants were able to post messages to the discussion by entering their names and responses into a specified area at the bottom of the discussion text.

The research team developed the questions posted by the moderator at the Phorum 3.3.2 site. Jenkins (1979) suggested that four questions are relevant to the consideration of a learning situation: (a) the content to be learned; (b)

TABLE 1 Demographic characteristics of the participants

	Participant						
Variable	Billy	Dan	Julie	Jessica	Sally	Kara	Tim
Age	21	32	28	29	26	41	35
Education	High school	Bachelor's	Some college courses	High School	Some college courses	Some college courses	High school
Mobility	Manual wheelchair	Power wheelchair	Power wheelchair	Manual wheelchair	Power wheelchair	Power wheelchair	Manual wheelchair
Communication means	Liberator, gestures, morse code (tapping with foot)	Pathfinder, gestures, writing in air with head	Liberator, speech	Dynavox 3100, vocalizations, gestures	Pathfinder, signs	Dynavox 3100, speech, gestures	Dynavox 3100, letter board, speech
Access	Head stick	Optical head pointer	Single switch (for Morse code) operated with left heel	Fingers	Fingers	Head stick	Fingers
Acceleration techniques	Unity[1]	Unity, pre-stored phrases, word prediction	Unity, pre-stored phrases, word prediction.	Pre-stored phrases organized on pages, word prediction	Unity	Pre-stored phrases organized on pages	Word prediction, abbreviation expansion, pre-stored phrases organized on pages

[1] Unity is a vocabulary organization strategy for use with Minspeak icons. More information is available at http://www.minspeak.com/faq.html

TABLE 2 History of past device use and age used (as appropriate)

Name	Billy	Dan	Julie	Jessica	Sally	Kara	Tim
Past AAC systems/age used	• Gestures (LT)[1]	• Gestures (LT)	• Gestures (LT)	• Gestures (LT)	• Word boards (NR)[2]	• Gesture (LT)	• Word board (11–present)
	• Alphabet board (5–7)	• Blissymbols [3] (7–24)	• Portable Typewriter (7–16)	• Speech (LT)	• Touch Talker with Minspeak (NR)	• Speech (LT)	• Handivoice 110 (15–19)
	• Light Talker[4] with Minspeak (7–13)	• Air Spelling (12–present)	• Computer (10–18)	• Alphabet board (LT)	• Touch Talker with Word Strategy (13–19)	• Word board (4–10)	• Epson SpeechPac (21–30)
	• Liberator with Word Strategy(14–20)	• Epson Speech Pac [5] (17–22)	• Liberator with Word Strategy (20–14)	• Handivoice 110 [6] (3–5)	• Liberator with Word Strategy (19–25)	• Handivoice 110 (10–29)	• Liberator with Unity (31–34)
	• Liberator with Unity (20–present)	• Liberator with Word Strategy (24–31)	• Liberator with Unity (24–present)	• Word board (14–18)	• Pathfinder with Unity (26–present)	• Light Talker with Word Strategy (35–40)	• Dynavox 3100 (34–present)
	• Horn on electric wheelchair (to get people to move) 8–present	• Pathfinder with Unity (31–32)	• "Mean right hook" (when desperate to get someone's attention) (6–present)	• Epson SpeechPac (21–26)		• Liberator with Word Strategy (40–present)	
				• Dynavox 3100 (27–present)		• Dynavox (41–present)	

[1] LT = life-time user
[2] NR = dates not reported by participant
[3] Blissymbols are a graphic symbol language with a wide vocabulary. Meaning-based Bliss units are sequenced to define the meaning of each compound symbol. More information is available at http://www.blissymbols.org/
[4] The LightTalker is a dedicated voice output communication device. Additional information is available from Prentke Romich Company, 1022 Heyl Road Wooster, OH 44691, USA, and at www.prentrom.com.
[5] Epson Speech Pac is a dedicated voice output communication device. It was manufactured by Adaptive Communication Systems Inc.
[6] Handivoice 110 is a dedicated voice output communication device. It was manufactured by Phonic Ear. Additional information is available from PhonicEar Inc., 3880 Cypress Drive, Petaluma, CA 94954-7600, USA.

characteristics of the learner; (c) the nature of the instruction; and (d) the type of assessment used. These four questions were used as an initial structure for the development of questions. Additional questions were added to gain more detailed information about the process of learning to use AAC technology, as well as to generate specific recommendations for technology manufacturers and communication professionals regarding supports for learning to use AAC. See Appendix A for a complete list of questions as they appeared at the website.

Procedures

Once appropriate consents from participants were obtained, the participants received a brief questionnaire. The questionnaire was used to gather background information about their educational experiences and a listing of their previous and current use of AAC systems.

The activities in the focus group discussion were based on the best practices used in traditional focus groups (Vaughn et al., 1996), with modifications to meet the demands of an Internet-based focus group discussion (McNaughton et al., 2001). Before they began the focus group discussion, participants were provided with training in the procedures for accessing and posting messages to the discussion site on Phorum 3.3.2. The moderator then presented guidelines for participation in the focus group. Specifically, the participants were asked to: (a) visit the discussion site two to three times per week; (b) contribute to each topic's discussion; and (c) attempt to present differences of opinion in a non-critical manner. A welcome page was established within the site to give participants the opportunity to practice posting messages, and to read the introductions of the other members of the focus group.

Following the introductory messages, the moderator began to introduce topics for discussion. A new topic was introduced on the home page every 4–7 days. Each new topic was designed to address an aspect of one of the research objectives (e.g., the process of acquiring and learning to use AAC technology), and was organized on a separate page within the bulletin board system. Fifteen topics were introduced by the moderator (see Appendix A for a complete list of questions posted by the moderator throughout the discussion).

The moderator closely monitored the discussions throughout their 9-week duration, checking the site on a daily basis, and thanking the participants for their comments. Both the moderator and the research team, (via the moderator), asked follow up questions of participants in order to clarify statements that may have been unclear.

During the 9 weeks, the participants posted a total of 10,814 words to 15 discussion topics. A thank-you letter that contained a summary of the themes and sub-themes that were observed in the discussion was sent to each of the participants as a member check (Vaughn et al., 1996) approximately 8 weeks after the last posting to the discussion. The participants were asked to confirm that the summary of the discussion reflected their own understanding and contributions. In addition, they were asked to rate, on a scale of 1–5, the helpfulness of each learning strategy identified in the discussion, and their interest in using the strategy. Participants were also encouraged to make additional contributions that were relevant to the discussion topics.

Data Analysis

The participants' contributions to the discussion pages were unitized according to Lincoln and Guba's (1985) definition of a unit as the "smallest piece of information about something that can stand by itself ... interpretable in the absence of any additional information other than a broad understanding of the context in which the inquiry is carried out" (p. 345). The unitized data were then arranged in a table that contained four categories: (1) participant's identification code; (2) title of the discussion strand in which the posting was entered; (3) numeric code (for the coding theme); (4) unitized datum (i.e., participants' comments).

Coding themes were developed post hoc based on a review of the participants' contributions, and operational definitions were created for the themes (Vaughn et al., 1996; Yin, 1994). These operational definitions were used to code samples of text, and the operational definitions were reviewed and modified, as necessary. Six major themes were identified: (a) selection of an AAC device; (b) knowledge and skills needed to use AAC technologies; (c) instruction and practice activities; (d) assessment of skill acquisition; (e) recommendations to others; and (f) unrelated statements. See Appendix B for operational definitions of the coding themes.

The third author assigned a numeric code to the unitized data based on the content of the statement and the operational definitions of the themes. The unitized data were presented with appropriate amounts of adjoining text so that a context for the comment was provided. After all of the data were coded, a reliability check was performed. Twenty percent of the data were selected at random to be coded by both the

researcher and a graduate student in the Department of Communication Sciences and Disorders who had received training in the operational definitions of the coding themes and coding procedures. An agreement score of 0.82 was calculated using Cohen's Kappa, a procedure that corrects for chance agreement among observers in situations in which a response is assigned to one of a number of categories (Suen & Ary, 1989). Landis and Koch (1977) have suggested that Kappa values above 0.81 can be considered as "almost perfect." Disagreements were resolved through discussion.

RESULTS

The results of this study are discussed in this section, including demographic information on the participants and the other five major coding themes of interest: Selection of an AAC device, the knowledge and skills needed to use AAC technology, instruction and practice activities, assessment of skill acquisition, and recommendations to others. A summary of themes, sub-themes and examples is provided in Table 3.

Selection of an AAC Device

The first major theme identified in the participant responses was selection of an AAC system. Participants reported a wide variety of experiences, and frequently emphasized their interest in giving meaningful input to the process. Two subthemes were identified in this category: the positive impact of taking a lead role, and the negative impact of a lack of control in the assessment process.

Some individuals were able to take a lead role in the decision-making process and selected a device based on their past experiences and conversations with other individuals who used AAC. As Sally commented, "Every time I needed a new AAC device, I told the SLP what I thought I needed and they agreed with me. I know my needs best." In at least one case, lack of involvement of professionals was seen as a *strength*; one individual commented: "Fortunately I didn't have a SLP working with me to cloud my decision behind their clinical jargon."

For others, the assessment experience was not as positive. Some individuals reported that they felt rushed within the assessment process. As Julie said, for example, "I was shown (the device) just briefly before ordering it. I really wasn't given the chance to use (the device) before deciding whether or not I would like it."

Knowledge and Skills Needed to Use AAC Technology

The second major theme identified in the responses of the participants was the knowledge and skills needed to make competent use of an AAC system. Three subthemes were identified in this category: linguistic competence, operational competence, and social and strategic competence.

Linguistic Competence

Much of the discussion related to linguistic competence focused on the decision-making process used for selecting vocabulary to be saved in the AAC device. Participants differed in their use of pre-programmed words and phrases. Some, such as Kara, mainly used spelling with word prediction. Others, such as Dan, used preprogrammed words but not phrases: "I don't really have too many pre-programmed phrases because I like to be spontaneous and form my sentences on the fly." Some participants tried to anticipate words and phrases that would come up in a particular situation, and programmed vocabulary that would help them to participate. As Jessica wrote: "My husband and I talked about what to program into my Dynavox, what phrases we thought would work, and when time went on I started programming some more real life phrases."

These first conversations were often the beginnings of iterative processes in which individuals who used AAC would use the device in interactions, and then store frequently used phrases. As Billy described, "When I talk to people, I would store some things I think I'll talk about again so I don't have to retype it again." Jessica described the selection of vocabulary as an iterative process: "Every few days I would change it (the programming in my Dynavox) and I still do. It is always an ongoing process for me to change something, and my needs are always changing."

Operational Competence

Participants reported three areas of knowledge related to operational competence: technical operation and upkeep, programming, and dealing with breakdowns. For some participants, just physically operating the device was a challenge. Because the assessment process had not considered the participants' use of the device in a wide range of positions and environments, the device was often difficult to physically access in any position other than sitting in a customized wheelchair. For most participants, however, once

TABLE 3 Coding themes, subthemes, and examples of issues discussed by participants.

Themes	Subthemes	Examples
Selection of an AAC device	Positive impact of lead role	• Importance of being in charge of decisions
	Lack of control	• Feeling rushed to make a decision
Knowledge and skills needed to use AAC technology	Linguistic competence	• Selecting vocabulary to be saved
	Operational competence	• Technical operation and upkeep
		• Programming
		• Dealing with technical breakdowns
	Social and strategic competence	• Gaining attention
		• Introducing the system to others
		• Dealing with breakdowns in conversation
Instruction and practice activities	Text and technological supports	• Usefulness of text supports
		• Challenges in initial use of device
		• Interest in new technological supports for learning
	Exploration	• Identification of effective techniques
		• Criticism by others
	Learning from professionals	• Wide variety of experiences
		• Lack of qualified professionals
	Drill and practice	• Use of daily practice
	Learning from peers	• Positive experiences
	Functional use in community	• enefits of "jumping right in"
		• Benefits of scaffolded experiences
		• Need for regular use to support retention
	Support from family and friends	• Assistance in creating learning activities
Assessment of skill acquisition	Indicators of success	• Successful use in the community
	Evidence of challenges	• Importance of developing "real world" skills
		• Challenge of dealing with public
		• Unreliability of technology
	Perceptions of ease of skill acquisition	• Time to learn encoding
		• Time to organize vocabulary

a satisfactory access method was identified, the actual physical operation of a device was relatively easy. As Jessica commented, "When I first saw the Dynavox™ I could use it right away, especially with the QWERTY keyboard with word prediction and phrases already on it." Participants commented on the fact that prior experiences with other devices or personal computers (especially if these devices were in the same family of devices, such as Minspeak[6]-based devices like the TouchTalker, Liberator, and Vanguard) made it easier to learn a new device.

With respect to the programming of vocabulary and the individualization of acceleration techniques, the participants spoke strongly to the need for the individual who uses the AAC device to be the central player in programming decisions. Billy wrote, "All of us agree that users should program their device (themselves). Everybody has a different personality and it would be better if they say what they want to." For some individuals, practice was needed to memorize the steps to program vocabulary. Jessica wrote, "I had to be (taught how to use) pages, pop-ups, and how to program it." For others, such as Kara, little time was needed to learn the programming sequence; instead, time went into the actual selection and organization of vocabulary for programming: "With the way I use my Dynavox, there was zero practicing. The only time-eater was customizing my pages."

The comments made concerning technology breakdowns clearly conveyed the important role that communication devices played in the lives of the participants. Jessica reported the following:

> Around the same time I felt comfortable going out by myself, my (AAC device) was acting up and giving me problems, so I couldn't go out any more by myself, because I felt unsafe going out by myself not knowing if my (AAC device) would work or not.

The unreliability of devices made it difficult for individuals who used AAC to make steady progress in learning to use their devices. As Kara commented, "Just when I would get good with (the AAC device), it would quit working."

Even for experienced users, device breakdowns were a disaster. As Dan observed, "I am going to be blunt here. I am pretty much screwed if my Pathfinder locks and I am alone or with somebody that doesn't know how to reset it."

The participants dealt with breakdowns in two ways – by developing personal expertise in the

device, and by taking advantage of support provided by the manufacturer. Julie wrote:

> If I have something wrong with my Liberator, between my mom and I we can usually figure (out) what is wrong with it. I pretty much know my device inside and out. ... I look through several Liberator manuals and go through all the tools underneath the key guard trying things out before calling Tech Support.

Participants praised the efforts of manufacturer support personnel, describing them as "very helpful."

While participants had developed strategies to get the information they needed to repair their devices themselves, they still needed someone to act as their "hands." As Kara observed, individuals who use AAC need caregivers who have the technical expertise to assist them in repairing a device. Many of the participants also needed assistance from a family member or aide to call technical support, as they did not have a back-up communication system that could be used to describe the problem.

Social and Strategic Competence

In addition to discussing the process of vocabulary selection as well as how to physically operate their devices, the participants also discussed the social and strategic knowledge needed to make effective use of AAC technology. Important areas of discussion included gaining attention, introducing the system to others, and dealing with breakdowns in conversation.

Participants described a wide variety of techniques to gain attention, including the use of preprogrammed phrases, repetition of a phrase with increasing volume, and the use of nonlinguistic methods (vocalizing, using the siren feature on their device, and hitting a head stick against their device). Many of the participants differentiated between techniques used with familiar partners (family and friends) and unfamiliar partners.

With familiar partners, simply starting to prepare a message (especially when the device produced audible feedback for key activation) was sufficient to gain attention. To gain the attention of individuals who were unfamiliar with AAC devices, sometimes more obtrusive methods were needed. Tim commented, "I usually have to yell to get noticed. After my chair broke down, people walked past me without listening to my device, I was sick of being ignored." For some individuals, initiating conversation with unfamiliar partners was difficult. Jessica wrote, "I usually do nothing to get people's attention, I don't like going up to complete strangers."

Participants differed in the strategies they employed to introduce their use of AAC technology to others. Some participants tried to anticipate (and answer) frequently asked questions about their devices by providing preprogrammed phrases that describe their AAC systems. As Julie wrote, "They are totally amazed when I give them a little spiel. I will say my name and 'this is my communication device called the Liberator. It lets me be more independent. I'm using Morse code to access my device.'" Other participants deliberately avoided discussion of their devices unless specifically asked. Dan wrote:

> When people I don't know come to talk with me they usually ask what my name is so I say my name with my Pathfinder. Their next question is usually what is the Pathfinder. I don't go out of my way to introduce my Pathfinder because it is a tool that I talk with, not a living thing. I found out if they want to know they will ask.

Participants described three strategies for dealing with breakdowns in conversation. First, they directed their communication partners to look at the screen on the device and to read the message. In situations in which that strategy would not be successful (e.g., on the telephone, when speaking with people with poor vision), participants slowed down the rate of speech on their devices, either by changing the setting or by adding commas after every word. Finally, participants reported that they rephrased their messages in an effort to be understood.

Learning Supports for Operating a Device

The third major theme focused on activities used to gain proficiency in the use of an AAC device, including activities used to learn how to operate and maintain an AAC device, activities used to learn how to program and retrieve vocabulary, and activities used to support community use. Six sub-themes related to instruction and practice activities emerged from this theme: text and technological supports, exploration, learning from professionals, drill and practice (memorization, visualization/mnemonics), learning from peers, and functional use in the community. A seventh sub-theme – support from family and caregivers – while not an instructional activity per se, was also identified. As well as discussing each technique, participants also rated the helpfulness of the six

TABLE 4 Participants' ratings of strategies to learn to program and retrieve vocabulary

		Used			Did not use		
Resource	Activity	Very helpful	Moderately or a little helpful	Not helpful	Want to	Don't want to	NR*
Text and technological supports	Interactive computer program				4	2	1
	On-board software programs (e.g., Icon Tutor)	3	1		1	1[1]	2
	Manuals (print)	3	2	1			1
	Manuals on CD-ROM				6	1	
	Manuals on Internet				7		
	On-line classes				7		
Individual exploration		6	1				
Learning from Professionals	Attending workshops	2	2		2		1
	Demos by reps	2	3				2
	Training by a SLP	2		2	2	1	
Structured practice	Drill and practice	2	1	1	1	2	
Learning from peers	Watching other individuals who use AAC		2		4	1	
	Advice from individuals who use AAC on listservs	5	1		1		
Functional use	Conversation with familiar partners	6				1	
	Conversation with unfamiliar partners	5	2				

[1]Did not use a Minspeak based device
*NR = no response

instructional techniques identified above, and their interest in using the technique as part of a follow-up activity (see Table 4).

Text and Technological Support

Most AAC device manufacturers provide manuals and other text materials to support learning. Some devices also include onboard software supports (e.g., the PRC icon tutor[7]) to assist individuals who use these particular AAC devices to make effective use of acceleration techniques. Participants described making use of both text (e.g., manuals) and technological supports (e.g., icon tutor).

Many participants described the manuals as helpful. As Jessica wrote, "With the RealVoice I had no real training. I just read the manuals myself. Reading the manuals really helped a lot."

The initial experience in trying to use manufacturer-supplied device manuals was not always positive. Julie wrote: "My mom got some information from the technicians, but we still didn't have any hands-on experience until it was delivered. My mom and I wanted to throw it off a cliff when I first got it." Participants identified a strong interest in receiving manuals in alternative formats (i.e., CD-ROMS and over the Internet); for some individuals, manipulation of text on the computer screen was easier than turning the pages of a book.

The onboard software supports (e.g., Icon Tutor) available in some devices assisted users who wanted to learn "on the fly." Dan described his experiences: "I really didn't have any learning structure (for learning the Pathfinder). If I needed to say a word that I didn't know the sequence for, I simply spelled the word and the icon sequence came on the screen."

For those individuals whose devices contained technological support for learning, this was a popular feature. All of the individuals who used this feature rated it as very or moderately helpful. The participants also expressed strong interest in an interactive computer program to help in the learning of their AAC technology. All participants described a strong interest in on-line classes, although none of them had participated in on-line training.

Exploration

Many of the participants described independent exploration of their devices as an initial learning strategy. As Jessica wrote, "At first I fooled around with the programming of my Dynavox, to

see what worked and what didn't.'' This approach to learning was sometimes criticized by others. Kara wrote the following:

> I think back to when I had my Light Talker, I used to play with it because I was comfortable with assistive technology, and my SLP and even the company representative said, ''No, that isn't right.'' But yet I saw a person that was really into technology doing exactly the same thing as I was doing.

All participants rated individual exploration as very or moderately helpful.

Learning from Professionals

Participants differed on the helpfulness of instruction provided by others. While learning AAC devices independently was described as '''OK' if a person was highly self-motivated'' (Julie), most participants described professionals as major sources of support in the learning process. Workshops held by manufacturers received ratings of very or moderately helpful from the four participants who took part in them , and the two who did not attend a workshop would have liked the opportunity to do so (one participant did not respond to this question).

Instruction from SLPs received mixed ratings. While two individuals received services that they found to be very helpful, two described instruction from the SLP as ''not helpful.'' For the three individuals who had not received services, two would have liked to receive services, and one did not want services.

Some participants described serious difficulties in obtaining appropriate support. Julie wrote,

> My Mom and I had a hard time finding a SLP who was willing to learn the Minspeak Application Program. They didn't understand its importance and value. They didn't want to take on the challenge of understanding and memorizing the vocabulary, and they broke out in a sweat when we showed them the thick Unity three ring binder.

Tim described having to travel for over an hour to get appropriate support, because ''no local hospital knew Minspeak.''

Drill and Practice

For devices with a structured pre-programmed vocabulary (e.g., Word Strategy[8]), some participants described their use of structured instructional and practice activities to learn the icon codes for the vocabulary. For example, Kara described the extensive use of drill and practice activities over a 2-year period to learn Word Strategy: ''My SLP made a list of icons for me to activate ... I was to practice it like somebody would practice the piano. It was sure dull. But I am glad I did it.''

Julie also made extensive use of drill and practice to learn Unity, a structured preprogrammed vocabulary with over 4000 encoded words:

> I had my mom take a couple of sections at a time out of the thick Unity binder and put them into a thinner binder so it wasn't too mind boggling for me. Then I would study the sequences and description ... I did most of my practicing (or) memorizing sitting on the family room floor with my Liberator perched on a chair in front of me along with a few sections of the Unity program (manual) in front of me. I did pretty good with motivating myself to keep on studying on a regular basis three or four times a week for two hours at a time ... It took about two years to learn the entire vocabulary really well.

For some individuals this structured practice was part of the high school curriculum. Billy described his experience:

> When I entered high school, I needed to take a foreign language. So my speech teacher and me asked the school if I could get Word Strategy as my foreign language and they let me. That's how I really learned a lot of Minspeak. During each week, my speech teacher gave me 10 words that she thought I would use to learn for the week, then she would test me every Friday. Then when final exams came I had a final exam on all of the words that she had tested me on.

Some participants were critical of drill and practice as a learning technique; they identified difficulty in generalizing from practice situations to actual use as a major concern. Kara wrote:

> I remember my first six months of therapy ... I didn't have my device yet and at night I would practice on this paper overlay with aides in a residential program. I would do wonderful at night. But do you think I could do that well in therapy? Heck no! I would get lectures on top of lectures.

Dan also questioned the usefulness of drill and practice activities:

> I don't see the necessity of being drilled on Minspeak sequences ... You have to teach a person how to apply (the words learned as codes) to express themselves ... I feel it is more natural to learn in a public setting. Isn't that how babies learn to talk?

Participants were divided in their ratings of drill and practice. While three of the participants viewed it as "very" or "moderately helpful," three viewed it as "not helpful" or said "did not use it and did not want to use it."

Learning from Peers

In addition to working with professionals, many participants described the benefits of learning from other individuals who used AAC. Billy wrote:

> Three summers ago I attended an AAC camp that helped me program some phrases to help me communicate faster. When I talked to people, I would store some things I thought I would talk about again so I didn't have to retype it again.

Two individuals who had observed others who used AAC both considered this to be a moderately helpful experience. Four individuals had not had this opportunity, but expressed an interest in being able to watch others using AAC systems. One individual had not had this experience, and did not want this experience.

While face-to-face interaction was viewed as desirable, the participants also expressed interest in other methods of communication. Asked to rate a variety of supports that assist in learning a device, five participants rated on-line listservs that feature high levels of participation by individuals who use AAC as a "very helpful" resource for obtaining information on how to program and use an AAC device.

Functional Use in the Community

Participants also described the benefits of learning to use the device by making functional use of it with familiar and unfamiliar partners. As Dan reported:

> I found the best way for me to learn anything is to just jump in and use the technology or whatever. This forces me to learn fast and be highly motivated. My rationale was the more I use Word Strategy or Unity the more I will learn. With this technique I learned Word Strategy in about three months, and Unity in about a month.

While many of the participants found that using the device in a real life environment was helpful, some individuals described the benefits of scaffolded experiences, in which strong external support was provided at first and then gradually reduced. Kara wrote:

> I would go out to the store and ask people questions and buy things by myself. At first I had someone with me but then a couple of weeks later they would start backing off so I could get used to being alone.

For individuals who used a variety of modes to communicate, a lack of real-world practice sometimes contributed to a slower rate of acquisition. For example, Tim wrote: "I have some speech that is understandable to most people; (because of this) I was not using Minspeak on a daily basis so I forgot a lot of codes for Unity." For others, such as Dan, reliance on a device meant that he was always learning: "I have to say I practiced constantly due to my learning technique and the fact that my Liberator/Pathfinder is my main source of communication."

Of the seven participants who responded to this question, conversation with familiar and unfamiliar partners was viewed as very or moderately helpful by all but one participant.

Support from Family Members and Caregivers

In discussing instruction and practice activities, it is important to note the key role of family members and caregivers. These individuals may not directly provide instruction, as in the case of a professional; however, their ongoing support in making drill and practice activities accessible, or in providing the transportation that created opportunities for functional use in the community, was often described as critical to successful acquisition.

Assessment of Skills Acquisition

The fourth theme discussed in the focus group dealt with the assessment of skill acquisition, i.e., indicators of progress (and evidence of challenges) in learning to make use of AAC technology. Subthemes included: indicators of success, evidence of challenges, and perceptions of ease of skill acquisition (cost of learning).

Indicators of Success

For many users, the principal benchmark for measuring success was successful use in the community. Julie wrote:

> Once, when I was at a mall, my attendant who was to meet up with me wasn't there. I went up to a waiter in a restaurant and she understood everything I said with my Liberator and called my mom like I instructed her to. That was a real nice experience.

Successful communication experiences provided motivation for additional study of needed skills. Julie commented, "When people pay attention to what I'm saying to them, it makes me want to use and perfect my device even more."

Evidence of Challenges

This subtheme included descriptions of indicators of limited progress in acquiring skills. Just as success in the real world was seen as evidence of progress, challenges in using AAC in daily interactions were also salient for the participants in this study. Participants made a distinction between having the skills to retrieve vocabulary in a clinical setting, and making use of the device in a real world context. For example, Dan wrote: "It is one thing if a user knows the icon sequence APPLE + NOUN means 'food.' However, it is another thing if the user knows how to ask a stranger in the real world for food." Jessica also described the differences between having access to vocabulary and being able to use it in a functional context.

> My husband and I talked about what to program into my Dynavox, what phrases we thought would work, and as time went on, I would program more real life phrases (into my Dynavox) ... I still have my caregiver talk for me most of the time instead of me using my Dynavox ... I have not developed the social skills to answer questions if someone comes up to me and asks a question.

Even when participants were prepared to use their devices in public situations, the response was not always positive. Julie described the following episode:

> One week (my SLP) wanted me to go into a department store and ask a clerk to help me look for pants using my Liberator. It was a disaster. My mom was with me and explained my device to an elderly clerk who was very interested in my Liberator and seemed willing to help. She was going off shift so she had another woman help me. The second lady was totally clueless about how my Liberator worked even after my mom explained it to her. She talked really loud into my Liberator when she was answering my questions. My mom told her it was me that was doing the talking "through" my device. Then she got right in my face and talked like I was deaf. We just walked out shaking our heads without buying a pair of pants.

Perceptions of Ease of Skill Acquisition

Comments on the ease of skill acquisition appeared to be related to the type of technology used. The individuals who used dynamic display systems and word-prediction systems frequently described their systems as "useable from the beginning ... right out of the box" (Jessica). With these systems, however, additional time was sometimes needed to identify and program needed vocabulary. As Jessica noted, this might pose certain challenges for some individuals.

> With new users it is hard to know what situations they will be in with their new devices, they have nothing to go on except what the manufacturer printed in the manuals, and no real-life scenarios to go on when they first get the device.

For those who were learning to use technology that had substantial amounts of pre-programmed vocabulary (i.e., the Liberator with Unity), a period of learning was often necessary. The individuals described the length of time needed to learn to make effective use of a device with an organized encoding system as ranging from 1 month for an individual learning a new version of a previously used encoding system (i.e., switching from Word Strategy to Unity) to 2 years (an individual learning Word Strategy with no previous experience in Minspeak). Clearly, these estimates are substantially affected by a large number of variables, and will vary for each individual.

Recommendations to Others

All participants were proficient users of their AAC systems, however they all had invested significant thought and effort into mastering the technology. Based on their experiences, the

TABLE 5 Summary of recommendations to others

Target audience	Recommendation
Individuals who use AAC	• Take a leadership role in making decision about technology • Practice accessing technology on a daily basis • Use technology in real world situations • Seek out other individuals who use AAC for instruction and support
Service providers	• Increase training for professionals • Develop consumer-driven assessment and instruction • Promote access to AAC at an early age
Technology developers	• Improve reliability of technology • Develop technology that can grow with the individual • Develop new instructional and practice techniques
General public	• Develop greater awareness of abilities and skills of individuals who use AAC

participants provided a wide variety of recommendations concerning technology acquisition and use by individuals who use AAC. Subthemes included recommendations to individuals who use AAC, service providers, technology developers, and the general public (see Table 5).

Recommendations to Individuals Who Use AAC

Recommendations to other individuals about acquiring and learning AAC technology were (a) taking a leadership role in making decisions about acquiring and using AAC technology, (b) practicing codes and access techniques on a daily basis, (c) using the technology in the real world, and (d) seeking out other individuals who use AAC for both instruction and support.

Many of the participants said it was important to take a leadership role in making decisions about AAC technology and encouraged would-be users of the technology to become key decision-makers with respect to everything from ensuring that proper attention was given to access techniques during the assessment process, to the selection of vocabulary and codes that made sense to the user. Participants recommended that individuals who use AAC should insist on an extended trial with the technology before making a purchasing decision. Julie wrote, "I felt like the device was pawned off on me before I had a chance to really test it out ... I really wasn't given the chance to use the device before deciding whether or not I would like it."

Participants discussed the need to invest time and effort into mastering the technology. For some, daily practice was seen as the key to success. As Julie wrote, "I think the people who have AAC devices should keep practicing the vocabulary and how they are accessing the devices on a daily basis. For me personally, it has helped to keep the encoding techniques fresh in my mind."

Other participants spoke of the need to combine real-life opportunities for use with more structured instructional opportunities. As Dan wrote, "You can't teach a person to communicate by drilling words (learned as codes) into a person's brain. You have to teach a person how to apply the words ... to express themselves." The importance of opportunities for interaction was seen as key to long-term success. As Jessica wrote, "Use the device in the real world."

Participants also described important ways that individuals who use AAC can help each other to learn to use an AAC device. First, individuals who are experienced AAC users can serve as role-models for novice users. As Dan wrote:

> When I was learning my Liberator eight years ago, I think it would have been helpful to see other experienced users use their Liberator in the community. I think it would have motivated me even more to learn my Liberator and to be successful like them.

Experienced users are also able to share their learning experiences, including particular methods and strategies they used to master the technology. As Jessica wrote:

> I would like to see the veteran users show up to the training classes and help the new users by showing them what they did on their device ... how they organized their pop-ups and pages, to see what works for them, maybe give the users some new ideas ... (it would be great) to be able to ask them questions.

Tim suggested that a users' group could serve both roles by bringing together novice and experienced users. The group could also provide an ongoing forum for the discussion of issues related to AAC.

Recommendations to Service Providers

Suggestions to service providers included increased training for professionals, more consumer-responsive services (assessment and instructional activities), and early access to AAC.

A number of participants expressed concern regarding the limited training in AAC received by most speech-language pathologists (SLPs). As Julie wrote, "Speech language pathologists need to step up to the plate of technology. I see a gap between the dreamers and developers of such equipment and the user being taught the device's full potential." While some felt this issue could be addressed with more training for speech-language pathologists, others wondered about the need for a new professional who would focus solely on issues of assistive technology. Kara wrote:

> I think the key to this learning problem is to develop a professional that isn't a SLP whose job is to teach us to communicate and to use assistive technology. To learn the TRUE potential of a device, we need somebody that is solely into assistive technology. As the field grows, the capabilities of AAC are going to be so amazing that it will take such a professional.

The participants expressed concern that assessments did not provide sufficient opportunities for consumer input. For example, Julie received a device that could only be used when she was seated in her electric wheelchair. As she wrote, "We should be evaluated in all of the positions we get into in a day to access our device ... the device was recommended before it was clear how I was going to use it." Improved training for health care professionals in consumer-driven assessment practices was recommended to address some of the concerns about assessment identified by the participants.

Participants also noted that service providers did not always take into sufficient consideration just how individual purchasers would learn the technology. For example, Julie wrote that she had significant difficulty identifying qualified professionals to assist her in learning her AAC technology. When she returned to the agency responsible for the assessment, "The educational technician said she felt bad knowing that they received money for helping to sell the device and didn't realize there was going to be such trouble with getting support once a person received one."

The participants emphasized the importance of consumers playing key roles in assessment of and decisions about the organization of vocabulary. This included both making sure that individuals who use AAC have the time and information needed to make decisions about the selection of AAC systems, as well as preparing consumers to play a central role in vocabulary selection and device programming. As Billy commented, "I came across this problem (of not being able to say what I wanted) in grade school ... When I was older I started to program myself and express who I am."

One participant also discussed the importance of ensuring that professionals provide early access to AAC technology. Sally commented, "(It is important to) start the device as early as possible because the device needs to develop with the child."

Recommendations for Technology Developers

Recognizing the key role that technology plays in their lives, the participants provided numerous suggestions to manufacturers for improving technology. Some of these suggestions related to the technology itself, while many related to new ways of assisting individuals who used AAC in learning to make effective use of AAC technology.

With respect to AAC devices, the major recommendation related to the reliability of the devices. Technical breakdowns severely disrupted the learning process, and the participants were very interested in technology that would perform reliably in a variety of environments and not break down.

Participants also expressed an interest in devices that would "grow" with the individual. While the participants recognized that individuals who use AAC need access to AAC technology from an early age, there was also the recognition that what was appropriate at age 4 will not meet an individual's needs at age 14. As Julie commented, "There should be room for changes after one gets used to the device and wants to become faster and more efficient."

In addition, participants had a number of suggestions regarding new supports for learning and instructional techniques. First, participants were interested in alternative formats to obtain information in printed manuals (e.g., putting manuals on a website or CD-ROM to facilitate independent use by an individual with physical disabilities; making videotapes of workshops available to individuals for whom travel is difficult). In addition, participants were also interested in the development of new instructional activities that would enable them to practice the development of communication skills while at the same time receive private feedback on their performance. For example, Julie suggested that an "interactive computer program geared to different age groups would keep a new user

interested in expressing himself while learning encoding.'' This could be especially useful for individuals who want to practice their skills in privacy or to explore the capabilities of the device in private. Julie spoke of the need for users to be able to ''go at their own pace, and to have time to play with the device.''

Recommendations for the General Public

The participants in this study frequently spoke of the confusion that they encountered when they attempted to use their AAC devices in public. Julie reported the following: ''They (strangers who see me using the Liberator) will ask my provider or me if I'm playing a game. They hear the beeping of my Morse code. I will shake my head like, 'No, I'm not playing a game'.''

Even when the method of device operation was clear, participants reported that members of the public frequently did not pay attention to their messages. Jessica wrote, ''The public talks to the aide not the user.'' Billy commented, ''I think the biggest barrier in the public's eye is that they don't want to wait while the users program their messages.'' While not directly stated, implicit in these comments is the need for greater awareness and patience from the general public.

DISCUSSION

The seven participants brought a wide range of experiences to this study. Common to all, however, was a preference for instruction appropriate to their personal needs and interests, difficulties in obtaining qualified support, and an interest in the development of new instructional approaches. These topics, as well as a brief examination of the implications of consumer-driven research, and limitations of the current study, will be discussed in the sections that follow.

Providing Appropriate Instruction

Making effective use of an AAC system draws upon skills from a wide variety of domains, and often requires both formal and informal instruction. The participants in this study described a wide variety of learning supports (e.g., print manuals, AAC listservs) and instructional activities, ranging from the more traditional (e.g., drill and practice) to the more futuristic (on-line tutorials).

Most of the learning supports and instructional activities were viewed positively. However, many of the most commonly used learning supports (i.e., print manuals, training by speech-language pathologists) received mixed scores. Although these supports received ratings of ''very helpful'' by some, others also rated them as ''not helpful.'' Part of this variation is probably due to the fact that the individuals who used AAC interacted with different people and materials. For example, all of the participants were rating different SLPs and were often rating different instructional materials. However, even when individuals were rating an activity that would seem to be somewhat uniform across participants (the use of print manuals) scores varied from a rating of *very helpful* to *not helpful*. Perhaps the area in which participants differed most strongly was in their use of structured drill and practice. While some individuals regularly studied vocabulary in an organized manner (e.g., Julie), others chose to learn vocabulary ''on the fly'' within the context of everyday interactions (e.g., Dan).

It is not clear how these preferences for learning may relate to prior learning experiences and knowledge. For example, Dan was already familiar with Word Strategy when he undertook the learning of Unity. This prior experience may have provided him with background knowledge in the underlying structure of the Minspeak vocabulary retrieval system that, from his perspective, was best supplemented by incidental learning experiences. For Julie, learning to make use of Unity was the first time she had attempted to master a comprehensive scheme for coding vocabulary. In this situation Julie's preferred strategy was an organized approach to systematically learning a large number of vocabulary items. Individual variations in preferences for instructional activities have been reported by other individuals who worked with AAC technology. Beukelman, Burke, Ball, and Horn (2002), in reporting the results of a study of the learning styles and preferences of pre-professional students in an introductory AAC course, noted that individuals may differ as to their ''preferred technology learning mode.'' These results speak to the need for instructors to consider carefully the background knowledge and learning preferences of the individuals with whom they work. The participants in this study expressed strong likes and dislikes, and there is recent evidence that suggests that responsiveness to learners' instructional preferences results in improved learning outcomes (Sankaran, Sankaran, & Bui, 2000). There also is preliminary evidence to suggest that initial difficulties in learning to use technology may be strongly associated with technology abandonment (Staehly, 2000), and that careful instruction with new technology increases the likelihood that the technology will be used appropriately.

In addition to considering individual preferences, there is also a need to consider a multi-

modal approach to the acquisition and learning process. All of the participants used more than one learning strategy or instructional activity in learning their technology. In addition, all of the participants identified at least one or more strategies that they would have liked to try, even though they had not used them. Plans for learning AAC technology should consider a wide array of strategies, and the AAC team should consider effective ways to match different instructional techniques to different areas of need.

Developing New Instructional Approaches

All of the participants in this study learned to make competent use of AAC technology. It can be argued, therefore, that the instructional approaches used with these individuals were effective. It is unclear, however, whether all of the instructional approaches were viewed as efficient (good return for time invested) and appropriate (McNaughton, Hughes, & Clark, 1997). All of the individuals in this study expressed an interest in the development of new instructional approaches, including computer-based instruction and opportunities to interact with experienced users. In addition, the sequencing of instruction is deserving of attention.

Computer-Based Instruction

Many of the individuals who were learning codes for vocabulary spoke of the significant challenges of learning the sequences for desired vocabulary items. Bereiter and Scardamalia (1993) have suggested that individuals learn best when they gradually acquire new skills in the context of performing a desired activity. Because individuals who use AAC may be reluctant to appear inexperienced while interacting with others, well-designed computer-based instruction might be especially useful in helping to introduce new vocabulary. Participants discussed their interest in the use of interactive computer programs in which they would receive support for technology learning within the context of a "virtual" conversation.

While computer-based instruction may be a valuable technique for learning new skills prior to interactions, participants also expressed an interest in technology that would transparently support AAC learning within real, ongoing interactions. For example, those individuals who used Minspeak-based systems highly valued the Icon Tutor because of its ability to provide support for learning codes within ongoing interactions. This technology enabled individuals to both use desired vocabulary items and to learn ways to produce the items more efficiently in the future.

Sequencing of Instructional Activities

At present, it is unclear how learning prior to an interaction and learning during an interaction might be best integrated. One participant suggested that it would be best to learn the use of AAC technology in ongoing interaction from the beginning, just as young children do. There may be important differences, however between the language environments of young children learning speech and individuals, especially adults, learning AAC. A child learning speech is surrounded by models of spoken language, and adults typically provide appropriate support for a child's first efforts. For the child learning to use AAC, communication partners may experience difficulty providing appropriate models during ongoing interactions and may not know how to address communication breakdowns. Adults who are using AAC within ongoing interactions may have a strong interest in demonstrating competence from the beginning, and may not want to be seen as being in a "learning mode" during important conversations.

The participants in this study used a wide range of AAC technologies, with a wide variety of learning demands and supports. Not all of the devices lent themselves to immediate "out-of-the-box" use. As a first step, many participants spoke of the need for regular intensive practice before feeling comfortable using a device with new and unfamiliar partners. A number of participants worked to balance independent study of vocabulary with functional use in the community.

It is of interest to note that research by Kojic-Sabo and Lightbown (1999) identified similar factors associated with successful outcomes for adults learning English as a second language. Students who combined independent study of vocabulary with opportunities to use the target language outside the classroom had better learning outcomes than students who relied upon study alone. The issue of a balance between traditional instructional activities and interactive use is an important area for future research in AAC. It is expected that issues such as the age, skill level, and motivation of the individual who uses AAC, as well as the AAC technology being used and the intervention goals, will influence the mixture.

Interactions with Experienced Users

Interactions between new and experienced AAC users have the potential to support the learning

process by providing (a) peer support to new users and (b) opportunities to model successful use of AAC systems. Many of the participants spoke of their interest in watching experienced users operate AAC system, both to learn specific techniques and to have a role model of what could be achieved. They also noted that other individuals who use AAC could also provide moral support, as they had shared similar challenges (Billy).

Traditionally, face-to-face user groups have been one way for individuals who use AAC to meet and share information. More recently the use of email and listervs (e.g., ACOLUG) have provided opportunities for individuals who use AAC to communicate and share success strategies at a distance.

Activities to Build Self-Confidence

Those who believe that they will be successful in learning a new language are typically more successful than those who have low expectations of success (Gardner, 1999). The self-confidence of some of the participants was clear from their statements. For example, Dan wrote, ''I had the best teacher when I learned Word Strategy on my Liberator and fortunately I had the same teacher when I switched to Unity on my Pathfinder. The teacher was myself.''

Students who have not had the life experiences needed to develop these same high levels of confidence may require additional support. A variety of learning experiences may help to build the confidence of a new users, including *scaffolded* support for using AAC systems in the community. Jessica wrote:

> At first I had someone with me and a couple of weeks later they would start backing off so I can get used to being alone. The same with the bus. They would go on with me on the bus, then a couple of weeks later they would follow the bus, then later they would meet me at a store.

The challenge for instructors is to work with people who use AAC to identify learning activities that will give them a high level of self-efficacy – and especially in the case of those who may have experienced failure in the past. As Julie noted, practicing with a device independently ''is OK if the person is highly self-motivated.'' The opposite is also true – individuals who have experienced frustration with devices in the past may be reluctant to invest significant effort in new learning.

While providing support for learners in controlled environments, instructional activities should also include opportunities for the gradual introduction to the use of new skills in natural environments. For many of the participants in the current study, use of new communication skills in the natural environment was the ultimate benchmark for success. While structured learning experiences can help build skills and provide expectations for success, it is successful use in the community that will ultimately result in increased feelings of self-confidence.

Obtaining Qualified Support

The participants in this study experienced serious difficulty in obtaining the needed professional assistance to identify, obtain, and learn an AAC device. Common barriers included clinicians who had limited knowledge of the wide variety of AAC devices available, or who, acting in their capacity as manufacturer's representatives, recommended a particular line of products. One individual who used AAC reported that they were told, in effect, that services would be withheld if they did not select the device preferred by the clinician.

In other situations, even selecting the recommended device did not lead to appropriate follow-up and support. Of the seven participants in this study, three reported that they were provided with minimal training and support after they received their AAC system.

The lack of trained professionals in the field is a commonly reported problem, both by individuals who use AAC (Horton & Horton, 2001; McNaughton, Light, & Arnold, 2002), and by the professionals themselves (Simpson, Beukelman, & Bird, 1998). Maintaining an adequate pool of trained professionals is an immense challenge to the field of AAC. There are at least two critical aspects to this challenge: first, it is important not to underestimate the number of individuals who will need to become familiar with AAC technology in order for an individual to receive appropriate support. While access to services change as individuals move from the educational system to adult life, individuals who use AAC will have an ongoing need for professional support (Lund & Light, 2001). For the individuals in this study who were proficient in the use of their system, skilled support was needed in the event of device breakdown. Second, SLPs may experience difficulty in obtaining and maintaining expertise in the wide variety of technology currently available. In summarizing the results of a comprehensive survey of speech language pathologists providing services in schools in Nebraska, Simpson et al. (1998) reported that

speech language pathologists said they felt "relatively low levels of competence" providing AAC services, especially when clients had severe impairments (p. 27). Suggestions from the participants in this study included the development of AAC specialists who would have AAC as their primary area of expertise, and the provision of additional training at both the pre-service and in-service level for those who traditionally work with individuals who use AAC.

While clearly a variety of efforts are needed to change the current situation, one important consideration may be to recognize the central role of the individual who will be using the AAC technology in the decision-making process. The priorities of those who use AAC may differ from those of professionals (e.g., the ability to use the device in a wide variety of settings and positions), and this may require a re-organization of traditional assessment roles and responsibilities. If individuals who will be using AAC systems are to play meaningful roles, assessment teams will need to ensure that they are informed participants in assessment and device selection activities, and that they have opportunities to try different systems and to discuss their questions with professionals, significant others, and other individuals who use AAC.

While high levels of consumer involvement may, at first glance, appear to require additional time on their part, participation from the early stages of the decision-making process will help to ensure (a) the selection of appropriate AAC technology, and (b) the commitment of the individual who is using the AAC device to the time and effort needed to learn the system. It is interesting that the participant in this study who described the highest level of satisfaction with the device-selection process was the one who made decisions based on his personal experiences and discussions with other individuals who use AAC.

Consumer-Driven Research

Not only does this study provide important insights into the experiences of individuals who use AAC in learning to use AAC technology, it also represents a unique contribution to the field as an example of consumer-driven research. Clearly, there are major benefits to including individuals who use AAC in every step of the research process. There is a greater chance of asking meaningful questions, using appropriate research tools, and successfully analyzing results if individuals with relevant life experiences play central roles (Balandin, McNaughton, Morgan, Rhaghavendra, & Williams, 2000).

The use of a consumer-driven research model may be especially important in qualitative studies, in which commonality between the researcher and the informant has been shown to facilitate the information exchange process (Adamson & Donovan, 2002; Wilde, 1992). Participants in a study are most likely to be open and honest in providing information if they believe that the individuals gathering information are honestly interested in what they have to say and are making a sincere effort to understand their perspective (De Andrade, 2000). We would argue that each member of the research team (individuals who used AAC, a family member of an individual who uses AAC, and a university-based researcher) played important roles in the development and implementation of this research project. Each made contributions based on their particular area of expertise, and each gained from the opportunities to view this study from the perspectives of individuals with very different life experiences.

Limitations

This research project provides an important contribution to the field by identifying the challenges and benefits of learning AAC technologies as reported by adults with cerebral palsy who use AAC and by providing a model for a consumer-driven research project. There were, however, several limitations to this study. Due to the use of Internet-based focus group discussions, participants in this study were required to be literate and to have computer access. Although functional literacy skills are clearly very helpful in communicative interactions, there are also individuals who are successful communicators who may not make extensive use of writing and spelling skills. The results of this study do not include the experiences of those individuals, nor do they convey the experiences of individuals who do not have computer access.

Additionally, the information provided in this paper is based on participant reports of past events rather than direct observations by a third party. As in any retrospective activity, the recollections of individuals may be influenced by their perspectives and memories of particular events (Koppenhaver, Evans, & Yoder, 1991).

SUMMARY

Today's AAC technology clearly holds enormous promise. As Beukelman (1991) has noted, "... the costs of AAC are partially hidden. The equipment and material costs are obvious; however, the

instruction and learning costs are not'' (p. 2). The individuals in this study describe a wide variation in the amount of time needed to learn to make effective use of a device. Some of this variation was due to the experiences and capabilities of the individuals themselves (for example, previous experience on a similar device appears to facilitate the transition to a new version of a particular technology). Some of the variation was also due to characteristics of the device – individuals introduced to iconic systems reported that it took them longer to learn to make functional use of their systems than did individuals who learned to use dynamic display systems, featuring familiar vocabulary representations.

Along with many other considerations, learning time should be considered as a factor in device selection. If the benefits of two devices are equivalent, the one with the shorter learning time is the better choice. At present, however, we do not have evidence of the increased benefits of one device over another – decisions must be made on an individual basis. For these reasons, therefore, the reported differences in learning time should not be used as the sole criteria in choosing an AAC system. There may be times when a strategy that is more difficult to learn at first provides long-term benefits, and so a decision is made to commit to the needed instructional time. For example, it may be easier for a young child to draw pictures of family members than it is for the child to learn to spell their names, however we still teach children to read and write because of the long term benefits. Adults undertake the time and expense needed to learn to operate a car because of the positive impact of being able to drive. The costs and benefits of these skills are well known. What is needed is a similar understanding of the costs and benefits of AAC technology (Drager et al., 2003; Light & Drager, 2002) so that individuals who use AAC can make informed decisions. The success of the participants in this study provides strong testimony to the powerful ways current AAC technology can be used. The fact that that it took highly literate individuals months of focused study to attain these levels of performance speaks to the need for change both in the technology itself and the supports that promote its effective use. While recognizing that there may sometimes be a trade-off between initial ease of use and long-term efficacy, we must still accept the challenge of reducing the learning demands of AAC technology and improving the strategies used to teach it. One of the participants in this study observed that the frustration of learning a new device was so great that ''When I first got my device, I wanted to throw it off a cliff.'' Clearly the cost of today's sometimes challenging AAC technology, and our too often ineffective instructional strategies, is not only lost time, but also anger and frustration at an individual's lost ability to communicate. Our goal should be the development of technology and teaching strategies that enable individuals to use AAC fluently without conscious attention, so that their attention can be focused on the interaction or activity. As one of authors who uses AAC (MW) commented when reading the summary of the results from this study, ''Learning to use a communication device should not be a challenge. Leading an active interesting life, while using the device to communicate with others, should be the challenge.''

Acknowledgements

This research is part of the Communication Enhancement Rehabilitation Engineering Research Center (AAC-RERC), which is funded by the National Institute on Disability and Rehabilitation Research of the U.S. Department of Education under grant number H133E980026. The opinions contained in this publication are those of the grantee and do not necessarily reflect those of the Department of Education. Additional information on the AAC-RERC is available at http://www.aac-rerc.org/. The authors would like to offer their sincere thanks to the participants who contributed their time and ideas to this project. Pseudonyms have been used throughout the text in order to protect the confidentiality of the participants. Because the web-based discussion did not easily support proofreading and editing functions for the participants as they posted their comments, we have made minor corrections of spelling and grammatical errors.

Notes

1 More information on ACOLUG (Augmentative Communication On-Line Users Group) is available at http://disabilities.temple.edu/programs/assistive/acolug/taco-lug.html

2 The Dynavox 3100 is a dedicated, voice output communication device. Additional information is available from Dynavox Systems, 2100 Wharton Street, Suite 400, Pittsburgh, PA 15203, and at www.dynavoxsys.com

3 The Pathfinder is a dedicated, voice output communication device. Additional information is available from the Prentke Romich Company, 1022 Heyl Road, Wooster, OH 44691, USA, and at www.prentrom.com

4 The Liberator is a dedicated voice output communication device. Additional Information is available from the Prentke Romich Company, 1022 Heyl Road, Wooster, OH 44691, USA, and at www.prentrom.com

5 Phorum 3.3.2 is a password-protected Internet bulletin board system that allows several individuals to participate in text-based discussions on a variety of topics. Additional

information is available at www.caup.washington.edu/software/conferweb.

6 Minspeak is a pictoral language representation technique. More information is available at http://www.minspeak.-com/about1.html

7 The PRC Icon Tutor displays the minspeak icon code for any vocabulary item that is spelled or selected with word prediction.

8 Word Strategy is a vocabulary organization strategy for use with Minspeak icons. More information is available at http://www.minspeak.com/faq.html

References

Adamson, J., & Donovan, J. L. (2002). Research in black and white. *Qualitative Health Research*, *12*, 816–825.

Atanasoff, L. M., McNaughton, D., Wolfe, P., & Light, J. (1998). Communication demands of university settings for students using augmentative and alternative communication. *The Journal of Postsecondary Education and Disability*, *13* (3), 32–47.

Balandin, S., McNaughton, D., Morgan, J., Raghavendra, P., & Williams, M. (August, 2000). *Developing inclusive research communities: Issues in promoting AAC user participation*. Paper presented at the 9th Bi-Annual Conference of the International Society for Augmentative and Alternative Communication, Washington, DC.

Bereiter, C., & Scardamalia, M. (1993). *Surpassing ourselves: An inquiry into the nature and implications of expertise*. Chicago, IL: Open Court.

Beukelman, D. R. (1991). Magic and cost of communicative competence. *Augmentative and Alternative Communication*, *7*, 2–10.

Beukelman, D. R., Burke, R., Ball, L., & Horn, C. A. (2002). Augmentative and alternative communication technology learning part 2: Preprofessional students. *Augmentative and Alternative Communication*, *18*, 250–254.

Charlton, J. I. (1998). *Nothing about us without us: Disability oppression and empowerment*. Berkeley, CA: University of California Press.

Dattilo, J., Light, J., St. Peter, S., & Sheldon, K. (1995). Parents' perspectives on leisure patterns of youth using AAC systems. *Therapeutic Recreation Journal*, *29,* 8–17.

De Andrade, L. L. (2000). Negotiating from the inside: Constructing racial and ethnic identity in qualitative research. *Journal of Contemporary Ethnography*, *29*, 268–290.

Drager, K., Light, J., Speltz, J. C., Fallon, K. A., & Jeffries, L. Z. (2003). The performance of typically developing 2 1/2 year olds on dynamic display AAC technologies with different system layouts and language organizations. *Journal of Speech, Language, and Hearing Research*, *46*, 298–312.

Gardner, R. C. (1999). Correlation, causation, motivation, and second language acquisition. *Canadian Psychology/Psychologie Canadienne*, *41*(1), 10–24.

Hart, B., & Risley, T. R. (1995). *Meaningful differences in the everyday experiences of young American children*. Baltimore, MD: Paul H. Brookes

Horton, R., & Horton, K. (2001). Getting the literacy and language skills needed for employment: Teaching is the solution. In R. V. Conti & T. McGrath (Eds.), *Proceedings of the Eighth Pittsburgh Employment Conference for Augmented Communicators* (pp. 46–51). Pittsburgh, PA: Shout Press.

Jenkins, J. J. (1979). Four points to remember: A tetrahedral model of memory experiments. In L. S. Cermak & F. I. M. Craik (Eds.), *Levels of Processing and Human Memory*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Johnson, P. L. (2000). Others say so, too. In M. Fried-Oken & H. Bersani (Eds.), *Speaking up and spelling it out* (pp. 47–56). Baltimore, MD: Paul H. Brookes.

Kent-Walsh, J., & McNaughton, D. (in press).Communication partner instruction in AAC: Present practice and future directions. *Augmentative and Alternative Communication*.

Kojic-Sabo, I. & Lightbown, P.M. (1999). Students' approaches to vocabulary learning and their relationship to success. *The Modern Language Journal*, *83,* 176–192.

Koppenhaver, D. A., Evans, D. A., & Yoder, D. E. (1991). Childhood reading and writing experiences of literate adults with severe speech and motor impairments. *Augmentative and Alternative Communication*, *7*, 20–33.

Landis, J., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics*, *33*, 159–174.

Light, J. (1997). 'Communication is the essence of human life': Reflections on communicative competence. *Augmentative and Alternative Communication*, *13*, 61–70.

Light, J., & Drager, K. (2002). Improving the design of augmentative and alternative technologies for young children. *Assistive Technology*, *14*, 17–32.

Light, J., & Lindsay, P. (1992). Message-encoding techniques for augmentative communication systems: The recall performances of adults with severe speech impairments. *Journal of Speech and Hearing Research*, *35*, 853–864.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic Inquiry*. Beverly Hills, CA: Sage Publications.

Lund, S., & Light, J. (2001). *Fifteen years later: An investigation of the long-term outcomes of augmentative and alternative communication interventions*. Final grant report submitted to the U.S. Department of Education, Office of Special Education and Rehabilitation Services, May 2001 [ERIC Document].

McNaughton, D., & Bryen, D. (2002). Enhancing participation in employment though AAC technologies. *Assistive Technology*, *14*, 58–70.

McNaughton, D., Hughes, C., & Clark, K. (1997). The effect of five proofreading conditions on the spelling performance of college students with learning disabilities. *Journal of Learning Disabilities*, *30*, 643–651.

McNaughton, D., Light, J., & Arnold, K. B. (2002). 'Getting your wheel in the door': Successful full-time employment experiences of individuals with cerebral palsy who use augmentative and alternative communication. *Augmentative and Alternative Communication*, *18*, 59–76.

McNaughton, D., Light, J., & Groszyk, L. (2001). 'Don't give up': The employment experiences of individuals with ALS who use AAC. *Augmentative and Alternative Communication*, *17*, 179–195.

McNaughton, D., Light, J., & Gulla, S. (2003). Opening up a 'Whole new world': Employer and co-worker perspectives on working with individuals who use ACC. *Augmentative and Alternative Communication*, *19*, 235–253.

Sankaran, S. R., Sankaran, D., & Bui, Tung X. (2000) Effect of student attitude to course format on learning performance: An empirical study in Web vs. lecture instruction. *Journal of Instructional Psychology*, *27*, 66–73.

Simpson, K. O., Beukelman, D. R., & Bird, A. (1998). Survey of school speech and language service provision to students with severe communication impairments in Nebraska. *Augmentative and Alternative Communication*, *14*, 212–221.

Simpson, K. O., Beukelman, D. R., & Sharpe, T. (2000). An elementary student with severe expressive communication impairment in a general education classroom: Sequential analysis of interactions. *Augmentative and Alternative Communication*, *16*, 107–121.

Staehly, J. (2000). The communication dance. In M. Fried-Oken & H. Bersani (Eds.), *Speaking up and spelling it out* (pp. 1–12). Baltimore, MD: Paul H. Brookes.

Suen, H. K., & Ary, D. (1989). *Analyzing quantitative behavioral observations data*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Todis, B. (2001). 'It can't hurt': Implementing AAC technology in the classroom for students with severe and multiple disabilities. In J. Woodward & L. Cuban (Eds.), *Technology, Curriculum, and Professional Development*. Thousand Oaks, CA: Corwin Press, Inc.

Vaughn, S., Schumm, J. S., & Sinagub, J. (1996). *Focus group interviews in education and psychology*. Thousand Oaks, CA: Sage Publications.

Wilde, V. (1992). Controversial hypotheses on the relationship between researcher and informant in qualitative research. *Journal of Advanced Nursing*, *17*, 234–242.

Yin, R. (1994). *Case study research: Design and methods*. Beverly Hills, CA: Sage Publications.

APPENDIX A
Questions

Question heading	Question text
Welcome	Welcome to the Discussion Site! I would like to start by giving everyone a chance to use this system and to introduce themselves! Please (1) Scroll down to the area labeled "Reply to this Message" (2) Type in your pseudonym in the "Your Name" box (please do not fill in your email address) (3) Type in a subject (for example, "news from my town!") Tell us a little bit about yourself – favorite hobby, favorite music, the weather where you are, just something to give you some practice on this site!
Selecting a device	What role did you play in the selection of the (most recent) device? Did you agree with the need for a device? Were you shown options? What weight was given to your opinion?
Learning to retrieve vocabulary (e.g., encoding techniques)	How were you taught to retrieve vocabulary and/or make use of encoding techniques? Who taught you? How many vocabulary items/encoding sequences were you taught at once?
Practicing ways to retrieve vocabulary/ encoding techniques	This set of questions is also related to retrieving vocabulary/encoding techniques. If you have not already done so, please look and respond to "Learning to retrieve vocabulary" before responding to the questions below. Thank you! How did you practice retrieving vocabulary/encoding techniques? How often did you practice? What did you do to practice? Where did you practice? Who assisted you in practicing? Was there a "cost" to this practice (did it take you away from other things you wanted/ needed to do)?
Maintaining your device	How were you taught to maintain your device (charge battery, program vocabulary, contact tech support)?
Using your device in the real world	Learning how to operate our devices in a technical sense is one thing, but it may or may not aid us in using our devices in real situations. This set of questions addresses how we learned to use AAC in everyday life. How were you taught to use your device in the "real world"? Did you discuss using particular techniques (for example: preprogramming vocabulary) in particular situations? Did you practice using your device in real situations (for example: using your device in a store)?
Learning previous devices	How did learning your current device differ from learning your previous devices? What methods did you use to learn your previous devices? How successful/unsuccessful were the methods? Were these methods used to learn your current device? Why or why not? How easy or difficult was it to learn any previous devices?
Introducing yourself to others	Once we learn how to use our device, we usually use it when we go someplace. Different people have varying reactions toward people who use AAC. This set of questions deals with reactions and how they affect us. What reaction did you get from others to the use of your device?

(*continued*)

APPENDIX A (*continued*)

Question heading	Question text
	How did you introduce yourself and your device? What reaction did you get from other people? What effect did the reaction of others have on your use of the device? What techniques have you found to be helpful in developing positive attitudes towards the use of your device?
Dealing with conversation breakdowns	The following three topics relate to dealing with situational factors affecting communication and what strategies we have learned to deal with these situations. What do you do when someone does not understand your device? How did you learn to do this and is it effective?
Gaining attention	What do you do when someone does not want to pay attention to you? How did you learn to do this and is it effective?
Dealing with device breakdowns	What do you do when your device does not work? How did you learn to do this and is it effective?
Recommendations to communication technology developers	The final four topics deal with your opinions about how it can be made easier for people to learn AAC devices. I encourage you to provide as much detail as possible. However, please remember to use your pseudonym and leave out your identifying information. What are your recommendations for changes in technology to make it easier for people to learn AAC devices?
Recommendations about learning AAC devices	What are your recommendations for changes in how we are taught a device to make it easier for people to learn AAC devices?
Recommendations about practicing an AAC device	What are your recommendations for changes in how we practice using a device to make it easier for people to learn AAC devices?
Recommendations about real world use	This is the final topic but please still check the site regularly for follow-up questions and/or responses made by other participants. What are your recommendations for changes in how we learn to make functional use of devices to make it easier for people to learn AAC devices?

APPENDIX B

Operational Definitions of Coding Themes

(1) Selection of an AAC device: Description of assessment/decision activities, including advice received from others about selecting a device, and issues related to funding.
(2) Knowledge and skills needed to use the AAC system: The knowledge needed to make competent use of an AAC system. Includes operational competence, linguistic competence, social competence, and strategic competence.
(3) Instruction and practice activities: The activities used to gain proficiency in the use of an AAC system. Includes instruction provided by others, and self-directed learning activities
(4) Assessment of skill acquisition: Indications of progress/success in learning to make use of an AAC device. Includes self-evaluation, general comfort level with device, reaction of society to device, speed and ease of acquisition.
(5) Recommendations to others: Suggestions regarding ways of overcoming barriers to the successful acquisition and use of AAC systems. Includes recommendations to individuals who use AAC, service providers, technology developers, and the general public.
(6) Unrelated statement: Comment or question that is unrelated to learning to making use of an AAC device. (e.g., "Hi everyone, it is great weather here!").