A Unique, Neurologically Integrated Approach Designed to Teach Letter Sounds and Formations

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Abstract

The purpose of this article is to present an integrated alphabetic approach that *simultaneously* teaches letter sounds and formations. We share with you the research that supports this integrated approach and present the procedures to implement this approach. Further, we document the effect of using this new integrated alphabet approach on the accuracy with which students learned to produce letter sounds and formations in two situations: first grade classrooms in a school in a Midwest suburb and in an inner city post-kindergarten summer school. Also, teacher comments and student voices are included. Results show that students who received integrated alphabet instruction reduced their sound and letter formation errors. Also, teachers advocate for one approach that *simultaneously* teaches phonics and handwriting. The findings of this study support the value of employing a methodology that combines instruction in letter sounds and letter formations through a neurologically integrated system.

"The initial and most obvious change [after teaching with the integrated alphabet-handwriting approach] was the eradication of reversals in their written work. The children also demonstrated fewer bottom to top letter writing errors. The flow of the children's writing showed greater confidence because the sequential formation of their letters supported by visual clues and continuous practice eliminated the need for reinforcement clues from wall cards or desk strips. These changes allowed the children to concentrate on their ideas being written, rather than the mechanics of writing." – Teacher of 29 years

"It helped because the letter looked like the picture. The picture of the kicker looks like a 'k' with his head down and kicking a ball. It's easier to remember the sounds. You can stretch out the sounds to write." – A first grade student

As evidenced by these quotes, alphabet and letter-sound knowledge is complex. 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 (Bear, Invernizzi, Templeton & Johnston, 2004). 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 (Bear et al, 2004). Alphabet knowledge is complex, yet integral to beginning readers and writers' development of literacy skills.

There are numerous approaches and methods to teach alphabet skills. Despite teachers using varied approaches to the best of their ability, some students still struggle in the process of becoming literate. This article presents one practitioner's (Mary) integration of theory, research and classroom innovations to develop an alphabetic-handwriting approach that broke down abstract symbols for students. Mary used this approach for seven years and it continues to be used in both regular and resource classrooms. We inform you of the research that supports this integrated approach, and document the effect of using this new integrated alphabet approach on the accuracy with which students learned to produce letter sounds and formations. Finally, we share voices of teachers and students who have used this integrated approach.

What the research says

Prerequisite to the development of formal literacy skills is the auditory understanding that words are made of sounds. Results of extensive research continue to provide evidence that phoneme awareness remains a strong predictor of reading ability and that children who lack in phonemic awareness remain poor readers (Blachman, 1984; Hoien, Lundberg, Stanovich, & Bjaalid, 1995; Wagner et al., 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.

Students' understanding of letter sounds and names has been found to be important for predicting subsequent reading success (McBride-Chang, 1999). Bramlett, Rowell, and Mandenberg (2000) found that letter recognition in kindergarten was the best predictor for reading achievement in first grade. Students who fail to automatically recognize letters struggle with their ability to process letters and grow in their orthographic knowledge (Bowers, Sunseth

& Golden, 1999). "Most mainstream, middle-class children take 5 years to acquire this alphabet knowledge at home and in preschool" (Bear, Invernizzi, Templeton & Johnson, 2004, p. 107).

Alphabet knowledge is best learned through naturalistic, fun, and gamelike 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 et al. (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. Moreover, she believed that children should learn to print the letters as soon as they were introduced. Writing allows access to the kinesthetic pathway, which is a strong, reliable learning channel for children (Sheffield, 2003; Zaporozhets & Elkonin, 1971).

Handwriting is critical to school success, writing development and written communication. Yet, the trend in recent years has been to de-emphasize instructional time devoted to handwriting (Graham & Weintraub, 1996). Typically, the natural learning

environment is believed to be conducive to produce good writers; therefore, handwriting is taught sporadically. However, it cannot be assumed that children will develop proper handwriting techniques in such an informal setting. Students need to be explicitly taught handwriting (Berninger, Vaughan, Abbott, Abbott, Rogan, Brooks, Reed, & Graham, 1997; Zaner-Bloser, 2003; Graham, Harris & Fink, 2000).

Some children who enter school are not developmentally prepared for the two-dimensional, bilateral skills that are necessary for schoolwork. It is essential that students can cross the central midline of the body and work in the midfield (Dennison & Dennison, 1989). The midfield is the area where the right and left visual fields overlap. It is difficult for children to cross the midline because they have to change motions from "toward me" to "away from me." This challenge is clearly seen when children are asked to draw a circle. Children under six years of age tend to begin their circle by starting at the bottom (near their body) and then draw away from themselves, which supports their perception that they are at the center of the universe. Children over age six usually begin the circle near the top and form it clockwise, towards their body (Beery, 1997). For students of older ages who have reversals in writing and reading the problems are often based on midline challenges. Children who have difficulty with the midline often lack the ability to process a linear, symbolic, written code and are labeled dyslexic or learning disabled (Dennison & Dennison, 1989).

"Visual-motor integration is the degree to which visual perception and finger-hand movements are well coordinated" (Beery, 1997, p. 19). Visual perception is the interpretation of visual stimuli. Young children focus on the whole. As they mature, they can usually discriminate details by age six, and analyze and synthesize parts/wholes by age nine. Likewise, children develop motor skills in a sequential manner, progressing from head downward and spine

outward. Therefore, finger activity is one of the last refinements in the shoulder-arm-hand progression/complex. A child may be well developed either in motor skills or visual skills, but may be unable to amalgamate the two. This integration of visual-motor senses is critical to learning (Ayers, 1972; Dennison & Dennison, 1989; Hannaford, 1995; Houston, 1982).

An integrated alphabet approach

Mary, a resource teacher, was challenged by an eight-year old first-grade student who, after being retained in kindergarten, was still unable to learn a single letter sound or a proper letter formation despite instruction using many methodologies. This led Mary to question what activity must occur in the brain in order for students to learn to read and write. To help answer the inquiry, Mary analyzed the student's strengths and weaknesses. He possessed good visual processing abilities. However, he struggled with some auditory weaknesses and was limited in his motor plan, or his ability to effectively move through space in an organized manner. Innovative ideas and questions formed in her mind. "Would it be possible to appeal to the right hemisphere in a manner that would stimulate the temporal and frontal lobes, and thereby illicit auditory recall of the letter sound and a motor movement for writing?" She thought of turning a letter into a picture. Then she wondered what the picture would have to contain to assist this child in learning a letter sound and formation. After pondering these new ideas, Mary decided that the picture shape would need to be dependent on both the letter's phoneme and grapheme, and she would need to teach the letters in sequence of motor plan rather than traditional alphabetic order. Thus, Mary developed an alphabet system that is a neurologically integrated approach designed to *simultaneously* teach sounds and letter formations. The system's 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. 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/ (not the sound /s/ typically segmented from the letter name *c*).

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/. Once sound-symbol correspondence is learned, students are able to blend sounds into words using pictures, then clues and ultimately abstract symbols.

During the fourth phase, students are subsequently taught how to integrate the written elements. Based on observation, Mary hypothesized student ability to cross the midline utilizing a mid-space start to form counter-clockwise circles in combination with diagonal lines and continuous strokes would reduce soft neurological signs. Therefore, she redesigned the alphabet letters. With specific attention given to spatial organization, crossing of the midline, integration and directionality students learn how to properly execute the writing of "*c*," or draw the "cat catching." The 26 letters of the alphabet use counter-clockwise circles, diagonal lines as well as continuous strokes. They are categorized into six motor-plan groups (e.g. circle letters) and in each group the letters are sequenced to continue to build on previous motions. The entire alphabetical letter formations can be successfully taught in approximately twenty to twenty-five 20-minute sessions.

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.

Learning letter sounds

Mary developed this alphabet approach for struggling learners. However, classroom teachers around the nation use it in their regular classrooms. Following are two examples (Shadow Ridge School and inner-city summer school) of students' letter-sound knowledge before and after using this new approach. In both cases students were shown a letter of the alphabet (i.e. abstract symbol) and asked to tell the sound of the letter. Appendix A documents the most common errors students make when they are asked to say the sound of a letter.

Shadow Ridge School

Shadow Ridge School was a suburban elementary school near a large Midwestern city. There were 78 first-grade students who were taught Lippincott phonics and McGraw-Hill sight reading with D'Nealian handwriting from September to February. In February, when students were asked to say the sound of a letter they made a total of 276 letter sound errors, averaging 3.4 errors per student. The teachers of these students had heard and seen evidence of the effectiveness of this new integrated alphabet-handwriting approach so they decided to spend the remainder of the school year teaching integrated alphabet-handwriting. After teacher-training and spring break, the students had only seven weeks to learn alphabet sounds and formations through the new approach. After seven weeks these same 78 students were tested again and they had reduced their total sound errors to 21, averaging 0.3 errors per student.

Inner-city summer school

Another example of how this new approach has helped students learn their letter sounds took place in an inner-city school district during summer school. One hundred twenty at-risk students were identified by the school district as unable to recall the 26 alphabet sounds or form lowercase letters of the alphabet at the end of kindergarten. Fifty-nine students enrolled in summer school but only 43 remained for the duration of the program and were post-tested at the conclusion of summer school. Students were instructed in the alphabet system approximately 43 hours during the summer months. On the pre-post assessments, each student was asked to provide the correct sound for each of the 26 letters. Therefore, each student's potential correct score was 26. This number, times the number of students (N=43) equals a total of 1118 sounds. On the pre-test, the 43 students properly said 305 out of the 1118 potentially correct sounds, which means the average student error was 18.91 sounds (SD=6.443). Therefore, prior to this

alphabet instruction, the 43 students knew approximately 25% of the letter sounds, or an average of seven of the twenty-six sounds. On the post-test, the students correctly recalled 1105 sounds, which decreased the average student error to .30 (SD=1.551). Therefore, after students received this intervention they were able to correctly recall sounds with 99% accuracy. It should be noted that of the thirteen errors on the post-test, ten of the thirteen errors belonged to a student with severe fine motor challenges and three errors belonged to two additional students. This means that 93% of the students (40 out of 43) were able to recall 100% of the letter sounds.

Learning letter formations

Another goal of this approach is to *simultaneously* teach letter sounds *and* formations which need to be directionally correct and well integrated for legibility. To accomplish this, Mary hypothesized student ability to cross the midline utilizing a mid-space start to form counter-clockwise circles in combination with diagonal lines and continuous strokes would reduce soft neurological signs. Appendix B documents the most common motor-plan errors. Figure 1 shows a student's handwriting before and after the integrated alphabet instruction.

Shadow Ridge School

At Shadow Ridge School, students were asked to write "*c*" for example and then their letter was analyzed against established criteria (see Appendix B). Until February, the 78 students received traditional D'Nealian handwriting instruction for approximately 15 minutes per day. When pre-tested, the students made a total of 1695 errors, which meant average student error was 21.7 errors per student. After their teachers incorporated the integrated alphabet approach for seven weeks, the students' errors decreased to 632, averaging 8.1 errors per student.

Inner-city summer school

At the inner-city summer school where students had been taught traditional ball/stick, the assessments were simplified. Students made an error on the pre-test if they did not know how to write the designated lower-case letter, or if they capitalized the letter, wrote the wrong letter or made the letter the wrong size. The two most common pre-test errors across students were wrong size (total errors pre-test=684), followed by capital letters (total errors=363). This means that most students were not cognizant of how to correctly form a letter within the line spaces and they were not certain of how to write the lower-case letter. On the post-test, students showed improvement in both error categories. Students made zero capital substitutions (substituting capital letters for lower case) and reduced the wrong size errors to 52. Descriptive statistics revealed the participants' mean error scores for pre-test (M=32.77; SD=12.98) and post-test (M=1.79, SD=.58). As can be seen, the scores dramatically decreased after intervention, which shows that students learned to correctly form lower-case letters.

What teachers say

Prior to the intervention at Shadow Ridge School or the inner-city school district, none of the teachers had previously used the new integrated approach. They employed other phonic approaches such as Open Court, Scott Foresman, and Hooked on Phonics. The handwriting program was either D'Nealian or ball/stick with frequent starts and stops.

The teacher in the introduction of this paper spoke how the integration of phonics and handwriting had decreased reversals and poor letter formation which contributed to greater written content. Fellow Shadow Ridge teachers raved about the improvement in their students' literacy skills as a result of the new integrated approach. Following are several teachers' comments.

Teacher A, first grade teacher

The integrated alphabet approach was instrumental in giving my first graders a place to go in their minds to conjure up a letter sound in a word they were to decode or spell, as well as the specific shape of a letter they were to print. You could watch their faces in thought as their eyes would go up and over to one side when 'finding' that picture in their heads. Immediately thereafter, their pencil would be forming that shape while simultaneously committing the correct sound to paper. Letter reversals were almost nonexistent because the directionality of each picture is built right into its corresponding story. There is absolutely no other approach that can help a child learn letter sounds and formations so sensibly and quickly.

Teacher B, first grade teacher of over 30 years

Teacher B mentioned numerous literacy approaches she has used during her teaching career prior to her implementation of the integrated alphabet. When using those programs although many children did learn to connect the letters to sounds, there were many that struggled with putting words onto paper. Some children had difficulty with the actual motor part of writing; not knowing how to form the letters, for example. Others could segment the sounds of a word but labored with recalling which letter made that sound or encoding.

Now that Teacher B teaches phonics and handwriting through an integrated approach, the children

learn the picture names very quickly, usually within four or five 15-minute lessons, and even children that I taught years ago still recall the alphabet letters. The sound/symbol piece moves along so quickly, too, with all 26 consonants and short vowel sounds

> mastered in eight to ten 15-minute sessions. Once the motor segment is presented, there is no stopping the immense quantity and quality of writing from young children. The connection between the picture, sound and motor plan is so strong, that the children write with ease.
>
> *Teacher C, kindergarten teacher*

> The constant integration of sound symbol and formation helps imprint in the brain the letters and sounds. Many times the children will use one or the other sense to help remember the letter formation or the sound or the letter picture. For children of low ability or non-English backgrounds this makes the alphabet a friendlier tool.

Later, Teacher C expanded and said that she has used any and every early literacy program on the market. With this integrated approach, Teacher C has "seen it succeed with all types of students." The students are excited, children can begin to read very quickly printed and cursive text, and "one of the beautiful things is that it can be used in conjunction with any other reading program on the market."

Without formal interviews, four other classroom teachers at Shadow Ridge School have made the following remarks when asked about the new integrated approach. One teacher said, "I like how picture supports letter shape." Another teacher voiced, "Easy transition from picture to sound, it's quick, very routine and the children love it!" A third teacher spoke, "My students are learning sounds of letters faster than any other program I've used." A fourth teacher said**,** "It's like magic. The children always ask for the magic show."

Likewise, the inner-city summer school teachers all reported positively about the new integrated approach. Teacher D said she "saw the students become good readers and writers." Teacher D stated that she continues to use the integrated alphabet approach with students who

have difficulty learning their basic literacy skills. Teacher E continues to use the approach and is often asked, "Why do your students write so well?" Teacher E said she "loves the approach for writing and wants the approach extended to teach capital letters." Teacher F spoke about the approach from a different angle. She said that the targeted students were easily distracted. With this approach, Teacher F noticed students increased engagement with the picture which assisted them to learn alphabet sounds and formations.

Elementary student voices

Not only do teachers have good things to say about the integration of phonics and handwriting in one approach, students also respond very positively as indicated in the student quote on the first page. Following are some first-graders comments about the pictures and sounds.

Student A "I remember that the letters and the pictures go together. They helped me in writing workshop because I could look at the letter and remember the sound that you taught me. I think they are helpful to other kids, too."

Student B "They help you read. You can remember the sound and stretch out the word. You can have more 'easiness' with them."

Student C "I think the pictures are cool. Sometimes I would practice the sounds at snack time for fun."

Student D "The pictures help you with the sounds because you can know what letter makes what sound. They help you read. Other kids would love to read and use them a lot."

Student E "I don't get mixed up with 'b' and 'd' because the pictures help me remember. I can write them and they aren't backwards!"

Beyond first grade

So what? Does this approach really make that much of a difference? What happens to students beyond first grade who receive this integrated approach? These worthy questions must be addressed as well.

Let's begin with the boy who challenged Mary to develop this integrated alphabet approach based on his strengths and weaknesses. The results were fulfilling because this struggling child was able to learn all of the sounds within an hour and he learned to correctly form his lower case manuscript letters within two weeks. The barrier of abstract symbols was broken and he rapidly caught up to the academic achievement of his peers. Later during his third grade school year, the Iowa testing company representatives visited the school to discuss this student's achievement. The achievement tests showed the student possessed low average cognitive abilities, yet he received one of the highest reading scores on the third grade achievement test. The representatives felt this discrepancy was too significant to be coincidental and the instructional methods used to teach him were discussed. They were surprised to learn about the fundamental literacy skill instruction this child received.

Another example of how the approach has impacted a student was mentioned by Teacher C at Shadow Ridge Elementary School. "I had a student who was diagnosed with mental impairment, and with the use of this integrated alphabet was able to crack the code and become a reader. This student, due to her early reading ability, was able to keep pace with regular education students at her grade level."

The students who participated in the inner-city summer school have continued to be solid in their alphabet knowledge and remain on grade level (teacher interviews, 2005). Individual anecdotes also surfaced in the follow-up teacher interviews. One example was a young boy

whose mother had never heard him speak a word. The teacher was able to get the little boy to cough to assist him to say the first sound /k/. Throughout summer school he learned all of his sounds, began to talk and his writing improved. His mother was invited to come to school one day and she said she was dumbfounded. She couldn't believe her son was speaking. Though he eventually qualified for special education services, he grew two years of reading last school year (teacher interviews, 2005).

A principal's voice should also be heard. After her school implemented the integrated approach, she spoke of the results.

> It eliminated reversals, the number of students referred for special education was less and the students who needed Title 1 were at a much higher functioning level than students had ever been previously. By second grade the students wrote pages and pages. Their writing became greater and more complex because they were more willing to take chances because they had the skills to sound out words and writing was very easy. It also gave them a lot more confidence. . .After we introduced the integrated approach in kindergarten, we didn't need to use preprimer reading text in first grade anymore. The students who qualified for Reading Recovery were new to our school and did not previously receive instruction in an integrated phonics-handwriting approach. We have seen a tremendous difference in the ability level of our students with a solid increase in grades 2-5. We work with a high ability population in a professional community. Prior to implementing the new approach we had about 50-55% of our student population of third graders score in the top quartile on standardized reading and language arts tests. Now we have about 70-80%. Parents also notice a difference, especially the parents with one child who received traditional phonics/handwriting and the other child who received integrated

instruction. They are just astonished in the increase of their second child's ability to read and write as a result of the different program. Teachers, parents and administrators have seen amazing results in students' literacy skills. The brain research is so logical it almost left us with the question, "Why haven't we been doing this for years?"

There are many stories of young children who have learned to 'crack the code' through the instruction of an integrated phonics-handwriting alphabet system. Some of the elementary students' words also convey their understanding of how sounds and formations work together. Experienced teachers have not seen anything like this before in their entire career and appreciate the difference it has made in their students' literacy skills. Additionally, follow-up assessments (both teacher-made and standardized) continually indicate that students who are *simultaneously* taught letter sounds and formations have improved alphabetic knowledge.

Reasons for success

In conclusion, some children struggle with learning their letter sounds and formation. It is our responsibility to make sure all students are successful in these basic literacy skills because they are the foundation for future learning. There are possible explanations why this integrated alphabet instruction positively impacted students' letter sound and formation knowledge.

For some children, arbitrary abstract symbols (i.e. letters) are meaningless. They need to find a connection between the new information and their prior knowledge. Wolfe (2001) wrote "the brain is a pattern-seeking device, always looking for associations between the information it is receiving and what is already stored. If the brain can find no link or association, it is highly unlikely that the information will be stored in long-term memory" (p. 179). It is to the students' advantage to learn the linear abstract alphabet through mnemonic imagery (Adams, 1990), emotion and movement (Hannaford, 1995) and active exploration of the relationships between

sounds, visual characteristics and motor movement of letter formation (Bear, et. al., 2004). This new integrated alphabet system was able to assist students to use their imagination to link an abstract symbol to known information.

Another reason these students were able to successfully learn their letter sounds and formations was due to the fact this approach integrates the visual (e.g. picture of a cat), auditory (e.g. alliteration of the "cat catching") and the kinesthetic (e.g. motor plan). Sylwester (1995) wrote "When objects are registered by several senses, they can be stored in several interrelated memory networks. A memory stored in this way becomes more accessible and powerful than a memory stored in just one sensory area, because each sensory memory checks and extends the others" (p. 96). Traditional methods of teaching sounds and letter formations rely on detail and rote memorization and often phonics (sound learning) is separated from handwriting (letter learning). In contrast, this integrated method was able to appeal to students' visual ability to stimulate auditory recall of letter sounds and proper formation. The new integrated alphabet system builds on multisensory learning by integrating the visual, auditory and motor learning so the three cannot be separated. It is this integration of learning that makes the new approach intersensory.

All teachers readily agree that phoneme awareness plays an important role in students' alphabet knowledge. Less common is the belief that the ability to properly form letters (handwriting) also contributes to literacy development. Although alphabet and letter-sound knowledge is complex, (letters have names, sounds and shapes and the three are not logically connected), few, if any approaches specifically target all areas of alphabet knowledge. As previously mentioned, this integrated approach is designed to trigger *simultaneous* intermodal responses. An image stimulates sound and movement and a sound may stimulate a picture or a

movement. It can be concluded that the new alphabet system is an approach that integrates early reading skills with handwriting through many senses. In this manner, students are able to make meaning of the abstract symbols. This, in turn, contributes to success in both reading and writing.

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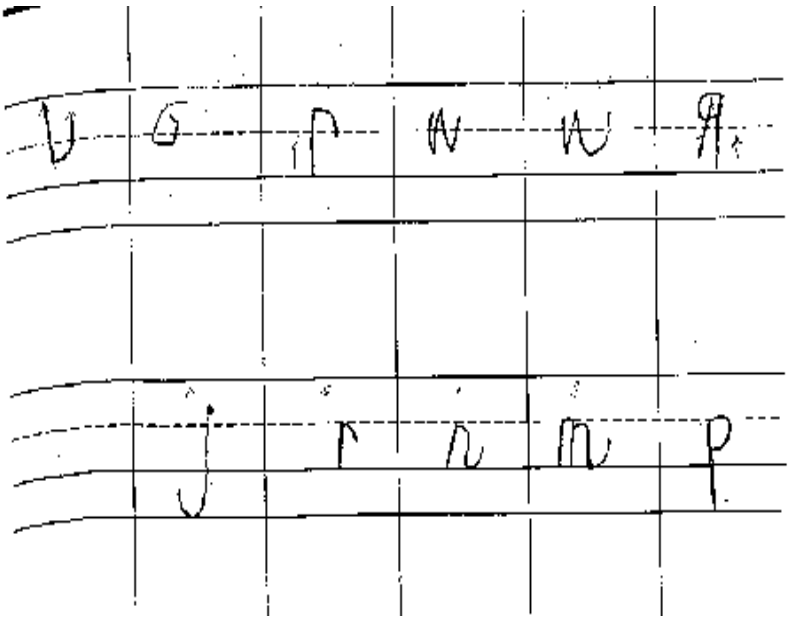
Figure 1



Top row is pre-test, bottom row is post-test. The student was asked to write the following letters from left-right: y j r n m p

Appendix A – Typical Sound Errors

C – pronounced ‘sss’ or ‘see’ /kuh/, /kah/
O – pronounced /u/
A – pronounced /u/
D – pronounced /b/
G – pronounced /j/
Q – pronounced /k/, /w/, /coo/ or /que/
S – pronounced /e-ss/, /e/
E – pronounced /i/, /u/, /a/, or /ee/
I – pronounced /j/, /l/
U – pronounced /y/, /w/, /you/
W – pronounced /d/, /m/, /double you/
Y – pronounced /w/, /g/, /j/
J – pronounced /i/, /l/
R – pronounced /er/
N – pronounced /en/, /m/, /e/
M – pronounced /em/, /n/, /e/
P – pronounced /b/, /d/
L – pronounced /j/, /el/, /e/
T – pronounced /f/, /j/
B – pronounced /d/, /p/
H – pronounced /n/
K – pronounced /er/
F – pronounced /t/, /ef/, /e/
X – pronounced /e-cks/, /k/, /sk/, /e/
V – pronounced /w/, /y/, /f/
Z – pronounced /s/

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Appendix B – Motor plan errors

General categories include:

1. Spatial organization (size, start dotted)
2. Cross midline (flat circles, curved lines, l-r diagonal, uneven spacing)
3. Directionality (inversion, bottom/top, reversals)
4. Integration (extra strokes open, disintegration open, confused form open, overshoot closed, separations open)
5. Memory (recall)
6. Combined problems (distortions, slingback)

Letter error possibilities:

C – start dotted, size, flat circles, l-r diagonal, reversals, bottom/top, confused form (closed), overshoot (closed), confused form (open), extra strokes (open)

O – start dotted, size, flat circles, reversals, bottom/top, bottom/top reversal, confused form (closed), overshoot (closed), confused form (open), extra strokes (open), distortions

A – start dotted, size, flat circles, reversals, bottom/top, top/bottom r-l, overshoot (closed), confused form (open), extra strokes, distortions

D – start dotted, size, flat circles, left/right diagonal, reversal, bottom/top, top/bottom r-l, overshoot (closed), confused form (open), extra strokes (open), distortions

G – start dotted, size, flat circles, reversals, bottom/top, bottom/top (reversal), overshoot (closed), confused form (open), extra strokes (open), slingback

Q – start dotted, size, flat circles, reversals, bottom/top, bottom/top reversal, overshoot (closed), extra strokes (open), confused form (open), distortions

S – start dotted, size, flat circles, l-r diagonal, reversals, bottom/top, extra strokes (open), distortions

E – size, flat circles, l-r diagonal, reversals, bottom/top, inversion, extra strokes (open), confused form (open), disintegration (open), slingback (open), distortion (open)

I – size, curved lines, l-r diagonal, reversals, bottom/top, extra strokes (open), recall

U – size, curved lines, l-r diagonal, uneven spacing, reversal, bottom/top, confused form, extra strokes (open)

W – size, curved lines, l-r diagonal, uneven spacing, bottom/top, inversions, extra strokes (open), separations (open), recall

Y – size, curved lines, l-r diagonal, uneven spacing, inversion, bottom/top, reversal, extra strokes (open), disintegration (open), recall

J – size, curved lines, l-r diagonal, reversals, bottom/top, extra strokes (open), recall, confused form

R – size, curved lines, l-r diagonal, right/left, bottom/top, reversal, separations (open), extra strokes (open), recall

N – size, confused form, l-r diagonal, uneven spacing, reversal, bottom/top, inversion, separations (open), extra strokes (open)

M – size, l-r diagonal, uneven spacing, bottom/top, inversion, reversal, separations (open), extra strokes (open), recall

P – size, l-r diagonal, bottom/top, reversal, bottom/top reversal, separations (open), extra strokes (open)

L – size, confused form, curved lines, l-r diagonal, reversal, bottom/top, extra strokes/disintegration (open), recall

T – size, confused form, curved lines, l-r diagonal, inversion, reversal, bottom/top, disintegration (open), recall

B – size, curved lines, l-r diagonal, reversal, bottom/top, bottom/top reversal, inversion, confused form (open), recall

H – size, confused form, curved lines, l-r diagonal, reversal, inversion, bottom/top, separations (open), disintegration (open), recall

K – size, confused form, curved lines, l-r diagonal, reversals, bottom/top, confused form, extra strokes (open), disintegration (open), distortions, recall

F – size, curved lines, l-r diagonal, inversion, reversal, bottom/top, rotation, extra strokes (open), disintegration (open), recall

X – size, top/bottom vertical l-r horizontal, top/bottom vertical, reversal, bottom/top r-l/l-r diagonal, inversion, disintegration (open)

V – size, vertical line, bottom/top r-l/l-r diagonal, top/bottom r-l diagonal (push/pull), disintegration (open)

Z – size, l-r diagonal, reversal, bottom/top, reversed distortions, disintegration (open)