INTEGRATED PICTORIAL MNEMONICS IN ENGLISH HELP PRESCHOOLERS LEARN HEBREW LETTER-SOUND RELATIONS

by

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Abstract

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by

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Children's ability to recognize letters and their corresponding sounds is of primary importance in early reading achievement (Ehri, Nunes, Willows, Schuster, Yaghoub-Zadeh & Shanahan, 2001). One useful strategy used in teaching pre-readers letter-sound relations is mnemonics (Ehri,1984). Mnemonics are effective because they connect seemingly unconnected bits of information in memory (Levin, 1993). Research has shown the value of mnemonics for first language learning and second language letter learning and vocabulary acquisition. This study explores what makes mnemonics most effective in letter learning. And once children learn the letters, do mnemonics exert a mediating influence to help them retain and apply their letter knowledge in reading and spelling words?

This study explored the use of two types of pictorial mnemonics to teach non-Hebrew speaking children Hebrew letter sound relations. Using a pretest-training-posttest repeated measures design, each child served as his or her own control. Students were given pretests to assess their English and Hebrew letter knowledge and overall cognitive ability. They then received training to segment initial sounds in words. Each child then learned five Hebrew letters with integrated mnemonics and five Hebrew letters with disassociated mnemonics. Integrated mnemonics were

presented on cards with the bare letter and, beneath it, the letter embedded in the mnemonic picture whose name began with the sound of the letter and whose shape resembled the shape of the letter (e.g., snake drawn as S). Disassociated mnemonics were also presented on cards with the bare letter accompanied by a picture or photograph beneath it. Although all the pictures depicted the same objects as the integrated pictures, they were drawn differently from the shapes of the letters. A week later, students were given posttests to assess memory for the letter-sound correspondences learned. Transfer posttests assessed the ability to apply learned letter knowledge in reading and spelling tasks.

Findings indicated that letter-sound relations learned using integrated pictorial mnemonics were learned more effectively, remembered more efficiently, and used in transfer reading and spelling tasks more successfully. Integrated mnemonics helped learners connect letter sounds with their arbitrary letter shapes by providing a non-arbitrary visual link.

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This is the day the Lord has created, be happy and rejoice in it!

To my Bubby

Table of Contents

List of Tables

Lists of Figures

List of Appendixes

Chapter 1

Introduction

This study explored how to facilitate memory for and application of letter-sound relations in pre-readers learning a foreign language alphabet. Two types of mnemonic aids to help students learn letter-sound correspondences were compared - integrated pictorial mnemonics and disassociated pictorial mnemonics. In the integrated pictorial mnemonic condition, the students were taught Hebrew letters using pictures that began with the same sound as the letters and resembled the shapes of the letters as well. In the disassociated pictorial condition or traditional approach to teaching letters, they were taught Hebrew letters also using pictures that began with the same sounds as the letters but the pictures did not resemble the shapes of the letters.

The questions of interest were whether the two approaches differed in how quickly children learned the correspondences, how well they remembered them, and whether this knowledge transferred equally well to reading and spelling tasks.

A review of the literature shows that only a limited body of research exists exploring Hebrew letter-sound relations for second language students. This study attempted to make an original contribution to the second language-learning field by studying integrated pictorial mnemonics as they apply in learning a foreign alphabet as well showing the importance of a transfer phase to allow children to apply letter-sound relations to reading and spelling tasks. A review of cognitive-linguistic processes involved in learning letter-sound relations, how these processes are involved in word reading and spelling, and how to assess transfer of these skills in

pre-readers and beginning readers is first presented. This is followed by a discussion of mnemonics and a review of techniques used to teach letters. A description of the Hebrew alphabet and how letter-sound relations are commonly taught to English-speaking children learning Hebrew is reviewed. Evidence regarding how a second written-spoken language is learned and how this might be adapted to what is already known about letter-sound relations in one's native language is presented. The dissertation study includes the rationale and hypotheses of the current study along with the methods, results and discussion. The paper concludes with contributions to the fields of both English and Hebrew letter learning and suggestions for further research.

Children's ability to recognize letters and their corresponding sounds is of primary importance in early reading achievement as described by Adams (1990) in her review of early reading research. Research has shown that letter knowledge and phonological awareness are two of the leading school-entry predictors of early reading achievement (Share, Jorm, Maclean & Matthews, 1984). Phonological awareness is an understanding that words are made up of speech sounds, while phonemic awareness is the ability to hear, identify, and manipulate the smallest individual sounds in spoken words (Strickland & Schickedanz, 2004).

One useful instructional strategy used to teach pre-readers letter-sound relations is integrated pictorial mnemonics (Ehri, Deffner & Wilce, 1984). Mnemonic strategies are effective because they create meaningful connections for learning seemingly unconnected bits of information to enhance memory for the connections (Levin, 1993). Although research had confirmed this in the areas of first language

learning and even second language letter learning and vocabulary acquisition (Levin, 1993, Mastropieri & Scruggs, 1991), important questions remain. Does the lack of familiarity with a new alphabet limit the effectiveness of integrated mnemonic strategies for English speaking pre-readers? If integrated mnemonics are effective, how pervasive is their influence? Once children learn letter shapes and sounds, can integrated mnemonics exert a mediating influence to help learners retain and apply their knowledge more effectively above and beyond the effects of disassociated mnemonics? In other words, can children use knowledge acquired through integrated mnemonics to read and spell more effectively than knowledge acquired through disassociated mnemonics?

Results of a pilot study revealed that children's speed of learning letter-sound associations was significantly faster with the integrated picture mnemonics than with letters taught using disassociated picture mnemonics. ANOVAs of performance on individual posttests indicated that differences between the two teaching methods fell short of significance. However, the lack of statistical significance may have been due to the small number of subjects. In an ANOVA that combined retention scores to compare the two conditions, integrated pictorial mnemonics proved significantly more effective than disassociated pictures. The interpretation was that although the use of pictorial mnemonics appeared to be an effective and engaging means of teaching Hebrew letters, more research was needed to determine the effectiveness of retaining and transferring material taught using this method.

The current research attempted to replicate and extend the pilot study by using

more subjects and exploring the area of transfer more thoroughly. The process of learning to read involves learning letter-sound correspondences and how to apply this knowledge to read and spell words. Students were taught letter-sound correspondences with different types of mnemonics. Then their ability to transfer this knowledge to reading and spelling words was compared. The prediction was that letters learned using the integrated picture method would be used to read and spell words more accurately than letters learned using the disassociated picture method.

Ehri, Deffner and Wilce (1984) found that teaching pre-readers letter-sound relations through the use of integrated pictorial mnemonics was more effective than teaching them letter-sound relations with disassociated picture mnemonics or with rote rehearsal of the associations. Pre-readers were divided into three groups to be taught letters using three different methods. Group one was shown pictorial mnemonics where the letter was embedded within the picture and formed part of its shape (e.g., *f*, /f/ was the stem of a flower) (integrated letter group). Group two learned the letter-sound relationships by being shown a comparable picture whose name also began with the given letter but the letter shape was not embedded in the picture (disassociated letter group). Group three was not shown any pictures but rather rehearsed each letter-sound association with the name of the picture used in the other conditions (control group). Results showed that the embedded picture group learned the letter-sound associations more successfully than the other two groups. Findings suggested that embedded pictures facilitated learning because they create memorable links between the shapes of the letters and their sounds, two otherwise unconnected concepts.

In a related study, Raschke, Alper and Eggers (1999) found that pairing visual and verbal cues with letter names was an effective way of converting letter names, which are intangible and abstract, into something that has meaning and is easier to remember. Using pictures that begin with a letter name (picture of a "bee") and rhyming sequences, children were able to learn the letters quickly and accurately. Picture mnemonics are thought to be effective because they are a quick and easy system that is fun for children and provides teachers with consistent letter cues. They found that this technique works with both learning disabled and non-learning disabled children. Whereas the Ehri et al. (1984) study explored letter-sound relationships, the Raschke et al. (1999) study focused on letter names. The study once again demonstrated the effectiveness of a mnemonic strategy when teaching early reading skills.

Foreign vocabulary and letter-sound instruction can also benefit from the use of mnemonic strategies. A study conducted by Gruneberg and Sykes (1996) explored the usefulness of pictorial mnemonics when teaching a non-Roman foreign alphabet. They compared the results of an experimental group, which was given mnemonics as study aids to learn Russian letters, to a control group, which received no strategy aids. Visual mnemonics provided a significant advantage in the learning of new letters that did not resemble English letters. "The advantage of using a visual mnemonic strategy is in relating to an English sound an otherwise meaningless shape" (Gruneberg & Sykes, 1996, p. 83). The researchers concluded that not only do mnemonics appear to offer a significant advantage as far as performance but there is also a psychological impact. Learning letters can slow down the initial pace of learning and may frustrate

the foreign language learner. Students who learn the letters more quickly can proceed further and are thus rewarded by acquiring a new vocabulary.

Letter recognition plays an important role in early reading development. Although researchers debate how predictive letter-recognition skills are for early reading ability, most agree that letter recognition is necessary in order for children to access the printed word (Juel, Griffith & Gough, 1986; Nasland & Schneider, 1996; Share, Jorm, Maclean, & Matthew, 1984). Perhaps it is because letters are not easily acquired that they are a good predictor of later reading success (Ehri, 1998). Letter names also help children relate phonemes to printed letters (Ehri, 1984).

Ehri (1998) has described the development of reading as a process that progresses through several phases of children's alphabetic knowledge. The first phase is prereading. Prereaders are able to recognize some letters but rely on visual cues such as letter height rather than letter sounds to "read" words. Print exposure and letter learning at this age are very important to encourage movement to a more advanced stage of reading (Ehri, 1998). The partial-alphabetic phase follows, when children form incomplete letter-sound connections to read words. Full alphabetic phase readers make accurate letter-sound connections and are able to read nonsense words accurately. At the last consolidated alphabetic phase, readers can easily read sight words and decode nonsense words quickly and correctly.

This theoretical framework was used to examine the effect of mnemonics on learning Hebrew letter sounds in English speaking children. In order for pictorial mnemonics to be effective, children must be at a stage of reading development where they are able to process the visual stimuli and relate them to particular sounds.

The present study explored the effectiveness of teaching Hebrew letter-sound associations using integrated and disassociated pictorial mnemonics. The hypothesis tested was that when Hebrew letters are taught using integrated pictorial mnemonics, students will learn, retain and transfer letter knowledge more effectively than when Hebrew letters are taught with disassociated pictures.

Chapter 2

Literature Review: Letter-Sound Relations

Letter-Sound Relations: Phase Theory of Reading Development

To clarify Hebrew letter learning and the effectiveness of pictorial mnemonics, it is important to understand how letter-sound relations are related to beginning reading and spelling. For pictorial mnemonics to work, children must be at a stage of reading development where they are able to process visual stimuli and relate it to a particular sound. The following section describes phase theory as it portrays the development of reading and spelling.

Ehri (1998) describes the development of sight word reading in four sequential phases by elaborating Gough's and Hillinger's two-stage model. Each stage is characterized by a strategy. As the child advances, earlier strategies are replaced by more advanced ones. During the first phase, the pre-alphabetic phase, or the logographic phase, children associate visual features of the letters with meaning. It is called pre-alphabetic because letter-sound relations are not involved in the visual connections. The children do not attend to the actual sounds of the letters, but rather attend to the visual cues. They notice the height of letters, the "tails" and other salient visual features of the letters. For example, a child might remember the word "dog" because of the letter g's tail. When attending to environmental print, they notice the visual features of the letters rather than the letter-sound relations themselves. This was found in a study conducted by Masonheimer, Drum and Ehri (1984). They found that children could not distinguish between altered and correct popular signs and labels. This suggested that the children were recognizing the visual features but not

the letters themselves. This is a default stage when children are not yet able to make letter connections but are able to recognize visual features of letters and words. Even though children may not be reading, exposure to print at this stage is essential to provide opportunities for letter recognition and incentive to proceed to the next phase. Children want to read but make arbitrary associations between letters and sounds (Ehri, 1998).

The children then move into the partial-alphabetic phase where they form incomplete letter-sound associations (Ehri, 1999). At this point, children focus on only some of the letters and sounds. They may recognize initial or final letter-sound relations in a word but not all the letters. Making use of some but not all of the letters is referred to by Ehri as phonetic cue reading (Ehri, 1987). Ehri and Wilce (1985) contrasted the strategies used by pre-alphabetic readers (referred to in the study as pre-readers) with those used by partial alphabetic phase children. Kindergarten age children were grouped according to ability to read words and taught to read two sets of word spellings. One set of words was written phonetically, with letters corresponding to sounds in the word (RNG for orange), while letters in the other words had unusual visual forms but bore no relationship to the sounds themselves (pRt for orange). Those children who were in the pre-alphabetic stage remembered best the words that had unusual visual forms while children who were in the partial alphabetic phase remembered best words with letter cues linking letters to sounds. Phonetic cue reading is a more efficient reading strategy because it takes advantage of the letter cues rather than arbitrary visual features.

Children reach the third phase, the full alphabetic phase, when they engage in

phoneme-by-phoneme segmentation and letter matching. There are complete connections made between the letters and the phonemes in the word's pronunciation. The alphabetic principle, that letters correspond to sounds, is in place when children can read novel print sequences or nonsense words. Ability to decode is a result of understanding the alphabetic principle. The last stage, consolidated alphabetic or orthographic phase, is the most advanced and complete stage of the reading process. Children consolidate or combine letter-sounds and are thus able to easily access sight words and decode irregular words and nonsense words rapidly and accurately.

Pre-alphabetic readers are usually preschoolers who have not yet had formal reading instruction. Partial alphabetic readers are found in kindergarten and early first grade when letter knowledge is taught and reinforced and early reading instruction has begun. First graders are generally in the full alphabetic phase when they are able to decode words. In second grade and beyond, children are generally in the consolidated phase when they are able to easily access sight words and read fluently whether the words are regular or nonsense words. The phases are not fixed to a certain age or grade but rather reflect skills that are generally found during that period. Younger children may be found at a more advanced phase while older children may be functioning at a very low phase (Ehri & Snowling, 2004).

Phase Theory and the Development of Reading and Spelling

Spelling development, according to Ehri (1986), parallels the reading acquisition process. The first stage is the pre-communicative stage where children scribble random letters and/or numbers to represent words and sentences. At this stage, there is very little knowledge of letter-sound correspondence, as seen in the

visual-cue reading phase. The next stage is the semi phonetic stage, where children begin to learn the names or sounds of letters and use this knowledge to choose letters for their spellings. The spellings are incorrect, but very logical. This parallels the phonetic-cue reading phase when children use partial letter-sound cues to read words. The third stage is the phonetic stage where children are able to produce spellings that contain letters for all the sounds in the words. At this stage, children begin to use vowels accurately. Since the children understand letter-sound correspondence, they often draw out the word when sounding it out and add extra letters to the spelling. This stage corresponds to the full alphabetic reading phase, where children associate all letters with their appropriate sounds. The last stage, the morphemic stage, is when spellers recognize and use word-based spelling patterns when they are most appropriate, rather than phonetic spellings. The last stage parallels the consolidated reading phase when children are able to read accurately and rapidly.

Learning to read words and learning to spell words are very closely related in that both tasks rely on knowledge of the alphabetic system. Learning graphophonemic patterns and relations provides the basis for learning spelling patterns while spelling instruction helps further the knowledge of the alphabetic system that in turn benefits processes used in reading (Ehri, 1998).

Juel, Griffith and Gough (1986) pinpoint the specific skill that underlies both reading and spelling success. They suggest that phonemic awareness is necessary in order for beginners to benefit from exposure to print in acquiring spelling-sound knowledge. The relation between word recognition and spelling is strong as both depend on similar sources of knowledge, principally phonemic awareness. Cataldo

and Ellis (1988) suggest that spelling influences reading. While beginning reading focuses mainly on the visual features of words and letters, early spelling development puts an emphasis on phonemes. Once the child understands that there is a connection between the printed word and the spoken word, the next step is to use the letters as clues or cues to figure out the sound of the word. Because explicit phoneme awareness is a fundamental part of beginning spelling, experience in spelling encourages the use of a phonological strategy in reading.

Ehri and Wilce (1987a) suggest that the reading and spelling relationship is causal – that learning to read improves the beginner's ability to spell, that spelling improves reading; in other words, that spelling and reading are reciprocally related to each other. This causal relationship is due to the effect of letter name knowledge on both reading and spelling (Ehri, 1986). Learning letter names helps children discriminate and remember the shape of letters and attach the relevant sounds to letters. Letter names give children nameable referents with which to associate phonemes (Ehri, 1984). Because letters are an arbitrary symbol system, there is little if any relationship between the shape of the letter and its label or sound. The current study attempts to demonstrate that when the symbols are given meaning, the learning proceeds more easily.

Importance of Letter Names in Teaching Letter-Sound Relations

Much theory has been developed and research conducted on the role of letter-sound relations in learning to decode words (Stahl & Murray, 1998). Letters or groups of letters are combined and used as building blocks to form sounds and words. Because letter-sound relations play a fundamental role in learning to read fluently, the

goal of instruction is for children to accurately and consistently associate printed letters and their sounds. But because letters are arbitrary, they can be difficult to learn and retain. Knowing letter names provides a head start in learning to read and makes the process of learning letter-sound relations proceed more smoothly because most letters contain relevant sounds in their names. This section will discuss the background theory and research on the role of letter-sound relations in learning to read and spell.

The exact role that letter-name knowledge plays in early reading has been controversial if not doubted or disproved by several studies exploring the value of letter-naming and its impact on reading (Jenkins, Bausell, & Jenkins, 1972; Johnson, 1969; Ohnmacht, 1969; Samuels, 1970; Silberberg, Silberberg, & Iverson, 1972). Blaiklock (2004) conducted a longitudinal study to explore the relationship between phonological awareness and reading skills, controlling for extraneous variables such as ability, phonological memory, pre-existing reading skills and letter knowledge. He tested 36 kindergarten children in two schools on six occasions the first year and three occasions the second year. The tests included readings skills tests, letter name knowledge, Peabody Picture Vocabulary Test, memory for digits, rhyme awareness, phoneme awareness and word reading. While his findings supported the connection between phonological awareness and reading skills for the above variables, when controlling for letter knowledge, those correlations became non-significant. This suggests that these connections are very much impacted by the role of letter knowledge.

In her critique of letter-name studies, Ehri (1983) stated that since most, if not

all letter names contain within them letter sounds, alphabet knowledge is the foundation that children can build on when acquiring the letter-sound system. Phonemic awareness and alphabetic knowledge allow the connection of graphemes to phonemes to happen, facilitating the bond of spellings to pronunciation and meanings (Ehri, 2005).

There is research which states that letter-name knowledge and phonemic segmentation are the two best predictors of early reading success (Bond & Dykstra, 1967, Chall, 1967, Juel, Griffith & Gough, 1986; Naslund & Schneider, 1996, Share, Jorm, Maclean, & Matthew, 1984). Perhaps it is because letters are not easily acquired, they are a good predictor of later reading success (Ehri, 1998). Letters names also help children relate phonemes to printed letters (Ehri, 1984).

As reported in the National Reading Panel meta-analysis (Ehri, Nunes, Willows, Schuster, Yaghoub-Zadeh & Shanahan, 2001) the impact of phonemic awareness instruction on helping children acquire phonemic awareness was large and statistically significant, with an average effect size of 0.86. Phonemic awareness is defined by the ability to focus on and manipulate phonemes in spoken words. It is included in the broader term of phonological awareness that refers to phonemic awareness and an awareness of larger spoken units such as rhymes and syllables. Phonemic awareness and letter knowledge are the two best school entry predictors of how well children will learn to read during the first two years of instruction (Share et al., 1984). Phonemic awareness instruction has been found to be most effective when letters are included as concrete markers for sounds because while sounds are short-lived and harder to grasp, letters are tangible and lasting (Ehri et al., 2001).

Worden and Boettcher (1990) explored more thoroughly children's acquisition of alphabet knowledge as revealed by their performance on five tasks. The tasks were individually conducted with 188 children ages 2 ½ to 7 ½ years old using upper and lower-case letters. The tasks included reciting letters, naming letters, printing letters, and producing the sound a letter makes, and giving a word that begins with the letter.

One comparison looked at the relationship between letter naming and sound production tasks. If letter names provide a foundation to which letter sound knowledge is added, then children should be able to name those letters whose sounds they could produce. However, if there is no correspondence between the letters, it would suggest that letter names and sounds are learned separately. Results showed that even when children could name the letters, they were not able to use the letters to produce sounds or words for those letters. Worden and Boettcher concluded that letter naming was therefore not as important a skill for beginning reading. They cited Ehri (1983) who stated that because most letter names contain their sounds, children who can name letters have some information to figure out letter sounds. Worden and Boettcher did not find that those letters named were easily associated with sounds and therefore downplayed the importance of letter names. However, their findings with six-year-olds appear to confirm rather than downplay Ehri's findings (Ehri, 1983). With six-year-olds, there were large and significant rank order correlations between uppercase letter naming and sound and word tasks. Alphabetic theory is supported by the findings that children who have mastered letter names can then use this knowledge for sound and word tasks. Because uppercase letters are learned first, they

are utilized more easily. It appears then that letter naming is a precursor to later skills that emerge once the solid foundation of letter knowledge is established.

In two experiments conducted by Share (2004), letter name knowledge was studied to determine whether letter name knowledge influences the acquisition of letter sound knowledge. In the first experiment, the experimental group was taught to label letter-like symbols with English letter names. Some of the letter names contained the "letter-sound" while other names did not. The control group was taught to label the same symbols with unrelated meaningful words. The children were then taught sounds for these letter-like symbols. Results showed that knowing letter names facilitated letter sound knowledge especially when the letter name contained the letter sound. Children who were able to isolate initial sounds were able to learn letter sounds more easily. The second experiment replicated the findings of the first with a new group of children. These experiments suggest that not only is letter naming a precursor to later skill development but that letter knowledge can actually affect letter sound development and has the most impact when children are able to isolate phonemes.

Carroll (2004) investigated the links between letter knowledge and two sub-skills of phoneme awareness and its strength as a predictor of reading ability in two related studies. Her choice of subskills was based on Bryne (1998) who suggested that phonemic awareness could be divided into two skills, segmentation and invariance. The first sub-skill was segmentation, separating a phoneme from a word (this includes skills such as phonemic isolation and phonemic completion). The second sub-skill was invariance, detecting that two phonemes are the same across two

different words (phoneme matching). In the first study, she tested 56 pre-readers twice over an eight month period to determine their levels of phoneme awareness in relation to their letter knowledge. Results showed that phonemic awareness success was dependent on letter knowledge. She further investigated this hypothesis with ten children using an intervention study. These children were taught letters using the "Letterland" storybook and their phonemic awareness progress was followed. Here too, there appeared to be a relationship between letter knowledge and phonemic awareness. She found knowing at least a few letter sounds is a threshold for the development of phonemic awareness. Learning letters teaches children sounds and connects them with visual symbols. Knowing these symbols allows children to approach words with a different eye and ear, as they listen for familiar sounds in words and are able to isolate the sounds within words. While Carroll did not explore the mnemonic aspect of letter learning, her research further bolsters the connection between phonemic awareness and letter knowledge, which was explored in the transfer phase of the present research (Carroll, 2004).

In summary, letter knowledge, whether of shape or name, plays an important role in laying the groundwork for later sound acquisition. Letter name knowledge can be a powerful predictor of early reading because visually distinct symbols are translated into phonetic information. The knowledge of shapes of letters may also serve as "a concrete representation to associate with later learning of letter sounds, providing instructional support" (Hohn & Ehri, 1983). While at early stages of reading children do not recognize letters, they eventually shift from relying on visual information about the word's form to phonetic information using the word's letters.

This letter knowledge is eventually used to aid spellings and store word pronunciations once connections are established between the graphemes in the word spelling and the sounds in the word pronunciations.

Transfer of Letter-Sound Relations to Beginning Reading and Writing

In order for letter-name or letter-sound instruction to facilitate reading, letter knowledge needs to transfer to reading and spelling. Letter knowledge includes knowledge of letter sounds and phonemic awareness, especially segmentation and blending (Ehri et al., 2001). Phonemic awareness is the ability to focus on and manipulate phonemes or units of spoken language. Instruction to enhance phonemic awareness and in turn, reading and spelling has included phoneme isolation (recognizing individual sounds in words), phoneme identity (recognizing a common sound in different words), phoneme categorization (recognizing a word with an odd sound in a set of words), phoneme blending (listening to separate sounds and combining them together to make a word), phoneme segmentation (breaking a word in to sounds by tapping out the sounds) and phoneme deletion (recognizing what word remains when a sound is removed) (Ehri, et al., 2001). The current research uses some of these tasks to study the transfer of Hebrew letter learning to reading and spelling tasks.

Bryne (1998) used a transfer task to explore whether kindergarten age children fully processed two letter-sounds, /b/ and /f/, and connected the sounds with the printed letter. They were taught to read “fat” and “bat” and screened for knowledge of the letters *f* and *b*. In the transfer task, they were presented with a forced choice reading task – they were shown the word “fun” and asked if it said

"fun" or "bun". Other word pairs were presented as well. In some cases they were shown one written word and given two spoken alternatives, and in other studies they heard a spoken word and had to choose which of two written words matched it. The results were just above chance (53% correct), suggesting that learners did not detect the links between the letters and the sounds they represent. Older children were able to complete the transfer task more accurately. Bryne (1998) found that the same children who understood how graphic symbols represent words in phrases had trouble understanding how graphic symbols represent phonemes in words. These children may have been in the pre-alphabetic rather than the partial alphabetic phase, and therefore could not process letters as symbols for sounds effectively.

To explore whether letter-sound learning transfers to reading and spelling tasks, Ehri and Wilce (1987b) compared the reading achievement of beginning readers in kindergarten who were assigned to two reading groups: (1) phonetic-cue readers and (2) cipher readers. Phonetic-cue readers read words by making connections between some of the letters in the spellings - a more elementary way of reading. Cipher readers use all the letter-sound relations in spellings to read – a more advanced stage of using letter-sounds. When reading, cipher readers were more skilled at decoding nonsense words than were cue readers. Cipher readers learned to read most of the words, whereas cue readers only learned to read a few words. Cipher readers also progressed more steadily, showing consistent gains on successive trials, while the scores of the cue readers were erratic. They would learn to read a word properly on one trial and then read it incorrectly on subsequent trials.

In the area of spelling, cipher readers also did much better than cue readers on

spelling tasks. They used more correct letters, vowels and consonant clusters. Cue readers spelled very few consonant clusters correctly. This suggests that when children can decode consonant clusters correctly, they are also able to spell these sounds. Cue readers have an easier time at spelling boundary letters than medial letters.

Cipher readers used different processes than cue readers. Cue readers used partial phonetic cues to read words, which suggested how cue readers read words. Cipher readers acquired phonemic awareness, the ability to segment words into phonemes and blend phonemes to form words. Therefore, cipher readers used not only letter-sound relations but were also able to use the sequences of letters to form pronunciations. These results showed the importance of letter-sound relations in reading development. Those with superior alphabetic knowledge remembered spellings more fully. Partial alphabetic readers however remembered boundary letters as well as full alphabetic readers. The more advanced the reader was in letter-sound relations, the more accurate the decoding was (Ehri & Wilce, 1987b).

This current study investigated the transfer of letter-sound knowledge to reading and spelling tasks. The prediction was that words spelled with letters learned using integrated pictures would be recalled more easily and more accurately than words spelled with letters learned with the disassociated pictures.

Chapter 3

Literature Review: Mnemonics for Teaching Letter-Sound Relations

Overview of Mnemonic Techniques and Their Importance

Mnemonic techniques help students acquire information and apply it in problem solving situations. Mnemonic strategies are effective because they add meaningful connections to seemingly unconnected bits of information. The learner first recodes the information into something more familiar and accessible, using images or other memory techniques. Because the learner relates the material to him or herself, the material becomes more meaningful and therefore easier to remember. The information is more easily retrieved because there is a more distinct way to access the newly learned material. In contrast, rote repetition often fails when students' long-term memory cannot be accessed to retrieve information" (Carney, Levin, & Levin, 1993).

Levin (1993) further described the use of mnemonic strategies as "the systematic procedure, which involves the transformation of otherwise difficult material into something more memorable." The material may be difficult for several reasons: the amount of material necessary to remember, the unfamiliarity of the subject matter, the complexity of the material, or the level of abstractness of the lesson. As organized learning strategies, mnemonic devices make learning more efficient for a variety of learners (Wang & Thomas, 1996). Mnemonics is useful as a learning strategy because it makes the information more concrete and familiar by using visual cues, thus encouraging students to organize new information and form meaningful associations to these familiar elements.

Mastropieri and Scruggs (1991) describe how mnemonic “images” are very effective, particularly in acquiring new material. The pictures provide mental images, which contain information that create a link to the student’s existing knowledge system. With practice, the learning becomes automatic, the mnemonic strategy is not necessary any longer, and the learner can apply the knowledge and use it in a general way.

Mastropieri and Scruggs (1991) add that mnemonics also increase students’ attention to the material, enhance meaningfulness and promote active manipulation and active reasoning. The goal of mnemonics should be to increase initial learning and long-term retention of important information. They describe the effectiveness of mnemonic strategies with disabled students and those at risk for school failure. Often these students have difficulty remembering information taught at school. Mnemonic instruction has been found to be a successful method of teaching and increasing retention among these students. Because mnemonics help to develop better ways to encode information, the material is then more easily accessed. Building on what they have already retained students can relate new information to the old material in long-term memory. Whereas gifted students often spontaneously invent their own mnemonic strategies, they also benefit from specific instruction and coaching to create and use mnemonics in different ways. Mastropieri and Scruggs caution however, that while mnemonics can be extremely effective, it is not an overall teaching method or curricular approach. Mnemonic instruction is a memory strategy that can enhance comprehension, but is not meant to be a comprehension strategy.

To summarize, there are several prominent effects of mnemonic techniques.

The material itself is simplified into more memorable “pieces” of information. The material becomes more concrete by use of visual cues and linked to previously learned material. In addition, mental images are created that further link to the existing information bank. Mnemonics also direct students’ attention to the material by presenting the information in an original way.

Mnemonics and Letter-Sound Relations

In beginning reading programs, pictures are often used to teach or reinforce letter learning, but usually the picture provided is not a mnemonic image. The picture gives information about the letter sound but is not a mnemonic because there is “no effective link between the letter and sound” (Mastropieri & Scruggs, 1991). The example given is an apple shown with the letter *A*. Since there is no explicit connection between the capital letter *A* and an apple, the apple image is not particularly effective in increasing recall of the sound of the letter *A* so the association must be learned by rote. Research has shown, however, that when provided with integrated pictures of the letter and the sound it makes, the pictorial image can be a very effective means of teaching letter-sound relationships. The letters need to form a necessary part of the picture, not just placed within or near the picture, in order for the mnemonic strategy to be effective. A direct retrieval path is needed, since the picture is what strengthens the link between the letter’s visual and phonetic properties (Levin, 1983). The importance of the integrated pictorial mnemonic is that it facilitates the direct retrieval path. When the picture is disassociated from the letter, the picture does not add information and the child may not remember the letter with ease.

Research of Mnemonic Techniques and Early Reading

As mentioned above, researchers and classroom teachers have found that letter-sound relations are central to the acquisition of reading and early reading and thus studies have been done to explore early reading and the use of mnemonics to facilitate letter-sound development and retention. Marsh and Desberg (1978) researched the task of learning letter sounds using mnemonics. Kindergarten students were given pictorial mnemonics to help learn letter sounds. Each letter sound was presented with a picture of an object with the same letter sound (what has been referred to in this paper as the disassociated picture condition) or an action representing that sound. For example, the letter *P* was shown with a pumpkin and the action was a boy blowing out a candle. As expected, presentation of both the picture and action aided the learner in identifying new letter sounds during training. However, once the letters were shown without the pictures or actions, both mnemonic techniques used to teach letter sounds were ineffective in helping the children recall the letter sounds. While Marsh and Desberg described their teaching technique as "the use of mnemonics", Levin (1983) argued that because there was no connection between the letter's visual properties and the picture or action shown, the children were no better off having used these techniques. In order for the pictorial mnemonic to be effective, it is crucial for the mnemonic to provide "a direct retrieval path" which establishes a clear relationship between the letter sound and its visual properties. The relationship between the visual and phonetic properties of a letter is strengthened by a picture that resembles the letter sound.

Ehri, Deffner and Wilce (1984) conducted two experiments with prereaders.

The first one compared the effectiveness of teaching letter-sound relations using integrated picture mnemonics to a control condition where letter sounds were taught using pictures with the same names as in the integrated condition but drawn differently (disassociated pictorial mnemonics). The second experiment replicated the findings of the first with more stimuli and included a no-picture condition.

Before letter sounds were taught, phonetic segmentation was pretaught to ensure that the children were able to isolate initial sounds of words. This step was necessary for the children to use the pictures or words to learn letters during the training phase of the study. The pretraining phase involved several tasks such as clapping one's hands to syllables, identifying beginning consonant sounds and using counters to number or mark off the phonemes heard in words. Pre-testing involved asking the children to demonstrate letter-sound knowledge and phonemic segmentation; necessary skills to participate in the study. In the second experiment a word-reading task was added to eliminate word readers from the subject pool. The Peabody Picture Vocabulary Test (PPVT-R) was also added to ensure similar ability across students.

The first experiment involved twenty children who were matched by pretest scores. Then each pair was randomly assigned to the experimental or control group. The pretesting and posttesting were conducted individually, while the training was done in groups. This was considered to be a weakness in the design of the study and was corrected in the second experiment. The children were trained using integrated pictures (experimental group) or disassociated pictures (control group) and were given the same instructions to trace the letter, draw the picture and segment its sound.

They were taught six letters over the course of six days and reviewed the letters already taught, each day.

In the second experiment, thirty pre-readers were matched based on pretest scores and then each of the three subjects was randomly divided into three training groups. Each child was individually trained within each group. Group one was shown pictorial mnemonics where the shape of the letter was embedded as part of the picture whose name began with the sound of the letter (e.g., *f,* /f/ was the stem of a flower) (integrated picture group). Group two learned the letter-sound relationship with a picture whose name began with the given letter, but the letter was not embedded in the picture and did not resemble the shape of the letter (disassociated picture group), as in the Marsh and Desberg study (1978). Group three was not shown any pictures but rather was taught letter-sound associations with the names of the pictures learned by the other groups (control group). In contrast to the first experiment, all five letters were taught at one time rather than over the course of six days.

Ehri et al. (1984) found that truly integrated pictorial mnemonics (where there is a relationship between the letter sound and picture shape) do improve children's letter sound learning. Their research found that teaching prereaders letter-sound relations through the use of integrated pictorial mnemonics was more effective than teaching them letter-sound relations with disassociated pictures or with rote rehearsal of letter-sound associations. The reason suggested is that the pictures link the form of the letter to its sound, two otherwise unconnected concepts. The students connect the letter shapes with their sounds using integrated pictures whose names prompt the

recall of the letter-sounds. Ehri et al. emphasized that it is important for the mnemonics to be easily connected to the visual features of the letter as well as to be simple and clear.

Fulk, Lohman and Belfiore (1997) wanted to find out whether mnemonic letter-sound training would work well with learning disabled students. Often these students have difficulty recognizing and decoding letter sounds and thus do not demonstrate age-appropriate reading competency. As mnemonics have been shown to be more effective than rote repetition of information or traditional instructional techniques, this type of training would seem to be ideal for this population.

The Fulk et al. (1997) study was conducted with three transitional first-grade children who were recommended by teachers to participate, and already identified as eligible for services. Following a baseline period, twenty consonant letters were presented using integrated picture mnemonics. The results showed that integrated picture mnemonics were effective for the acquisition of letter-sound relations. Data collected after two and four-week intervals showed that the results were maintained over time.

In a study conducted by de Graff, Verhoeven, Bosman and Hasselman (2007), integrated mnemonics paired with fading rehearsal was studied to see if this method would be effective in teaching letter sounds to thirty nine kindergarten age children. Three training conditions were compared: integrated mnemonics with fading rehearsal, embedded integrated mnemonics and a no-picture condition. The integrated mnemonic condition was included to compare the effectiveness of the fading strategy being investigated. The no picture condition was included to ensure

that rote rehearsal was not responsible for the fading condition effects. An additional question that the researchers explored is whether phonemic segmentation is a necessary skill to properly use mnemonics and whether children who are able to segment initial sounds benefit more from mnemonics. All the training and testing was done using a computer to allow for intense and individual training with limited teacher involvement as well as reliability. Human monitoring was used to evaluate the children's letter sound production.

The study found that the letters learned in the fading condition were recalled significantly more than in the embedded condition in the productive recall phase of the study. The researchers suggested that fading helps children focus on the visual features of the letter and help them transfer stimulus control to the letter rather than rely on the picture as a "crutch". It was only on the retention test that the fading condition significantly outperformed the no-picture condition. While it might seem that rote rehearsal works, children did learn more letters, make fewer errors and needed fewer trials in the fading condition. While the rote rehearsal of the no-picture condition worked, in terms of efficiency, the fading condition was superior to the no-picture method.

It is interesting that this study found that the embedded condition to be no more effective than the no-picture, in fact maybe even less effective. This may be because of the mnemonics themselves. If the salient visual features of the letters are not amplified or connected to the picture, then the picture will not serve as a trigger any more than having no picture at all. While the researchers maintain that they used the criteria outlined by Ehri et al. for designing integrated mnemonics, the example

shown in the paper does not appear to employ a salient visual feature of the letter and first sound of the picture name. The letter "m" was a mouth, shown in the fading condition as an "m" superimposed on a picture of a mouth with no apparent connection between the "m" and a mouth. In the current research study, great care was taken to make sure that the letter and the picture were tightly connected with the letter features as integral parts of the picture.

The second question addressed in de Graff et al. study was whether it was necessary to teach the children how to segment prior to training session. The results showed that in the embedded integrated picture condition as well as the no picture condition, the children who were able to segment initial sounds well outperformed those who were not able to segment well. However, in the fading condition, there was no significant difference between good and poor "segmenters", although the results were in the expected direction. The authors suggest that this may be due to the segmentation training that occurs with the training session itself, albeit not explicit. It is also possible that the lack of significant results may be due to lack of power.

Transfer of Mnemonic Strategies

In his report card of twenty years of mnemonic usage, Levin (1993) gave an "A" or "accolades earned" for mnemonic illustrations. He described mnemonic illustrations as those materials developed specifically for areas of high factual content. He pointed out that students' acquisition of definitions of vocabulary items, both foreign and native are enhanced. He found that at lower educational levels, mnemonic illustrations could help young children rapidly acquire letter sound correspondences as was found in the study done by Ehri et al. (1984). Illustrations

facilitate the acquisition of concrete but not easily remembered factual information. He cautioned that research should be done to investigate transfer and application of material learned through mnemonic illustrations.

In order to establish the effectiveness of mnemonics, retrieval and transfer must be demonstrated. A study conducted by Lange and Pierce (1992) looked at young children and their ability to learn a strategy and maintain it. The strategy taught was an organizational study-recall strategy and was taught to four and five year olds. The results show that young preschool age children will continue to use a newly learned strategy when motivated to perform well and when briefly told why the strategy is important and how, when and where to use it. While this study was not specifically done using mnemonic techniques, findings indicate the importance of including these steps to maximize transfer in any mnemonics study with preschoolers. In the current study, reading and spelling transfer tasks were included because letter-sound knowledge is only a means to an end, namely a strategy to facilitate reading and spelling rather than the goal itself.

The Use of Mnemonics to Teach a Foreign Language

A study conducted by Gruneberg and Sykes (1996) explored the usefulness of pictorial mnemonics when teaching a non-Roman foreign alphabet to English readers. The Russian alphabet contains some letters that look like English letters but do not have the same sounds. These letters were often confusing for English readers, as they would often substitute the English sound for the correct Russian sound. Other letters do not resemble English letters and thus were new stimuli for the students. One example was the Russian letter that sounds like an F. The students were told to

imagine that the letter looks like a *f*ishing *f*loat. The object shape resembled the letter shape. A first letter mnemonic was also used for letters that look the same but sound differently in English and Russian.

Grunberg et al. compared performance of the experimental group that was given mnemonics as study aids to learn Russian letters to a control group that received no strategy aids. While the two groups did not differ in the time taken to learn the letters, there was a significant difference favoring the mnemonics group in the memory for new letters that did not resemble English letters. A visual mnemonic strategy allows the arbitrary letter to be linked to an English sound (Gruneberg & Sykes, 1996). Those letters that resembled English letters were more difficult to learn perhaps due to the conflicting information of previously learned English letters. The researchers concluded that not only do mnemonics appear to have a significant advantage as far as performance but there is a psychological impact as well. Often when learning to read a non-Roman alphabet, students become frustrated at the initial stage of learning letters. Because learning letters can slow down the initial pace of learning, the foreign language learner may become frustrated and not want to proceed further. Once students learn the letters, they are able to begin learning to read the new language more quickly and are rewarded by acquiring a new vocabulary. Enhancing the speed of acquisition of foreign language alphabets may also positively enhance foreign language learning.

A study was conducted to explore both the importance of mnemonics and the need to present all instructional material in a logical hierarchy when teaching Chinese and Japanese Kanji letters (Lu, Webb, Krus, & Fox, 1999). The concept of hierarchy

as it relates to this study is logical arrangement of instructional material by use of a computer program that analyzed the relationship of the letter designs. The hypothesis was that presenting material in an optimal manner should enhance recall. Furthermore, there should be an interaction effect between mnemonic strategy use and the sequencing of material above and beyond the effect of each variable on its own - only logical sequencing or only mnemonic strategy use.

Participants were sixty undergraduate volunteers who were chosen from several introductory educational psychology courses at a large university in the southwest United States. The participants were randomly assigned to two between-subject groups based on their arrival at the study site. The students were presented with Japanese and Chinese kanji characters in a hierarchical or random order, with or without mnemonics. In order to design the mnemonics, those Chinese and Japanese kanji characters found to be more prevalent in commercial textbooks were selected. Twenty-five adults were shown the characters and their meanings and asked to think of what phrase would help create a mnemonic to remember the character and the sound. The most frequently selected mnemonics were used in this study. The mnemonics chosen ranged from 2 to 14 words. The descriptive mnemonics were presented under the character and the meaning of the character was in capital letters. For example, the character for mountain was shown with the mnemonic “Three peaks of a MOUNTAIN” under it. The parallel non-mnemonic set would have the word “MOUNTAIN” underneath the character.

Determining the hierarchical order for presentation was based on the calculation of the optimal learning hierarchies for a separate group of students. These

students were taught the letters and asked to recall them. Using a computer program, their rate of recall determined the most efficient learning hierarchies for character presentation.

The study participants were presented with the letters on computer screens hierarchically or randomly ordered, with or without mnemonics. Recall and recognition tests were given. The results found that the students both recalled and recognized characters better when they were arranged in a hierarchical fashion presented with mnemonics as compared to the other conditions. While none of the interaction effects reached statistical significance, the results suggest that organizational techniques help to make the information easier to learn and recall.

The research suggests that both mnemonic and organizational strategies are important learning devices. Mnemonics are useful, particularly in teaching letters resembling pictures that trigger many associations. The more information that can be encoded when the characters resemble pictures, the more access cues will be provided to long-term memory (Paivio, 1990). The goal of mnemonics is the facilitation of retrieval of information in long-term memory.

Learning a Second Language

While much work has been done studying how one learns to read in their native language, there has been less investigation of learning to read a second language (Verhoeven, 1990). Verhoeven explained that learning to read a second language presents two types of linguistic problems: interlingual and intralingual. Interlingual learning problems are those that are caused by a conflict or interference of the native language and the second language, while intralingual problems are those

that are caused by the specific and unique structure of the second language. While in the past most second language reading problems were thought of as being interlingual issues, recent research has begun to recognize intralingual issues as playing a greater role in second language reading problems (Verhoeven, 1990).

Reading acquisition is a complex process both in one's native and second language. Beginning readers use three representational systems to learn to recognize words: phonemic mapping or association of letters to sounds; recognition of orthographic patterns and finally, recognition of sight words – those words already stored in memory. Regularity of orthography and direct instruction in letter-sound relations facilitates children's comprehension of the alphabetic principle and its use in reading. When learning to read, children gradually move from accessing word representations through phonemic mapping to accessing most words directly from memory (Ehri, 1986).

Second language acquisition presents difficulties in all three areas as learners may have a more difficult time associating letters to sounds, are less efficient using orthographic redundancies to help with letter recognition, and may be deficient in sight words. Since their vocabulary is more limited, it becomes more difficult to create a mental word bank that can be accessed quickly and directly (Favreau, Komoda, & Segalowitz, 1980).

On the positive side, literacy skills acquired in one language can be transferred to another language. Bialystok (2005) studied what impact different writing systems may have on the development of language skills of bilingual children. This is obviously an issue for children learning Hebrew and English writing

systems. Four groups of children in first grade were compared on early literacy tasks. Three groups contained children who were bilingual in Spanish-English, Cantonese-English or Hebrew-English. The fourth group was English monolingual. All the children received the same English reading tasks and the bilingual groups also were given the equivalent tasks in their second language. Results showed that all bilingual children outperformed monolingual children but with a greater advantage for those learning a foreign language with a different alphabet system. Perhaps different alphabet systems allow the child greater insight into the underpinnings of how language works and how language is decoded into words. The transfer of reading skills from language to language was only present when the two languages used the same system. According to this study, Hebrew affords children the advantage of learning a second language by exposing them to a new coding system but the transfer of reading skills is limited by the different alphabet system.

The use of context plays an important role for second language readers. In a study comparing second language French speakers and native French speakers, both groups used a dual strategy of orthographic and contextual information. The study revealed that while the second language readers may need context more as an aid or crutch, their language base is weaker and thus they cannot rely on context as much as is needed. Second language readers may not achieve the same degree of automaticity as first language readers and may not attend to the higher level of comprehension of text in recognizing unfamiliar words. The second language readers used a more "bottom-up" strategy and relied on orthographic information more than first language readers, even though they could have benefited from the context cues (Cziko, 1980).

Chapter 4

Literature Review: Hebrew Language

Description of Hebrew Language

Hebrew differs from English in many ways. Hebrew is read from right to left (in contrast to English) and the alphabet has 22 basic consonants and 10 letter vowels and final letters as shown in Figure 1. While there are no upper or lowercase letters, there are several letters that rise above the letter line and drop below the line. The letters are vocalized in combination with vowels of a much smaller size. Seven vowels appear below the line of print, while two have letterforms and two appear above the letters, suspended in mid air. Those appearing below the line of print and those suspended in mid-air are small dots, resembling the period punctuation sign. Hebrew letter architecture, relative to the Latin alphabet, is square with few curves and diagonals. There are many letters that resemble each other differing only in minute curves or dots. When reading Hebrew, children may often confuse letters as well as vowels (see Figure 2). Shimron and Navon (1981) suggested that relative to English, Hebrew letter recognition times were slower. This may be due to the similarities between the Hebrew letters.

Today, there are two systems of writing Hebrew. Voweled writing is used in printing children's books, poetry, prayer books and sacred scriptures. Children learn to read in pointed Hebrew, which has almost perfect grapheme-to-phoneme correspondence (transparent orthography). However, phoneme-to-grapheme relationships are duplicated across letters. This means that there are many Hebrew words that could be spelled with alternative letters (Share & Levin, 1999).

Unvoweled writing is used to print most books, newspapers and all other types of written communication (Shimron, 1993). Because of the simple and predictable syllable structures and word roots, unvoweled text is easily read.

Hebrew Letter-Sound Research

As the current research explores Hebrew letter development, it is important to review letter learning studies relevant specifically to Hebrew. Levin, Patel, Margalit and Barad (2002) examined whether letter names in Hebrew play the same role as letter names in English. Whereas previous research supported the value of learning English letter names, it was not clear whether this would be true for Hebrew letters. Hebrew letter names are lengthier, include more than one consonant unrelated to the letter sound, and have a longer sound structure, which often obscures the letter sound. Levin et al. focused on the early stages of spelling and word recognition in Hebrew. They explored whether children used letter names to connect print and speech.

Children were asked to isolate initial phonemes in words as well as to spell words in writing. Pairs of words were presented, each having one word with a letter name sequence and one matched word that began with the same initial letter sound but not the full name. An example of a letter-word pair was kuf'sa and and kar'ton; the target Hebrew letter was Kuf. Results showed that Hebrew letter names affect children's ability to connect letters and speech when asked to isolate initial letter sounds and spell words. Children often used partial letter names because of the length of some Hebrew letter names and the lack of appearance of the whole letter name in words. This supports the current research, which explores Hebrew letter sounds rather than Hebrew letter names when comparing integrated pictorial

Figure 1

Note. From *Reishith Binah* (page 1) by National Jewish Outreach Program,1998, New York, NY.:Bloch Publishing Company. Copyright 1974, 1998 by National Jewish Outreach Program. Reprinted with Permission.

Figure 2

Note. From *Reishith Binah* (page 2) by National Jewish Outreach Program,1998, New York, NY.:Bloch Publishing Company. Copyright 1974, 1998 by National Jewish Outreach Program. Reprinted with Permission.

mnemonics and disassociated mnemonics.

Hetzroni and Shavit (2002) studied the use of mnemonic strategies when teaching Hebrew letters to children with mild mental retardation. The study compared the effects of a direct letter teaching strategy to a mnemonic strategy that paired letters and pictures. Twenty four students between the ages of 10 and fifteen participated in the study. In contrast to the current study, their study involved disassociated pictures rather than integrated pictures. The students were either shown just the letter or a letter picture. Results showed that students in the disassociated picture group performed significantly better than those in the control group (only letters). The study confirmed the effectiveness of the mnemonic strategy of pairing an arbitrary symbol with a more meaningful piece of information. The students not only learned more effectively but also were able to retain the information better. The current research extends this study's findings by comparing disassociated picture mnemonics and integrated mnemonics to see whether an integrated picture facilitates an even stronger connection between the new material and existing pictorial information.

Shimron and Sivan (1984) explored whether readers' first or second language orthography affects their reading time and comprehension in each language. They found that native English speakers read more quickly in their native language than did native Hebrew speakers in theirs. Several factors were examined, the one most relevant to the present research was letter architecture. The more similar the letters appeared, the more difficult letter recognition became. Compared to English letters, Hebrew letters are more uniform which leads to confusion between letters. Share and

Gur (1999) came to similar conclusions in their research investigating how prereaders approach commercial (e.g., Coca Cola signs) and noncommercial print (children's names in lockers). This was a follow-up study to the above-mentioned Masonheimer, Drum and Ehri study (1984). They found that even though prereaders can identify non-commercial print like children's names on lockers, the more similar the letters, the more difficult it became for prereaders to "read". Yet, in an experiment obscuring initial and final letters, Hebrew readers outperformed English readers. This may be because Hebrew words are more visually distinct within the word in contrast to English words which are more visually distinct at the beginning of sentences and proper names. The children attended to the whole word rather than the initial letters and therefore, their attention was distributed across the word.

How Hebrew is Taught as a Second Language

Concurrent language instruction exists primarily in Jewish day schools that offer a dual curriculum. Most schools are set up so that Hebrew language and Judaic studies are taught half of the day, while secular studies (e.g. math, science, English literature and language) are taught the other half day. Each language serves as the primary language of instruction for that half of the day. Except for immigrant children, the students in these schools speak English as their first language and are learning Hebrew as a second language. Hebrew instruction begins at an early age, in nursery or kindergarten.

There is a debate over whether the teaching of Hebrew in the United States constitutes the teaching of a second language or foreign language. Halabe (2005) explains the differences between the two terms. A second language is one that is

learned by living in a country where that language is spoken and by being immersed in it. By learning it, people are preparing themselves to live in that country and speak the dominant language. A foreign language is defined as one that is studied in a country where that language is not the dominant language, in order to use it when traveling to the country where the language is spoken, read its literature or communicate with its speakers. Halabe suggests that Hebrew falls into a new category of language acquisition, "Identity Language" or "Cultural Language". While second and foreign language learning emphasizes daily communication, Hebrew language learning focuses on that and more. The ability to access Scriptures, stories, popular music and prayers create ambitious goals for learners. It is important therefore, to provide children with very positive experiences at the beginning of their Hebrew language journey, namely letter learning.

Kupinsky (1983) studied a program designed to develop simultaneous reading skills in English and Hebrew for kindergarten-age students in Detroit, Michigan. Two kindergarten classes totaling 38 students were studied during the school year. In this school, beginning reading in both languages was emphasized. The children's native language was English and the purpose of the program was to develop Hebrew reading fluency. Each student received group and individual instruction, group instruction with the teacher and individual time with an aide. The method used to teach Hebrew was letter-by-letter, emphasizing the "one-to-one correlation between graphemes and phonemes in Hebrew". Feitelson (1988) recommended teaching letter by letter rather than whole words since Hebrew letters resemble one another and can be easily mistaken for each other. By emphasizing the differences between the

letters, children were expected to identify letters more accurately.

The Hebrew letters were taught using two different instructional texts. One text, Otiot (a workbook) (Leichtman, 1960) and Mealeph Ad Tof (a reader) (Langsam, 1972) were used. The Otiot method involved introducing each letter and key words associated with it. The lesson presented each new letter, while showing how it differed from previously presented letters and how it was different from letters similar in shape or sound. Auditory and visual discrimination activities took place in conjunction with the workbook, which preceded the lesson in the reader. The reader, Mealeph Ad Tof (literally from A to Z) presented the letters in alphabetical order. Letters and vowels were introduced one at a time. During each lesson, more words were introduced as more letters and vowels were taught. The reader and workbook provided the basic decoding skills necessary for reading in Hebrew. A reading approach emphasizing single letters in contrast to one another was used rather than specified mnemonics. The English program used Beginning to Read, Write and Listen (Rowland, 1971). This program used text and workbooks with multi-modal, multi-sensory activities. The students wrote, cut and pasted in the letter book and learned to write the letter, identify its sound and blend it with previously learned letters. The letters were not learned in alphabetical order but rather based on perceptual continuity. For example, the first ten letters learned were all circle-based letters. The students were encouraged to blend sounds and at the end of the program were able to read from a controlled vocabulary text.

At the end of the year, the students were given a criterion referenced test (Beginning Assessment Test of Reading, 1975) to evaluate their beginning reading

skills in English and a Hebrew reading diagnostic test (Koallen Diagnostic Test of Elementary Hebrew Reading, 1975). Ninety two percent of the students exceeded the BATR criterion of 70% or above, with an average score of 86% mastery in English. Sixty-one percent of the students equaled or surpassed the DTHR mastery criterion of 70% mastery with an average score of 71% in Hebrew. There were strong positive correlations between each of the total test scores and their subtest scores for letter naming, letter sounds and sentence comprehension. The results on each test suggest that the kindergarten students were able to learn to read two languages, although the levels of reading ability differed between the two languages.

Hebrew Language Primers

Reishith Binah (1974, 1998) has been widely used in teaching Hebrew letters and reading to adults. The National Jewish Outreach Program (NJOP), established in 1987, has used this textbook as part of its Jewish outreach work with adults. This text differs from the above mentioned texts in that it presents letters in an order based on perceptual continuity rather than alphabetically. This allows the reader to read sentences at the end of the first lesson. When working with adults, NJOP felt that this serves as a motivator and encourages students to continue with the program (NJOP teachers' guide, 1996). The text does not present similar looking letters in the same lesson but rather has a chart in the front of the book (1998), which shows the similarities between letters, as shown in the above Figure 2. As part of the lessons, mnemonics are verbally presented to make the text more engaging as well as provide hints and clues about the letters.

Many of the NJOP mnemonics focus on the construction of the letter, rather

than on what picture the letter resembles. For example, the letter *Dalet* which makes a /d/ sound and the letter *Reish* which makes a /r/ sound resemble each other. The program offers a set of mnemonics to discriminate between the two letters. The Hebrew letter *Dalet* has a "dent" while the Hebrew letter Reish is "rounded". Since the reading program is six sessions, verbally presented mnemonics can facilitate greater ease of learning and greater speed. It is interesting to note however, that the mnemonics in this text were not presented pictorially as they were in this research study. To this date, no research of the NJOP reading program has been conducted.

After examining other popular children's reading instruction textbooks, it appears that written Hebrew is being taught to children primarily using phonics and Hebrew words beginning with the target letters. One catalog (Berhman House, 2001) describes one Hebrew beginning reading textbook as having visual discrimination practice, similar letter-sound and vowel-sound drills and writing practice. One of the books, Shalom Alef Bet includes picture cues, which link new letters to heritage words. These cues are not related, however, to the shape of the letter but rather are Hebrew words, which begin with the presented letter sound. In Let's Discover the Alef Bet (2000) the illustrations all begin with the same sound as the Hebrew letter. While the catalog description states, "provide pictorial reinforcement to link letters and sounds", no integrated connection is being made between the shape of the letter and the letter sound. The Hebrew letter *Bet* /b/ is drawn using buttons and the instructions state to color the letter blue.

In Sam the Detective's Reading Readiness (1995), children learn letter sounds by repeating the name of the Hebrew letter and naming things in English that begin

with the Hebrew letter sound (the picture for Hebrew letter *Pay* contains pajamas, a parrot, a penguin, a pencil, a piano, and more). Again, no connection is being made between the letter shape and sound. In Look Listen and Read Alefbet I – Letters, (1987) the children are presented with words that have an initial Hebrew letter followed by the rest of the word in English with a disassociated picture next to it. In a newly developed curriculum, Tal Am (2003), letters are taught phonetically with Hebrew words associated with the letter presented. The letters are presented in alphabetical order except for the letter *Shin* which is introduced after the first letter *Aleph*.

In a recently published book, My Friends – The Alef Beis (Chait, 2005), efforts were made by a talented illustrator to utilize the concept of integrated mnemonics to teach Hebrew letters. On the opening page, every Hebrew letter was presented in a different color or pattern. The color or pattern name in Hebrew began with the same letter as the presented Hebrew letter. Within the book itself, every Hebrew letter is depicted according to a Hebrew language mnemonic. For example, the letter *Dalet* is drawn as a *Decal* – palm tree in Hebrew. Each letter is surrounded by pictures of objects beginning with that particular letter sound, with the words being in Hebrew. While this book utilizes the concept of integrated mnemonics, the book targets children who already know their letters. It would be difficult for an English speaking child to learn Hebrew letter sounds using Hebrew mnemonics, albeit integrated.

For the most part, it appears that the use of formal integrated mnemonics has not been the chosen method of teaching Hebrew letters. This study aims to extend

previous studies and demonstrate the effectiveness of integrated pictorial mnemonics in the Hebrew letter acquisition process, recall and reading and spelling transfer tasks.

Chapter 5

Rationale and hypotheses

The purpose of the present study was to explore integrated pictorial mnemonics as an extension of the study done by Ehri and Wilce (1984). The Ehri and Wilce study explored the effectiveness of integrated pictorial mnemonics for teaching pre-readers English letter-sound relations compared to disassociated pictorial mnemonics and no-picture mnemonics. Findings showed that children learned more letter-sound associations using integrated mnemonics. The present study served to extend the Ehri and Wilce study by exploring how mnemonic strategies facilitate learning a foreign language alphabet system by English speaking children. In addition, the study explored the transfer of letter-sound relations to reading and spelling tasks which was not part of the Ehri and Wilce study.

The following hypothesis was tested in this study: students who are taught Hebrew letters with integrated pictorial mnemonics, will learn, retain and transfer letter knowledge more effectively than students who are taught Hebrew letters with disassociated pictorial mnemonics.

The independent variable was the type of letter mnemonic used to teach students the Hebrew letters. The dependent variables were the number of trials needed to learn each set of letters correctly, the level of retention of the two sets of letters as measured by various posttests, and the ability to transfer and apply the letter-sound relations in reading and spelling tasks.

Chapter 6

Method

Participants

Thirty six children from two different schools participated in this study. Five additional students began the study but were dropped before the letter-sound instruction phase for various reasons elaborated below. There were 15 boys and 21 girls with a mean age of 5 years, 2 months who participated in the entire study. Two waves of students were studied, 12 children from the 2002 pre-kindergarten class, and 21 children from the 2004 pre-kindergarten class at the Cohn Early Childhood Learning Center of the Levite Jewish Community Center preschool program in Birmingham, Alabama. Thirty three children were Caucasian, two were African American and one student was Asian. While students at the school were multi-ethnic with diverse cultural backgrounds, the Jewish population was represented more than typical of the larger Birmingham general population. Twenty five students were identified as Jewish with varying levels of observance, while eleven students were not Jewish. Despite the fact that the teachers were not Jewish, Jewish values, traditions and some Hebrew words were taught, albeit on a less intense level. Hebrew alphabet posters were hanging in the classroom but no formal Hebrew letter instruction was included in the curriculum. Three children from the Bais Ariel Chabad preschool also participated in this study The Bais Ariel Chabad preschool is comprised of a Jewish population with Jewish teachers. The students are provided with an enriching Jewish pre-school education

The participants were pre-readers selected from pre-kindergarten classes.

Several pretests were given to select students who met the criteria for the study. In addition, performance during training was used to further select or exclude children from this study. The selected participants were those who were (1) unfamiliar with letter-sound correspondences of Hebrew letters as determined by the pretests, (2) familiar with the English alphabet (knowledge of more than half of the capital and lowercase letters), (3) proficient speakers of English, (4) without any apparent hearing loss, acquired neurological disorder, uncorrected vision problems and/or severe emotional problems, (5) able to learn to segment initial phonemes during pretraining, and (6) able to learn names and segment initial sounds of target pictures to criteria. Of the five who did not qualify, one child lacked sufficient knowledge of English letters, one child knew too many Hebrew letters, two couldn't learn picture names while the other two children were not able to learn to segment initial sounds when given phonemic segmentation pre-training. All the children who qualified for the study remained in the study. There was one student who completed the posttests more than three days after training as he was absent due to a family trip. Twelve students who were in the first wave did not complete the transfer tasks.

Parents were asked to sign consent letters if they were interested in having their children participate in the study. The parents were told that there were no apparent risks. The goals and content of the study were explained in accordance with the Graduate School and University Center of the City University of New York Institutional Review Board guidelines (see Appendix A for principal permission letter and Appendix B for the parent permission letter).

Material and Procedures

Students were tested and trained individually. The four sessions included: pretesting, training, posttesting and transfer testing.

Screening and Pretesting

1. Letter Knowledge. Students were given three pretests to assess their English and Hebrew letter knowledge and word reading ability. The first two tests consisted of Hebrew and English letters presented in a flip-chart form. All upper and lowercase English letters and Hebrew letters were presented in a random order (see Appendix C for the script, pre-testing materials, and scoring sheet). The third test was the Woodcock Johnson III Letter Word Identification subtest. The split-half reliability of this subtest is reported as .94. A correct score was noted when either the name or the most common sound was given for the letter. Alternative responses and/or errors were recorded. The maximum score on the English pretest was 26 for both capital and lowercase letters while the maximum Hebrew letter score was 23. Testing was discontinued once the child finished the given list of letters. Children were eliminated from the study based on their lack of English letter knowledge, if they did not know more than half of the capital or lowercase letters. One child was eliminated for this reason. The purpose was to select children who had experienced no difficulty learning letter names or sounds and who understood the nature of the relationships to be taught. Also, this insured that children understood task directions when they were explained and modeled using English letters. Those students who did not qualify were asked to identify pictures in the pre-primer reading task so as to complete the session on a positive note and not to make them feel left out or

uncomfortable.

The Hebrew letter task eliminated students who already knew the Hebrew letters to be taught in this study. There was one student who was disqualified because of her Hebrew letter knowledge, as she knew 22 of the 23 presented letters.

2. Reading Words. Children were tested on their ability to read 14 pre-primer level words (see Appendix C for the script, pre-testing materials, and scoring sheet). There were 4 sheets displaying 14 pre-primer written words to read and seven pictures to name. The words were selected from a list of preprimer level words (Harris and Jacobson, 1972). The words were: no, stop, play, go, dog, fun, work, big, and, ball, daddy, the, red, and up. The pictures were: fish, ball, banana, balloon, scissors, rabbit and dog. To minimize frustration, children were asked to recognize pictures as well as words. A correct score was noted when either the word was read correctly or the picture was correctly identified. Alternative responses or errors were recorded. The maximum number correct was fourteen. Testing was discontinued once the child finished the given list. Students were able to participate in the study regardless of whether they were able to read the primer words.

3. Vocabulary. The Peabody Picture Vocabulary Test was used as an estimate of vocabulary and overall cognitive ability. The first wave of 12 students was given the Peabody Picture Vocabulary Test Revised (1981) while the second wave of students was tested using the Third Edition (1997). The examiner followed the publisher's testing guidelines. She said each stimulus word aloud, the child viewed four pictures on a page and selected the picture that best illustrated the meaning of the word. The examiner established a floor below which the child was assumed to know

all word meanings and a ceiling above which the child was assumed to know no word meanings. When the child made a choice with his or her finger, the response was noted and recorded. The experimenter did not watch the child select the correct picture so as not to influence the choice made.

The PPVT-R test manual reported internal consistencies from .61 to .88, and alternate form reliability values from .71 to .91. The Third Edition reported a split-half reliability of .86 to .97 (median .94) with a test-retest reliability of .91 to .94 (median 92). Students were not eliminated from the study based on the PPVT scores unless their score was significantly below average. No student displayed low vocabulary scores.

Training

Phonemic Segmentation Pre-training.

The pre-training phase began by teaching the child to segment initial sounds of familiar proper names. Children were taught to segment initial sounds because this skill was needed to segment the initial sounds of picture names during letter-sound training. The names were Lenny, Nancy, Tom, David, Sharon, Mary, Kim, Sam, David, Bob and Harry. If the child made an error, the error was corrected. The child then repeated the name and the first sound correctly and continued. The complete list of names was reviewed until one hundred percent mastery was achieved. If the child missed more than five names on the first trial, the examiner began the list again. If more than five names were missed on the second trial, the child was dropped from the study. One child was dropped from the study at this point. The criterion for each task was reached when the child achieved two perfect trials – ten correct responses

twice (see Appendix D for the script, phoneme segmentation materials, and scoring sheet).

Next the child was shown a combination of ten photographs and drawings on a flip chart and asked to name the pictures. The names accepted or taught as correct were house, key, lizard, teapot, nose, mitten, ship, desk, sun, body. These were the same pictures used to teach the letter sounds. After naming the pictures, the child was then instructed to segment the initial sounds of the pictures' names. The child was asked what each word meant and unfamiliar words were explained. For most children, the segmentation phase proceeded very quickly. If a child had difficulty segmenting the initial sounds, the examiner repeated the word and had the child focus on her mouth. If the child was still unable to perform the task, he or she was asked to repeat the picture names. This was done to end the session on a positive note after which the child was dropped from the study. The maximum number of correct responses was ten. Two of the children had difficulty with this task and were dropped from the study.

Letter-sound Training.

Ten Hebrew letters were selected for training based on those letters that were identified as resembling pictures whose names began with sounds symbolized by the letters. To create the materials, objects whose name began with the targeted letter-sounds were drawn as shown in Appendix D1. The pictures were named in English rather than Hebrew, so the mnemonic was an English word. This was because the students were non-Hebrew speaking.

Two sets of ten mnemonic cards were used. These cards were designed to

help teach letter-sound recognition. One set (the integrated picture set) consisted of cards each printed with the bare letter and, beneath it, the letter embedded in the mnemonic (see Figure 3). The other side of the card was blank. The other set (disassociated picture set) consisted of cards each printed with the bare letter accompanied by a picture or photograph beneath it on one side and blank on the other side (see Figure 4).

Once it was established that the child was able to segment initial sounds, the letter training session began. The letter-sound training was conducted individually using a study-test procedure. One session was allocated to teaching children each of the two sets of letter-sound relations to a criterion of five perfect trials. If they did not reach criterion after twenty trials, they were dropped from the study. No child was eliminated from the study at this point.

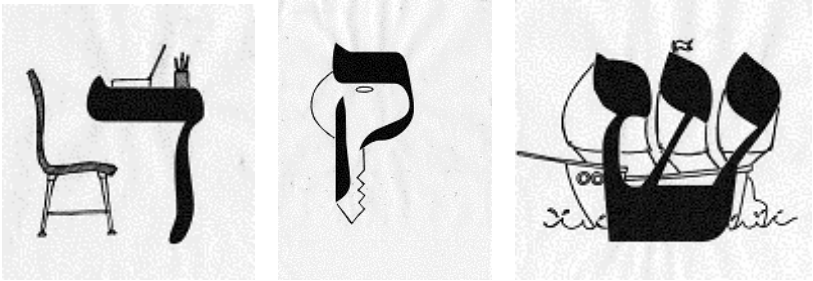
Each child was taught five letter-sound associations with integrated picture mnemonics and five letter-sound associations with disassociated picture mnemonics in the same session. The particular set of letters (Set A or Set B) taught in each mnemonic condition was counterbalanced among children to control for item-specific effects. The letter-sound relations taught in Set A were: /h/, /l/, /s/, /b/, /t/ (see upper half of Figures 3 and 4). The letter-sound relations taught in Set B were: /sh/, /k/, /n/, /d/, /m/ (see lower half of Figures 3 and 4). Also the order in which each type of mnemonic was learned was counterbalanced among children. This ensured that all four sequences were equally divided among the participants.

The first study trial began by telling the child that s/he will learn some letters and the sounds they make. In the integrated picture condition, the child was told,

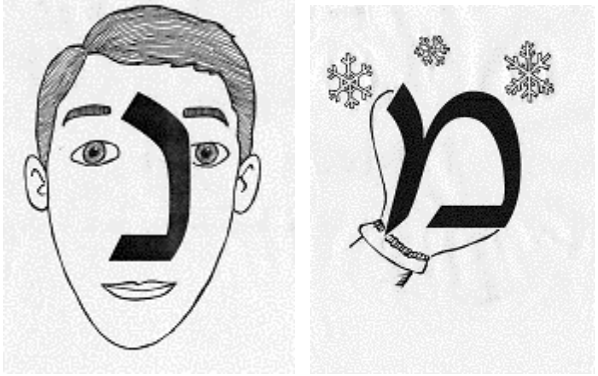
"The pictures and their names will give us clues about the sounds that Hebrew letters make. The pictures will help you remember the sounds of the letters". The child was then shown an integrated picture of a letter and object whose name began with the targeted letter sound and told what it was. The child named the picture. If correct, the instructor repeated the name of the picture. If the child named the picture incorrectly, the instructor corrected the child and said what the picture was. Then the child was instructed to segment the initial sound of the picture. If correct, the instructor repeated the information and if not, the child was corrected and asked to say the correct sound. The child was told to trace the letter using his/her finger and to write the letter on a piece of paper. The purpose of tracing and then drawing the letter was to direct attention to the letter shape and to facilitate recall (see Appendix E for the script, integrated mnemonic training materials, and scoring sheet).

In the disassociated-picture condition, the instructions and procedures were identical except that disassociated letter pictures were used instead of integrated letter pictures. The child was told, "The names of the pictures will give us clues about the sounds the Hebrew letters make. The picture names will help you remember the sounds of the letters," (See Appendix F for the script, disassociated picture training materials, and scoring sheet).

The test trial phase followed the initial study trials within the same session and was conducted in the same manner for both integrated picture and disassociated conditions. Test trials were repeated until children reached criterion. On each trial, a set of bare letter cards (without any pictures) was presented and the child was asked to say the sound of each letter. If the child failed to provide the correct sound, the

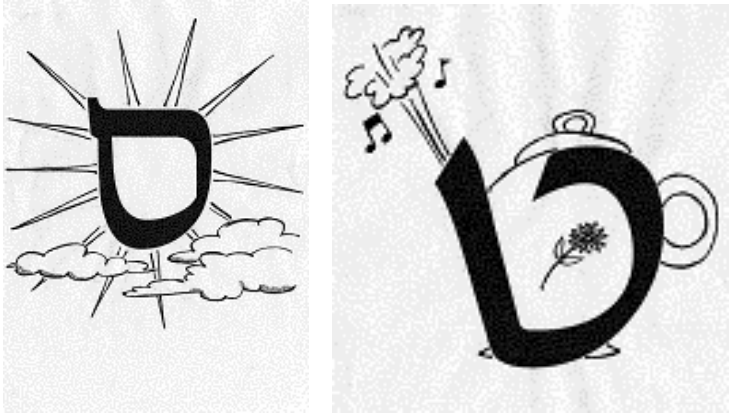


/d/ desk /k/ key /sh/ ship



/n/ nose /m/ mitten

/b/ body /h/ house /l/ lizard



/s/ sun /t/ teapot

Figure 3: Ten Hebrew integrated pictorial mnemonic letters

Figure 4: Ten Hebrew disassociated pictorial mnemonic letters

Note. Photographs from *My First Word Board Book* by Angela Wilkes, New York, NY.: DK Publishing Company. Copyright 1997, Reprinted with Permission.

child was shown the picture and asked to say the correct sound. If the child said the correct sound, the examiner continued with the next card. If the child gave the incorrect sound or said the name of the picture, the examiner asked the child to say the initial sound of the picture's name. The examiner then repeated the correct information, reiterated that the picture began with the specific letter sound, and had the child repeat the correct sound. The child completed the test trial phase when s/he had recalled all five letters perfectly on five successive trials. The order of presentation of letters was randomized across trials to ensure that learning rather than memorization of a particular letter order had occurred.

Posttests to Assess Learning.

The third session took place one week after the conclusion of the training session. If the child was absent, the post-test was given as soon as possible after that and the amount of time elapsed was noted. The posttests assessed memory for the letter-sound correspondences learned. The six subtests were administered individually in one session. The maximum number correct for each set of letters on each test was five (see Appendix G for the script, post-test materials, and scoring sheet).

1. Recall Sounds for Letters. The purpose of this test was to assess memory for the letter-sounds taught. Each child was shown each of the 10 bare target letters printed on cards and asked to say the sound associated with the letter. The letters were presented in a random order. A correct score was noted when the letter sound was recalled correctly. Alternative responses or errors were recorded. The maximum score for each set of letters was 5.

2. Write Letters for Sounds. This test evaluated whether the child remembered the

shapes of the letters learned. The examiner said each target sound, the child repeated the sound and then wrote the Hebrew letter that makes that sound. A correct score was noted when the letter was written correctly or closely resembled the letter. Alternative responses or errors were noted. The maximum score for each set of letters was 5.

3. Recognize Letters for Sounds. This post-test was intended to assess recognition memory for the sound-letter relations that were taught (see Appendix H for letter array sheet). The examiner said the sound of a letter and the child pointed to the correct letter out of an array of ten letters. A correct score was noted when the correct letter was pointed to. Alternative responses or errors were recorded. The maximum score for each set of letters was 5.

4. Recall Picture Aids for Letters. This post-test was used to assess memory for the integrated pictures and the disassociated pictures that were taught as mnemonics. The original letter-sound training cards displaying bare letters were used. Each of the 10 target letters was shown and the child stated the object/word that helped him or her learn that letter sound. A correct score was noted when the correct object/word was stated. Alternative responses or errors were recorded. The maximum score for each set of letters was 5.

5. Match Letter-Sounds to Unseen Pictures. In this task the child matched Hebrew letters to new, unseen pictures whose names began with the sounds of the letters. The purpose of this posttest was to assess children's ability to use taught letters to spell initial sounds in words. The maximum score for each set of letters was 5.

Before beginning this post-test, the examiner modeled the task using English

letters and pictures. The examiner first said the pictures' names and the child repeated them. Then the child was instructed to draw a line from each picture to the letter that made the beginning sound of the picture name. If the child was able to correctly match the letters and pictures, the examiner proceeded to the Hebrew matching task. If the child was unable to match the first picture correctly, the examiner modeled the correct answer and the child matched the next letter. The pictures and English letter sounds were: jelly beans /j/, rabbit /r/, watermelon /w/, fish /f/, and pizza /p/. Note that the English sounds used to model this task were not the same sounds used to teach the Hebrew letters.

The examiner then introduced a new set of pictures not practiced during training. She reviewed the names to make sure the child used the intended name. The children were not taught to segment initial sounds in the names but rather were taught to name the pictures by saying the whole name. These pictures started with the same letter sounds that were taught but were not the same pictures used during letter training. The examiner named each picture and the child repeated the name before drawing a line from the picture to the letter that made the same beginning sound. There were two sheets presented one at a time. Each sheet displayed the five letters taught with one type of mnemonic. Set one contained the following pictures and Hebrew letter sounds: doll /d/, motorcycle /m/, shoe /sh/, nest /n/, and kite /k/. Set two contained the following pictures and Hebrew letter sounds: lion /l/, scissors /s/, hat /h/, television /t/, and button /b/ (see Appendix G for letter-picture matching sheets). A correct score was noted when a letter was correctly matched to the picture beginning with the same initial sound. Alternative responses or errors were recorded.

The maximum score for each set of letters was 5.

6. Match Letters to Disassociated Picture Aids. This post-test assessed whether children recognized connections between the letters and the five disassociated mnemonics they had been taught. Only the disassociated pictures were tested because the integrated pictures included letters embedded in the pictures. The child was given a sheet with all 10 letters displayed. Then each disassociated picture was shown, the experimenter pronounced its label (e.g., ship) and the child pointed to its letter. All 10 disassociated pictures were presented, so 5 of these were familiar because they had served as the disassociated mnemonic for that child and 5 pictures were not familiar. It was expected that children would recognize more of the disassociated pictures they had been taught than those they had not. Note that although they had not seen 5 of the disassociated pictures, for example, the picture of *ship*, they had seen 5 different pictures of the same objects in the integrated condition, for example, a ship drawn to resemble the letter shape. Because of this, if children remembered which letters symbolized the first sound of the labels spoken by the experimenter, then they would have a basis for responding correctly. Scores for seen disassociated pictures were compared to scores for unseen pictures. The maximum score for the disassociated set of letters was 5.

Transfer Tasks.

The transfer tasks were administered three days after the posttest session. The number of elapsed days was noted if it exceeded three days. Before the transfer tasks were conducted, the child reviewed all ten letters. A data sheet kept track of the child's performance. If the child did not remember the sounds of any letters,

feedback was provided using the same cards as when trained. This was to ensure that the mnemonics used in training were reactivated in memory. After the child was able to recall all the letters accurately twice in succession, he or she was given several reading and spelling exercises to explore whether performance differed according to the type of mnemonic used to learn the letters (see Appendix H for reading and spelling transfer task materials, script and record sheet).

1. Spelling Transfer Task. The spelling transfer task was an invented spelling task. The child heard and spelled (using blocks) words comprised of the ten letter sounds taught. Each word included sounds of two of the letters taught. Five of the words were composed of pairs of integrated picture mnemonic letters and five words were composed of disassociated picture letters. The words, printed here in Roman characters, were spelled with blocks printed with the Hebrew letters taught. The words in one set were cone (k-n), dash (d-sh), muck (m-k), shed (sh-d), and name (n-m). The words in the other set were hole (h-l), sub (s-b), tale (t-l), less (l-s), and bit (b-t). Each letter was used in each position and the vowels differed across each set of five words. (Note that Hebrew vowel sounds were not taught in this study.)

The examiner first modeled the task using English letters to ensure that the directions were understood. The child was familiar with the English letters used. The sounds modeled were not those that were taught in Hebrew. The child was then given English letter blocks and shown how to use the letters to spell a word in English. These words were fur, pear, jar and rip. After the child was able to replicate the model words using the English letter blocks, the test trials were conducted using Hebrew letter blocks. A correct score was noted when a word was spelled correctly.

Alternative responses or errors were recorded. The maximum score for each set of letters was 5.

This task examined whether students were able to use the Hebrew letter-sound relations they had learned to spell words. The prediction was that words containing integrated letter-sounds would be spelled more accurately than words containing disassociated letter-sounds. The combined Cronbach's alpha reliability was 0.88.

2. Word Learning Task. The next transfer task was a word learning task. Ten cards displayed words spelled with the letter sounds taught. Simplified spellings for each word consisted of two letters. Five of the words contained integrated picture mnemonic letters, and five spellings were composed of disassociated picture letters. The words, written here in Roman characters, were presented to the child in Hebrew letters. One word set included shade (sh-d), comb (k-m), neck (n-k), dish (d-sh), and moon (m-n). The other set was heel (h-l), light (l-t), suit (s-t), boss (b-s), and tub (t-b). Each letter was used in each position and the English vowel sounds were varied across each set of five words but the vowels were not spelled (i.e., no Hebrew vowels were taught). The children were given eight trials to learn to read the words with feedback. During the first study trial, children were told how to read the words. All subsequent trials were test trials with corrective feedback. The words were ordered randomly to ensure that the child did not succeed by memorizing the words. On the scoring sheet, the experimenter noted which words were read correctly. The subtest was scored by noting the first trial in which all words in each set were read correctly.

This task examined whether the students were able to use the letter-sound relations they had learned to remember how to read the words with practice. The

prediction was that words built out of the integrated picture letters would be learned more easily and remembered better than words built out of the disassociated picture letters.

3. Memory for Simplified Spellings. In this task children used Hebrew letter blocks to spell the words that they had just learned to read in the word learning transfer task. The examiner modeled the task first, choosing two English letter blocks to spell a word that they had modeled earlier in the word learning transfer task. The child was then instructed to write the word the instructor said using Hebrew letter blocks. A correct score was noted when the word was spelled correctly. Alternative responses or errors were recorded. The maximum score for each set of letters was 5.

This task examined whether children were able to use trained letter-sound relations to recall the spellings of words they had just learned to read. The prediction was that the words containing letters learned using integrated pictures would be spelled more easily than words containing letters learned with the disassociated pictures. The combined Cronbach's alpha reliability was 0.89.

4. Word Recognition Task. A simple reading task (Byrne, 1998) was administered. To explain the task, the child was first shown two written English rhyming words that did not include sounds taught during Hebrew letter training sessions; jug and rug (j-g and r-g). The child was told to point to the word that the examiner spoke. If the child performed the task correctly, the examiner continued, using Hebrew letters. If the child did not do the task correctly, the examiner modeled the task again using English letters. The first word set included the following pairs of words (using Hebrew letters to spell initial and final consonants): mine/shine, duke/nuke, nod/cod and cash/mash.

The second word set included the following pairs of words: hat/bat, soul/bowl, tab/lab and ball/tall. The words were presented on cards using Hebrew letters. A correct score was noted when the correct word was pointed to. Alternative responses or errors were recorded. The maximum score for each set of words was 4.

This task explored whether children could use the letter-sound relations they had learned to recognize letter sounds in words without having to actively produce the sounds. This rhyming word exercise required the child to discriminate and match initial letters to sounds in words. The prediction was that there would be fewer errors with words containing integrated picture letters than with words containing disassociated picture letters. The combined Cronbach's alpha reliability was 0.75.

5. Simple Reading Task. In the final task (Bryne, 1998), the child was given a card with one word written on it. The examiner said two words and the child was instructed to say which word matched the card. The task was first practiced with two English words, wig and zig. Note that the letter-sounds in these words were not those taught in Hebrew. The targeted words were the same used for the other word recognition task. A correct score was noted when the student was able to say which word the instructor stated matched the word on the card. Alternative responses or errors were recorded. The maximum score for each set of words was 4.

This task examined how children used the letter sounds relations to recognize a word without having to generate its pronunciation from its spelling. In contrast to the earlier Bryne rhyming task (1998), in this exercise the child had to listen for the initial sounds of the two words to detect which matched the initial letter in the written word. The prediction was that there would be fewer errors with words containing

integrated letters than words containing disassociated letters. The combined Cronbach's alpha reliability was 0.78.

Design and Statistical Analyses.

The present study was conducted with 36 students placed randomly into four equal groups to ensure that the outcomes were independent of both the particular set of pictures learned with mnemonics and the order in which they were learned. Group 1 learned Set A integrated picture mnemonics first and Set B disassociated pictures second. Group 2 learned Set B integrated picture mnemonics first and Set A disassociated pictures second. Group 3 learned Set A disassociated pictures first and Set B integrated picture mnemonics second. Group 4 learned Set B disassociated pictures first and Set A integrated picture mnemonics second. Prescribed scripts were used to ensure that the instructions were comparable if not identical for both training conditions.

All of the training and testing was conducted individually. The study employed a pretest-training-posttest repeated measures design, with each child serving as his or her own control. Each session lasted between 45 and 60 minutes. A record sheet was used to record scores during each stage of the study. The twelve students in the 2002 class did not participate in the transfer session. To rule out letter set and order effects, a two-way independent groups ANOVA was conducted using each subject's difference score as the dependent variable. The two independent variables were letter set (Set A letters learned with integrated mnemonics and Set B with disassociated mnemonics versus the reverse) and order (the order in which the mnemonics were learned: integrated first and disassociated second versus the

reverse).

Performance on training, posttest and transfer results was subjected to matched pair t-tests to examine whether integrated pictorial mnemonics facilitated learning Hebrew letter-sound relations more effectively than disassociated pictures. The independent variable was the type of mnemonic (integrated or disassociated), a repeated measure. The dependent variable for the training phase was the number of trials needed to learn the letters. Note that for the training phase, the lower the score, the better the student performed. The dependent variables for training and the posttest phases involved correct performance on the various tasks. A two-way ANOVA was conducted to compare the course of learning for the two mnemonics. The independent variables were type of mnemonic and trials (1-5), with the dependent variable being number of trials needed to learn the letters.

Chapter 7

Results

The purpose of the study was to explore the contribution of mnemonics to the learning of Hebrew letters and their sounds. It was hypothesized that letters taught using integrated mnemonics would require fewer trials to learn, would be recalled more effectively, and would transfer to reading and spelling tasks more easily than letters taught with disassociated mnemonics.

Characteristics of Participants.

Two waves of students were tested at two separate times, one group in 2002 (*N*=12) and another group in 2004 (*N*=24). Characteristics of the participants and mean performance on pretests are shown in Table 1. To address the possibility that the groups tested in 2002 and in 2004 were different, *t*-tests were applied to compare the two groups. As no significant differences were found on any of the pretests (all *p*s <.05), the two groups were combined.

The range of ages spanned 13 months, from 4 years, 7 months to 5 years, 8 months, with a mean age of 5 years, 2 months. The English uppercase letter scores ranged from 15 to 26 with a maximum score of 26, while English lowercase letter scores ranged from 19 to 26 with a maximum score of 26. The Hebrew letter scores ranged from 0 to 6 with a maximum score of 23. Scores on the ten target letters ranged from 0 to 2, with 29 of the students knowing none of the target letters, 5 students knowing 1 letter and 2 students knowing 2 letters. Students' ability to recognize primer words ranged from 0 to 12 out of a maximum of 14 words. From mean scores, it is apparent that students on average could name most upper and lower

Table 1

Student Characteristics, Mean Pretest Performance and Standard Deviations

Characteristics Sample	2002 Sample	2004 Sample	Total
Measures	M (SD)	M (SD)	M (SD)
Gender	9 girls, 3 boys	12 girls, 12 boys	21 girls, 15 boys
Age (in months)	63.92 (2.57)	62.19 (3.52)	62.75 (3.34)
English uppercase (26 max)	21.67 (2.87)	25.63 (0.81)	23.25 (2.59)
English lowercase (26 max)	24.83 (2.03)	22.46 (1.35)	23.25 (1.96)
Hebrew letters (23 max)	0.58 (0.95)	0.75 (1.39)	0.69 (1.27)
Target letters (10 max)	0.16 (0.37)	0.29 (0.61)	0.25 (0.55)
Primer words (14 max)	1.08 (0.86)	2.29 (3.12)	1.89 (2.65)
Vocabulary (Standard score)	110.66 (9.51)	113.70 (8.65)	112.75 (9.07)

Note. There was a total of 36 students tested.

case letters in English but they knew few if any Hebrew letters that were taught. It was interesting that while most of the children knew very few if any Hebrew letters, several commented that the pretest letters looked like letters they had seen on a dreidel, a spinning top played with on Chanukah. In fact, three of the ten letters taught in the experiment appear on the dreidel. Yet, even though they recognized a similarity between the Hebrew test letters test and the dreidel, they had no greater success identifying those letters.

Most students read hardly any words, indicating that they were novice or non-readers (i.e., 81% of the children were only able to read two words or less). The mean vocabulary standard score on the PPVT-III test was above average based on test norms, with a mean standard score of 112 and a range of 97 to 134. Although the scores were varied, the students served as their own controls, so variance between the students did not impact comparison of the two types of mnemonics used in this study.

Learning Letter-Sounds During Training

As a preliminary analysis, performance during training was subjected to a two way analysis of variance to assess the effects of letter set (Set A vs. B) and order (i.e., which type of mnemonic was learned first vs. second). These two variables were included for control purposes. The score was the number of trials needed prior to achieving a criterion of five perfect successive trials learning letter-sounds for each type of mnemonic. The dependent variable was the *difference* between the integrated and disassociated scores for individual students. The mean difference was compared as a function of the two independent variables (letter set and order) in an independent groups design. Test statistics are reported in Tables 2 and 3. There were

Table 2

Descriptive Statistics of Letter Set (S) and Order (O) as Independent Variables and Difference Scores as the Dependent Variable

			Order (O)
		N	*M (SD)*
Set (S)			
A	Disassociated First	9	- 5.1 (5.44)
	Integrated First	9	- 3.1 (2.71)
B	Disassociated First	9	- 4.1 (4.30)
	Integrated First	9	- 5.2 (4.21)

Note. Letter Set A and B each had five letters with integrated picture mnemonics and five letters with disassociated picture mnemonics.

no main effects or interactions involving letter set or order. Because no significant effects were detected, these variables were dropped from further analyses.

Students were trained on two different types of mnemonics to learn ten Hebrew letters, five letters of each type. The test of the intercept in the ANOVA reported in Table 3 was highly significant (F (1, 32) = 44.59, $p < .01$), indicating that the difference in performance between integrated and disassociated mnemonics was statistically significantly. All students reached a criterion of five perfect successive trials in learning both types of mnemonics. The number of trials ranged from 1 to 7 in learning integrated mnemonics and ranged from 2 to 19 in learning disassociated mnemonics. Students needed many fewer trials to achieve a criterion of five perfect successive trials using integrated picture mnemonics (M = 3.89, SD = 1.60) than using disassociated picture mnemonics (M = 8.19, SD = 4.15). Results (t (35) = -6.78, $p<.01$) confirm the superior effectiveness of integrated pictorial mnemonics when teaching Hebrew letter-sound relations.

An analysis of performance across the first five test trials during training was conducted to examine the course of learning with integrated mnemonics and disassociated mnemonics. A repeated-measures within subjects ANOVA was conducted with type of mnemonic and trials as the independent variables. The number of correct sounds given in response to letters was the dependent measure. Mean performance is presented in Table 4 and depicted in Figure 5. A significant main effect of mnemonic type was detected, F (1, 35) = 54.53, $p < .01$, as well a main effect of trials, F (4, 140) = 135.76, $p < .01$, and a significant interaction between the mnemonic and trials, F (4, 140) = 3.34, $p < .05$. From Figure 5, it is apparent that

Table 3

Test Statistics in Two-way ANOVA of Difference Scores In Letter Learning Task with Letter Set (S) and Order (O) as Independent Variables

Source	*df*	*MS*	*F*
Between subjects			
Intercept	1	667.36	44.59*
Set (S)	1	1.36	0.91 *ns*
Order (O)	1	.694	0.46 *ns*
S x O	1	26.6	1.78 *ns*
Error	32	14.97	

* $p < .01$

ns not significant at $p < .05$

Table 4

Mean Number of Letters Learned and Standard Deviations in Parentheses During the First Five Trials

	Trial 1 *M (SD)*	Trial 2 *M (SD)*	Trial 3 *M (SD)*	Trial 4 *M (SD)*	Trial 5 *M (SD)*
Integrated	1.52 (1.1)	3.19 (1.3)	3.81 (1.2)	4.53 (0.8)	4.81 (0.4)
Disassociated	1.11 (0.9)	1.97 (1.4)	2.64 (1.2)	3.32 (1.4)	3.33 (1.7)
Difference	.41	1.22	1.17	1.21	1.98

Note. The standard deviation is in parentheses, the maximum number of letters is 5.

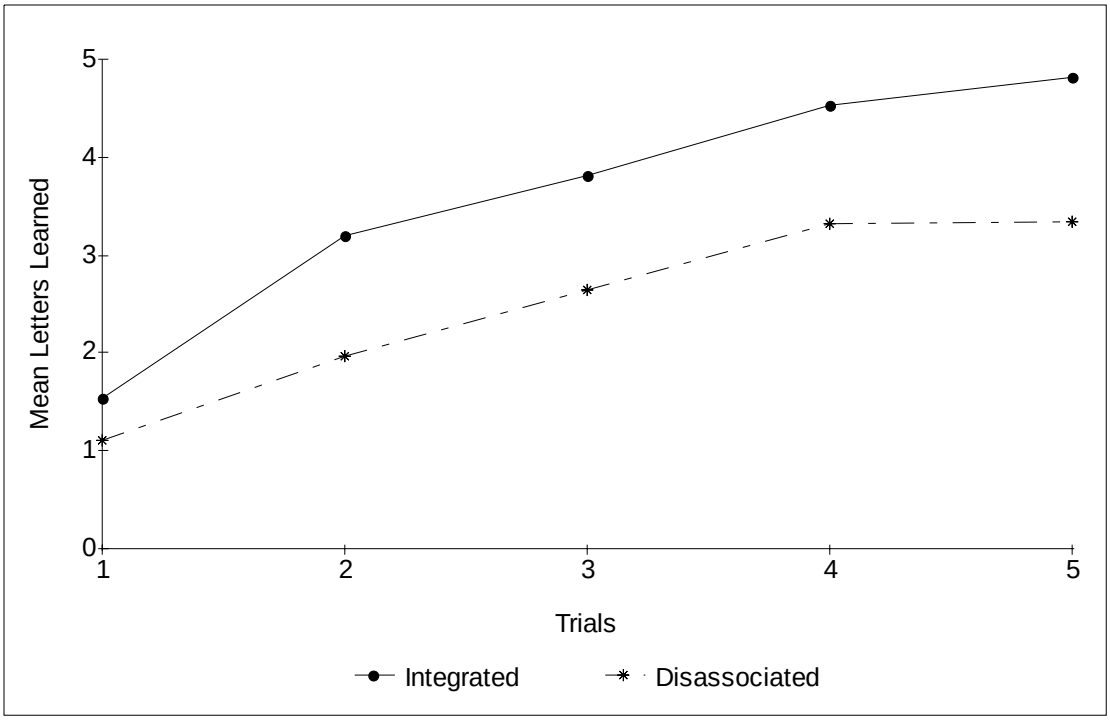


Figure 5. Mean performance learning letters over the first five trials by mnemonic type.

recall of letter-sounds improved on successive trials and that the performance using integrated mnemonics was superior to performance with disassociated mnemonics across all trials. In addition, the difference favoring integrated over disassociated mnemonics was especially small at the beginning (Trial 1), remained similar across the next three trials, and then became larger by the final trial. This occurred because students were reaching criterion sooner, after a mean of 3.9 trials, in the integrated mnemonics condition.

To determine whether the advantage of integrated over disassociated mnemonics held across all the letters that were taught, the number of trials needed by children to learn each letter to criterion was counted, and means for each letter were calculated. Results are shown in Table 5. Comparison of values reveals that superior learning with integrated mnemonics held for 9 out of 10 letters. The letter *Shin* /sh/ showed no difference between the two methods. In no cases were disassociated mnemonics more effective in teaching letters than integrated mnemonics. The *Lamed*, /l/ letter sound, that used *lizard* as the mnemonic stood out as the easiest to learn in the integrated condition. The letter representing the /sh/ sound taught with *ship* as the mnemonic was the easiest to learn in the disassociated condition.

To summarize, findings show that there was a significant effect due to the type of mnemonic. Children learned letter sounds faster when they were taught with integrated mnemonics than with disassociated pictorial mnemonics. The benefit was evident at the very beginning of learning and it grew increasingly large as learning proceeded. In a letter-by-letter comparison, all but one letter was learned better with integrated mnemonics, and no letters were learned better with disassociated

Table 5

Mean Number of Trials Needed to Learn Each Letter-Sound Association When Taught with Integrated Picture Mnemonics (IP) and Disassociated Picture Mnemonics (DP)

Letter-sound	Picture Name	Mean Trials Needed		Difference
		IP	DP	
/b/	body	2.22	4.06	- 1.84
/d/	desk	2.61	3.83	- 1.22
/h/	house	2.78	3.67	- 0.89
/t/	teapot	2.44	5.67	- 3.23
/l/	lizard	1.83	3.67	- 1.84
/m/	mitten	2.39	3.44	- 1.05
/n/	nose	2.39	4.50	- 2.11
/s/	sun	2.72	4.72	- 2.00
/k/	key	2.56	5.22	- 2.66
/sh/	ship	2.22	2.22	0

Note. The measure was the mean number of trials that children needed to learn the letter. The lower the number, the fewer trials needed.

mnemonics.

Analyses of Errors During Training

Analyses of the errors made during the training phase revealed that most errors involved a failure to respond or a failed attempt to produce the correct sound for the displayed letter. However, even after the children responded with the correct letter-sound, retaining this information was a challenge. The letter-sound results were analyzed letter by letter to see how often the children failed to recall a letter-sound after they had recalled it correctly on a previous trial. Sixty-four percent of children learning with disassociated mnemonics forgot the letter sound subsequently at least once and needed to be shown the disassociated picture and letter. In comparison, only 31% of children who learned using the integrated pictorial method forgot and needed to be retrained. Further inspection of errors made during the training phase revealed that certain letters were more difficult to remember than others. The letter *Tet* /t/ was confused with *Lamed /l/* and *Samech* /s/, more often when taught with disassociated pictorial mnemonics (31%) than with integrated pictorial mnemonics (8%). The reason for greater difficulty is unclear. Perhaps greater shape similarity was the cause (see letters in bottom half of Figure 4).

Posttests to Assess Letter-Sound Learning

One week following training, children's ability to recall letters was measured using six posttests. Statistical analyses were done only on the first five posttests since the sixth posttest tested letters taught with disassociated pictures and not integrated. Matched–pair *t*-tests were conducted to compare effects of the two types of mnemonics in each task. Means and test statistics are reported in Table 6. All

Table 6

Mean Performance on Posttests for Integrated (IP) and Disassociated (DP) Methods of Learning Letter-Sound Associations

Posttest	IP (N = 36) *M (SD)*	DP (N = 36) *M (SD)*	*t* (35)	Effect size[a]
1. Recall sounds for letters	3.0 (1.4)	2.0 (1.4)	3.32**	.71
2. Write letters for sounds	1.8 (1.3)	1.3 (1.1)	2.33*	.42
3. Recognize letter for sounds	2.9 (1.7)	2.2 (1.4)	2.15*	.45
4. Recall names of picture aids	3.6 (1.3)	1.6 (1.1)	8.91**	1.67
5. Match letters to initial sounds of words naming new pictures	3.9 (1.5)	2.3 (1.2)	5.69**	1.19

Note. Standard deviations are in parentheses. Maximum score = 5.

*$p < .05$ **$p < .01$

[a] Effect size was calculated by subtracting the mean of the disassociated mnemonic score from the mean of the integrated mnemonic score and dividing the difference by the pooled *SD.*

comparisons were statistically significant favoring the integrated mnemonics condition. Children were able to recall letter sounds better when they were taught with integrated mnemonics than with disassociated mnemonics. They were also able to write the letters more effectively when they had learned the letters using integrated mnemonics. They could recognize the integrated letters better than the disassociated letters when presented with an array of letters and told the letter sound. The test assessing memory for picture aids verified that children remembered the integrated mnemonic picture better, thus making them more available for use. The fifth recall test required children to match letters to initial sounds in the names of pictures that they had not previously seen. The significant result revealed that children were able to use letters learned with integrated mnemonics more effectively than disassociated letters to recognize initial sounds in new words.

Comparison of mean performance across posttests shown in Figure 6 reveals that some memory tasks were more difficult regardless of the method used to teach the letters. The writing task appeared to be difficult for all letter sounds regardless of teaching method. The difference favoring integrated over disassociated mnemonics was greatest when children were asked to recall picture aids. They remembered the integrated pictures much more easily than the disassociated pictures relative to the differential ease evident in the other recall tests. Writing performance scores were lower than all other recall posttests with differences between integrated and disassociated not very great. This may be because while letter tracing was practiced during training, letter writing was not. Also, children of this age group are just developing their fine motor skills and are not skilled at writing letters even in their

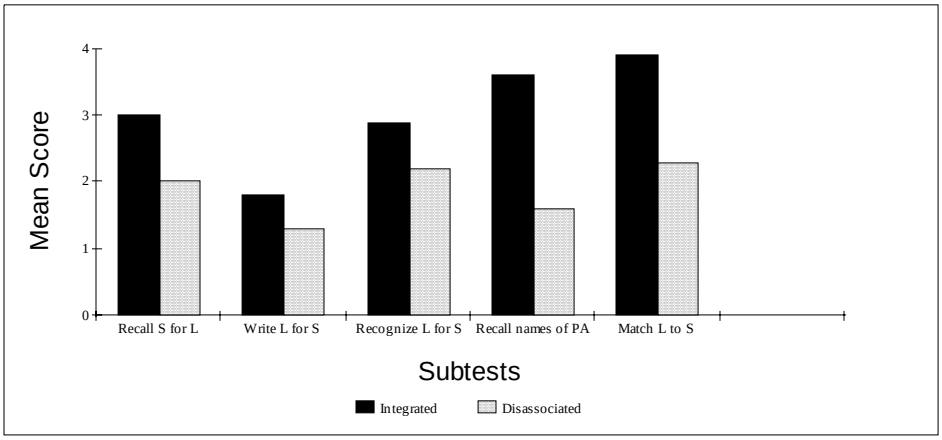


Figure 6. Comparison of performance on posttests for integrated and disassociated methods of learning.

Note. The following abbreviations represent the following words:

S = sounds

L = letters

PA = picture aids

native language. Fourteen percent of students received a zero score in the integrated condition while 28% received a zero score in the disassociated condition.

In a letter-by-letter comparison, the individual letters were tabulated for the first recall posttest, (recall of letter-sound associations when shown the bare letter cards) to determine how many times each letter was recalled correctly for both the integrated and disassociated conditions. This was done to determine the percentage of children recalling each sound correctly. Most of the letters (80%) were recalled more easily when learned using the integrated picture method as compared to disassociated picture method as shown in Table 7. One letter sound /h/ was recalled more easily using the disassociated picture method and one letter sound /sh/ showed no difference between the two methods. The letter sound /l/ was remembered most easily with integrated mnemonics.

In summary, memory for letter sounds using the integrated picture method was superior to memory for letter sounds using the disassociated picture method on all the posttests. Eight out of ten letters were recalled more effectively when taught using the integrated picture method. Thus, effects were evident across letters as well as across children in these tasks after a week's delay following training.

Analyses of Recall Errors

On the posttests, most errors involved a failure to respond or a failed attempt to say the correct letter sound for the displayed letter. There was a lack of recall consistency from posttest to posttest. Children would remember a letter on one posttest but not on another. This inconsistency is not surprising as the tests extracted

Table 7

Percentage of Students Recalling Each Letter Learned with the Integrated Picture Mnemonic (IP) and the Disassociated Picture Mnemonic (DP) in the Letter-Sound Recall Posttest

Letter-sound	Recall Percentage		
	IP	DP	Difference
/b/	61%	39 %	+ .22
/d/	61%	56 %	+ .05
/h/	44 %	50 %	- .06
/t/	72 %	22 %	+ .55
/l/	83 %	29 %	+ .54
/m/	56 %	39 %	+ .17
/n/	67 %	33 %	+ .34
/s/	50 %	33 %	+ .17
/k/	39 %	28 %	+ .11
/sh/	61 %	61 %	.00
Mean %	53%	33%	+.20

somewhat different types of information. Additionally, three errors involved creating new mnemonics. That is, on letters taught using integrated pictures, when the students couldn't remember the mnemonic, they invented new ones. For example, *Bet* became "boy" instead of "body". The letter *Hey* became "H" instead of "house". Another student offered the mnemonic "bear" for *Bet* instead of "body".

Posttests to Assess Transfer to Reading and Spelling Tasks

Posttests were also given to assess whether children were able to apply in letter knowledge in reading and spelling tasks. These tests were given three days after the posttest session. The prediction was that the letters learned using integrated pictures would transfer more easily than the letters learned with the disassociated pictures.

However, before these transfer tasks were administered, a pre-transfer task was given in which the letters were reviewed to establish that the students could produce all ten letter sounds. Each student was shown the ten bare letter cards and asked to recall the letter sounds. If the child did not remember the sounds of any letters, feedback was provided using the same training cards. After the child was able to recall all the letters accurately twice, the transfer tasks commenced.

Comparison of mean performance recalling letter-sounds in the pre-transfer task revealed findings consistent with performance on the earlier posttest given after training. The integrated method (M = 3.83, SD = 1.01) was favored over the disassociated method (M = 2.63, SD = 1.24), (t (23) = 3.55, $p < .01$). Mean performance is shown in Figure 7. More interesting and surprising to see was that students recalled letter-sounds of both types *better* on this delayed pre-transfer task

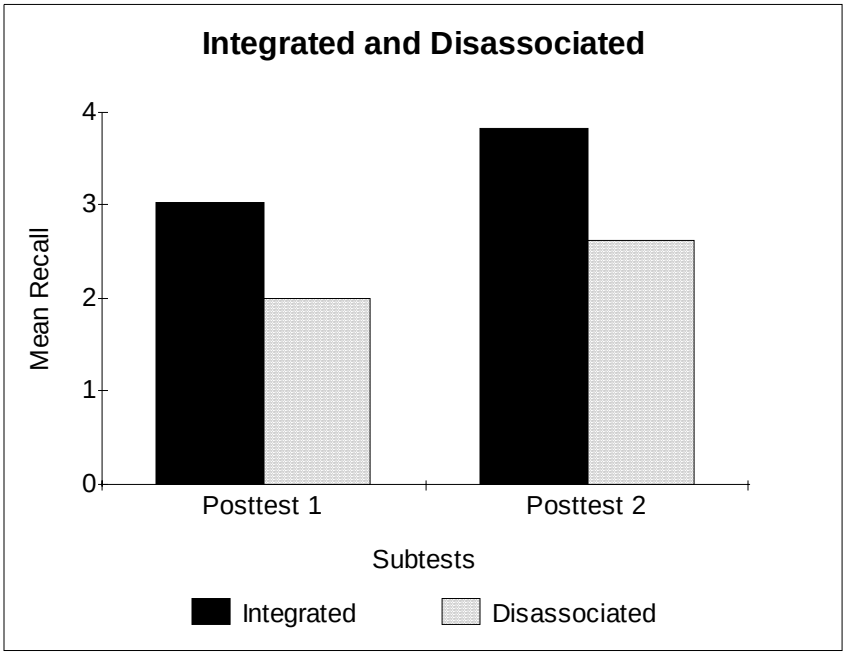


Figure 7. Comparison of mean recall of letter sounds on Posttest 1 and Posttest 2.

than on the earlier posttest (integrated recall: $M = 3.0$, $SD = 1.4$; disassociated recall: $M = 2.0$, $SD = 1.4$, $t\ (35) = 3.32$, $p < .01$) (see Figure 7). Scores on Posttest 2 reflect scores prior to any feedback or review. Although the letters had not been taught between these two test points, they may have been indirectly practiced as students responded to the five posttests. This may have constituted a review sufficient to boost scores on the delayed pre-transfer task. To test effects statistically, each child's scores were summed to combine both types of mnemonics. Scores on Posttest 1 were compared to scores on Posttest 2 for the twenty four students that participated in both phases of the study. A pairwise *t*-test was conducted and results confirm that letter-sound recall did significantly increase ($t\ (23) = 3.13$, $p < .01$).

In a letter-by-letter analysis, all letters but one were recalled more effectively when learned using integrated pictures as compared to disassociated pictures. These findings are shown in Table 8. The letter /h/ was the only letter recalled more easily when learned with the disassociated method. This same letter proved exceptional on the earlier posttest (see Table 7). Comparison of percentages in Tables 7 and 8 show that on average recall benefited from integrated mnemonics to the same extent at Posttest 1 and Posttest 2.

Twenty four children completed the transfer tasks assessing children's ability to apply their letter sound knowledge in the reading and spelling tasks. Means and test statistics comparing performance with letters learned in the integrated and disassociated mnemonics conditions are reported in Table 9.

The first transfer task evaluated whether the children were able to spell previously unseen words using Hebrew letter blocks. The results showed that

Table 8

Percentage of Students Recalling Each Letter-Sound that was Learned with the Integrated Picture Mnemonic (IP) and the Disassociated Picture Mnemonic (DP) on Posttest 2 (the Pre-Transfer Recall Task)

Letter-sound	Recall Percentage		
	IP	DP	Difference
/b/	92 %	58 %	+34 %
/d/	83 %	67 %	+ 16 %
/h/	50 %	58 %	- 8 %
/t/	67 %	58 %	+ 9 %
/l/	83 %	58 %	+ 25 %
/m/	83 %	42 %	+ 41 %
/n/	58 %	42 %	+ 16 %
/s/	58 %	50 %	+ 8 %
/k/	67 %	25 %	+ 42 %
/sh/	83 %	75 %	+ 8 %
Mean %	72%	53%	+ 19 %

children used the integrated letters more effectively than the disassociated letters to spell words (see Table 9).

The second transfer test explored word learning. Children practiced reading ten words, half of which were comprised of integrated picture letters and the other half, disassociated picture letters. The dependent measure was the number of trials required for each word set to be recalled perfectly up to a maximum of 8 trials. Here too, the significant result demonstrated that children were able to use letters learned with the integrated method more effectively than letters learned with the disassociated method to remember how to read words.

The third transfer test examined whether children were able to use blocks to spell the words they had just learned to read. As shown in Table 9, the results confirmed that the words spelled with integrated letters were recalled more easily in a spelling task than words spelled with disassociated pictures.

The final two transfer tasks were based on simple reading tests designed by Bryne (1998). One test required the child to point to one word the examiner said from an array of two words. In the other test, the child was given a card with one word. The examiner said two words and the child was instructed to say which word matched that on the card. Performance on these tests did not differ statistically for the two types of mnemonics although the effect size was moderate favoring the integrated condition in one case. From Table 9, it is apparent that scores were close to ceiling in both cases, thus possibly obscuring differences.

In summary, children performed significantly better on transfer spelling and

Table 9

Mean Performance on the Transfer Posttests as a Function of the Type of Mnemonics Used to Teach Letter-Sound Associations, either Integrated Mnemonics (IP) or Disassociated Mnemonics (DP)

Test	IP *M (SD)*	DP *M (SD)*	*t* (23)	Effect size [a]
Spelling with blocks (5 max)	3.6 (1.5)	3.0 (1.9)	3.50**	.35
Word learning [b] (8 max)	3.7 (1.9)	4.8 (1.3)	-2.39*	- .69
Memory for simplified spellings (5 max)	3.8 (1.7)	3.3 (1.9)	2.12*	.28
Word recognition A[c] (4 max)	3.8 (0.7)	3.3 (1.1)	2.01*ns*	.56
Word recognition B[d] (4 max)	3.4 (1.0)	3.5 (0.8)	-0.70*ns*	-.11

Note. Standard deviations are in parentheses. *$p < .05$, **$p < .01$, *ns* not statistically significant at $p < .05$

[a] Effect size *d* was calculated by subtracting the mean of the disassociated mnemonic score from the mean of the integrated mnemonic score and dividing the difference by the pooled *SD.*

[b]Measure is the number of trials needed to learn to read the words once perfectly, so a lower score indicates better performance.

[c] In Word recognition A, the child pointed to the word spoken by the examiner from an array of two words.

[d] In Word recognition B, the examiner spoke two words and the child repeated the word that matched the word on the card.

reading tasks with words made of integrated picture taught letters than words made of disassociated picture taught letters. On simple reading tests (Bryne, 1998), results did not differ significantly between the two types of letters possibly due to ceiling effects.

Transfer Error Analyses

Errors on the transfer tasks were analyzed. Most errors involved a failure to respond or a failed attempt to properly read or spell the letter patterns. Nine of the children (38%) were observed to use reading skills to help them figure out the letter patterns. They sounded out the letter combinations or used initial letter sounds in an attempt to read words. This was true for letters learned using both methods.

Chapter 8

Discussion

The results revealed the effectiveness of using English-based integrated pictorial mnemonics when teaching Hebrew letter-sound relations as a second language alphabet to children who speak English and have yet to learn Hebrew. The superiority of this method was most clearly demonstrated in the training and recall segments of the experiment. The results support the hypothesis that letters learned using integrated mnemonics help learners remember letters by providing non-arbitrary visual links to letter sounds. In addition, superior performance on the transfer tasks revealed that students who were taught letter-sounds using integrated mnemonics were better able to transfer their knowledge to rudimentary reading and spelling tasks.

Theoretical Background and Its Implications on Integrated Mnemonics

As posited by Ehri (1999), reading and spelling progress along a course involving successive phases of development. Each phase is characterized by the predominant connection that bonds written words to their pronunciations and meanings in memory. Earlier phases of reading development focus on building the connections between the letter shape and name or sound. In order for reading development to progress, it is necessary for grapheme-phoneme connections to be learned (Ehri, 1998). Children need to know letters well enough so that connections can be formed to link the spellings of words to their pronunciations and meanings in memory.

Phase theory portrays the predominant processes used by students to read and spell words during each phase. The present research demonstrated that integrated mnemonics work in tandem with the particular phase of reading development, promoting letter-sound development. In the pre-alphabetic phase, children adopt a visual approach by default because they appear to lack the knowledge or ability to use letter names or sounds to form alphabetic connections. If, however, there was a stronger relationship between the print and sound, they might rely less on the visual distinctiveness of the letter and focus more on the letter sound. Integrated mnemonics allows the pre-reader to use the picture not as an exclusively visual cue, but rather as a means of accessing the phonetic cue. It serves to bridge the visual to the phonetic. In addition to the letter shape, pictures give a sense of stability and permanence to the sounds which are fleeting. They also help to increase interest and attention to the letters by assigning meaning to the arbitrary letters. The mnemonic needs to be salient and to be drawn so that the child focuses on the unique parts of the particular letter.

By creating this letter-sound link, integrated mnemonics can help move children from the pre-alphabetic to the partial alphabetic phase of development. At the partial phase, children begin to attend to the letter sounds themselves and start to connect letters to their sounds in reading and writing words. Integrated mnemonics strengthen the link between the letter and sound and thus reinforce this sometimes tenuous connection.

In the last two phases of reading development, integrated mnemonics play less of a role because the letter-sound connections have been well learned and

incorporated into word reading and spelling. Once the letter-sound relationships are fully in place, readers are able to decode new words and recognize letter patterns. In the full alphabetic phase, children are making complete letter sound connections to read and write words. Being able to learn letter-sounds quickly and retain them efficiently is important when making accurate letter-sound connections.

Evidence suggests that the children who participated in this study were in the partial alphabetic phase during the transfer phase as they were able to use alphabetic cues to learn to read words and spell words when taught with either type of mnemonic. They associated each letter with a distinct sound, but not with complete accuracy. They were able to demonstrate phonemic awareness in the transfer phase, manipulating letters and sounds to spell and read words. They used blocks and pointed to letters on cards in segmentation and invariance tasks (Bryne, 1998). They could complete these tasks with some level of accuracy although there were errors of letter omission or not assigning all letters to sounds. Importantly, they were able to do these tasks just by learning an unfamiliar set of letter-sound relations without any direct instruction in word reading and spelling. Letters learned with integrated mnemonics were more effectively used to read and spell words than letters learned with disassociated mnemonics. Therefore, integrated mnemonics improved children's ability to process words at the partial alphabetic phase.

Children were not functioning at the full alphabetic phase in using the letters to read and spell words. They spelled few words perfectly. Their spellings were partially correct rather than completely correct (see Table 9). They took a mean of

3.7 trials to learn to read the words, indicating that they were reading the words from memory rather than decoding them.

According to Juel, Griffith, and Gough (1986) the skill that underlies reading and spelling development is phonemic awareness. Phonemic awareness allows readers to benefit from print to get spelling sound knowledge. The use of integrated mnemonics helps the child attend to initial letter sounds in the presented pictures and then creates a meaningful link to the sound. This emphasis on phonemes facilitates the development of reading and spelling skills.

Cataldo and Ellis posit that once the child understands that there is a connection between the printed word and the spoken word, the next step is to use the letters as clues or cues to figure out the sound of the word. When presented with an integrated mnemonic, according to Cataldo and Ellis' theory, the child would see the letter, realize that the letter can "say its sound" and because of the link established between picture and sound, figure out what the sound is.

Being able to easily access letter sounds when shown letters reinforces the importance of Paivio's dual coding theory (1990). The theory suggests that visual and verbal information are processed differently creating separate representations for the different types of information. The extensively the information is processed, the more easily it can be accessed. Because of this, the nonverbal code (picture) is mnemonically stronger (contributes more to the additive recall effect) than just the verbal code (letter sound). Concrete images that are provided to the learner facilitate the learning process. Images allow the child to grasp the presented material more easily and then recall the information more effectively because the information has

been coded in two distinct ways. The integrated mnemonics contributes by allowing children to establish a tighter link between the verbal letter sound and the concrete image.

Ehri and Wilce (1987) describe the reading-spelling relationship as causal, that they are reciprocally related. Learning letter names helps children discriminate and remember the shapes of letters and helps them attach correct sounds to letters. Letter names give children referents with which to associate phonemes. The problem however, is that these referents are arbitrary; there is no apparent link between letters and sounds. The present research on integrated mnemonics suggests that when letters are given special meaning and when the meaning links letter shapes to sounds, the learning proceeds more easily. Both reading and spelling are affected as seen in the transfer phase of this experiment. Not only were the integrated letters learned more quickly and remembered more effectively but they were used more efficiently in reading and spelling tasks as well.

Share and Gur (2004) found that children who were able to isolate initial sounds in letter names were able to learn letter sounds more easily. Not only is letter naming a precursor to later skill development but letter knowledge can actually affect letter sound development and has the most impact when children are able to isolate phonemes. In their study, children who were taught to label English letters with arbitrary names had an easier time when the letter name contained the letter sound. The current research showed that the letter name and sound link can be furthered when the letter is not an arbitrary shape but rather has meaning in and of itself. Integrated mnemonics are effective as they linked a meaningful picture to letter

sounds above and beyond a picture that begins with the letter sound.

Level of cognitive development also affects how letter sounds are associated with their images or shapes. Children who have not yet reached a certain developmental point will find it difficult to learn how to segment initial sounds or use pictorial mnemonics (Ehri, 1998, Share & Gur, 2004). In order to participate in the current research study, children were taught how to segment initial sounds in order to benefit from both integrated and disassociated mnemonics instruction. This was necessary because using a pictorial mnemonic involves segmenting the initial sound in order to link the letter image to a picture beginning with the letter sound. As mentioned above, there were two children who were excluded from the study because they were not able to segment initial sounds even after training.

The goal of mnemonics is the facilitation of the retrieval of information in long-term memory. By adding meaningful connections to seemingly unconnected information, the learner is then able to access material more effectively (Carney, Levin & Levin, 1993). More specifically, mnemonic images provide mental pictures which contain information that create a link to the student's existing knowledge system. This increases the student's attention to the material, enhances meaningfulness and promotes active manipulation of the information. The better encoded the material, the more easily it will be accessed (Mastropieri & Scruggs, 1991; Mastropieri & Scruggs, 1998).

The current research confirmed prior mnemonic studies. When using integrated mnemonics, the students were able to learn the material more quickly, remember the letters more efficiently and use the letters in transfer tasks more

effectively. Marsh and Desberg (1978) found that pictures were not particularly effective in helping students recall letter sounds, but their mnemonics were not integrated into the pictures. When the letters and the pictures were integrated as in Ehri, Deffner and Wilce's study (1984), pictures strengthened the link between letters and their sounds. The current study strengthens previous findings, showing that integrated pictorial mnemonics facilitate a more direct retrieval path especially when the mnemonics are truly integrated.

Mnemonics were found to be an effective strategy to teach Russian letters to students who knew English (Gruneberg & Sykes, 1996). The students benefited most when the letters did not look like English letters. When the letters looked like English letters but had different sounds, the letters were hard to remember because of the conflicting information. In the current study, Hebrew letters were distinct from English letters so letter resemblance did not present an issue. Hebrew letters in general though, are less distinct than English letters. In fact, when English and Hebrew letter recognition time was compared, Hebrew letter recognition took longer, perhaps due to the greater similarity among Hebrew letters (Shimron & Navon, 1994). In fact, native English readers read more quickly than native Hebrew readers possibly because the letter architecture slows readers down. Feitelson (1988) suggested teaching Hebrew letter by letter rather than using the whole language approach since the letters resemble each other. These studies along with the current research support the concept that integrated mnemonics is particularly useful in languages with high letter similarity, because it requires the learner to attend to the distinctive parts of the letter and also provides a familiar image to link to the letter

sound. It is also important when constructing the most effective mnemonic, that the critical features of the particular letter be highlighted as well as those features that distinguish them from other letters. This is particularly true in Hebrew where many letters resemble one another.

In the Gruneberg and Sykes study (1996) mnemonics contributed to the ease of acquisition of Russian letters, particularly new letters. They also found that providing integrated mnemonics has a positive psychological impact, by providing children with the necessary tools to learn information more easily as well as in a more entertaining way. They use the term “subjective reward”. They posited that when the learning is laborious and slow, learners may be turned off or have negative feelings toward the foreign language with a new alphabet. Speed of letter learning may in fact contribute to the learner’s progress in second language learning. In the current study, the children benefited from the integrated mnemonics both in their ease of learning and greater recall. While the psychological impact of the two types of mnemonics was not explored, namely the children were not asked to rate the pictures they liked better, successful learning and retention of letter sounds would suggest a greater comfort level with the integrated letters as compared to the disassociated letters.

Mnemonic Value of Integrated Mnemonics in Letter-Sound Training

The training phase clearly demonstrated that children learned the letters more quickly when taught using integrated pictorial mnemonics. Over five trials, the children utilized the integrated mnemonics more effectively to learn the letter sounds and thus fewer trials were needed. When taught using the disassociated method, children needed to be shown the disassociated pictures and letters several times as

there was nothing to trigger the memory link between letter and sound. Because they could not retain the letter associations as easily, they needed more trials to learn the letter sounds. These results were not affected by the teaching order (i.e., which type of mnemonic was learned first) or which set of letters was taught with which method.

In most reading programs, pictures are often used but they are not as effective because there is no particular connection between the picture's name and the shape of the letter (Mastropieri & Scruggs, 1991). Integrated pictorial mnemonics activate more effective connections between the letters and their sounds as shown in this study and in the study done by Ehri, Deffner and Wilce (1984). Effective integrated mnemonics allow children to relate the picture's name and letter shape to each other so that sight of the letter shape activates in memory the object depicted whose first sound is the sound of the letter (Ehri & Wilce, 1987).

These findings also support research done by Gruneberg and Sykes (1996), showing that integrated pictorial mnemonics are an effective way of teaching non-Roman foreign alphabets by allowing the child to learn with fewer frustrations (Gruneberg & Sykes, 1996). Ease of learning is crucial when introducing a child to a new alphabet. By associating the letters with pictures, the child is able to grasp the letters more quickly as they are presented in a fun and entertaining manner.

Mnemonic Value of Integrated Mnemonics in Recalling Letter-Sound Relations

In contrast to disassociated mnemonics, integrated pictorial mnemonics are effective because they facilitate the connection between the letter sound and shape in the child's memory. Posttest results measuring recall confirmed the effectiveness of the integrated pictorial mnemonics method of teaching letter-sound relations. The

children recalled the picture more effectively in the integrated condition than in the disassociated condition suggesting that they implemented the mnemonic strategy of linking the letter to the picture. It was easier to recall letter sounds because of the connection made between letter shape and sound as shown in an earlier study conducted by Ehri, Deffner and Wilce (1984).

Children had difficulty writing the taught letters regardless of the method used to teach the letters. This may be because letter writing was not practiced during the training session. Additionally, in this study, the children were presented with the letter and then taught the sound rather than listening to the sound and then being shown the letter. When asked to write the letters in the posttest section, they were presented with the letter sound and asked not only to remember the letter but to write it as well. Producing the letter in the "reverse" of the direction learned (going from sound to letter) may have contributed to the depressed writing scores.

In an analysis of the successive steps of the experiment, it was interesting to note that scores rose on the delayed letter recall test as compared to the initial letter recall task. The delayed task was given three days after the recall battery. One possible explanation attributes improvement to the review of letters that took place during the recall tasks. Perhaps children's memory for letter sounds was activated repeatedly during the course of the posttest session and this may have strengthened their letter-sound knowledge.

V*alue of Integrated Mnemonics on Transfer Tasks.*

This research showed that teaching with the integrated pictorial mnemonics facilitated the transfer of letter-sound information to reading and spelling tasks more

than disassociated mnemonics. This is important information because it showed that newly learned letters were not only retained but also applied in new learning situations. The obvious explanation is that integrated mnemonics were better secured in memory and hence available to influence performance. Even though children met a stiff criterion in learning letter-sound relations in both conditions, after one week the letters learned with disassociated mnemonics were not as well recalled so the children needed more retraining prior to the transfer tasks.

One of the most important concerns of those who teach students to read has been to insure that knowledge of letter-sound relations transfers to reading and spelling tasks. It is not enough to know letters; the information has to be applied to reading and spelling tasks. The present research makes an important contribution by showing that this teaching method has an impact not only on learning and recall of letter-sound relations but also on the application of this knowledge. Very likely, transfer was facilitated by the inclusion of instruction in phonemic segmentation. To insure that students would be able to associate the first sound in picture names to letters, they were taught to segment the first sounds of words when training began. Further research is needed to determine whether this was a necessary step that facilitated learning and transfer.

Children coming into the foreign language classroom typically have already learned letter sound associations in the writing system of their native language. The already acquired skills in their native language give children the framework needed to learn a new language more effectively. Bialystok, Luk and Kwan (2005) found that when bilingual learners were compared to monolingual learners, bilingual learners

show an advantage on early literacy tasks in both their native and new language. This advantage, attributed to the transfer of literacy skills, is only apparent when the two writing systems use the same alphabetic system. In this study, Spanish and Hebrew were considered to be the same alphabetic system as the graphemes in both languages represent phonetic segments. Chinese, in contrast, is a character based language where the morpheme is associated with semantic and phonological properties. (Bialystok, Luk & Kwan, 2005). The writing system impacts development of literacy because each system uses a different type of symbolic relationship between letter shape and sound which require different processing skills. When bilinguals use the same type of alphabetic system, they are at an advantage since this allows for a greater transparency of the reading code. When children need to use the letters in different and unfamiliar ways, they become more aware of the use of letters and sounds. Using the same reading system for two different languages may give the children greater depth of understanding of the alphabetic code in both children's primary and second language.

Bialystok et. al (2005) equates the Roman and Hebrew letter system. However, it is not clear to what extent unfamiliar letter shapes impact letter learning and development and extending of the reading code from the native language (in this case English) to a second language. The present study explored what happens when the foreign language uses unfamiliar letter shapes. Learning a second language with new letters gives children the advantage of added language exposure and thus greater awareness of language, but they may have more difficulty with the language because of the new letter system. Integrated mnemonics allowed children learning a different

alphabetic system to have a greater connection to the letters which may have facilitated the sharing of literacy tasks between the two languages.

Effective Hebrew letter teaching using integrated mnemonics may also facilitate the letter naming skills and letter sound development in Hebrew due the transfer of literacy skills and awareness of language. Learning Hebrew letters effectively may be a predictor of reading achievement in Hebrew as in English as discussed earlier (Carroll, 2004). The use of integrated mnemonics is effective not only because of the connections made between the letter and sound but also because it presupposes the ability to isolate initial letter sounds. Share (2004) found that children who were able to isolate initial sounds were able to learn letter sounds more easily. Integrated mnemonics can be utilized to help children learn new letter sounds and use them effectively.

Carroll (2004) found that letter knowledge can help facilitate the development of phonemic awareness, specifically phoneme segmentation by facilitating the connection between the individual sounds and visual symbols. Once children can relate letter sounds to their shapes, they actively look for familiar sounds within words. They scan words, listening for sounds they know and then picking out the familiar letters. This can further explain the positive performance on the transfer tasks of the children in the present study. Carroll explored some of the specific sub-skills directly affected by letter-learning, specifically phonemic isolation, phonemic completion, and phonemic matching (Carroll, 2004). Present findings showed that letters learned using integrated mnemonics were used more efficiently in the transfer tasks than disassociated mnemonics. This bears on Carroll's research as it shows how

the quality of letter learning can shape the development of application of phonemic awareness skills in reading and spelling tasks.

External Validity

The findings generalize to those students who know their letters in their native language and can segment initial sounds in words. In order to be included in this study, children had to know at least half of the letters in the English alphabet, both upper and lowercase. Results showed scores on English uppercase letters that ranged from 15 to 26 with a maximum score of 26, while English lowercase letter scores ranged from 19 to 26 with a maximum score of 26. The Hebrew letter scores ranged from 0 to 6 with a maximum score of 23. Students' ability to recognize primer words ranged from 0 to 12 out of a maximum of 14 words. From mean scores, children could name most upper and lower case letters in English but they knew few if any Hebrew letters. Most were novice or non-readers (81% of the children were only able to read two words or less). The mean vocabulary standard score on the PPVT-III test was above average based on test norms, with a mean standard score of 112 and a range of 97 to 134. Children who do not have the same phonemic and alphabetic awareness and vocabulary levels as these students in this study may not show the same learning, recall and transfer benefits.

In this study, children were taught to segment initial sounds in words rather than just selecting those who already could. Two students who were not able to complete this task were excluded from the study. Other students were dropped when naming and segmenting initial sounds in target pictures. Being able to segment initial sounds allows the child to make the connection between the picture and the letter

sound. Thus, findings can only be generalized to a population that is able to learn to segment initial sounds.

This population was not ethnically or culturally unique despite the fact that the children attended the Jewish community center. Because of the small Jewish population in Birmingham and the positive reputation of the school, the program's student body is reflective of the general population in the city. The findings therefore can be generalized to a similarly diverse population.

Letter By Letter Comparison

The letters themselves were compared to see if there were differences in the way that particular letters were learned using integrated or disassociated mnemonics. Very interesting information was found. While most of the letters were more effectively learned when trained with integrated mnemonics, there were two letters that did not fit that pattern.

In one analysis of recall on the posttest one week after training ended, the letter Hey /h/ was found to be recalled more easily in the disassociated picture condition. One possible explanation for the apparent lack of success using an integrated mnemonic to train the /h/ sound is that the mnemonic was not as memorable as the other mnemonics. Inspection of Tables 4, 6, and 7 support this interpretation. A ranking of the effectiveness of the 10 integrated mnemonics revealed that the mnemonic for /h/ was among the least effective, ranking at the bottom (9^{th} or 10^{th}). Figure 3 shows that the letter was depicted in the shape of a house. It may be that the strokes of the letter did not trigger this mnemonic easily in memory. Perhaps if the house had been drawn as having a flat roof corresponding to the top of the

letter, it would have been more effective. Or a different mnemonic conforming more to the letter's shape might have improved its effectiveness, for example, a head, a heater, or a helmet. It may also be that the drawing of the house was too busy and confused the learner. Performance with the integrated mnemonic was not much different from performance with the disassociated mnemonic for /h/ during the training, recall and transfer sessions because the disassociated mnemonic was among the more effective mnemonics in this set, ranking 3rd or 4th out of 10.

The other notable letter sound was the letter Shin /sh/, the only consonant digraph including in the study. Consonant digraphs are made up of two consonants working together that make one unique sound. In Hebrew, the /sh/ sound is represented by one letter rather than two as in English. Interestingly, there was no difference between the two mnemonic methods in the mean number of training trials to learn this letter-sound association. Moreover, there was little or no difference in mean posttest recall and mean pre-transfer recall. Rankings of the ease of learning with the two types of mnemonics for Shin in Tables 4, 5, and 6 revealed that it was Number 1 among the disassociated mnemonics in all three tables, and its rank ranged from 2.5 to 5 in the integrated mnemonic condition.

What is it that made this letter so unique that it did not need an integrated mnemonic aid to help children connect the sound to the letter shape? Several possibilities can be offered. Whereas the phoneme /sh/ is represented in English by two graphemes, in Hebrew there is only one grapheme for this sound. As noted by Ehri and Nunes (2002), different languages represent phonemes differently. Because /sh/ is not a single letter in English, this may have caused it to stand out in

comparison to the other letters which have the same number of graphemes in Hebrew and in English. Perhaps this made the letter unique and easier to learn for native English speakers. The Tal Am curriculum actually teaches the Shin as the second of twenty two letters, while in fact it is the second to last letter in the ordered Hebrew alphabet. Because children were not tested to see whether they knew that SH symbolized the /sh/ sound in English, this explanation could not be verified.

An alternative explanation is that the Shin's shape is unique when compared to the other Hebrew letters. Its three columns may make it distinct and thus easier to learn. This may help to explain why children did not need the benefit of the integrated mnemonic to recall this letter sound. Integrated mnemonics might have been more helpful if this letter had been taught in a group of letters more similar to it in shape. This possibility awaits study. Another issue was that the font used for the /sh/ in the recall and transfer task was slightly different than the one used in the training task (see Figure 3 and Appendix G). The Shin in the training phase had a flat bottom while the shin in the recall and transfer phase had a slightly slanted bottom. While the two fonts are quite similar, this may somehow affected scores for this letter. On the other hand, because Shin is such a unique looking letter, there didn't seem to be a significant impact due to the slight difference in bottom of the letter.

Alternative Explanations for the Contribution Made by Integrated Mnemonics

It is important to rule out alternative explanations that might account for the greater effectiveness of the integrated pictorial teaching method. The two training conditions differed in that the letter appeared as part of the picture in the integrated condition whereas the letter appeared separately from the picture in the disassociated

condition. As a result children's attention was divided in the latter condition but not the former condition. That is, they may have spent less time looking at the letter in the disassociated than in the integrated condition, so the former took longer to learn. Although this might explain why training was slower, it does not explain the difference in recall performance three days later. Both sets of letters were taught to criterion. Because training in the disassociated condition took longer, children were exposed to and looked at these letters more times than they looked at the letters in the integrated condition. Nevertheless, on the recall tests three days later, they still recalled letters learned with integrated mnemonics better. Thus, this explanation can be ruled out.

Another possibility is that viewing the letters imposed on and integrated into the pictures was more interesting or unusual and caused children to pay more attention to letters than viewing the letters separated from the pictures, and these factors were the cause of enhanced learning in the integrated condition. Although this might explain faster learning, as argued above, it does not explain superior recall, because both sets of letters were taught to criterion, so children were forced to learn both sets.

Another alternative explanation that was ruled out is that the letters taught using integrated mnemonics were easier to learn. This explanation does not apply because the letters were counterbalanced and thus all the letters were taught with both integrated and disassociated mnemonics.

Experimenter bias favoring integrated mnemonics is unlikely. While the experimenter conducted both the integrated and pictorial training conditions, there

was a specific script that was followed for both integrated and pictorial mnemonics as well as the posttests and transfer tasks as well.

Features that May Enhance the Effectiveness of Mnemonics

As seen in this research study as well as in previous studies, the closer the letter-sound link, the more effectively the material is learned (Matropieri & Scruggs, 1988). A direct retrieval path, in this case the picture, facilitates the letter-sound connection (Levin, 1983). If the chosen object's mnemonic is a "stretch" in resembling the letter shape, the mnemonic loses its effectiveness. Thus it is important that the object or mnemonic tie into the salient features of the letter being taught.

Hebrew letters can be hard to distinguish due to their similar features. Share and Gur (1999) found that although Hebrew letters look very similar to each other, prereaders attended to their distinctiveness when they read. Thus, it is important to design mnemonics using the most distinct features of the letters. It is also important to find a font that does not have too many serifs that might confuse the learner as to what is part of the letter and what is decoration.

According to Wang and Thomas (1996), mnemonics need to be concrete nouns, rather than action verbs or adjectives to be most effective. Nouns provide straightforward visual aids rather than abstract connections. Paivio's dual coding theory (1990) supports the idea that images enhance memory. He posits that verbal information is retained more effectively if a visual image is activated in memory. Pairing an integrated letter-picture with a letter sound enhances the formation of an image that includes the letter in memory.

Instructional Implications

Letter knowledge has been found to facilitate the acquisition of phoneme awareness (Carroll, 2004). In her research teaching prereaders letter skills, Carroll found that not only does letter knowledge impact phoneme awareness but the growth of letter knowledge affects different aspects of phoneme awareness. Knowing at least a few letter sounds is a threshold for the development of phonemic awareness. According to Ehri (1983), alphabet knowledge is the foundation of the letter-sound system because letter names contain the letter sounds. Integrated mnemonics provides instructors with a useful tool that can assist in teaching letter sounds, in turn enhancing letter name instruction. To use this tool effectively, teachers need to be provided with the proper instruction to maximize its benefits.

Teachers need to know phases of reading development to modify or enhance their instruction to meet students' needs. As mentioned earlier, integrated mnemonics benefit children differently depending on where they are in the phases of reading development. Children in an earlier phase may attend to the unique shape of certain letters so teachers could point out distinct parts of the letters. At this point, it may not be a good idea to introduce letters that are very similar. As the child progresses to a more advanced phase, children attend to each letter sound connection. Similar letter architecture may not present as much difficulty at this point.

Certain skills may be necessary to properly use mnemonics, in particular integrated mnemonics. According to the current research, children would benefit from knowing how to segment initial letter sounds in words. Teachers should be trained to teach students to listen for the initial sounds to maximize the benefit of

integrated mnemonics. Learning how to segment also facilitates other areas of phonemic awareness which in turn helps letter sound development and other reading skills.

Research has shown that for mnemonics, specifically integrated mnemonics, to be as effective as possible, teachers need to be instructed how to use mnemonics and what makes mnemonics most effective. Although not highlighted in this study to ensure uniformity between groups, in the classroom, students should be informed of the purpose of instruction and the rationale for using mnemonic strategies. While in this study, the terms "integrated mnemonics" and "disassociated mnemonics" were used, perhaps in a classroom setting, alternative and more user-friendly terms should be used. Instead of disassociated mnemonics, teachers can use the terms "separated mnemonics" or "traditional approach to teaching letters".

As part of the lesson, the teacher should model the process, showing how the initial letter sound is not only the initial sound of the picture but the letter looks like the picture too. In order for the integrated component of the mnemonic to be activated, children have to recognize that the letter sound resembles the letter shape. Pictures alone are not necessarily effective (Marsh & Desberg, 1977). The child needs to recognize the integrated link (Ehri, Deffner & Wilce, 1984). Children should then trace the letter and the picture to further strengthen the image and sound to increase attention to the letter and image and link them to the child's existing knowledge system (Carney, Levin & Levin 1983; Levin, 1983; Levin, 1993). The mnemonic strategy should be practiced orally with feedback provided. Reviewing,

practicing and positive reinforcement should facilitate effective retention and application of the mnemonic strategy (Mastropieri & Scruggs, 1991).

For example, the teacher can introduce the mnemonic by stating, “Today we are going to learn the letter “Lamed”. Sometimes letters look like pictures that start with the letter sound. The letter “Lamed” looks like a lizard, can you see that?” The teacher then traces the letter, showing how the parts of the letter resemble the parts of the lizard. “This is the head of the lizard, his wiggly body and his tail.” The children should then be given an opportunity to trace the letter “Lamed” and the lizard. When the teacher reviews the letter the next day, she should ask the class to remind her, “W\hat does the letter “Lamed” looks like?”

Integrated mnemonics can be a useful tool in giving the second language learner a foothold into the new language and in the case of Hebrew and other languages, a new alphabet. There are special issues that arise when children learn a second language. There are interlingual issues due to conflicts between the new language and the first language, and there are intralingual issues due to the specific and unique structure of the second language (Verhoeven, 1990). While literacy skills can be transferred from language to language (Favreau, Komoda & Segalowitz, 1980), a more limited vocabulary as well as difficulty recognizing sight words and orthographic patterns can present problems. Because second language readers rely more on bottom up skills, the context cues that they might use are not as available to them (Cziko, 1980). Integrated mnemonics can be a useful tool in giving the second language learner a foothold into the new language and in the case of Hebrew and

other languages, a new alphabet. A positive feeling toward a new language is very important in increasing motivation to learn (Gruneberg & Sykes, 1996).

Along with integrated mnemonics, teachers can provide their students with an enriched environment of pictures with labels, enlarged letters, songs and stories. These tools help provide the necessary context that the second language does not automatically have. Particularly in classrooms where Hebrew is learned not only as a language but as an identity (Halabe, 2005), positive environmental support would further enhance the effectiveness of integrated mnemonics and the general efficiency of Hebrew reading.

Teachers should feel empowered that they can facilitate children's reading development rather than feeling that reading development progresses own its trajectory with little input from the teacher. This study demonstrates that with the right tools, letter learning can be facilitated. By teaching children different sounds and connecting them with visual symbols, children are given the tools necessary to penetrate the "written code". By using both imagery and sound to encode the letters, the information will be more easily accessed (Paivio, 1990). Teachers can help advance the letter learning process by giving children the tools to move forward. Explicit instruction in the use of integrated mnemonics can help students advance in the area of letter learning and in turn in the areas of reading and spelling.

This study can also serve as an instructional model for preparing children to learn letter-sounds with integrated mnemonics. The phases of the study can be viewed as steps in the letter-sound learning process. First, the teacher assesses whether the child is ready to learn letter-sound relations by determining what skills

the child does or does not have. Once the teacher determines that the child is ready to learn, the teacher then proceeds to teach phonemic awareness, specifically segmentation skills using names and objects. When the child is able to isolate initial sounds, the teacher can then teach letters using integrated mnemonics as a means of strengthening the letter-sound connections. Finally, the teacher can facilitate transfer of these newly acquired letter-sound skills by giving the child simplified reading and spelling tasks. This framework can guide the teacher, by providing specific sequential steps to follow in the letter-sound development process.

Strengths and Limitations of the Study Design

The results of this study support using integrated mnemonics rather than disassociated mnemonics when teaching letter sounds. The study confirms the results found by Ehri, Deffner and Wilce (1984) which showed that English letters were more effectively learned and recalled when taught using integrated mnemonics. This study provides additional support of the integrated mnemonic method when teaching a foreign alphabet to English speaking students. Additionally this study extended the Ehri and Wilce study by included the reading and spelling transfer tasks. This is particularly important since learning letters serve as a means to an end rather than the final goal itself. While it is important to know one's letters, transfer to reading and spelling skills is the final determinant of letter learning success.

One strength of this study was its counterbalanced design. Each child was taught five letters using the integrated method and five letters using the disassociated method. Not only did the children serve as their own controls, but the five letters learned with each types of mnemonic as well as the order in which they were

presented were counterbalanced. The results provided clear support in favor of integrated mnemonics.

Another strength of the study was that letter sounds were taught rather than letter names since letter names in Hebrew can be lengthy and the whole letter name is not usually found in words. Additionally, English words were chosen as the mnemonic links making it easier for children who spoke English but not Hebrew to learn the letter-sound relations.

The present study provides evidence for the strength of integrated mnemonics for training, recall and transfer of Hebrew letter sounds. However, there were several limitations to this research. Because only ten out of twenty two Hebrew letters were taught, it is not clear whether effective integrated mnemonics could be created for the other letters. This awaits further study.

Another limitation concerned a particular posttest in the recall section, which required children to match five initial sounds in words to five letters. In this task the child matched Hebrew letters to new, unseen pictures whose names began with the sounds of the letters. Because the matching task had the same number of letters and pictures on the each page and the integrated and disassociated letters were presented separately, once two items were matched, it became easier to match remaining items correctly. While there was still a difference in favor of integrated mnemonics, in future studies this posttest task should be modified to include all ten letters together, thereby reducing the influence of guessing.

Another limitation was the scoring of the writing recall task. Because the children were not skilled at writing due to their young age, it would have been

beneficial to have specific criteria to judge whether the letters were written correctly. In addition, inter-rater reliability would have help insure that the scoring was accurate.

Directions for Further Research

Based on the results of this study, there are issues to be addressed by future research. One question involves investigating which properties of integrated mnemonics make them most effective. This is important for developing new mnemonics. Two sets of integrated mnemonic pictures could be developed for identical letters and then taught to the students. One set of letter mnemonics could be verb pictures such that the letter would be doing an action, while the other set would be nouns. An example of a verb integrated mnemonic would be the /d/ sound depicted as someone dancing. Using a design similar to the current study, there would be two groups with each group learning half the letters using one type of mnemonic picture and half the letters using the alternative pictures. The results could then be compared to see if there is a difference in rate of learning and retention favoring one of the two types of integrated mnemonics. It is thought that nouns are more concrete and easier to visualize and thus would be more effective in teaching letter sounds (Paivio, 1990). As mentioned earlier, the more effectively a memory is visually encoded based on dual-coding theory, the more easily it can be recalled. Specific instructions to use imagery enhances recall. This is especially the case for concrete language. However, even abstract language can be enhanced if students are encouraged to concretize abstract words (Paivio, 1990).

Another question that remains for further research is whether the mnemonic picture is more effective as an English word or a Hebrew word. In some Hebrew alphabet teaching programs, the mnemonics are well chosen but they are in Hebrew. This presents the learner with a challenge that seems to contradict the concept of using mnemonics to teach letters. If the child does not know the object's name in Hebrew, then it is unclear how the child can connect the picture's initial sound to a letter shape.

If mnemonics are taught with Hebrew nouns, the children would first be taught the spoken nouns and their meanings before the letter-sounds were taught using these nouns as mnemonics. In the Ehri, Deffner & Wilce study, children did not know what a yak was, but they learned and remembered the name of the animal as they used it to learn the letter-sound association for "y". Children would not need to master spoken Hebrew before they could use Hebrew nouns to learn letter-sound relations. However, learning would be slower for non-Hebrew speakers than if the mnemonics were taught with English nouns. This might be important for learning a second language as many learners do better in learning a second language when they can read as well as speak the second language. The hypothesis is that once the ten nouns are taught in Hebrew, integrated mnemonics would be more effective than disassociated mnemonics. However, in a study that compares the effectiveness of Hebrew and English mnemonics, children would still be expected to learn the letter sounds more quickly using native language mnemonics.

Another area to be explored is whether there is a difference in the way children and adults utilize mnemonic aids. It would be interesting to study adults

using the same study design. Because adults are more knowledgeable and have had more life experiences, the hypothesis would be that they would be even more responsive to mnemonic aids, both integrated and disassociated. It would be interesting to see whether they would be able to use more abstract or verbal rather than concrete integrated pictorial mnemonics.

One question addressed in de Graff et al. study (2007) was whether it was necessary to teach the children how to segment prior to teaching the mnemonics. The results showed that in the embedded integrated picture condition as well as the no picture condition, the children who were able to segment initial sounds well outperformed those who were not able to segment well. However, in the fading condition, there was no difference between good and poor performers. The authors suggest that this may be due to the segmentation training that occurs with the training session itself, albeit not explicit. It is also possible that because the differences in the fading condition between the good and poor performers of the first sound skill were in the expected direction, the lack of significant results may be due to lack of power. It could also be that the fading mnemonic technique is so powerful that it compensates for the specific initial sound isolation training. It would be important to further explore this using the integrated mnemonics in this study to see whether they are powerful enough to not only teach letter sounds but to teach segmentation as well. The question that would need to be addressed is whether children who learn to segment from integrated mnemonics can isolate initial sounds in other tasks.

Conclusion

In summary, integrated mnemonics have been shown to be an effective method of teaching Hebrew letters, facilitating retention and then using the letters in novel reading and spelling situations. It is crucial for the integrated mnemonic to consist of a closely linked picture and letter shape in order for the picture to serve as a memory aid, triggering the recall of the letter sound. Teachers can use this technique as a means of teaching letters in an engaging fashion to their students, with the knowledge that not only is it fun, but also effective.

Appendix A

Parent permission letter (front and back)

To: Parent/Guardian of a preschool student at Cohen Early Childhood Learning Center
From: Adina H. Shmidman, M.S. Ed. Graduate Student at CUNY Graduate School
Re: Conduct of project on Hebrew letter-sound learning

My name is Adina Shmidman and I am an advanced Ph.D. student in the Educational Psychology program at the Graduate School University Center of the City University of New York (CUNY), in the field of literacy acquisition. I am the principal investigator of a project, entitled, "Using English pictorial mnemonics to teach Hebrew letter-sound relations." This is a research study of Hebrew letter learning. I am interested in studying how children recognize and learn Hebrew letters. I have received approval from the school director to conduct a study with students in the Pre-K and kindergarten classes. The purpose of this letter is to request your written permission allowing your child to participate in this study. All the students in your child's class are being invited to participate.

In this project I will study Hebrew letter recognition and letter-sound relations in order to better understand how children learn to distinguish their letters. I will work individually with each child during school hours in a room near your child's classroom. I will work with each child individually from 1 to 5 occasions. Each session will last between 20 to 30 minutes. Children will be given several tasks to determine how familiar they are with Hebrew letters and their sounds. Children who are unfamiliar with letters and letter-sound relationships may receive training to improve their letter-sound knowledge. The activities will resemble those typically used by teachers in classrooms to teach pre-reading skills. I will be working with students during school hours in or near the classroom.

Participation in this project holds promise of benefiting students and teachers. There are no known risks involved in this study. Children usually enjoy the individual attention and the opportunity to show what they have learned about the letters of the alphabet. The benefits of your child's participation is that of learning Hebrew letters and advancing our understanding about how children learn to read Hebrew and this in turn may help benefit Hebrew reading instruction in schools. There will be approximately 40 participants taking part in this study.

In order for your child to participate in this project, your written permission is required. If you are agreeable, please complete and sign the attached permission form and return it to your child's teacher as soon as possible. Keep the second copy for your files.

Your participation in this project is completely voluntary. Any child who participates is free to withdraw from the study at any time for any reason without any consequence. Any information that might help your child's teacher better understand your child's pre-reading skills will be shared with the teacher with your permission. Otherwise, your child's performance will be kept confidential. I may publish results of the study, but the names of people, or any identifying characteristics, will not be used in any of the publications. If you would like a copy of the study, please provide me with your address and I will send you a copy in the future.

Any further information can be obtained by contacting Adina Shmidman at (205) 871-3141 or ashmidman@aol.com or my advisor, Dr. Linnea Ehri at (212) 817-8294 or LEhri@gc.cuny.edu. If you have any questions concerning your child's rights as a participant in of this study, you can call Ms. Hilry Fisher at the CUNY Graduate School, Office of Sponsored Research, (212) 817-7523 or hfisher@gc.cuny.edu.

Sincerely.

Adina H. Shmidman

Please, if agreeable, sign and return this sheet to your child's teacher as soon as possible.

CONSENT TO PARTICIPATE IN THIS RESEARCH STUDY

Title of the Study:	Using English pictorial mnemonics to teach Hebrew letter-sound relations.
Principal Investigator:	Adina H. Shmidman Ph.D. Program in Educational Psychology Graduate School and University Center of the City University of New York Phone: (205) 871-3141

Date: _____

I grant permission for my child _____ to participate in this research project. I have read the description of the study. I understand that my child will be asked to perform some English and Hebrew letter activities. I am agreeable to all the terms and conditions. The letter answers all the questions I have to my satisfaction. The researchers have given me a copy of this form. I consent to allow my child to participate in this study.

Signature of parent: _____

Birth date of child: _____

Signature of researcher: _____

Appendix B

Principal permission letter (front and back)

Dear Principal,

I am inviting your school to participate in a study that I am conducting. This research project studies Hebrew reading readiness of students in pre-Kindergarten. I invite your students to participate in my study and need your written permission to facilitate this matter.

I will meet with the students individually a maximum of five times in a room during school hours. The sessions will be arranged with the teacher to ensure that the children will not miss any important activities in the classroom. Each session will last approximately 20-30 minutes. The purpose of this study is to explore Hebrew letter recognition and letter-sound relations. The tasks given to the student during this time are similar to activities that occur in classrooms as part of reading readiness instruction and therefore poses no known risk to the students.

The pretest session involves asking the child to identify English and Hebrew letters and name pictures. I will then teach each child several Hebrew letters using a pictorial mnemonic and then see how well they remember the letters they learned.

Participation in this project holds promise of benefiting students and teachers. Children usually enjoy the individual attention and the opportunity to show what they have learned about the letters of the alphabet. Children who participate in the training portion of the study will gain additional knowledge about Hebrew letters. Results of this study should advance our understanding about how children learn to read Hebrew and this in turn should benefit Hebrew reading instruction in schools.

Children generally enjoy these sessions and look forward to them. Any child, however, that wishes to discontinue is free to do so without any consequences. Information about the children's reading readiness skills that will help your teachers better understand your students will be shared with the teacher provided that the parents have no objection.

Results may be published in a scholarly journal. Participants' identities will remain anonymous. Thank you for your interest in this research project. I appreciate your time and consideration and look forward to working with you, your staff and your students.

Any further information can be obtained by contacting Adina Shmidman at (205) 871-3141 or ashmidman@aol.com or my advisor, Dr. Linnea Ehri at (212) 817-8294 or Lehri@gc.cuny.edu. If you have any questions concerning the child's rights as a participant in of this study, you can call Ms. Hilry Fisher at the CUNY Graduate School, Office of Sponsored Research, (212) 817-7523 or hfisher@gc.cuny.edu.

Sincerely,

Adina H. Shmidman

CONSENT TO PARTICIPATE IN RESEARCH STUDY
ON HEBREW LETTER-RECOGNITION

Title of Study: Using English pictorial mnemonics to teach Hebrew letter-sound relations.

Principal Investigator: Adina H. Shmidman
Program in Educational Psychology
Graduate School and University Center of the
City University of New York

Date: _____

I have read the description of the study. The study involves students from pre-Kindergarten. The researcher will meet with the students individually a maximum of five times in a room near their classroom during school hours. The researcher will schedule the sessions with the teacher to ensure that the children will not miss any important activities. Each session will last approximately 20-30 minutes. There is no known risk to those who participate in this study.

The purpose of this study is to explore Hebrew letter recognition and naming. The researcher will ask the child to first identify English and Hebrew letters and name pictures. Then the child will learn several Hebrew letters using pictorial mnemonics and then be evaluated on how well she or he remembers the letters taught.

I am agreeable to all the terms and conditions and grant permission for students from this school _____ to participate in this research project.

_____ _____
(Signature of principal) (Signature of researcher)

Please sign the two copies of this form. Retain one copy for your records and return one copy to the researcher.

Appendix C

Directions for the English Letter Identification Pretest

The letter identification test measures the subject's ability to identify letters of the English alphabet.

Subjects are presented with the list of capital and lowercase letters out of order and are told the following:

"I will show you a list of letters. I would like you to tell me the name or sound that each letter makes. If you do not know the letter, you may guess or say that you don't know it. Are you ready? Good. Remember to name the letter or tell me the sound it makes."

If child gives an acceptable but less common sound, ask once:

"Can you tell me another sound that the letter makes?"

A correct score is noted when either the name or the most common sound is given for the letter. Alternative responses and/or errors are recorded. Testing is discontinued once the child finishes the given list of letters.

Scoring:

Common responses to be accepted for letter with several sounds:

C /k/ G /g/

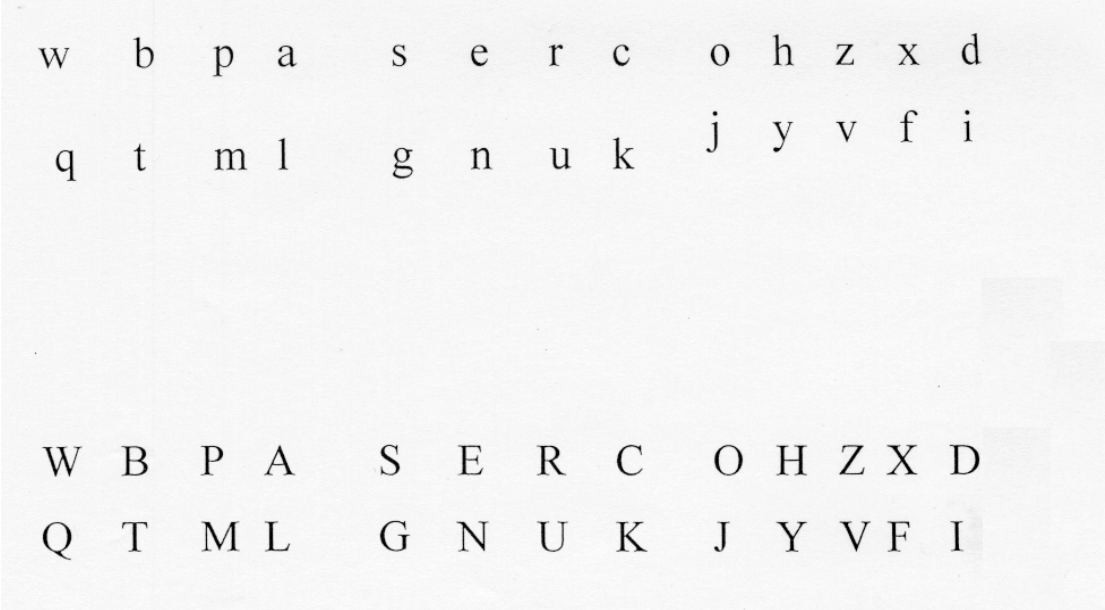


Figure C1. English letter identification pretest

Appendix C

Directions for the Hebrew Letter Identification Pretest

The letter identification test measures the subject's ability to identify letters of the Hebrew alphabet. Subjects are presented with cards with five Hebrew letters on each card and are told the following:

"I will show you a list of letters. These are letters that are used to write words in Hebrew. Do you know what Hebrew is? (note response). **I would like you to tell me the names of the letters or their sounds. If you do not know the letter, you may guess or say that you don't know it. Are you ready? Good. Remember to name the letter or tell me the sound it makes."**

A correct score is noted when either the name or the most common sound is given for the letter. Alternative responses and/or errors are recorded. Testing is discontinued once the child finishes the given list of letters.

Figure C2. Hebrew letter identification pretest

Appendix C

Directions for the Word Reading Pretest

The word reading test measures the subject's ability to read words.

Subjects are presented with cards with English words and pictures and are told the following:

"I will show you some words and pictures. I would like you to read the words you know and name the picture that you see. If you do not know the word, you may guess or say that you don't know it. Are you ready? Good. Remember to read the word or tell me what the picture is.

A correct score is noted when either the word is read correctly or the picture is correctly identified. Alternative responses or errors are recorded. Testing is discontinued once the child finishes the given list.

Appendix C

Figure C3. Pre-primer words and pictures.

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Appendix C

Pretest Record Sheet

Name: _____

Date of Birth: _____
Test date: _____
Age _____

Lowercase _____/26
Uppercase _____/26
Hebrew _____/23
Primer Words _____/14
PPVT-R _____

Upper	Lower	Hebrew	Primer Word
W	w	א	no
B	b	י	p - dog
P	p	ז	stop
A	a	ג	
Q	q	ת	play p-ball
T	t	ל	go
M	m	נ	
L	l	ט	dog
S	s	מ	p-fish
E	e	ק	fun
R	r	ש	
C	c	ס	work
G	g	ב	p-scissors
N	n	ד	big
U	u	ה	and p-rabbit/bunny
K	k	ו	ball
O	o	ח	
H	h	כ	daddy
Z	z	ע	p-banana
X	x	פ	the
D	d	צ	red
J	j	ר	p-balloon
Y	y	ך	up
V	v		
F	f		
I	i		

___ ____ ____ _____

Appendix D

Phonemic Segmentation Pretraining

I am going to say a person's name to you. I want you to repeat the name and tell me the first sound in the name. I will show you what I mean. I'll say the name and the first sound and I would like you to say the name and the sound - to repeat after me.

Training Word 1: "Vicky" /v/

Good! Now you try one on your own. Remember I'll say the word and you say the word and tell me the first sound in the word.

Now begin training with feedback.

Lenny

Nancy

Tom

Mary

Kim

Sharon

Sam

David

Bob

Harry

If the child makes an error, correct the error. Then have the child repeat the name and the first sound correctly and continue. Review the complete list of words until one hundred percent mastery is achieved. If the child misses more than five words on the

first trial, begin again. If more than five words are missed on the second trial, it suggests that this child is not an appropriate subject for this study.

Thank you – you certainly worked very hard on this.

Criterion is one trial of 10 perfect responses.

Appendix D

Detailed Picture Training And Initial Sound Segmentation Training

Of The Picture Names Phase (both groups)

Today we are going to learn some Hebrew letters and the sounds they make. We are first going to look at ten different pictures and see what they are. Here is a picture and I will tell you what it is. When I say what the picture is, repeat the word after me. Try to remember what these different pictures are. Let's try one. Remember I will tell you what the picture is and you repeat the word after me.

Trial: This is a dog.

(child repeats, "This is a dog".)

If the child is able to do this, continue with ten words. If not, model and redo the trial.

Look at the picture. It is a dog.

This is a:

key	lizard
teapot	nose
mitten	ship
desk	sun
body	house

Now it's your turn. Please tell me what these pictures are.

Record number correct. The picture names will be done until one perfect trial is attained.

Now that you know all these different pictures, we are going to look at them again and this time, tell me what sound it starts with.

Trial: Let's try one together.

This is a dog - d.

If child does this example correctly, proceed with next ten. If not, model and redo trial.

Watch me. This is a dog, /d/. Let's try again.

Record number correct. The complete list of picture names will be repeated until a perfect trial is met.

Appendix D

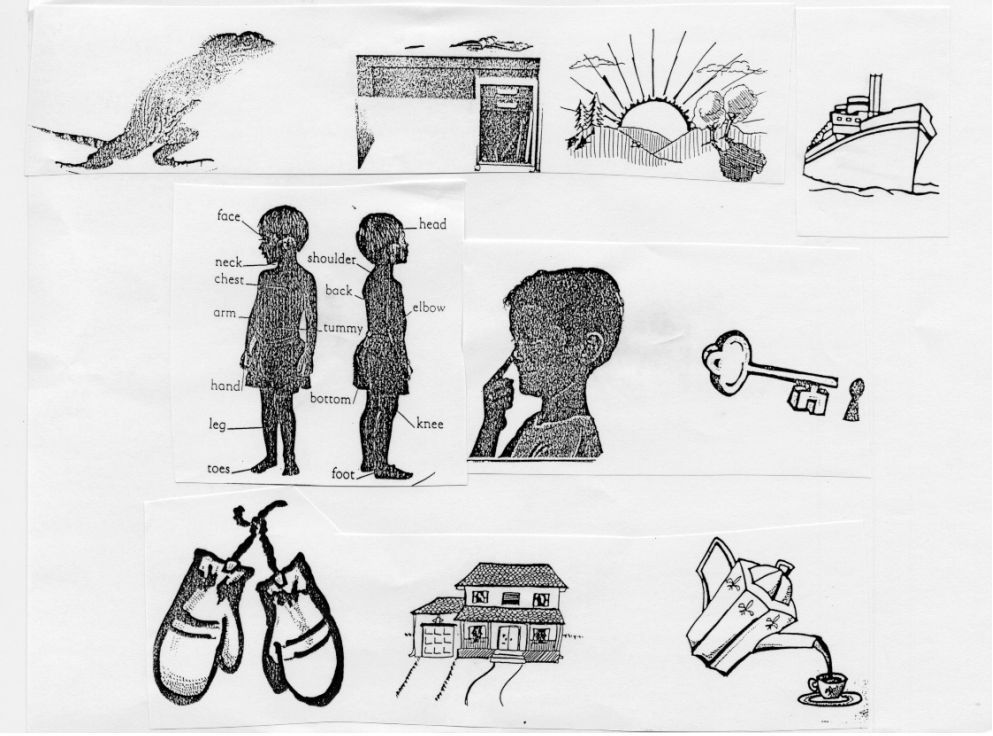

Figure D1. Pictures used to teach initial sound segmentation.

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Appendix D

Pretraining and letter training scoring sheet

Name:_____ **GROUP:** **A** In – 2D **B** 2D-1In
C 2In – 1D **D** 1D-2In

Initial Sound Segmentation			**Pretraining**		
Lenny	__	__	Body	__	__
Nancy	__	__	Ship	__	__
Tom	__	__	Nose	__	__
Mary	__	__	Key	__	__
Kim	__	__	Lizard	__	__
Sharon	__	__	Desk	__	__
Sam	__	__	Sun	__	__
David	__	__	Mittens	__	__
Bob	__	__	House	__	__
Harry	__	__	Teapot	__	__

Letter Sound Training

ד	ק	נ	מ	ש
מ	ד	ד	ק	נ
נ	נ	ק	נ	מ
ק	ש	מ	ש	ד
ש	מ	ש	ד	ק
ד	ק	נ	מ	ש
מ	ד	ד	ק	נ
נ	נ	ק	נ	מ
ק	ש	מ	ש	ד
ש	מ	ש	ד	ק
ב	ל	ט	ה	ס
ה	ב	ב	ל	ט
ט	ט	ל	ט	ה
ל	ס	ה	ס	ב
ס	ה	ס	ב	ל
ב	ל	ט	ה	ס
ה	ב	ב	ל	ט
ט	ט	ל	ט	ה
ל	ס	ה	ס	ב
ס	ה	ס	ב	ל

Appendix E

Letter Sound Training – Integrated Picture Phase

The routine will be study trial (steps 1-5) to be followed by the test trial (steps 6-7), which will be repeated for the five letters in the picture-mnemonic phase.

Routine I: Study trial (letter training) 1-5

Repeat once for each of 5 letters.

We are going to use the pictures and their names to give us clues about the sounds that Hebrew letters make. The pictures will help you remember the sounds of the letters.

1- Present the letter plus the mnemonic picture.

Here is the letter and the picture that will help you remember the letter and its sound. Look at the letter. The picture looks like the letter.

2- Name the object that looks like the letter**:**

Name the picture that looks like this letter.

(If child is correct) **That's right. It is a (name the picture).**

(If child is incorrect) **It is a (name the picture).**

See how the picture looks like the letter.

Use finger to trace the letter and explain how it is related to the picture.

3- Segment the first sound:

Tell me the first sound in _____ .

(If child is correct) **That's right. (Picture) starts with (name the sound) and looks like this letter. This letter makes the sound (name the sound).**

(If child is incorrect) **(Picture) starts with (name the sound) and looks like this letter. This letter makes the sound. You say the sound.**

4- Letter tracing:

Now trace the letter with your finger. Good.

5- **Now copy the letter on this paper.** (give child a paper and pencil) (same paper can be used for all five letters).

6. Repeat steps 1-5 with each letter.

<u>Routine II: Test trial – name sound</u>

7- Test trials:

Now I'm going to show you those letters again one at a time. You look at each one and try to remember its sound. To remember, think of the name of the picture that looks like the letter and remember its first sound.

Use stack of 5 flash cards, with letter on one side and letter plus picture on the other side.

Routine:

(Show letter) **"Tell me its sound."**

(If correct) **"Good."** (Go to next card.)

(If wrong:)

(If child says name of picture)

"Tell me the first sound of _____"

(Turn card over and review connection)

(Picture) starts with (name the sound) and looks like this letter.

This letter makes the sound (name the sound). You say the sound.

(child responds)

Continue trials to five correct trials.

Appendix E

Figure E1. Integrated picture letter cards.

Appendix F

Letter Sound Training – Disassociated Picture Phase

The routine will be study trial (steps 1-5) to be followed by the test trial (steps 6-7), which will be repeated for the five letters in the picture-mnemonic phase. You give one study trial (training all five letters) followed by multiple test trials until child reaches criterion of 5 perfect successive trials in a row saying the sound of the letter.

Routine I: Study trial (letter training) 1-5

We are going to use the names of pictures to give us clues about the sounds that Hebrew letters make. The picture names will help you remember the sounds of the letters.

1- Present the letter plus the photos:

Here is the letter and the picture that will help remember the letter and its sound. Look at the letter and the picture.

2- Name the object that begins with the letter:

Name the picture.

(If child is correct) **That's right. It is a (name the picture).**

(If child is incorrect) **It is a (name the picture).**

Look at the picture and the letter.

First encircle finger around picture, then around letter.

3- Segment the first sound

Tell me the first sound in (the word).

(If child is correct) **That's right. (Picture) starts with (name the**

sound). This letter makes the sound (name the sound).

(If child is incorrect) **(Picture) starts with**

(name the sound). This letter makes the sound (name the sound).

You say the sound.

4- Letter tracing:

Now trace the letter with your finger. Good.

5-Letter writing

Now copy the letter on this paper (give child a paper and pencil)

(The same piece of paper can be used for all five letters)

6- Repeat the previous steps (1-5) with each letter.

Routine II: Test trial – Name sound

7- Test trials:

Now I'm going to show you those letters again one at a time. You look at each one and try to remember its sound. To remember, think of the name of the picture and remember its first sound.

(Use a stack of 5 flash cards, with letters on one side, and letter plus picture on the other side).

Routine:

(Show letter) **"Tell me its sound."**

(If correct) **"Good" (Go to next card.)**

(If wrong)

(If child says name of picture) **“Tell me the first sound of _____.”**

(Turn card over and review connection)

(Picture) starts with (name the sound). This letter makes the sound (name the sound). You say the sound. (Child responds).

Continue trials to five correct trials.

Appendix F

Figure F1. Disassociated picture cards letter cards.

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Appendix G

Posttest Script

Introduction to Posttest Phase:

Now I am going to ask you to try very hard to remember the letters we learned the last time. It might be hard but I want you to try your very best at remembering as much as you can.

1- Recall of letter-sound associations.

Subject is shown the bare ten letters one at a time. Both sets of letters are mixed together randomly.

Here are the letters we learned. Tell me the sound each letter makes.

Using cards, the subject is shown letter by letter and asked to say the sound the letter makes.

2- Recall and production of letter shapes.

Now I will say the sound of each letter. You write the letter I say.

The child has to write the letter learned when the examiner says the sound.

3- Sound-letter recognition.

I'm going to say the sound of the letter we learned. Point to the letter that makes this sound.

A sheet with an array of ten letters will be presented one by one to the child. The child has to point to the correct letter the examiner sounds.

4- Recall of picture aids.

I am going to show you a letter. Tell me what picture we saw that helped you remember the letter sound.

Showing the child the letter, the child states the object/word that helped recall the letter sound. Both sets of letters are mixed together randomly.

5-Letter-picture matching.

Practice sheet with English letters**:**

Look at these pictures. First I'll say the picture name and you repeat it. Now draw a line from each picture to the letter that makes the beginning sound of the picture name.

(If correct) **"Good"** (Go to Hebrew letter sheets.)

If wrong, model correct answer.

Let's try this one together.

Look at these pictures. First I'll say the picture name and you repeat it. Now draw a line from each picture to the letter that makes the beginning sound of the picture name.

Continue with Hebrew letter sheets.

Look at these pictures. First I'll say the picture name and you repeat it.

This is to ensure that the subject knows the correct names of the pictures presented.

Draw a line from each picture to the letter that makes the beginning sound of the picture name.

Two sheets with five letters and five new unseen pictures on each sheet are presented to the subject. The child names each of the pictures and then draws a line from each letter to the picture that has the same initial sound as the letter. The two sets of letters correspond to the integrated and disassociated

picture treatment.

6- Match letters to Disassociated Picture Aids.

Point to the picture of the _____. Point to the letter that the _____ helped you remember.

The child is shown two sheets, one with the 10 letters taught and one with the 10 pictures that were used to teach the letters. The letters are presented in alternating order, with each letter learned with an integrated picture followed by a letter learned with a disassociated picture. The experimenter pronounces the name of a mnemonic picture and asks the child to point to the letter associated with that picture.

Appendix G

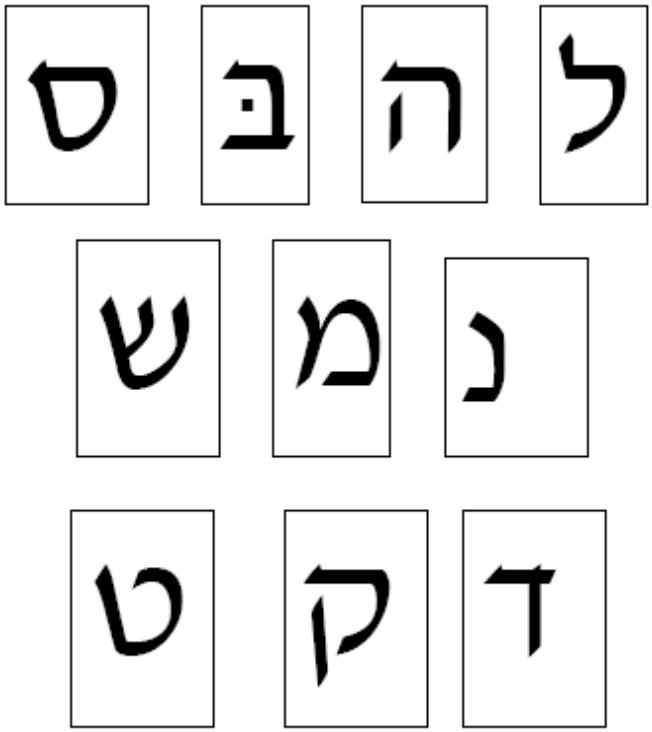

Figure G1. Bare letters on cards.

Appendix G

Figure G2. Letter array sheet.

Appendix G

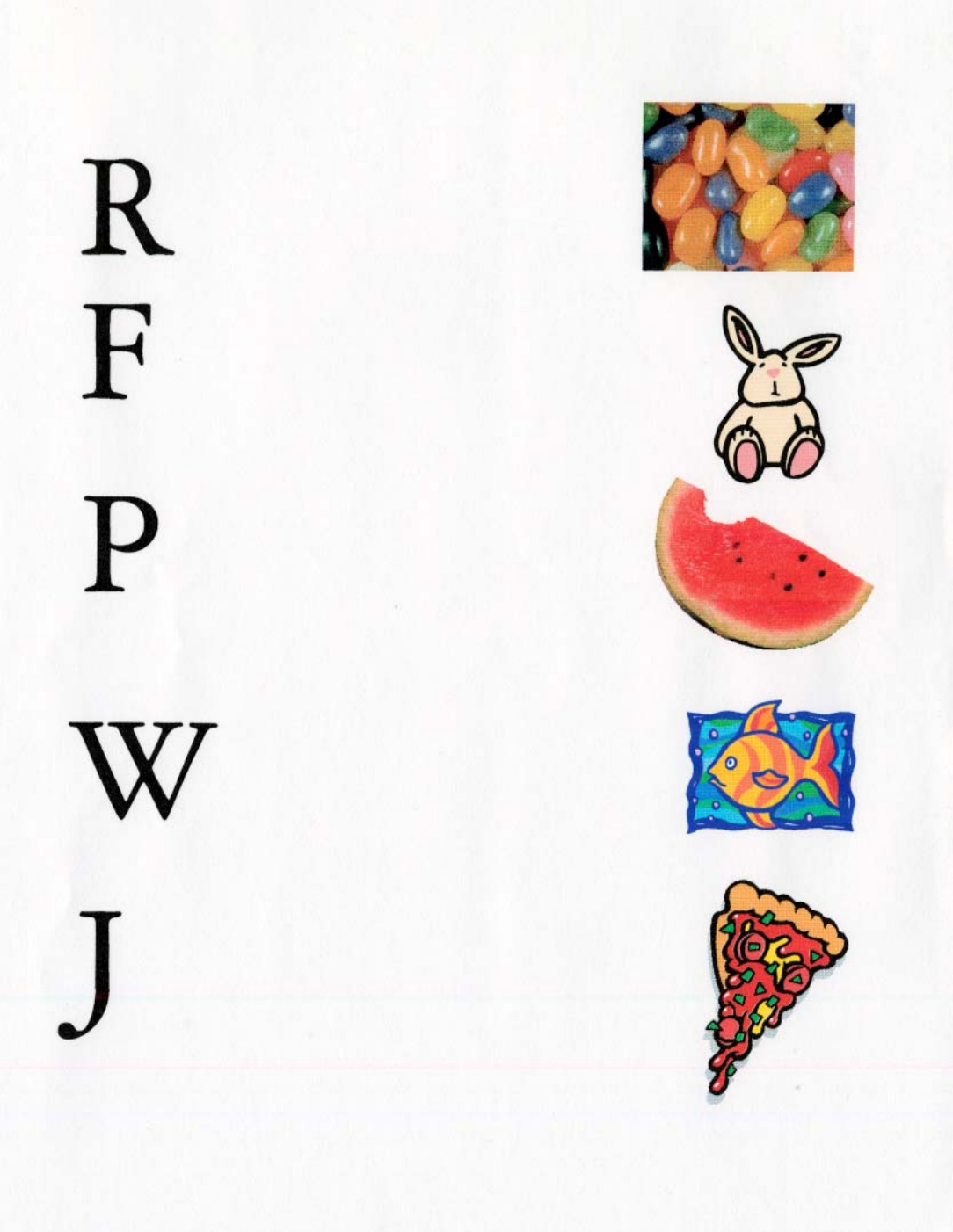

Figure G3. Letter-picture matching sheet (English letters).

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Appendix G

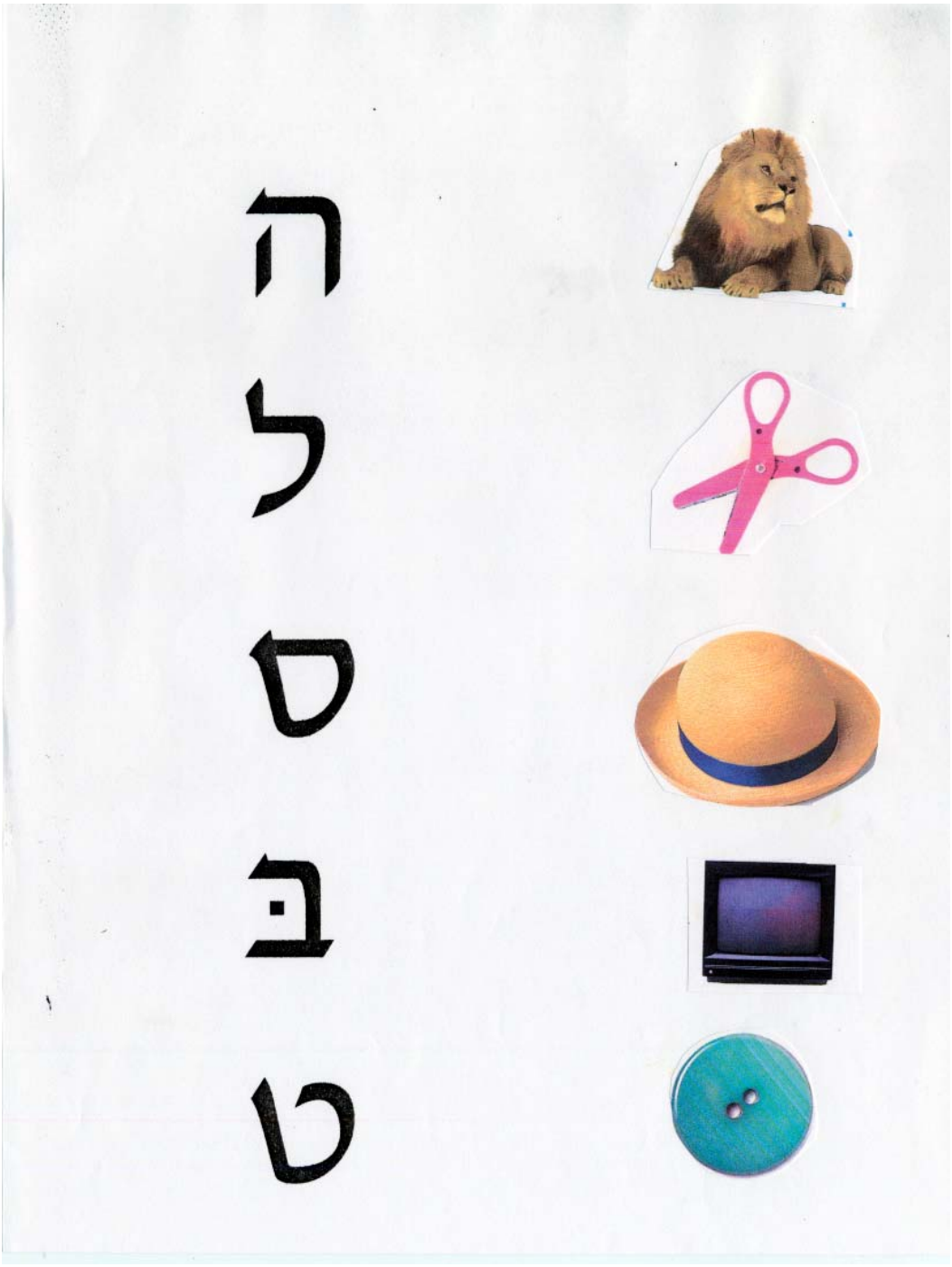

Figure G4. Letter-picture matching sheet (Hebrew letter set one).

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Appendix G

Figure G5. Letter-picture matching sheet (Hebrew letter set two).

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Appendix G

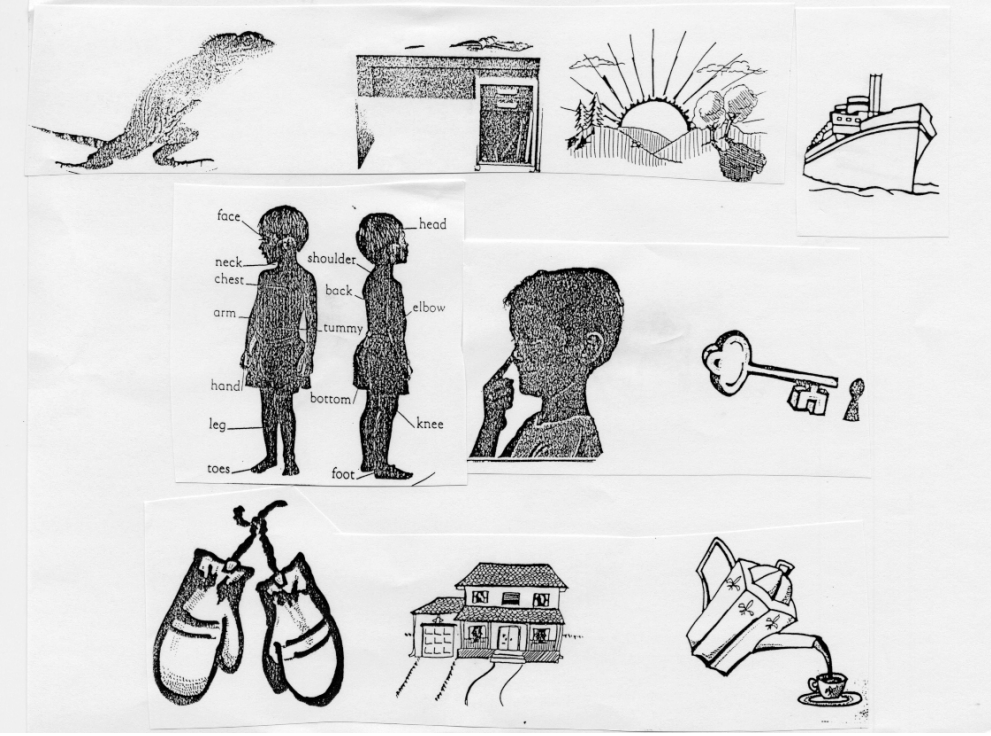

Figure G6. Pictures used to teach disassociated mnemonics.

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Appendix G

Posttest Record Sheet

Name:_____ **GROUP:A 1In - 2D B 2D-1In**
Date: _____ **C 2In - 1D D 1D-2In**

Posttest Record Sheet

Posttest 1: Recall of letter-sound associations (bare cards)

ט ב ס ל ה מ ד נ ק ש

Posttest 2: Recall and production of letter shapes (blank paper)

ט ב ס ל ה מ ד נ ק ש

Posttest 3: Sound-letter recognition (Point to letter of presented sound – ten letter array)

ט ב ס ל ה מ ד נ ק ש

Posttest 4: Recall of picture aids (Present letter, tell what picture helped remember)

ש_____ה_____
ק_____ל_____
נ_____ס_____
ד_____ב_____
מ_____ט_____

Posttest 5: Letter-picture matching (matching sheets)

ט ב ס ל ה מ ד נ ק ש

Posttest 6: Picture letter and word letter recall (Present picture - point to ten letter array that picture recalls)

ש_____ה_____
ק_____ל_____
נ_____ס_____
ד_____ב_____
מ_____ט_____

Appendix H

Transfer task script

A. Ten letter review- refresher session

I am going to show you the letters we learned. Tell me what sound each letter makes.

If the child does not know a letter, feedback is provided by telling the child the letter sound. Criterion is reached when the child is able to say the letter sounds for all ten letters three perfect runs..

1. Spelling transfer task.

Remember that you learned some Hebrew letters. I want you to try to remember those letters as best as you can. We are going to do some fun things with those letters. First we are going to learn how to spell some words in English and then in Hebrew. I will say each word to you. You will use these magnetic letters in front of you to spell the sounds you hear in the word.

1. Test trial I: Model using English magnet letters

   FR PR JR RP

   Let's try one together. The word is fur. I hear the sounds /f/-/r/.

   We will choose two letters to spell fur.

   Take the f. **This letter spells /f/ in fur.**

   Take the r. **This letter spells /r/ in fur.**

   See how I spelled fur.

   Now you spell fur.

The child copies – says sounds as pulls out letters.

Repeat with the following three words until one perfect trial. Record the spellings.

1. Model word one:

Now let's try to spell another word. Spell the sounds you hear in pear.

I hear the sounds /p/ - /r/.

Take the p. **This letter spells /p/ in pear.**

Take the r. **This letter spells /r/ in pear.**

See how I spelled pear.

Now you spell pear.

The child copies – says sounds as pulls out letters.

2. Model word two:

Now let's try to spell another word. Spell the sounds you hear in jar.

I hear the sounds /j/ - /r/.

Take the j. **This letter spells /j/ in jar.**

Take the r. **This letter spells /r/ in jar.**

See how I spelled jar.

Now you spell jar.

The child copies – says sounds as pulls out letters.

2. Model word three:

Now let's try to spell another word. Spell the sounds you hear in rip.

I hear the sounds /r/ - /p/.

Take the r. **This letter spells /r/ in rip.**

Take the p. **This letter spells /p/ in rip.**

See how I spelled rip.

Now you spell rip.

The child copies – says sounds as pulls out letters.

Now we are going to learn how to spell some words in Hebrew. I will say each word to you. Use two magnetic letters in front of you to spell the word I say.

1. Test trial I:

Say

The word is _____. Use two letters to spell _____.

2. Repeat with all ten words. Only five letters should be put out for each set. After each spelling, the letters should be scrambled. Record the spellings.

<u>Set A:</u>

Cone	O	k-n
Dash	a	d-sh
Muck	u	m-k
Shed	e	sh-d
Name	A	n-m

Set 1:

נק שד קמ דש מנ

Set B

Hole	O	h-l
Sub	u	s-b
Tale	A	t-l
Less	e	l-s
Bit	I	b-t

Set 2:

טב סל לט בס לה

2. Word learning task.

Remember that you learned some Hebrew letters. I want you to try to remember those letters as best as you can. We are going to do some fun things with those letters. We are going to learn how to read some words that are spelled with Hebrew letters. I will tell you how to read each word. You will practice until you can remember what all the words say. I will help you learn them.

1. Study trial: Model

Routine

Present each card with a word written on it; say:

This word says _____. Look at the letters and read it yourself _____.

(Child reads the word on the card).

Proceed with test trials.

(Remaining trials are test trials):

Routine

Present each card with word, say:

Read it.

If wrong, tell the child:

This word says _____. Look at the letters and read it yourself _____.

3. Continue with the test trials for 8 trials with a different order of cards on each trial.

Record the child's success and errors on each trial.

Set A:

shade (sh+d)

comb (k+m)

neck (n+k)

dish (d+sh)

moon (m+n)

נמ שד קנ מק דש

Set B:

heel (h+l)

light (l+t)

suit (s+t)

boss (b+s)

tub (t+b)

בט סב טס טל לה

3. Memory for simplified spellings.

You have learned to read ten words. I want to see if you remember the letters you saw in words. Here are the Hebrew magnet letters we used before. I am going to say a word and I want you to pick the letters you saw I the word.

Routine

Write _____.

Set A:

shade (sh+d)

comb (k+m)

neck (n+k)

dish (d+sh)

moon (m+n)

דש

מק

קנ

שד

נמ

Set B:

heel (h+l)

light (l+t)

suit (s+t)

boss (b+s)

tub (t+b)

לה	טל
טס	סב
בט	

4. Word recognition task

Here are two words. I am going to say a word and I want you to point to the one that I say. Let's first try it with two English words.

Jug/Rug

If correct, continue with Hebrew words

If incorrect, model.

Listen to the first sound in the word "Jug". Tell me the first sound.

Good. Now what is the first sound in "Rug". Good. Now I am going to say one word and I want you to point to the one that I say.

Jug/Rug

If correct, continue with Hebrew words.

If incorrect, model one more time.

(Note number of times modeled)

Word list:

Set A:

mine/shine

duke/nuke

nod/cod

cash/mash

Set A:

נמ	נש
קנ	קד
דנ	דק
שמ	שק

Set B:

hat/bat

soul/bowl

tab/lab

ball/tall

Set B:

טה	טב
לס	לב
בט	בל
לב	לט
WIG	ZIG

Now I am going to ask you to do something a little bit different. I am going to say two words. Tell me which word matches the card in front of you. Let's try it first with two English words.

Show: wig

Remember, I am going to say two words. You tell me which word is on the card.

Say: **wig or zig**

If correct, continue with Hebrew words. If incorrect, model.

Listen for the first sound in the words. Listen to the first sound in the word "Wig". Tell me the first sound. Good. Now tell me the first sound in "Zig".

Good. Now I am going to say two words. Point to the word that is on the card.

Show: zig

If correct, continue with Hebrew words.

If incorrect, model one more time.

(Note number of times modeled)

Set A:

mean/shean	נמ/נש
nick/mick	קנ/קמ
kin/din	נק/נד
shame/came	מש/מק

Set B:

hill/till	לה/לט
sub/hub	בס/בה
late/hate	טל/טה
bit/hit	טב/טה

Appendix H

Set one:

דש מק

קנ שד

נמ

Set two:

לה טל

טס סב

בט

Figure H1. Transfer word learning task in binder.

Appendix H

Figure H2. Transfer word recognition task in binder.

Appendix H

Name: Letter Set:
Date:

Transfer Task Record Sheet

A. **Refresher Session: (binder)**

ש	ש	ש	ש	ש	ש	ש	ש	ש	ש	ש	ש
ה	ה	ה	ה	ה	ה	ה	ה	ה	ה	ה	ה
ק	ק	ק	ק	ק	ק	ק	ק	ק	ק	ק	ק
ל	ל	ל	ל	ל	ל	ל	ל	ל	ל	ל	ל
נ	נ	נ	נ	נ	נ	נ	נ	נ	נ	נ	נ
ס	ס	ס	ס	ס	ס	ס	ס	ס	ס	ס	ס
ד	ד	ד	ד	ד	ד	ד	ד	ד	ד	ד	ד
ב	ב	ב	ב	ב	ב	ב	ב	ב	ב	ב	ב
מ	מ	מ	מ	מ	מ	מ	מ	מ	מ	מ	מ
ט	ט	ט	ט	ט	ט	ט	ט	ט	ט	ט	ט

1. <u>Spelling transfer task.(blocks)</u>

Example: fur
Practice with English words: (record spellings)
Pear
Jar
Rip

Hebrew words Set A:

שד	dash	_____
קמ	muck	_____
נק	cone	_____
דש	shed	_____
מנ	name	_____

Hebrew words Set B:

לה	hole	_____
לט	tale	_____
סל	less	_____
בס	sub	_____
טב	bit	_____

2. Word learning task.(binder)

SET I:
shade
דש ____דש ____ דש ____דש ____דש ____דש ____דש ____דש
comb
מק ____ מק ____ מק ____מק____ מק ____ מק ____ מק ____ מק ____
neck
קנ ____ קנ ____ קנ ____ קנ ____ קנ ____ קנ ____ קנ ____ קנ ____
dish
שד ____ שד____ שד ____ שד ____ שד ____ שד____ שד ____שד ____
moon
נמ____ נמ ____ נמ ____ נמ ____ נמ ____ נמ____ נמ ____
נמ ____

SET II:
heel
לה ____ לה ____ לה ____ לה ____ לה ____ לה ___ לה ____ לה ____
light
טל ____ טל ____ טל ____ טל ____ טל ____ טל ____ טל ____
לט ____
suit
טס ____ טס____ טס ____ טס ____ טס ____ טס___ טס ____ טס ____
boss
סב ___ סב ____ סב ____ סב ____ סב ____ סב ____ סב ____
סב ____
tub
בט ____ בט ____ בט ____ בט ____ בט ____ בט ____ בט ____ בט ____

3. Memory for simplified spellings (blocks)

Set A:shade (sh+d) _____comb (k+m) _____neck (n+k) _____dish (d+sh) _____moon (m+n) _____
Set B:heel (h+l) _____light (l+t) _____suit (s+t) _____boss (b+s) _____tub (t+b) _____

4. Word recognition task.(binder)

Example: jug/rug

Set A:

mine/shine	נמ/נש
duke/nuke	קד/קנ
nod/cod	דנ/דק
cash/mash	שק/שמ

Set B:

hat/bat	טה/טב
soul/bowl	לס/לב
tab/lab	בט/בל
hall/tall	לה/לט

Example: say “wig or zig” (choose the one on the card)

Set A:

mean/shean	נמ/נש
nick/mick	קנ/קמ
kin/din	נק/נד
shame/came	מש/מק

Set B:

hill/till	לה/לט
sub/hub	בס/בה
late/hate	טל/טה
bit/hit	טב/טה

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