

**Evidence-based Intervention &
Apps to Improve Literacy Outcomes
for Children with Autism
Who Require AAC**

Janice Light, David McNaughton, &
Jessica Caron
Penn State University
Handouts at <http://aac.psu.edu>



The Penn State AAC Literacy Team

- Elizabeth Benedek-Wood
- Suz Boyle
- Shelley Chapin
- Jessica Currall
- Christine Holyfield
- Clark Knudtson
- Maggie Lamb
- **Kelsey Mandak**
- Ashley McCoy
- Lauramarie Pope
- Ethan Richtsmeier
- Amanda Slowey



Benefits of literacy skills

- Literacy skills are critically important
 - Support participation in education
 - Enhance employment opportunities
 - Facilitate personal expression & social relationships (e.g., texting, blogs, Facebook)
 - Allow access to enjoyable leisure pursuits (e.g., reading, surfing the Internet, accessing social media)



**Benefits of literacy skills for
individuals with ASD with CCN**

- Literacy skills are even more important for individuals with autism spectrum disorder (ASD) who have complex communication needs (CCN)
 - Expand communication options significantly
 - Increase perceptions of competence
 - Increase self-esteem

The problem

- More than 90% of individuals with CCN enter adulthood without functional literacy skills (Foley & Wolter, 2010)
- As a result, they are severely restricted in their participation in
 - Education
 - Employment
 - Healthcare
 - Community living

Barriers to literacy learning

- Lack of literacy curricula adapted to meet the needs of individuals with CCN
 - Existing literacy curricula assume spoken language foundation & require spoken responses
- Lack of AAC technologies that support the transition from graphic symbols to text



Goals of presentation

- Share **evidence-based instruction** to enhance the literacy skills of children with ASD who require AAC
 - Describe instruction
 - Share research results with case examples to illustrate
- Share **evidence-based apps** designed to support the transition from graphic symbols to literacy
 - Describe the apps
 - Share research results & case examples to illustrate



Instruction to build literacy skills of children with ASD who require AAC



Components of effective evidence-based literacy intervention (from Light & McNaughton, 2009)

1. Sufficient time allocated for instruction
2. Appropriate skills targeted in instruction
3. Effective instructional procedures
4. Adaptations to allow active participation of individuals with CCN
5. Positive rapport & motivating instruction
6. AAC technologies that support the transition from graphic symbols to text

Skills targeted in intervention

- Emergent literacy skills
 - Reading to child & talking about texts
- **Phonological awareness skills**
 - Sound blending and phoneme segmentation
- **Letter-sound correspondences**
- **Decoding skills**
- **Sight word recognition skills**
- **Shared reading with partner**
- **Reading independently and understanding texts**
- **Early writing skills**

Direct instruction in basic skills

- **Model**
 - Instructor demonstrates the skill for the student
- **Guided practice**
 - Instructor provides scaffolding support /prompts to help the student perform the skill successfully
 - Instructor gradually fades the scaffolding support
- **Independent practice**
 - Student performs the skill independently
 - Instructor provides feedback

Applying skills in meaningful literacy activities

- **Provide frequent opportunities to apply skills in meaningful literacy activities**
 - Demonstrate purpose of literacy
 - Increase motivation for learning to read & write
 - Enhance generalization of skills
 - Encourage generalization to new materials /contexts
 - Provide additional opportunities to practice skills
 - Build fluency in basic skills
 - Practice integration of skills required to read and write

Checklist for effective literacy instruction	
<ul style="list-style-type: none"> ❑ Make instruction meaningful 	<ul style="list-style-type: none"> ▪ Target important literacy skills ▪ Include motivating words & topics ▪ Make connections to personal experiences
<ul style="list-style-type: none"> ❑ Modify the activity to support participation 	<ul style="list-style-type: none"> ▪ Utilize familiar content /task formats ▪ Provide pictures or signs as response options ▪ Select foils carefully ▪ Provide oral scaffolding support as required
<ul style="list-style-type: none"> ❑ Provide effective instruction 	<ul style="list-style-type: none"> ▪ Model task ▪ Provide guided practice to promote success/ minimize error ▪ Provide feedback on responses ▪ Promote independence by fading support
<ul style="list-style-type: none"> ❑ Ensure multiple opportunities to practice skills 	<ul style="list-style-type: none"> ▪ Provide focused instruction at least 3-5 times per week ▪ Practice new skills and review previously learned skills in meaningful activities ▪ Provide 10 or more opportunities to practice each skill

Case Example: MF

- MF started intervention at 3;2
- Diagnosis of ASD
- Delayed expressive, receptive, and social development
- At start of study, **very limited speech** (~15 words /speech approximations to request)
 - speech progressed throughout intervention
- Vision, hearing, and mobility all within functional limits
- Receiving speech therapy and ABA services through Pre-K

Skills Targeted at First Stage of Literacy Instruction

Skill	Instruct	Mastered
Sound Blending	+	
Initial Phoneme Segmentation		
Letter Sound Correspondences	+	
Decoding		
Sight Words		
Shared reading	+	
Reading Comprehension		
Writing		

Instruction in sound blending

- Goal
 - The student will blend phonemes presented orally & determine target word
- Task
 - Present 4 or more AAC symbols/ pictures & label orally
 - Say the target word orally with each phoneme extended 1-2 seconds
 - Student must blend the phonemes and
 - point to /select the AAC symbol or
 - say/sign the word



Letter-Sound Correspondences

- Goal
 - The student will match a target phoneme presented orally to the correct letter
- Task
 - Present 4 or more letters
 - Say the target phoneme (sound) e.g., m
 - Student must select the letter that represents the target phoneme
- Alternative task
 - Show the student a letter
 - Student must say the letter sound



Next steps: Introducing basic skills

Skill	Instruct	Mastered
Sound Blending		+
Initial Phoneme Segmentation		
Letter Sound Correspondences		+
Decoding	+	
Sight Words	+	
Shared reading	+	
Reading Comprehension		
Writing		

Decoding

- Goal
 - The student will decode a written word & match it to the correct AAC symbol /picture or say/sign the word
- Task
 - Present 4 or more AAC symbols/pictures; review
 - Present the target written word
 - Student must read the word and
 - point to / select the AAC symbol /picture of the target word or
 - match the word card to the symbol /picture or
 - say/sign the word



Sight Words

- Teach sight word recognition
 - Highly motivating words that are too complex to decode
 - Irregular words that are frequently occurring
- Goal /task
 - Present 4 or more written words
 - Say the target sight word
 - Student must select the correct written word
 - Use this task if sight words are not easily imaged

swim	eat
horse	school

Shared Reading

- **Goal:** The student will read sight words and/or decode target written words during shared reading activity
- **Task:**
 - Present a 5-10-page book
 - Present the simple written sentence with the target word highlighted
 - Read the sentence out loud and pause at the target word
 - *Student should read the target word and sign/say/point to pictures from an array*



Shared Reading Book Examples:

Book Example 1.

Theo is on a **cat**. Theo is on the **bed**. Theo is on the **hat**.

Book Example 2.

Alvin is **under the cat**. Alvin is **under the bag**. Alvin is **under the bus**.

Book Example 3.

Simon sees **the black cat**. Theo is **on the red bed**. Alvin is **under the hat**.

Case Example: MF

Checklist for effective literacy instruction


- ✓ Make instruction meaningful
 - Include motivating words & topics
 - *Alvin and the Chipmunks*
- ✓ Modify the activity to support participation
 - Provide picture options in earlier sessions, then fade
 - *E.g., Field of 4 pictures in decoding*
- ✓ Provide effective instruction
 - Provide guided practice to promote success/ minimize error
 - *E.g., saying each sound and helping to decode when needed, also reading words that hadn't been introduced to him yet*
- ✓ Ensure multiple opportunities to practice skills
 - Books from decoding were included into shared reading
 - Books were 10 pages in length

Next steps: Putting it all together

Skill	Instruct	Mastered
Sound Blending		+
Initial Phoneme Segmentation		
Letter Sound Correspondences		+
Decoding		+
Sight Words		+
Shared reading	+	
Reading Comprehension	+	
Writing (Encoding)	+	

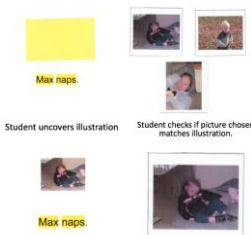
Writing (Steps towards encoding)

- **Goal:** The student will encode words
- **Task:**
 - Present six (or more) letters in a circle (not a line)
 - Present the target word in picture form (e.g., cat)
 - *Student must select the right letters and put them in the right order to encode/spell the target word*
- **Considerations:**
 - Start with CVC words with known letter-sound correspondences
 - Start with letter tiles, then transition to keyboard
 - Start with one or two high-interest words and slowly build from there (for sight words)



Reading With Comprehension

- **Goal:** The student will decode or recognize by sight each word in a sentence and process the words to derive the meaning of the full text
- **Task:**
 - Student reads the text (illustrations are covered)
 - *Student selects the picture that represents the meaning from the group*



MF – Summary of Sessions

<p>Sessions (First 5 months)</p> <ul style="list-style-type: none"> • Sound blending • Letter sounds • Decoding • Shared reading 	<p>Sessions (Next 2 months)</p> <ul style="list-style-type: none"> • Letter sounds • Decoding • Sight words • Shared reading 	<p>Sessions (Next 3 months)</p> <ul style="list-style-type: none"> • Decoding • Sight words • Comprehension • Encoding • Shared reading
--	--	---

Case Example: MF

Checklist for effective literacy instruction

- ✓ Make instruction meaningful
 - Include motivating words & topics
 - *Alvin and the Chipmunks, Pete the Cat, Nemo*
 - Related to personal experiences
 - *Talked about family members and pets*
- ✓ Modify the activity to support participation
 - Provide picture options
 - *E.g., Field of 4 pictures in decoding*
 - Select foils carefully
 - *E.g., One icon with similar initial letter in decoding*
- ✓ Provide effective instruction
 - Model task
 - Provide guided practice to promote success/ minimize error
 - *E.g., saying each sound aloud during guided practice for encoding*
 - Provide feedback on responses
- ✓ Ensure multiple opportunities to practice skills
 - Practice new skills and review previously learned skills in meaningful activities
 - Provide 10 or more opportunities to practice each skill
 - *E.g., decoding trials were out of 10, shared reading books were 10 pages long*

MF – Summary

- MF made significant gains in literacy in 1 year
 - Participating in ~20 hours of instruction
 - No literacy instruction by family (other than shared reading) and limited literacy instruction by Pre-K (letter names and sounds)
- MF will be entering Kindergarten fully included
 - As his mom adds: with better literacy skills than his twin sister!

Case example: A

- 3 years 10 months old
- Autism
- Preschool with reverse integration
 - One on one aide (TSS)
- Interested in books
 - Loves Mickey Mouse, Sesame Street
- Communicates telegraphically via
 - Signs / gestures
 - Graphic symbols – PECS
 - Vocalizations /speech approx
- Frustrated
 - challenging behaviors
- Pre-literate

Skills Targeted at First Stage of Literacy Instruction

Skill	Instruct	Mastered
Sound Blending -with visual supports (letters)	+	
Initial Phoneme Segmentation	+	
Letter Sound Correspondences	+	
Decoding		
Sight Words		
Shared reading		
Reading Comprehension		
Writing		

Teaching sound blending with visual supports

- Present written word with illustration covered
- Point to the letters in sequence
 - Say the letter sounds in sequence with each phoneme extended 1-2 seconds
 - If student knows letter sounds, he/she can say them
- Student must blend the sounds and
 - select the AAC symbol /picture from choices provided or
 - say/sign the word



Skills Targeted Next Stage of Literacy Instruction		
Skill	Instruct	Mastered
Sound Blending -with visual supports (letters)	+	
Initial Phoneme Segmentation	+	
Letter Sound Correspondences	+	
Decoding	+	
Sight Words	+	
Shared reading	+	
Reading Comprehension		
Writing		

Skills Targeted More Advanced Literacy Instruction		
Skill	Instruct	Mastered
Sound Blending	+	
Initial Phoneme Segmentation	+	
Letter Sound Correspondences	+	
Decoding	+	
Sight Words	+	
Shared reading	+	
Reading Comprehension	+	
Writing – encoding words & writing stories	+	

- ### Answering basic reading comprehension questions
- Student reads the text
 - Initially student reads one page; answers question
 - Reduce working memory demands
 - Later reads several pages; then answers questions
 - Instructor asks appropriate questions
 - Start with simple factual questions
 - Later introduce more complex inference questions
 - Student may respond via
 - Speech
 - Signs
 - Pointing to pictures or written choices /multiple choice questions
 - Typing answers /using letter cards

- ### Writing instruction
- Teach basic skills
 - Phoneme segmentation skills
 - Letter-sound correspondences
 - Keyboard knowledge
 - Encoding skills – single words
 - Provide opportunities to apply skills in meaningful writing activities
 - Telling stories
 - Use photos or pictures as visual supports
 - Start with familiar motivating experiences
 - Publishing books
 - Use the books for reading activities
 - Share books with others

Case Example: A

Checklist for effective literacy instruction

- | | |
|--|---|
| <ul style="list-style-type: none"> ✓ Make instruction meaningful | <ul style="list-style-type: none"> ▪ Include motivating words & topics <ul style="list-style-type: none"> ▪ <i>Sesame Street, Mickey Mouse</i> ▪ Relate to personal experiences <ul style="list-style-type: none"> ▪ <i>Talk about family members and pets</i> |
| <ul style="list-style-type: none"> ✓ Modify the activity to support participation | <ul style="list-style-type: none"> ▪ Provide pictures as response options /use familiar tasks <ul style="list-style-type: none"> ▪ <i>E.g., Field of 2-4 pictures</i> ▪ Use visual supports <ul style="list-style-type: none"> ▪ <i>E.g., letters to support sound blending</i> |
| <ul style="list-style-type: none"> ✓ Provide effective instruction | <ul style="list-style-type: none"> ▪ Model task ▪ Provide guided practice to promote success/ minimize errors <ul style="list-style-type: none"> ▪ <i>E.g., provide oral scaffolding support for internal re-audiotization</i> ▪ Provide feedback on responses ▪ Regularly introduce new skills |
| <ul style="list-style-type: none"> ✓ Ensure multiple opportunities to practice skills | <ul style="list-style-type: none"> ▪ Practice new skills and review previously learned skills in meaningful activities ▪ Provide 10 or more opportunities to practice each skill |

Results

- 5 years 2 months old
 - Results after approximately 60 hours of instruction over 50 weeks
- Mastered basic literacy skills
 - Letter sound correspondences
 - Single word decoding / sight word recognition skills
 - Reads more than 200 words independently
 - Decodes novel regular words
 - Recognizes frequently occurring sight words

Results

- Reads simple books independently
 - Reads stories with 30-40 words
 - Responds to factual wh-questions with >80% accuracy
 - Learning to respond to inference questions
- Writing skills
 - spells more than 50 words
 - Attempts any word with sound spelling
 - writes simple stories
- Enters Kindergarten as a reader and writer
 - Literacy skills exceed those of most typically developing peers
 - Included in regular education class; placed in highest reading group

Results

- Significant increases in speech, language, & literacy skills
 - Significant decreases in challenging behaviors
- Use of written language as visual support for speech & language development
 - Use of letters / written words to support speech production
 - Improved intelligibility
 - Increased length of utterances
 - Use of written words /sentences to support language development
 - Increased range of vocabulary
 - More complex sentence structures / word endings

Email 8 years old

Hi Miss Janice

It's [student's name]. Im a good reader. Thank you for making me happy with with reading. Where are your Janice books? I loved reading them. Im in third grade at [name of school]. I watch my old Janice movies. Do you watch Janice movies? Where are you working now?

Love,
Anna

Adaptations for older students

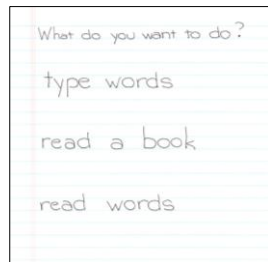
- Many individuals with ASD and limited speech do not receive literacy instruction when they are young
 - It is never too late to start literacy instruction
- Special challenges in working with students who are older
 - Many years of limited speech may result in
 - Limited language skills
 - Learned passivity or frustration /challenging behaviors
 - Reduced opportunities for learning
 - Lower expectations
 - Difficult to gauge capabilities

Case example: B

- 12 years old
- Diagnosed with autism
- Seizure disorder
- Special school
- Communicated telegraphically
 - Gestures / reaching for items
 - Vocalizations
 - PECS
 - Speech generating device
 - Approximately 15-20 vocabulary concepts
- Nonliterate
- Literacy intervention
 - one on one instruction; once per week
 - 45-60 minute sessions – initially frequent breaks; gradual decrease in breaks

Adapting instruction to meet complex needs

- Use written schedule & choice to structure instruction
- Support comprehension & language skills
 - Start with familiar, high interest concepts
 - Teach new language concepts in context
- Adapt instructional sequence & tasks to meet needs and skills



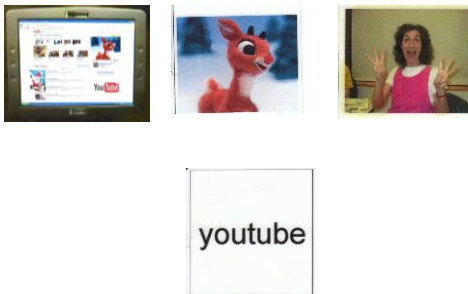
Adapting instruction to meet complex needs

- Use familiar tasks to teach new skills
- Incorporate instruction in sight words early
 - Demonstrate the meaning of text & increase motivation
 - Reduce field size to ensure success; gradually increase field
- Introduce shared reading activities early
 - Utilize highly motivating reading materials
 - Focus on personal experiences
 - Enhance motivation
 - Provide context to support understanding
 - Use repeated language structures to support comprehension e.g., [student] likes _____

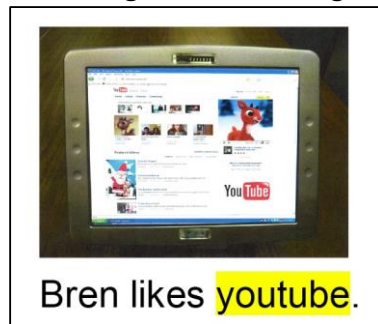
Initial instruction

Skill	Instruct	Mastered
Sound Blending		
Initial Phoneme Segmentation		
Letter Sound Correspondences		
Decoding		
Sight Words – high interest	+	
Shared reading – favorite topics	+	
Reading Comprehension		
Writing		

Instruction in sight word recognition Teach high interest words



Apply sight word recognition skills during shared reading



Later instruction

Skill	Instruct	Mastered
Sound Blending	+	
Initial Phoneme Segmentation		
Letter Sound Correspondences • Introduce incrementally	+	
Decoding	+	
Sight Words	+	
Shared reading	+	
Reading Comprehension		
Writing /encoding		

Adapting instruction to meet complex needs

- Adapt instruction in letter-sound correspondences
 - Modify sequence of letter-sounds to accommodate interests
 - Link letter-sounds to sight words to support learning
- Provide visual supports when teaching phonological awareness skills
 - Reduce demands on auditory processing
 - Introduce sound blending with written words (visual cues of letters)

Letter sound correspondences “y” book

- Link target letter sound to words that start with this letter sound
 - Choose words that are familiar & motivating for the student

Apply skills during shared reading Increase number of words targeted



Bren reads a book.



Janice says, wow.

Later instruction

Skill	Instruct	Mastered
Sound Blending	+	
Initial Phoneme Segmentation	+	
Letter Sound Correspondences	+	
• Introduce incrementally		
Decoding	+	
Sight Words	+	
Shared reading	+	
Reading Comprehension		
Writing /encoding	+	

Next steps in literacy instruction

- Introduce writing skills
 - Introduce keyboard as soon as know 6-7 letter-sounds
 - Highlight letters as acquired
 - Introduce phoneme segmentation to support writing
 - Provide oral scaffolding support with phoneme segmentation



B: Results after 40 hours of instruction

- 13 years old
 - Results after approximately 40 hours of instruction over a 17 month period
- Acquired early conventional literacy skills
- Letter sound correspondences
 - 10-12 letter-sound correspondences
- Single word reading
 - Reads more than 50 words
 - Increased rate of acquisition

B: Results after 40 hours of instruction

- Shared reading
 - Participates actively in shared reading activities
 - Reads books with 3-4 words targeted per sentence with >80% accuracy
- Writing skills
 - Building competence in single word encoding
 - Some scaffolding support /adapted keyboard
- Demonstrates high levels of intrinsic motivation
 - Demonstrates increased confidence
 - Demonstrates improved attention
 - Works for 45-60 minutes without a break

Case Example: B

Checklist for effective literacy instruction


<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Make instruction meaningful 	<ul style="list-style-type: none"> ▪ Started with sight word /shared reading to build motivation ▪ Then taught basic skills; always provided opportunities to apply skills in meaningful activities ▪ Included motivating familiar topics – family, youtube ▪ Modeled function and meaning of text
<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Modify the activity to support participation 	<ul style="list-style-type: none"> ▪ Utilized familiar content /task formats ▪ Provided pictures as response options ▪ Provided visual supports & augmented input ▪ Modeled task requirements; reduced field initially ▪ Taught new concepts in context
<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Provide effective instruction 	<ul style="list-style-type: none"> ▪ Provided model, guided practice, independent practice ▪ Promoted independence by fading support ▪ Provided feedback on responses
<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Ensure multiple opportunities to practice skills 	<ul style="list-style-type: none"> ▪ Provided instruction only once per week due to distance <ul style="list-style-type: none"> ▪ Ideally more frequent & intensive instruction ▪ Practiced new skills & reviewed old skills ▪ Provided repeated opportunities to practice each skill

Instruction in literacy skills

- Instruction in literacy skills is critical for children with ASD and CCN
- With effective evidence-based instruction, children with ASD can increase their literacy skills & enhance their language skills
- How else can we maximize literacy learning by children with ASD who require AAC?

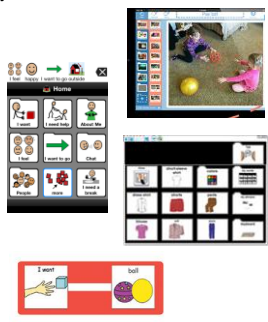
Barriers to literacy learning

- Lack of literacy curricula adapted to meet the needs of individuals with ASD and CCN
 - Existing literacy curricula require spoken responses
- **Lack of AAC technologies that support the transition from graphic symbols to text**



Current AAC technologies /apps with picture symbols

- Individuals with ASD & CCN who are nonliterate typically use AAC systems/apps with picture symbols
- The design of these systems/ apps does not support the transition to literacy
 - Text is available above picture symbol but individuals do not attend to static text (Brown et al., 2015)
 - Text is displayed in message bar but displacement of text from picture does not support learning association



AAC apps to support the transition from graphic symbols to text

These apps are intended to complement, not replace, literacy instruction



AAC technologies to support transition from graphic symbols to literacy (T2L)

• A solution

- Transition to literacy (T2L) is a software feature for AAC technologies /apps
- Conceptualized & developed by Light, McNaughton, Jakobs, & Hershberger (2014)
- T2L provides dynamic presentation of text with speech output when a picture symbol is selected
- T2L provides a first step in the transition from use of picture-based AAC technologies /apps to literacy

AAC technologies to support the transition to literacy (T2L)

• Transition to literacy (T2L) software feature

- Individual selects a picture symbol from AAC display
- Written word appears dynamically
- Written word is spoken by the app



• 2 apps

- Grid-based T2L app developed by Saltillo (Hershberger)
- VSD T2L app developed by InvoTek (Jakobs)
 - Incorporated into SnapScene by TobiiDynamox



Research-based design of T2L feature

- Design of T2L feature is grounded in the state of the science in visual cognitive processing, literacy instruction, and instructional design (Light et al., 2014)
 - Individual selects graphic symbol from personalized AAC system
 - Literacy learning is driven by the individual's interests & needs and utilizes personally relevant vocabulary, thus increasing motivation & engagement (Light & McNaughton, 2009)
 - Text is dynamically presented on the screen
 - Movement is strong attractor of visual attention, increasing learner's attention to the text (Wilkinson & Jagaroo, 2004)
 - Text is paired with graphic symbol & speech output
 - Direct active pairing supports learning of association between written word & referent (picture symbol and/or spoken word) (e.g., Browder & Xin, 1998)
 - Text is consistently incorporated into communication
 - Integration of literacy supports into AAC provides increased opportunities for functional learning & use throughout the day (Light & McNaughton, 2014, 2015).

T2L feature for AAC apps A first step in the transition to literacy

- T2L apps are intended to **complement, not replace** literacy instruction
- Current T2L apps
 - only support sight word acquisition
 - are a **first step** in T2L technologies that provide a direct bridge from picture-based systems to literacy
- Future developments are required to further support the full transition to literacy

Investigating the effects of T2L apps on literacy learning

- Series of single subject experimental designs
 - Children and adults with ASD, CP, & IDD
- Research hypothesis
 - Individuals with CCN will increase literacy skills as a result of T2L app
- Design
 - IV = T2L app
 - VSD or grid
 - DV = Accuracy reading single words

Study 1: Preliterate preschoolers with ASD (Mandak, Lamb, Light, & McNaughton, 2016)

- What is the effect of the T2L app with dynamically displayed text on the acquisition, maintenance, and generalization of single word reading by pre-literate preschoolers with ASD?
- 4 children diagnosed with Autism Spectrum Disorder
 - 3-5 years old
 - 3 Males & 1 Female
 - All attend a LEAP preschool
 - Each classroom has 4 children with ASD and 8 children who are typically developing
 - All were preliterate

Design

- Single-subject across participants multiple probe design
- Phases: baseline, intervention, generalization, and maintenance
 - a) baseline condition (prior to exposure to tablet technology);
 - b) exposure to tablet technology with the AAC app;
 - c) generalization (to new photographs of target words not used in intervention)
 - d) maintenance

Dependent Variable

Dependent variable

- % accuracy reading single words (matching written word to picture)

Materials

- 10 words from Brown bear book
- Images from Brown bear book
- Words ranged from 3-7 letters (e.g., cat & teacher)



Probe procedures

- Probes to measure the dependent variable conducted at baseline, intervention, & maintenance/ generalization
- For the probes, participants were presented with four images (images from the Brown bear book)
 - 1 target sight word + 3 foils
- Participants were told to read the word and match the word to the correct picture.
 - "Read the word, give me the picture that goes with this word"
- The placement and order of the target words and foils were randomized
- No confirmatory feedback was provided

Intervention materials

- During intervention, participants were exposed to the T2L VSD app
- Brown bear book displayed on the app on Samsung Tablet
 - Dynamic text for each of the animals in the book
 - Text appeared with speech output upon selection of the animal
- No other instruction during intervention



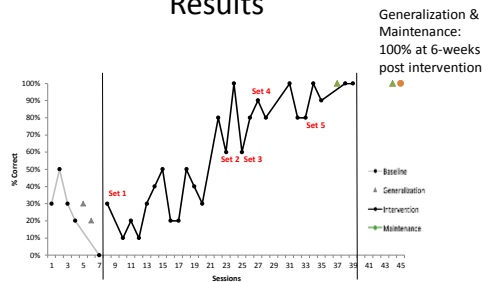
Intervention procedures

- Words were introduced in sets of 2 for a total of 5 sets
- Each participant began the intervention phase with introduction of the first pair of sight words
- Once the first pair reached criterion, the 2nd pair was introduced
 - Criterion: 2/2 target words during two consecutive sessions
- Each intervention session took approximately 5 minutes and included two "read throughs"
 - 1st Read Through - participant activated the target sight words 2x
 - Bear 2x
 - Cat 2x
 - Participants also activated any previously acquired sight words during the first read through
 - 2nd read through of book- participants returned **only** to the two target pages for an additional 3 activations/page
 - For example, if the target sight words were bird and dog (the 2nd pair), they only returned to these pages. The other pages/sight words were not activated.

Case example: M

- 4 years, 2 months old
- Diagnosed with ASD at 2.5 years
- Has attended a LEAP preschool for 2 years
 - Made significant gains in past year
- Now relies on speech to meet most communication needs
- Language skills
 - PPVT4 Standard score: 95 (37%ile)
- Literacy skills (per teacher report)
 - Knows most uppercase letter names and most lowercase letter names, with some reversals
 - Knows some letter sounds
 - Knows "a few" sight words (<5)

Results

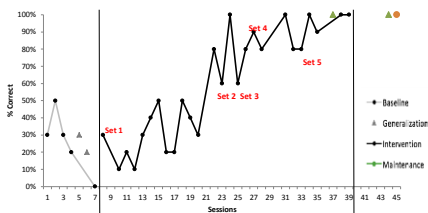


Baseline average: 26% correct (range: 0%-50%)

M. acquired the 10 target sight words after 26 intervention sessions (2 hours, 10 minutes of intervention)

Generalization & Maintenance: 100% at 6-weeks post intervention

Results



Set	Number of Sessions to Reach Criterion	Total Exposure Time (per word)
Set 1: bear & cat	13	3 mins 15 sec
Set 2: bird & dog	3	45 sec
Set 3: duck & sheep	2	30 sec
Set 4: horse & fish	4	1 min
Set 4: frog & teacher	4	1 min

Once M. acquired the first set of words, he reached criterion on the other sets in 4 or less sessions (1 minute or less of exposure time per word)

STUDY 2: TRANSITION TO LITERACY – GRID DISPLAY INDIVIDUALS WITH ASD, CCN, AND LIMITED LITERACY SKILLS (CARON ET AL., 2016)

Research Question:

- What is the effect of the T2L grid software on the acquisition, maintenance, and generalization of single word reading by school-aged children with ASD, CCN, and limited literacy skills?



Methods/Participants:

- Multiple probe across word-set design
 - 12 words, 3 sets of 4 words
- 4 Participants
 - All individuals were:
 - Males
 - Diagnosed with ASD
 - Described as having complex communication needs
 - Described as having limited literacy skills
 - <20 sight words
 - Minimal letter-sound correspondence knowledge
 - Not decoding



Materials/Procedures:

Sight Word Probe Materials (how we assess learning)

- Word printed on yellow
- Images representing targeted words
- Personally relevant words
 - Words range in length (4-8 letters)
 - One word with the same initial letter in word set (e.g., *camo* and *camping*)



RERC on AAC

Materials/Procedures:

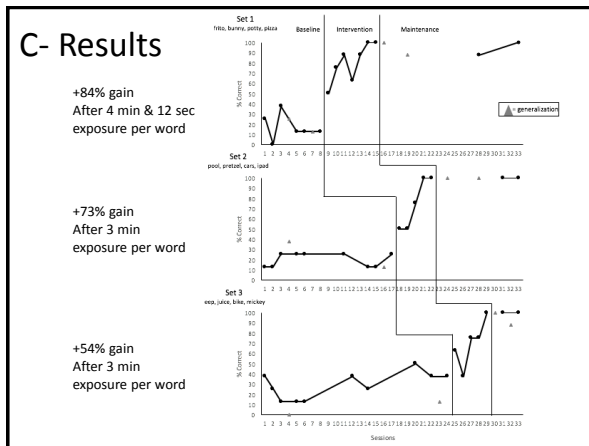
Exposure/Intervention Materials

- T2L Software Feature
 - NovaChat Device
 - dynamically displaying text
 - Emerging from the graphic within AAC software
 - Speech-output to match the text displayed
 - 12 words total, Set of 4 targeted at a time
 - 12 exposures to each word, per sessions (word on screen for 3 seconds)



C

- Age: 9
- ASD Diagnosis:
 - CARS assessment – “Severe”
- Communicates:
 - Idiosyncratic signs
 - Physical Communication
 - Word approximations
- Educational Setting:
 - ½ day (4 hours) of 1:1 ABA services
 - ½ day of 1:1 virtual charter school
- Literacy Skills:
 - Identified all LSC
 - PPVT: SS- 40
 - Not independently decoding
 - <20 sight words (per teacher report)

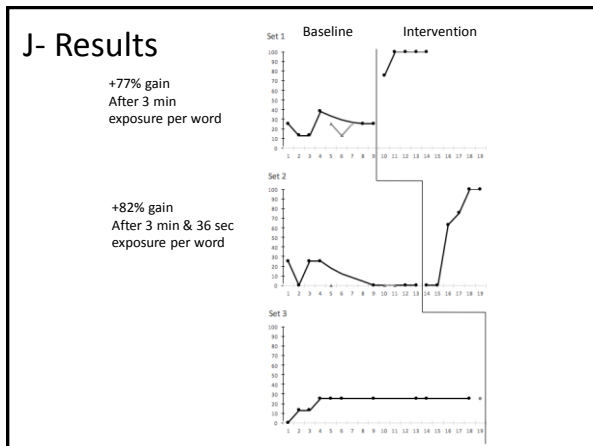


C- Exposure Data

Word Set	Total # of Sessions	# of Exposures per word	Exposure Time per word
Set 1: Frito, bunny, potty, pizza	7	84	252s (4 min, 12s)
Set 2: Pool, pretzel, cars, ipad	5	60	180s (3 min)
Set 3: Jeep, juice, bike, mickey	5	60	180s (3 min)

J

- Age: 18
- ASD Diagnosis:
 - CARS assessment – “Severe”
- Communicates:
 - Idiosyncratic signs
 - Limited use of iPad with AAC app
- Educational Setting:
 - High School, Multiple Disability Class
- Literacy Skills:
 - Identify all LSC
 - PPVT4: SS- 40
 - Not independently decoding
 - <20 Sight words (reported by teacher)



J- Exposure Data

Word Set	Total # of Intervention Sessions	# of Exposures per word	Exposure Time per word
Set 1: Washer, wrench, baler, shovel	5	60	180s (3 min)
Set 2: Harrow, hose, pliers, litter	6	72	216s (3 min, 36 sec)
Set 3: Camping, camo, pager, lure	0	0	0

Summary

- These cases provide preliminary evidence that a redesign in AAC apps, including the provision of dynamic text features paired with graphics and speech output, positively impacts the single-word reading of individuals with ASD, CCN, and some limited skills.

Summary of preliminary results

Impact of AAC T2L apps on literacy learning

- Introduction of the T2L apps resulted in successful acquisition of written words by young children and older children with ASD
 - VSD T2L app
 - Grid-based T2L app
- Most individuals acquired the written words successfully with only minimal exposure to the words via the app
- Individuals who had some beginning literacy skills seemed to learn faster than those who were nonliterate at the start
 - Ideally individuals with CCN would use the T2L AAC app as an extension to effective literacy instruction
- Remember that these are preliminary results and should be interpreted with caution

The art and science of literacy intervention

- The science of literacy intervention
 - Implement effective evidence-based instruction
 1. Allocate sufficient time for instruction
 2. Target appropriate instructional content / skills
 3. Implement effective instructional procedures
 4. Provide adaptations to allow active participation of individuals with CCN
 5. Provide access to AAC systems that support the transition to literacy
 6. Build positive rapport and ensure motivating instruction

Checklist for effective literacy instruction

- | | |
|--|---|
| <input checked="" type="checkbox"/> Make instruction meaningful | <ul style="list-style-type: none"> ▪ Target important literacy skills ▪ Include motivating words & topics ▪ Make connections to personal experiences |
| <input checked="" type="checkbox"/> Modify the activity to support participation | <ul style="list-style-type: none"> ▪ Utilize familiar content /task formats ▪ Provide pictures or signs as response options ▪ Select foils carefully ▪ Provide oral scaffolding support as required |
| <input checked="" type="checkbox"/> Provide effective instruction | <ul style="list-style-type: none"> ▪ Model task ▪ Provide guided practice to promote success/ minimize error ▪ Provide feedback on responses ▪ Promote independence by fading support |
| <input checked="" type="checkbox"/> Ensure multiple opportunities to practice skills | <ul style="list-style-type: none"> ▪ Provide focused instruction at least 3-5 times per week ▪ Practice new skills and review previously learned skills in meaningful activities ▪ Provide 10 or more opportunities to practice each skill ▪ Introduce T2L apps to support literacy learning |

The art and science of literacy intervention

- The science alone is not enough
- The “art” of literacy intervention is also critical
 - the belief and the commitment to the right of all individuals to have the opportunity to learn & seek their full potential

Additional resources

- Websites
 - Light, J. & McNaughton, D. *Literacy instruction for learners with autism, cerebral palsy, Down syndrome and other disabilities.* <http://aacliteracy.psu.edu>
 - The RERC on AAC <http://rerc-aac.org>
- Webcast
 - Light, J. & McNaughton, D. (2010). *Improving literacy outcomes for individuals with autism spectrum disorders and limited speech.* Webcast presented at <http://aacliteracy.psu.edu/index.php/page/show/id/17>
 - Light, J. & McNaughton, D. (2006). *Maximizing the literacy skills of individuals who require AAC.* Webcast presented through the RERC on AAC <http://rerc-aac.org>
- Instructional resources
 - Light, J. & McNaughton, D. (2009). *Accessible Literacy Learning (ALL): Evidence-based reading instruction for learners with autism, cerebral palsy, Down syndrome and other disabilities.* San Diego, CA: Mayer-Johnson

Additional resources

- Literacy apps
 - Grid-based T2L app see Saltillo <https://saltillo.com/>
 - VSD T2L app see InvoTek <http://www.invotek.org/>
 - ALL app and SnapScene app with T2L feature see TobiiDynavox <http://www.tobii-dynavox.com/>
- Selected publications
 - Light, J. & McNaughton, D. (2009). Meeting the demands of the curriculum for conventional and advanced readers and writers who require AAC. In G. Soto & C. Zangari (Eds.). *Practically Speaking: Language, literacy, and academic development for students with AAC needs*. Baltimore, MD: Paul H. Brookes Publishing Co.
 - Light, J., McNaughton, D., Weyer, M., & Karg, L. (2008). Evidence-based instruction for individuals who require augmentative and alternative communication: A case study of a student with multiple disabilities. *Seminars in Speech and Language, 29*, 120-132.
 - Light, J. & McNaughton, D. (2013). Literacy intervention for individuals with complex communication needs. In D. Beukelman & P. Mirenda (Eds.) *Augmentative and alternative communication: Supporting children and adults with complex communication needs*. Baltimore, MD: Paul H. Brookes Publishing Co.

For further information on literacy intervention & apps, visit

<http://aacliteracy.psu.edu>

<http://rerc-aac.org>



For handouts, visit <http://aac.psu.edu>

AAC at PSU

Home News Faculty Educational Opportunities Research AAC Services Prospective Students Web Resources

ASHA 2016 Presentations by PSU Faculty and Students!

to attend on November 3, 2016 in Adults, Children, Family Research, Student Studies Research, News, Presentations

Presentations by PSU Faculty and students will be presenting at the ASHA 2016 conference in Philadelphia, Pennsylvania. Please see below for the schedule. Links to downloads of presentations and/or handouts will be uploaded as they become available!

Thursday, Nov. 17, 2016

→ Supporting the Language Development of Children With Complex Communication Needs: Just-in-Time Programming of AAC Apps (10:30 AM – 12:30 PM)

→ Impacts of Parent Training on AAC Use in Emotion Communication With Children With Down Syndrome (1:30 PM – 3:00 PM)



Upcoming events

ASHA Conference

August 6-13, 2016

Toronto, Canada

Search

Categories

- Adults (26)
- Children (226)
- Family Research (127)
- Funded Projects (26)
- Graduate Student Research (102)
- News (236)
- Presentations (101)
- Publications (27)
- Uncategorized (6)

Acknowledgements

- We are especially grateful to the individuals who participated in this project. Thank you for allowing us to be a part of your lives.
- The contents of this presentation were developed under a grant from the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR grant number #90RE5017) to the Rehabilitation Engineering Research Center on Augmentative and Alternative Communication (RERC on AAC). <http://rerc-aac.org>
- NIDILRR is a Center within the Administration for Community Living (ACL), Department of Health and Human Services (HHS). The contents of this presentation do not necessarily represent the policy of NIDILRR, ACL, HHS, and you should not assume endorsement by the Federal Government.
- Funding for some of the students involved in this project was provided by U.S. Department of Education grants #H325D110008 and #H325K080333
- The authors have no conflict of interest

RERC on AAC

