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Elias Clinton
Black Hills State University, clintonelias@gmail.com

Tom J. Clees
University of Georgia, tclees@uga.edu

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Recommended Citation
Clinton, Elias and Clees, Tom J., "Using iPads and Video-Based Instruction to Teach Algebra to High School Students with Disabilities" (2016). *National Youth-At-Risk Conference Savannah*. 76.
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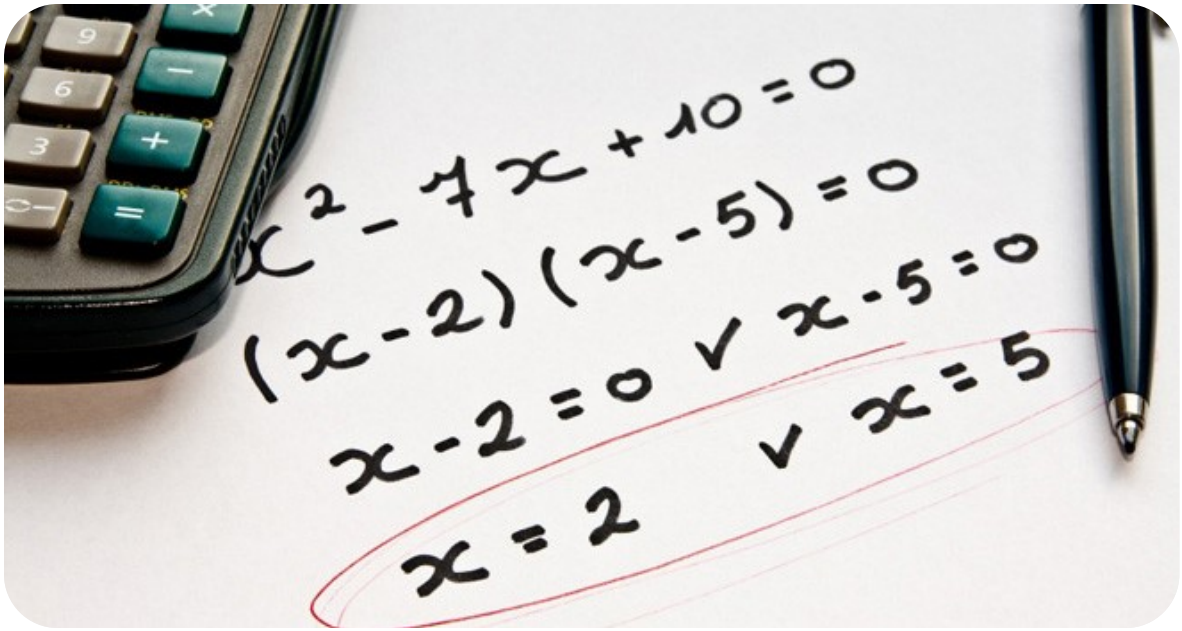
Using iPads and Video-Based Instruction to Teach Algebra to High School Students with Disabilities



Elias Clinton, Ph.D.
Black Hills State University
elias.clinton@bhsu.edu

&

Tom Clees, Ph.D.
University of Georgia
tclees@uga.edu

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:

$$9 - 3(7x - 1) = 4(2 - x)$$

Participants

Participant	Age	Disability
Eugene	15 years	Emotional/Behavioral Disorder
Noah	15 years	Emotional/Behavioral Disorder
Morgan	14 years	Autism Spectrum Disorder
Carol	16 years	Attention Deficit Hyperactivity Disorder

Task Analysis

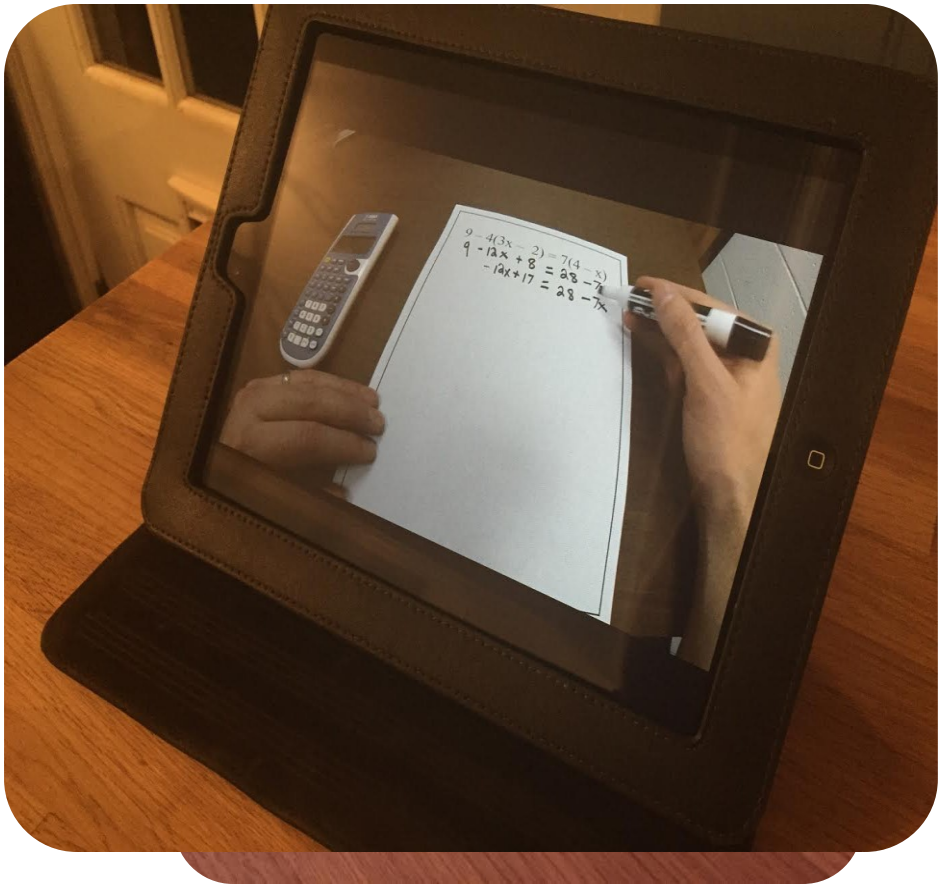
Task Analysis for Target Equations

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

Equations

Target equation:

$$9 - 3(5x - 1) = 4(1 - x)$$

Generalization equation:

$$4 + 1(9x + 5) = 6(7 + x)$$

Generalization

"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)

Generalization

- **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

Generalization

- **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.

Generalization

- **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

Student Name: _____ **Date:** _____

Directions: Solve the equations

$$9 - 4(3x - 2) = 7(4 - x)$$

Student Name: [redacted]

Date: 2-27

Directions: Solve the equations

$$9 - 4(3x - 2) = 7(4 - x)$$

$$9 - 12x + 8 = 28 - 7x$$

$$-12x + 17 = 28 - 7x$$

$$+7x \qquad\qquad +7x$$

$$-5x + 17 = 28$$

$$-17 \quad -17$$

$$\frac{-5x}{-5} = \frac{11}{-5}$$

$$x = -2.2$$

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

Results

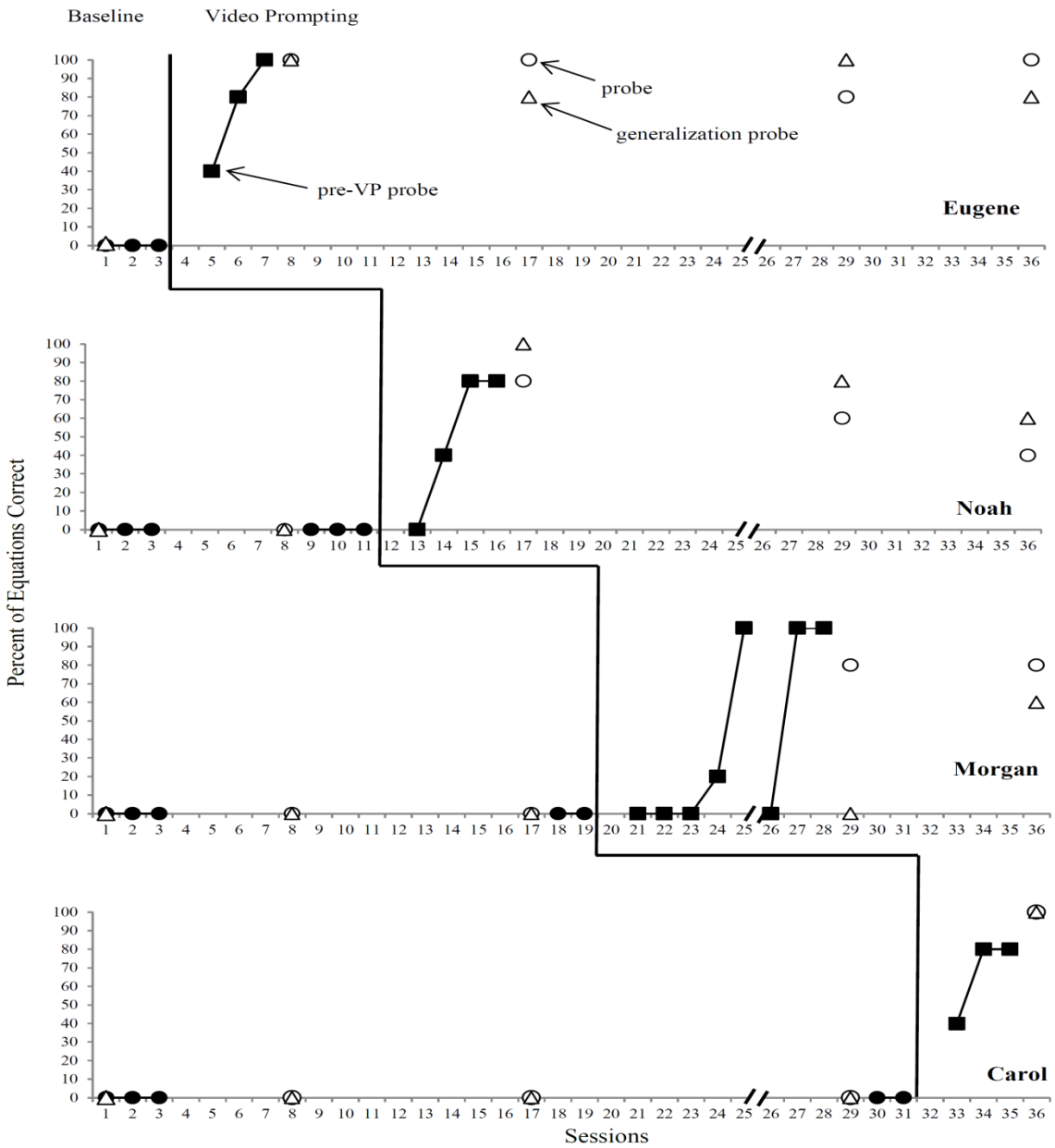


Figure 1. *Percentage of equations solved correctly by the participants for baseline, pre-Video Prompting (VP), probe and generalization probe sessions.*

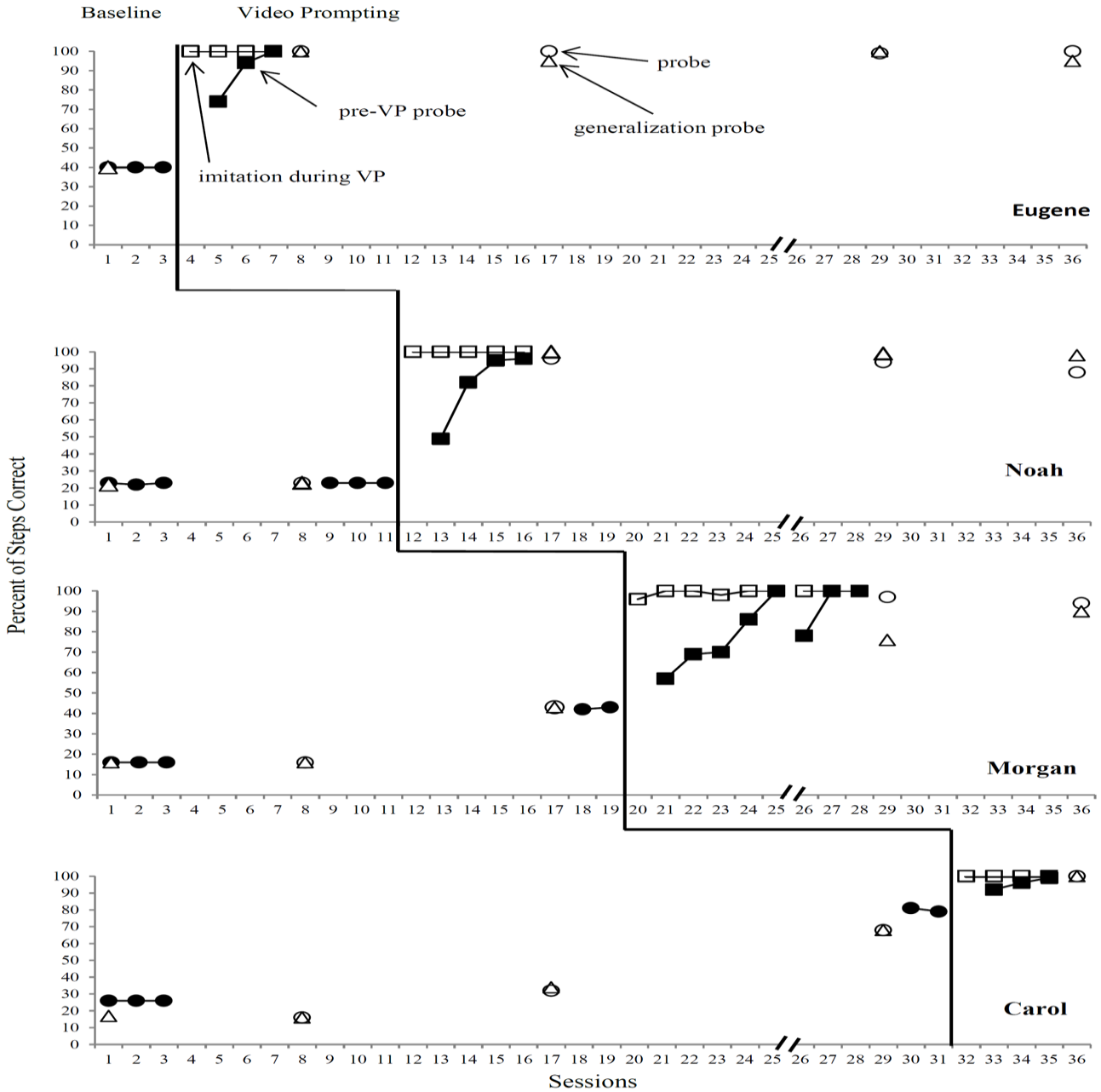


Figure 2. *Percentage of steps completed correctly by the participants for baseline, pre-Video Prompting (VP), Video Prompting, probe, and generalization probe sessions.*

Results

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

Results

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?

References

Baer, D. M., Wolf, M. M., & Risley, T. R. (1968). Some current dimensions of applied behavior analysis1. *Journal of Applied Behavior Analysis, 1*(1), 91-97.

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