Evidence-based Strategies in Augmentative and Alternative Communication (AAC)

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Annual Conference 2013

Program

- Prominent AAC Strategies for ASD & Developmental Disabilities
  - Manual Signs and Gestures
  - Picture Exchange Communication System (PECS)
  - Speech-Generating Devices (SGDs)
- Moving from PECS to SGDs and iPads
  - Case Examples and Demonstration
  - Discussion

Autism Spectrum Disorders (ASD)

Triad of symptoms with
1. Impairments in language and communication
   - Deficits in language can range from completely nonverbal to acquiring the ability to speak.
2. Impairments in social interaction
   - Results in lack of motivation to communicate with other people – even when these individuals have acquired some language competence and use.
3. Restricted and repetitive patterns of behavior
   - Pre-occupation with restricted patterns of interest can impede social and communicative development.

Proportion of Nonverbal Children with ASD

- Autism includes a “delay in, or lack of the development of spoken language” (American Psychiatric Association, 2000)
- 14-25% of children diagnosed with an autism spectrum disorder (ASD) present with little or no functional speech (Lord & Bailey, 2002; Lord, Risi, & Pickles, 2004)
  - Autistic disorder only: 50% of children are functionally non-verbal
  - No sufficient natural speech or writing to meet their daily communication needs (Light, Roberts, DiMarco, & Greiner, 1998)
- Candidates for intervention in augmentative and alternative communication

Other Developmental Disabilities (DD)

- Intellectual Disability: umbrella term for large range of syndromes and conditions that result in cognitive impairment
  - Commonly experience significant difficulty with spoken communication
  - Many do not use speech as primary mode of communication
  - High incidence of problem behavior
- Cerebral Palsy
  - Unique motor control issues
  - Up to two thirds also experience intellectual disability

Proportion of Nonverbal Children with DD

- Prevalence of Intellectual Disability is between 1-3% worldwide (WHO, 2001)
- ID may be largest proportion of school-age individuals that require AAC supports
- Up to 38% of preschool-age children with ID have AAC needs (Beukelman & Mirenda, 2013)
- AAC is crucial part of service delivery to this population (National Joint Committee for the Communication Needs of Persons with Severe Disabilities, 2003)
AAC and Autism

- AAC strategies particularly used in ASDs/DDs:
  - Manual signs and gestures
  - Pictographic symbols sets/systems
  - High technology speech generating devices (SGDs) for synthesized and/or digitized speech output
  - Practitioners face difficult task selecting a suitable approach
  - Evidence-based practice (EBP):
    - Using research outcomes as a major basis for clinical and educational decisions (Lloyd, 2001)

Manual Signs

- Manual signs: unaided form of communication; unaided communication does not rely on any aids or devices external to the body and uses only body parts (Lloyd et al., 1997).
- One of the first forms of AAC applied to non-speaking individuals with ASD; introduced in the 1970s and used successfully for more than 30 years
- Can refer to a natural sign language (e.g., American Sign Language) or to production of manual signs as a code for a spoken language
- By the mid-1980s, manual signing was often used in combination with speech, this approach was labeled as “total” or “simultaneous” communication (SC)

Why Choose Manual Signs?

- Easy to imitate (Sundberg, 1990)
  - Individuals with ASD may have difficulty controlling vocal folds but display strengths with imitating actions
- Signs are less transient than words (Fulwiler & Fouts, 1976)
  - Less frustrating to learn than vocal speech
- May overcome negative history associated with speech (Sundberg & Partington, 1998)

Manual Signs: Empirical Evidence

- Expressive signing
  - 5 studies including 22 participants concentrated on teaching manual signs and monitoring sign production as an outcome variable
  - Across experiments teaching manual signs ⇒ “highly effective”
- Simultaneous communication (SC):
  - Barrera, Lobato-Barrera, and Sulzer-Azaroff (1980) taught one participant expressive language skills using three different instructional methods:
    ⇒ Simultaneous communication superior to sign alone and oral training
**Manual Signs: Empirical Evidence (cont.)**

- Expressive signing, simultaneous communication:
  - Remington and Clarke (1983) compared simultaneous communication versus sign alone training in two participants: no difference
  - Saraydarian (1994), group study: 10 participants exposed to training program that taught object referents in the form of simultaneous communication, sign alone instruction and oral instruction ‡ sign alone condition superior, effect size $g = 0.36$ indicating moderate effect

- Receptive speech:
  - Brady and Smouse (1978) compared effects of SC (Effect Size = 100 %) vs. sign alone (ES = 50 %) training on receptive speech in one participant.
  - Carr and Dores (1981) provided SC training to three participants and measured their correct responses on a receptive language discrimination task: Effect sizes were 100 % for each one.

**Manual Signs: Empirical Evidence Summary**

- Summary:
  - Both groups of experiments, expressive speech and receptive speech, yield high outcome scores
  - Evidence suggests it is a viable communication option

- Possible explanations for effectiveness:
  - Better choice than vocalization because it is easier to prompt an action than a vocalization (Sundberg, 1990)
  - Involves more iconic representation than spoken language (Sundberg)
  - Motor imitation is an easier behavior to teach because the teacher can make use of physical prompting and fading procedures (Sundberg & Partington, 1998)

**Manual Signs Limitations**

- More and more research studies are revealing motor control problems in ASD
  - Clumsiness
  - Poor muscle tone
  - Difficulty with fine and gross motor skills
  - Seen in about 80% of children with autism, but not part of diagnostic criteria (Hilton et al., 2012; Isenhower et al., 2012)

- Children with ASD often acquire only limited sign vocabulary and signs tend to be poorly articulated

- Burden on communication partners: social environment may not be fluent in sign language

**Manual Signs Limitations (cont.)**

- Intelligibility:
  - Rotholz et al. (1989): two adolescents with autism were taught to order fast food interacting with staff unfamiliar to them
    - 0-25% of manual sign requests were understood
    - 80-100% of graphic symbol requests were understood

**Manual Signs Conclusions**

- Future research implications:
  - Lack of studies comparing manual signing or gestures against an aided mode of communication such as graphic symbols ‡ More comparative efficacy studies are needed to clarify if learners with autism actually do better and/or have a preference for one communication modality over another
  - How to use manual signs as part of a multi-modal communication system consisting also of graphic symbols, communication boards, SGDs, and vocalizations (when available) ‡ need research into effective strategies for teaching the conditional use of manual signs
Gestures

- Gestures: body movements or sequences of coordinated body movements to represent an object, idea, action, or relationship without the linguistic features of manual signs
  - Examples: pointing or yes-no headshakes
  - One of the earliest developing non-linguistic forms of unaided communication (Loncke & Bos, 1997)
  - Individuals with autism, however, rarely use gestures as an alternative communication strategy, even if they have difficulty speaking (Loveland, Landry, Hughes, Hall, & McEvoy, 1988)

Why Choose Gestures?

- Use of gestures serves as a precursor to later development of language skills (Merford & Goldin-Meadow, 1992)
- Gestural behavior also important for establishment and maintenance of social interaction and social reciprocity (Garfin & Lord, 1986; Koegel & Frea, 1993)
- Appropriate for early AAC intervention to facilitate symbolic development
- Motor demands not as much of an issue as with manual signs

Gestures: Empirical Evidence

- Two studies focused on teaching gestural communication skills
  - Buffington, Krantz, McClannahan, and Poulson (1998) taught gestures in combination with oral speech, measured frequency of correctly produced gestural and verbal responses: PND scores of “highly effective” for all four participants
  - Carr and Kemp (1989) provided training in communicative pointing (e.g., to obtain toy), observed frequency pointing occurred: again PND scores of “highly effective” for all four participants

Gestures: Empirical Evidence Summary

- Summary:
  - Appears to be very effective communication option but limited amount of studies at this time
  - Compared to manual signs it seems that gestures are underrepresented and not well researched in this population
    - Surprising, because of its correlation with vocal use and preceding speech development
    - More research needed to build up the empirical support for gestural communication
    - Also need more comparative efficacy studies

Picture Exchange Communication System (PECS)

- Structured behavioral intervention program to teach use of visual-graphic symbols for communication (Bondy & Frost, 1994)
- Teaches to make requests by handing/exchanging symbols for desired items
Picture Exchange Communication System (PECS)

- Picture Exchange Communication System (PECS) protocol (Bondy & Frost, 1994)
  - Phase I: Physical Exchange
  - Phase II: Expanding Spontaneity
  - Phase III: Picture Discrimination
  - Phase IV: Sentence Structure
  - Phase V: Responding to "What do you want?"
  - Phase VI: Responsive and Spontaneous Commenting

Why Choose PECS?

- Requires very few prerequisites
  - Only prerequisite individual can clearly indicate wants and needs
- First skill taught in PECS is requesting
  - Often targeted in early instruction of individuals with developmental disabilities due to motivational considerations (Reichle & Sigafoos, 1991)
- Systematically targets spontaneous communication acts, a particular deficit in autism
- PECS graphic symbols are highly iconic
  - Can be easily recognized by the learner and are more recognizable by communicative partners

PECS: Empirical Evidence

- Systematic reviews (particularly meta-analyses) are preferred evidence to document empirical support:
  - Preston and Carter (2009)
    - Increase in communication skills in most learners, effects on problem behavior reduction and increasing natural speech less clear
  - Hart and Banda (2010)
    - Increases in functional communication skills in all but 1 subject
  - Flippin, Reszka, and Watson (2010)
    - “Promising but not yet established evidence-based intervention for facilitating communication in children with ASD ages 1–11 years”

PECS Summary

- Considerable empirical support for using PECS as a beginning communication strategy
- Overall shows strong effectiveness for teaching initial requesting skills
- Some evidence to indicate: more effective than manual signing in terms of requesting
- Effect is less clear for other outcome variables such as speech production, social or challenging behavior
- When treatment goals is speech production no sufficient evidence to inform practice in favor of PECS or manual signing
  - In general, mixed results on this outcome measure

PECS Summary (cont.)

- Methodological issues in PECS studies
  - Often lack investigation of maintenance
  - Skill generalization sometimes reported, but what counts as generalization varies greatly
  - Participant descriptions lack detail
  - Sparse reports of treatment integrity

PECS appears as a promising intervention that presents with emerging empirical support, but critical questions are still to be answered

Evidence-based Strategies in AAC

SPEECH-GENERATING DEVICES
Speech-Generating Devices (SGDs)

- Portable, computerized devices producing synthetic or digitized speech output when activated
- Graphic symbols are used to represent messages, activated by finger, switch, head stick, etc., selecting a symbol from the display
  - LightWRITER
  - BIGMack

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### SGDs (cont.)

**Fixed Display**
- Graphic symbols located in separate squares of a grid, organized into rows and columns
- Limited vocabulary

**Dynamic Display**
- Selection from a display results in a new array of graphic symbols
- Larger vocabulary sets

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### SGDs (cont.)

**Visual Scene Displays**
- Language concepts are embedded into contextual scenes
- Objects and events within the photograph are then used as symbols for communication
- May be used in a dynamic display system

⇒ Not ideal for learners with severe autism due to sensory processing difficulties

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### SGDs (cont.)

- Example of a child with ASD using an SGD:
  - [http://www.youtube.com/watch?v=s4GAX-IXE_k&NR=1](http://www.youtube.com/watch?v=s4GAX-IXE_k&NR=1)
- Example of synthetic speech output:
  - [http://www2.research.att.com/~ttsweb/tts/demo.php#top](http://www2.research.att.com/~ttsweb/tts/demo.php#top)

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### Why Choose SGDs?

- Allows composing more detailed messages
- Enable user to communicate very precise requests and prevent communication breakdown
- Voice output (aka speech output) may facilitate acquisition and maintenance of communication skills
- Producing speech can be perceived as more natural
  - Better intelligibility
  - Easier to get attention
  - Higher likelihood of receiving a listener response
Why Choose SGDs? (cont.)

- iPads and other tablet devices are
  - Lightweight and portable
  - Cost-efficient compared to dedicated SGDs
  - Easy to program
  - Highly motivating to use
  - Socially appealing (peer acceptance)

SGDs: Empirical Evidence

- Van der Meer, & Rispoli (2010), systematic review:
  - Found 23 studies with a total of 51 children aged 3-16 years
  - Positive outcomes reported for 86% of studies, most commonly targeting requesting skills
  - Potentially effective option for teaching communication skills in ASD
- Ganz et al. (2012), meta-analysis:
  - Included 8 studies on SGDs, 9 studies on PECS, 7 other graphic symbols
  - Effect size estimates were 99% each for SGDs and PECS, 61% for others
  - SGD or PECS use yields significantly higher effects

SGDs: Empirical Evidence (cont.)

- Schlosser et al. (2009): “…SGDs represent a viable and effective AAC option for individuals with ASD”
- Empirical evidence speaks a clear message, effectiveness of SGDs no longer a question
- Wendt and Golinker (2012): “SGDs are one part of the standard of care to improve the functional communication and other outcomes for clients with ASD”
  - Important when applying for SGD funding from insurance agencies!

Research Questions

- Practitioners/parents: after successful mastery of (initial) PECS phases, can the child move on to a SGD? (Grether, 2007)
- “…research into innovations to the PECS protocol is a laudable direction and should be continued using rigorous methodologies” (Schlosser & Wendt, 2008)
- Project goals:
  - Modify traditional PECS protocol for implementation and transition to an SGD
  - Evaluate the effects of such a modified PECS protocol on increasing requesting skills, social-communicative behaviors, and emerging speech
  - Evaluate effectiveness of a particular device for such purpose that is built upon PECS principles

Evidence-based Strategies in AAC

MOVING FROM PECS TO SPEECH-GENERATING DEVICES
Experimental Design

- Multiple Baseline Design across participants (Baer, Wolf, & Risley, 1968)
  - Intervention phase split into PECS phases and SGD phases, followed by maintenance phase
  - 3 children, 9-11 yrs., severe autism and non-verbal
- Dependent measures:
  - Requesting skills: number of correct requests during 20-trials session
  - Social-communicative behavior: number of responses including eye contact, physical orientation towards comm. partner, positive affect via smiling/laughter
  - Emerging speech: word vocalizations or word approx.

Materials and Setting

- Traditional PECS book with PCS symbols for desired items
- Proxtalker -“sentence strip that actually speaks”:
  - picture card is put on ProxTalker display ➔ speak out the symbol referent in form of prerecorded digitized speech
  - several picture cards can be combined to speak sentences
  - symbols used were identical to PECS symbols
- Departmental Speech Clinic: 3 sessions per week

Modified PECS Protocol

(Preference Assessment)

- Phase I: Physical Exchange
- Phase II: Expanding Spontaneity
- Phase III: Picture Discrimination
- Phase IV: Sentence Structure
- Phase V: Responding to “What do you want?”
- Phase VI: Responsive and Spontaneous Commenting

(Original PECS protocol by Bondy & Frost, 1994)
SPEAK all!

- The purpose is to help teach the process of constructing sentences
- Customizable to each child’s specific needs
  - Allows the instructor to use recorded audio and custom images
- Seamlessly connects with PECS or ProxTalker intervention
- Selection Area on top replaces PECS book
- Sentence Strip at bottom speaks selected graphic symbols
- “Shuffle button” randomly regroups graphic symbols
- DOWNLOADABLE ON ITUNES (free app) Appstore>Education>Purdue>SPEAKall!

Autism Apps can be Noisy Places for Those Who Cannot Process It

- Moving from Mid-Technology (ProxTalker) to High-Technology (iPad)

Effects on Requesting Skills
Effects on Social-Communicative Behavior

Effects on Emerging Speech

QEEG Brainmap of Neurotypical Individuals

Participant on 6/18/11

Participant post-intervention 12/9/11

Further Research on SPEAK all!

- Multiple Baseline Design across settings (Baer, Wolf, & Risley, 1968)
- Intervention repeated across clinic, home, and school environments following PECS instructional phases
- iPad with SPEAK all!® replaces ProxTalker, intervention starts immediately with iPad

Dependent measures:
- Requesting skills: number of correct requests during 20-trials session
- Emerging speech: word vocalizations or word approx.
Participant 2 - Requesting

Participant 2 – Speech

SPEAK all! Parent Training
Young Girl - Baseline

SPEAK all! Parent Training
Young Girl - Intervention

SPEAK all! Parent Training
Young Girl - Intervention

SPEAK all! Parent Training
Young Girl – Maintenance & Generalization
Conclusions

- Findings provide support that AAC can have facilitative effect on natural speech development
- There may be a particular role for shaping echolalic utterances
- Refute myth that AAC prevents speech
- Confirm augmented input may enhance expressive and receptive communication development
- Confirm PECS principles (behavioral) hold true regardless of modality

Conclusions (cont.)

- All participants mastered iPad intervention, but varied in ability to complete later protocol phases; effects are replicable across settings
- Gains in speech production most notable for echolalic child able to request in spoken sentences after fading out iPad
- Other participants varied in effects on natural speech production
- Pre-treatment speech skills and degree of cognitive impairment likely moderator variables

Conclusions (cont.)

- Results underscore the potential of including parents for maximizing benefits of AAC intervention in autism
- Clinicians should recognize the value of joint parent-professional partnerships, and develop expertise for parent training

Acknowledgements

- Aforementioned projects were supported by
  - Project Development Team within the ICTSI NIH/NCRR Grant Number RR025761
  - Technology Development Grant from the Innovation and Commercialization Center – Information Technology
  - Research Fellowship from Purdue Center for Families
  - Purdue Research Foundation International Travel Grant

Acknowledgements (cont.)

- Thanks to ProxTalker.com, LLC for providing devices!
- Thanks to Purdue EPICS Team!
- Thanks to the families who agreed to participate in our research!
Further Information on SPEAK all! / SPEAK now! Apps

- Download on iTunes (free app)
  Appstore>Education>Purdue>SPEAKall!
  http://itunes.apple.com/gb/app/speakall/id478863940?mt=8
- Instructional Videos:
  http://youtu.be/h2hWMQc8IUg
- Support Site:
  http://epicsecn.purdue.edu/iaaac/#speakall

Questions ???

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References: SGD Studies


References: SGD Studies (cont.)


References: PECS to SGDs


References: PECS to SGDs (cont.)