A STUDY OF THE USE OF WORDMAPPING IN NINTH-GRADE REMEDIAL

ENGLISH CLASSES

Except where reference is made to the work of others, the work described in this dissertation is my own or was done in collaboration with my advisory committee. This dissertation does not include proprietary or classified information.

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A STUDY OF THE USE OF WORDMAPPING IN NINTH- GRADE REMEDIAL

ENGLISH CLASSES

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A STUDY OF THE USE OF WORDMAPPING IN NINTH-GRADE REMEDIAL

ENGLISH CLASSES

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DISSERTATION ABSTRACT

A STUDY OF THE USE OF WORDMAPPING IN NINTH-GRADE REMEDIAL

ENGLISH CLASSES

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The purpose of this study is to examine the effectiveness of using wordmapping

with struggling learners between the ages of 13 and 15. An experimental group (the

wordmapping group) and a treated control group (the vocabulary group) studied the same

lists of words each week. The researcher taught students in the wordmapping group to

divide the words into syllables, count the phonemes in each syllable, and write the letters

corresponding to each phoneme. The classroom teacher taught the vocabulary group the

meanings of the words. Data on spelling, reading comprehension, and reading decoding,

was collected from 20 students, 14 in the wordmapping group and 6 in the vocabulary group.

There was a statistically significant difference ($p < .05$) on the posttest scores of the two groups on two measures of spelling. No significant differences were found in the posttest measures of reading comprehension or reading decoding. The study provides support for using wordmapping to help older students improve their spelling skills.

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Style manual used: American Psychological Association Style Manual, 5th Edition

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Computer software used: SPSS 11.5 for data analysis; Microsoft Word 2007 for word

processing

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CHAPTER ONE

INTRODUCTION

This chapter presents an introduction to the dissertation. It begins with the

background of the problem, that is, what is the foundation for research on teaching older

learners to spell correctly? A brief statement of the problem follows the background.

Research needs to be conducted on how to teach older students to spell correctly. The

purpose of the study, to investigate the use of wordmapping in a high school classroom,

is presented, and the research questions which guided the study are stated. The

significance of the study is supported by information from the National Reading Panel

report, the National Assessment of Educational Progress report, and research that shows

the negative impact a student can experience because of poor spelling skills. The

introduction concludes with a discussion of limitations on the scope of the study.

Background of the Problem

How can we effectively teach older learners to spell correctly? Spelling has been

taught in schools for many years, but as Venezky pointed out, during the 1960s and

1970s, few scientists considered spelling to be a topic worth studying (Venezky, 1989).

It is interesting to note that neither the 1994 edition or *The Handbook of*

Psycholinguistics (Gersbacher) nor the 2006 edition (Traxler & Gersbacher) contain

chapters on spelling.

More recently, spelling has been studied by literacy researchers; however, very little of the research has focused on spelling of high school age students. The renewed interest in spelling is in part based on the work of researchers such as Read (1971) who studied the invented spellings of young children. This work has been extended by researchers who have studied spelling as a developmental process (Ehri, 2000a, 2000b; Henderson, 1981; Henderson & Templeton, 1986; Invernizzi & Hayes, 2004; Templeton & Morris, 2000; Trieman, 1998), researchers who have focused attention on the role that phonemic awareness plays in learning to spell (Castiglioni-Spalten & Ehri, 2003; Castle, Riach, & Nicholson, 1994; Davidson & Jenkins, 1994; Drake & Ehri, 1985; MacDonald & Cornwall, 1995; Stahl & Murray, 1994), and others who have examined the role that morphology plays in the English spelling system (Nagy, Berninger, & Abbott, 2006). Although researchers do not agree on the specific phases and descriptions of spelling development or on the roles of explicit or implicit learning in spelling development, there is general agreement among researchers that "most learners share a common developmental sequence of acquisition of orthographic knowledge" (Templeton & Morris, 2000, p. 4).

Statement of the Problem

There has been little research conducted on the spelling of older students. Research on spelling has focused on the spelling of younger children. Developmental models inform us on how spelling is acquired and other studies point to effective instructional practices, but these studies do not inform us on how to instruct older students who have not reached appropriate levels in their spelling development. In the

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research studies which have been conducted, the connection of phonemic awareness to spelling is clear (Drake & Ehri, 1985; Juel, 1988; Graham, 1990). Researchers have found that the ability to map graphemes onto phonemes correctly helps children learn to spell correctly (Ehri & Soffer, 2000). However, in most spelling programs, students are merely given a list of words to memorize and reproduce on weekly spelling tests (Bloodgood, 1991). Graham (2000) makes it clear that spelling does need to be taught explicitly, that it can't be "caught" from reading. The time pressure of reading does not allow time for word study. Because spelling is an important element of literacy instruction, research is needed on older students' spelling.

Purpose of the Study

The purpose of this study is to examine whether teaching high school struggling learners to use a wordmapping method to learn spelling words would increase their spelling ability, their decoding ability, or their reading comprehension. The wordmapping method was chosen because it makes the grapheme-phoneme connections clear to students and this connection is thought of as necessary for spelling (Battacharya & Ehri, 2004; Ehri & Soffer, 2000; Ehri & Wilce, 2000).

Dr. Bruce Murray, Mrs. Geralyn Murray, and I conducted a pilot study in the spring semester of the 2005-2006 school year. Subjects for the study were students with specific learning disabilities in two public high schools, one in Georgia and one in Alabama. The pilot study, which will be explained more thoroughly in Chapter 4, used a within-subjects research design and did not result in significant differences between the weeks that students used wordmapping and the weeks that they studied the words in their

preferred manner, but it did indicate directions for further study. The present study is a redesigned extension of the pilot study.

<div align="center">Research Questions</div>

The following research questions guided the study:

1. Do students who study wordmapping score significantly higher on a standardized posttest measure of spelling than do students who study words without using wordmapping?

2. Do students who are taught to use the wordmapping method for spelling place more letters correctly in the words on a standardized posttest measure of spelling than do students who study words without using wordmapping?

3. Do students who are taught to use the wordmapping method for spelling score higher on a cumulative teacher-made test of words taught than do students who study the same words without using wordmapping?

4. Do students who are taught to use the wordmapping method for spelling place more letters correctly on a teacher-made cumulative test of words taught than do students who are taught the same words without using the wordmapping method?

5. Do students who study wordmapping score significantly higher on a posttest measure of reading decoding than do students who study words without using wordmapping?

6. Do students who study wordmapping score significantly higher on a posttest measure of reading comprehension than do students who study words without using wordmapping?

7. Do students who study wordmapping score significantly higher on a posttest measure of vocabulary than do students who study words without using wordmapping?

Significance of the Study

While there is a considerable body of research focusing on spelling, little research has been conducted on the spelling of older students. The National Reading Panel report noted that spelling is related to phonemic awareness, but that phonemic awareness and phonics instruction had not been found to be effective for older students, with effect sizes for phonemic awareness studies ranging from -0.04 to 0.33 (NICHD, 2000, p. 2-71). The effect size for phonics studies was 0.09 (NICHD, p. 2-116).   However, only eight phonemic awareness studies and 13 phonics studies included students over the first grade, and the studies only included students through sixth grade (NICHD, 2000). Part of the reason for the dearth of studies of older students may well be that for most students, direct spelling instruction ends at the end of sixth grade at the latest. As students move from the primary and elementary grades to middle and high school, instruction becomes more and more content-focused. Teachers assume that requisite skills, including spelling, were taught in the earlier grades (Moats, 2004). However, not all students enter high school as good spellers.

National Assessment of Educational Progress (NAEP) data on writing includes spelling as a component of writing ability. Even at the basic phase, twelfth-grade students are expected to be able to "demonstrate sufficient command of spelling, grammar, punctuation, and capitalization to communicate to the reader" (USDOE, 2003, p. 13). At the proficient phase, students should "have few errors in spelling, grammar,

punctuation, and capitalization that interfere with communication" (USDOE, 2003, p. 12), and at the advanced phase it is expected that students will "enhance meaning through control of spelling, grammar, punctuation, and capitalization" (USDOE, 2003, p. 11). While the NAEP does not report directly on spelling, it is apparent that spelling is an important component of writing. Examination of the 2002 data shows that 74% of twelfth-grade students scored at or above the basic phase, 24% scored at or above the proficient phase, and only 1% achieved the advanced phase. Twenty-six percent of twelfth-graders scored below the basic phase in 2002 (USDOE, 2003, p. 21). It is important to help students improve their ability to spell correctly in order to help them improve their overall written expression.

Poor spelling ability has an impact on students' grades. By the time students are in high school, writing is a critical skill. As Graham and Harris point out, "It is the primary means by which students demonstrate their knowledge in school" (Graham & Harris, 2005, p. 65). The writing of students who are poor spellers is often evaluated negatively by teachers (Scott, 2000). Graham (1990) also points out that "Cognitive resources directed to spelling compete with those needed for generating content," resulting in poorer quality of writing.

Students who are poor readers are often poor spellers (although the link does not appear to be bi-directional, as many poor spellers are good readers). Poor spelling is often a cause of frustration and humiliation for older students (Massengill, 2006). Because they fear embarrassment, older poor spellers may avoid activities that reveal their weaknesses and refuse to participate in classroom activities that involve spelling. Vocabulary assignments often include spelling as part of the grade, thus penalizing

students for their lack of knowledge (Moats, 2004; Massengill, 2004). Graham (2000) points out that spelling does in fact need to be taught, that it is not acquired naturally through reading or by simple exposure to language, and Bloodgood (1991, p. 204) notes that rote memorization is not enough to help students transfer words from short-term memory to meaningful activities such as writing.

In the present study, two groups were used to examine the effects of wordmapping instruction on the spelling and reading achievement of students. The experimental group received instruction in using the wordmapping method to learn weekly lists of spelling words. A treated control group studied the same lists of words, but focused on word meanings and was instructed to study the words for the weekly spelling test using their preferred method of studying. The two groups were used to examine if the wordmapping method of spelling made a difference in the spelling and reading achievement of struggling learners.

Limitations to the Scope of the Study

The study included the following limitations:

1. This study used a quasi-experimental research design. As Campbell and Stanley (1963) note, in a natural social setting such as a school, a researcher can introduce some of the elements of a true experimental design, for example, what to measure, but the researcher lacks full control over exposure to treatment. In this study, subjects could not be randomly assigned from a common population because I had to use intact classes. However, Campbell and Stanley also point out that the use of a control group, even though subjects were non-randomly assigned, strengthens the design when a

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pretest-posttest design is used, as was the case in this study. While such a design does

control for main effects of history, maturation, testing, and instrumentation, regression

may not be as well controlled for; however, using an Analysis of Covariance (ANCOVA)

increases the probability that differences between groups on the posttest measure are the

result of treatment. ANCOVAs adjust for differences on the covariate, in this case the

pretest score, then evaluate whether the means on the dependent variable (in this case, the

posttest) are the same across groups (Green & Salkind, 2003, p. 191).

Because a true experimental design could not be used in this study, threats to

external validity could not be controlled and the results should not be generalized beyond

the experimental population.

2. The treatment conditions were limited to wordmapping instruction and word

meaning instruction.

CHAPTER 2

REVIEW OF THE LITERATURE

This chapter presents a review of the literature pertaining to the study. The first section reviews the literature on the development of spelling, while the second section is concerned with literature on the spelling of older learners. The third section reviews works which examine the role of specific abilities in spelling. The final section reviews studies that are concerned with spelling instruction. Although most of the studies use young children as subjects, the information derived from these studies is pertinent to this study because older learners with low spelling ability may follow the same sequence of spelling development as do younger normal-ability students (Viise, 1996).

Development of Spelling Ability

There are several theories and models of spelling development. While these models do not always agree on specific details, there is general agreement that learning to spell is a developmental process during which learners progress through identifiable phases or stages. There is further agreement developed through research that spelling is not learned naturally through exposure to written language, but rather that it must be taught (Graham, 1990). In this section, major theories of spelling development and rationales for teaching spelling are discussed.

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Ehri's (2000a, 2000b) model of spelling development parallels her model of reading development.   In fact, she views spelling and reading as "two sides of the same coin" and states that the line between reading and spelling is blurred, that reading and spelling are not really very different from one another (Ehri, 2000b, p. 14).

Ehri (1992, 1997, 2000b, 2005) proposes a connectionist theory of spelling, that is, when a reader sees and pronounces a word, their memory of the alphabetic system is used to make connections between the graphemes used in the word's spelling and the phonemes heard in the word's pronunciation.   After several repetitions, the word's spelling is bonded to its pronunciation and retained in memory (Ehri, 2000b).

Ehri further proposes that there are three ways we read and spell words: by memory, by invention, and by analogy (Ehri, 2005b, p. 26). Beginning spellers need phonemic awareness skills to create spellings, because they must be able to segment words into phonemes so they can choose the appropriate graphemes. Beginning spellers also call upon the partial information about the spelling of words that they hold in memory. Thus, their spellings may be phonetically accurate even though they are technically "incorrect." As students progress in spelling, they can begin to spell unfamiliar words by analogy, that is by using their knowledge of familiar words to spell unfamiliar words. Spelling by invention, by memory, or by analogy all require that children have some knowledge of the alphabetic system. Spelling by memory and by analogy also require that children have enough well-spelled related words and word forms in memory so that they can transfer the knowledge to new words (Ehri, 2000b, p. 27).

Ehri's theory of spelling development consists of three phases. It is important to note that these phases are fluid, not fixed. Phases may overlap, and the mastery of all skills in one phase may not be necessary to begin to use skills from the next (Ehri & McCormick, 1998). In the prealphabetic phase, children are not yet aware of the alphabetic principle, and their "writing" bears little resemblance to standard English. Forms that resemble letters may be used, but the "letters" used don't correspond to any sounds, and children cannot read their "writing." During this phase, children are not using any kind of spelling at all (Ehri, 2000b, p. 29).

After children become aware that there is a relationship between letters and sounds and know at least some of the letter names, they enter the partial alphabetic phase. In this phase, "children use their knowledge of letter names or sounds to form connections between salient letters seen in words and sounds detected in pronunciation" (Ehri 2000b, p. 28). At this partial alphabetic phase children still lack complete knowledge of the alphabetic system. Spellings are incomplete because children still have little knowledge of phoneme-grapheme correspondences. Consonants are most commonly used, and letters may be selected by the sounds of their names. Ehri notes that a child at this phase may write *chicken* as *HKN* because /*ch*/ is heard in the letter name for *h* (*aitch*). Children at this stage have trouble remembering how to spell a word because they have only partial knowledge of the alphabetic system (Ehri, 2000b, p. 28).

The full alphabetic phase of spelling commences when children can segment words into phonemes and know at least some phoneme-grapheme vowel correspondences. At this phase, children still invent spellings to some extent, but their spelling is more complete than at the partial alphabetic phase and contains more vowels

than were previously present. Because they have a better understanding of the alphabetic system, children at this stage are better able to remember spellings. Spelling by analogy becomes possible because children now have a large enough store of correctly spelled words in memory to draw on (Ehri, 2000b, p. 24).

When children learn about recurrent graphophonemic structures such as syllables, affixes or prefixes, they are able to spell longer, multisyllabic words and are better able to remember the spellings of longer words. At this consolidated alphabetic level, children know graphophonemic units as such as –*est* as consolidated units, thus making them easier to remember (Ehri, 2000b, p. 29).

Henderson (1981) also views learning to spell words as a developmental process. Children begin to learn about words very early, and will begin to make marks that resemble words before formal reading instruction begins. In this preliterate-prephonetic stage, letters and drawings are mixed. In the preliterate-phonetic stage, children, when asked to spell a word, will write the initial consonant; thus *dog* is written *d*. Although spelling is incomplete, a child at this stage does have an idea of what a word is and no longer uses drawings and symbols to "write" a word (Henderson, 1981, p. 71).

Once children know the letters they enter the letter-name stage of spelling in which each phoneme is represented by the letter that is closest to the sound the child hears. In this stage, the word *rain* would be spelled *ran*. According to Henderson, this shows that children are not just memorizing words but are also using "a complex strategy of orthography that is consistent and incredibly accurate phonetically" (Henderson, 1981, p. 72).

Henderson's next stage is a transitional stage, during which children begin to use their sight vocabulary to inform their spelling. Instead of spelling *rain* as *ran*, it is now spelled *rane* because the child has learned to use a silent-e to mark a long vowel. After vowels are mastered, children begin to understand the consonant patterns (e.g., doubled consonants) that allow them to examine and spell multisyllabic words (Henderson, 1981, p. 73).

Others have expanded Henderson's model. Henderson and Templeton (1986), Templeton and Morris (2001), and Invernizzi and Hayes (2004) propose that there are three layers of information represented by spelling. The first layer, the alphabetic layer, matches the sounds and letters in a word from left to right, just as the word is read. This layer is obvious and some words are spelled with this direct matching (for example *mat* where *m*=/*m*/, *a*=/*a*/, and *t*=/*t*/). However, there are many words in English that can't be spelled by alphabetic matching (Templeton & Morris, 2001, p. 3). Examples of these words include *island* and *sword*.

The next layer in this model is the pattern layer, which operates within the syllables of a word. An example of this layer is the vowel-consonant-silent-*e* pattern. This pattern signals a long vowel, as in *bake*. As well as operating within syllables, the pattern layer operates between syllables. A word like *pilot* has the vowel-consonant-vowel between syllable pattern. Knowledge of the patterns helps students to spell words correctly (Templeton & Morris, 2001, p. 4).

The final layer in this model is the meaning layer. In this layer students learn that word parts that have similar meanings are usually spelled consistently even though the pronunciation changes with the form (for example *bomb/bombard*). Henderson and

Templeton state that a proficient speller may call on knowledge of all of these layers to spell an unknown word (Templeton & Morris, 2001, p. 6).

Bear, Invernizzi, Templeton, and Johnson (2004) draw on Henderson's theory and describe the development of students' word knowledge as a continuum rather than as discrete stages. In their view the phases are differentiated in two ways: by the kinds of cues children use as they encounter new words and by their "specific featural knowledge of how the English spelling system works" (p. 8). In this model, the first phase of development, the emergent phase, is divided into three parts. The earliest stage describes the "writing" of children who are not yet able to read (Henderson's preliterate-prephonetic stage; Bear et al., 2004; Henderson, 1981). As in Henderson's model, children in this phase make no use of the alphabetic principle in their writing. If real letters are used at all, there is no relationship between letter and sound. Children in the middle emergent phase still lack the concept of sound-symbol correspondence, but use more real letters and have started to grasp the concept of directionality in writing. By the late emergent phase (Henderson's preliterate-phonetic stage) children understand what a word is, use spacing between words, and have begun to make some letter-sound matches (Bear et al., 2004; Henderson, 1991). This is a result of learning to spell.

After the emergent phase, children move into the letter-name alphabetic spelling phase, which again is divided into three parts. During the first part of this phase children consistently apply the alphabetic principle to consonants and would spell *bake*, *bk*. In the middle part of the letter name-alphabetic spelling phase, children still use phonetic spelling strategies but have learned to segment words and use the middle vowel sound to spell. At this point, *bake* would be spelled *bak*. By the late part of this phase children

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can match short vowel sounds to correct spellings and begin to spell by analogy.

Consonant digraphs and consonant blends are usually spelled correctly and children

begin to use long vowel markers such as silent-*e* (Bear et al., 2004).

The next phase, within word pattern spelling, is the point at which some spellers

get stuck. Most spellers in this phase are 7-10 years old, but "many adult low-skilled

readers remain in this stage" (Bear et al., 2004, p. 15). This phase begins when students

are able to spell single-syllable, short vowel words correctly. In the within-word pattern

stage, students have to abandon the linear, sound-by-sound approach and begin to learn

patterns and letter sequences. They begin to look at vowels more closely and to learn

long-vowel patterns. This phase parallels Henderson's transitional phase (Henderson,

1991). During this time, students must make a transition from the alphabetic to the

meaning layer of English spelling (Bear et al., 2004).

By the time students are in upper elementary or middle school most enter the

syllables and affixes phase of spelling development. They now examine multisyllabic

words and learn how spelling preserves spelling-sound relationships at syllable junctures.

Students also begin to understand the meanings of affixes. The final phase in this model

is the derivational relationships spelling phase. At this point, students begin to examine

the meanings of root words, to use morphology to understand how and why the meanings

and spellings of word parts remain consistent in multisyllabic words even though

pronunciations may vary.

Gentry (2004) conceptualizes spelling development in a way that is similar to

Ehri's phase theory. His phases of developmental spelling correspond to a great extent

with Ehri's phases of word learning, although Gentry's phases begin with a phase that

has no equivalent in Ehri's model. In this first phase, children have no ability to use letters or to spell. When students move into Ehri's prealphabetic stage, they begin what Gentry refers to as precommunicative spelling (Ehri, 2000b; Gentry, 2004). During this phase, students use letters in their "writing" without matching the letters to sounds. As they continue to the partial alphabetic phase of word reading, children are able to make some letter-sound matches, thus demonstrating that they have partial phonemic awareness. In Gentry's model, children at the full alphabetic phase of word writing begin to use one letter for each sound in the word, showing that they have complete phonemic awareness. Gentry's last phase parallels Ehri's consolidated alphabetic phase. Children are able to use letter combinations based on phonics, but they are not yet accurate spellers, since they may use the wrong combinations and patterns for the word or syllable they are trying to spell (Ehri, 2000b; Gentry, 2004).

The stage or phase theories developed by Ehri (2000), Henderson (1991), Gentry (2004) or Bear et al. (2004) propose that the stages children pass through in learning to spell are marked by their use of different types of information. In contrast, Trieman (1998) and others view spelling development as rather more continuous. In this view, known as the strategy approach, children from the very beginning draw on a variety of strategies in their efforts to spell. According to strategy theory, even very young children are able to use familiar patterns and knowledge of morphology in their spelling; this is why even first grade children seldom begin a word with *ck*. They have already discovered that *ck* does not appear at the beginnings of words. Further, by first grade, children know enough about morphology to spell *dirty* with a *t* rather than with a *d*

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(*dirdy*) because they recognize the relationship between *dirt*, where the *t* is phonetically correct, and *dirty*, which could be spelled phonetically with a *d* (Trieman 1998, p. 7).

Strategy theory also disagrees with the idea expressed in stage and phase theories that there is "consistency among a child's spelling at a given point in time" (Trieman 1998, p. 8). Instead of a child in the letter-name phase spelling *bar* as *br* and mess as *ms*, strategy theory suggests that such consistency is not always found and that children instead draw on a number of different strategies and different types of knowledge when they attempt to spell words (Bourassa & Trieman, 2001; Trieman, 1998). Perhaps, as Trieman and Bourassa suggest, an accurate view is "to depict spelling development as consisting of the predominant use of a particular process or strategy at different points in time, but not to the complete exclusion of others" (Bourassa & Trieman, 2001, p. 4).

As can be seen from the preceding discussion, there is general agreement among these theories. All propose that children who are learning to spell move through a series of developmental stages or phases which are related to their knowledge of the alphabetic principle, words, and the conventions of English spelling. As Templeton and Morris say, "The fundamental insight that has emerged from this line of research is that most learners share a common developmental sequence of acquisition of orthographic knowledge. There is not unanimity of opinion, however, regarding the description and characterization of this development over time" (Templeton & Morris, 2000, p. 4).

Theories such as those discussed above have led researchers to the understanding that spelling is not something that can be acquired naturally. Although spelling, reading, and writing share a common base of underlying knowledge, learning to spell requires

direct instruction. It cannot be acquired on an "as-needed basis" through reading and writing (Graham, 1990; Templeton & Morris, 2000).

<center>Spelling of Older Learners</center>

In this section, several studies that are concerned with spelling of older readers are discussed. Greenberg, Ehri, and Perrin (1997) and Viise (1996) examined the spelling of adult literacy learners, while Battacharya and Ehri (2004) examined the effect of different conditions on the decoding, memory, and spelling of sixth- to ninth-grade students. Scarborough, Ehri, Olson, and Fowler (1998) studied the phonemic awareness of college students. While varied in purpose and method, all contribute to our knowledge of older spellers' development.

Greenberg, Ehri, and Perrin (1997) used a reading-level-match design to examine whether adult literacy students and reading-level-matched elementary school students have similar word-reading processes. Their study compared adult literacy students and elementary school children in decoding-related tasks. The students in the study completed three phonological tasks, decoding pseudowords, deleting phonemes in words, and segmenting words into phonemes, and five orthographic tasks, reading a list of atypically spelled words, spelling words correctly, identifying which word of a pair of nonwords was more wordlike, identifying which of a pair of letter positions is more common, and distinguishing pairs of words that are spelled differently but rhyme. Two hypotheses for the study were advanced. First, if adult literacy students perform similarly to elementary school students on tasks, it would indicate that adult literacy students and elementary school students follow the same path to literacy but that adult literacy

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students do so more slowly. Second, if adult literacy students perform worse than elementary school students, it would indicate that the adult students are deficient in some reading processes and that their deficits may explain their difficulty in learning to process words.

To assess their development of spelling knowledge, the researchers dictated 20 words from an inventory designed to assess spelling development.   The results indicated that adults read more sight words correctly than did the children, but children spelled more words correctly. Adults had relative orthographic strengths but phonological weaknesses when compared to elementary school students. Greenberg, Ehri, and Perrin suggest that this indicates that the two groups differ in their development of orthographic and phonological ability. They further suggest that systematic instruction is necessary for students to learn the alphabetic system and to practice using it in reading and writing, and that the adult literacy students may have been at risk for reading failure when they entered school and did not receive adequate instruction to overcome this risk. Learning how spelling symbolizes speech at the phonemic level is harder in English than in some other languages, and a lack of instruction may have made it more difficult for the adult literacy students to catch up to other students.

Scarborough, Ehri, Olson, and Fowler (1998) studied phonemic awareness after elementary school. Of particular interest is the third study in their paper, in which they examine how well-educated adults segment words after they have been instructed to consider how the sounds are represented by letters. Ehri (1992) has suggested that the units used by readers to bond pronunciations to spellings are the graphophonemic units in a word. Adults, who are used to "thinking about letter-sound relationships in terms of

graphophonemic units", should not have difficulty in identifying the sound elements that are represented by letters, especially in words where there is a one-to-one correspondence between letters and phonemes.

Subjects for the study were 46 college students who were presented with a list of 19 words and were instructed to draw marks under single-letter or multiple-letter parts of a word that represented a single phoneme. They were told to leave silent letters unmarked. Four of the words had one-to-one correspondences between phonemes and graphemes. The remaining 15 had silent letters, digraphs, and words which had complex relationships between phonemes and graphemes. The mean number of words correctly segmented was only 7.6, less than half the total number presented. If a group of college students did this poorly on a task requiring mapping grapheme-phoneme correspondences, it may indicate that for poor spellers, explicit instruction in this area is important.

Battacharya and Ehri's 2004 study examined how three conditions (graphosyllabic analysis, reading unanalyzed whole words, and untreated control) affected sixth- to ninth-grade students' ability to decode novel words, remember how to read words, and remember how to spell words. The hypothesis of the study was that students in the graphosyllabic treatment would be better able to decode words and pseudowords, remember words for reading and spelling, and use known words to analogize.

Sixty students in sixth- through ninth- grades who read 2 to 5 years below grade level participated in the study. Participants were randomly assigned to a syllable treatment group, a treated control group, or an untreated control group. Students in the

treatment groups took the pretest, met for four training sessions, then took the posttest.

Students in the control group remained in their reading classes. Students in the syllable

treatment group practiced a 5-step process of word analysis. First, students pronounced

the word, and then gave its meaning. If necessary, they were given help pronouncing the

word and giving its meaning. They then orally divided the word into syllables and

matched the written and pronounced syllables. Finally, they blended the syllables to read

the word. The treated control group practiced reading the same set of words, but they

read them as whole words and did not analyze the parts of the words.

The results of the study indicate that the syllable training did help struggling

readers remember the spellings of words better than the other two groups. The students

who read the whole words without analyzing them remembered spellings better than the

untreated control group. Battacharya and Ehri suggest that any practice with reading

words will strengthen memory for the spelling of the words, but the benefit is much

stronger when words are analyzed at the graphosyllabic level. There may be several

reasons for the benefit. The syllable group may have helped students to pay more

attention to all the letters rather than focusing on just the beginning and ending letters,

and may have helped students stop trying to guess words based on a partial reading of the

letters. This may have benefited students because "struggling readers have more

difficulty remembering how to read and spell words because they form only partial

connections in memory" and syllable training helped students to "more fully bond

spellings to pronunciations in memory" (p. 344). According to the authors, this study

"supports the value of teaching struggling readers to read multisyllabic words by

analyzing and matching their syllabic constituents to pronunciations" (p. 345). The study

also seems to support the value of teaching students to carefully analyze the spelling and pronunciation of words to enhance their ability to spell the words later.

In a 1996 study, Viise compared the spelling development of adult literacy students and elementary school students. She hypothesized that adults and children who spelled at the same general level would make the same kinds of spelling errors. She also hypothesized that the errors would disappear when more advanced levels of reading and spelling were reached. The subjects for her study were a group of 195 elementary school students and a group of 124 adults who were enrolled in adult literacy programs. Viise used a Word Feature Spelling list which she developed for the study. On this list, the words are divided into subgroups of five words each, with each subgroup composed of words that are examples of the same spelling feature. Words were arranged to follow the developmental pattern suggested by Henderson (1981) and others. There were 24 features, which were divided into three achievement levels. Spelling was scored by counting the number correct on each sublist of the Spelling Feature List. Only the feature being considered in the subgroup was examined, so for Feature A, a score of correct was given if the subject had the correct beginning consonant.

The analysis of the data showed that a similar pattern existed in all groups. More complex spelling features were not accomplished until simpler features were mastered, and this was true for both adult literacy students and children. Viise found that the order in which spelling features are mastered is similar in both children and adult literacy students. One finding of interest was that there were differences in the area of phonological processing. Adults tended to depart from the phonic spelling of a word when the word had a morphemic ending. Adults had particular difficulty with the

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representation of syllable units in multisyllabic words, suggesting possible difficulties with phonemic awareness.

Phonological Awareness and Spelling

Based on Viise's finding that older learners who struggle with spelling follow the same developmental sequence as beginners, it is appropriate to review some of the studies that have been done with younger learners. Specific phonological/phonemic skills were of interest in several studies. Ball and Blachman conducted a study in 1991 to evaluate the effect that teaching children to segment words and teaching them letter names and letter sounds might have on reading and spelling acquisition. Davidson and Jenkins (1994) examined the impact of training in blending, segmenting, or a combination of both on beginning readers' reading and spelling, while segmenting was the focus of Castiglioni-Spalten and Ehri's 2003 study. Castle, Riach, and Nicholson's 1994 study evaluated the effects of teaching the phonemic awareness skills of segmentation, deletion, substitution, and rhyme on spelling ability.

MacDonald and Cornwall (1995) were interested in whether or not early phonemic awareness correlates with later reading achievement. Drake and Ehri (1984) used an alternative approach to word pronunciation to help children remember how to spell words, and Ehri and Soffer (1999) studied the relationship of graphophonemic awareness to spelling development. The final study in this section is Nagy, Berninger, and Abbott's 2006 study of the effect of morphological awareness on students' reading comprehension, decoding, and spelling.

While the studies are diverse in purpose and methodology, they all contribute to our understanding of spelling. Support for the importance of phoneme awareness in learning to read and spell comes from Ball and Blachman's 1991 study, which evaluated the effects of teaching kindergarten children to segment and also teaching letter-names and letter-sounds. Eighty-nine kindergarten students participated in the study. Children were grouped according to pretest scores and randomly assigned to one of three groups, a phoneme awareness group, a language activities group, or a control group. Students in the phoneme awareness group learned to segment words. They were taught to pronounce an item after the instructor had pronounced it, then to say each phoneme and move a tile to represent the phoneme. After three weeks of this activity, letters were written on some tiles to help students learn the connection between letters and sounds. Other segmentation activities were introduced during the second component of training including sound categorization activities. In the third component of the training, children were taught letter names and letter sounds. Children in the language activity group participated in several different activities including vocabulary development and listening to stories. Additionally, the children in this group received letter-name and letter-sound instruction. The control group got regular classroom instruction with no special intervention.

A spelling measure was included as a posttest. Children spelled five words and two scores were calculated, the total number of words spelled correctly and a developmental score which was designed "to evaluate the extent to which an unconventional spelling captured the phonetic structure of the word" (Ball & Blachman, 1991, p. 58). Analysis of the scores showed that the phonemic awareness training group

scored significantly higher on both measures of spelling than either the language activity or control groups and that the language activity and control groups did not differ significantly from each other.

Davidson and Jenkins (1994) conducted a study designed to examine how specific phonemic processes contribute to beginning word reading and spelling. Their purpose was to determine the impact of phonemic awareness training that taught blending, segmenting, or a combination of both on beginners' ability to read and spell words.

Subjects for the study were 40 kindergarten students who were randomly assigned to 1 of 3 treatment groups or to the control group. In the segmentation treatment, students heard a word pronounced then were asked what sounds they heard. Corrective feedback and modeling of the separate sounds continued until the students responded correctly. Ten items were introduced in each session and treatment continued until all students reached mastery. In the blending treatment group, an instructor presented the sounds of each consonant-vowel combination, then had the students say the word the sounds made, e.g., " 'm' 'y', say it fast. 'my' " (Davidson & Jenkins, p. 152). Instruction continued until mastery was achieved. In the third treatment group, the students learned to segment and then to blend. Segmentation was reviewed regularly during the blending training. The students in the control group listened to stories during the treatment period. Results of the study indicated that both segmenting-only and segmenting-blending helped students' spelling. Davidson and Jenkins found no evidence that learning to blend alone was helpful in learning to spell.

Another study which examined whether teaching children to segment words would improve their ability to read and spell was conducted by Castiglioni-Spalten and

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Ehri (2003). This study was designed to compare two methods of teaching beginning readers to segment words. One group was taught to use articulatory pictures to segment while the other group was taught to use blocks. A third group served as an untreated control. The hypotheses of the study were 1) that students taught to segment will perform better than untaught students in learning to read words by memory and inventing partial alphabetic spelling; and 2) those students taught to segment using articulatory gestures will read and spell better than those who learn to segment without articulatory gestures.

The subjects for the study were 45 kindergarten students who were in the partial alphabetic phase of reading development. Students from the same schools were placed in triplets based on pretest measures and members of triplets were randomly assigned to 1 of 3 groups. The first group (mouth) was taught to segment words using articulatory pictures that showed the mouth positions used to produce different sounds. The children were taught to pronounce the separate sounds in a word or pseudoword then place a picture for each sound in a diagram of blocks. Students in the second group (ear) also learned to pronounce the sounds, but positioned blocks without pictures as they segmented. The students in the control group remained in their classes and received regular instruction.

Results of the study showed that students in both the mouth and ear groups were able to spell more sounds correctly than students in the untreated control group. Interestingly, effect sizes for spelling were approximately the same for both mouth (0.96) and ear (0.95), indicating that the training was equally effective and that using articulatory pictures had no advantage for spelling.

Davidson and Jenkins' (1994) study, Castiglioni-Spaltman and Ehri's (2003) study, and Ball and Blachman's (1991) study all indicate that teaching students to segment words may help them learn to spell the words.

A group of New Zealand researchers worked within a whole language program to examine the contribution of phonemic awareness training to learning to spell (Castle, Riach, & Nicholson, 1994). Thirty kindergarten children were matched in pairs, and then assigned to 1 of 2 groups. One group, the control group, used a whole language approach to writing with process writing, in which children write their own stories using their own invented spelling. The second group participated in activities designed to increase their phonemic awareness. These activities taught segmentation, substitution, deletion, and rhyme. Both groups were given pretests and posttests, including spelling measures.

When results were analyzed, the analysis showed that there was a significant difference between groups on the standardized spelling posttest, and that the phonemic awareness training group's scores were significantly higher than the control group's scores. The researchers also gave an informal spelling test which included pseudowords. The phonemic awareness group had a greater ability to spell pseudowords, perhaps, as the authors suggest, because their increased phonemic awareness helped them use grapheme-phoneme correspondences. Overall, the results of Castle, Riach, and Nicholson's (1994) study support the idea that phonemic awareness facilitates spelling development, at least for young children.

MacDonald and Cornwall (1995) reassessed students who had participated in an earlier study of phonemic awareness when they were in kindergarten to see if there was a correlation between early phonemic awareness and later reading and spelling

achievement. The findings of the initial study (MacDonald & Gates, 1983, cited in

MacDonald & Cornwall, 1995) indicated that a strong correlation (r = .44) exists between

phonemic deletion abilities and word identification for kindergarten students (MacDonald

& Cornwall, 1995, p. 524). In the 1995 study the researchers reassessed the original

participants to determine if there was a similar correlation between their phonemic

deletion ability in kindergarten and their reading and spelling achievement in high school.

The authors hypothesized that reading and spelling achievement eleven years later would

be significantly correlated with their phonemic deletion ability.

Of the 58 students who participated in the original study, 24 were located and

agreed to participate in the follow-up. A number of tests were administered to assess

phonemic awareness, reading, and spelling abilities. The results of this study indicated

that phonological awareness is a long-term predictor of word identification and spelling

skills. Students who had high phonological awareness in kindergarten had higher

spelling skills in high school than did students who had had lower phonological

awareness as kindergarteners. This study supports the idea that phonological awareness

skills are important in learning to spell.

In a 1984 study, Drake and Ehri examined an alternative approach to pronouncing

words that are to be learned as spelling words. They suggested that directing children to

use the pronunciation key provided in commercial spelling programs could interfere with

memory for the spelling of the word because children might remember incorrect letters in

the sound spelling (Drake & Ehri, p. 301). They designed a study to test two hypotheses:

1) that creating a "careful pronunciation" for a word in which pronunciation is modified

so that letters are all pronounced phonemically would enhance memory for the spelling;

and 2) that "pronouncing sound" spellings using the pronunciation keys of spelling programs would interfere with memory for the correct spellings.

Subjects for the study were 42 fourth-grade students who were matched according to spelling ability. Members of the matched pairs were randomly assigned to groups, one to a phonetic training group and the other to the conventional training group. Students were taught either the careful pronunciation or the phonetic representation using phonetic spelling symbols. Words taught were the same for both groups. Ehri and Drake found that students in the conventional group, who were taught the careful pronunciation of conventional spellings (for example, *exercise = ex er ci se*) spelled more words correctly than did subjects in the phonetic group, who were taught using a dictionary pronunciation key (for example, *exercise = ek sər siz*). The students in the conventional spelling group also remembered silent letters and those letters that represented schwa vowels better than the phonetic group students.

In this study, the hypothesis that having students produce careful pronunciations of words would help them to remember the spellings and having students pronounce the sound spellings would interfere with the memory for spelling was borne out. Drake and Ehri also found that the effect for poor spellers was greater than the effect for good spellers.

This study raises doubts about using the pronunciation keys found in dictionaries and commercial spelling programs, especially for poor spellers. While careful pronunciation may cause learners to mispronounce the word, it does make the letters in the word more memorable. Most of the mispronunciations were minor, and did not

interfere with word reading because the reader already knew the correct pronunciation of the word, having heard it in speech.

Ehri and Soffer (1999) studied the relationship of graphophonemic awareness (the ability to match graphemes to phonemes in words) to reading and spelling development in children at three different literacy levels. They hold that a student must learn "how many different letters in the spellings of words function as graphemes to symbolize specific phonemes" and "how to segment pronunciations of words to detect these phonemes" (Ehri & Soffer, 1999, p. 2). The purpose of Ehri and Soffer's 1999 research was to examine graphophonemic unit marking skills in readers at different levels of ability and to determine whether students' awareness of graphophonemic units changed as students gained more skill in reading and spelling.

Participants were 78 students in second- through fifth- grades. Students were given a grade level spelling test, a graphophonemic unit marking task, and a common spelling test. The graphophonemic unit marking task had three parts. First the experimenter modeled marking the graphophonemic units, pronouncing each sound and then circling the letter or letters that correspond to the sound. Students completed a practice activity, and then took a test on which they marked the graphophonemic units on a list of 24 words.

The results indicated that older students were able to mark more words (both simple and complex) correctly than were younger students. When spelling scores were analyzed, a strong positive correlation was found between spelling scores and marking graphophonemic units correctly for the least mature spellers. Correlations were weak and nonsignificant for the older spellers, leading the authors to suggest that beginning

spellers, those in the full alphabetic phase of learning, rely more heavily on analyzing graphophonemic units than do older spellers in the consolidated phase, who use more larger units to spell. This study supports teaching graphophonemic awareness as well as phonemic awareness to help children learn to read. Although the subjects were elementary school children, the findings may also be applicable to older struggling readers, who may need the support provided by graphophonemic training.

As Ehri and Soffer (1999) point out, as students mature as readers and spellers, they begin to move away from graphophonemic analysis and begin to use larger units in words. Nagy, Berninger, and Abbott (2006) studied the effect of morphological awareness, phonological memory, and phonological decoding on reading comprehension, reading vocabulary, and spelling. They were interested in whether morphological awareness made a significant contribution beyond that of phonology. They note that when students learn letter-sound correspondences in phonics programs, they still need other strategies to enable them to deal with the complexities of English orthography (p. 136). The need for additional strategies increases as students encounter content-area text containing more complex, low-frequency, and unfamiliar words. According to the authors, morphological awareness, the ability to analyze words into their component morphemes, should help students read and spell complex words for two reasons. First, because morphemes occur more frequently than words, a low-frequency complex word can be processed quickly because the morphemes are familiar, and second, when a word in chunked into morphemes rather than individual letters there are usually fewer units that need to be processed (p. 137).

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Participants in the study were 607 fourth- through ninth-grade students. Measures of morphological awareness, phonological abilities, and literacy outcomes (reading, vocabulary, reading comprehension, spelling, and decoding) were administered to all participants and results were analyzed. The correlation between morphological awareness and spelling (0.66) was significant ($p < .001$). At all grade levels morphological awareness made a significant, unique contribution to spelling, although the strongest effects were for the sixth and seventh grade group. This finding is consistent with Bear et al.'s (2004) theory of spelling development in which morphology, the meaning layer, is the last stage to be studied. This study supports teaching morphological awareness, but because the benefits are greater for older students, struggling readers may need more instruction on phonemic and graphophonemic skills before they progress to the study of morphemes.

Spelling Instruction Studies

As well as studies that examine the roles phonology and morphology play in spelling, there is a group of studies that informs us on the value of different approaches to spelling instruction. It is apparent that simply presenting a list of words on Monday and testing students on Friday is not enough to allow the students to learn to spell words (Bloodgood, 1991; Graham, 2000). Researchers have examined different ways of teaching spelling so that students are able to use the words. Gaskins and her colleagues from the Benchmark School have developed the Word Detective program for use with struggling readers and spellers (Gaskins, Ehri, Cress, O'Hara, & Donnelly, 1997). Foorman, Francis, Lieberman, and Novy's 1991 study examined the effects that letter-

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sound instruction had on the reading and spelling of first- grade students, while Foorman et al. (2006) studied the role that teacher effectiveness and time spent on literacy instruction had on the literacy outcomes of elementary school students in high-poverty schools. Graham, Harris, and Chorozempa (2002) conducted a study that examines the contribution of spelling instruction to spelling, reading, and writing, while another study reports the effects of spelling-only instruction, spelling and composing instruction together, and composition-only instruction on the reading, writing, and spelling of children (Berninger et al., 2002). In the final study in this section, Ehri and Wilce (1987) examined the differences between cue reading and cipher reading and note the differences in spelling ability as children progress from cue to cipher reading. While these studies, like the others in this chapter, have young children as subjects, they inform us about the ways different methods of spelling instruction affect individuals' spelling ability.

The work done by Gaskins and her colleagues at the Benchmark School includes the development of the "Word Detective" approach to teaching spelling (Gaskins, 2004; Gaskins et al., 1997). In this program, teachers choose key words each week. The key words are chosen to represent common sound-letter patterns and to allow the children to learn different ways to analyze words. At the beginning of the program, teachers clarified for students the goals of the program. This step was considered important because the process of fully analyzing the words is a somewhat laborious and monotonous process and the teachers believed that if the children understood why it was important, they would be more willing to participate. Next, children were taught to analyze the words carefully by segmenting words into sounds, then comparing the sounds

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to the letters and determining which letter or letters match each sound (Gaskins, 2004, p. 72).   Students learned to stretch out the pronunciation of a word so that they could segment it into its constituent phonemes and count the sounds. They then learned to match a letter or letters to each sound and to write the word. During guided practice, the students practiced going through this procedure to match letters and sounds in unfamiliar words, and included self-assessment in their activities. Students check to make sure that they have really learned the key words for the week, and often work with partners to share what they have learned about the words. The teachers found that students who were taught with the Word Detective program made greater gains in reading and spelling than did a previous group who had not been taught with the Word Detective program, although the difference for spelling was not statistically significant (Gaskins et al., 1997, p. 325).

Foorman et al. (1991) studied the role of letter-sound instruction as it affects reading and spelling. In their study, they expected that children who were explicitly taught letter-sound correspondences would spell and read regular words more accurately than children who were not taught letter-sound correspondences and would apply the correspondences to exception (non-regular) words, misspelling them in an effort to regularize them. They also predicted that children who received more letter-sound instruction that included phonemic segmentation and blending skills would have better knowledge of word spellings and more accurate word readings.

The subjects, 80 first grade students, came from three classrooms in which letter-sound correspondences were taught and three classrooms where the emphasis was on teaching words in meaningful contexts. In the classrooms where letter-sound

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relationships were not taught, spelling was taught daily using a method in which teachers showed students the word, pronounced the word, pronounced each syllable, then each letter-sound. Students then pronounced and wrote the word. This approach did provide some letter-sound instruction for these students, but the researchers point out that students in the letter-sound classes received over three times more letter sound instruction. The classrooms with more emphasis on letter-sound relationships also had a 20-minute spelling lesson each day. Teachers dictated a list of words and students worked with the words each day in their workbooks. Both groups took spelling tests on Friday.

The researchers administered a spelling test three times, in October, February, and May. When the data were analyzed, significant differences in favor of the letter-sound group were found. The letter-sound group improved faster than did the non-letter-sound group in spelling both regular and exception words. The findings from this study support Ehri's (1989) theory that knowing how to spell a word is relevant to being able to read the word; thus teaching children letter-sound relationships will improve both reading and spelling.

The impact of teacher effectiveness and time spent on literacy instruction was the focus of a 2006 study by Foorman et al. They were interested in how these variables would affect literacy outcomes for elementary school students in high poverty schools. One hypothesis tested in this study was that the "activities to which teachers allocate time during reading/language arts instruction and ratings of teacher effectiveness will explain variability in reading and spelling achievement above and beyond students' initial ability" (Foorman et al., 2006, p. 6).

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This was a large study involving 17 schools and 1285 first- and second-grade students. All the schools involved were identified as high-poverty, with the percent of students qualifying for free or reduced lunch ranging from 85% to 100%. Researchers observed and coded the activities in each classroom for instructional format and content, and for on-task or off-task behavior. Among the content categories were spelling instruction and spelling in the context of reading instruction. Teacher effectiveness was measured using a checklist which rated teachers on competency in planning, management, instruction, monitoring students learning, and personal characteristics, and a global rating of teacher effectiveness on a 1 to 7 scale where 1 was "not effective" and 7 was "highly effective"(Foorman et al., 2006, p. 9).

Spelling was measured only at the end of the study, and the researchers found that for highly effective teachers the amount of time dedicated to teaching spelling did not have a significant effect on spelling outcomes, perhaps because these teachers spent more time on phonemic awareness activities than they did directly teaching spelling. For low-effective teachers, the more time spent on grammar, mechanics, and spelling, the lower the spelling outcomes. The researchers noted that the spelling instruction presented by these teachers consisted mainly of independent work in spelling workbooks so students did not spend time on the phonemic awareness activities that the students of the more effective teachers participated in. This study demonstrates that teacher effectiveness is important to literacy outcomes, including spelling, and that independent work and working in workbooks are not in and of themselves sufficient to teach spelling regardless of how much time is devoted to these activities.

Another study by Graham et al. (2002) examined the contribution of spelling instruction to spelling, reading, and writing. They noted that spelling is important to writers in several ways. A misspelled word may cause readers not to understand an author's message; poor spelling can influence the way a teacher evaluates a child's competence as a writer; and difficulty mastering spelling may lead students to avoid activities that require writing (p. 669).

Because spelling is important to writing, the authors designed their study to examine the relationships between spelling and writing. Because some investigators believe that there are very close relationships between spelling and reading, and that learning to spell enhances children's ability to read (Adams, 1990; Ehri, 2000b), the study also examined the link between spelling and reading.

In the study 60 second-grade children who were identified as at-risk for spelling failure were randomly assigned to either spelling instruction or math instruction. Each group received instruction for six months. During these six months, 48 spelling lessons (8 units with 6 lessons in each unit) were taught. Activities included word-sorting, word hunts, word building, phonics practice, and spelling test correction. Review of patterns and skills taught earlier was also included. Students in the math group received 48 math lessons (8 units with 6 lessons in each unit) but no extra spelling instruction. Spelling, reading, and writing assessments were administered as pretest and posttest measures.

Analysis of posttest measures showed that students in the spelling group spelled more words correctly than did students in the math group and that the word attack skills of the spelling group improved more than those of the math group; however, spelling instruction did not make a statistically significant difference on a word recognition test.

The differences between the two groups for spelling were maintained on the maintenance measures, but there was not a statistically significant difference in word attack skills after six months. The students in the spelling group performed better on a writing fluency test, but there was not a statistically significant different for story length or story quality. The gain in writing fluency was not apparent on a maintenance measure administered six months after the end of the study.

Although the findings were mixed, the study does support the existence of a link between spelling and writing and between spelling and reading. It is important to teach spelling explicitly and systematically, especially for those students who are weak spellers and at-risk for spelling failure. Extra spelling instruction may help these students acquire both sentence writing and word-attack skills in addition to strengthening their spelling skills (Graham et al., 2002, p. 683).

An experimental study conducted to examine the effects of spelling-only instruction, composing-only instruction, or a combination of spelling and composing instruction also supports the need for spelling instruction (Berninger et al., 2002). The researchers were interested in whether combining these two specific components of writing would be more effective than teaching either component alone. They note that in traditional phonics instruction children are taught letter-phoneme correspondences for single letters and a letter-by-letter strategy for sounding out words, but when children try to apply this to spelling, that is, to transforming speech into written form, they may become confused because many words in English don't have one-to-one correspondences. There are instead alternations, which are "alternative ways of

representing the same phonemes in English orthography" for specific spelling units of letters that don't correspond to a phoneme (Berninger et al., 2002, p. 295).

The hypotheses for the study were that explicit instruction will result in greater learning than practice alone; that explicit instruction aimed at spelling would improve spelling; that explicit instruction aimed at composition would improve composition; and that explicit instruction in both the alphabetic principle and its alternations would have added value over instruction in the alphabetic only.

Subjects for the study were 96 third-grade students who were randomly assigned to one of four groups: spelling only, composing only, combined spelling and composition, and control. Children in the spelling-only group received instruction in the alphabetic principle and were taught to apply it to spelling words. They also received explicit instruction in alternations. The compose-only group learned to write informational and persuasive essays using graphic organizers as scaffolds, and also participated in reflexive discussion with teachers and peers. During reflexive discussion the students engaged in discussions that would facilitate the lesson planned for the day. The discussions included brainstorming ideas, debating ideas, or discussing word choices and sentence construction. At other times, students discussed revising their work (Berninger et al., p. 296). In the combined treatment group children received instruction in the alphabetic principle and in teacher-directed writing. They did not receive instruction in alternations nor did they participate in discussions about their writing.

Pretest and posttest spelling measures were administered. Analysis of the results showed that, as expected, spelling training did improve spelling of taught words and that explicit training in the alphabetic principle and alternations added value above alphabetic

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alone to children's ability in phonological decoding but not for word-specific learning of taught words. This study indicates the existence of a link between spelling and reading.

Ehri and Wilce (1987) differentiate between cue reading and cipher reading. In cue reading, words are remembered by specific distinctive visual features of the spelling which are then associated with the word's pronunciation and meaning (for example, the "humps" in the middle of the word "camel"). Cipher reading develops when children have learned their letters, have phonemic segmentation skills, and understand that spellings correspond to pronunciations. This study was designed to learn more about how phonetic cue reading differs from cipher reading and whether learning to decode transfers to spelling tasks. According to Ehri (1984) and Juel, Griffith, and Gough (1986), learning to decode should transfer to spelling for two reasons. First, decoding skill allows the reader to store word spellings in memory, and second, decoding should allow spellers to segment words into phonemes that can be matched with letters.

Thirty kindergarten students were tested on measures of reading skills and intelligence. They were placed in either a cipher-training or a cue-training group. Cipher-trained subjects learned to read sets of similarly spelled words that were mostly nonsense syllables, and cue-trained subjects were taught to produce isolated sounds corresponding to the consonant letters in the cipher-training words. Cue-trained subjects were also taught real words with beginning sounds that were associated with the sounds of the letters (Ehri & Wilce, 1987, p. 5). A dictation test of 15 words taught was given as a posttest measure. Students wrote each word, then were asked what the word spelled on whether it looked right. Cipher readers were less likely than cue readers to change their spellings as a result of these questions. When the posttest results were analyzed, cipher

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readers outperformed cue readers on spelling dictation and also recorded more correct letters. This finding indicates that "the ability to decipher print makes an enormous contribution to word reading and word spelling skills…decoding skill by itself is responsible for these advantages" (Ehri & Wilce, 1987, p.11).

Summary

In the preceding review of the literature, major theories of spelling development were reviewed. While there are some areas of disagreement, most theorists agree on the major points. Spelling appears to develop in stages or phases, although children may use strategies from more than one phase at a time. While there are similarities between reading and spelling development, reading is not in and of itself sufficient for students to learn to spell. As Graham (1990) pointed out, spelling cannot be caught from reading, but must be taught.

Studies which involved older readers indicated that older students who struggle with spelling do benefit from systematic instruction in spelling (Greenberg, Ehri, & Perrin, 1997). Viise's (1996) study showed that adult literacy learners progress through the same stages that younger struggling reading-level-matched readers do, but adult learners move through the stages more slowly. Battacharya and Ehri's (2004) study show the value of supporting older struggling readers' spelling with instruction in syllabication and word analysis.

Studies that investigated the relationship between phonological awareness and spelling show that there is a correlation between phonemic awareness and spelling (Castle, Riach, & Nicholson, 1994; Davidson & Jenkins, 1999; MacDonald & Cornwall,

1995). Several studies support the importance of teaching students to segment words to help them learn to spell (Ball & Blachman, 1991; Castiglioni-Spalten & Ehri, 2003; Davidson & Jenkins, 1994). Drake and Ehri's study shows that teaching students to study words that are pronounced phonemically helped students remember the correct spellings of words while Ehri and Soffer found that teaching students to develop graphophonemic awareness helped them learn to read and spell.

Several studies on spelling instruction provided insight into the utility of different approaches to spelling instruction. Letter-sound instruction was found to be effective by Gaskins et al. (1997) and Foorman et al. (1991). Other studies supported the need for spelling instruction (Berninger et al., 2002; Graham et al., 2002.) as opposed to letting students acquire spelling from reading. All of the preceding studies provided direction for the present study.

CHAPTER 3

METHODOLOGY

This chapter describes the methodology of the study. The purpose of the study, to

investigate the use of wordmapping in a high school classroom, and the research

questions that guided the study are restated. The research design is described and the use

of a quasi-experimental design is explained. The participants, ninth-grade remedial

English students and the instruments used in the study are described. The procedures

used to train students in wordmapping are explained, and the chapter concludes with a

discussion of how the instruments were scored.

Setting

The study was conducted during the fall semester of the 2006-2007 school year at

a public high school in a small city in west Georgia with a student body of 1090. Forty-

six percent of the students qualified for free and reduced lunches. There are 598 white

students, and 390 black students. In this population, 102 students were identified as

"other."

Communication Skills classes, which were remedial English classes for ninth-

grade students, were used for the study. Students were placed in these classes based on

Criterion-Referenced Competency Test (CRCT) scores from eighth grade or

recommendations from eighth grade teachers. I selected classes for participation based

on my availability (during an inclusion period and planning period) and the agreement of cooperating teachers to participate in the study. All students in the selected classes were invited to participate in the study, and all students participated in the activities for their class, but only those students who returned signed parental informed consent and student assent forms had their data included in the study. Twenty students participated, 14 in the wordmapping group and 6 in the vocabulary group. There were only 16 students in the class divided between the wordmapping group and the vocabulary group, and although only 4 students declined to participate, the vocabulary group was small in comparison to the wordmapping group. Of the students in the wordmapping group, there were 8 males and 6 females. One was white, 11 were African-American, and 2 were Hispanic. In the vocabulary group, 2 were white, 3 were African-American, and 1 was Hispanic. There were 4 females and 2 males in the group. All students participated in the activities as part of their classroom instruction.

A 10-week pilot study conducted during the spring semester of the 2005-2006 school year provided guidance for this study. Dr. Bruce Murray, Mrs. Geralyn Murray, and I designed a study to investigate the effects of wordmapping in two high school special education classes. Subjects in the study were 21 students who were placed in special education resource classes in two public high schools in Georgia and Alabama. The students all had individual educational plans (IEPs) that had goals for increasing language skills. In the pilot study we used a within-subjects design, so that each student served as his or her own control. The students took the Kaufmann Test of Educational Achievement (KTEA-II) spelling subtest as a pretest and posttest measure (Kaufman & Kaufman, 2004).

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The words used in this study were science vocabulary words. Teachers presented three words each Monday and two words each Tuesday. On Wednesday and Thursday, students reviewed the words, and on Friday they took a test. During the first week of the study, students learned and used the wordmapping method for studying the words. During the second week, the words were presented without wordmapping and students were directed to study the words in their preferred manner. Wordmapping and non-wordmapping methods were used on alternate weeks for the remainder of the 10 weeks.

Informal observations during the course of the study revealed a problem with the research design. After 3 weeks, 4 of 8 students in one class said that they always used wordmapping to study the words and 2 said that used wordmapping most of the time, even on non-wordmapping weeks. This made it difficult to assess the impact of wordmapping on the students' spelling skills.

Analyses of Variance (ANOVAs) were conducted on pretest and posttest scores. No significant differences were found between the weeks the students used wordmapping and the weeks they studied the words independently. When we examined the results, another problem appeared to be the small number of words studied each week. One researcher reported that with only 5 words to study, several of her students were able to memorize the words right before the test without really studying them. We also used a test of all 50 words studied as a posttest measure. Scores on the posttest were low, and we were concerned that test fatigue might have been a problem, especially since our subjects were students who were struggling learners.

The present study did not use a within-subjects design because we realized that once the students mastered the wordmapping method, some were using it as their

preferred method of study for every week. We also felt that the number of words studied each week needed to be increased. Some of the students were easily able to memorize the words just before the test so we were not able to detect any differences between the wordmapping and non-wordmapping weeks. The number of words on the final test was reduced to prevent test fatigue from affecting the scores. With this in mind, the following research questions were developed for the present study.

Research Questions

The following research questions guided the study:

1. Do students who studied wordmapping score significantly higher on a standardized posttest measure of spelling than do students who study words without using wordmapping?

2. Do students who are taught to use the wordmapping method for spelling place more letters correctly in the words on a standardized posttest measure of spelling than do students who study words without using wordmapping?

3. Do students who are taught to use the wordmapping method for spelling score higher on teacher-made cumulative test of words taught than do students who study the same words without using wordmapping?

4. Do students who are taught to use the wordmapping method for spelling place more letters correctly on a teacher-made cumulative test of words taught than do students who are taught the same words without using the wordmapping method?

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5. Do students who study wordmapping score significantly higher on a posttest measure of reading decoding than do students who study the same words without using wordmapping?

6. Do students who study wordmapping score significantly higher on a posttest measure of reading comprehension than do students who study words without using wordmapping?

7. Do students who study wordmapping score significantly higher on test of vocabulary than do students who study the same words without using wordmapping?

Research Design

This study used a quasi-experimental research design. Intact classes were used, and although students were randomly assigned to classes, the selection of classes included in the study was based on scheduling.   There were two groups in the study. The wordmapping group was composed of members from two classes. In the first class, all students were included in the treatment and in the second class the students were randomly assigned, half to wordmapping and the other half to vocabulary study. Wordmapping treatment groups were selected at times when the researcher was able to meet with them. Because the vocabulary group was drawn from the same class as one of the wordmapping groups, it was not randomly selected.   Students in both groups had been placed in Communication Skills (remedial English) classes based on grades or teacher recommendations at the end of the eighth-grade year. Scheduling into specific classes was done by computer, with intervention by an administrator to resolve schedule conflicts.

A pretest-posttest design was used. In this study, subjects could not be randomly assigned from a common population because I had to use intact classes. However, Campbell and Stanley (1963) point out that the use of a control group, even though subjects were non-randomly assigned, strengthens the design when a pretest-posttest design is used, as was the case in this study. While such a design does control for main effects of history, maturation, testing, and instrumentation, regression may not be as well controlled for; however, using an Analysis of Covariance (ANCOVA) increases the probability that differences between groups on the posttest measure are the result of treatment. ANCOVAs adjust for differences on the covariate, in this case the pretest score, then evaluate whether the means on the dependent variable (in this case, the posttest) are the same across groups (Green & Salkind, 2003, p. 191).

One group of instruments was administered in the classroom by either the classroom teacher or me. These tests were the Kaufman Test of Educational Achievement or KTEA spelling subtest (Kaufman & Kaufman, 2004), the Reading Placement Test (Touchstone Applied Science Associates, 2001), the weekly spelling tests, the final word list, and the vocabulary test. The KTEA reading comprehension and decoding subtests were individually administered by school system special educators.

Pretests and posttests were used to compare the effects of the two different treatment conditions, wordmapping and vocabulary study. In the wordmapping condition, students were instructed in the wordmapping method, which involves breaking words into syllables, counting phonemes, drawing blanks for each phoneme, and placing the correct letters in each blank. Vocabulary study students used the same list of words as did the wordmapping students, but focused on the meanings of the words rather than

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the spellings. Treatment conditions were used to examine the effects of two different

types of instruction on students' spelling, decoding, and comprehension.

Instruments

Several different measures were used. One group of tests was used as pretest and

posttest for both groups. This was done to determine the effect of the treatment. Tests

that were given at the beginning and end of the study are as follows.

The KTEA spelling subtest, a dictation test of 60 words, is a standardized test of

spelling ability (Kaufman & Kaufman, 2004). Validity and reliability are reported in the

manual. Split-half reliability coefficients for the spelling subtest for ninth grade were .90

and .93 (Kaufman & Kaufman, 2004, p. 90). For purposes of this study, the score used is

the percent correct rather than standard scores, and basal and ceiling points were not

used. This was done so that each student would produce a large number of spellings that

could be analyzed both for percent correct and for correct letter placement (which is

explained later in this chapter). I administered this test to the wordmapping groups and

the classroom teacher administered it to the vocabulary group. The test was administered

at the beginning and the end of the study.

The Reading Placement Test (Touchstone Applied Science Associates, 2001) was

provided with the curriculum adopted for the Communications Skills classes and was

required to be given in all Communications Skills classes. The Reading Placement Test

is a 56-item test that requires students to read progressively more difficult passages. At

the end of each passage, a cloze paragraph is presented and the student chooses the

correct word from a list given on the same page. This test was administered by the classroom teacher at the beginning and end of the study.

At the request of administrators, the KTEA reading comprehension and reading decoding subtests were administered to all students in the Communication Skills classes. These tests were administered by system personnel in September and May. They are individually administered tests, and split-half reliability coefficients as reported in the test manual are 0.95 and 0.96 for the reading comprehension subtest and 0.97 and 0.97 for the decoding subtest (Kaufman & Kaufman, 2004, p, 90). The reading comprehension subtest requires students to read progressively more difficult passages silently, read one to three questions at the end of each passage, and orally provide the answer to the examiner. Basal is reached when three consecutive questions are answered correctly, and the cutoff point is three or more incorrect answers in a set of five words. Scores are reported as standard scores. The decoding subtest requires students to read a list of progressively more difficult words. Basal is reached when three words are read correctly and the cutoff is reached when three or more words in a set of five words are read incorrectly or passed. Scores are reported as standard scores.

In addition to the above instruments, several other measures were used. One of these was the weekly word lists, which were developed to teach wordmapping and were used by the wordmapping and vocabulary study groups. These lists combined words that were likely to be encountered on standardized tests, including the SAT, and words that students might encounter in their content area reading. This approach was used at the request of the cooperating teachers and the administration. Words were drawn from several different sources, including *500 Key Words for the SAT* (Gulotta, 2006), *Words*

Their Way (Bear et al., 2004), *The Spelling List and Word Study Resource Book* (Fresch, & Wheaton, 2004), *The Vocabulary Teacher's Book of Lists* (Fry, 2004), and student nomination. Student-nominated words were ones that were encountered in content area reading. The word list for each week had 12 words. While traditional spelling programs usually present between 20 and 25 words each week, some research suggests that it is inappropriate for struggling spellers to try to learn this many (Scott, 2000, p. 71). For this reason, and because of time constraints, 12 words were considered an appropriate number.

Posttest-only measures were two tests that were given to measure how well students learned the words on the weekly word lists. The first of these posttests was a list that sampled the words taught during the study. I selected 24 words, three from each weekly list, for the test. For the wordmapping group, words were dictated by the researcher, and for the vocabulary group, words were dictated by the classroom teacher. A vocabulary test was also administered to both groups to examine their knowledge of the word meanings. This was a cloze test with 24 items and participants used a word bank.

<div align="center">Procedures</div>

The students in the fourth period class were randomly assigned to either wordmapping or vocabulary study. Instruction took place during the first 15 minutes of each period and lasted for nine weeks. Only eight weeks of the data were used because weekly tests were inadvertently returned to students in one group before they could be analyzed.

<div align="center">51</div>

Wordmapping instruction followed a weekly pattern. On Monday, the first six words on the weekly word list were introduced using a standard procedure as follows:

1. I pronounced the word and gave a brief explanation of the meaning.

2. Students were told to say the word slowly, stretching it out, and to count the syllables. A slash was put on the board for each syllable.

3. Students were told to stretch each syllable out and count the number of sounds in each syllable. They were told to pay attention to their mouth positions if they weren't sure of the number of sounds. Students responded and discussed the number of sounds until agreement was reached, then a blank was put on the board for each sound.

4. The rest of the syllables were mapped the same way.

5. I then placed the correct letters in each blank.

This procedure is shown in Figure 1.

6. Students' attention was directed to any parts of words where more than one letter occupied a blank. Students were also instructed not to draw a blank for silent letters but to put them above the line. (For example, *smile* would be mapped s/m/i/l^e).

7. I then asked the students "What are the tricky parts of the word?" For the word *avoidance* they would identify the schwa vowels in the first and third syllables. Schwa vowels were always identified as "tricky parts" as were silent letters.

This process was repeated for each word, and the session ended with a quick review where I pronounced each word, noted the "tricky parts," and briefly gave the word's meaning.

Model of Wordmapping for the Word Avoidance

1. Word is pronounced.

2. Syllables counted and marked: / /

3. Sounds for first syllable counted and marked: __/   /

4. Sounds for second syllable counted and marked: ___/___ ___ ____/

3. Sounds for third syllable counted and marked: ___/___ ___ ___/ ___ ___ ___

5. Letters placed: _a_/_v_ _oi_ _d_/ _a_ _n_ _c_ [e]

On Tuesday, we quickly reviewed the first six words then followed the procedures for the next six words, ending with a quick review. Wednesdays, the students participated in cooperative learning activities for review. Activities varied from week to week. They included a concentration-type game. Students played in groups of four. Each group had a deck of cards with all of the words introduced during the week and a selection of review words that had previously been introduced. There were two cards for each word, one with the word correctly printed and the other with the wordmap and some but not all of the letters. Students had to match the cards correctly. This was a popular activity with students.

Another popular activity was playing hangman. One student put the correct number of markings for syllables and phonemes on the board while others guessed the letters. In order not to be "hanged," the students who were guessing had to tell the student at the board where each letter should be placed.   This was played in groups of four or five and was one of the most frequently requested activities.

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The students sometimes participated in study-buddy pairs, first using wordmaps to correctly spell the words and then quizzing each other on the words. Spelling bees were another popular activity. I called out the word. Students worked in teams, and the speller had to put the wordmap on the board, put the correct letters in the spaces, and write the word in cursive. Teammates were allowed to assist the person at the board and students on the team provided lively if sometimes inaccurate clues for the speller.

On Thursdays, students participated in a teacher-led review of wordmapping, followed by a quiz. Students graded their own papers, errors were discussed, and corrections were made. On Friday, students chose a review activity and then took the weekly test.

The vocabulary study group was instructed by their classroom teacher using the same list of words that the spelling group was working with. On Monday and Tuesday the words were introduced on the overhead. The teacher told the students that they would take a spelling test of Friday but gave no direction on how they should prepare for the test. Wednesday the students discussed and the teacher reviewed the words. Students either generated their own sentences or filled in a cloze sentence worksheet. On Thursday the teacher reminded the students that there would be a test the next day and gave them time to study the words using their preferred method. The teacher reviewed the word meanings on Friday. Both groups took a dictation test on Fridays, and the vocabulary group also took a test on word meanings, using either cloze sentences or matching words and definitions. The classroom teacher used the vocabulary grade for a test grade for the vocabulary group and the spelling grade as a test grade for the experimental group.

The posttest measures given at the end of the study were the KTEA spelling test, the reading placement test, the vocabulary test, and the word list. The KTEA reading comprehension and reading decoding tests were given in April, five months after the end of the study.

Scoring

Because the number of letters correctly placed was of interest, the weekly test, KTEA spelling test, and word list were scored two ways. The first score, which was the grade used by the classroom teacher for the wordmapping group each week, was the percent of words spelled correctly. The second score, the percent of letters correctly placed, was calculated because I was interested in examining whether wordmapping would help students more closely approximate correct spellings even if the words were not spelled 100% correctly. The following method was used to score the number of letters correctly placed.

1. The score for each word equaled 1 point for each letter placed correctly plus 1 point if the word was correctly spelled. For example, the word *miscellaneous* had a total possible score of 14 (13 letters plus 1 point for correct spelling).

2. Letters in students' spellings were matched with the letters in correct spelling. For example, *m i s c e l l a n e o u s* was matched with the students' spelling of *m i s e l l i o u s*. In the example, the students' spelling received a score of 9 because the letters matched were *m, i, s, e, l, l, o, u,* and *s.* After the letters were matched the score was calculated as a percentage of points earned out of the possible points for the lists. This procedure is illustrated in Figure 2.

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Figure 2

Example of Scoring

m i s c e l l a n e o u s
| | | | ⁄⁄ ⁄⁄
m i s c l l i o u s

_____

CHAPTER 4

RESULTS

Introduction

This chapter describes the statistical procedures used to analyze the data collected in the study and presents the results of the analyses.

Data Analysis

One-way analyses of covariance (ANCOVA) were used to analyze the data collected. Since pretest and posttest scores were compared, ANCOVA were used to evaluate the differences between the two groups (wordmapping and vocabulary) on the dependent variable (posttest scores) while statistically controlling for the covariate (pretest scores) (Green, Salkind, 2003, p. 159). For all F tests, partial η^2 (eta squared) is included as a measure of effect size. Partial η^2 indicates the proportion of variance in the dependent variable that is explained by the independent variable (Green & Salkind, p. 153). When using partial η^2, 0.01 is considered a small value, 0.06 a moderate value, and .14 a large value. These values differ somewhat from the standard values of 0.2 for small, 0.5 for moderate, and 0.8 for large effect sizes used with other statistics.

Spelling Measures

One groups of research questions regarded outcomes on four spelling measures, the KTEA spelling subtest percent correct, the KTEA spelling subtest letter placement percent correct, the word list percent correct, and the word list letter placement percent correct. The adjusted and unadjusted means are presented in Table 1. Standard deviations are not presented for the adjusted mean because the ANCOVA statistically controls for the covariate in the adjusted mean.

Table 1

Adjusted and Unadjusted Group Means for KTEA Spelling Percent Correct

Group	Adjusted Mean	Unadjusted Mean	SD
Wordmapping	68.79	72.07	13.39
Vocabulary	58.98	51.33	10.80

For the KTEA spelling subtest percent correct, a one-way ANCOVA was conducted. The independent variable was group (wordmapping or vocabulary), the dependent variable was the posttest score, and the covariate was the pretest score. The ANCOVA was significant, $F(1, 17) = 11.63$, $p < .05$ ($p = .003$). Partial η^2 was .41. Significant differences between the groups were found when pretest scores were held constant.

The KTEA spelling subtest was also scored for percent of letters correctly placed. The adjusted and unadjusted means are presented in Table 2. Standard deviations are not

presented for the adjusted mean because the ANCOVA statistically controls for the

covariate in the adjusted mean.

Table 2

Adjusted and Unadjusted Group Means for KTEA Spelling Letter Placement Percent Correct

Group	Adjusted Mean	Unadjusted Mean	SD
Wordmapping	86.97	88.86	7.03
Vocabulary	78.08	73.76	14.62

A one-way ANCOVA was conducted for the percent of letters correctly placed.

For this test, the independent variable was group (wordmapping or vocabulary), the

dependent variable was the posttest score, and the covariate was the pretest score. The

results of the ANCOVA were significant, $F(1, 17) = 9.49$, $p < .05$, $(p = .007)$. Partial η^2

was .36. Significant differences between the groups were found when pretest scores were

held constant.

The word list test was given as a posttest only measure. As with the KTEA

spelling subtest, two scores were obtained, the total percent correct and the percent of

letters placed correctly. The group means are presented in Tables 3 and 4.

Table 3

Group Means for Word List Total Percent

Group	Mean	SD
Wordmapping	60.0	20.18
Vocabulary	24.0	19.76

Table 4

Word List Letter Placement Percent Correct

Group	Mean	SD
Wordmapping	88.14	7.95
Vocabulary	68.00	19.70

One-way ANOVAs were conducted on both scores. For both ANOVAs, the independent variable was group and the dependent variable was the posttest score. There was no covariate because the test was used as a posttest only. Both ANOVAS were significant. For the total percent correct on the word list test, $F(1, 18) = 13.52$, $p < .05$, ($p = .002$), Partial $\eta^2 = .43$. A significant difference between the groups was found. A one-way ANOVA was also conducted for the percent of letters correctly placed on the word list test. The ANOVA was significant, $F(1,18) = 11.07$, $p < .05$, ($p = .004$). Partial η^2 was .38.

Reading Comprehension

Two reading comprehension tests were given as pretest and posttest measures. The first of these was the KTEA reading comprehension subtest. Adjusted and unadjusted group means are presented in Table 5. Standard deviations are not presented for the adjusted mean because the ANCOVA statistically controls for the covariate in the adjusted means.

Table 5

Adjusted and Unadjusted Group Means for KTEA Reading Comprehension

Group	Adjusted Mean	Unadjusted Mean	SD
Wordmapping	87.67	87.85	10.34
Vocabulary	83.37	83.00	0.56

A one-way ANCOVA was conducted. The dependent variable was the posttest score, the independent variable was group, and the covariate was the pretest score. The ANCOVA was not statistically significant, $F(1, 16) = 1.09$, $p > .05$, ($p = .342$). Partial η^2 was .06. No significant differences between groups were found when the pretest scores were held constant.

The Reading Level Placement test was given as a second measure of reading comprehension. This test was given as both a pretest and a posttest. The adjusted and unadjusted group means are presented in Table 6. Standard deviations are not presented

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for the adjusted mean because the ANCOVA statistically controls for the covariate in the adjusted mean.

Table 6

Adjusted and Unadjusted Group Means for Reading Level Placement

Group	Adjusted Mean	Unadjusted Mean	SD
Wordmapping	78.0	79.43	13.52
Vocabulary	69.37	67.60	4.72

A one-way ANCOVA was conducted, with group as the independent variable, the posttest score as the dependent variable, and the pretest score as the covariate. The ANCOVA approached significance, $F(1, 16) = 4.02$, $p < .05$ ($p = .062$), partial $\eta^2 = .20$. However, significant differences between the groups were not found at the $p < .05$ level when pretest scores were held constant.

Decoding and Vocabulary

The KTEA decoding subtest was given as a pretest and posttest measure. The adjusted and unadjusted means are presented in Table 7. Standard deviations are not presented for the adjusted mean because the ANCOVA statistically controls for the covariate in the adjusted mean.

Table 7

Adjusted and Unadjusted Group Means for KTEA Decoding

Group	Adjusted Mean	Unadjusted Mean	SD
Wordmapping	91.29	93.00	7.72
Vocabulary	89.71	86.00	10.26

A one-way ANCOVA was conducted, with group as the independent variable, the posttest score as the dependent variable, and the pretest score as the covariate. The results were not significant, $F(1, 16) = .404$, $p > .05$ ($p = .534$). Partial η^2 was .03. No significant differences between groups were found when pretest scores were held constant.

The last measure, the vocabulary test, was given as a posttest measure. Means are presented in Table 8.

Table 8

Group Means for Vocabulary

Group	Mean	SD
Wordmapping	27.21	21.11
Vocabulary	27.50	12.42

A one-way ANOVA was conducted. The independent variable was group and the dependent variable was the posttest score. There was no covariate because the vocabulary

test was given as a posttest only. The ANOVA was not significant, $F(1, 18) = .001$, $p >$ .05, ($p = .976$). Partial η^2 was .00. No significant differences between groups were found.

CHAPTER 5

DISCUSSION

Introduction

This chapter presents a discussion of the results of the wordmapping study, the implications of the results, and the limitations of the study. Recommendations for further research conclude the chapter.

Summary of the Results

The purpose of this study was to investigate the effects of two ways of teaching words, wordmapping and vocabulary study, on the spelling, reading decoding, and reading comprehension abilities of a group of ninth-grade struggling learners. Twenty ninth-grade students from two Communication Skills classes were divided into two groups, wordmapping and vocabulary study. The spelling, reading decoding, and reading comprehension abilities of each group were measured using standardized pretests. Four standardized tests, the KTEA spelling, KTEA reading decoding; KTEA comprehension, and Reading Level Placement test, were given as both pretest and posttest measures. Two tests designed for the study, the word list and vocabulary tests, were given as posttest- only measures.

The tests were scored, and analyses of covariance (ANCOVAs) were conducted for the pretest posttest measures. Analyses of covariance were used because the

ANCOVA evaluates whether the means on the dependent variable, in this case the posttest scores, are the same across groups (wordmapping and vocabulary) while adjusting for the covariate (in this case, the pretest scores). The results of the ANCOVA indicate whether the adjusted group means differ significantly from one another. Analyses of variance (ANOVAs) were conducted to evaluate the results of the posttest-only measures. The findings of the study indicate that the group that learned wordmapping differed significantly from the vocabulary study group on all posttest measures of spelling. They showed significant advantages in the percent of words spelled correctly on both the KTEA spelling test ($p = .007$, $F(1, 17) = 9.49$, partial η2 = .41) and the word list test ($p = .004$, $F(1, 18) = 11.07$, partial $\eta2 = .43$). The wordmapping group also showed a significant advantage when the percent of letters placed correctly was analyzed both on the KTEA ($p = .007$, $F(1, 17) = 9.49$, partial $\eta^2 = .36$) and on the word list ($p = .004$, $F(1, 18) = 11.07$, partial $\eta2 = .38$.

This advantage may be due, at least in part, to two components of the wordmapping instruction. First, wordmapping teaches students to segment words when they are told to listen to and count the sounds in each syllable and then to draw blanks to correspond to each sound. When they do this, they segment each syllable into its component phonemes. There is a body of research that supports the idea that phonemic awareness, especially phonemic segmentation, helps students learn to spell words (Ball & Blachman, 1991; Castiglioni-Spalten & Ehri, 2003; Castle, Riach, & Nicholson, 1994; Davidson & Jenkins, 1994). The wordmapping method of teaching spelling words teaches students to listen carefully to the sounds of the words and to segment. Students learn to say a word slowly and listen carefully to the sounds of each syllable, to count the

number of sounds in the syllable, and then they see the letters that are used to spell the sound.

While it is usually assumed that by the time students are in high school, they no longer need phonemic awareness training, Scarborough et al. (1988) found that even a group of college students had difficulty segmenting complex words, while Greenberg, Ehri, and Perrin (1997) suggest that systematic instruction is needed for even older learners to learn the alphabetic system and to be able to use it in reading and writing. Struggling readers may have even more need for reinforcement of their phonemic awareness abilities. Although students in the vocabulary study group did study the words as spelling words, they were not taught to segment or syllabicate the words, and thus they did not learn to syllabicate the words or to segment them into the component sounds. Their attention was not drawn specifically to the correspondences between the letters and the sounds. Since the students in the vocabulary study group were struggling learners, as were the students in the wordmapping group, they did not get the reinforcement of their phonemic awareness abilities that the wordmapping group received.

Wordmapping also helps students develop graphophonemic awareness. After students have drawn the blanks for the sounds they hear, the teacher places the correct letters in the blanks. Ehri and Soffer (1999) found that teaching children to mark graphophonemic units by marking or circling the letters that corresponded to each sound improved their spelling when compared to a group of children who did not learn to mark graphophonemic units. Wordmapping is a form of marking the units, since students first hear the word, then draw an appropriate number of blanks, and finally place the correct letters into the blanks. Battacharya and Ehri (2004) found that sixth- to ninth- grade

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students who were taught graphosyllabic analysis that involved dividing words into syllables and then matching written and pronounced syllables improved their spelling. When students learn to wordmap, they divide the words into syllables and then match the letters and sounds, and so this too may strengthen their spelling abilities.

Although some research has found that older learners do not benefit from phonemic awareness training, this group of learners may have benefited even though they are in high school. Viise (1996) found that adult literacy learners followed the same pattern of spelling development as did elementary school students, and that complex spelling tasks were not accomplished until the simpler tasks had been learned. Since phonemic awareness is foundational for both reading and spelling, it appears that struggling readers of any age may benefit from methods of instruction that provide the kind of age-appropriate phonemic awareness support given in wordmapping. Another factor that may have helped the wordmapping students improve their spelling was that they enjoyed the wordmapping class and seemed to look forward to both the wordmapping and the activities they participated in during the week. I observed that they were very enthusiastic about counting the number of sounds in each syllable (there was often a spirited discussion when they didn't agree), and that the students really enjoyed the group activities. The opportunity to practice the spelling words with team competitions like hangman, concentration, or spelling bees helped the students in the wordmapping group look forward to the class and participate actively and enthusiastically. Often on Wednesdays students came into the class asking if they were going to play hangman or concentration, and on Fridays when they chose their own review activities, there were sometimes three or four different reviews going on at the

same time. Research indicates that cooperative learning activities are important in motivating students to learn (Shaaban, 2006).

No significant differences were found between the groups on the decoding or vocabulary measures (partial $\eta^2 = .03$ for decoding and partial $\eta^2 = .00$ for vocabulary). I had expected that the students in the vocabulary group would perform better on a test of the words they were taught since the focus of their instruction was to study the word meanings. I reviewed each student's test. This review revealed that many of the students in both groups apparently made very little effort on this test. Two patterns could be seen. Eleven students left the majority of the questions blank, and answered 6 or fewer items out of 20. Eight students copied the word list into the blanks, making only a few changes. Another possible reason for the low scores on the vocabulary test was that because of scheduling constraints, this test had to be given during the week of final exams, by which time the students had already taken end-of-course tests and final exams in several subjects. A possible explanation for the low scores and lack of significant difference between the groups may be that the students were suffering from test fatigue and didn't try to remember what they had learned.

Word reading could be expected to improve for wordmapping group since there is research that shows a link between spelling and word reading. "A combination of instruction in phonological awareness and spelling instruction facilitated children's word reading" (Ehri, 1989, p. 358). For the students in this study, however, better spelling skills did not equate with better word reading skills. This may be because decoding was not being explicitly taught in the reading section of the Communication Skills class and during wordmapping I did not draw attention to the link. Perhaps explicitly teaching

students to apply their wordmapping strategies to reading unfamiliar words would have strengthened their decoding abilities.

Reading comprehension did not improve for either group, which was not unexpected since word recognition did not improve. When word recognition improves and students are able to devote less cognitive energy to decoding, they can devote that energy to comprehension but in this study students were still struggling to decode individual words.

<div align="center">Limitations</div>

There were several limitations to the study. The participants were limited to students who were identified as needing extended instruction in language arts during the 2006-2007 school year and who were enrolled in remedial classes at a public high school in a small city in Georgia. Because this is a special population, the results of this study may not generalize to non-remedial students. The small number of participants limits the power of the study. If the study could have been conducted over several semesters to increase the number of participants, it would have strengthened the findings; however, the Communications Skills classes were not taught the following semester at the participating school.

It was not possible to determine how much spelling instruction or what kinds of spelling instruction the participants had had previously, and the treatment conditions were limited to wordmapping instruction and vocabulary study instruction. Previous exposure to other types of instruction may have influenced the results of this study, and using different treatments might have affected the outcome.

Another limiting factor was the nonrandom assignment of classes. Ideally, participating classes would have been selected from all Communications Skills classes being taught, but this was not possible. The study was conducted in a public school, and scheduling constraints, the availability of the researcher to conduct training, and the willingness of classroom teachers to participate dictated which classes would participate. If the participants could have been randomly selected, it would have strengthened the study. Although the classes were not randomly selected, students were randomly assigned within one of the classes, which strengthened the study. Given the exigencies of working within a public school, the quasi-experimental research design, while not ideal, allowed the research to be conducted while interfering as little as possible with the day-to-day functioning of the classes.

Implications

The importance of teaching spelling is clear. Students who cannot spell adequately are at a disadvantage in high school, when writing becomes a critical skill, and a student's poor spelling often impacts the grade the student earns on written work (NCES; 2003; Graham & Harris; 2005; Graham, 2000). The results of this study have several implications for teaching spelling to older struggling learners. Teaching students to segment words and to count syllables and the sounds within each syllable can improve students' word learning and spelling. While it is frequently assumed that phonemic awareness training is not needed at the high school level, age-appropriate activities that teach segmenting may help the struggling learner at this age. Wordmapping teaches both segmentation and letter-sound correspondence in a way that is appropriate and enjoyable

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for high school students. Students who learned the segmenting and letter-sound correspondence skills were able to make progress and were able to move past the stages that had been problematic for them in the past.

Cooperative learning activities were observed to improve the learning of the students in the wordmapping group. The students in the wordmapping group participated willingly in the activities, which they enjoyed. Hangman, concentration card games, spelling bees, and study-buddy pairs were all requested on Fridays when the students had a choice of how to review the words for the test. While there is support for cooperative learning in high school, many teachers do not take the time to plan such activities. For spelling, at least, the results of this study indicate that it is well worth the time spent to plan and carry out these activities.

This study addresses the problem of how to teach older students who have not been successful in learning to spell. While the study did not address the reasons for these students' lack of success, the findings of the study indicate that the wordmapping method of teaching spelling can have a positive impact on the learning of these students.

Recommendations for Further Research

The following recommendations for further research are made based on the results of this study.

1. Conduct the study using a larger number of participants to improve the generalizability of the results. If this study could have been conducted over a period of two semesters with the same participants, the power of the study would have been increased.

2. A study comparing wordmapping with another spelling instruction method such as word study would provide insight into the relative strengths of different spelling instruction strategies. In this study vocabulary instruction did not have a noticeable impact on either the word knowledge or the spelling ability of the students in the vocabulary study group. Comparing wordmapping to a program such as word study, which has been shown to be effective, would provide more information about the strength of wordmapping.

3. Include specific instruction within the wordmapping framework to help students apply the wordmapping strategies to decoding. In this study, the classroom teacher did not provide decoding instruction in the reading classroom, and I did not provide it during the wordmapping instruction.   If students could use the same strategies they learn in wordmapping to help them decode words, not only their spelling but their reading could be enhanced.

4. Conduct a study with and without cooperative learning experiences to explore to what extent the cooperative learning experiences increase spelling above and beyond the contribution of wordmapping. In this study, only the wordmapping group had cooperative learning experiences. A study in which both groups had the same cooperative learning experiences would help to find the extent to which cooperative learning strengthened the wordmapping experience.

5. Conduct the study using a true experimental design with full random assignment of subjects. If I had been able to randomly assign the participants to the groups to study, the research design would have been stronger.

6. Replicate the study with younger students at a similar developmental spelling. This could help examine whether wordmapping is an effective means of instruction for normally developing spellers.

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APPENDIX A

Informed Consent/Assent Letter

INFORMED CONSENT/ASSENT
for a Research Study Entitled Investigating Wordmapping in a High School Class

You are invited to participate in a research study to compare the benefits of two word-study techniques. This study is being conducted by Nancy Steinen, doctoral student in Reading Education, and Dr. Bruce Murray, Associate Professor in the Department of Curriculum and Teaching at Auburn University. You were selected as a possible participant because you are in a 9th Grade Communications class.

The study will last ten weeks, and it will be conducted during your regular class time. Students will be assigned to one of three groups. Some students will use wordmapping to analyze and remember the spellings of a list of vocabulary words provided by Mrs. Steinen every week. In wordmapping, students will learn to divide words into syllables, determine how many sounds there are in each syllable, draw blanks for each sound within the syllable, then put the letters that make up the sound into each blank. Other students will study the meanings of the same words that are used in the wordmapping. They will work with their classroom teacher to learn the meanings and uses of the words. Some students will study a set of words and meanings provided by their classroom teacher as part of her regular instruction. All groups will take pretests and posttests in spelling, vocabulary, and reading comprehension so we can analyze how effective different kinds of instruction are.

If you choose not to participate in the study, you will continue to participate in the normal classroom instruction, which will include the spelling or vocabulary instruction for your class; however, your data will not be included in the study. If you do participate, you may withdraw at any time without penalty, and you may retrieve your information or have it removed from the study. Your decision whether or not to participate will not jeopardize your future relations with Auburn University, the Department of Curriculum and Teaching, or Carrollton High School.

The only risks with this study are a risk of breach of confidentiality and a risk that you might feel coerced to participate; however, only Mrs. Steinen and your teacher will see the papers with your identifying information. After they have recorded grades, your name will be removed from each paper, and no one else will have a way to find out who took which test. Your teacher and Mrs. Steinen will not know who has chosen to participate until after the study is over and your grades have been recorded. If you decide not to allow us to use your information, you will still participate in one of the three groups as part of your language arts instruction but we will not use your data in our study. Your information will remain confidential. If we publish what we learn in a professional journal or at a scientific meeting, none of your personal information will be included.

You may improve either your spelling or vocabulary from your work in this study. You may get more confident in spelling and in written expression, and you may increase your reading comprehension. Teachers may learn a better way to teach spelling or vocabulary. We cannot

promise you that you will receive any or all of the benefits described. If at the end of the study, we find that one of the experimental instructional treatments (wordmapping or word study) proves to be effective in helping students learn the spelling and meanings of words and you were not included in that group, either Mrs. Steinen or your teacher will provide the opportunity for you to learn this technique. This will give you the opportunity to learn using the same procedures that were used during the study.

If you have any questions, we invite you to ask them now. If you have questions later, please contact Mrs. Steinen at 770-834-7726 or Dr. Murray at 334-844-6934. We will be happy to answer them. You will be provided a copy of this form to keep. For more information regarding your rights as a research participant you may contact the Auburn University Office of Human Subjects Research or the Institutional Review Board by phone (334)-844-5966 or e-mail at hsubjec@auburn.edu or IRBChair@auburn.edu.

HAVING READ THE INFORMATION PROVIDED, YOU MUST DECIDE WHETHER OR NOT YOU WISH TO PARTICIPATE IN THIS RESEARCH STUDY. YOUR SIGNATURE INDICATES YOUR WILLINGNESS TO PARTICIPATE. If you choose to participate, please return this letter to Mrs. Joy Holley, Curriculum Director, Carrollton High School.

_____

_____
Participant's signature   Date   Investigator
                                                      Date

_____

                                                      _____
                                                      _____
Print Name   Parent/Guardian Signature
                                                      Date

WORD LIST

altruism

anathema

antibiotic

anticlimactic

antihero

antinuclear

antipathy

antiseptic

appetite

audacious

auspicious

avoidance

bearable

benign

boisterous

camouflage

confidence

contraband

capricious

contradict

conscious

caustic

contrary

caution

curious

daunted

deference

denounce

disappoint

disjointed

dubious

embroider

emphasize

euphemism

exploitation

fermentation

foist

furious

futile

fortunate

gregarious

gnash

gnat

gnaw

gnome

harangue

illegal

illegible

illegitimate

illiterate

illogical

immaterial

immediate

immemorial

immerse

imminent

immiscible

immitigable

immoderate

immodest

inaudible

inauspicious

incalculable

incautious

inconvenient

incorribile

indiscreet

inoffensive

inordinate

insurmountable

invoice

irreconcilable

irregular

irrevocable

irrigation

jaunty

knowledgeable

laud

lovable

livable

loiter

malicious

miserable

moisture

obvious

officious

opposition

poise

prevarication

puncture

rejoice

sedition

supercilious

various

voluminou

APPENDIX C

WORD LIST TEST

immemorial

inauspicious

inoffensive

incautious

miserable

livable

auspicious

obvious

supercilious

irrigation

prevarication

antinuclear

poise

exploitation

moisture

anathema

caustic

incorrigible

denounce

deference

destitute

gnat

emphasi

VOCABULARY TEST

1. When you don't tell the truth, you _____.

2. Acid is _____; it will burn if you spill it on the table.

3. Losing the first game got the team off to an _____ start.

4. Jane has a great deal of _____ and can handle any situation.

5. Our very poor grades made it _____ that we need to study more.

6. People who whine and complain can make everyone else _____.

7. The _____ child ran in front of the car.

8. There is a lot of _____ in the air when it rains.

9. John was _____ and without money when he lost his job and had

to live in his car.

10. Mrs. Jones had to _____ over and over how important the

test is.

11. A _____, large, warm overcoat will help you stay warm.

12. The child was completely _____ and out of control. She would not do

anything her parents told her to.

13. After the fire, our house was not _____.

14. It was a very _____, good sign when we won $500.

15. The very idea of losing was _____ to the coach.

16. Most students in Europe are very respectful and show a lot of _____

to their teachers.

17. From times _____ parents have complained about the

music their children listen to.

18. John's behavior on the job is very _____. He never hurts

anyone's feelings.

19. That man is such a snob. He treats people in a very _____ way as if

he thinks he's better then everyone else.

20. We need some kind of _____ system to keep the plants watered.

21. Many people who want to avoid war join _____ groups that want

to ban nuclear weapons.

22. Taking advantage of elderly people is a kind of _____ and abuse.

23. When he found what lies the man had told, John decided he had to

_____ him and ask him to tell the truth.

24. I don't like when the little _____ buzzes around my food.