Using Dynamic Assessment for Early Sentence Structures with Children using an iPad AAC App

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Clinical Challenges

How do we accurately assess children’s abilities to use aided AAC to develop generative language skills?

Dynamic Assessment (DA) – A Holistic Approach

- Incorporates active teaching within the assessment process
- Aims to modify cognitive functioning
- Identifies barriers to learning and degree of support required is identified
- Measures degree of clinical support required
- Measures examiner effort
- Evaluates learning potential

Zone of Proximal Development

• Rooted in Vygotsky’s sociocultural theory of learning
• Difference between a child’s level of independent performance and level of assisted performance
• Level of potential development is determined through problem solving under adult guidance or in collaboration with more capable peers

Graduated Prompting

• Uses a predetermined, least-to-most cueing hierarchy
• Indicates child’s ZPD by measuring amount of support required
• Measures changes in level of support required across similar tasks
• May indicate transfer of learning
Applications of DA in Speech-Language Pathology

<table>
<thead>
<tr>
<th>Identify a speech/language disorder</th>
<th>Inform intervention decisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Used to identify language disorder in culturally and linguistically diverse populations</td>
<td>Used to predict future communication performance in children with language impairment</td>
</tr>
</tbody>
</table>

Research Questions

1. How much support do preschoolers using AAC need to create simple, rule-based sentences using an AAC iPad app?
2. Do these children show rapid improvements (i.e., modifiability) in their sentence productions when a least-to-most cueing hierarchy is used?
3. Is performance during dynamic assessment predictive of future performance?

Rationale for Current Studies

Emerging evidence that DA may be a powerful tool when evaluating children with severe disabilities

Important to gain an understanding of how much support children who use AAC require to demonstrate generative language skills using AAC

No known studies have used DA to examine the early syntactic productions of children who use aided AAC

Research Design

• Study 1 & 3
  • Part of an NIH-funded study in the Department of Speech and Hearing Sciences at the University of New Mexico

• Study 2
  • Part of an ASHFoundation-funded study at in the Department of Communication Sciences and Disorders at the University of Central Florida

All children participated in DA prior to beginning an experimental phase (plus intervention as required)

Participants

<table>
<thead>
<tr>
<th></th>
<th>Amy</th>
<th>Ben</th>
<th>Carmen</th>
<th>Darryl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronological age (yr/mo.)</td>
<td>5;10</td>
<td>5;0</td>
<td>5;1</td>
<td>5;9</td>
</tr>
<tr>
<td>Gender</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>Disability</td>
<td>Suspected ataxic speech disorder</td>
<td>Severe speech disorder</td>
<td>History of TBI; Microdeletion of 7q11.23</td>
<td>Severe speech disorder</td>
</tr>
<tr>
<td>Test of Auditory Comprehension of Language</td>
<td>27th percentile</td>
<td>77th percentile</td>
<td>10th percentile</td>
<td>73rd percentile</td>
</tr>
<tr>
<td>IAEC (no context/content)</td>
<td>129/122</td>
<td>196/94</td>
<td>106/153</td>
<td>33%/68%</td>
</tr>
</tbody>
</table>

Note. TBI = Traumatic Brain Injury. *The deletion has been associated with autism, but data are incomplete in the research literature at this time. Ben does not demonstrate symptoms of autism.

Study 1

5-Year-Old children's Sentence Productions using Aided AAC
Setting, Experimenters, and Instrumentation

- DA and experimental sessions administered by the author, another SLP graduate student and the principal investigator for the larger study.
- Conducted in a private therapy room.
- Approximately 2, 60-minute sessions per week.
- Video-recorded.
- iPad containing Proloquo2Go™ app.
- Static pages with line drawings representing target vocabulary.

Communication Board Used During DA

Communication Board Used During Experimental Task

Targets

<table>
<thead>
<tr>
<th>Target</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agent-Action</td>
<td>PENGUIN JUMPS</td>
</tr>
<tr>
<td>Attribute-Entity</td>
<td>HAPPY PENGUIN</td>
</tr>
<tr>
<td>Possessor-Entity</td>
<td>PENGUIN’S MOTORCYCLE</td>
</tr>
<tr>
<td>Action-Object</td>
<td>CHASES PENGUIN</td>
</tr>
<tr>
<td>Agent-Action-Object</td>
<td>MONKEY CHASES PENGUIN</td>
</tr>
<tr>
<td>Attribute-Agent-Action</td>
<td>HAPPY PENGUIN JUMPS</td>
</tr>
</tbody>
</table>

DA Session Materials

- Puppets and plastic animals representing target vocabulary.
- Additional materials used to depict various conditions (e.g., water sprayer to make animals wet).
- Objects representing possessions.
- Simple prompts used to demonstrate actions (e.g., box for animals to hide behind).

DA Session Procedures

Adapted from Olswang and Bain’s (1996) procedures.

- Graduated Prompting.
- DA for each target administered in a separate block.
- 10 trials administered for each semantic-syntactic target.
- Child’s production at each level of cueing recorded.
- Examiner used toy animals and objects to demonstrate target structure.
Cueing Levels

<table>
<thead>
<tr>
<th>Level</th>
<th>Prompt</th>
<th>Example</th>
<th>Scoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level A</td>
<td>Elicitation question/prompt</td>
<td>Arrange happy Penguin and sad Penguin as well as contrast puppets, happy Cow and sad Cow, in front of child. Point to the happy Penguin. Who is this?</td>
<td>4</td>
</tr>
<tr>
<td>Level B</td>
<td>Spoken and aided model of a contrast target</td>
<td>Point to sad Cow, then point to happy Penguin. Look, this is sad Cow SAD COW and this is HAPPY PENGUIN.</td>
<td>3</td>
</tr>
<tr>
<td>Level C</td>
<td>Direct spoken model of the target</td>
<td>Point to happy Penguin. See, this is happy Penguin. WHO IS THIS?</td>
<td>2</td>
</tr>
<tr>
<td>Level D</td>
<td>Direct spoken and aided model of the target</td>
<td>Point to happy Penguin. Tell me, happy Penguin HAPPY PENGUIN.</td>
<td>1</td>
</tr>
</tbody>
</table>

Sample Data Sheet: DA

- Scoring: Point value assigned for each trial
- Data Reliability: 33% of the data re-coded by a coder blinded to the purposes of the study and order of the data
- Reliability calculated for scoring procedures: Kappa = 1.0 (perfect agreement)

Experimental Task Materials

- iPad with same communication board except for inclusion of different characters: Mickey Mouse Clubhouse characters
- Separate iPad containing videos depicting target relations

Experimental Task Procedures

- Examiner showed child a video depiction of given target
- Then asked elicitation question/prompt
- E.g., for agent-action target the elicitation prompt was, “What’s happening?”
- Child was then expected to produce the target structure using the graphic symbols on the iPad (e.g., GOOFY CRIES)
- Examiner presented 10 randomly ordered videos depicting target structures

Data Collection: Experimental Task

- Scoring: Percent of correct productions for each set of 10 videos depicting a target structure
- Data Reliability: 33% of the data were re-coded by a coder blinded to the purposes of the study and order of the data
- Reliability calculated for scoring procedures: Kappa = 1.0 (perfect agreement)

Research Question 1:

How did the children perform at each cueing level?

- Targets produced accurately at each of the four cueing levels at some point during DA
- All participants produced the targets at Level A cueing
- Mean level of support was above 2.5 for all participants for most targets
Research Question 2: Did the children’s performance change during each DA session?

- Performance on first five trials compared with performance on last five trials
  - Taken as a group, results were HIGHLY significant; p<.001
  - Scores on second half of the trials for any given session were higher or the same for 21/24 trials

Research Question 3:

Correlation Between DA and Experimental Task

- Strong correlations for Children B, C, & D
- Mild correlation for Child A

Many similarities to Study 1

- Setting
- Materials
- Cueing hierarchy
- Communication pages on iPad
- Inclusion criteria for participants

- Main changes
  - Targets
  - Multiple baseline and intervention sessions followed DA

Study 2

Productions of YES/No Statements and Questions using Aided AAC

Participants

<table>
<thead>
<tr>
<th></th>
<th>Alex</th>
<th>Bella</th>
<th>Cory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronological age (mo.)</td>
<td>4;10</td>
<td>6;2</td>
<td>4;9</td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>Disability</td>
<td>Developmental apraxia of speech</td>
<td>Down syndrome</td>
<td>Developmental apraxia of speech &amp; auditory processing disorder</td>
</tr>
<tr>
<td>Test of Auditory Comprehension of Language</td>
<td>65th percentile</td>
<td>5th percentile</td>
<td>45th percentile</td>
</tr>
<tr>
<td>IASCC (no context/context)</td>
<td>16/32%</td>
<td>38/61%</td>
<td>13/35%</td>
</tr>
</tbody>
</table>

Targets

<table>
<thead>
<tr>
<th>Target</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject + auxiliary verb + main verb</td>
<td>GOOFY IS CRYING</td>
</tr>
<tr>
<td>Auxiliary verb + subject + main verb</td>
<td>IS GOOFY CRYING?</td>
</tr>
</tbody>
</table>
Results

- Observational data:
  - All children were able to complete the DA task
  - Alex and Bella's performance in DA was comparable, but Bella took approximately twice as long to complete the intervention
  - Cory required full support on DA and took the longest to complete the subsequent intervention

Study 3:
Preliminary Findings
(some data collection in process)
3- AND 4-Year-old children's sentence productions using aided AAC

Method:
Participants

- 10 children ages 3 & 4
- Less than 50% intelligible (single word, unfamiliar listeners)
- Most had no prior AAC experience

<table>
<thead>
<tr>
<th>Child</th>
<th>PPVT-IV</th>
<th>TACL-3</th>
<th>Leiter-R</th>
<th>Full IQ SS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AE</td>
<td>Percentile</td>
<td>AE</td>
<td>Percentile</td>
</tr>
<tr>
<td>G (4;8)</td>
<td>3,7</td>
<td>13</td>
<td>3,10</td>
<td>13</td>
</tr>
<tr>
<td>H (4;11)</td>
<td>5,2</td>
<td>54</td>
<td>4,9</td>
<td>39</td>
</tr>
<tr>
<td>I (3;11)</td>
<td>3,8</td>
<td>37</td>
<td>3,5</td>
<td>23</td>
</tr>
<tr>
<td>J (4;2)</td>
<td>5,10</td>
<td>92</td>
<td>4,9</td>
<td>84</td>
</tr>
<tr>
<td>K (4;1)</td>
<td>5,11</td>
<td>97</td>
<td>4,4</td>
<td>61</td>
</tr>
<tr>
<td>L (4;1)</td>
<td>4,4</td>
<td>30</td>
<td>3,7</td>
<td>5</td>
</tr>
<tr>
<td>M (4;3)</td>
<td>4,1</td>
<td>43</td>
<td>3,10</td>
<td>27</td>
</tr>
<tr>
<td>N (4;3)</td>
<td>5,0</td>
<td>58</td>
<td>4,3</td>
<td>27</td>
</tr>
<tr>
<td>O (3;5)</td>
<td>7,8</td>
<td>85</td>
<td>3,4</td>
<td>77</td>
</tr>
<tr>
<td>P (3;3)</td>
<td>2,9</td>
<td>30</td>
<td>3,5</td>
<td>65</td>
</tr>
</tbody>
</table>

Research Question 1:
How did the children perform at each cueing level?

Participants' performance at each cueing level during DA
- Targets accurately produced at all cueing levels
- Overall, higher levels of cueing needed than for Study 1, but still successful at Level A cueing for some participants
- Possessor-entity target required the least amount of cueing, followed by locatives, then attribute-entity, then agent-action-object

Research Question 2:
Did the children's performance change during each DA session?
- Performance on first five trials compared with performance on last five trials
  - Results were highly significant, p < .001
  - Scores on second half of the trials within each set of probes were higher or the same for 31/36 DA sessions

Research Question 3:
Was there a relationship between DA performance and mastery of target in intervention?
(Preliminary findings)
- Significant correlation between the participant's performance in DA and performance the subsequent intervention
  - Pearson: r² = 0.48
Summary

• Set appropriate expectations:
  • Five-year-old children who use AAC are able to learn to construct basic messages using graphic symbols with relatively little support
  • Three- and four-year-old children were also successful but required more support overall
  • Initial data with question forms are promising
  • Significant improvements in performance may be noted even within a brief DA task

Predicting Future Performance

• DA may help predict future performance on similar AAC tasks
  • Useful in determining goals for intervention
    • Little to no cueing needed during DA → Select more challenging targets
    • Moderate cueing needed during DA → Probably an appropriate target
    • Extensive cueing needed during DA, especially with no accurate responses at all → Consider slightly simpler target

Future Directions

• Assess participants with varying ages and cognitive abilities
• Assess other language areas: morphology, semantics and more complex syntactic structures

Acknowledgements

• Many thanks to:
  • The children and families who participated in the studies
  • AAC Lab students from UNM and UCF for countless hours of hard work
  • The NIH and ASHFoundation for supporting this work

References


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