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Using iPads and Video-Based Instruction to Teach Algebra to High School Students with Disabilities

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Video-Based Instruction (VBI)

- Video Modeling Other
- Video Self-Modeling
- Point-of-View Video Modeling
- Video Feedback
- Video Prompting

Most VBI research has targeted functional and social skills

- Few studies on VBI and academic skills for learners with disabilities (Prater, Carter, Hitchcock, & Dowrick, 2011)
Purpose of the Study

Video Prompting → chained tasks
- Algebraic equations
  - Distributive property
  - Combining like numerical terms
  - Isolating the variable

Example:

\[ 9 - 3(7x - 1) = 4(2 - x) \]
<table>
<thead>
<tr>
<th>Participant</th>
<th>Age</th>
<th>Disability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eugene</td>
<td>15 years</td>
<td>Emotional/Behavioral Disorder</td>
</tr>
<tr>
<td>Noah</td>
<td>15 years</td>
<td>Emotional/Behavioral Disorder</td>
</tr>
<tr>
<td>Morgan</td>
<td>14 years</td>
<td>Autism Spectrum Disorder</td>
</tr>
<tr>
<td>Carol</td>
<td>16 years</td>
<td>Attention Deficit Hyperactivity Disorder</td>
</tr>
</tbody>
</table>
Task Analysis

Task Analysis for Target Equations

Simplify left side using distributive property

- Step 1: distribute first term on left and write product below
- Step 2: distribute second term on left and write product below
- Step 3: drop down constant on left
- Step 4: drop down equal sign
- Step 5: distribute first term on right and write product below
- Step 6: distribute second term on right and write product below
- Step 7: combine terms and write sum below
- Step 8: drop constant on left
- Step 9: drop equal sign
- Step 10: drop constant on right
- Step 11: drop variable on right
- Step 12: write variable under right side
- Step 13: cross out cancelling variables on the right
- Step 14: write variable under left side
- Step 15: add left variables and write sum below
- Step 16: drop constant on left
- Step 17: drop equal sign
- Step 18: drop constant on right
- Step 19: write constant under left side
- Step 20: cross out cancelling terms on the left
- Step 21: write constant under right side
- Step 22: subtract numbers and write difference below
- Step 23: drop variable
- Step 24: drop equal sign
- Step 25: write coefficient under the left side
- Step 26: cross out cancelling terms on the left
- Step 27: write coefficient under the right side
- Step 28: divide numbers on right and write answer below
- Step 29: drop variable
- Step 30: drop equal sign
VP Materials

- GoPro Hero 3
  - Tripod
- iPad 2
  - Belkin Trifold Case
- PlayerExtreme App
Creating the Video Models

- Recorded using GoPro Camera
  - point-of-view perspective
- Imported video file into iMovie
- Exported video file as .mp4
- Saved to Dropbox
- Video file accessed on iPad via PlayerExtreme application
Target equation:

\[ 9 - 3(5x - 1) = 4(1 - x) \]

Generalization equation:

\[ 4 + 1(9x + 5) = 6(7 + x) \]
“A behavioral change may be said to have generality if it proves durable over time, if it appears in a wide variety of possible environments, or if it spreads to a wide variety of related behaviors.” (Baer, Wolf & Risley, 1968)
Generality and Objectives: Acquisition > Fluency > Maintenance > Generalization

Given the items to make a peanut butter sandwich, James will independently make a sandwich in 2 minutes or less in each of three (or more) typical settings (e.g., kitchens, picnic table, classroom), for 3 consecutive trials dispersed across two weeks for each setting.

Maintenance occurs when behavior continues over time following the removal of procedures that established the behavior.

Maintenance AKA: Response maintenance; Resistance to Extinction; Durability; Behavioral Persistence
Stimulus Generalization occurs when responses that have been reinforced in the presence of a specific stimulus occur in the presence of different but similar stimuli.

Response Generalization occurs when training of behavior(s) that are members of a response class result in the occurrence of untrained members of the response class.
Factors that promote generalization:
- Train & hope (not what to do)
- Sequentially modify environments
- Use Natural contingencies
- Train sufficient exemplars (stimulus exemplars are used in general case programming)
- Train loosely
- Use indiscriminable contingencies
- Program common stimuli
- Train self-management responses
Planning instruction to promote generalization

- Teach functional behaviors
- Design or modify environments to support adaptive behaviors
- Consequate with natural reinforcers
- Teach skills in vivo when possible
- Employ physical and social stimuli that are common to those of the target setting(s)
- Provide multiple stimulus and response exemplars
- Vary nonessential stimuli
- Move from continuous to variable schedules of reinforcement
- Employ self-mediated antecedent and consequent stimuli
- Reinforce prompted and unprompted generalizations
Methods

- **Pre-Baseline Screening**
  - prerequisite skills (e.g., digit printing, calculator skills, a task related construct, attention)
  - proficiency: target and generalization equations

- **iPad Training**
  - Demonstration
  - Completion of a novel chained task using VP

- **Baseline**
  - Materials: worksheets, pencil, calculator
  - 5 equations
  - No time limit
  - Dependent Measures: 1) percent of equations correct 2) percent of steps
Methods

- **Intervention**
  - Only one participant at a time
  - Materials: iPad, worksheets, pencil, calculator
  - Pre-VP probe: 5 equations (assessment)
    - No time limit
  - VP: 2 equations (training)

- **Dependent Measures**
  - Assessment:
    - Percent of equations correct
    - Percent of steps correct
  - Training
    - Percent of steps imitated correct
Directions: Solve the equations

\[9 - 4(3x - 2) = 7(4 - x)\]
9 - 4(3x - 2) = 7(4 - x)

9 - 12x + 8 = 28 - 7x

-12x + 17 = 28 - 7x

+ 7x  + 7x

-5x + 17 = 28

-17 - 17

-5x = 11

-5

-5

x = -2.2
Methods

Probe Sessions (follow-up assessment)
- Conducted after participant reached mastery (i.e., 80% of equations correct for two consecutive sessions)
- Materials: worksheets, pencil, calculator
- 5 target equations: $9 - 3(5x - 1) = 4(1 - x)$
- 5 generalization equations: $4 + 1(9x + 5) = 6(7 + x)$
- No time limit

Dependent Measures
- Percent of target equations correct
- Percent of generalization equations correct
- Percent of steps correct on both
Figure 1. Percentage of equations solved correctly by the participants for baseline, pre-Video Prompting (VP), probe and generalization probe sessions.
Figure 2. Percentage of steps completed correctly by the participants for baseline, pre-Video Prompting (VP), Video Prompting, probe, and generalization probe sessions.
Social Validity

- Enjoy using the iPad and the videos?
- Videos and iPad taught the target skill?
- Videos and iPad useful for future instruction?
  - All participants “strongly agree” or “agree”
- Videos and iPad efficient use of time?
  - 3 participants: “strongly agree” – 1 participant “disagree”
- Teacher: “Strongly agree” to all items
Suggestions for improving the intervention:

**Eugene:** “Nothing. I like it just how it is. It helped me a lot.”

**Noah:** “It would have been better if the math was a fun game.”

**Morgan:** “The teacher could improve it by making the equations shorter and easier.”

**Carol:** “Don’t change it. It helped me because it went through all the steps slowly. It helped me learn how to do it.”
Implications for Practice

- Cost-efficient
- Time-efficient
- High school students interested in post-secondary education
- Independent learning
  - Time efficient for practitioner
- VBI via mobile technology
  - across school environment
  - school to home
  - reluctant learners
    - typical approaches to instruction – aversive
    - tablets, computers, video: associated with recreation
Questions?
