

Upfront



Clinicians consider AAC interventions when communication impairments are severe and a person's ability to communicate effectively is compromised. Typically, adults who benefit from AAC aids, techniques, symbols and strategies are described in the literature as having either dysarthria (paralysis of muscles required to produce intelligible speech); apraxia (coordination/motor planning problems that interfere with the production of intelligible speech); aphasia (deficits in syntax, semantic, phonologic and/or pragmatic aspects of language); or aphonia (inability to produce voice as a result of removal or impairment of organs related to speech production, such as vocal folds, tongue or larynx.)

On the other hand, children who benefit from AAC strategies are more typically described as having cerebral palsy, autism, developmental delay, Down syndrome, Rett syndrome, severe cognitive impairments and so on, rather than having a specific type of speech and/or language disorder. The tendency not to label the underlying speech disability in children who benefit from using AAC techniques may reflect how intertwined speech development is in the language acquisition process. There is, however, one group of children that AAC specialists often do label with a specific type of disorder, those with developmental apraxia of

speech (DAS). This issue of ACN considers what we know and don't know about children with DAS, and the role that AAC techniques play in helping these children communicate more effectively. **For Consumers** takes a look at definitions of DAS and discusses the controversies surrounding the diagnosis. **On the Web** describes resources for family members and professionals interested in learning more about DAS and the use of AAC as an intervention strategy. **Clinical News** considers the differential diagnosis between DAS and phonologic delays in children.

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For Consumers



Developmental apraxia of speech (DAS) with Gary Cumley, Ph.D., Laura Ball, Ph.D. & Amy Skinder-Meredith, Ph.D.

What is DAS?

A diagnosis of developmental apraxia of speech (DAS) is difficult to make, particularly in young children. These children are not deaf or aphonic, but their speech is delayed well beyond what would be expected for their age or developmental/cognitive level. Such children exhibit certain characteristics that suggest a motor component to their speech intelligibility problems, but they are not dysarthric (*i.e.*, there is

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no evidence of paralysis of the tongue, lips or palate). They have speech that is very difficult to understand; and their articulation problems are resistant to traditional phonological intervention methods.^{1,2,3}

Some children with DAS also have language problems. All of them have reduced expressive language skills compared to their receptive language. Some are multi-handicapped and have additional diagnoses of developmental delay, autism, Down syndrome, mental retardation or other congenital conditions. In addition, these children

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may exhibit nonspeech characteristics known as oral and/or limb apraxia and reduced diadochokinetic rates,^{4,5,6} or “soft” neurological signs, mental retardation and neuromuscular disorders.⁷ For the purposes of this issue, DAS is defined as a moderate-severe phonological disorder that is neurologically-based and affects the ability to program and produce volitional movements for speech.⁸ Children with DAS often make limited progress and, when DAS is severe, their prognosis for intelligible speech is guarded.^{2,8,9,10, 11,12}

Similar to definitions of acquired apraxia of speech (AOS), definitions

of developmental apraxia of speech (DAS) typically focus on the inability or difficulty in carrying out purposeful voluntary movements for speech, in the absence of a paralysis of the speech musculature. Crary offers a definition that takes into account the fact that motor speech disorders will affect and influence the development of phonology and language in children:

... the term developmental verbal dyspraxia is used to represent the developmental counterpart to acquired apraxia of speech. The hopeful advantage gained by using this term is to project that the developmental version is a more ‘linguistically encompassing’ disorder than its adult counterpart. . . We offer the assumption that similar ‘motor-linguistic’ processes may be operating in both children and

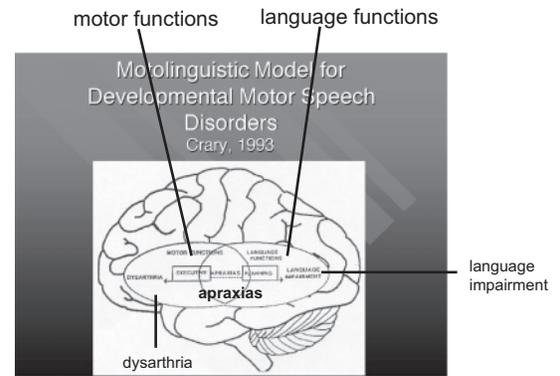


Figure 1. Neuropathology of DAS

adults; yet, because of the ‘undeveloped’ nature of language in children, the disorder has a more widespread linguistic effect.¹³

Controversies

In the field of communication disorders, there is confusion and controversy surrounding DAS. Experts do not always agree on the descriptive label, definition, salient characteristics, assessment procedures and intervention approaches.¹⁰ Factors influencing the controversy include the complexity of the disorder, as well as the limited experiences, knowledge and skills that speech-language pathologists may bring to the diagnosis and treatment of children with DAS.^{11,12}

Terms used to describe children who show unusual speech production patterns that are suspected to be motoric in origin include: developmental apraxia of speech;¹⁴ developmental verbal apraxia,¹⁵ verbal dyspraxia;¹⁶ and developmental verbal dyspraxia.^{13,16,17}

Developmental apraxia is different from the verbal apraxias observed in adults with cerebral vascular accidents and/or traumatic brain injuries. DAS may be caused by a genetically transmitted disorder,¹⁸ problems prenatally or at birth, differences in the rate of development or quality of myelination (covering or sheath for the nerve cells in the brain), neurological disorders, developmental delays, or

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While this differential diagnosis may be an important component in designing a speech therapy program, the severity of the speech disorder is typically what triggers the need for AAC approaches, independent of the cause. The **Case Example** section provides a description of a Michigan program uses AAC techniques to serve children with DAS and severe language impairments. **University & Research** gives the results of three published empirical studies of the use of AAC techniques with children who have DAS. Finally, the **AAC-RERC** section announces an exciting new web cast series on AAC for 2002.

Thanks to Laura Ball, Gary Cumley, Marlene Cummings and Amy Skinder-Meredith who assisted me in preparing this issue of ACN. I have not thought as long and hard about DAS since 1989, when I first wrote about it in ACN. Like everyone else, I work with many children who “walk but don’t talk,” who have a diagnosis of DAS. These children

struggle and, when they grow up, many still have speech intelligibility problems. This is a group of people who benefit from AAC. My experience has been that children with severe DAS are far better off when treatment options address their language and communication disorders, as well as their speech motor and speech problems. We need to do a better job of using AAC techniques as a way to support these “partially verbal” children.

I wish you all a happy holiday season and a very safe, happy and productive Year 2002.

Sarah W. Blackstone, Ph.D.
CCC-SP, Author



something else. The location and type of neuropathology underlying DAS is not well understood beyond the fact that DAS is (1) a disruption in the central sensory-motor processes, (2) interferes with the motor learning for speech and (3) causes delays or deviances in the processes involved in planning and programming movement sequences for speech. Figure 1 illustrates the notion that motor speech disorders in children may fall on a continuum, which helps to account for the often observed disruption in speech motor and language functions in many children with suspected DAS.¹⁹

At this time we have only hypotheses regarding the underlying neuropathology of DAS. Researchers continue to debate about the origin of the disorder, or whether it has a linguistic/phonological basis or a more motor/sequencing cause.²⁰ Researchers strive to locate children with no co-occurring deficits, to determine a specific genetic phenotype of the disorder.

For today's children, however, these discussions do little to assist speech-language pathologists or parents to select and implement efficacious treatment approaches that can both remediate the severity of speech impairment and ameliorate the functional impact of that speech impairment on a child's expressive and receptive language development, behavior, social interactions, self esteem and learning capabilities.

A confluence of symptoms

Another cause of confusion and controversy relates to defining the salient characteristics of DAS. Table I lists a number of features used to identify DAS. In a recent study, Ball had three "expert" speech-language pathologists decide whether 36 children with suspected DAS had a diagnosis of DAS.²¹ She used the

Table I. Characteristics of DAS from the literature

*1	Articulation errors with a motor component.
*2	Variable articulation productions (e.g., mostly sound omissions, but also difficulties with complex sounds (e.g., fricatives /s, z, sh/, affricates /ch, j/ and consonant clusters /st, sp, sl, etc. Substitution of different sounds in different contexts). Variation in type of phonemic processes used.
*3	Increase in errors with increased length of words/phrases and phonemic complexity.
*4	Inconsistent errors (correct production one time, incorrect another).
*5	Phonemic errors on production of vowels.
*6	Sequencing errors in word, phrase, sentence, conversational productions.
7	Delayed initiation of articulatory movements for speech production.
*8	Groping to find correct articulation placements, and/or trial/error behavior.
*9	Attempt to self-correct articulation errors unsuccessfully.
*10	Intermittent hyper/hyponasal resonance on production of speech sounds.
*11	Prosodic variations in speech productions including phoneme by phoneme production (if children have been in therapy and learned this pattern) of words.
12	Connected speech poorer than single word production.
13	Presence of an oral apraxia.
14	Predominant use of simple syllable shapes.
15	Difficulty imitating words and phrases.
16	Limited consonant and vowel repertoires.

items marked with an asterisk in Table I in her study:

Three speech-language pathology "experts," employed at a (1) medical center, (2) public school system and (3) university speech and hearing clinic respectively, had a minimum of five years of experience working with children with severe speech and language disorders. As a group, they established a list of suspected DAS characteristics. Subsequently, each expert independently viewed videotaped samples of 36 children with suspected DAS referred by SLPs in the state of Nebraska. The experts rated each child on salient characteristics using a rating scale of 1=definitely not DAS; 2=probably not DAS; 3=possibly DAS; 4=probably DAS and 5=definitely DAS. The purpose was to confirm a diagnosis of DAS in each child.

These experts confirmed the diagnosis of DAS in all 36 children. Twenty-six of the children (nearly

70 percent) were assigned a mean rating of 5.0, indicating strong agreement among the experts. Nine children (24 percent) received a mean score of 4.0 or more. One child received a rating of 3.33. Ball concluded that, contrary to the reports of some researchers, these data show that speech-language pathologists can agree about which children have DAS, when clear criteria are used.²¹

Traditional approaches to intervention

Traditional interventions for DAS have focused primarily on increasing or improving the articulatory proficiency of these children. A few decades ago, intervention programs

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such as Prompts for Restructuring Oral Muscular Phonetic Targets (PROMPT),²² Touch-Cue methods,²³ and Melodic Intonation Therapy (MIT)²⁴ were developed or adapted from adult motor speech literature as a means of improving the intelligibility of children with DAS. Today's interventions also focus on incorporating a motor speech perspective in intervention planning. Examples include intervention methods and procedures by Strand and McCauley¹⁴ and Kaufman.²⁵ These techniques emphasize learning and executing motor patterns, rather than emphasizing linguistic or phonological patterns of speech production. Other body movements are often used simultaneously to facilitate specific types of oral movements consistent with the body movement. Principles of motor learning are emphasized. More recently, clinical interventions based on a perspective of managing co-existing communication, academic and social concerns are being proposed.^{11,26,27,28} Within this framework, intervention approaches that augment speech and language deficits and enable children to communicate using a variety of AAC techniques across environments are beginning to emerge.

Gestures and manual signs

Children with severe DAS often use gestures to communicate specific messages. Some develop elaborate and idiosyncratic gestural systems. For decades, professionals and families have introduced more formal gestural systems, such as sign language, to help young children who “walk but don't talk” to convey meaning. This approach is known as Total Communication (TC). While TC is an effective option for some children with DAS,

it also has drawbacks:

1. A TC approach requires that communication partners become proficient in learning and using manual signs.
2. A TC approach requires that a child formulate signs accurately so that their signs are intelligible to others.

Many children with DAS have generalized motor planning difficulties or limb apraxia and are unable to formulate accurate signs. Few people outside the deaf community are proficient at using or recognizing manual signs. Thus, when manual signs and gestures are considered as part of an intervention plan, one needs to assess the situation very carefully. Trying to communicate with people who either don't know sign language or can't recognize your sign productions will only add to the frustrations children with DAS experience in communicating.

Other AAC approaches

Children with DAS have a higher probability of failed communication interactions because of their reduced level of intelligibility and their difficulty initiating and participating successfully in interactions. They are at risk for developing behavior problems and face issues related to self-esteem and failing repeatedly in social and academic realms.^{26,27}

Intervention approaches that focus only on improving the articulatory proficiency, which simply support speech attempts through the use of manual signs, can not meet the needs of children with severe DAS or children with severe phonological disorders.²⁸ As a coping mechanism, these children may avoid talking, simplify their vocal responses and/or rely on nonverbal gestures to support and convey the intent of their message.

These children need access to language and they need to exercise their right to communicate. AAC approaches directly address the

functional communication needs of children and important quality of life issues. AAC treatments provide compensatory ways to communicate and express language.²⁸ The desired outcomes of AAC interventions relate to a child's ability to express language and to communicate effectively across environments. SLPs select from a variety of AAC strategies to augment a child's impaired speech. These include manual signs/gestures, low tech displays with graphic symbols or words, high tech devices with graphic symbols or words and conversational repair strategies. AAC treatment approaches are used in conjunction with, not in lieu of, an intense speech therapy program.

Summary

Some children who “walk but don't talk” have a diagnosis of DAS. To remediate these children's severe speech and language disorders and ameliorate the myriad of secondary problems caused by their speech intelligibility problems, AAC treatment approaches are used in conjunction with intense speech therapy. However, many questions remain unanswered. Among these are:

1. For children with DAS, what effect does the introduction of AAC techniques have on the quality and quantity of the communication interactions and on overall communicative effectiveness?
2. What modes of AAC are used most effectively by which children over time?
3. What role should AAC interventions play in early childhood, in elementary school years and during high school?
4. What are effective approaches to remediate speech in children with DAS? How intensive should therapy and how should progress be measured over time?
5. Given the lack of data linking oral motor treatment approaches to any improvement in speech intelligibility/production, what, if any role, does oral motor therapy play in the treatment programs of children with DAS?



On the Web



Information sources for parents & professionals

Parents of children with DAS who want to learn about DAS and related interventions often find it difficult to access good resources. The professional literature on DAS is rather dense, and can be difficult for parents and even professionals (*e.g.*, Blackstone) to follow. This section describes six websites that offer easily accessible information for families and professions. I would recommend CASANA's site (#6) as your first stop. It is quite well done and very approachable.

1. <http://www.asha.org/speech/disabilities/index.cfm> The American Speech-Language-Hearing Association (ASHA) site has some introductory information and a few links to other sites. Pages on the site discuss aspects of DAS assessment and treatment options.

2. <http://www.tayloredmktg.com/dyspraxia/das.html> This site has articles written by speech-language pathologists for families. A unique feature is a list of individuals from around the world with DAS. Go to the site and then find the *worldmap* and *usamap* pages.

3. <http://www.apraxia.cc/> Hosted by the CHERAB Foundation (Communication Help, Education, Research, Apraxia Base), this site focuses on children with severe neurologically-based speech conditions. Included on the site are pages that describe apraxia, therapies, assessment and more.

4. <http://www.dyspraxia.com.au> This site is hosted by the Australian

Dyspraxia Support Group and Resource Centre located in New South Wales. It has basic information and good links to sites in the U.K., Canada, Ireland and Australia.

5. <http://apraxiaontario.homestead.com/index.html> This site is hosted by the Expressive Communication Help Organization (E.C.H.O.) located in Toronto, Canada. Established by parents for parents, it has some very nice information.

6. <http://www.apraxia.org/index.about.html> Hosted by the Childhood Apraxia of Speech Association of North America (CASANA), the site has a useful "site map" and search feature. Check out the following pages when you visit this site:

Clinical News



Differential diagnosis: Developmental apraxia of speech and phonologic delay

Amy Skinder-Meredith, Ph.D.

This article considers whether a child has a diagnosis of developmental apraxia of speech (DAS) or a phonologic delay. The diagnosis of DAS is challenging because many speech-language pathologists do not feel confident in differentiating DAS from a phonological delay. "Phonologic delay" refers to an impaired phonologic system (*i.e.*, the representation of the speech sound at a linguistic level) without concern for a motor planning component. As noted earlier, although developmental apraxia is believed to be motoric in nature, it has a widespread linguistic effect.

Help! Enables parents/professionals to ask questions that require quick answers.

Frequently asked questions (FAQs).

Speech Topics. Articles relevant to the treatment and diagnosis of DAS, including an article about the use of AAC in treatment by Dr. Gary Cumley.

The Apraxia-Kids Monthly. An on-line newsletter with articles, upcoming seminars, latest research, new books, and articles.

Family essays. Comments from parents and grandparents.

Resources. Lists of materials for families and professionals in the U.S., Canada and the United Kingdom.

Interactive forums. Web pages include Talk to Others, message boards, e-mail discussion lists, an apraxia chat group and regional apraxia parent support groups (worldwide).



Thus, children with DAS demonstrate impaired phonologic systems, as do children with phonologic disorders.

However children with DAS's ability to acquire the sound system of their language is undermined by their difficulties managing the intense motor demands of connected speech.²⁹

Finding children for a study who have 'DAS' as the *primary* component to their communication disorder can be very difficult for researchers. For example, in one study, 24 children with suspected DAS were referred as participants. They ranged in age from four to nine years. Of those, only six met the study criteria (no cognitive delay, dysarthria, or pervasive developmental disorder). An additional four children had an early history consistent with DAS, but, at the time of the study, their DAS appeared to have resolved into a

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phonologic delay. Six of the 24 children had a phonologic delay only. The other eight children had additional disabilities, which excluded them from the study.

Children with DAS are a heterogeneous population. While they share a cluster of symptoms, there is no agreed-upon diagnostic marker for DAS. Unlike acquired apraxia of speech, there is no known neurological site of lesion or any other accompanying hard neurological sign. Instead, there are soft neurological signs, such as fine and gross motor difficulties and characteristics that are similar to other communication disorders, like phonologic delay. These children demonstrate frequent sound omissions, poor expressive language skills, a limited phonetic repertoire and reduced diadochokinetic rates.

Another factor that makes differential diagnosis of DAS difficult is the age of the child at the time of diagnosis. A child may appear to have DAS at age two, but look quite different at age three. Differentiating between DAS and phonologic delays at a very young age is difficult. Many characteristics will be shared, especially the child's decreased phonetic repertoire and predominant use of simple syllable shapes. In addition, inconsistency of errors appears to be more of an indicator of severity than of either DAS or a phonologic disorder. In a small study, Betz found that five young children with severe phonologic delay had just as many inconsistent errors as five young children with DAS.³⁰

Assessment

How does one differentiate DAS from a severe phonologic delay? Strand and McCauley suggest that

clinicians focus on the type of processing impairment (cognitive vs. linguistic vs. motor planning vs. motor execution) rather than diagnosing a child as having or not having DAS.²⁹ The clinician needs to describe the particular set of motor behaviors that may be responsible for the disruption in phonologic performance.

Figuring out the relative contribution of factors contributing to a severe speech impairment requires a comprehensive speech evaluation, including (1) history, (2) examination of the child's neuromuscular status, (3) structural-functional examination, motor speech examination, and (4) a thorough description of the sound system. Once dysarthria, hearing and structural anomalies (such as cleft palate) are ruled out or factored in, the clinician moves to differentiating between a motor component and a linguistic component. The developmental history, motor speech examination, and description of the sound system will help in differentiating these two entities.

Developmental History. When taking a history of speech development in a child with suspected DAS, we frequently hear the following:

- Quiet baby, did not play with sounds or babble much.
- When babbling occurred, it was undifferentiated (included few or no consonant sounds).
- Says a word, then never says it again.
- Little attempt to imitate sounds or words.
- Resists attempts of adults/others to get him to imitate sounds/words.
- Limited vocabulary for age level.
- Intelligibility of words is poor.
- Words tend to be general in use (e.g., "num num" used to represent anything good).
- Attempts to communicate through gestures, vowel sounds or other means.
- Demonstrates frustration at not being understood, but seems to understand everything.

Children with DAS may also present with a history of feeding issues, such as having a tendency to

Syllable Shapes	1 syllable % correct	2 syllable % correct	3 syllable % correct
CV	94%	50%	15%
VC	55%	25%	10%
CVC	50%	31%	5%
VCC	33%	0%	0%
CVCC	15%	0%	0%
CCVC	0%	0%	0%

fill their mouth with food (they may desire increased proprioceptive feedback), difficulty with sucking from a nipple or drinking from a cup, and immature chewing patterns. Children with DAS are more apt to need other ancillary services, such as occupational and physical therapy, than children with just a phonologic delay.

Motor Speech Examination. A motor speech examination considers performance during speech as well as the length and phonetic complexity of sounds in words and connected speech. One component is comparing different syllable shapes (e.g., V, CV, CVC, CCVC, CCCVC, CCCVCC, etc.). SLPs may conduct a Syllable Shape Inventory to demonstrate difficulties when word length increases. The example shown in Table II represents the syllable shape inventory of a child with DAS who experienced difficulty on words with more complex syllable shapes.

Children with DAS and children with phonologic delay have more difficulty as the length of an utterance increases. However, the difficulty is more marked in children with DAS. For example, if the child is asked to repeat a series of lengthening utterances, such as *base*, *baseball*, *baseball player*, the child with DAS may produce *base* correctly, but drop out sounds and distort the vowel when producing

baseball. On the other hand, a child with a phonologic delay may say *base* correctly and then go back to the phonological process he uses on longer words when saying *baseball* and *baseball player*. While children with DAS may also have delayed phonological processes, they are more likely to show other types of errors (e.g., vowel distortions and prosodic errors); and their errors will be less consistent than the errors of children with phonologic delays.

SLPs can also use a technique known as an *integral stimulation approach*,³¹ which is modified from the *Eight Step Continuum* for acquired apraxia of speech.³² This approach allows the clinician to assess what occurs when temporal relations are varied (e.g., simultaneous production vs. immediate imitation vs. delayed imitation). Integral stimulation is useful in both treatment and assessment of DAS, as described below:

If a child is unable to produce a word in imitation, the clinician provides a simultaneous model (e.g., “Watch and listen and we’ll say the word together.”) Children with motor planning difficulties do much better when they have a simultaneous model and the rate of speech is decreased. Tactile cueing may also be necessary.

After producing the word correctly several times during simultaneous production, the clinician will see if the child can maintain correct articulation with just a visual model (e.g., the clinician just mouths the words while the child says the word).

The clinician gradually fades cues and increases the time between the child’s production and his/her own. Children who have severe motor planning underlying their speech disorder demonstrate marked differences between simultaneous production and delayed imitation.

In essence, when the clinician asks the child to imitate a model after a pause, the clinician is asking the child to retrieve the motor plan. This can take a lot of practice. In using a simultaneous production technique, the clinician decides what level of phonetic complexity and utterance length to start with. For

example, if the child is only speaking in undifferentiated vowels, the clinician may begin with differentiated vowels and combine them in CVs, VCs and CVCs. If the child is speaking in CVCs with correct vowels in single syllable words, the clinician may build on the CVC with more complex syllable structures and try bisyllabic and multisyllabic words and phrases.

Other Areas of Assessment

Davis, Jakielski, and Marquardt proposed that there are three primary speech characteristics that help differentiate DAS from other types of speech delay.³³ These three areas include: vowel errors, inconsistency of errors and prosodic disturbances.

Vowel errors. When clinicians do a motor speech evaluation, it is important that they sample all of the vowels and hear their productions in different syllable shapes. A child with DAS may be able to produce vowels correctly in isolation but have difficulty when putting the vowel in a CVC or longer syllable structure.

Children with phonologic delays are not apt to make vowel errors. Vowel errors consist of neutralizing vowels, reducing diphthongs to monophthongs, tensing lax vowels, and laxing tense vowels. With the exception of rhotic vowels, typically developing children correctly produce vowels by age three.

Inconsistency of errors. When examining consistency of errors, the clinician will need to elicit a set of words multiple times. The SLP can use the formula in Table III to judge the consistency of errors (i.e., ratio of most consistent production over total number of productions). A study by Bradford and Dodd used the *25 Word Test for Inconsistency*.³⁴ They considered children who

Table III. Formula for determining error inconsistency

Target	Productions	Ratio
Scissors	[sldEz] 3x [slzU] 2x	3/5
Pajamas	[padamaz] 2x [dapada] 2x [padZama] 1x	2/5
Airplane	[apen] 3x [arpwen] 2x	3/5
Wagon	[woegIn] 5x	5/5
Telephone	tE/E/o] 2x [tEwEpo] 1x [tEfo] 1x [fon] 1x	2/5
TOTAL	15/25 = .6 x 100= 60%	

scored more than 40 percent to be making inconsistent errors. Assessing the inconsistency of errors is an area that would benefit from more research to determine (1) what is meant by *inconsistent* errors and (2) at what point do we decide a child’s speech is characterized as having inconsistent errors. This measure is not appropriate for children with very limited speech.

Prosodic disturbances. Another area clinicians should assess is prosody. Some researchers believe that a prosodic disorder is a diagnostic indicator for a subset of children with DAS.^{18,35,36} One theory is that if prosodic aspects of speech are disordered, the effect on articulation is adverse. Another theory is that children with DAS are struggling to plan correct articulatory movements for speech and this results in disordered prosody. Regardless, children with DAS demonstrate prosodic disturbances, while those with phonologic delay typically do not.

Clinicians can assess prosody in several ways:

- Observe prosody in conversational speech: measure percent of utterances with abnormal stress, phrasal stress, percent of multisyllabic words with abnormal stress, etc.
- Observe whether child stresses the appropriate words and syllables.
- Determine if the child uses contrastive stress (e.g., I want to go home vs. I want to go **home**.).
- Assess whether the child can imitate the prosodic contour of modeled sentences.

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- Observe what happens to the child's prosody when they are attempting to produce the correct sounds. Do they produce the word or utterance with equal stress, carefully articulating one syllable at a time? [Note: Sometimes this can be an artifact of speech therapy.]

Careful and thorough assessment will assist the clinician in deciding the relative contribution of motor planning and linguistic impairment to the child's speech disorder.

Of course, it is also important to assess cognition (using a test that does not require a verbal response) and hearing and oral structures, and to thoroughly assess language. Language learning and literacy deficits often occur in children with DAS. Even when children appear to have normal language skills early on, they may demonstrate difficulty in "higher language processes," such as categorizing, organizing and abstracting, in the third or fourth grades.³⁷

As DAS is merely a cluster of symptoms, children with DAS comprise a heterogeneous group. Children who present with only a motor planning component to their speech disorder are rare. When a child is highly unintelligible, differentiating between a severe

phonologic delay and DAS can be even more challenging.

Speech therapy

Regardless of the primary deficit, children with severe speech impairments need intensive speech therapy early on. Young children benefit from frequent short sessions (e.g., up to four times/week for 30 minutes a session). These are preferable over longer, less frequent sessions. In general, children with phonologic delay progress more quickly than children with DAS. This means that the child with DAS will need these intensive services longer.

To make speech therapy motivating for the unintelligible child (DAS or severe phonological delay), it is helpful to begin by working on a core vocabulary that gives the child some power and social gratification. The initial vocabulary begins with simple syllable shapes and stimulative phonemes. Over time, the therapy systematically expands the child's phonetic repertoire and sound sequencing ability so they can make different syllable shapes. An initial vocabulary might include: 'no', 'all done', 'hi Mom', 'hi Dad', 'go'. These words are motivating and

phonetically simple. For children with DAS, it is extremely important to work on sequencing sounds together rather than working on sounds in isolation. In other words, work on 'go' as one word, not 'g-o'. Conversely, children with severe phonologic delay often will generalize and use sounds they learn in isolation in words and phrases.

Language therapy

While working on speech with an unintelligible child, it is also necessary to address language development issues. Therefore, augmenting speech with picture symbols, sign language, and/or naturalistic gestures is extremely beneficial and provides the child with alternative ways of expressing ideas and basic concepts. Ready-made picture symbol books allow children to participate in story telling and other activities using picture symbols. As children are able to produce more of their messages verbally, use of alternative modes of communication fades. 🌐

Case Examples



Designing an AAC program for children with DAS with Marlene Rayner Cummings

In 1996, 22 students were enrolled in the Utica Community Schools (UCS) Early Childhood Special Education program. Seven of the children (3 boys and 4 girls, ages 3 to 5 years old) had unintelligible, limited or no verbal speech. At the time, SLP assessments revealed that

these students had developmental apraxia of speech (DAS) and their expressive and, in some cases, receptive language skills were also delayed.

Within the school district there were no intensive programs that could meet the needs of students with severe DAS who did not have the primary diagnosis of autism or severe physical or cognitive impairments. Their social and academic development was considered at risk. Therefore, staff designed a dynamic intervention plan to enable these

children to acquire language, literacy and social communication skills, first in a self-contained preschool classroom and subsequently, in kindergarten and first grade classrooms with support from the AAC team.

The resulting program is known as the Augmentative/Alternative Communication Program and Assistive Technology Center. Located in Havel Elementary School in Utica, Michigan, it received the Michigan Speech-Language-Hearing Association award for the "Program of the Year" in March 2000.

To enroll in the program, students must:

- Be three to five years of age.
- Lack expressive communication and/or have speech that is unintelligible to at least some familiar partners.
- Have language delays, which may be due to the lack of opportunities to verbally manipulate language.
- Not evidence significant cognitive impairment, severe physical disabilities or symptoms of autism.
- Demonstrate the potential to be academically competitive.

The program is designed to insure that the children receive optimum educational opportunities with an emphasis on communication skill development using a collaborative team approach. Students receive instruction in the program’s special education classroom and in regular education classrooms. Daily schedules are strategically arranged to allow students to participate in core curricular content, while receiving intensive training in communication, literacy and assistive technologies.

Key components

Components of the program include:

- 1. Sensory-motor therapies.** Intensive neurologically based sensory-motor therapies address hyper/hypo sensitivity issues and motor planning problems. The sensory-motor program is supervised by an occupational therapist.
- 2. AAC therapy.** Assistive technologies and AAC strategies are used to develop language and literacy skills. AAC approaches used include: (a) aided language stimulation to model expressive communication using symbol supports, (b) use of symbol communication dictionaries to increase vocabulary and generate novel symbol based phrases and (c) symbol based classroom flipbooks which allow students to participate in typical “circle time” routines by using visual supports during verbal activities. (e.g., reciting ABC’s, months, days of the week,

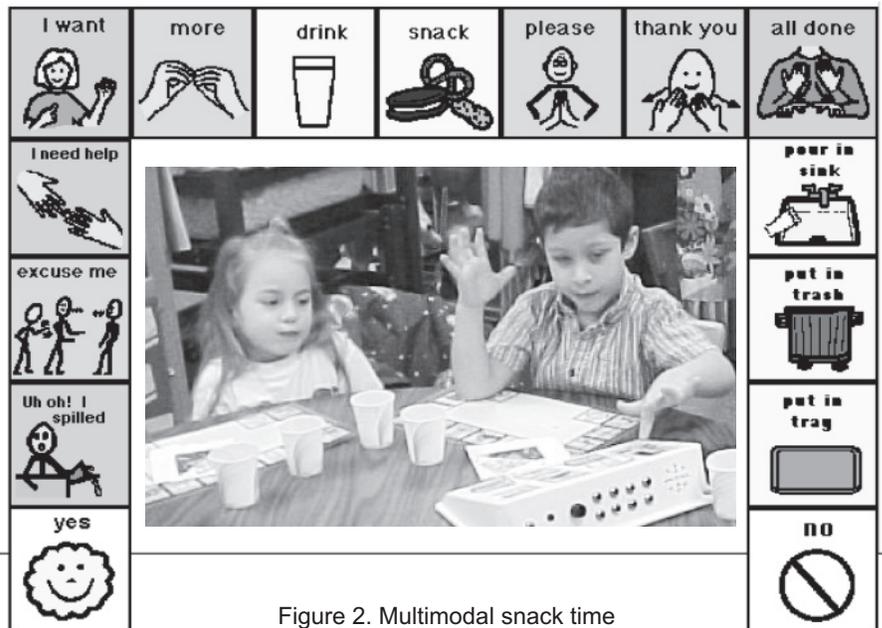


Figure 2. Multimodal snack time

nursery rhymes and chants).

3. Speech-language therapy. Direct speech-motor therapy (PROMPT) and speech therapy is provided individually and in small groups, using augmented stories to support early literacy competencies and concept development (rhyming, patterning, sound identification).

4. Social work services. Direct social work services are provided in individual and small group settings. Assistive technologies and techniques (symbol boards, speech output devices, social stories) are used to facilitate social skill development.

5. Early Childhood Curriculum. Monthly thematic units are chosen to expose children to basic core vocabulary, early language concepts and basic language structures. Stories, nursery rhymes, and songs augmented with symbols and low and high tech AAC devices allow students to manipulate and use language. Kindergarteners and first graders participate in the general education curriculum with support from the AAC program.

6. Parent involvement and training. Families attend staff meetings, technology trainings and AAC strategy sessions. The monthly thematic family calendar includes several family projects and activities, which are sent into school to support student participation and home/school communication.

Collaboration. A key component of the program is the collaborative team that supports each student in the classroom.* This team, in various configurations, discusses individual student issues and develops program parameters, methods and strategies.

* Team members include family members, classroom teacher, assistive technology assistant, teaching assistants, general education teachers, school psychologist, school social worker, speech-language pathologist, occupational and physical therapists and county/state/national experts.

Family involvement. Families of children with DAS face many important questions and decisions. Many have been encouraged to “wait and see” or to expect their children to “outgrow” their speech problem. The program staff directly support the families and address their concerns by a) discussing each child’s speech prognosis, b) helping families make decisions about the focus of intervention, c) being sensitive to lifestyle and family preferences and d) helping families to integrate communicative supports across environments and partners.

Continued on page 10

Case Examples, Continued from page 9

Transition. After first grade, the students leave the program and return to their home school. To support each student's smooth transition from the AT Center to the local elementary school, program staff shares expertise, resources and equipment with district teams who will be working with students in second grade and beyond. Equipment comes from the Assistive Technology Equipment Collection and Resource Library, which has adapted books, communication displays, computer software applications, AAC devices, switches and alternative keyboards, as well as journals, books, newsletters and electronic reference materials.

During the student's last year in the AAC program, the transition team meets three or four times to share written, verbal and video portfolios. Student observations, technology training and classroom visitations are just a few of the ways staff, families and students collaborate.

Emphasis on communication skills development. The program's communication-based curriculum is specifically designed to support the development of basic language concepts, language structures and language use. As a result, students are given multiple opportunities to develop, understand and express language. Symbol/word-based intervention materials allow students to physically, auditorily and visually explore, understand and manipulate early language concepts and basic core vocabulary through literature, nursery rhymes, songs, and finger plays. Typical early childhood activities are chosen to provide opportunities for targeted communicative interactions throughout the day. Communicative expectations



Figure 3. Expressing thoughts and opinions using an AAC device

and a variety of assistive technologies are identified for each activity. Adult and typical peer models are utilized to provide consistent, ongoing examples of communication initiations, turn taking, sentence building, *etc.* Communication strategies employed include:

Use of icon displays and AAC devices.

Low and high tech AAC devices are used to augment activities that involve classic literature, nursery rhymes and finger plays to increase core vocabulary, patterning and phonemic awareness. For example, the book *Brown Bear, Brown Bear* is introduced along with: (1) single symbols so students can retell the story line and change the story's order and endings; (2) an augmented book to which children can add art and then take the book home for additional readings; (3) single switches that are used to repeat lines in the story and increase student participation; (4) symbol displays that contain additional animals, colors and actions to expand the story line; (5) props that students can manipulate during story retelling and (6) AAC devices that allow the students to read the story word-for-word and line-by-line.

Augmented songs. Low-tech displays and AAC devices allow children to explore language concepts, rhyming,

repeating lines and enhancing social participation. Examples are *Song Boards* by Carol Goossens', *Storytime Songs* by Patti King-Debaun and classic early childhood songs augmented with symbols placed on single switches, AAC devices and computer software.

Use of single and multi-level AAC devices. AAC devices can support language, literacy and social interactions. Some examples are the: (1) Big Mac for repeated lines, (2) *Step-by-Step* communicators for simple story retelling, (3) *Zygo Macaw* to read stories symbol by symbol and change endings, (4) *CheapTalk* for snack time and simple classroom routines, (5) *DynaMyte* for language development and interactive communication, (6) *Dynamo* for social interaction and short predictable communication exchanges.

Use of symbol-based classroom communication books. Communication books are used to help develop academic vocabulary and support expressive communication attempts. One example is a symbol-based classroom flipbook containing typical "circle time" vocabulary (colors, letters, numbers, months, weather, basic concepts, song choices, chants, shapes, classroom rules). Students use these as visual supports and as low-tech expressive communication tools during verbal chants and single response interactions.

Use of activity-based communication displays. Activity-based displays can support a child's understanding and use of core vocabulary. Examples include communication displays from *Engineering the Preschool Classroom* by Carol Goossens', as well as displays created specifically for board games, bingo and other play-based communication activities.

Use of an augmented literacy series. Teaching emergent literacy skills (e.g., developing a sight word vocabulary and manipulating letters and sounds) is important. Staff uses the *Learn To Read Literacy Series* by Creative Teaching Press to provide a consistent approach to literacy skill development. For example, Level 1 supports basic language concept development and Level 4 has books on Science, Social Studies, Math and Fun and Fantasy. Books are augmented with symbol sentence strips for line-by-line text manipulation and single symbols are available for word-by-word story retelling. By the end of the program, students have typically acquired adequate literacy and communication competencies to support learning.

Outcomes

The AAC Program and AT Center were designed with a specific student profile in mind. Of the seven students with AAC needs who entered the program in 1996, one student moved out of district. Another student, whose speech is now intelligible, is in 4th grade. Three students are in 3rd grade--one has intelligible speech and two are using DynaMytes with Gateway 54 software to support their expressive communication and classroom participation. Two students are in 2nd grade. Both use DynaMytes with Gateway 54 software. Here are descriptions of three of these students.

4th grader. This student entered the program at age three with many behavior, sensory and language needs. Since then, the student has progressed from being minimally

verbal to extremely unintelligible to being understood 90% of the time by unfamiliar listeners. He continues to receive extensive learning supports and now has a diagnosis of severe LD.

3rd grader. This student entered the program at age 5^{1/2} with minimal AAC supports prior to his placement in the program. He manifested many accompanying sensory, cognitive and language difficulties, and his expressive communication consisted of five to ten single word approximations. This student can now express single and two word combinations. He uses natural gestures to greet others, express basic needs, protest and get listener's attention. He is presently using a Dynamyte with Gateway 54, a symbol-based communication dictionary, an augmented literacy program (*AlphaSmart, Co:Writer and Write Out Loud*) to support written language in his regular education classroom.

2nd grader. This student enrolled in the program at age 3. At that time, the student used 10-15 word approximations and had marked delays in sensory, fine and gross motor skills. The student appeared to have typical learning potential and made significant expressive and receptive communications gains in the program. Currently, the student uses 3-5 word sentences with 40-70% intelligibility depending on context, complexity and familiarity of the listener. Speech is augmented by a symbol-based communication dictionary and a Dynamyte with Gateway 54. The AAC device is used primarily as a repair strategy for unintelligible verbal communication and to

support decoding needs in the literacy program. The student depends on verbal communication to communicate at home and with peers. Co:Writer and Write OutLoud are used to support written language in the classroom. 

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King-DeBaun, Pati, Storytime Songbook I and II. Creative Communicating P.O. Box 3358 Park City, UT 84060

Learn To Read Series by Creative Teaching Press, P.O. Box 2723, Huntington Beach, CA 92647-0723

The PROMPT system. The PROMPT Institute, Santa Fe, New Mexico, USA, Toronto, Ontario, Canada

Dynavox, Dynamo Dynavox Systems, Inc., 2100Wharton Street, Pittsburgh, PA 45203 8-00-697-7332, www.dynavoxsys.com

BIGmack Communication Aid, Step-by-Step AbleNet 1081 Tenth Avenue S.E., Minneapolis, MN 55414-1312. 800-322-0956, www.ablenetinc.com

CheapTalk Enabling Devices, 385 Warburton Avenue, Hastings-on-Hudson, NY 10706. 800-832-8697, www.enablingdevices.com

Macaw Zygo Industries, Inc., P.O. Box 1008, Portland, OR 97207-1008. 800-234-6006, <http://www.zygo-usa.com>

University & Research



Three empirical studies

Research has shown that the introduction of AAC positively supports the communication interactions and language development of children with severe speech impairments and can provide individuals with greater opportunities and access to communicative interactions. However, there is limited research that addresses the use of AAC devices with children who have a diagnosis of DAS. Examples of three studies investigating the effects of AAC interventions on children with DAS are described below.

Single case

Culp conducted a single case study with an eight-year-old girl with DAS, her mother and school staff. The intervention focused on teaching the child's communication partners to use different AAC modes (*i.e.*, sign language, gestures, and a communication book) and to facilitate the child's communicative interactions. Results were positive. The girl's communication interactions were enhanced when partners supported the use of AAC techniques and she used them.³⁸

Three cases

Cumley and Swanson conducted a descriptive case study of three children with DAS: (1) a preschooler, (2) an elementary school-aged student, and (3) a junior high school student.³⁹ The study investigated the effects of a multimodal AAC intervention approach on communication, *i.e.*, the use of gestures, manual signs

and various AAC low and high tech aids, as well as speech.

Preschool student: Researchers introduced the Wolf, a voice output device, and a remnant book, which allowed the child to initiate and reference past experiences with familiar and unfamiliar communication partners. Results showed the student's mean length of utterance increased, as did her opportunities for engaging in language and conversational discourse.

Elementary school-aged student: Researchers focused on supporting natural speech production and providing effective strategies and AAC aids to increase the student's opportunities for interaction. As a result, she was able to successfully establish communication topics through the use of her remnant book and repair her frequent communication breakdowns using a symbol dictionary.

Junior high school student: Before treatment, this student did not initiate or attempt to repair his communication breakdowns. Instead he relied on his communication partners to take an active role in the repair process. With AAC aids, he began to take more responsibility and attempted to repair some of his frequent communication breakdowns.

In summary, results indicated that when AAC tools and strategies were introduced, these children had greater opportunities to initiate and maintain interactions, as well as to repair communication breakdowns. They used these strategies across various communication situations, with both familiar and unfamiliar communication partners.³⁹

Sixteen cases

Cumley reported on 16 school-age children between the ages of three and seven who had severe phonological disorders and/or suspected DAS.⁴⁰ All had received ongoing speech and language intervention services through the public schools, but had made minimal progress. The goals of the study were to determine the effects

of a low-tech AAC approach on the quality and quantity of the children's communication interaction. The study had three phases: pre-treatment (no AAC boards available); treatment (AAC boards available); and post-treatment (no AAC boards available).

Researchers provided only 1 hour and 40 minutes of training over three sessions to each child. In the pre-treatment phase, no board was available. Then, the researcher familiarized the children with a communication board during play and book reading situations. Boards were available to use during the treatment phase of the study. The board contained graphic symbols and was designed around contextual-based activities. During the post-treatment phase, boards were not available. Interactions between the children and the investigator during each phase of the study were videotaped for subsequent analysis.

After viewing the tapes, researchers assigned each child to a frequency-of-use group. Assignments were made by calculating the total number of times each child used the AAC board during the treatment phase. Of the sixteen children, five were assigned to the low frequency AAC user group and seven were assigned to the high frequency group. The four children in the medium-use group were not included in subsequent analysis. Researchers noted that the children in the high frequency AAC user group tended to have more severe phonological disorders than children in the low frequency AAC user group.

Proportional data were calculated and group comparisons made across the three phases and across the variables of comprehensibility and communication modality, contingent

communication and communication breakdowns, as described:

Comprehensibility and communication modalities. Researchers classified all communication attempts as comprehensible (understood) or non-comprehensible (not understood). Then they described each attempt according to communication modality used during the videotaped communication interactions (gestures, non-conventional signs, manual signs, vocalizations, verbalizations, AAC, drawing, and writing.)

Contingent Communication. Researchers classified partner questions as either *yes/no* or *Wh question* forms and the children's responses as either a *response to yes/no questions* or *Wh questions*.

Communication Breakdowns. The severity of the phonological disorders affected the children's level of intelligibility and resulted in a high frequency of communication breakdowns. Researchers noted all communication breakdowns, how the children tried to repair each breakdown and whether or not they were successful.⁴⁰

Results

The results of the study suggested that children's phonological disorders directly influenced whether children with DAS used AAC techniques. The more severe the phonological disorder, the more often children used communication boards if they were available. Characteristics of low and high frequency users are described below.

Low frequency AAC users

The low frequency group consistently used spoken words and/or gestures as their primary mode of communication. When communication boards were available, the low frequency group showed little change in the proportion of spoken words and/or gestures used. The boards did not have an adverse effect on the child's use of speech. In fact, the low frequency group demonstrated a marked increase in their use of speech when the boards were available. These individuals

showed no apparent pattern in answering *yes/no* and *Wh* questions and used only speech for repairing their communication breakdowns.

High frequency AAC users

Unlike the low frequency users, high frequency users behaved differently during the treatment condition. Specifically, when boards were available, they:

1. Were more comprehensible when communication board(s) were used.
2. Decreased the proportion of gestural use and increased the use of the communication board.
3. Replaced some gestures with communication board use.
4. Were more successful answering *yes/no* and *Wh* questions using a communication board.
5. Responded to questions more frequently when the board(s) were available.
6. Replaced less symbolic forms of communication (gestures) with a more symbolic form of communication (graphic symbols).
7. Repaired their communication breakdowns more successfully when communication boards were available, than they did using speech.

The high frequency group used primarily spoken words and gestures to repair their communication breakdowns in the nontreatment conditions, but, when communication boards were available, half of their successful communication repairs were accomplished using the AAC boards. When using the boards to repair breakdowns, the high frequency group showed a slight decrease in speech and gestures as a primary repair strategy, proportional to their use of boards.

Conclusion

The study showed that even with minimal exposure to communication boards (a total of 1 hour and 40 minutes), positive changes were noted in the quality and quantity of

the children's communication interactions during the treatment condition. The children with the most severe phonological disorders tended to use the AAC communication modalities provided more than children whose speech impairments were less severe.

Summary

Frequently parents and even some SLPs worry that the introduction of AAC will inhibit the use of speech. These studies alleviate those fears. The empirical data from Cumley's studies provide speech-language pathologists with a rationale for introducing AAC to children with severe phonological disorders and/or DAS. After a very short time period, children with severe speech impairments benefit from using AAC techniques. This means that SLPs can introduce AAC approaches and determine whether they will benefit a child rather quickly. In addition, these studies demonstrate that children can and will use AAC techniques for a variety of purposes, including repairing communication breakdowns, establishing topics, answering questions and using language rather than nonlinguistic forms. It appears that the more impaired the speech, the more readily children will rely on AAC techniques.

The introduction of AAC boards did not adversely affect the frequency with which children spoke. Instead, it appeared that communication boards may have visually supported the children's use of language and increased their speech output. These studies show that AAC not only supports natural speech attempts but also supports the use of language and enhances communication effectiveness. 

The AAC-RERC



Across space and time: 2002 Interactive Lecture Series in AAC The Kornreich Assistive Technology Center, the AAC-RERC and USSAAC

The technological advances of the 21st century already are changing how we do things. As the first “virtual” RERC, the AAC-RERC is now using a variety of new technologies to facilitate collaborations among its partners who live and work from coast to coast. The seven partners of the AAC-RERC [Duke University, Pennsylvania State University, Temple University, University at Buffalo, University of Nebraska–Lincoln, University of North Carolina–Chapel Hill and Augmentative Communication, Inc.] conduct research and develop projects, provide training and disseminate pertinent information to AAC stakeholders.

The Kornreich Assistive Technology Center is a Division of the National Center for Disability Services and is located in Albertson, NY. It is committed to bringing new educational and training opportunities to professionals and consumers, particularly in the area of AAC. Within the Kornreich Center is a state-of-the-art technology center equipped with the latest technology in web casting, video conferencing and more. These technical and human resources at the Kornreich Assistive Technology Center will support AAC educational web casts by experts.

Collaboration

In what promises to be a positive collaboration, the AAC-RERC, the Kornreich Assistive Technology Center and the United States Society

of Augmentative and Alternative Communication (USSAAC) will offer AAC professionals, augmented communicators and their families training opportunities they can easily access from their home or office. Each of the collaborators has a unique contribution to bring to the table. The Kornreich Technology Center plays the lead role by hosting and providing financial and technical support for each web cast. The AAC-RERC assists by developing content for the lecture series and working to expand the diversity of the audience. USSAAC will offer ASHA CEUs to participants who wish to pay for them.

Working together, the collaborators share a common goal: to provide information in the area of AAC that is high quality, up-to-date, relevant, useful and accessible. A shared vision of the collaborators is that the web casts be an innovative way to involve augmented communicators and family members in the training, research, development and treatment discussions that tend to occur among professionals during conferences and workshops.

Iris Fishman, Director of the Kornreich AT Center, will host the web casts and serve as moderator during the live question and answer period following each presentation. The AAC-RERC partners [David Beukelman, Sarah Blackstone, Diane Bryen, Kevin Caves, Frank DeRuyter, Jeff Higginbotham, Janice Light, David McNaughton, Janet Sturm, Michael B. Williams and David Yoder] will be among those to provide the lectures. A total of 1.5 hours is allotted for each session in the lecture series. Questions to the presenters are e-mailed in.

Lecture Series

In December, the Kornreich AT Center hosted two lecturers: Lewis Golinker from the Assistive Technology Law Center who spoke on *Medicare funding of AAC devices* and Pat Ourand of Associated Speech and Language Services, Inc. who presented *How to do assessments for augmentative communication*. The January lecture will be presented by Drs. David Beukelman and Laura Ball on the topic of *AAC techniques and people who have ALS: Clinical decision making*.

It is simple to join a web cast. The required technologies are a computer and an Internet connection. The *Real Player* software is needed to view the web cast and *Shock Wave* software is needed to participate in the discussion with the speaker. Both *Real Player* and *Shockwave* are available free of charge.

Participation in each web cast is offered for free (at least for now). After each web cast, the lecture is archived and can be viewed later by anyone wishing to see the tape.

For questions about the web cast series, please e-mail Iris Fishman ifishman@ncds.org The Kornreich web site is <http://www.kornreich.org>

You can link to the Kornreich web site and the web cast archives from the AAC-RERC web page <http://www.aac-rerc.com>.



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Resources

Laura J. Ball, Ph.D., Assistant Professor Munroe-Meyer Institute for Genetics and Rehabilitation, 985450, Nebraska Medical Center, Omaha, NE 68198, 800-656-3937/402-559-6460. lbali@unmc.edu

Gary D. Cumley, Ph.D., Associate Professor, School of Communicative Disorders, University of Wisconsin-Stevens Point, 1901 4th Ave., Stevens Point, WI 54481, USA, 715-346-4699. gcumley@uwsp.edu

Marlene Kayner Cummings, M.S., Utica Community Schools Augmentative/Alternative Communication Program and Assistive Technology Center, Havel Elementary School, 41855 Schoenherr Road, Rochester Hills, MI 48307, 586-254-8299. mrc1mncs@ucs.misd.net

Amy E. Skinder-Meredith, Ph.D., Assistant Professor, Dept. of Communication Sciences and Disorders, University of Minnesota Duluth, 229 Bohannon Hall, 10 University Dr., Duluth, MN 55812, 218-728-9152. ameredith@d.umn.edu



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1 Surf Way, #237
Monterey, CA 93940

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