Evidence-based Interventions in Augmentative and Alternative Communication (AAC) for Autism Spectrum Disorders

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Program
- Prominent AAC Strategies for ASD
  - Picture Exchange Communication System (PECS)
  - Speech-Generating Devices (SGDs)
  - Moving from PECS to SGDs and iPads
- Using iPads and AAC apps for augmented language interventions (E. Studebaker)
  - Case Examples
  - Discussion

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

AAC Definition
- Augmentative and Alternative Communication (AAC):
  1. The supplementation or replacement of natural speech and/or writing. (Lloyd, Fuller, & Arvidson, 1997, p. 1)
  2. The area of research, clinical and educational practice … to compensate for temporary or permanent impairments, activity limitations, and participation restrictions of persons with severe disorders of speech-language production, and/or comprehension. (ASHA, 2005, p. 1)

AAC and Autism (cont.)
- AAC strategies particularly used in ASDs:
  - 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)
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

Why Choose PECS?

- Requires very few prerequisites
  - Only prerequisite individual can clearly indicate wants and needs
- First skill taught in PECS is requesting
- 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

<table>
<thead>
<tr>
<th>Study</th>
<th>N</th>
<th>Phases</th>
<th>DV</th>
<th>PND-Mean</th>
<th>PND-Range</th>
<th>Appraisal</th>
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<tr>
<td>Ganz (2007)</td>
<td>3</td>
<td>I-IV</td>
<td>Words imitation</td>
<td>4 (I)</td>
<td>0-8</td>
<td>Suggestive</td>
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<tr>
<td>Marckel (2006)</td>
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<td>IV</td>
<td>Requesting generalization (untrained items)</td>
<td>100 (H)</td>
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<td>Tincani (2006-1)</td>
<td>2</td>
<td>I-III/IV</td>
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<td>100</td>
<td>Suggestive</td>
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<tr>
<td>Charlop-Christy (2002)</td>
<td>3</td>
<td>I-IV</td>
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<td>100</td>
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<td>Anderson (2001)</td>
<td>6</td>
<td>I-III</td>
<td>Requesting-PECS</td>
<td>67 (H)</td>
<td>29-100</td>
<td>Conclusive</td>
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<tr>
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<td>Word vocalizations</td>
<td>0 (I)</td>
<td>0</td>
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<tr>
<td>Angermeier (2007)</td>
<td>4</td>
<td>I-III/III</td>
<td>Requesting-high iconic</td>
<td>67 (C)</td>
<td>67</td>
<td>Conclusive</td>
</tr>
<tr>
<td>Tincani (2004)</td>
<td>2</td>
<td>I (II as best)</td>
<td>Requesting-PECS</td>
<td>92 (H)</td>
<td>83-100</td>
<td>Preponderant</td>
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</tbody>
</table>

Each study includes the following levels:
- Study: The name of the study or researcher
- N: The number of participants
- Phases: The phases of PECS
- DV: The dependent variable measured in each study
- PND-Mean: The mean of the PND scores
- PND-Range: The range of the PND scores
- Appraisal: The type of appraisal made for each study
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

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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SPEECH-GENERATING DEVICES
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

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

SGDs (cont.)

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)

Example of a child with ASD using an SGD:
- 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
SGDs: Empirical Evidence


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

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MOVING FROM PECS TO SPEECH-GENERATING DEVICES

SGD Advantages

- Additional provision of speech output presented as (a) antecedent auditory stimuli (a.k.a. “augmented input”), and/or (b) consequence auditory stimuli (a.k.a. “feedback”) may benefit learners with developmental disabilities
  ⇔ Gains in receptive and expressive language skills in adolescents with intellectual disabilities using SGDs (Romski & Sevcik, 1993, 1996)
- SGD may allow more independent form of communication (voice output understood by variety of familiar and unfamiliar comm. partners)

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

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
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)
PECS Phase II Video Clip
End

ProxTalker Phase II Video Clip
Beginning

ProxTalker Phase V
End

Ipad Phase
End
- Moving from Mid-Technology (ProxTalker) to High-Technology (iPad)

Effects on Requesting Skills

Effects on Social-Communicative Behavior
**SpeakAll!®**
- 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)

Research on iPad-SpeakAll®
- Multiple Baseline Design across settings (Baer, Wolf, & Risley, 1968)
  - Intervention repeated across clinic, home, and school environments following PECS instructional phases
  - iPad with SpeakAll 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.

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**Participant 1 - Requesting**

**Participant 2 – Requesting**
Participant 3 - Requesting

Participant 4 - Requesting

Ipade and SpeakAll!®
Participant 2 - Beginning

Ipade and SpeakAll!®
Participant 2 – End

Ipade and SpeakAll!®
Participant 3 - Baseline

Ipade and SpeakAll!®
Participant 3 – Middle Stages
Ipad and SpeakAll!®
Participant 3 – End

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

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AUGMENTED LANGUAGE INTERVENTIONS

Using AAC to Supplement Speech and Language Intervention
- **Aided Language Stimulation**: clinician highlights a symbol on the child’s communication board while providing verbal stimuli (Goossens’ et al., 1992)
- **Augmented Communication Input**: similar to Aided Language Stimulation but SGD instead of board, communication partners learn to activate symbols on the SGD to augment their speech input (Romski & Sevcik, 1993; 1996)
- **Aided Language Modeling**: use of language boards to implement aided language intervention during interactive play activities (Drager et al., 2006)
  
  **Watch the following cases!**

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References


References (cont.)


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References: PECS Studies


References: PECS Studies (cont.)


References: SGD Studies


References (cont.)

References: SGD Studies
(cont.)


References: PECS to SGDs
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