

# Mnemonic Strategies: Improving Letter-Sound Correspondence for Students with Dyslexia Enrolled in an EFL Program in Belgium

*Ulviye Şener Akın  
Phillip J. Belfiore*

**ABSTRACT:** The purpose of this study was to examine the effects of integrated, or imbedded, mnemonics on consonant letter naming and consonant sound production for four, 3rd grade Belgian students with dyslexia, and at-risk for academic failure in an urban English-as-a-Foreign-Language (EFL) classroom. Mnemonic picture flashcards were designed, where the target consonant letter was imbedded as an integral part of the picture (e.g., letter D as dinosaur, letter F as flower), with assistive computer technology. In addition, corrective feedback was provided during intervention sessions. Results showed that (1) all four students reached 100% mastery on consonant letter naming, and (2) two of four students reached 100% mastery for consonant sound production. Letter-sound correspondence performance maintained two weeks post-intervention. Generalization data showed, once consonant letter-sound correspondence was mastered, all students produced novel words that began and ended with consonant letter and sound. Social validity data were collected from students, teachers, and parents to document the intervention effectiveness and socially important outcomes.

## THE PROBLEM

Students at-risk for academic failure are often characterized as having reading difficulty (Lerner, 2003), memory difficulties (O'Shaughnessy & Swanson, 1998), and problems choosing and using effective strategies (Mastropieri & Scruggs, 2007). The most widely researched form of reading difficulty is dyslexia, a specific learning difficulty, affecting the ability to learn to read and spell, and associated

---

Address correspondence to: Ulviye Sener Akın, Ph.D. Candidate in Special Education, Ankara, Turkey +905056499767. E-mail: ulviye\_2000@yahoo.com)

with phonological processing problems (Snowling, 2000). There is extensive literature on the phonological skills of readers with dyslexia. For example, a review by Snowling (2000) reported robust impairments of phonological memory, phonological awareness, phonological learning, nonword repetition, and rapid automatized naming.

For purposes of the present discussion, a key issue is whether and to what extent children with dyslexia possess phoneme awareness, because this skill set is necessary for transition to the alphabetic phases of development. Many studies point to problems of phonological awareness in children with dyslexia at the level of the rhyme and the phoneme (e.g., Manis, Custodio & Szezulski, 1993; Manis et al., 1997; Scarborough, 1990). Moreover, as children with dyslexia develop, it seems that their difficulty with phoneme level skills persists (Swan & Goswami, 1997). This difficulty at the phoneme level results in major limitations in the development of word recognition, word and reading comprehension, and reading fluency. A second contributory factor to delayed reading, at least in the early years of schooling, is poor letter knowledge, something children diagnosed with dyslexia often exhibit (Scarborough, 1990). Taken together, difficulties with phoneme awareness and with letter learning constitute a significant problem for the acquisition of the alphabetic principle (Byrne, 1998). This may explain why the majority of children with dyslexia are slow to progress from the pre-alphabetic to the alphabetic phase.

The alphabetic phase comprises two parts, (1) alphabetic understanding, or the knowledge that words are made up of letters that represent different sounds, and (2) phonological recoding, highlighting the relation between those letters and sounds to pronounce and spell words (National Institute of Child Health and Human Development, 2000). Juel (1988) identified the primary difference between good and poor readers is the ability to use letter-sound correspondence to identify words. The combination of instruction in phonological awareness and letter-sounds correspondence results in children (1) acquiring and applying the alphabetic principle early in their reading careers and (2) becoming efficient and fluent readers (Juel, 1988). More specifically, Adams (1990) suggests understanding that letters have a relationship with sounds in words (i.e., a one-to-one letter-sound correspondence) is foundational to the successful beginning reader. According to Ehri (2005), when children acquire letter knowledge and some phonemic awareness, they move from the pre-alphabetic phase to the alphabetic phase.

Phonemic awareness is an essential prerequisite for the development of reading skills, in both first and foreign/second languages.

In English-as-a-Second-Language (ESL) and English-as-a-Foreign-Language (EFL) programs, letter-sound correspondence and phonemic awareness are also vital elements in early success in English language reading. As Sparks and Ganschow (1995) have reported, students who exhibited difficulties in foreign language learning, have most difficulty with the phonological/orthographic “code” of language (i.e., letter-sound correspondence). This difficulty with language codes for the students at-risk for failure in EFL/ESL might be more problematic for students with identified learning difficulties. Behavioral strategies have been shown to be helpful with such difficulties. Researchers have documented the effectiveness of mnemonic strategies in the acquisition of letter-sound correspondence (Agramonte & Belfiore, 2002; Fulk, Loman, & Belfiore, 1997; Sener & Belfiore, 2005). Additionally, mnemonic instruction has benefited students in general and special education classrooms, ranging from the elementary grades (Uberti, Scruggs, & Mastropieri, 2003) to college students (Rummel, Levin, & Woodward, 2003). With respect to the needs of students with learning difficulties, research on the use of mnemonics has documented success in increasing vocabulary instruction and factual information (Terrill, Mastropieri, & Scruggs, 2004; Scruggs & Mastropieri, 2000), and mathematics facts (Irish, 2002). Mnemonic strategies are extremely versatile and can be adapted to multiple academic curricular content areas (Fontana, 2004; Scruggs & Mastropieri, 1991).

## **THE SOLUTION**

Belfiore and colleagues (Agramonte & Belfiore, 2002; Fulk, et al., 1997; Sener & Belfiore, 2005) developed an imbedded mnemonics strategy in which the target stimulus (i.e., the letter) is fully integrated into the mnemonic (e.g., the letter/r/was the part of a robot), operating as a discriminative stimulus to increase correct responding to letter and sound when paired with the imbedded mnemonic. In this current study, unlike the earlier research, assistive computer technology was used to create the imbedded mnemonic letter flashcards, integrating trendy pictures into the consonants. For example, the letter/g/; for girl, was integrated into Elsa’s face, and/x/was integrated into the body of X-Men (popular animated characters among children). Using simple, computer-generated pictures and images via assistive technology established a comfort level in teachers to create similar, cost-effective materials.

The purpose of this study was to examine the effects of integrated mnemonics on consonant letter naming and consonant sound production for four, 3rd grade Belgium students, all diagnosed with dyslexia, and reading difficulties. Specifically, we were seeking to expand the work Sener & Belfiore (2005) in several ways; (1) by addressing the English language needs of Belgian elementary grade students with dyslexia, and at-risk of failure in EFL coursework, (2) by targeting a Belgian urban international school setting, (3) by assessing the impact of the mnemonics strategy on the generalized production of new words beginning and ending with the sound of the target letter, (4) by using assistive technology in creating mnemonic flashcards, and (5) by collecting social validity data.

## EVIDENCE OF EFFECTIVENESS

### Participants and Setting

Belgium is a small country in the center of Europe. Its population is nearly 11 million. Belgium is generally considered as having quite a complex structure. As well as the federal government, three different communities have their own governments (Ministers and Parliament); the Flemish, the French, and the German. There are three regions on the geographical ground, (1) the Flemish region; (2) the Brussels-Capital region, and (3) the Walloon region. Each region is responsible for social services (including education services). Although each of the three education systems are directed independently, they have common basic features. For example, primary education comprises six years (grades 1 to 6), as does secondary education (grades 7 to 12). In addition, most children in Belgium enter kindergarten when they are 2.5 years old, and receive 3.5 years of kindergarten education. At the age of 6, children enter primary school. Primary classes include roughly 20–30 children per single classroom. Following primary school, students enter secondary education, followed either by vocational training or by college or university. All Belgian children are required to continue their education (and in most cases remain at school) at least until they are 18 years old (Desoete, Roeyers, & De Clercq, 2004). Additionally, it is reported that 4% of all pupils attend special education schools (Lafontaine, 2006). Our research relates mainly to the French-speaking community, consisting of two regions; the Brussels Region and the Walloon Region.

The study was conducted in the French-speaking community, with four students enrolled in a primary private school that housed three full day, general education 3rd grade classrooms with approximately 20 students in each classroom, located in the urban French speaking community of Belgium. The classroom had one teacher and a teacher assistant. The four participants were enrolled in the 3rd grade, all diagnosed with dyslexia. All students demonstrated reading difficulties in both the French and English-as-a-Foreign-Language (EFL) classroom. All students had been tested by the school psychologist approximately one month prior to the beginning of the study. The first researcher asked, and secured the permissions of their parents for the study.

Francisco was nine years old, receiving speech therapy within the school setting. Physicians diagnosed Francisco with cerebral palsy, which required classroom modifications (i.e., enlarged keyboard, equipment for proper physical positioning). Achievement tests were not administered to Francisco during his assessment due to limited verbal responses; only performance scales were administered. Louis was nine-years-old, and diagnosed with a learning difficulty dyslexia and dyscalculia in accordance with local identification guidelines, including evidence of a severe discrepancy between potential and achievement test. His native language was French. Emma was eight and one half years of age. Emma's native language was French. The psychologist's reports stated that Emma demonstrated difficulty recalling information in language arts. Lori was a nine year Italian girl, diagnosed with dislexia in accordance with local identification guidelines. Lori was referred for additional academic support due to her reading problems.

In the 3rd grade, students have second language English instruction outside of their regular classroom curriculum. Each student, to be included in this study, met the following criteria; (1) referred by the English language teacher to be at-risk for failure in the EFL classroom, (2) unable to recognize English letters and unable to produce the corresponding letter sounds, (3) demonstrate a continual lack of progress in the language classes as reported by the English and French language teachers, and (4) have not been exposed to mnemonic instruction prior to this study.

The 3rd grade level was targeted because it is this level when English language teaching in this private primary school began quite intensively. Curriculum in 1st and 2nd grade focus on intensive literacy methods in the French language, including guided reading, group reading, and journal writing. English lessons during the 3rd grade

were three hours per week. All sessions were conducted in the private staff room, under the guidance of a special education teacher.

### Dependent and Independent Variables

The primary dependent measure was the number of lower-case English consonant letters named correctly when a 14.9 cm × 21 cm black line on white flashcard was shown (e.g., after seeing the flashcard with letter/s/, the student says/s/). A second dependent measure was the number of correctly produced consonant sounds after stating the English letter name (e.g., after seeing the flashcard with/s/and saying/s/, the student says the sound/Ss/). While most of the sounds between English and French consonants are very different, the consonant letters of the English and French alphabet are visually similar. Also, both are adapted from Latin alphabet and consist of 26 letters in total. However, some special letters are placed in some words in French language such as, œ (e.g., œil, fœtus, bœuf, œuf) and æ (e.g., et cætera, tænia, ex æquo). A third dependent measure, assessed during generalization probes, was defined as the number of novel words produced given the correct flashcard letter name and sound [e.g., after the student identified the flashcard/s/and the sound as/Ss/, novel

**Table 1. Characteristics of the Participants**

<i>Name</i>	<i>Gender</i>	<i>Grade/ Year</i>	<i>Special Need(s)</i>	<i>Special Service Support</i>	<i>Native Language</i>	<i>Originality</i>	<i>Reading Test Achievement</i>
Francisco	M	3rd grade (9Y)	dsylexia speech deficit celebral palsy	3 hours reading and math; 1 hour speech therapy	Portugese	Born in Belgium	Under accep- teable level (reported by the teacher)
Louis	M	3rd grade (9Y)	dsylexia dsycal- sulia	3 hours reading and math	French	Born in Belgium	Under accept- eable level (reported by the teacher)
Emma	F	3rd grade (8.5Y)	dsylexia	2 hours reading	French	Born in Belgium	Under accep- teable level. (reported by the teacher)
Lori	F	3rd grade (8.5Y)	dsylexia	2 hours French; 2 hours reading	Italian	Immigrant	Under accept- eable level (reported by the teacher)

Y-Years; F-Female; M-Male



**Figure 1.** Example of Mnemonic Flashcard for the Lower-Case Consonant /c/; Caterpillar.

words that began with or ended with the letter/s/were counted (e.g./sail/,/glass/)]. This third dependent measure was assessed once during the baseline phase and once during the maintenance phase for each participant to test for generalization from letter-sound mastery to novel word production.

The independent variable was a mnemonics strategy in which each of the 21 lower-case consonant letter was fully integrated (i.e., imbedded) into a student-known picture as an essential part of that picture (e.g., the letter/h/was drawn as part of a horse). Flashcard pictures were taken from various website clip art images. Final mnemonic flashcards were laminated. Mnemonic consonant flashcards (14.9 cm × 21 cm) were designed for each consonant letter. Consonant letters were fully integrated into a picture of a common item that began with the initial sound of the consonant letter (See Figure 1). The element of integration is what distinguishes these mnemonic illustrations from more traditional phonics materials.

### **Data Collection**

Before data collection, the first author obtained permission from school administrators and the parents of the four students. The

first author described and modelled assessment and intervention procedures with the English language teacher. At this time, the study was discussed with the school psychologist, the special education teacher and students who were selected to participate. During baseline phase, the teacher and the teacher assistant collected session data on the first and second dependent variables (consonant letter naming and consonant sound production) in the afternoon. The teacher presented all 21 consonant letter flashcards in each session. During the intervention phase, the integrated mnemonic flashcard strategy was implemented in the morning, followed by assessment in the afternoon. Assessment during the intervention phase was identical to assessment during the baseline phase. The generalization data were collected once during the baseline phase and once during the maintenance phase for each student. Maintenance sessions were conducted one week and two weeks post intervention for each participant, and were identical to baseline and intervention assessments.

### **Experimental Design**

A single case multiple baseline-across-students design was applied to monitor the effectiveness of the mnemonics strategy on behavior. Consonant named correctly were the primary dependent variable, and the sequential introduction on intervention was determined when criteria was met on this variable. This criteria level was set at 71% consonants named accurately (15/21), and once this level was achieved, intervention was introduced to the next student. For example, when Fransisco reached criteria (15/21) on session nine, intervention was introduced to Louis on session 10. The sequential introduction of intervention when using the multiple baseline design established experimental control within each participant (from baseline to intervention) and across participants (from baseline to intervention) (Belfiore, 2015). More specifically, a multiple baseline design establishes experimental control by noting both (1) the change in the dependent measure (consonant names and sounds) as each participant moves from the baseline phase to the intervention phase, and (2) the change in the dependent measure for each participant once the intervention phase is introduced, while responding remains unchanged across the other participants continuing under the baseline phase (Belfiore, 2015). The multiple baseline design allowed researchers to document the impact of mnemonics strategy on a student-by-student basis.



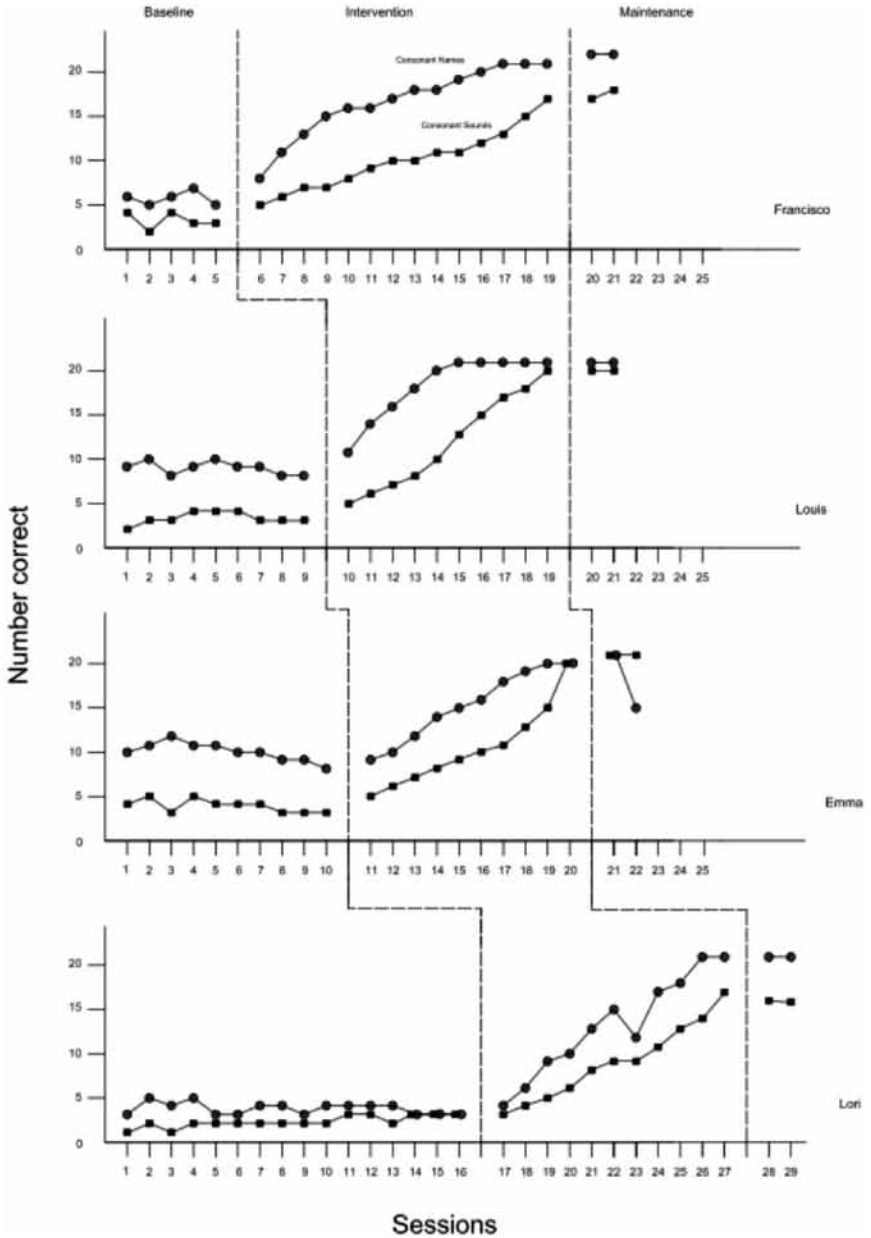


Figure 2. Multiple Baseline Design across Four Students; Black Circles Represent Number of Consonant Names Spoken Correctly and Black Squares Represent the Number of Consonant Sounds Spoken Correctly.

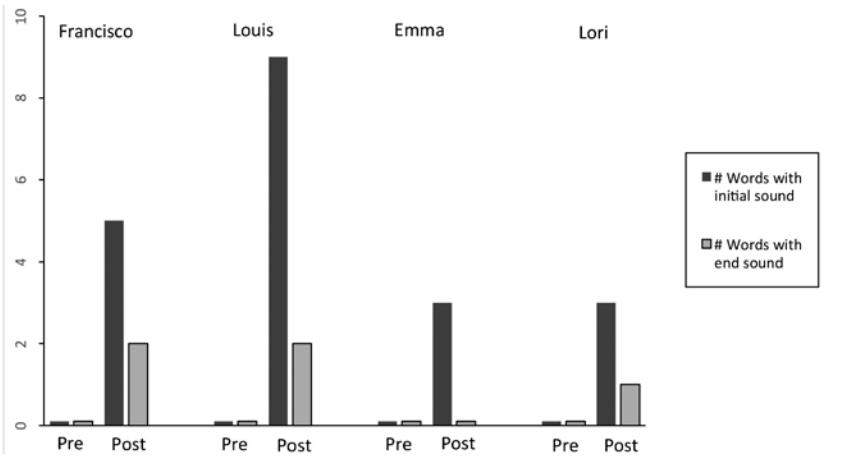


Figure 3. Pre-Intervention and Post-Intervention Generalization Probes on the Number of Novel Words Spoken with Initial Sound (Black Bar) or End Sound (Grey Bar) of a Given Target Consonant.

## PROCEDURES

### Baseline

Prior to the baseline phase, to familiarize students with the assessment procedure, a black line capital letter flashcard/A/was presented, and each student was asked to name the letter and then produce the letter sound/Aa/. The teacher sat across from the student, placing the flashcard/A/on the table. The teacher waited about 5 sec. for the student to respond. The teacher provided no feedback to the student. The letter/A/was used because it was not included in the target sets. Once students mastered the procedures with the/A/flashcard, baseline was initiated. During the baseline phase, 21 lower-case consonant letters, prepared on 14.9 cm × 21 cm flashcards, were shown to the students in a random order.

The teacher sat across from the student, placing one consonant flashcard down at a time. The teacher waited about 5 sec. for the student to respond, and then placed the next flashcard down on the table. The teacher provided no feedback to the student during baseline assessment. Student responses (correct, incorrect, no response) were recorded on a data sheet, and the number of correct responses was calculated and graphed. The teacher thanked the student at the end of each baseline session.

**Intervention**

Prior to the intervention phase, to familiarize students with the mnemonics strategy, a sample integrated mnemonics flashcard using the capital letter/O/was practiced. The letter/O/was integrated into the circle of an orange, and was highlighted with a 8 mm thick black stroke, whereas the remainder of the picture was drawn with a thin black line approximately 4 mm. The/O/flashcard containing the integrated mnemonics picture was presented individually to the student. The practice procedure was (1) the teacher placed the mnemonic flashcard on the table in front of the student, (2) the teacher said "this is the orange, the letter O; it says/au/," (3) the teacher asked the student "What is the picture? What is the letter? What does it say?" (4) the teacher waited for the correct repeated response to be given by the student (e.g., student says "orange, O,/au/"). After students mastered the/O/practice flashcard, intervention began.

During the morning intervention, the 21 integrated mnemonic consonant letter flashcards were presented randomly, one at a time. The teacher started each session by greeting the student, and saying "Lets start." The teacher placed the mnemonic flashcard on the table in front of the student, and said "this is a leg, the letter l; it says/ell/," The teacher asked "What is the picture?" If student responded correctly, the teacher replied "That is correct, this is leg", If student responded incorrectly, teacher replied "No, the picture is leg, what is it?" If the student did not respond within 5-seconds, the teacher replied "The picture is leg, what is it?" The teacher then asked "What is the letter?" If student responded correctly the teacher replied "That is correct, the letter is l." If the student responded incorrectly, the teacher replied "No, the letter is l, what is it?" If the student made no response, teacher replied "The letter is l, what is it?" Lastly, the teacher asks "What is the sound?" If the student responded correctly, the teacher replied "That is correct, the sounds is/ell/." If the student responded incorrectly, the teacher replied "No, the sound is/ell/, what is it?" If the student made no response, the teacher replied "The sound is/ell/, what is it?"

Using this error correction strategy required the student to accurately complete the response sequence (picture, letter name, letter sound) for each consonant, for each trail. Either the student initially repeated the response sequence accurately (a correct response), or the student repeated the response sequence accurately following a second prompt by the teacher (following an incorrect or no response). At the end of the session the teacher thanked the student for participating.

Assessment during the intervention occurred in the afternoon, and was identical to baseline assessment. As in baseline, the teacher sat across from the student, placing one consonant flashcard down at a time. The teacher waited about 5-second for the student to respond, and then placed the next flashcard down on the table. The teacher provided no feedback to the student during assessment. Student responses (correct, incorrect, no response) were recorded on a data sheet, and the number of correct responses was calculated and graphed. The teacher thanked the student at the end of each assessment session.

### **Maintenance and Generalization**

Maintenance data were collected on all 21 consonant flashcards at 1-week and 2-weeks post intervention. Maintenance procedures were similar to those carried out during baseline and intervention assessment, using the same letter flashcards. Generalization data were collected once during baseline and once during maintenance. During generalization, each student was asked to name words that began and ended with the sound of the target consonant (e.g., the words begin or end with/P/sound). Only novel words (i.e., those words not on the mnemonic flashcards) beginning or ending with the target consonant were counted as correct.

### **Inter-Observer Agreement and Procedural Integrity**

Agreement was assessed through the use of a second observer independently observing 60% of the sessions across baseline and intervention, equally distributed across the four students. Percentage of agreement was calculated by dividing the number of agreements plus disagreements, then multiplying by 100. Interobserver agreement for letter recognition ranged from 96%–100% (mean, 96%), for letter sound production ranged from 98%–100% (mean, 99%), and for generalization words ranged from 98%–100% (mean, 99%). Procedural integrity was monitored by a second observer during 40% of the all sessions. Integrity was assessed for initial session prompt, presentation prompts, trial feedback, and session feedback. Procedural integrity was 100% across all session components

### **Social Validity**

Social validity data were collected to measure social acceptability of procedures and outcomes. Students, parents, and language teachers

were asked to complete a questionnaire consisting of 5 questions using a 3-point Likert scale form to understand their reflections with the mnemonic strategy. Results emphasized student, parent, and teacher perceptions of mnemonic intervention effectiveness and satisfaction, and the potential for future use. In addition, social validity was enhanced by implementation of the independent variable over extended time periods, by typical intervention agents, and in typical physical and social contexts.

## RESULTS AND DISCUSSION

### Accuracy

#### Consonant Letter Names

*AQ: Please  
confirm the  
heading levels*



Overall, baseline data on the number of letters named correctly for Francisco, Louis, Emma and Lori averaged 5.8, 8.8, 10.9, 5.3, respectively. With the introduction of the mnemonics flashcards, accuracy data for each of the four student showed an ascending trend until reaching mastery (21/21 consonant names). During the intervention phase, consonant letter names said correctly increased for Francisco, Louis, Emma and Lori, with an average of 16.7, 18.4, 16.3, 9.5, respectively. Francisco required 11 sessions of intervention to reach mastery (21/21 consonant names). Louis required five sessions of intervention to reach mastery. Emma required eight interventions session to reach mastery, while Lori required nine intervention sessions to reach mastery on consonant names.

#### Consonant Letter Sounds

Baseline data on the number of letter sounds said correctly for Francisco, Louis, Emma and Lori averaged 3.2, 3.2, 4.4 and 3.2 respectively. Baseline performance on letter sound accuracy was below baseline performance on letter naming accuracy across all four students. With the introduction of the mnemonics flashcards, accuracy data for each student showed an ascending trend, but not as steep a trend as observed with letter name accuracy. During the intervention phase, letter sounds said correctly increased for Francisco, Louis, Emma and Lori, showing an average of 10.0, 11.9, 10.4 and 8.5, respectively. Louis and Emma reached 100% mastery (21/21) on letter sounds correct. Francisco and Lori ended the intervention phase with 17/21 and 16/21 letter sounds correct, respectively.

## Maintenance

Maintenance data were collected at 1-week and 2-weeks probes following the termination of formal instruction. For Francisco, maintenance data showed performance remaining at 100% mastery at the 1-week and 2-week checks with 21/21 consonant named correctly. Additionally, for Francisco, maintenance data showed 17/21 consonant sounds said correctly at 1-week check, and 18/21 consonant sounds said correctly at 2-week check. For Louis, maintenance data showed performance remaining at 100% mastery at the 1-week check with 21/21 consonant names and 21/21 consonant sounds were said correctly. Additionally, for Louis, mastery was maintained on both consonant names and sounds at the 2-week check (21/21). For Emma, maintenance data showed performance remaining at 100% mastery at the 1-week check with 21/21 consonant names and 21/21 consonant sounds said correctly, while at the 2-week check, 15/21 consonant names and 21/21 consonant sounds were said correctly. Lastly, for Lori, maintenance data showed performance remaining high at the 1-week check with 21/21 consonant names and 16/21 consonant sounds said correctly, and at the 2-week check, 21/21 consonant names and 16/21 consonant sounds said correctly.

## Generalization

Generalization data were collected once during the baseline and once during maintenance for each student (See Figure 3). Generalization during baseline showed none of the four students producing any novel words beginning with or ending with the target consonant letters. One week following the end of intervention Francisco produced five novel words with the beginning target consonant/m/(2);s/(2);t/(1), and two novel words ending with that consonant/m/(1);p/(1). Louis produced nine novel words beginning with the target consonant/f/(2);d/(2);m/(2);k/(1);s/(2), and two novel words ending with that consonant/m/(1);s/(1). Emma produced three novel words beginning with the target consonant/h/(1);b/(1);d/(1), yet no novel words ending with that consonant. Lori produced three novel words beginning with the target consonant/f/(1);b/(1);k/(1), and one novel word ending with that consonant/k/(1).

## Social Validity

Using a 3-point (1-no, not at all; 2-somewhat; 3-yes, very much) Likert scale, results of a 5-question social validity survey showed

both teachers and all surveyed parents of the students liked the mnemonic flashcard intervention very much, scoring each question a three. Three of the four students also liked the intervention very much, scoring a three for all five questions. One student, Lori, scored four of the five questions a three, and one question (“Would you like your friends to do this too?”) with a score of 2. The students said they (1) liked the pictures, (2) liked this activity more than other alphabet activities, and (3) wanted to participate in more such studies. Both teachers said they found the intervention useful and more fun. All parents were happy that their children benefited from the study.

## Discussion

In this study imbedded picture mnemonic, when paired with each lower-case consonant letter, served as a discriminative stimulus ( $S^d$ ), controlling accurate responding, and resulting in increased performance in consonant letter-sound correspondence for all four students. Prior student knowledge of the pictures selected for the mnemonic flashcards increased the saliency of each flashcard as a discriminative stimulus. For example, during intervention phase, when each student was shown the mnemonic flashcard, and each student independently produced the name of the known picture in the presence of the flashcard, the student (1) not only *heard* the initial consonant sound (e.g., student says “snake,” student hears/Ss/), but (2) also *saw* the highlighted consonant/s/imbedded in the picture of snake while saying the correct initial consonant sound (e.g./Ss/) of the known picture (e.g., snake). This initial pairing of known (picture) with unknown (consonant name and sound) was further enhanced by immediate teacher feedback following each student response (e.g., “This is snake, letter s and the sound is/Ss/.”). In the end, through repeated practice (i.e., opportunities to respond to academic stimuli) and corrective teacher feedback during intervention sessions, the previously unknown consonant name and sound were mastered, so that when students saw only the letter/s/flashcard during assessment sessions, the student responds correctly.

This was not the case during the baseline phase, when the black-white consonant flashcard served as a stimulus delta, not controlling student responding, resulting in low performance during baseline assessment for each student (see Figure 2 baseline data). Following the mnemonic intervention the black-white consonant flashcard is now a discriminative stimulus, controlling accurate student letter-sound responding, without the imbedded mnemonic (see Figure

2 intervention data). Maintenance data, at 1-week and 2-weeks post-intervention, indicate that students with learning difficulties, specifically with dyslexia, can retain newly acquired skills after formal teacher directed intervention has ceased.

Additionally, and of equal importance, results of this study showed each student generalized the mastered letter-sound correspondence post-intervention, to initial and/or end sound placement in word construction. During the intervention phase, phoneme identity was taught by using a visual prompt (i.e., the picture mnemonic flash-card). For example, during intervention each student was repeatedly presented with, and responded to the letter/s/and the sound/Ss/integrated into the picture of snake. The repeated consonant letter-sound practice during intervention resulted in the students producing such novel words as/school/and/dress/during generalization probes conducted in the maintenance phase of the study. Adams (1990) suggested associating isolated letter-sounds with segmented sounds in words, and then generalizing that information to new words, is the first step to beginning reading.

Given that all four students in this study increased production of novel words with beginning or end sounds during the generalization phase (see Figure 3), researchers and educators should not target or isolate alphabetic mastery (i.e., letter-sound correspondence) as an end to instruction, but once students master letter-sound correspondence, educators and researchers must plan for, and begin to evaluate the students' ability to link isolated letter names and sounds to beginning and end word construction. Mastery at the consonant letter-sound level should be viewed as only the first step. Ehri's (2004) suggested beginning readers at this level can use their letter knowledge and phonemic awareness to read words by connecting partial letters, typically in initial and final positions, to sounds in the words. Therefore, in addition to producing novel words, students can use the acquired letter-sound mastery to devise partial spellings of words by identifying initial and end sounds. Furthermore, students increased their self-confidence following mastery of letter-sound correspondence by their willingness to attempt to produce novel words starting and ending with the target letter. By building a history of student success, students may acquire a sense of self-efficacy, or belief in self. The results of the social validity survey reported that students had a positive attitudes toward both the content and the method of instruction.

Student outcomes from this study have strategic advantages for general classroom practice and curriculum adaptations for students with identified learning difficulties. More specifically, the construction,




implementation, and evaluation of an imbedded picture mnemonic flashcard strategy can be very beneficial for students with dyslexia in EFL/ESL classrooms. This is especially true for (1) students not finding success in phonics/phonemic awareness, (2) general education classroom teachers looking for effective and efficient phonics/phonemic practices, and (3) students at risk for academic failure in language classes, specifically in the area of alphabetic understanding (Agramonte & Belfiore, 2002; Fulk et al., 1997; Sener & Belfiore, 2005).

Additionally, teachers benefit from on-line technology to produce the mnemonic flashcards, not having to expend additional instructional time (or not having the artistic abilities) to hand drawing pictures. In previous research (Agramonte & Belfiore, 2002; Fulk et al., 1997; Sener & Belfiore, 2005), teacher-made simple black line drawings were used, and results were equally positive without on-line, computer generated support. Therefore, teachers have the option to either hand draw pictures or use assistance from on-line computer websites. In the end, whether hand drawn or computer generated, the key criteria for successful imbedded mnemonics is the students' ability to readily and consistently identify the selected pictures to be used.

## **CONCLUSION**

One step to increase student academic performance is to provide resources and professional development for teachers, administrators, and families on research-based, best academic practices easily assessable to public classroom teacher use. To this end, results from the study have important pedagogical implications for general classroom practice. The ease of construction, implementation, and evaluation make using a phonics mnemonics strategy very practical for the EFL student not having success in early phonics/phonemic awareness, and the EFL classroom teachers looking for effective phonics/phonemic practices. Specifically for the EFL classroom, mnemonic strategies, as implemented in this study, begins to build a collection of research-based/evidence-based best practices that will benefit students not able to access special services, but identified "at-risk" for academic failure. Teachers and researchers reported that mnemonics were especially appropriate for children who often have difficulty across all academic subject areas (Scruggs & Mastropieri, 1991), and specifically in the area of alphabetic understanding (Agramonte & Belfiore, 2002; Fulk et al., 1997; Sener & Belfiore, 2007). The above-mentioned results of the current study should prompt future mnemonics research in other

academic areas within the Belgian education system. But more importantly, this study provides a systematic research model to evaluate evidence-based academic strategies in an applied, general education setting. 

## REFERENCES

- Adams, M. J. (1990). *Beginning to read: Thinking and learning about print*. Cambridge, MA: MIT Press.
- Agramonte, V., & Belfiore, P. J. (2002). Using mnemonics to increase early literacy skills in urban kindergarten students. *Journal of Behavioral Education, 11*, 181–190.
- Belfiore, P.J. (2015). *Single subject experimental research: Monograph*. Mercyhurst University Publishing. Erie, PA.
- Byrne, B. (1998). *The foundation of literacy: The child's acquisition of the alphabetic principle*. UK: Psychology Press.
- Desoete, A., Roeyers, H., & De Clercq, A. (2004). Children with mathematics learning disabilities in Belgium. *Journal of Learning Disabilities, 37*, 50–61.
- Ehri, L. (2005). Development of sight word reading: Phased and findings. In M. Snowling & C. Hulme (Eds.), *The science of reading: A handbook* (pp. 135–154). Malden, MA: Blackwell.
- Fontana, J. (2004). Social studies and students with disabilities: Current status of instruction and a review of intervention research. In T. E. Scruggs & M. A. Mastropieri (Eds.), *Advances in learning and behavioral disabilities: Vol. 17. Research in secondary schools* (pp. 179–210) Oxford, UK: Elsevier.
- Fulk, B. M., Lohman, D., & Belfiore, P. J. (1997). Effects of integrated picture mnemonics on the letter recognition and letter-sound acquisition of transitional first-grade students with special needs. *Learning Disability Quarterly, 20*, 33–42.
- Irish, C. (2002). Using peg- and keyword mnemonics and computer-assisted instruction to enhance basic multiplication performance in elementary students with learning and cognitive disabilities. *Journal of Special Education Technology, 17*, 29–40.
- Juel, C. (1988). Learning to read and write: A longitudinal study of 54 children from first through fourth grades. *Journal of Experimental Psychology, 80*, 437–455.
- Lafontaine, D. (2006). *International Perspectives on Education Policy*, pp. 93–104.
- Lerner, J. (2003). *Learning disabilities: Theories, diagnosis, and teaching strategies* (9th ed.). Boston: Houghton Mifflin.
- Manis, F. R., Custodio, R., & Szezulski, P. A. (1993). Development of phonological and orthographic skill: a 2-year longitudinal study of dyslexic children. *Journal of Experimental Child Psychology, 56*, 64–86.
- Manis, F. R., McBride-Chang, C., Seidenberg, M. S., Keating, P., Doi, L. M., Munson, B., & Petersen, A. (1997). Are speech perception deficits associated

- with developmental dyslexia? *Journal of Experimental Child Psychology*, 66, 211–235.
- Mastropieri, M. A., & Scruggs, T. E. (2007). *The inclusive classroom: Strategies for effective instruction*. Upper Saddle River, NJ: Merrill/Prentice Hall.
- National Institute of Child Health & Human Development. (2000). *Report of the national reading panel: Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction: Reports of the subgroups*. National Institute of Child Health and Human Development, National Institutes of Health, Washington DC.
- Rummel, N., Levin, J.R., & Woodward, M.M. (2003) Do pictorial mnemonic text learning aids give students something worth writing about? *Journal of Educational Psychology*, 95, 327–334.
- O'Shaughnessy, T. E., & Swanson, H. L. (1998). Do immediate memory deficits in students with learning disabilities in reading reflect a developmental lag or deficit? A selective meta-analysis of the literature. *Learning Disability Quarterly*, 21, 123–148.
- Scarborough, H. S. (1990). Very early language deficits in dyslexic children. *Child development*, 61, 1728–1743.
- Scruggs, T. E., & Mastropieri, M. A. (1991). Classroom applications of mnemonic instruction: Acquisition, maintenance, and generalization. *Exceptional Children*, 58, 219–229.
- Scruggs, T. E., & Mastropieri, M. A. (2000). The effectiveness of mnemonic instruction for students with learning and behavior problems: An update and research synthesis. *Journal of Behavioral Education*, 10, 163–173.
- Sener, U. & Belfiore, P. J. (2005). Mnemonics Strategy Development: Improving alphabetic understanding in turkish students, at risk for failure in EFL settings. *Journal of Behavioral Education*, 14, 105–115.
- Snowling, M. J. (2000). *Dyslexia*. Oxford: Blackwell Publishing.
- Sparks, R. L., & Ganschow, L. (1995). A strong inference approach to causal factors in foreign language learning: A response to MacIntyre. *The Modern Language Journal*, 79, 235–244.
- Swan, D., & Goswami, U. (1997). Phonological awareness deficits in developmental dyslexia and the phonological representations hypothesis. *Journal of Experimental Child Psychology*, 66, 18–41.
- Terrill, M. C., Scruggs, T. E., & Mastropieri, M. A. (2004). SAT vocabulary instruction for high school students with learning disabilities. *Intervention in School and Clinic*, 39, 288–94.
- Uberti, H. Z., Scruggs, T. E., & Mastropieri, M. A. (2003). Keywords make the difference! Mnemonic instruction in inclusive classrooms. *Teaching Exceptional Children*, 35, 56–61.

**Phillip J. Belfiore**, PhD, Department of Education, Mercyhurst University. Dr. Belfiore is a professor in the Hafenmaier School of Humanities, Arts, and Social Sciences, and Chairperson of the graduate program in Special Education and Applied

Disability Studies. Areas of research interest include applied behavior analysis, urban education, and low-incidence disabilities.

**Ulviye Sener Akin**, PhD Candidate, Department of Special Education, Gazi University. Ulviye Sener Akin is a special education specialist and an English teacher in the Ministry of Education. Areas of research interest include learning difficulties, memory strategies, inclusive education, and language teaching methods for students at risk for failure.

## IMPLEMENTATION GUIDELINES FOR CONSONANT LETTER-SOUND MNEMONICS STRATEGY

### Materials needed for implementation

- Design black line on white assessment flashcards for each of the 21 lower-case consonant letter. The letter will be highlighted with a 4–8 mm thick black stroke.
- Design mnemonic consonant flashcards for each of the 21 lower-case consonant letter. Consonant letter will fully be integrated into a picture of a common picture that begins with the initial sound of the consonant letter (See Figure 1). The letter will be highlighted with a 8 mm thick black stroke, whereas the remainder of the picture is drawn with a thin black line approximately 4 mm. (See Figure 1). Assistive computer technology (e.g. clip art or web images) may be used to create the imbedded mnemonic consonant flashcards, integrating trendy pictures into the letters.
- Design data collection sheet

### Baseline Procedures

The teacher sits across from the student, placing one lower-case, black-white consonant flashcard down at a time. The teacher waits about 5-second for the student to respond, and then places the next flashcard down on the table. The teacher provides no feedback to the student during baseline assessment. Student responses (correct, incorrect, no response) are recorded on a data sheet, counting the number of correct responses, and then graphing that number on a line graph. The teacher thanks the student at the end of each baseline session.

### Intervention

**A. Teacher-Student Modeling.** Prior to intervention, the teacher informs the student that *“We will practice letter sound correspondence. I think it will be fun and helpful.”*

1. The teacher places the mnemonic flashcard on the table in front of the student,
2. The teacher says *“this is the orange, the letter O; it says/au/,”*
3. The teacher asks the student *“What is the picture? What is the*

letter? What does it say?"

4. The teacher waits for the correct repeated response to be given by the student (e.g., student says "orange, O,/au/").
5. After students master the/O/practice mnemonic flashcard, intervention begins.

***B. Implementation of Mnemonics Flashcard Intervention.***

During intervention, usually in the morning, the 21 integrated mnemonic consonant letter flashcards are presented randomly, one time each. The teacher starts each session by greeting the student, and saying "Let's start."

1. The teacher places the first mnemonic flashcard on the table in front of the student, and says "this is a leg, the letter/l/; it says/ell/,"
2. The teacher asks "What is the picture?"
  - a. If student responds correctly; teacher replies "That is correct, this is leg."
  - b. If student responds incorrectly; teacher replies "No, the picture is leg, what is it?"
  - c. If the student does not respond within 5-seconds; teacher replies "The picture is leg, what is it?"
3. Then the teacher asks "What is the letter?"
  - a. If student responds correctly; teacher replies "That is correct, this is l."
  - b. If the student responds incorrectly, teacher replies "No, the letter is l, what is it?"
  - c. If the student makes no response; teacher replies "The letter is l, what is it?"
4. Lastly, the teacher asks "What is the sound?"
  - a. If the student responds correctly; teacher replies "That is correct, the sound is/ell/."
  - b. If the student responds incorrectly; teacher replies "No, the sound is/ell/, what is it?"
  - c. If the student makes no response; teacher replies "The sound is/ell/, what is it?"
5. At the end, the teacher thanks the student.

***C. Daily Assessment.*** Assessment during intervention usually occurs in the afternoon, and is identical to baseline assessment. The

teacher sits across from the student, placing one lower-case, black-white consonant flashcard down at a time. The teacher waits about 5-second for the studuet to respond, and then places the next flashcard down on the table. The teacher provides no feedback to the student during this assessment. Student responses (correct, incorrect, no response) are recorded on a data sheet, counting the number of correct responses, and then graphing that number on a line grpah. The teacher thanks the student at the end of each daily assessment.

***D. Maintenance.*** Intervention can end once the student can name all 21 consonant flashcards during the daily assessment. Maintenance data should be collected on all 21 consonant flashcards 7–10 days after the intervention is over to monitor mastery. Maintenance procedures are identical to those carried out during the daily assessment, using the same 21 black-write consonant letter flashcards.

***E. Generalization.*** Generalization data should be collected once during baseline and once during maintenance. During generalization, using the same 21 black-write consonant letter flashcards, the student will be asked to name words that began or ended with the sound of the target letter (e.g., if the/p/flashcard is placed on the table, the teacher asks “What words begin with the letter? What words end with the letter.”). The teacher counts only novel words (i.e., words not on the mnemonic flashcard).