

# Supporting Decoding by Individuals with Down Syndrome Through an AAC App Feature

*Lauramarie Pope & Christine Holyfield*

ASHA Annual Convention  
November, 2021

# The Team!

*Janice Light*

*Erik Jakobs*

*David McNaughton*

*Emily Laubscher*

*Olivia Pfaff*

Background

# The Importance of Literacy in Adolescence and Adulthood

- Full participation in adolescent and adult life means engaging meaningfully in social, academic, and vocational contexts
- Increasingly, engagement in such contexts is achieved in no small part by applying literacy skills



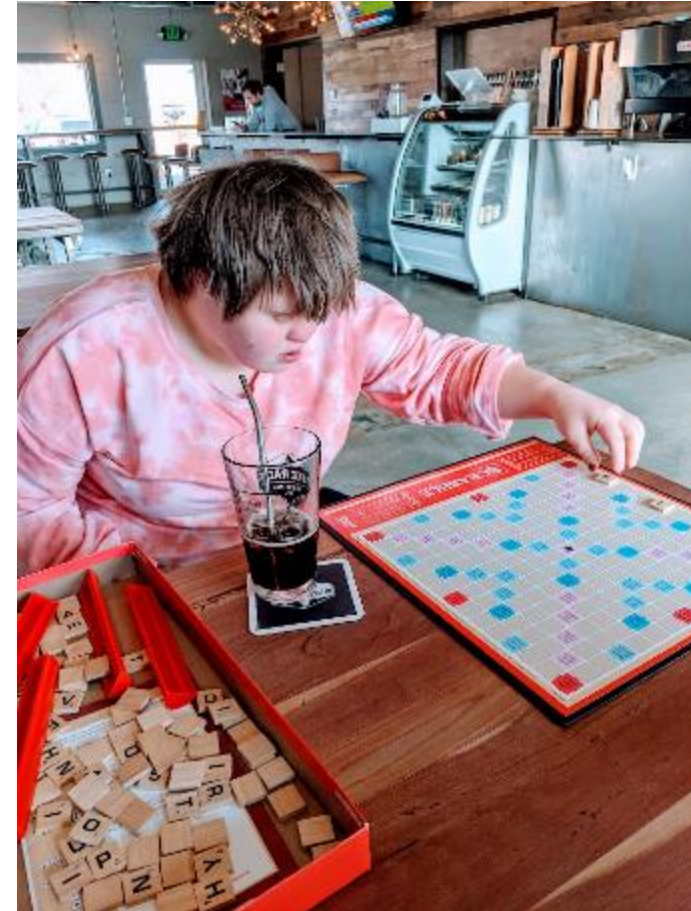
# Literacy and Adolescents and Adults with Limited Speech



- For adolescents and adults with restricted speech, the importance of literacy is further elevated
- Using a keyboard option on AAC technologies allows for fully generative communication unincumbered by the need to pre-program words into the device or a reliance on others for access to vocabulary

# Literacy for Adolescents and Adults with Down Syndrome

- Unfortunately, most adolescents and adults with Down syndrome and limited speech do not have functional literacy skills
- Furthermore, they have reached an age where educational opportunities to develop literacy skills are limited



# AAC Technology Designed to Support Literacy



- In recent years, AAC researchers have advanced the science of effective AAC technology design, expanding the scope of what AAC technology can support
- Specific to literacy, an AAC technology feature was recently developed to support the recognition of single words, or sight word reading

sing



shop



bike



swim



phone



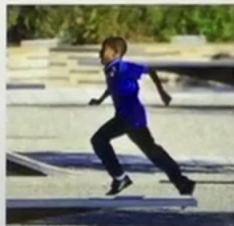
home



walk



run



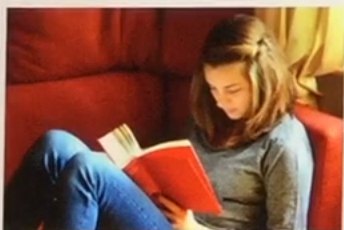
shoes



bake



read



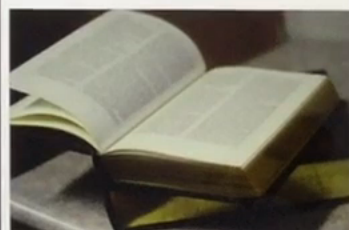
eat



sleep



book



bowl





# AAC Technology Designed to Support Literacy

- Empirical evidence revealed the efficacy of the feature in increasing single word reading
- Research focused on adolescents and adults, including adolescents and adults with Down syndrome, showed the AAC technology feature could improve their reading of single words
- Access to this app feature should be supplementary to direct literacy instruction



# New Technological Development

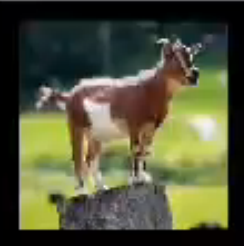


- Sight word reading is an important and functional skill
- However, it does not represent full functional literacy
- Therefore, AAC researchers developed a new technology feature with a goal of expanding the reach of AAC technology to building decoding skills

example : Navigating

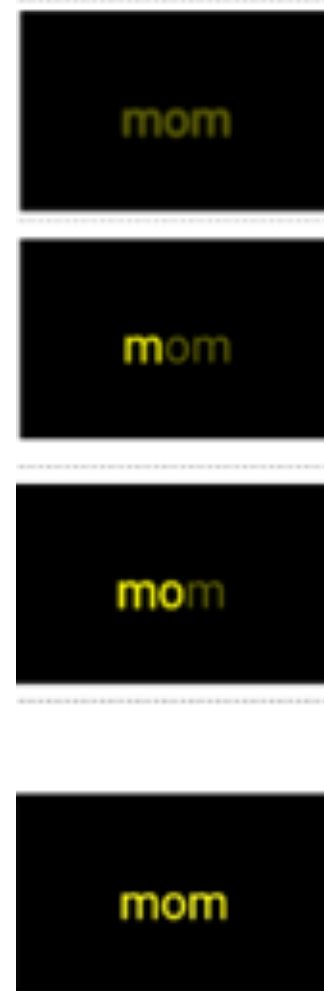


# Default : Navigating



# Theoretical Support for the Newly Developed Feature

- Text appears dynamically and enlarges
- Motion and enlargement drives visual attention to text
- Each letter highlighted in turn
- Luminance drives visual attention to letter
- Letter sound is spoken slowly as letter is highlighted
- Speech output supports phonological processing



# The Current Studies



- This presentation will briefly share about three recently completed studies evaluating the efficacy of the new app feature
- All three studies were focused on exploring use of the feature by adolescents and adults with Down syndrome

# The Current Studies

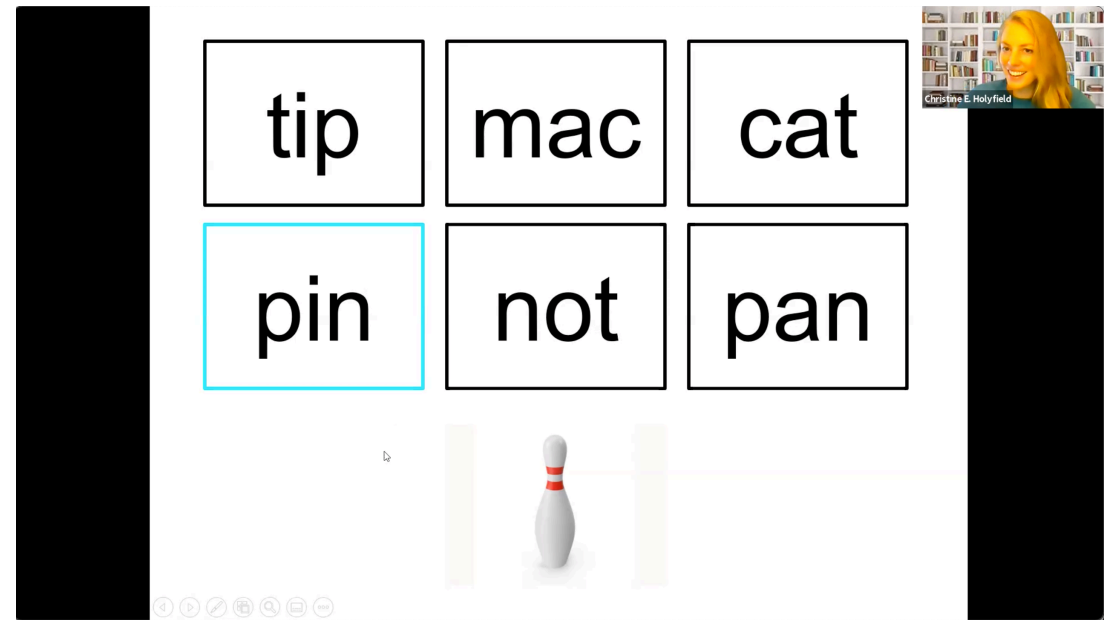
# Overview of Study Designs

- All studies used single subject research design methodology
- All studies followed guidelines from the What Works Clearinghouse for single subject research
- All studies had at least two phases: a baseline phase in which only testing occurred, and an intervention phase in which participants interacted using the AAC app with the novel feature to support decoding



# Remote Adaptations

- Due to the pandemic, all studies were implemented remotely via Zoom
- PowerPoints for both testing and teaching were screen shared over Zoom, with remote control and sound sharing with the participants enabled



# Study #1

Effect of the decoding feature on the **basic decoding skills** of individuals with Down syndrome

# Research Questions

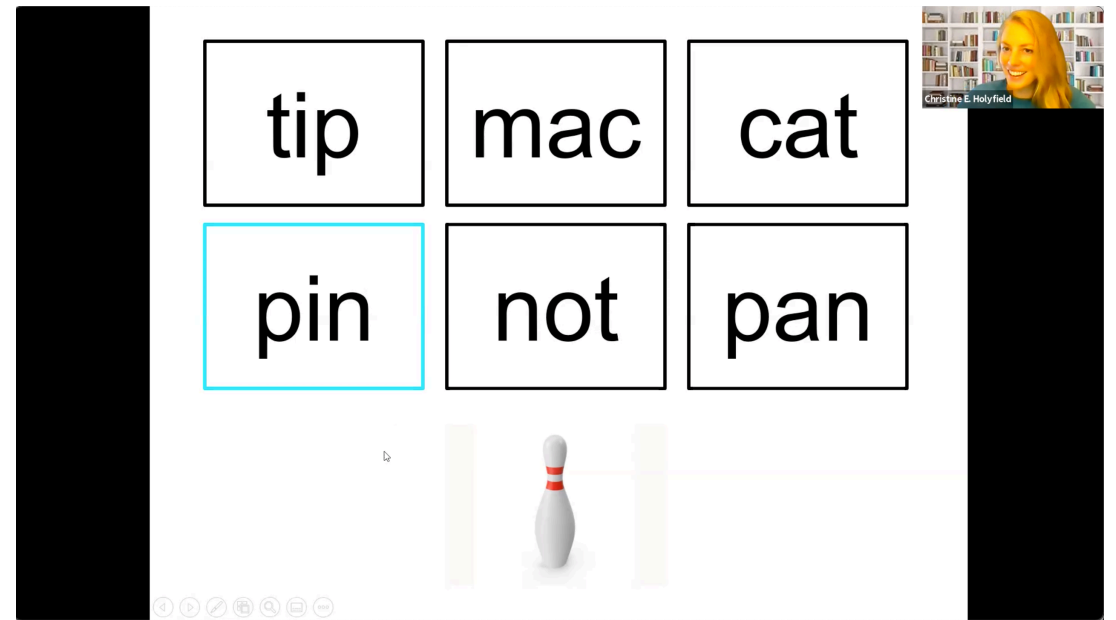
- What is the effect of exposure to the AAC decoding app feature during motivating interactions on the **single word reading** of *untaught* CVC words by participants with Down syndrome and limited functional speech?
- What is the effect of exposure to the AAC decoding app feature during motivating interactions on the **single word reading** of CVC words *taught through the app* by participants with Down syndrome and limited functional speech?

# Participants

- Three individuals with Down syndrome participated
- Two participants were adolescents
- One participant was a young adult
- All participants had limited speech that was difficult for others to understand
- All participants had some letter sound knowledge, but had not yet developed decoding skills

# Probing Reading Performance

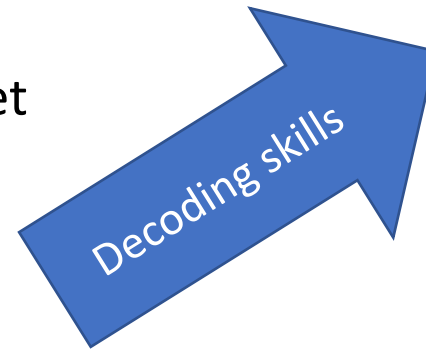
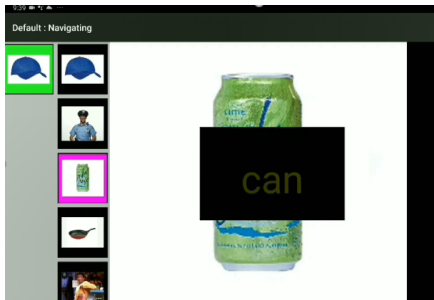
- Single-word reading of regular, CVC words was tested throughout the study
- Participants were tested on both words that were taught in the study using the AAC app feature and words that never appeared on the app, to ensure increases in true decoding skills
- No teaching or differential feedback occurred during testing



# Target Words

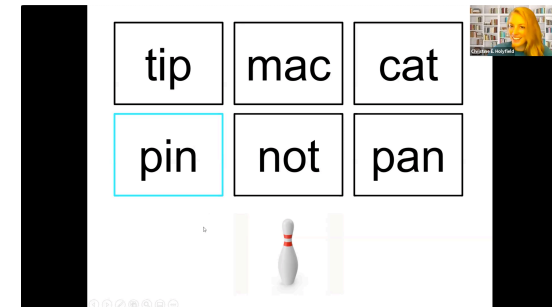
## Taught

- 3-letter CVC words
- Included only a small group of target letter sounds (t, m, c, p, n, a, i, o)
- Probed for reading performance
- **Taught via the AAC app feature during intervention**



## Untaught

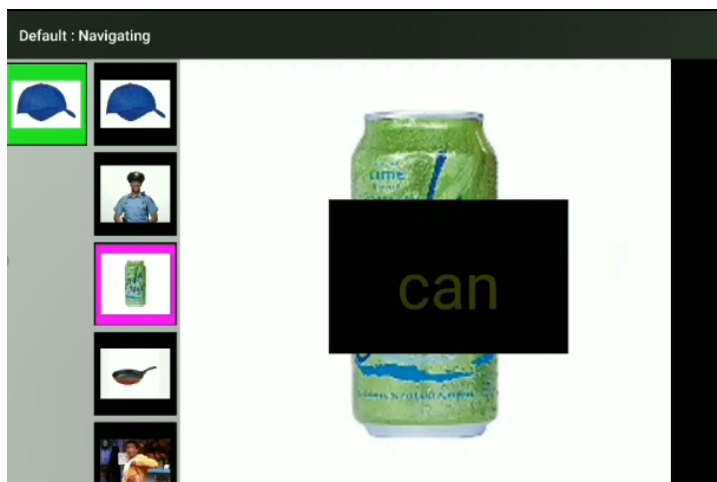
- *Different* 3-letter CVC words
- Included only the *same* small group of target letter sounds (t, m, c, p, n, a, i, o)
- Probed for reading performance



# Interacting Using the App



What does Elsa see?



- Participants engaged in a structured adapted book shared reading interaction with the researchers
- Participants answered questions about the adapted books using the AAC app with the feature to support decoding enabled

# Results

- All three participants showed increases in reading both taught and untaught words following repeated interactions with the AAC app with the decoding feature
- Effect size estimations show a medium to strong effect of the novel decoding feature on participant performance

Participant	Untaught Words (Effect size)	Taught Words (Effect size)
1	0.81 (medium)	0.68 (medium)
2	0.79 (medium)	0.74 (medium)
3	0.96 (strong)	0.87 (medium)



# Study #2

Effect of the decoding feature on **more advanced decoding skills** of individuals with Down syndrome

# Research Questions

- What is the effect of exposure to the AAC app decoding feature on the **single word reading** of 3-5 letter *untaught* words by participants with Down syndrome and limited functional speech?
- Do any observed effects maintain 1-3 weeks after intervention has ended?
- Do any observed effects generalize to increases in encoding (spelling words)?

# Participants

- Three individuals with Down syndrome participated
- Two participants were young adults
- One participant was an adolescent
- All participants had limited speech that was difficult for others to understand
- All participants had some decoding skills, but they were limited

# Probing Reading Performance

- Single-word reading of 3-5 letter words was tested throughout the study
- Participants were tested on words that never appeared on the app, to ensure increases in true decoding skills
- No teaching or differential feedback occurred during testing

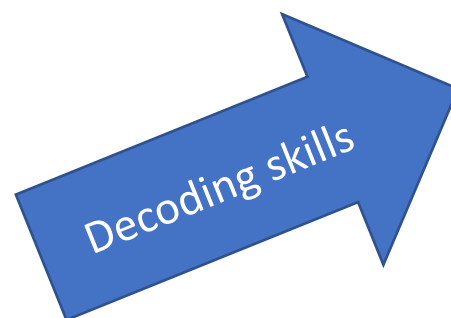
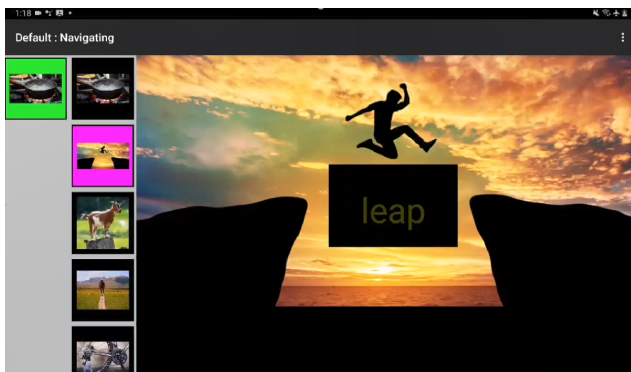
cod	code	cad	coal
cowed	coat	coil	cot



# Target Words

## Taught

- 3-5 letter words
- Included a small group of medial vowels (oi, ea, oa, e)
- **Taught via the AAC app feature during intervention**



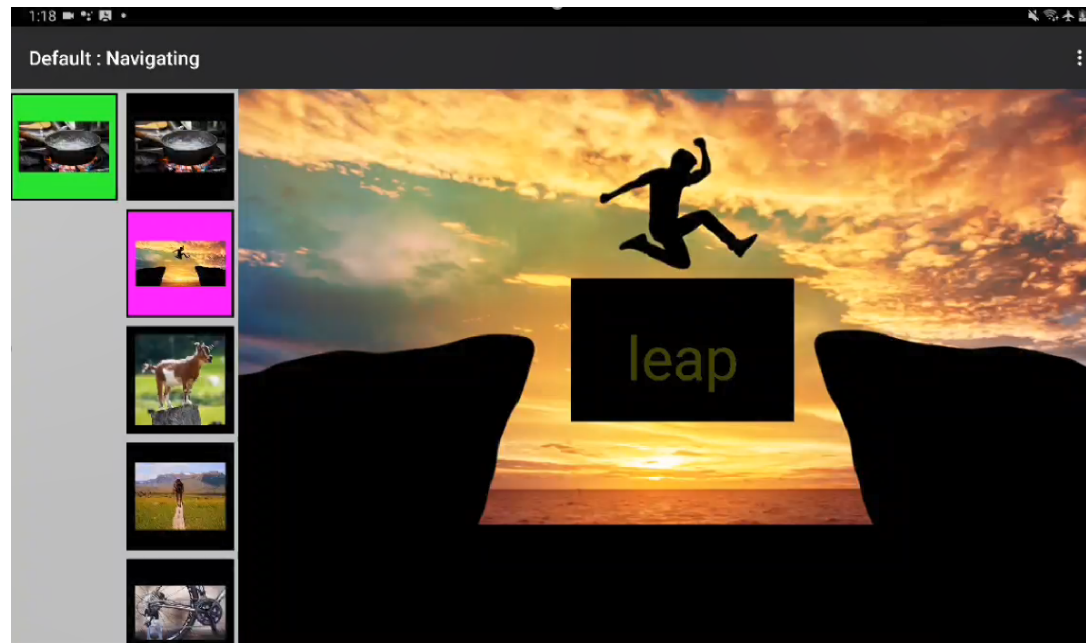
## Untaught

- *Different* 3-5 letter words
- Included the *same* small group of medial vowels (oi, ea, oa, e)
- **Probed for reading performance**

cod	code	cad	coal
cowed	coat	coil	cot



# Interacting Using the App



- Participants engaged in a structured interactions with the researchers
- Participants completed cloze phrases using the AAC app with the feature to support decoding enabled

# Results

- All three participants showed increases in reading untaught words
- All three maintained those increases at least three weeks after exposure to the app feature ended
- Effect size estimations show a medium effect of the decoding feature during intervention, and a strong effect in the maintenance phase

Participant	Baseline to Intervention (Effect size)	Baseline to Maintenance (Effect size)
1	0.86 (medium)	1.0 (strong)
2	0.73 (medium)	1.0 (strong)
3	0.80 (medium)	1.0 (strong)

# Study #3

Effect of the decoding feature on **encoding skills** of an individual with Down syndrome



# Research Questions

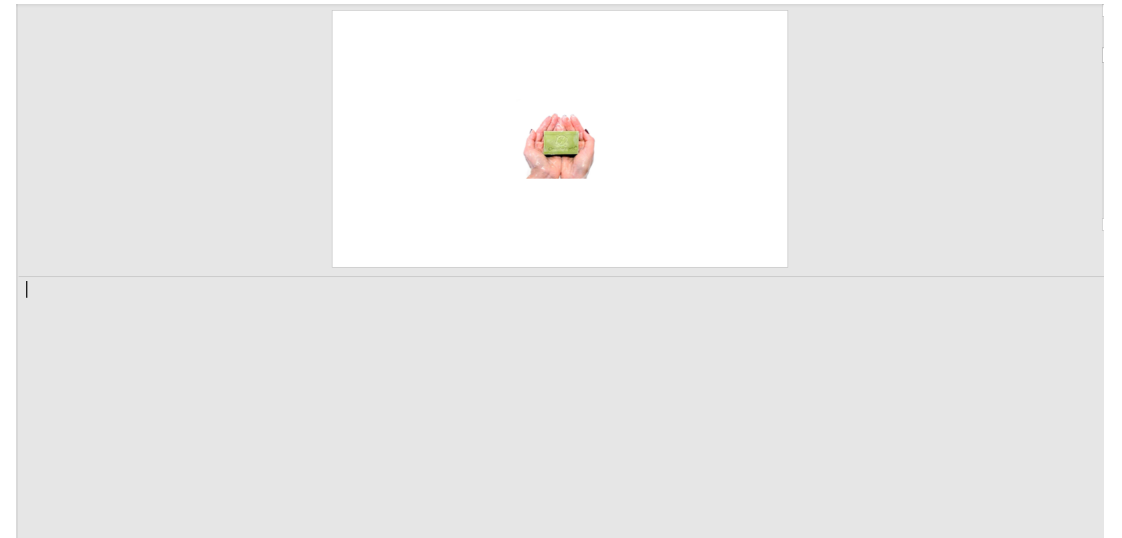
- What is the effect of exposure to the AAC decoding app feature on the single word **encoding** of 3-5 letter *untaught* words by the participant with Down syndrome and limited functional speech?
- Do any observed effects maintain 1-3 weeks after intervention has ended?

# Participant

- One adolescent with Down syndrome participated
- The participant had limited speech that was difficult for others to understand
- The participant had relatively strong decoding skills, but struggled with encoding
- Three different word groups were targeted (medial oi, ea, oa), with separate baselines for each word group and a staggered start to intervention across word groups

# Probing Reading Performance

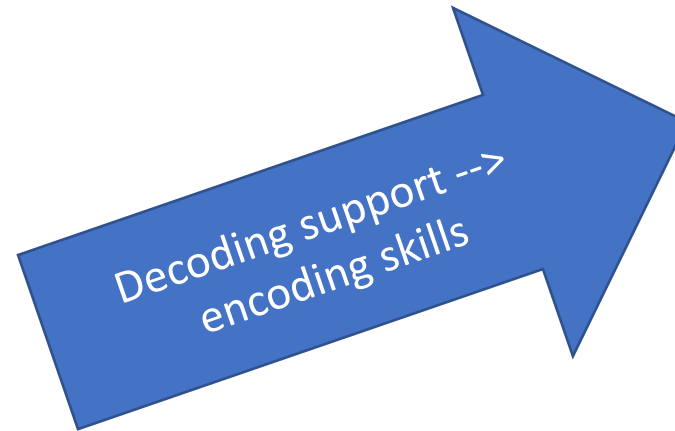
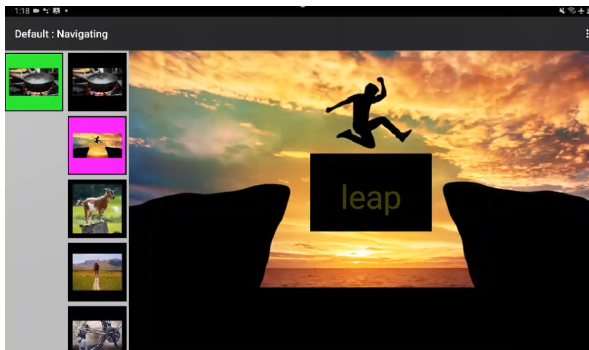
- Single-word encoding was tested throughout the study
- The participant was tested on words that never appeared on the app, to ensure increases in true encoding skills
- No teaching or differential feedback occurred during testing



# Target Words

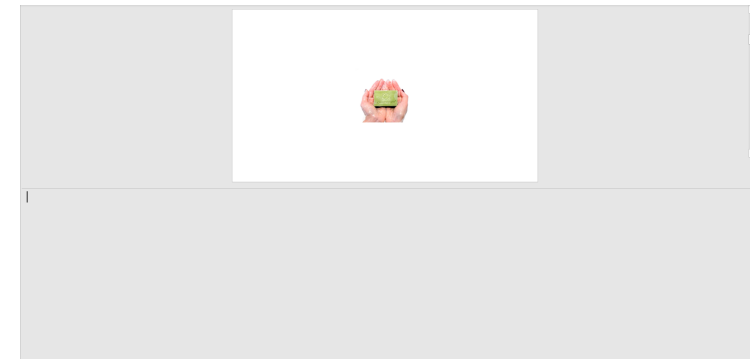
## Taught

- 3-5 letter words
- Included a small group of medial vowels (oi, ea, oa)
- **Taught via the AAC app feature during intervention**

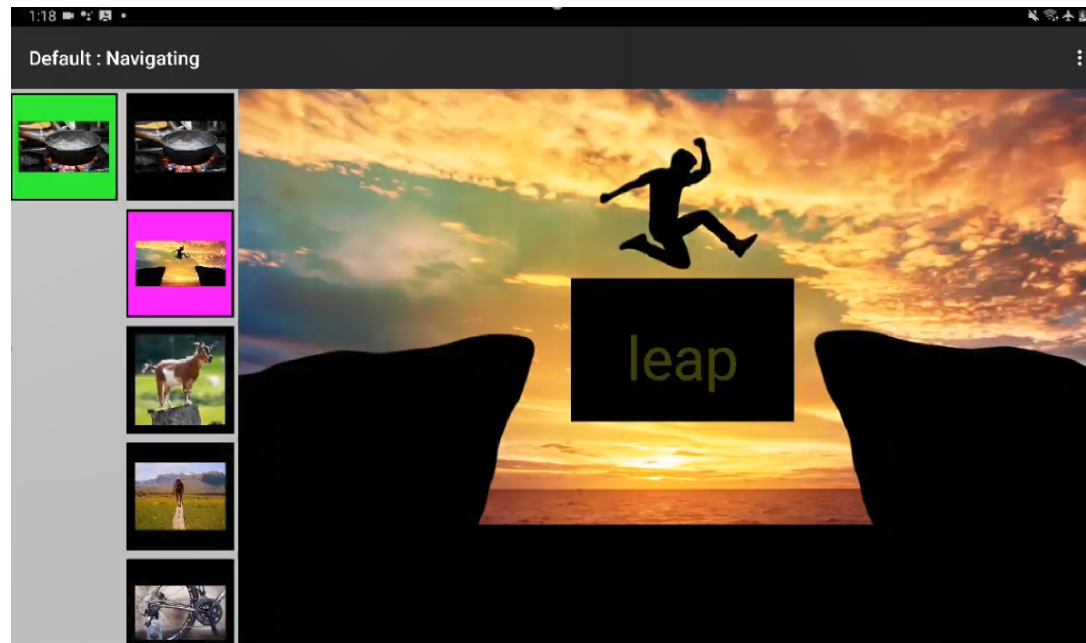


## Untaught

- *Different* 3-5 letter words
- Included the *same* small group of medial vowels (oi, ea, oa)
- **Probed for encoding performance**



# Interacting Using the App



- The participant engaged in a structured interactions with the researchers
- The participant completed cloze phrases using the AAC app with the feature to support decoding enabled

# Results

- The participant increased her encoding for each word group
- Further, her encoding skill increases maintained for at least three weeks after exposure to the AAC app feature ended

Word Group	Baseline to Intervention (Effect size)	Baseline to Maintenance (Effect size)
“ea”	0.73 (medium)	1.0 (strong)
“oi”	0.95 (strong)	1.0 (strong)
“oa”	0.63 (weak)	1.0 (strong)

# Discussion and Implications

# Discussion of the Studies

- The findings of this study are consistent with previous research evaluating the app feature designed to support single word reading in that a feature infused into AAC apps can effectively build literacy skills for individuals with developmental disabilities who use AAC and have limited literacy



# Implications of the Studies

- When designed appropriately, AAC technology alone can support the emergence of decoding – a skill foundational to “cracking the code” of reading
  - Direct literacy instruction is essential – access to this feature would supplement direct instruction
  - Access to this feature as additional practice outside of direct instruction could speed up the learning process
- In addition to supporting decoding skill development, the app feature may also support encoding skills
- Thus, the app feature may support the transition toward generative, keyboard-based AAC communication

Thank you!

Questions?

Comments?

Thoughts?