Best teaching practices in Applied Behavior Analysis

William Ahearn, Ph.D., BCBA
Using research to inform best practice

- Research into teaching procedures
  - What works
    - The best procedure?
- Stages of best practice
  - What do we know
  - How many things work?
  - Comparative studies!
  - Prediction of effective practice
  - Identifying crucial “pre-requisites”
EIBI: Best Practice!

- Lovaas, 1987; McEachin, Smith, & Lovaas, 1993
- Meta-analyses
  (e.g., Eldevik, Hastings, Hughes, Jahr, Eikseth, and Cross, 2009)
- Cochrane review
  (Reichow, Barton, Boyd, & Hume, 2013)
- AAP (2001); NIMH (2007); Surgeon General (1999)
<table>
<thead>
<tr>
<th></th>
<th>RJA Point</th>
<th>RJA Gaze</th>
<th>IJA</th>
<th>Cognitive</th>
<th>Play</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main Effect (Time)</strong></td>
<td>$F(1, 91)=15.14, p&lt;.01$</td>
<td>$F(1, 91)=25.14, p&lt;.01$</td>
<td>$F(1, 91)=4.06, p&lt;.01$</td>
<td>$F(1, 91)=24.57, p&lt;.01$</td>
<td>$F(1, 91)=7.92, p&lt;.01$</td>
</tr>
<tr>
<td><strong>Main Effect (Age)</strong></td>
<td>$F(1, 91)=23.12, p&lt;.01$</td>
<td>$F(3, 91)=3.66, p&gt;.01$</td>
<td>$F(3, 91)=8.50, p&lt;.01$</td>
<td>$F(3, 91)=1.66, p&gt;.01$</td>
<td>$F(3, 91)=4.36, p&gt;.01$</td>
</tr>
<tr>
<td><strong>Interaction</strong></td>
<td>$F(1, 91)=12.14, p&lt;.01$</td>
<td>$F(3, 91)=2.54, p&gt;.01$</td>
<td>$F(3, 91)=7.50, p&lt;.01$</td>
<td>$F(3, 91)=12.87, p&lt;.01$</td>
<td>$F(3, 91)=14.36, p&lt;.01$</td>
</tr>
<tr>
<td><strong>Post-hoc tests</strong></td>
<td>18-23-month-olds improved more than all other age groups; no differences between other age groups</td>
<td>N/A (Scores increased from Time 1 to Time 2)</td>
<td>18-23-month-olds improved more than all other age groups; no differences between other age groups</td>
<td>18-23-month-olds improved more than all other age groups, 24-30-month-olds group improved more than 2.5 and 3-year-olds</td>
<td>18-23-month-olds improved more than all other age groups; no differences between other age groups</td>
</tr>
</tbody>
</table>
Common elements of effective programs (Dawson & Osterling, 1997)

- Curricula focus in major deficit areas
  - Becoming aware of world around them
  - Imitation
  - Communication
  - Play skills
  - Social interaction

- Establish/generalize these skills

- Functional Tx of problem behavior
  - Self-injury/Stereotypy/Aggression/Etc.
ABA: What we know now

- Behavior analysis works!
- Problem behavior
  FA and TX is a BP!!!
- Skill building???
  Verbal behavior (mands but)
  Play and social skills (generalization)
  Independent functioning (outcomes)
- But, there is so much more to learn
<table>
<thead>
<tr>
<th>Least-to-Most</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Independent</em></td>
</tr>
<tr>
<td>Light touch/shadow</td>
</tr>
<tr>
<td>Manual guidance at upper arm</td>
</tr>
<tr>
<td>Manual guidance at forearm</td>
</tr>
<tr>
<td><strong>Hand over hand</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Most-to-Least</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hand over hand</strong></td>
</tr>
<tr>
<td>Manual guidance at forearm</td>
</tr>
<tr>
<td>Manual guidance at upper arm</td>
</tr>
<tr>
<td>Light touch/shadow</td>
</tr>
<tr>
<td><em>Independent</em></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Most-to-Least with 2-s Delay</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hand over hand</strong></td>
</tr>
<tr>
<td>2-s delay, manual guidance at forearm</td>
</tr>
<tr>
<td>2-s delay, manual guidance at upper arm</td>
</tr>
<tr>
<td>2-s delay, light touch/shadow</td>
</tr>
<tr>
<td><em>Independent</em></td>
</tr>
</tbody>
</table>
A Comparison of Most-to-Least and Least-to-Most Prompting
Some students need Most-to-Least Prompting
Adding 2 s delay to Most-to-Least Prompting
Taking research into practice for broad application

- Developing an assessment
  - Prompt Type
  - Prompt Fading
  - Generality Test
Jess Seaver & Jason Bourret

• Evaluate an assessment designed to identify a differentially effective response prompt type and prompt-fading procedure for individuals with autism-spectrum disorders
Resp. Prompt – Exp. 1

- **Participants**
  - 8 Males, 2 Females

- **Materials**
  - Novel, 8-step Lego® play constructs
    - 1 block/base = 1 step
  - Independent raters
    - Color
    - Placement
    - Shape
  - Counterbalanced across participants
Experiment 1

• Response-Prompt Assessment
  – Prompt type
    • Verbal+gestural
      – “Pick up red block and put there”
    • Model
      – Therapist demonstrates step
    • Manual guidance
      – Hand-over-hand
  – Prompt fading
    • 2-s progressive delay
      – Immediate prompt, 1-s delay, 2-s delay, 4-s delay, no prompt
General Procedures

• Multielement Design
• Forward Behavior Chaining
• 10 Trials Per Session
• Untrained Steps Not Completed
• No Error Correction Procedure
• Preference Assessment
  – Reinforcement
    • Training Step
General Procedures

• Criterion to Fade Prompt
  – 2 consecutive, correct responses

• Criterion to Advance Step
  – 2 independent, consecutive and correct responses

• Criterion for Mastery
  – Independent completion of all 8 steps for 2 consecutive trials

• Criterion to End Experiment
  – Replication of results across 2 consecutive exposures
Experiment 1 Results Summary

<table>
<thead>
<tr>
<th>Name</th>
<th>Prompt Type</th>
<th>Exposures</th>
<th>Learning Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kate</td>
<td>Model</td>
<td>2</td>
<td>No</td>
</tr>
<tr>
<td>Dan</td>
<td>MG</td>
<td>2</td>
<td>Yes</td>
</tr>
<tr>
<td>Andrew</td>
<td>Model</td>
<td>2</td>
<td>Yes</td>
</tr>
<tr>
<td>Mario</td>
<td>Model</td>
<td>2</td>
<td>Yes</td>
</tr>
<tr>
<td>Levi</td>
<td>Model</td>
<td>2</td>
<td>Yes</td>
</tr>
<tr>
<td>John</td>
<td>Model</td>
<td>2</td>
<td>No</td>
</tr>
<tr>
<td>Brian</td>
<td>MG</td>
<td>2</td>
<td>Yes</td>
</tr>
<tr>
<td>Adam</td>
<td>V+G</td>
<td>3</td>
<td>No</td>
</tr>
<tr>
<td>Emma</td>
<td>Model</td>
<td>4</td>
<td>No</td>
</tr>
<tr>
<td>Jackson</td>
<td>N/A</td>
<td>4</td>
<td>No</td>
</tr>
</tbody>
</table>
Prompt fade – Exp. 2

– Prompt type
  • Effective prompt type

– Prompt fading
  • LTM
  • 2-s progressive delay
  • MTL
Procedures

• LTM
  – Verbal and Gestural
  – Manual Guidance
  – Model
    • No prompt
    • Initial model – block 2.5 cm off of table
    • Partial model – block within 2.5 cm of base
    • Base Model – hovering block 2.5 cm over base destination
    • Full Model
Procedures

- 2 s progressive delay
- MTL
  - V+G
  - Model
  - MG
    - Hand-over-hand
    - Forearm
    - Upper arm
    - Light touch
    - No prompt
# Experiment 2 Results Summary

<table>
<thead>
<tr>
<th>Name</th>
<th>Prompt Fade</th>
<th>Exposures</th>
<th>Learning Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kate</td>
<td>Delay</td>
<td>2</td>
<td>Yes</td>
</tr>
<tr>
<td>Dan</td>
<td>Delay</td>
<td>2</td>
<td>No</td>
</tr>
<tr>
<td>Andrew</td>
<td>LTM</td>
<td>2</td>
<td>No</td>
</tr>
<tr>
<td>Mario</td>
<td>LTM</td>
<td>2</td>
<td>No</td>
</tr>
<tr>
<td>Levi</td>
<td>Delay</td>
<td>2</td>
<td>Yes</td>
</tr>
<tr>
<td>John</td>
<td>LTM</td>
<td>2</td>
<td>No</td>
</tr>
<tr>
<td>Brian</td>
<td>Delay</td>
<td>2</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Generality test – Exp. 3

- Generality Test
- Most-effective procedure
  - Assessment informed
- Least-effective procedure
  - Lowest frequency of independent steps per trial
Procedures

• Participants
  – 4 Males, 1 Female

• Materials
  – Educationally-relevant skills
    • 8 steps each
    • Task difficulty
    • Folding clothes, envelope stuffing, stapling papers, hole punching, making trail mix, and setting a table

• Replication
  – Most-effective procedure used twice
Procedures

• Verbal and Gestural (cont.)
  – MTL (e.g.)
    • Point to shirt and motion as if picking something up while stating “pick up shirt”
    • Point to shirt while stating “pick up shirt”
    • Point to shirt while stating “pick up”
    • State “pick up”
    • Student responds without a prompt
## Experiment 3 Results Summary

<table>
<thead>
<tr>
<th>Name</th>
<th>Most Effective</th>
<th>Least Effective</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kate</td>
<td>Model w/ Delay</td>
<td>V+G w/ MTL</td>
<td>Replication</td>
</tr>
<tr>
<td>Andrew</td>
<td>Model w/ LTM</td>
<td>V+G w/ MTL</td>
<td>*Replication</td>
</tr>
<tr>
<td>Levi</td>
<td>Model w/ Delay</td>
<td>V+G w/ MTL</td>
<td>Replication</td>
</tr>
<tr>
<td>John</td>
<td>Model w/ LTM</td>
<td>MG w/ MTL</td>
<td>Replication</td>
</tr>
<tr>
<td>Brian</td>
<td>MG w/ Delay</td>
<td>V+G w/ MTL</td>
<td>*Replication</td>
</tr>
</tbody>
</table>

*Least effective procedure potentially effective
Focus on the Analysis in ABA

- Relatively Reliable Results
- Limitations
  - Verbal + gestural prompt
  - Criteria for ending assessment
  - Equating response effort
  - Generality of results
- “Best” Teaching Procedure
  - Results suggestive of learning repertoire
    - Assessment as dependent measure
Prompt Types for QAnswering

• Echoic Prompts
  – Experimenter provides vocal model
    • Includes 1 word directives or complete sentences (Ahearn, MacDonald, Graff, & Dube, 2007)
  – Effectiveness has been demonstrated for teaching social questions (Secan, Egel, & Tilley, 1989)

• Textual Prompts (Finkel & Williams, 2001)
  – Experimenter provides textual model
    • Includes written words, lists, or instructions (Ahearn et al., 2007)
  – Used to teach children to engage in intraverbal behavior (conversations) (Krantz & McLannaghan, 1993; Sarokoff et al., 2001)
Keenan, Ahearn, & Miguel (2007)

![Graph showing cumulative number of trials for three participants: Jake 0%, Colin 80%, and Sean 100%. The graph compares the number of trials for 'echoic' and 'textual' categories.]
Cook, Ahearn, & Miguel (2009)

Cumulative Number of Trials to Criterion

- Parker 88.9%
- Benjamin 38.2%
- Walker 69.2%

Percentage of words read

- Echoic
- Textual
Related Matters

• “Best” Teaching Procedure (cont.)
  – Participant’s “preference”
    • Hanley, Piazza, Fisher, Conrucci, & Maglieri, 1997
  – Procedural integrity
  – Lower effort
  – Learning through observation
Bancroft, Weiss, Libby, & Ahearn (JABA; 2011)
Bancroft, Weiss, Libby, & Ahearn (JABA; 2011)
Teaching Observational Learning to Children Diagnosed with Autism

Jacquelyn MacDonald and William H. Ahearn

Western New England University

The New England Center for Children
MacDonald & Ahearn (JABA; in rev.)

- Run OL Assessment across five tasks
- Choose one deficient task to teach
- Teach: Attending to model
- Teach: Imitation
- Teach: Delayed Imitation
- Teach: Consequence Discrimination
- Re-assess OL tasks and task variations
MacDonald & Ahearn (JABA; in rev.)

<table>
<thead>
<tr>
<th>Task Variants for Observational Learning Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OL Tasks</strong></td>
</tr>
<tr>
<td>Hidden Item Task</td>
</tr>
<tr>
<td>Computer Game</td>
</tr>
<tr>
<td>Academic Task</td>
</tr>
<tr>
<td>Construction Toy</td>
</tr>
<tr>
<td>Building Toy</td>
</tr>
</tbody>
</table>
Slow to no progress in learning

- Procedural integrity
- Reinforcement
- Exposure to task – massed practice
Baseline

Increased Rate of Exposure to Training Trials

Percentage of Trials with Independently Correct Responding - Community Signs

Sessions
<table>
<thead>
<tr>
<th>Participants</th>
<th>Number per week during Baseline</th>
<th>Average number per week during Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Trials</td>
<td>Sessions</td>
</tr>
<tr>
<td><strong>AJ</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community Signs</td>
<td>45</td>
<td>5</td>
</tr>
<tr>
<td>Reading</td>
<td>45</td>
<td>5</td>
</tr>
<tr>
<td>Manual Signs</td>
<td>25</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Bret</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sequencing Pictures</td>
<td>50</td>
<td>10</td>
</tr>
<tr>
<td>Tooth Brushing</td>
<td>25</td>
<td>5</td>
</tr>
</tbody>
</table>
Another problem

- One variable that could slow learning is prompt dependency
To assess whether differential reinforcement of prompted and independent responses is effective in decreasing prompt dependency.
Method

- Three reinforcement programs
  - Differential Reinforcement 1: most potent reinforcer delivered for independent responses
  - Differential Reinforcement 2: no reinforcement provided for prompted responses
  - No Differential Reinforcement: same reinforcer delivered for prompted and independent responses
Method

- Three sets of sight words were taught using a matching to sample (2 s c. delay/MTL)
Research to Practice: Practice to Research

- When setting our goals as clinicians
  - Research can help set our agenda
  - For ASDs, the goals are clear
  - But, how to get there not always clear

- Research in treatment settings
  - The best way to identify effective Tx
  - These effective teaching tools can be bettered
  - Best practices can be revealed
Focused Best Practice Research - NECC

- Established groups
- Provide resources
- Learn and distribute
Treatment Research at NECC
“Preventing” Severe Behavior

Treatment Research at NECC
Tx of Stereotypic Behavior

A Case History in Best Practice

- Stereotypic behavior circa 2000
- Function-based TX?
Context: Presence of others

- SD
- EO/AO
- R
- APP Beh.
- Sr+
- R
- Automatically Reinforced Behavior
- Socially-mediated consequences
- Sensory consequences
A Case History in Best Practice

- Stereotypic behavior circa 2000
  - Status as functional operant class
  - Manualized recommendations
  - Status of evidence
- Establish competing behavior! How?
- RB for Auto SIB (N=1-2)...
- NCR (Piazza et al. 1998/2000)?
  - Ahearn et al. (2003/2005)
- DRO! (but does not foster CB!)
- DRA?
Response Interruption + RD – Ahearn et al. (2007)

- 5-minute sessions
  - No interaction baseline
  - Reinforce requesting/app speech
- Contingent upon vocal stereotypy
  - Establish attention (eye contact)
  - Ask social questions (hi-p compliance)
  - Reinforce requesting/app speech
Response interrupt + redirect (RI+RD)

Percentage of intervals - Vocal Stereotypy

BL  RI+RD  BL

Session

Frequency appropriate speech

appropriate  VS

Cal
A Best Practice Revealed

- Spurred a flurry of studies on this technique
  - Martinez & Betz (2013)
- Several variants of RIRD effective
- TX comparisons have favored RIRD (however!)
- Added components that target supporting adaptive skills likely superior to RIRD alone
  - Colon, Ahearn, et al. (2012)
- Vanderkerken et al. (2013)
  - Meta-analysis of SCE for VCB (N=74)
  - Large TX effect (e.g., RIRD – VS+)
RIRD video

Clip 4 - BL

Clip 5 – RIRD 1st session
Moving on past RIRD

Clip 6 – Teaching social reciprocity

Clip 7 – Generalization
Establish Appropriate Behavior

- Social interaction (via prompting)
  (e.g., Odom & Strain, 1986; MacDonald et al., 2009)
- Play skills (via prompting & whatever)
  (e.g., Libby et al., 2009; Tereshko et al., 2011)
- Collateral effects → Less stereotypy
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  - Research can help set our agenda
  - For ASDs, the goals are clear
  - But, how to get there not always clear
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  - The best way to identify effective Tx
  - These effective teaching tools can be bettered
  - Best practices can be revealed
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