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At-Risk Preschoolers Become Beginning Readers With Neurologically Integrated Alphabet Instruction

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The purpose of this study was to determine the effectiveness of a neurologically integrated approach in teaching 22 at-risk preschoolers their letter sounds by comparing the results to preschoolers who received traditional ball-and-stick letter-naming. Three sequential phases to teaching the experimental method include imagery, auditory, and integration and sound blending. Students received pre-, mid- and post-tests for sound recall and word blending. Analysis of covariance and descriptive statistics measured growth. Results indicate that significant changes occurred in the experimental students' knowledge of letter sounds and word blending compared to students who received the traditional approach. Reasons for their superior performance are mentioned. It is recommended to explicitly teach at-risk children their alphabet knowledge through a neurologically integrated approach that mirrors brain development.

Introduction

Preschool. During these formative years, young children begin to emulate adults by “pretend reading” as they learn about the world of print. Emergent readers begin to recognize letters and understand words are made of sounds; alphabet knowledge is a fundamental skill. In the last decade, we have come to better understand the importance of literacy experiences in preschool (Raban & Ure, 1999). Preschool programs may produce positive effects and lead to stronger academic growth, especially for children who come from at-risk homes where language and literacy may not be prevalent (Conyers, Reynolds, & Ou, 2003; Reynolds, Temple, Robertson, & Mann, 2003; Snow, Burns & Griffin, 1998). Short-term and long-term benefits have been documented as a result of preschool interventions (Burchinal, Peisner-Feinberg, Pianta, & Howes, 2002; Durlak, 2003; Morrison, Bachman, & Connor, 2005).

Alphabet skills learned in these early years are so important for life success, and yet many children struggle to break the code. In her attempts to help these students, the second author of this chapter developed an alphabet approach. The results of this approach have produced phenomenal alphabet gains for first graders (author, 2007; author in press). Because the neurologically and developmentally appropriate method appeals to developing brains, we wondered if preschoolers could benefit from early intervention. Therefore the purpose of this chapter is to compare the aforementioned innovative alphabet approach with a traditional ball-and-stick letter-naming phonics curriculum on the performance of 4 year-old at-risk children in an inner city preschool.

Theoretical Framework

To meet the goals of this study, it is of value to understand the research on alphabet knowledge and at-risk preschool learners. Information about this neurological approach is also presented.

Alphabet knowledge

Children need to understand that words are made of sounds. The broad term for this understanding is phonological awareness, which is the consciousness of sounds within words (Blachman, 2000). It is an auditory understanding and not directly tied to print. Research shows that phoneme awareness remains a strong predictor of reading ability and that children who lack in this phonemic awareness remain poor readers (Blachman, 1984; Høien, Lundberg, Stanovich, & Bjaalid, 1995; Wagner, Torgesen, Rashotte, Hecht, Barker, Burgess, Donahue & Garon, 1997). Furthermore, research suggests that phonemic awareness is more effective when the phoneme (sound) and the grapheme (letter) are combined in instruction (Ball & Blachman, 1991; Bradley & Bryant, 1985; Ehri & Wilce, 1987). This phoneme-grapheme correspondence is phonics; understanding the sound-symbol association is necessary for literacy processes. Foy and Mann (2006) discovered that rudimentary levels of phonological awareness helped children learn letter-sound associations. More explicit phonological awareness was bi-directionally linked with letter-sound and letter-name knowledge. Research has documented that letter-sound knowledge is critical for decoding and recognizing words; children who struggle to learn letter-sound knowledge will often be delayed in their overall reading ability (Duncan & Seymour, 2000). Further, “letter-sound knowledge may ultimately be a better predictor of subsequent reading-related skills than is letter naming” (McBride & Chang, 1999, p. 7). This may be in part because letter-sound knowledge is similar to phonological awareness.

Learning symbols (graphemes) is fundamental to skilled reading and writing. Yet, for beginning readers and writers, there is a lot to learn about letters; letters have names, sounds and shapes and the three are not logically connected. For example, the letter name for “c” is pronounced “see,” its pure phoneme should be correctly pronounced /k/ and its shape is an almost-closed “o.” To complicate matters, only eight letters of the alphabet have names from which the sounds can be derived (e.g., *b, d, j, p, t, k, v, z*) and numerous letter names are similar. For instance, *b, e, p, d, t, c, g, v,* and *z* all have the “ee” as the final sound in their name. Additionally, several letter names begin with a short /e/ sound (e.g., *f, m, n*). Many letters make more than one sound (e.g. “c”) depending on surrounding letters. When learning a letter’s shape, there are vertical, horizontal and diagonal intersections and up-down and circular movements to coordinate.

Complex alphabet knowledge is best learned through naturalistic, fun, and game-like manner (Delpit, 1988). This claim is further supported by Hannaford (1995) who asserts that by age five, children’s logical hemisphere of their brain has not matured sufficiently for them to learn their letters through a linear, logical process with few mnemonic images. As children grow, their brain and body develop in a certain sequence. The gestalt hemisphere usually has a dendrite growth spurt between ages four and seven, whereas the logical hemisphere typically grows rapidly between seven and nine years of age. Therefore, young children who have been taught to learn their numbers and letters in a linear, logical fashion with few images may experience high levels of stress. Logical instruction defies natural development of brain functions and children have to work very hard at learning alphabet knowledge. Children need to learn letters through association, image, emotion and spontaneous movement. Bear, Invernizzi, Templeton & Johnston (2004) stated that children should learn through “active exploration of the relationships

between letter names, the sounds of the letter names, their visual characteristics, and the motor movement involved in their formation” (p. 107). Adams (1990) recommended that children learn the visual shapes of individual letters through a keyword/picture display before learning the sounds of the letters.

At-risk preschool learners

One factor that may create conditions less than ideal for learning literacy is poverty (Allington, 1991). Duncan and Seymour (2000) found low socio-economic status (SES) to be associated with students’ ability to learn letter sounds and their ability to decode and recognize words. Dodd & Carr (2003) discovered that SES played a significant role in children’s performance on letter-sound recognition, recall and reproduction. Age and gender were not key factors in their research.

A study completed by Molfese, Modglin, Beswick, Neamon, Berg, Berg, & Molnar (2006) evaluated the skills of 57 four-year old low-income children who attended a pre-kindergarten program. A number of tests were administered in the fall (October-November) and spring (April-May). These included general cognitive measures, phonological awareness assessments, environmental print tests and early reading measures. Surprisingly, half of the students showed little or no growth in letter identification despite instruction. For the students who learned approximately 7 letters, their letter identification scores correlated with their phonological processing, ability to detect rhyme, and knowledge of environmental print.

It has been found that at-risk children require more instructional time (Hanson & Farrell, 1995) and often need to receive letter-sound instruction that is longer in duration and more explicit and more intense (Blachman, 2000). Molfese et al., (2006) discovered that young children who possess less cognitive ability are at greater risk for making little or no gains in

letter knowledge skill, possess less awareness of environmental print, and experience less mastery of reading. These children may need “special instructional attention by preschool teachers to receive more explicit instruction in these skill areas” (p. 302). Foster (2004) conducted a study in which he determined that students’ reading performance was linked to the number of risk factors in students’ lives. Foster recommended that schools may need to reevaluate their instructional methods and identify research-proven approaches. If students are not mastering the concepts and skills through the established approaches, schools should make changes in their methods of instruction, even if they differ significantly from previous methods.

DeBaryshe & Gorecki (2007) evaluated the effectiveness of preschool emergent literacy enrichment curriculum. They worked with three Head Start Centers. One center used the traditional Head Start curriculum. Another center supplemented students’ learning with experimental math and the third center provided enrichment in experimental reading. Those in the literacy environment showed greater gains in phonemic awareness and writing. No group differences were found on expressive vocabulary. These results convey the importance of curriculum for early literacy programs.

Connor, Morrison, and Slominski (2006) investigated the experiences provided to preschoolers and how they contribute to young children’s skill and language development. There were 156 preschoolers (approximately 38% of total enrollment) who were tested in the fall and spring on alphabet, letter-word recognition, and vocabulary. Twenty-five teachers completed questionnaires and received observations. Substantial variability was found in the amount and types of language and activities that occurred in the classroom. Connor, Morrison and Slominski discovered the more time spent in code-related activities (e.g. rhyming, writing letters) the

greater alphabet and letter-word recognition. Students who received more meaning-focused activities such as book reading and play showed more vocabulary growth.

A new integrated alphabet approach

This integrated alphabet approach is a practical, instructional methodology that *simultaneously* teaches phonemic awareness, letter sounds and letter formations. It was created on the principles of developmental and neurological mechanisms of learning in young children (Dennison & Dennison, 1989; Hannaford, 1995). Rather than teach skills in isolation, the integrated alphabet approach serves as an intersensory feedback system that triggers visual/auditory/motor responses and integrates them into reading, writing, and spelling. This methodology utilizes carefully selected visual images in conjunction with precisely crafted stories as a springboard to *transform* abstract symbols into meaningful letters which elicit specific consonant and short vowel sounds and integrated hand movements for writing.

The methodology goes a step beyond multisensory learning (the actions of seeing, saying, and doing) to a term that can be coined intersensory. This intersensory learning is taught in four phases. First, imagery is used to introduce students to a mnemonic symbol that represents both a sound and a letter. This means that the object's beginning sound and its shape are identical to the letter sound and letter shape, respectively. During the second phase, students learn the correct phoneme for each picture. Third, students join together the abstract letter with the sound to make a sound-symbol correspondence, followed by blending sounds into words. During the fourth phase, students are subsequently taught how to integrate the written elements. Through these phases, visual-auditory-motor learning works together. The new alphabet system does not isolate the phases, so phonics and handwriting cannot be separated. This integration of learning takes the new alphabet system beyond the multisensory to make it intersensory.

The principle of multifaceted learning exposure is applied to each letter of the alphabet. Each letter of the alphabet has its own device, which is comprised of stationary and movable parts; notched cardboard and acetate slide back and forth, left and right. How and when these parts are moved determines how the information is disseminated during the four phases. This alphabet concentrates on the pure phoneme associated with consonants and the short vowels, which typically are the most difficult for children to master. Therefore, the twenty-six letter set is essential and complete for students to learn beginning reading/writing/spelling skills.

Purpose

The new integrated approach was designed to teach children alphabet knowledge based on their developmental and neurological needs. The teaching of phonemes, graphemes and motor movement has been integrated into one approach. It was developed to assist all students, including those at-risk, in gaining alphabet skills to avoid their falling behind in their academic achievement. Previous research has documented the method's effectiveness (author, 2007; author, in press). Because struggling readers need more explicit and intense instruction (Blachman, 2000; Molfese, et al. 2006) and schools may need to evaluate their methods of instruction (Foster, 2004) we have chosen to use this approach in an at-risk preschool center during children's foundational years. The traditional method of ball-and-stick letter-naming instruction was taught in one classroom. The second classroom implemented the innovative and integrated alphabet method. Therefore, the purpose of this study was to determine the effectiveness of this neurologically integrated approach in teaching at-risk preschoolers their letter sounds by comparing the results to children who received the traditional approach.

Methodology

Participants

Four-year old students in an inner city preschool were assigned to two classrooms. The control classroom had 22 students enrolled in a full-day preschool. The experimental classroom had 22 students in a half-day preschool. The learner population was comprised of African American students who came from economically disadvantaged homes.

Each classroom had one head teacher and one aide. The head teacher in the traditional classroom had used a ball-and-stick letter recognition/letter-naming method for many years. The head teacher in the experimental classroom was trained in the integrated method before school started.

Assessment procedures

Students were individually tested three times during the year: pretested in September, tested mid-year in February and post-tested in May. The procedures for pre-, mid- and post-testing were identical and included assessment of sounds and words. An outside assessor, the second author of this paper, conducted all the assessments for reliability purposes.

To evaluate sound knowledge, the trained tester held a card with one letter on it and asked the child to tell her the sound, *not* the letter name. The child's response (whether correct or incorrect) was documented for all 26 letters of the alphabet. Next, the tester had an 8 ½ x 11 paper with 12 words: *cat, zip, hum, van, jug, fox, web, lid, red, yell, sock, quit*. The assessor pointed to one word and asked the student to read it. After a child missed three words in a row, assessment ceased.

Instructional materials and procedures

Experimental. Twenty-six individual devices, or cards with overlays, were used to disseminate the information of the twenty-six letters of the alphabet. Each teaching tool had a picture that began with the sound of that letter. Color illustrations were used to verify the visualized image created by the visual clues and mnemonically assist students in learning the name of the picture and the letter's sound. These visual images, combined with stories, worked in conjunction with directional arrows. The image and arrows supported students in properly forming the letters by emphasizing the need for the student to start at a specific point and cross the midline. The visual devices that included visual clues, color illustrations and directional arrows stimulated sound recall and letter formation.

For this study, three of the four sequential phases were taught: imagery, auditory, and integration and sound blending. In the first phase, students were introduced through imagery to a symbol that represented both a sound and a letter. This meant that the object's beginning sound and its shape was identical to the letter sound and letter shape, respectively. During the second phase, students learned the correct phoneme for each picture. Third, students joined together the abstract letter with the sound and began to sound blend. The multifaceted learning was applied to each letter of the alphabet.

Following is an example with the letter "c." First, students are introduced to an abstract symbol representing a picture which stimulates imagination. This quick phase teaches all 26 pictures in approximately ten 20-minute sessions. The teacher presents the picture with a brief story or description (emphasizing alliteration), followed by the teacher simultaneously tracing the letter (picture) to prepare students for the motor plan (fourth phase). The students are introduced to the imagery of a symbol that represents both a sound and a letter. This means that

the object's beginning sound and its shape are identical to the letter sound and letter shape, respectively. For example, letter "c" shows a picture of a cat, the contour of its face with an open jaw grabbing at the mouse. The cat's face represents letter "c," and the students learn that "c" is "cat catching."

During the second phase, students learn the correct phoneme for each picture. This phase usually takes approximately ten to fifteen 20-minute sessions. Once the students know all the picture names, they then segment and learn to produce the correct sound (or pure phoneme) for the initial consonants and short vowels. They learn that the initial sound of cat says /k/ and when they see the image of the cat catching, they pronounce the pure phoneme /k/.

Third, is the integration phase which usually is learned in two or three 20-minute sessions. Students join together the abstract letter with the sound to make a sound-symbol correspondence. The picture of the cat is removed and the students must learn the abstract symbol "c" is a picture of a cat and says /k/. After learning several letters/sounds, students are able to blend them together into words.

Control. The teacher in the control classroom had been teaching preschool for a number of years. She always taught students to learn the name of the letter and the sound of the letter simultaneously. A traditional ball-and-stick manuscript was used in instruction and supported by visuals such as the letter chart. The teacher used creative games and songs to teach the letters of the alphabet. Earobics was the supplemental program used.

Earobics is a research-proven program. Ninety-seven percent of students who receive the instruction achieve significant improvements in reading (Earobics, 2007). Earobics website states it is the most validated and quantifiable reading intervention program. The approach combines research-based strategies, engaging technology and multi-media. It claims be

multisensory and uses music, audiocassettes, videotapes, and talking CDs that keep students engaged. Picture word cards and letter-sound cards combined with little books, big books and leveled readers offer beginning readers a variety of tools. Overall, Earobics is a comprehensive reading program that teaches all critical areas outlined by the National Reading Panel (Earobics, 2007).

Data analysis

We used quantitative methods to analyze data. We knew we had a quasi-experimental sample so we chose to run independent samples t-tests to determine there were no group differences for sounds ($M = .80, .00$) and words ($M = .00, .00$) control and experimental respectively. Thereafter we conducted analysis of covariance. For the ANCOVA, the post-test was the dependent variable (the same for both groups), the pre-test was the covariate and the method was the independent variable (variable that could be manipulated). We ran ANCOVA for the total number of sounds correctly produced, and then we also conducted an ANCOVA for the number of words read correctly. We also ran descriptive statistics to show the means across both control and experimental groups for total sounds correctly produced and total number of words read correctly.

Results

The purpose of this study was to analyze the effectiveness of an integrated alphabet approach in teaching at-risk preschool students their letter sounds and assist them in reading words.

Letter sounds

We used analysis of covariance to determine if there was an improvement in students' ability to correctly produce sounds for each letter of the alphabet over time, and if there was a

change, whether the groups differed in how much their sound production had improved from pre to post-tests. Overall, across the two groups (control and experimental) taken together, there was a significant change in sound production ability during the course of the intervention, $F(1, 31) = 12.61, p = .00$. The interaction effect testing whether the groups differed in how much they improved over time based on the approach was also significant, $F(1, 31) = 140.94, p = .00$.

Descriptive statistics show pre-test sound scores for the control group ($M = .80; SD = 1.61$), and the experimental group ($M = .00; SD = .00$). The post-test revealed an increase for both the control ($M = 9.44; SD = 5.13$) and experimental ($M = 23.79; SD = 2.46$) groups. Figure 1 illustrates the mean scores for the number of correctly produced sounds (post-test) for the two groups.

Blending sounds into words

We used analysis of covariance to determine if there was an improvement in students' ability to blend sounds into words over time, and if there was a change, whether the groups differed in how much their reading had improved from pre to post-tests. Overall, across the two groups (control and experimental) taken together, there was not a significant change in reading ability during the course of the intervention, $F(1, 29) = .17, p = .68$. The interaction effect testing whether the groups differed in how much they improved over time based on the approach was significant, $F(1, 29) = 5.89, p = .02$.

Descriptive statistics show pre-test word reading scores for the control group ($M = .05; SD = .22$), and the experimental group ($M = .00; SD = .00$). The post-test revealed an increase for both the control ($M = .44; SD = .98$) and experimental ($M = 1.67; SD = 1.78$) groups. Figure 2 illustrates the mean scores on the number of words read (post-test) for the two groups.

Conclusion

This study was a school year intervention posed to help at-risk preschoolers prepare for kindergarten by providing them with direct instruction in sound knowledge and word reading. A number of studies have shown that low socioeconomic status affects students' performance on learning the alphabet (Dodd & Carr, 2003; Duncan & Seymour, 2000; Molfese et al., 2006). Children who come from disadvantaged homes have experienced less exposure to print and possess weaker alphabet knowledge (Bear, Invernizzi, Templeton, & Johnston, 2004). Despite the external factors that make learning more challenging, the students who received the experimental teaching method showed positive gains in their letter-sound knowledge and reading ability.

Preceding studies have documented preschoolers from low-SES families learn, on average, 29% (Bowey, 1995) to 38% (Molfese et al, 2006) of their letter sounds. In this research, students who received the traditional approach learned 36% of their letter sounds, which falls into the averages previously reported. In contrast, the students who received the integrated alphabet approach learned 91.5% of their letters. As educators, we expect all students to mature and learn over time. Yet the positive success rate of students who received the experimental approach is unusual and noteworthy.

There are reasons to support why the children who received the integrated alphabet approach outperformed those who received traditional phonics instruction. First, this new integrated alphabet approach attempts to logically connect the letter sound, shape and name by providing a keyword/picture, so the three aspects of learning are not separate or abstract. Young children learn best with pictures and mnemonic hooks (Adams, 1990; Hannaford, 1995). Since most of human's learning comes through the visual route (Fiske & Taylor, 1984), the curves,

colors, size, and lines portrayed in the picture positively affected students' consciousness of features and visual memory. Learning letters through image improves retention. One possible reason may be the "emotional" connection children have with images. Vail (1996) wrote, "Emotion, the on/off switch for learning...has the power either to open or close pathways, doorways, or windows to learning" (p. 36). When young children see the pictures rather than an abstract letter, their ability to be emotionally engaged opens the pathway in their brain.

Second, the approach strengthens phonemic awareness through alliteration (e.g. the cat catching) and by teaching students the pure phoneme. Children without phonemic awareness cannot develop letter knowledge (Juel, 1996). The integrated approach also combines the phoneme with the grapheme. Although phoneme awareness is auditory and not directly tied to print, research has shown the benefits of bridging the sound-symbol association (Ball & Blachman, 1991; Bradley & Bryant, 1985; Ehri & Wilce, 1987). Juel (1996) says students must unlock the relationship between the sounds of the words and the letters which they read and write. It is the integration of phonemic awareness and letters that assists children in decoding unknown words in text (CIERA, 1998).

Third, the approach integrates students' learning of letter sounds and names so the tasks and processes are not isolated. The ability to recognize letters has been a strong predictor of reading success (Bowers, Sunseth, & Golden, 1999; Bramlett, Rowell, & Mandenberg, 2000). McBride-Chang (1999) found differences between letter-naming and letter-sound knowledge. The association of letter names/sounds is not a simple one. McBride-Chang wrote both were "developing in substantially overlapping though different ways" (p. 9) and contribute unique variance to reading-related skills. The integrated alphabet approach used in this study teaches students first to recognize letters through imagery. Then sounds and motor movements are

emphasized *before* teaching students the name of the letter. This sequence of instruction is developmentally appropriate (Hannaford, 1995).

Fourth, the approach explicitly teaches the alphabet through four phases. Direct instruction of alphabet knowledge has been found to be essential (Blachman, 2000; DeBaryshe & Gorecki, 2007; Hanson & Farrell, 1995; Molfese et al. 2006). Snow, Burns and Griffin (1998) said that reading failure may be prevented by providing explicit instruction in letters and their sounds. The explicitness of each phase as previously outlined truly contributes to the success of students.

Fifth, the approach is systematic in building connections. Each phase builds on the previous one and all the skills (phonemic awareness, decoding, handwriting) are intertwined in a deliberate and accessible manner. The integrated method teaches the letters based on their motor plan. Rather than starting traditionally with A and finishing instruction with Z, students learn letters that are related such as *c, o, a, d*. Learning is all about making connections. Every encounter with something new requires the brain to connect it to an existing memory category of networked neurons. The neurons make the brain a thinking and learning organ. Learning is functional when the brain can link new material to other associations (Jensen, 2005). Teaching to the human brain is based on a real understanding of how the brain works. It elevates teaching into a challenging field (Caine & Caine, 1994).

We recognize this study targeted a small group of students in an inner-city preschool. The sample size prevents the findings to be generalized to all preschool populations. We also note that follow-up reading assessments of the students as they progressed through kindergarten and first grade are not included in this study. There are several possibilities for future research. It would be worthwhile to conduct a similar study in a number of preschool classrooms to

increase sample size and determine findings based on multiple populations of learners.

Nationally recognized phonemic awareness assessments could be used to determine the amount of growth and whether it is significant. Ideally, conducting a long-term study, following the students through grade three or four, would provide information about the long-term effects on students' literacy development.

In sum, it was the goal of this new integrated approach to provide preschoolers with meaningful, as well as developmentally and neurologically appropriate methods to learn their alphabet. At-risk students who received this intervention were able to master alphabet knowledge in a relatively short amount of time. The new alphabet approach assists students in their memory retrieval by providing a picture for each sound. Further, it is an intersensory approach that integrates visual/auditory/motor responses. In conclusion, this study supports previous research showing the link between letter sound and blending; this knowledge is the foundation for reading and writing.

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Figure 1

Post-test results for sounds

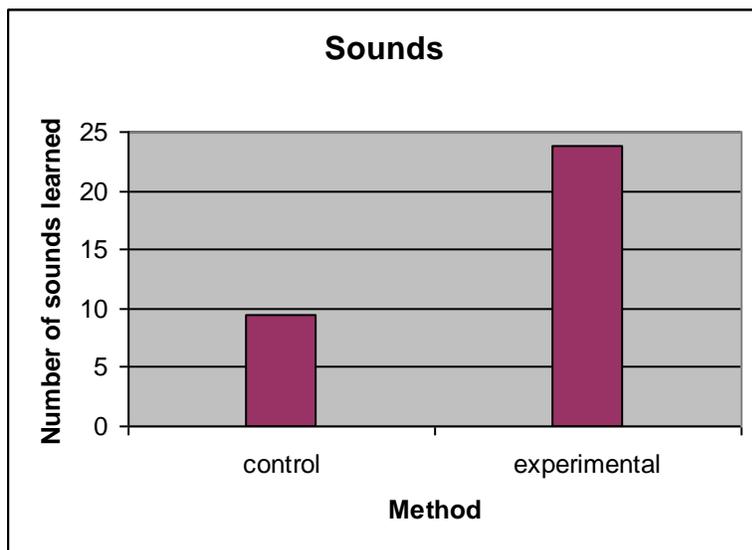


Figure 2

Post-test results for words

