

Phonic Faces Storybooks and Children with Complex Communication Needs

Meher Banajee, M.S., CCC-SLP
Assistant Professor
LSUHSC
Communication Disorders Dept

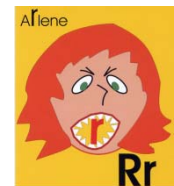
Janet Norris, PhD.
Professor
LSU

Communication Sciences and Disorders Dept



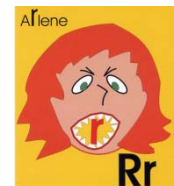
Introduction

- **Children who are physically challenged and have severe speech and language disorders are at a greater disadvantage for acquiring literacy skills**
- **Limited opportunity to organize expressive language information in any modality**
- **Understanding the development of symbolic thought helps to recognize and compensate for these challenges as written language is developed**



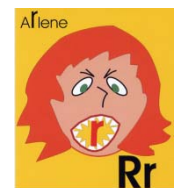
Introduction

- **Language - a complex symbolic system**
- **To become a competent user of language, an infant must develop the ability to mentally represent objects, states, and actions**
- **Then they have to refer to the mental representation with an arbitrary symbol such as a spoken or written word (Bates et al., 1979)**
- **Symbolic thought develops during the first 2 years of life starting at the reflexive stage**
- **Between 2 and 7 years symbols are organized and literacy skills develop**
- **Piaget's first 2 stages of development (Sensori-motor and Pre-operational) helps us to understand this process**



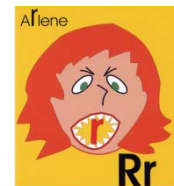
Piaget and symbolic thought

- **During the sensori-motor and preoperational stages much of learning is action oriented**
- **Learning based on object manipulation and experimentation**
- **Children with physical disabilities are at a disadvantage**
 - **Persistence of atypical reflexes (e.g., atonic neck reflex)**
 - **Lack of independent exploration of toys**
 - **Learned passivity or disinterest in external stimuli**
 - **Prevents assimilation and accommodation of these movements into more elaborate schemas (eye-hand coordination)**
 - **Schemas developed through observation**
 - **Poor development of internal schemas**



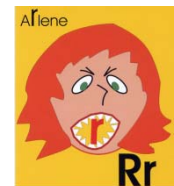
Pre-operational stage

- **Egocentered thought and language**
 - Greater decentering of thought in time and space
 - Development of cognitive organization and object categorization
 - Phonological awareness starts at 4 years but does not end until past 7 years of age
 - Initially focus only on one dimension
 - Name letters and sounds (4 years)
 - Point them out in words
 - But unable to manipulate them within words until 5 -5:6 years of age
 - Association of letters to sounds (5-5:6 years)
 - Sound blending (6-7 years)



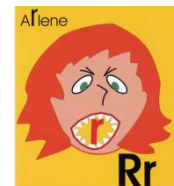
Pre-operational stage

- **Children with severe speech and language disabilities unable to engage in sound play**
 - **Unable to blend sounds to form words verbally**
 - **Unable to practice sound-letter association verbally**
 - **Experiment with sound deletion and substitution**
 - **At risk for developing these schemas**
 - **Vulnerable for limited development of written language skills**



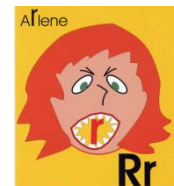
Written language

- **Same as oral language – a symbolic system**
- **Second year of development – print communicates**
- **Hollistic knowledge**
 - Recognize letters without knowing they are parts of words
 - Watch adults read books but have no knowledge of specific words or orthography
- **End of pre-operational stage**
 - Coordinating parts (letters) to make a whole (words)
 - Written symbol is a letter as well as parts of words (hierarchical categorization)
 - Letters can be combined to form words and words can be divided into letters (reversibility)



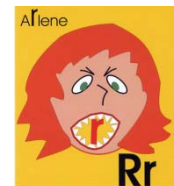
Written language

- **Manipulation of letters and sounds**
- **Manipulation of writing utensils**
- **Children with severe speech and physical disabilities at risk**
- **Learn (develop symbolization) from observation of adult manipulation of objects**
- **This learning is different lack random play/manipulation of objects**
- **Learn names of letters and sounds but cannot blending or reorder sounds**



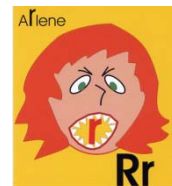
Review of Literature

- **AAC users are considerably delayed while developing reading skills (Koppenhaver, 2001, Erikson, 2003)**
- **Reading with comprehension is a daunting task for most AAC users**
- **Only 10% learn to read at grade level (Koppenhaver & Yoder, 1993)**
- **Poor phonological skills (Foley, 1999; Dahlgren-Sandberg, 2001; Vandervelden & Siegel, 2001)**



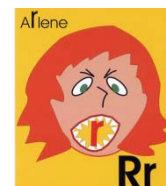
Reasons for limited literacy skills

- **Prerequisite skills for literacy skills**
- **Limited expectations of caregivers and teachers**
- **Limited access to reading materials**
- **Appropriate testing materials**



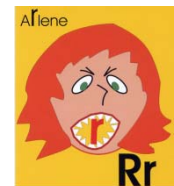
Prerequisite skills for literacy

- **Literacy in schools is not initiated until communicative competence is achieved (Koppenhaver, Coleman, Kalman and Yoder, 1991)**
- **In many curricula, language learning for them is broken up into sub-skills that have no relation to learning language or literacy**
 - operational competence
 - linguistic competence
 - social competence
 - strategic competence (Beukelman & Mirenda, 2003)
- **Skills taught in isolation**
- **Intervention is limited to artificial “skill and drill” sessions**
 - students practiced “learning” their communication devices
 - picture identification
 - locating symbols on their AAC devices



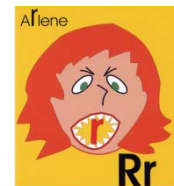
Prerequisite skills for literacy

- **Vocabulary limited to adult selection**
 - No combination of core and fringe vocabulary (Banajee, DiCarlo & Strickland, 2003)
 - Phonics page not included or used by therapist and teachers during instruction
 - Vocabulary limited to full sentences
 - Word based vocabulary difficult to use and time consuming
 - Morphological endings seldom used
 - AAC users have limited time to experiment with words and vocabulary on their communication devices (Bradley & Bryant, 1985; Cunningham, 1995; Lundberg, 1988; Lundberg, Frost & Peterson, 1988; Mann, 1984; Wagner & Torgenson, 1987)



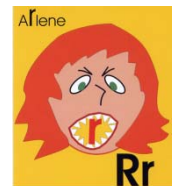
Low expectations of parents, caregivers and teachers

- Labels such as “disabled,” “delayed”
- Literacy rated as a low priority, and care of physical and medical needs as a high priority
- Face-to-face communication and development of independence in physical self-help skills
- Teacher expectations affect the way they behave and respond to children
- When teachers view students as capable of learning
 - They engage students interactively
 - Present them with active learning opportunities



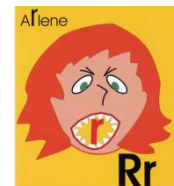
Limited access to literacy materials

- **Active participate in the reading process**
- **Children with physical disabilities have fewer quantitative and qualitative book reading experiences than their peers**
 - **With parents**
 - **With teachers**



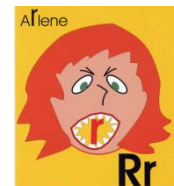
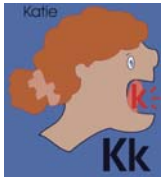
Difficulty with Assessing Students Reading Level

- **Unable to say the sounds or words**
- **Unable to verbally produce words that rhyme**
- **Unable to blend sounds together and verbally produce the resulting word**
- **SLPs and teachers use choice making or eye gaze using correct sound productions and foils on a choice board**
- **Internet based assessment (Iacono & Cupples, 2004)**
- **Bristow and Fristoe (1988)**
- **Iacono and Cupples (2004)**



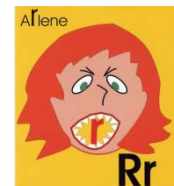
Phonological awareness

- **Phonological awareness is the ability to think about, reflect on and manipulate the sound structures of a language (Gough, Bradley & Bryant, 1983, 1985; Gough, Larson & Yopp, 2000; Yopp, 1988)**
- **Best predictor for reading difficulties in young children (Blachman, 1983; Bradley & Bryant, 1983; Cunningham, 1995; Perfetti, Beck, Bell, & Hughes, 1987).**
- **Tasks in Phonological awareness**
 - **Rhyming**
 - **Discrimination and production**
 - **Phoneme isolation**
 - **Identifying the sounds in the initial, medial and final position**
 - **Segmentation**
 - **Substitution**
 - **Deletion**
 - **Blending**



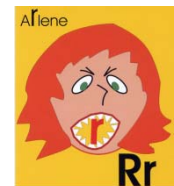
Traditional alphabet books

- One letter per page
- Each letter associated with the beginning sounds of objects depicted in pictures on the page
- Sounds occurring in other positions in words not highlighted
- Sometimes objects used started with diagraphs or blends
- Sometimes both capital and small letters were used
- Typically developing students may or may not have a problem with this format
- Phonologically challenged students however, unable to hear and therefore make an association between the sounds and the letters

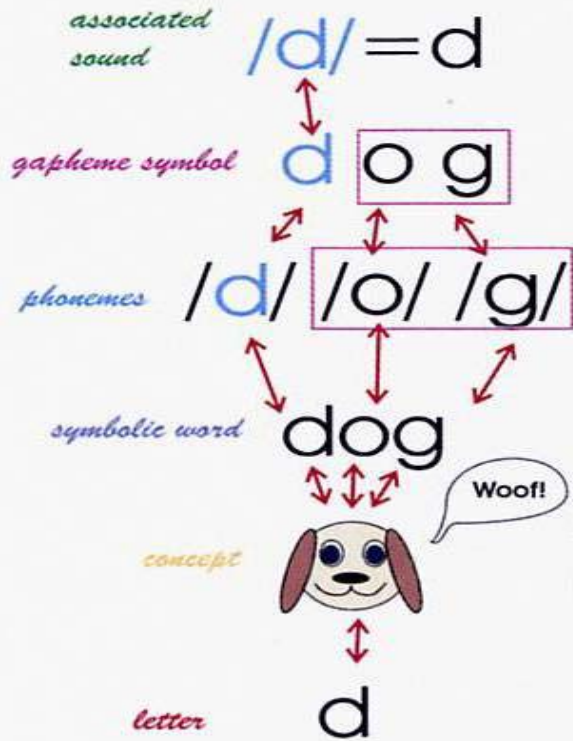


Phonological awareness and iconic alphabet

- **Symbolic organization**
- **Hierarchical and reciprocal relationship between concept and symbol (word)**
- **The patterns recognized as segmented phonemes (i.e., phonological awareness)**
- **The phonemes in turn linked to alphabetical symbols (letters)**
- **Transformations can occur**
- **Alphabet books bootstrap this learning for some children who have no problems with phonological awareness**



Auditory Hierarchical Structure



75% of students understand auditory concepts

so the first sound, /d/, is the sound for letter "d"

each auditory sound can be visualized using a letter

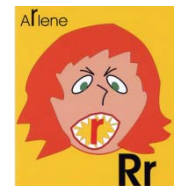
The auditory word "dog" can be segmented into sounds, and only the first is important rather, the word "dog" (auditory concept)

is for dog, but not the image of a dog

the letter "d"

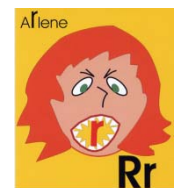


"d" is for "dog" means ...



Phonological awareness and iconic alphabet

- Without phonological awareness relationship of letter to sound is memorized via direct instruction
- The conceptual structure is indexical (not hierarchical and symbolic)
- When 3 sounds pronounced in sequence a word cannot be heard
- Transformations cannot be performed
- Children with severe speech and physical impairments are at-risk

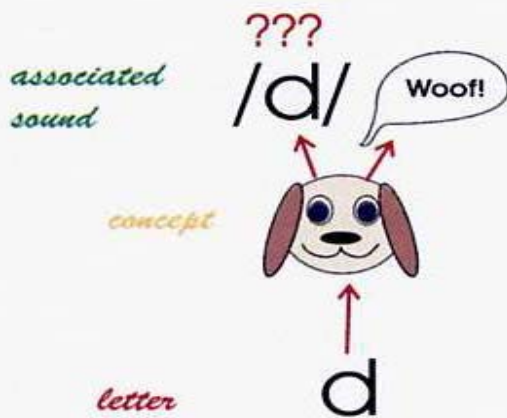


Visual Conceptual Structure

"d o g" says
du - ahhh - gu

no matter how fast
you say it

so I'll memorize it
but I don't understand
it and can't use it



but dogs don't
say /d/ but teacher
says they do???

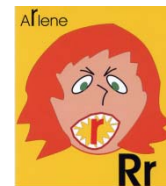
is for a dog

the letter "d"

25% can only think
about concepts
visually

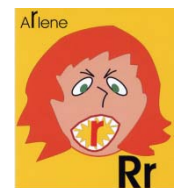
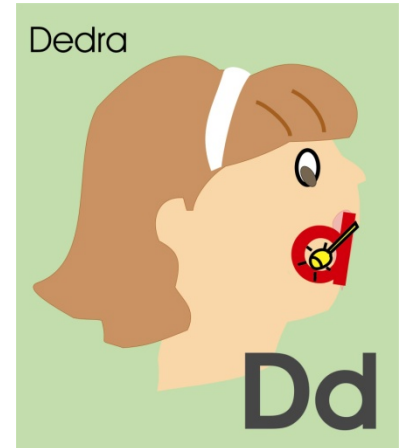


"d" is for "dog" means ...

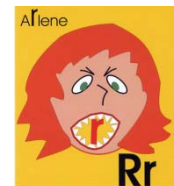
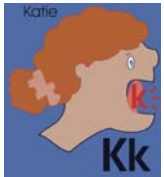
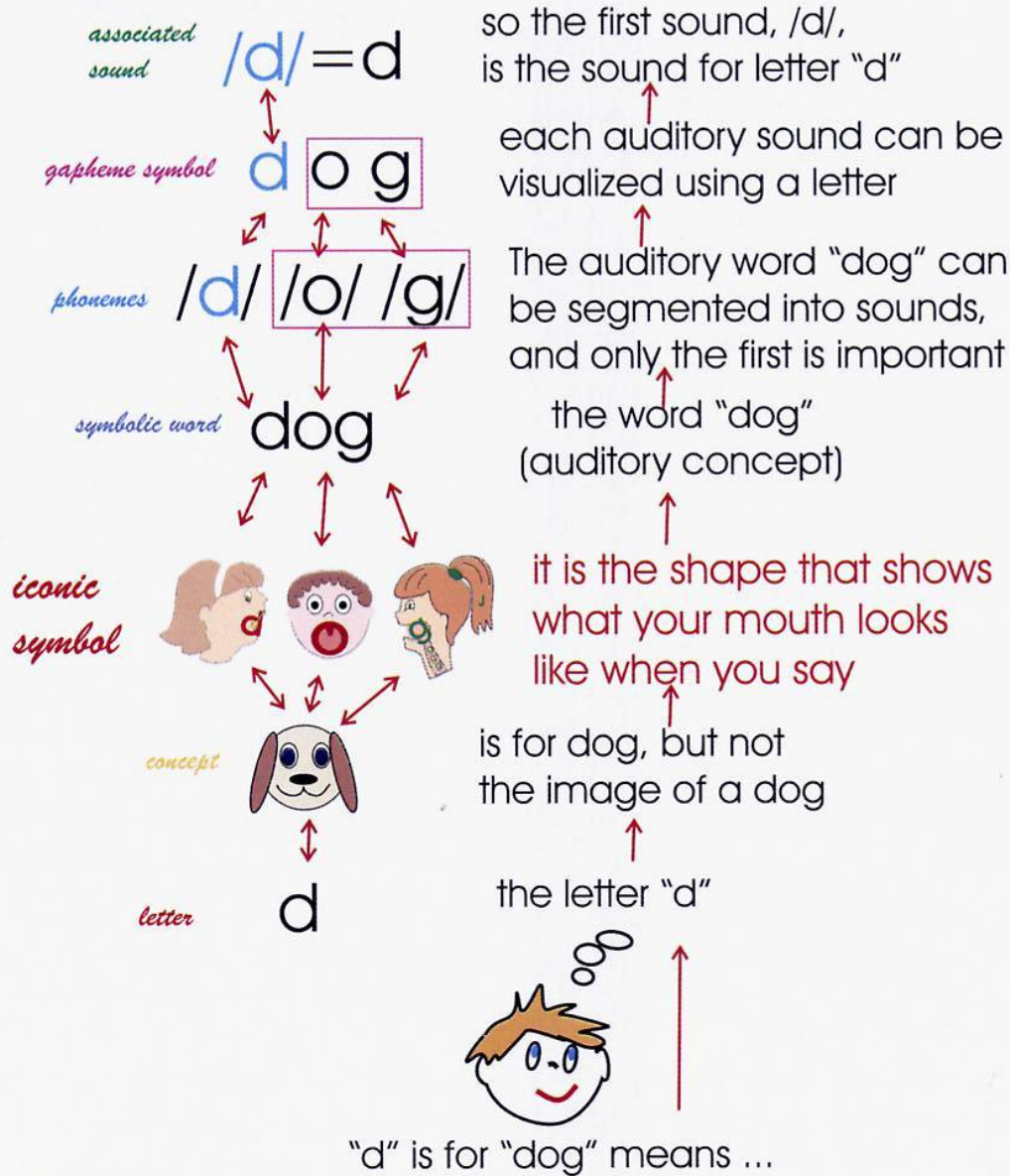


Phonological awareness and iconic alphabet

- **Phonic Faces (Norris, 2001) show the relationship between letters and sounds**
- **Letters drawn in the mouth represent features of sound production.**
- **Letter in the face teaches relationship between letter and its sound**
- **Provides a bootstrap for developing phonemic awareness**
- **For example, the association “d” is for “dog” requires the child to segment the symbolic word “dog” into phonemes, delete all but the initial phoneme, and then associate that phoneme with an arbitrary letter**

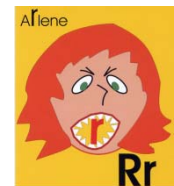


Iconic Bootstrap to Hierarchical Structure



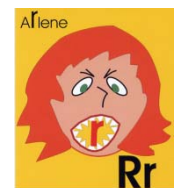
Phonic faces and phonic faces storybooks

- ***Phonic Faces Alphabet Storybooks:***
 - Incorporate features of both alphabet books and storybooks
 - Each book focuses on one phoneme and its corresponding letter (i.e., consonants), consonant or vowel digraph (i.e., “ch,” “oi”), phoneme variation (i.e., voiced and voiceless “th”), or letter variation (long and short vowel “a”)
 - Producing the phoneme is a natural part of the story as the book is read
 - In “Peter Pops,” he hears it, feels it, sees it pop, or tastes it
 - The /p/ letter is shown popping all around the popcorn kernels and as the top lip in Peter’s mouth.
 - The accompanying text encourages readers to make the sound, that is, “Peter’s ears heard it pop. P, p, p! Can yours?”
 - The letter “p” is found in different word positions (initial, medial, final), in capital and lower case format, and in isolation and within words
 - Thus, phonemic awareness training can be done in the context of the meaningful text of the story



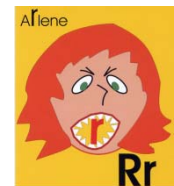
Purpose of the study

- **Determine if the Phonic Faces alphabet within reading experiences (i.e., Phonic Faces alphabet-storybooks) will improve the reading skills of children with disabilities using an AAC device**
- **Learning from Phonic Faces stories compared to learn from traditional alphabet book within and across sessions**
- **The following questions were specifically addressed:**
 - **Will targeted letter-sound recognition show greater gains following the reading of a Phonic Faces alphabet storybook in an e-book format compared to reading a traditional alphabet book in e-book format?**
 - **Will letter in word position recognition improve for the targeted letter following the reading of a Phonic Faces alphabet storybook in e-book format compared to reading a traditional alphabet book in e-book format?**
 - **Will learning occur for phonological and print awareness skills that are visualized or talked about in the e-book but not targeted for learning?**



Methods

- Three children with severe speech and physical impairments participated in the study
- Implemented at the children's homes
- The duration of the study was 10 weeks
- The first and last weeks were devoted to pre- and post-testing and 8 weeks (i.e., 1 hour 4 times weekly) were devoted to intervention
- Sounds to be targeted during intervention were determined using The Phonological Awareness Test (Robertson & Salter, 1997) during pre-testing
 - Subject SA worked on letters “k” and “s”
 - Subject SB worked on “r” and “t” and
 - Subject SC worked on “t” and “p”.
- During the intervention sessions, the children were presented with the target sounds using e-books
- Target sounds were subjected to the Phonic Faces Storybooks and Alphabet Storybooks alternately in a random manner during each session
- Five probes were used to assess the change in the phonological skills of the children at the end of each session.

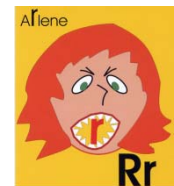




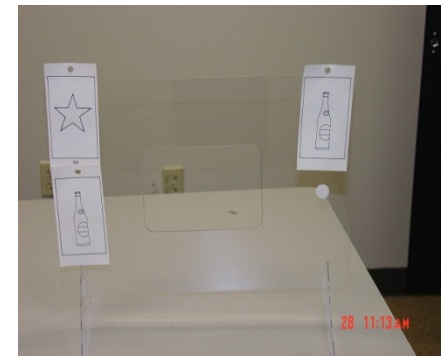
Subjects



- **Participants were 3 children between the ages of 5 and 9 years who were using AAC devices to augment or compensate for limited speech production**
- **Subjects were selected on the basis of the following criteria:**
 - **Emergent readers (recognized some sight words but could not read connected text)**
 - **Age appropriate receptive language skills (Nonspeech Test, Huer, 1995)**
 - **Used their communication devices without any difficulty**
 - **Normal vision and hearing**

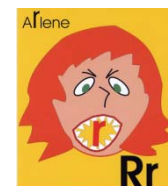


Procedures



- **Pretest/post**

- **The Informal Reading Inventory, 8th edition (Burns & Roe, 2006)**
 - **Word recognition**
 - Graded word lists (i.e., 20 words presented in isolation)
 - **Silent comprehension**
 - **Oral/verbal comprehension**
 - Reading passages (readability between preprimer and 12th grade)
- **3 equivalent forms (i.e., A, B, and C)**
- **Not based on norms but on grade level equivalency**
- **Method of responding is oral**
- **Tasks modified**

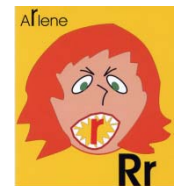


Procedure



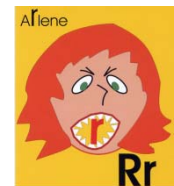
- **Pre/posttest**

- The Phonological Awareness Test (Robertson & Salter, 1997).
 - This assessment battery evaluates phonological awareness, grapheme knowledge, and decoding skills using separate subtests.
 - 7 subtests used in the study:
 - Rhyming
 - » Discrimination
 - » Production
 - Segmentation
 - Isolation
 - Substitution
 - Deletion
 - Blending
 - Grapheme



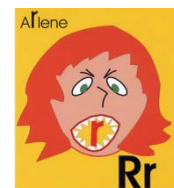
Procedures

- Adaptations to test procedures
 - Using eye gaze or pointing
 - Separating words
 - Using correct answers with foils
 - Use of engine, car and caboose for initial, medial and final position
 - Mouth positions for different sounds



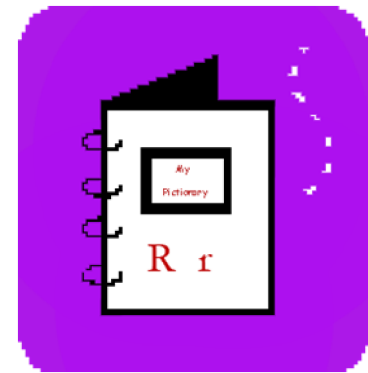
Procedures

- **Probes:**
 - Five probes were given following each session
 - Each probe was designed for an AAC response mode
- **Probe 1:**
 - Given one of the targeted letters, the subject indicated the associated sound
- **Probe 2:**
 - Given one of the targeted sounds, the subject indicated the associated letter.
- **Probe 3:**
 - Given a letter name, the subject indicated the associated letter
- **Probe 4:**
 - Given a written word with the target sound in an initial, medial, or final position, the subject indicated the position in which the letter was found by pointing to the initial – medial – final position on a train (engine – car – caboose)
- **Probe 5:**
 - Given a word with the target sound in an initial, medial, or final position, the subject indicated the position in which the sound was heard by pointing to the initial – medial – final position on a train (engine – car – caboose)

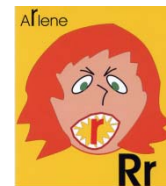
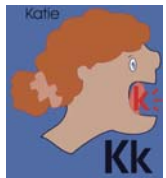




Materials

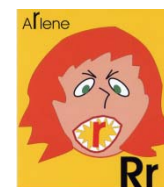


- **Adapted Alphabet and Phonic Faces storybooks:**
 - Books were scanned, pictures cropped and pasted into Microsoft PowerPoint software program
 - Slides created (one slide for each page).
 - The text typed and programmed to scroll across the screen using a mouse click.
 - Recorded spoken text
 - Animation (motion paths such as diagonal right movement or spin) programmed and activated with a mouse click. Transitions between slides activated with mouse clicks
 - A switch interface (hardware from Don Johnston Company) with a rocking lever switch used to activate mouse click
 - Books were be selected on basis of the results of the Grapheme subtest of Phonological Awareness Test.
 - Books of sounds that the participant demonstrated greatest difficulty with were chosen.



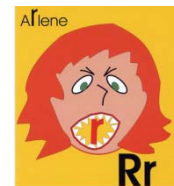
Materials

- **Phonic Faces Cards:**
 - Phonic Faces were scanned into the computer and stored as symbols
 - The Phonic Faces symbols inserted into appropriate overlays on the communication devices
 - The corresponding sound recorded into the devices
 - Used to select a letter in response to a letter name or sound prompt, or to indicate the sound heard within a word or associated with a letter
 - Used throughout the intervention and in the probes measuring target skills following each session.



Data analysis

- **Repeated ANOVA**
 - 3 subtests of the Informal Reading Inventory
 - 7 subtests of the Phonological Awareness test
 - The gain in standard scores calculated
- **Results from the daily intervention sessions were analyzed using**
 - visual analysis
 - assessing trends and levels between adjacent phases
 - a paired t-test analysis.



Results

- Standardized Test Performance Pre-Posttest
 - Subject SA improved from the poor range on all subtests to the average
 - Subject SB from the very poor or poor range to average or slightly below
 - Subject SC improved from poor or below average range to average on all subtests
 - Their gain in standard deviations ranged from +1.0 to +2.9 s.d., (clinically significant)
 - The results of the ANOVA indicate differences between the scores are significant ($p < 0.05$)

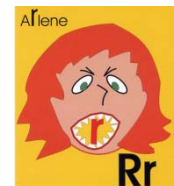


Table 2

Comparison of Pretest and Posttest Scores for 7 Subtests of The Phonological Awareness Test for Three Subjects with Severe Delay in Expressive Language Skills.

Dependent Variable	Subject A			Subject B			Subject C		
	Pre Test	Post Test	Gain in s.d.	Pre Test	Post Test	Gain in s.d.	Pre Test	Post Test	Gain in s.d.
Rhyming									
<u>Percentile rank</u>	9	70		3	15		2	48	
<u>Standard scores</u>	72	110	+2.6	61	88	+1	71	106	+2.4
Segmentation									
<u>Percentile rank</u>	9	88		5	38		4	83	
<u>Standard scores</u>	73	115	+2.8	74	97	+1.5	72	115	+2.9
Isolation									
<u>Percentile rank</u>	9	61		7	33		21	52	
<u>Standard scores</u>	71	109	+2.6	74	97	+1.5	83	99	+1
Deletion									
<u>Percentile rank</u>	8	33		6	37		7	46	
<u>Standard scores</u>	75	95	+1.4	73	96	+1.4	74	97	+1.7
Substitution									
<u>Percentile rank</u>	9	65		8	39		28	74	
<u>Standard scores</u>	83	103	+1	76	96	+1.5	90	106	+1
Blending									
<u>Percentile rank</u>	7	46		3	14		3	47	
<u>Standard scores</u>	77	104	+1.6	59	88	+2	63	99	+2.5
Graphemes									
<u>Percentile rank</u>	7	61		3	24		20	47	
<u>Standard scores</u>	69	108	+2.6	58	93	+2.3	81	98	+1

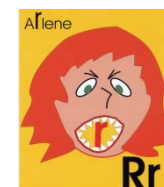
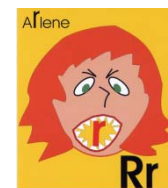


Table 3

Profile of Means, Standard Deviations, and Results of Repeated Measures ANOVA for 7 Su of the Phonological Awareness Test

Dependent Variable	Pretest	Posttest	F	sig
Rhyming				
<u>M</u>	67.67	97.33	292.74	.003
<u>SD</u>	4.72	13.01		
Segmentation				
<u>M</u>	77.00	107.77	623.12	.002
<u>SD</u>	9.00	7.00		
Isolation				
<u>M</u>	73.00	96.00	306.25	.009
<u>SD</u>	1.00	1.50		
Deletion				
<u>M</u>	75.33	100.00	288.21	.003
<u>SD</u>				
Substitution				
<u>M</u>	58.67	79.67	355.84	.003
<u>SD</u>	5.69	7.37		
Blending				
<u>M</u>	63.33	90.00	256.74	.004
<u>SD</u>	12.21	12.86		
Graphemes				
<u>M</u>	64.33	90.00	121.00	.008
<u>SD</u>	14.57	12.12		



Non-standardized Test Performance Pre-posttest

- **Inspection of means showed that higher scores were achieved at posttest for all measures**
- **To determine if these means were reliably different, repeated measures ANOVA was used to test for significance**
- **The results of the ANOVA indicate differences between the scores are significant ($p < 0.05$)**

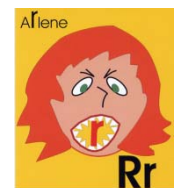


Table 4
Comparison of Pretest and Posttest Scores for Word Recognition, Silent Reading and Listening Comprehension Subtests of the Informal Reading Inventory for all Three Subjects with Severe Expressive Language Skills.

Subject SA			
Dependent Variable	Pre Test	Posttest	Reading Level
Word recognition (% correct)	20	40	Below Pre-primer
Listening comp. (% correct)	32	53	Below Pre-primer
Silent reading (% correct)	25	35	Below Pre-primer
Subject SB			
Dependent Variable	Pre Test	Posttest	Reading Level
Word recognition (% correct)	30	45	Below Pre-primer
Listening comp. (% correct)	35	63	Below Pre-primer
Silent reading (% correct)	37	56	Below Pre-primer
Subject SC			
Dependent Variable	Pre Test	Posttest	Reading Level
Word recognition (% correct)	10	30	Below Pre-primer
Listening comp. (% correct)	28	37	Below Pre-primer
Silent reading (% correct)	13	45	Below Pre-primer

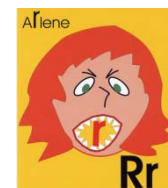


Table 5

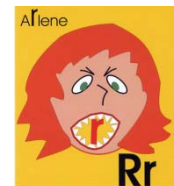
Comparison of Pretest and Posttest Error Scores for 3 Subtests of the Informal Reading Inventory for Three Subjects with Severe Speech and Language Disabilities.

Dependent Variable	Pretest	Posttest	F	sig
Word recognition				
<u>M</u>	20.00	38.33	130.00	.008
<u>SD</u>	10.00	7.63		
Listening comprehension				
<u>M</u>	35.00	51.00	138.51	.009
<u>SD</u>	8.89	13.11		
Silent comprehension				
<u>M</u>	25.00	45.33	121.00	.008
<u>SD</u>	7.57	10.50		

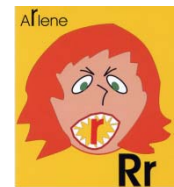
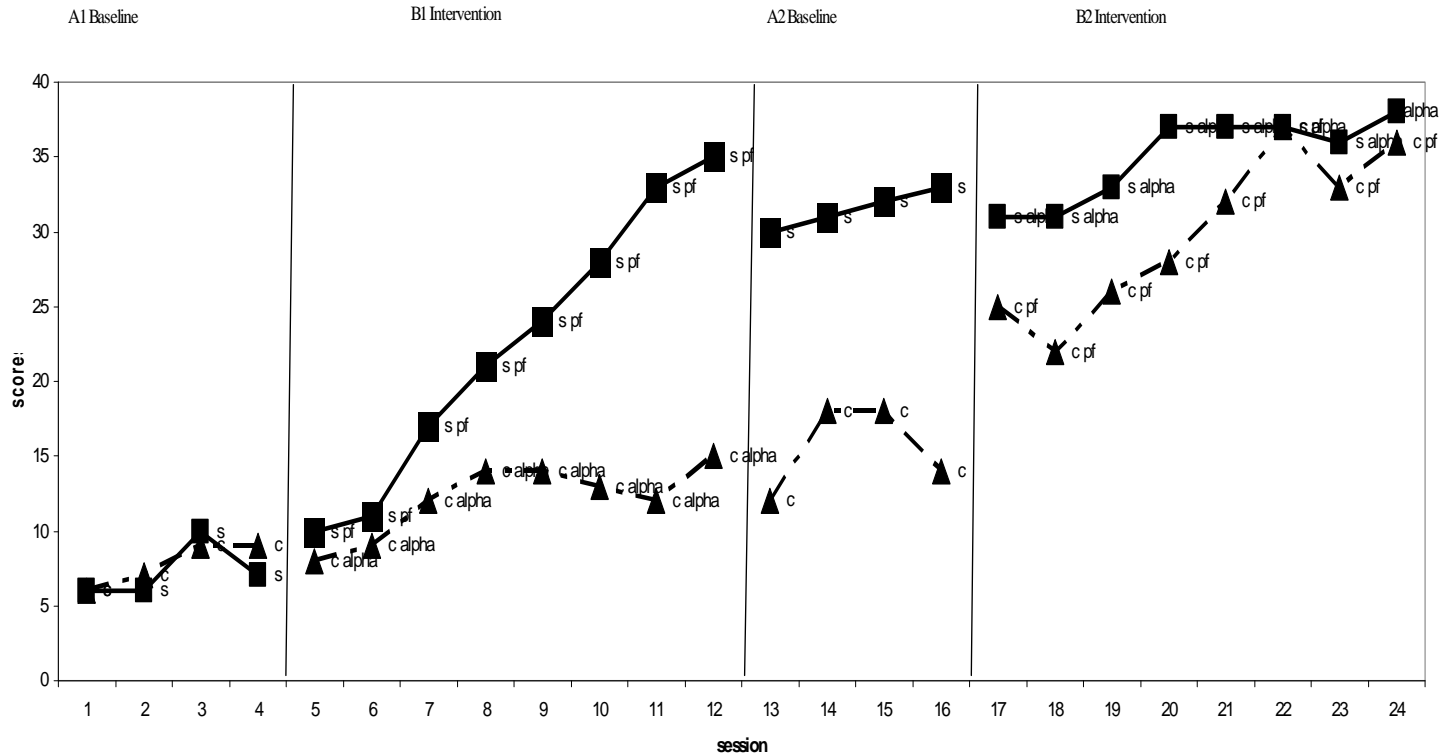


Analysis of probes

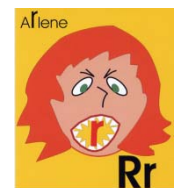
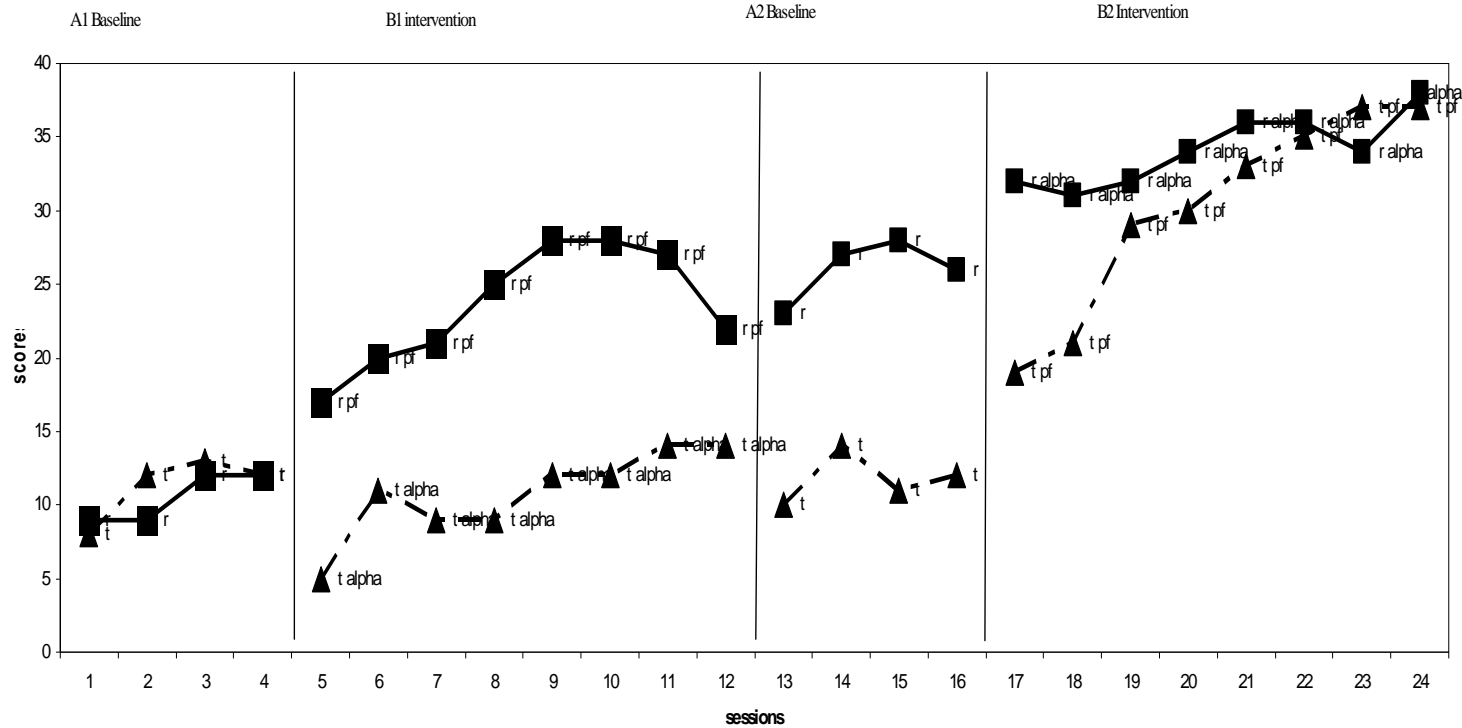
- **Visual inspection**
 - Scores for all three subjects demonstrated similar scores (between 0 and 2)
 - A gradual but steady increase in scores in first intervention phase (B1) for both graphemes
 - Phonic Faces Storybook scores increased a greater rate
 - Levels maintained during second baseline (A2)
 - During the second treatment phase (B2), the scores for both the graphemes increased and equalized to a near mastery level near the end of the phase
 - The Phonic Faces condition achieved results more rapidly
- The results of the paired t-tests indicate differences between the scores are significant ($p < 0.05$)



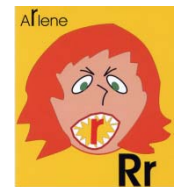
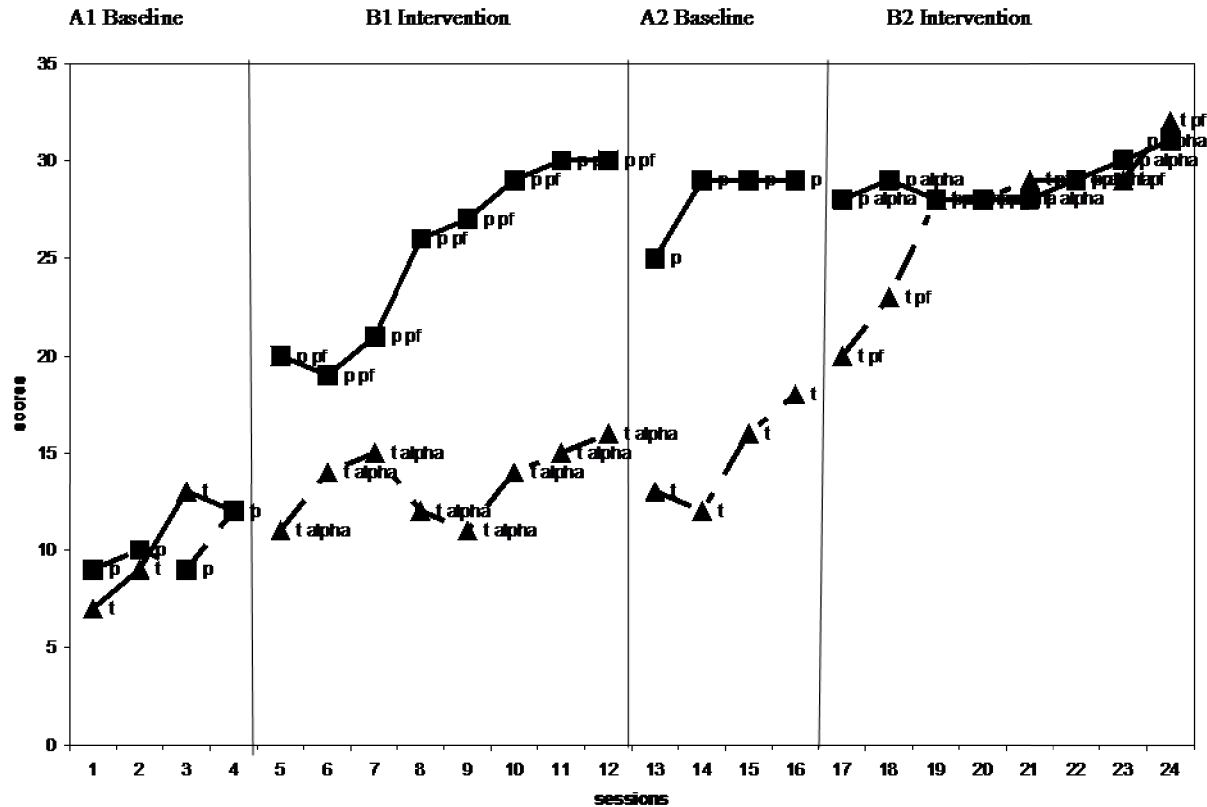
Comparison of Scores of all 5 probes for SA during Baseline and Intervention Phases under Conditions of Phonic Faces Storybooks versus Use of Alphabet Storybooks



Comparison of Scores of all 5 probes for SB during Baseline and Intervention Phases under Conditions of Phonic Faces Storybooks versus Use of Alphabet Storybooks

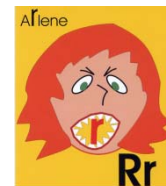


Comparison of Scores of all 5 probes for SC during Baseline and Intervention Phases under Conditions of Phonic Faces Storybooks versus Use of Alphabet Storybooks



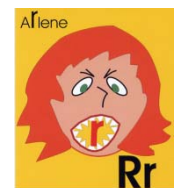
Improvement in Phonological Awareness

- **Reasons for phonological awareness**
 - **Lack of exposure**
 - **Skills that require phonological manipulation improved**
 - **Organizing the knowledge regarding sounds and letters in a consistent manner**
 - **hierarchical organization**
 - **not just memorizing responses to tasks**
 - **The skills were learned in context rather than in isolation**
 - **Self-organizing process that occurs whenever language is learned**
 - **Do children with severe speech and motor impairments perform poorly on phonological awareness tasks because of their inability to actually produce the sounds due to oral motor difficulties?**
 - **The students did not improve on oral motor productions**
 - **Some process other than oral motor production is key to phonological awareness**



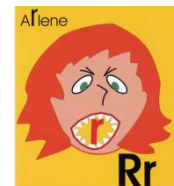
Improvement in grapheme knowledge

- At pretest all scores were low, with standard ratings of very poor for SA and SB and below average for SC (Standard Score of 69, 58, and 81, respectively)
- At posttest, all scores improved to average range (108, 93, and 98)
- Statistically and clinically significant (change in gain scores from +1.0 to +2.6 s.d.)
- Once exposed, a range of letter-sounds were learned even without specific instruction



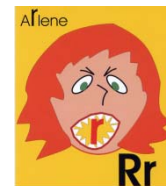
Improvement in reading

- **Improvement in reading not an actual goal**
- **Word recognition increased from 2-6 to 6-9 words**
 - Repeated reading of the storybooks
 - Scrolling of text as it was heard
 - Emerging decoding skills due improved phonological awareness
 - Further investigation needed
- **Improvement in listening and silent reading comprehension**
 - SA and SB increased performance to the lower ranges of instructional comprehension for listening
 - SC improved but remained at the frustration level
 - SB improved to the lower ranges of the instructional level for silent independent reading
 - SA and SC improved but remained in the frustration range.



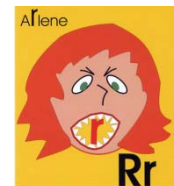
Other benefits

- **Benefit from print and efficacy of e-books**
 - **Phonic Faces Storybooks provided context for internalizing grapho-phonemic patterns for generalization to new sounds and letter patterns.**
 - **All subjects tried to imitate the sounds.**
 - **All subjects preferred reading Phonic Faces storybooks.**
 - **Computers increase student motivation and involvement in learning**
 - **Motivated by the graphics, sounds and ease with which they can access information.**
 - **The use of e-books motivated the children**
- **Benefit from adapted testing procedures**
 - **Good estimate of the participant's phonological and reading skills**
- **Implications for AAC users**
 - **Limitations of vocabulary**
 - **Children with limited speech and physical abilities have good potential to use print as a symbol system.**



Limitations

- **Six important limitations are identified which include:**
 - **Use of a small number of subjects that shared a similar profile**
 - **Use of only two graphemes**
 - **lack of a control group that used paper books instead of e-books**
 - **Lack of a control group that used “skill and drill” teaching strategies to develop phonological awareness skills**
 - **Lack of a control group that was not exposed to print materials**
 - **A comparison of use of Phonic Faces Storybooks versus Phonic Faces by themselves.**



Summary

- **The purpose of this study was to take a beginning step into answering questions about the capacity of severely impaired non-verbal children acquiring early reading skills**
- **This goal has been met, with important implications for the critical need to prioritize literacy skills for children with severe speech and motor impairments**
- **While many questions remain unanswered, it is clear that children with the profile presented by these subjects are excellent candidates for literacy, and instruction should begin sooner than is typically provided**
- **The study also shows that Phonic Faces storybooks provided a better context for learning alphabetic and phonological awareness principles than a traditional alphabet book.**

