Comparing the Effects of Computer-Assisted Instruction with and without Video Stimuli To Teach Science Content

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What is Computer-Assisted Instruction (CAI)

- Instructional Technology vs. Assistive Technology
- Any technology that actually provides the specialized instruction
- Can be used in separate settings and inclusive settings
- Addresses barriers to inclusion or high-quality instruction
  - Using already available software decreases cost
  - Individualized to meet student needs
  - Customized to match student preferences and interests

Is CAI and Evidence-based Practice?

- Knight et al. (2013)
  - 65 empirical articles (group and single case research designs) were included in the analysis
  - Findings suggest a low level of evidence to support the use of CAI
- Wong et al. (2015)
  - Two reviews
    - National Standards Project- 775 studies
    - National Professional Development Center on ASD- 175 studies
  - Finding support CAI as an EBP
- Root et al. (2017)
  - Evaluation based on 10 single case and two group design studies
  - Findings suggest CAI to teach academics meet criteria to be deemed an EBP
  - Not enough studies teaching science

Characteristics of Effective CAI Interventions

- Effective studies use principles of systematic instruction
  - Stimulus prompting
  - Error correction and feedback
  - Delay intervals
  - Stimulus fading (Knight et al., 2013)
- CAI to teach science content
  - 5 science terms and applications of those terms (Smith, Spooner, & Wood, 2013)
    - Did not include video instruction
  - 5 parts of an amoeba and their function (McKissick, Ley Davis, Spooner, Fisher, & Graves, 2018)
    - Included video instruction
- Data from both CAI studies demonstrated acquisition of targeted skills, but the data look very different……

How Can CAI Support Rural Special Educators?

- Addresses a lack of resources Does not require expertise in special education pedagogy for general educator
  - Does not require special educator to have content area expertise
- Provides a high-quality activity for students so teachers can attend to other responsibilities
- Technology can combat geographic isolation

(Berry et al., 2011; Brownell et al., 2005; Hammond & Ingals, 2003; Howley et al., 2011)

Why Science?

- Science inquiry is about problem-solving
  - The ability to ask questions about the natural world
  - The ability to create ways to answer those questions
- Teaching science process skills are generalizable across curricula
  - Students with ASD struggle to generalize skills across settings, materials, and people
- Science has personally-relevant (i.e., functional) applications
  - Why is it important to wash your hands before you eat?
  - Why shouldn't I drink water directly from the lake?

(Knight, Wood, McKissick, & Kuntz, 2018; McKissick, 2018; Spooner, McKissick, Knight, & Walker, 2014)

Research Questions

Smith et al. (no videos)

- What is the effectiveness of embedded CAI on student acquisition of science terms?
- Who what extent will students generalize target science terms and applications to class activities within the inclusive setting?
- What are the participant's perceptions of using CAI within the inclusive setting?
- What are teacher perceptions of using CAI within the inclusive setting?

McKissick et al. (videos)

- What is the effectiveness of a CAI intervention package on student acquisition of science terms and their function?
- What are the participants' opinions of using a CAI package to teach grade aligned science concepts?
- What are the teacher/paraprofessionals' perceptions of using a CAI package to teach grade aligned science concepts?

Participants

Smith et al. (no videos)

- Matt (12 years)
  - Asian/Pacific Islander
  - Male
  - IQ= 69 (WISC IV)
  - Verbal
  - Science and ELA in gen ed. setting
- David (11 years)
  - African American & Caucasian
  - Male
  - IQ= 59 (WISC IV)
  - Verbal
  - ELA in gen ed. setting
- Ken (12 years)
  - Native Hawaiian/Other Pacific Islander
  - Male
  - No IQ score on file
  - Verbal with some echolalia
  - Academics in segregated setting

McKissick et al. (videos)

- Penny (14 years, 8 months)
  - Caucasian
  - Female
  - IQ= 71 (WISC III); GARS= 98
  - Verbal with some echolalia
  - Academics in segregated setting
- Sheldon (14 years, 11 months)
  - Hispanic
  - Male
  - IQ= 49 (WISC III)
  - Verbal with some echolalia
  - Academics in segregated setting
- Leonard (13 years, 6moths)
  - African American
  - Male
  - No IQ score on file; GARS= 113
  - Verbal, mostly echolalic
  - Academics in segregated setting

Research Methodology for Both

- Multiple probe across participants (Cooper, Heron, & Heward, 2007)
  - Dependent Variable: number of correct responses on probe slideshow
  - Independent Variable: CAI intervention package
- Social Validity
  - Teachers and participants
- Reliability and Fidelity
  - Across at least 30% of sessions across conditions
  - Log recording opportunities to complete intervention

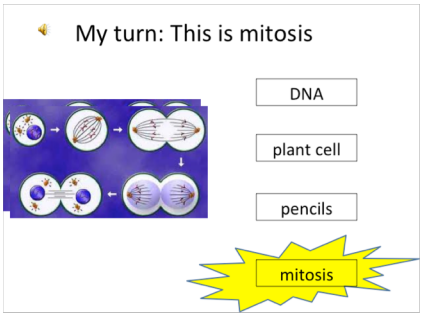
Probes for Both

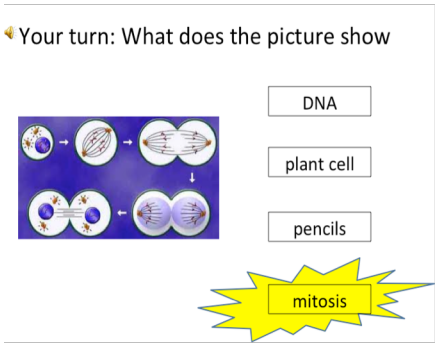
- Implemented in segregated special education classroom
- Materials
  - 3 versions of probes to limit memorization
  - Randomized order of response option
  - Smith et al. used an iPad
  - McKissick et al. used school computers

Smith et al. CAI Intervention

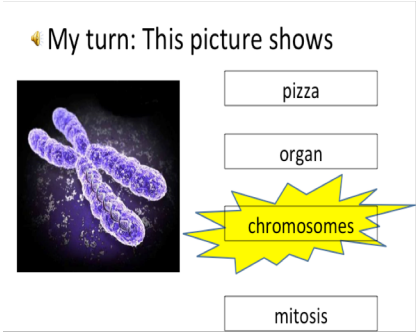
- Setting: 7th grade science classroom
- 12 total slides per unit
  - Touch science term associated with picture
  - Touch science term associate with definition
  - Touch science term associated with application
- Explicit instruction via model test format
  - Yellow star response prompt
    - My turn slides: appeared automatically
    - Your turn slides: appears after 4 seconds if participant does not respond OR appears if participant makes an incorrect response
  - Slide show only advances if participant makes a correct response

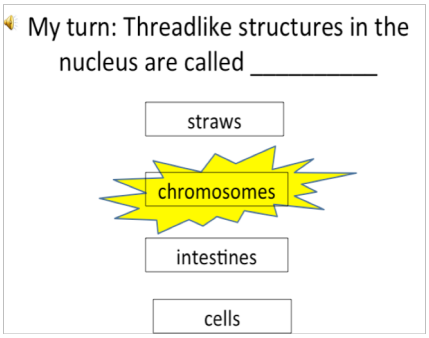
Intervention Slides





Intervention Slides





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McKissick et al. CAI Intervention

- Setting: Special education classroom
- 31 slides
  - 2 minute video about amoebas
  - Video introducing the term (e.g., cell membrane, nucleus, pseudopod)
  - Explicit instruction on term and function
  - Reinforcing video for selecting the correct response
    - Based on student preferences
- Explicit instruction via model test format
  - Yellow star response prompt
    - My turn slides: appeared automatically
    - Your turn slides: appears after 4 seconds if participant does not respond OR appears if participant makes an incorrect response
  - Slide show only advances if participant makes a correct response

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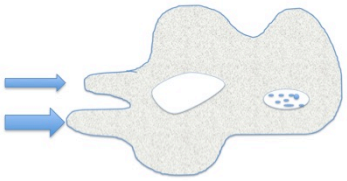
Probe Slide

What are the arrows pointing to?



- food vacuole
- pseudopods
- pencil
- nucleus

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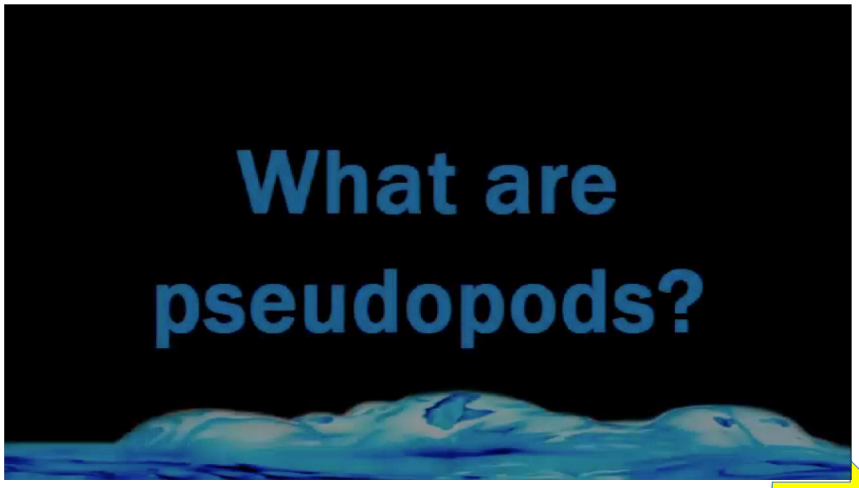
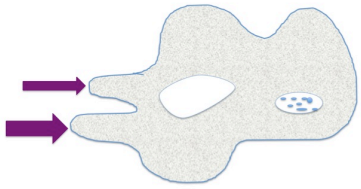
Great Work! When you are finished watching the video click the arrow to continue

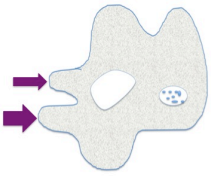


Intervention Slides

My Turn: The arrows are pointing to the **pseudopods**



Your turn, what are the arrows pointing to?



nucleus

pencil

pseudopods

food vacuole

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Intervention Slides

Your Turn: The _____ helps the amoeba move.

cell membrane

food vacuole

ruler

pseudopods

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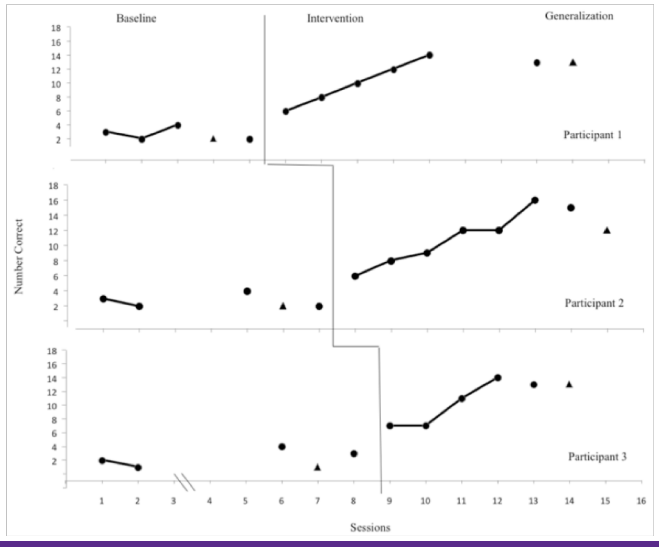
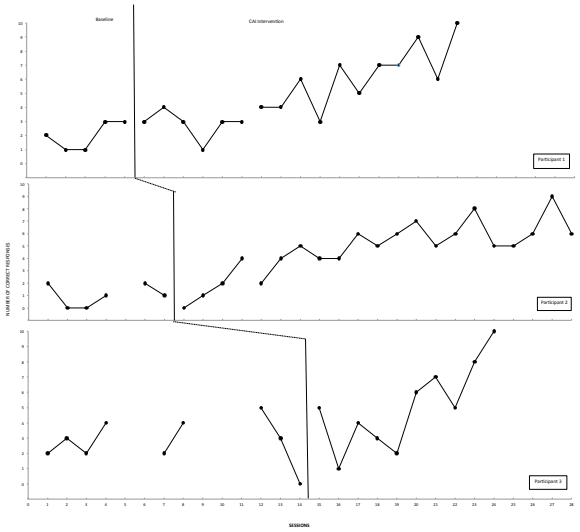
Reinforcement Slides

That's Right!

Without Videos Data (Smith et al.)



With Videos Data (McKissick et al.)



Data Comparison

Smith- without videos

- All three participants acquired 5 terms and 5 applications
- Functional relation
- Immediate change in level following introduction of CAI
- Stead increasing trend
- Sessions to criterion
  - Matt- 5
  - David-6
  - Ken-4

McKissick- without videos

- All three participants acquired 5 parts of an amoeba and 5 functions
- Functional relation
- Change in level between 1 and 6 sessions of CAI
- Variable data
- Sessions to criterion
  - Penny- 17
  - Sheldon- 21
  - Leonard- 10

Social Validity

Smith- without videos

- Teachers agreed…
  - Skills were important
  - CAI was effective and feasible
  - CAI was not disruptive
  - Time well used
- Students agreed
  - Liked using iPads
  - Pictures helped learn targeted skills
  - Would like to use iPads in the future
  - Did not feel isolated from the class

McKissick- without videos

- Teachers
  - Skills were important and valuable
  - CAI was effective and feasible
  - CAI was not disruptive
  - Time well used
- Students agreed
  - Liked using CAI program
  - Preferred CAI over textbook
  - Pictures helped learn target skills
  - Would like to continue using CAI
  - Did not feel isolated from the class
  - When asked if the video clips helped learn the target skills, one student indicated "yes", one student "no", and the other student "maybe"

Limitations

Smith- without videos

- Some participants did not continue going to inclusive science
- At the time, iPad was only tablet capable of showing animations
- Inconsistencies synching to Key Note
- CAI is an intervention package

McKissick- without videos

- No generalization or maintenance data due to winter break
- Had to implement multiple sessions a day for Sheldon
- Mechanical issues with school computers
- CAI is an intervention package

Why the Discrepancy?

- Embedded video clips vs. video models
- Order of CAI intervention
  - Video then instruction OR instruction then video?
- Inclusion vs. segregated setting experience
  - Academic vs. non-academic inclusion
  - History of receiving previous science instruction
- Terms taught linked to a personal experience
  - Tornados
    - Intervention includes floor plans of participants' homes and school

Next Steps

- CAI to teach science practices not isolated skills
  - Making observations
  - Conducting an experiment
- Replication with video models
  - Showing how to use equipment for an experiment
- Implementation in general education classroom
  - Collaborative Pre-teaching
  - Does it impact participation and engagement?
  - Does it change teacher perceptions?
- Teacher created CAI

QUESTIONS?

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