

EFFECTS OF PRESERVICE AND INSERVICE TEACHER KNOWLEDGE ON THE
ANALYSIS OF SPELLING ERRORS AND
CHOICE OF APPROPRIATE INSTRUCTIONAL ACTIVITIES

A Thesis

by

SUZANNE HUFF CARREKER

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of
MASTER OF SCIENCE

August 2007

Major Subject: Curriculum and Instruction

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ABSTRACT

Effects of Preservice and Inservice Teacher Knowledge on the Analysis of Spelling Errors and Choice of Appropriate Instructional Activities. (August 2007)

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Chair of Advisory Committee: Dr. R. Malatesha Joshi

Teacher knowledge enhances instruction. Of particular importance for spelling instruction is literacy-related content teacher knowledge. This knowledge includes awareness of individual speech sounds, syllables, and morphemes in the English language. Teachers who possess this knowledge are better able to assess student needs and design instruction that meets those needs so that students learn to spell well.

In this study, 36 preservice teachers and 38 inservice teachers completed a survey and three measures. The survey asked teachers to calibrate their knowledge of phonemic awareness, phonics, and spelling. The measures assessed the teachers' literacy-related content knowledge and their ability to use this knowledge to analyze student spelling errors and choose appropriate instructional activities to meet student needs. Overall, the preservice teachers were more positive in their assessments of their literacy-related content knowledge while the inservice teachers demonstrated greater literacy-related content knowledge. Neither group was adept in analyzing students' spelling errors although the inservice teachers were better able to choose appropriate instructional activities.

DEDICATION

To Larry, my rock

and

To James and Elsa, my greatest teachers

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CHAPTER I

INTRODUCTION

In recent years, there has been a growing interest in research on teachers' literacy-related content knowledge and practices (e.g., Cunningham, Perry, Stanovich, & Stanovich, 2004; McCutchen, Abbott, et al., 2002; Moats, 1994; Spear-Swerling, Brucker, & Alfano, 2005). The reason for this increased interest is succinctly encapsulated in a statement by The National Commission on Teaching and America's Future: "What teachers know and can do is one of the most important influences on what students learn" (as cited in Darling-Hammond, 1998, p. 6).

Statement of the Problem

In spite of the fact that teacher knowledge is one of the most important factors in children's learning to read and spell, teachers do not always have sufficient knowledge of literacy-related content to teach reading and spelling effectively (e.g., Bos, Mather, Dickson, Podhajski, & Chard, 2001; McCutchen, Harry, et al., 2002; Moats, 1994, 1999). McCutchen and Berninger (1999) cited two factors for this lack of knowledge. First, many teachers have not received comprehensive preservice training on how to teach reading and spelling, and their inservice training is rarely more comprehensive than their preservice training (cf. Moats & Lyon, 1996). Secondly, a body of converging scientific evidence on effective practices of teaching reading and spelling was not

This thesis follows the style of the *Journal of Educational Psychology*.

available to many teachers. In fact, a robust body of evidence has been amassed and intently disseminated only within the past decade (e.g., Snow, Burns, & Griffin, 1998; National Reading Panel, 2000; No Child Left Behind, 2001).

Some recent studies (e.g., Bos et al., 2001; Cunningham et al., 2004; Moats, 1994; Spear-Swerling et al., 2005) have looked at levels of teacher literacy-related content knowledge, specifically phonemic awareness (i.e., awareness of sounds in spoken words) and English language structures (i.e., syllables, base words, prefixes, suffixes, inflectional endings, orthographic patterns). Other studies (e.g., McCutchen, Abbott, et al., 2002; Moats & Foorman, 2003; Spear-Swerling & Brucker, 2004) have looked at levels of teacher literacy-related content knowledge and changes in teacher practices and student achievement as the results of increased teacher knowledge. Increased literacy-related content knowledge facilitates teachers' interpretation of assessments, selection of appropriate words for reading and spelling instruction, analysis of reading and spelling errors, and constructive feedback to students' errors (Moats, 1994; Spear-Swerling et al., 2005). In other words, informed teachers are more sensitive to the learning needs of individual students and make adjustments to instruction based on those needs because students learn best when instruction is proximate to their particular stage in learning to read and spell (Brady & Moats, 1997; Moats, 1999). However, these studies have shown that many teachers do not have the requisite knowledge to provide informed instruction.

Spelling and Informed Instruction

Chomsky (1971) noted that young children who did not know how to read used their knowledge of sounds and letters to spell words. While the spellings did not conform to conventional spellings, they did highlight the children's understanding of sounds and letters. The seminal work of Read (1971) furthered the idea that the spellings of young children can provide valuable information about their awareness of sounds and relationships among sounds. Read documented consistent features in the spellings that 20 preschoolers invented, using their unconscious awareness of the sound structure of words. Influenced by Chomsky and Read, other researchers (e.g., Bear & Templeton, 1998; Frith, 1985; Gentry, 1982) suggested that spelling progresses in stages and that analyzing students' invented spellings or spelling errors can be a meaningful teaching tool.

Analyzing students' spellings is proposed to help the teacher evaluate students' understanding of sounds and letters and to direct the teacher in prescribing specific instruction to meet students' needs (i.e., informed instruction; Moats, 2000; Treiman, 1998). To analyze students' spellings, the teacher must be aware of the constituent sounds within words. With this knowledge, the teacher can determine whether a student's spelling, although erroneous, demonstrates that the student at least is detecting all the sounds in the target word. For example, the spelling of the word *flame* as *flam* demonstrates that the student has heard each sound in the word while the spelling *fam* does not demonstrate the same awareness of sounds. The latter spelling indicates that

instruction should be adjusted to include practice in segmenting words with three or four phonemes.

The teacher must also understand the structures within words, such as syllables, prefixes, and suffixes, in order to assess the spellings of longer words and derivatives. For example, a student's awareness of suffixes, specifically inflectional endings, is reflected in the spelling of the word *matched* as *mached* while not in the spelling *macht*. The latter spelling suggests that instruction should be adjusted to include: 1) the explicit introduction of how to spell the inflectional ending *ed*, and 2) opportunities to practice spelling contrast words, such as *just* and *jumped* or *seed* and *seemed*.

Informed instruction takes advantage of a student's errors to design the most appropriate instruction for the student. A student's spelling errors provide visible representations that are especially telling of what he or she knows or does not know and would seem to be an excellent vehicle for designing informed instruction.

Teacher Knowledge

Informed instruction requires that teachers have solid knowledge of phonemes and language structures because "the teacher who understands language will understand why students say and write the puzzling things that they do and will be able to judge what a particular student knows and needs to know about the printed word" (Moats, 2000, p. 1). However, Moats (1994) found that many inservice teachers – some with graduate degrees – could not segment three- and four-phoneme words, could not identify structures such as inflectional endings, and consistently confused phonemic awareness with phonics instruction. This lack of knowledge of phonemic awareness and English

language structures has been documented in subsequent studies (e.g., Bos et al., 2001; Cunningham et al., 2004; Spear-Swerling et al., 2005). Bos et al. extended the Moats study to include preservice teachers as well as inservice teachers. They found that overall the inservice teacher scored higher on measures of literacy-related content than the preservice teachers and that special education inservice teachers performed higher than regular education teachers, but many inservice teachers in both regular and special education were not secure with their knowledge of phonemes and other language structures.

Not only do many teachers lack literacy-related content knowledge, they are unaware that they lack this knowledge. Cunningham et al. (2004) asked teachers to calibrate their perceptions of their knowledge of phonemic awareness, language structures, and children's literature. The researchers found that teachers were fairly accurate in their assessments of their knowledge of children's literature but overrated their knowledge in the two other domains. Spear-Swerling et al. (2005) found similar results when they asked teachers to rate their own knowledge of phonemic awareness and language structures. Accurate perception of knowledge is important to ensure that teachers are receptive to and make appropriate use of new information offered through professional development (Cunningham et al., 2004). Significant effects of increased teacher literacy-related content knowledge on student outcomes have been documented (e.g., McCutchen, Abbott, et al., 2002; Moats & Foorman, 2003; Spear-Swerling & Brucker, 2004).

Research-Based Instruction

In addition to sufficient teacher knowledge, teachers must employ research-based instruction. However, in the past 50 years there has been a debate over how to teach reading. In 1955, Flesch called for an end to the whole-word approach that was failing too many children. A decade later, Chall (1967) continued the campaign for the use of phonics-based instruction. In the mid-1970s, the whole-language movement gained prominence and supported a more naturalistic approach to learn reading, without the “drill-and-kill” of phonics (Richardson, 1991). Adams (1990), after an extensive review of reading research, proposed a balanced approach to reading. Most recently, the Report of the National Reading Panel (NRP; 2000), which was mandated by the U. S. Congress, identified five essential components of effective reading instruction: phonemic awareness, phonics, fluency, vocabulary, and comprehension. The No Child Left Behind (NCLB; 2001) *Reading First* program promotes the use of these research-based components.

Spelling was not included as a separate component in the NRP: It was subsumed under phonics. Spelling research has lagged behind reading research. The exclusion of spelling as a separate component in the NRP and the paucity of spelling research should not be construed as a proposition that spelling is not important. Spelling plays an important role in reading development (Ehri, 1989; Ehri & Wilce, 1987; Frith, 1985).

Bryant and Bradley (1980) demonstrated that spelling and reading are not the same thing, and the strategy for learning to spell is different from the strategy for learning to read. In their study, both impaired and non-impaired readers could read more

words correctly than spell correctly, and many were able to spell some words they could not read. If spelling required the same strategy as reading, then children could spell all the words they read and read all the words they spell, which is not always the case. Reading and spelling involve different mechanisms. Spelling needs to be considered as a separate and important component of literacy instruction (Joshi & Aaron, 2005).

Purpose of the Study

The purpose of this study is to determine preservice teachers and inservice teachers' calibrations of their own literacy-related content knowledge as well as establish their actual levels of this knowledge. Additionally, the study investigates the effects of literacy-related content knowledge on analyzing student spelling errors and choosing appropriate instructional activities based on student spelling errors.

The questions that will be investigated in this study include:

- 1) Are preservice teachers and inservice teachers realistic in calibrating their own knowledge of phonemes, phonics, and spelling?
- 2) What are the actual knowledge levels of participants about phonemes, syllables, and morphemes?
- 3) Does this knowledge levels influence preservice and inservice teachers' perceptions of student needs and subsequent instruction? That is, does the application of knowledge of phonemes, syllables, and morphemes help teachers analyze spelling errors and, based on those errors, choose the instruction that would best teach what a student does not understand to improve his or her spelling?

Benefit of the Study

Measuring the literacy-related content knowledge of preservice and inservice teachers and their self-calibrations will add additional information to the current body of research on teacher knowledge. Furthermore, measuring preservice and inservice teachers' ability to analyze spelling errors and choose appropriate instructional activities based on those errors may predict a teacher's potential in using informed instruction in the classroom and heighten awareness of what teachers need to learn in preparation and professional development programs.

Hypothesis

Both preservice and inservice teachers will not accurately calibrate their literacy-related content knowledge. Some teachers will overestimate their knowledge and some will underestimate their knowledge. Additionally, the current levels of the preservice and inservice teachers' literacy-related content knowledge will impact their ability to correctly analyze student spelling errors and choose appropriate instructional activities. Greater literacy-related content knowledge will result in greater accuracy in the analysis of spelling errors and choices of appropriate spelling instructional activities.

Definition of Terms

The following terms are used in this thesis. Definitions are presented to add clarity to the use of the terms:

Blend A blend has two or more adjacent letters whose sounds blend or flow smoothly together. Each letter in a blend retains its individual sound (e.g., *bl*, *cl*, *cr*, *dr*, *str*, *spl*).

Calibration of knowledge In this study, calibration of knowledge refers to the determination and evaluation of what is known and what is unknown.

Digraph A combination of two letters that represents one phoneme or speech sound (e.g., *ch*, *sh*) is a digraph.

Grapheme A grapheme is a letter or a combination of letters (e.g., *sh*, *ch*, *tch*, *dge*) that represents a single phoneme.

Inflectional ending An inflectional ending is a morpheme at the end of a word that indicates tense, number, mood, or person (e.g., *ed*, *es*, *ing*, *s*; Moats, 2000).

Literacy-related content knowledge This knowledge refers to the understanding of language structures, such as phonemes, syllables, morphemes, and orthographic patterns, that are part of phonics and spelling instruction.

Morpheme A morpheme is the smallest unit of meaning, such as a base word, root, prefix, inflectional ending, or suffix.

Morphology The study of morphemes and how they combine to form words is known as morphology.

Orthographic depth The explicitness of the phoneme-grapheme correspondences in a writing system is known as the orthographic depth. A language with nearly perfect phoneme-grapheme correspondences has a shallow orthography (e.g., Finnish). A language with more opaque phoneme-grapheme correspondences has a deep orthography (e.g., English; Seymour, 2006).

Orthography This word describes the writing or spelling system of a language and the rules that govern the system (Henry, 2003; Moats, 2000).

Phoneme A phoneme is a speech sound or the smallest unit of sound that makes a difference in the meaning of a word (e.g., /s/ in *sit* and /p/ in *pit*; Henry, 2003).

Phonemic awareness Phonemic awareness is the awareness of and ability to manipulate the speech sounds in spoken words.

Phonics Instruction that teaches the sound-letter patterns and structures of language is known as phonics.

Phonological awareness Phonological awareness involves the sensitivity to the overall sound structure of language, such as rhyming, counting syllables, and counting phonemes (Carreker, 2005a).

Phonology This word describes the sound system of spoken language and the rules that govern the system (Moats, 2000).

Syllable A syllable is a speech unit of language that contains one vowel sound and can represent a word or part of a word (Carreker, 2005a).

CHAPTER II

LITERATURE REVIEW

The purpose of this study is to investigate teacher knowledge of phonemes, syllables, and morphemes and the effects of this knowledge on the analysis of spelling errors and choice of appropriate instructional activities. This chapter will review teacher knowledge studies, spelling development, and spelling instruction.

Teacher Knowledge Studies

Moats's (1994) landmark survey heightened interest in the literacy-content knowledge of teachers. On her survey, Moats noted that many teachers do not have adequate literacy-related content knowledge. Subsequent studies confirmed the lack of knowledge of phonology and English language structures of teachers with varying degrees of preparation and experiences (Bos et al., 2001; Cunningham et al., 2004; Spear-Swerling et al., 2005). Teachers are often unaware that they lack this knowledge, which has been linked to student achievement (Cunningham et al., 2004). Teachers who were rated as having high background and experience scored well below ceiling on measures of literacy-related content knowledge. Many had been designated to work with students with the greatest needs in reading and spelling and were seen as the literacy experts on their school campuses (Spear-Swerling et al., 2005). A description of teacher-knowledge studies follows.

Survey of Teacher Knowledge

Moats (1994) surveyed 89 inservice teachers using her Informal Survey of

Linguistic Knowledge. Fifty-two teachers were given a prototype version of the survey, and the other 37 were given a refined version. All 89 participants represented an equally distributed group of experienced classroom teachers, reading teachers, speech-language pathologists, classroom teacher assistants, and graduate students. Some of the participants had graduate degrees. The range of experience was from 0 to 20 years, with an average of 5 years. The survey measured their knowledge of linguistic terms, phonics, and phonemic and morphemic awareness.

Overall, the participants showed insufficient knowledge of spoken and written language structures, information that is necessary to explicitly teach beginning readers or readers with learning disabilities. Moats (1994) suggested that without this knowledge, teachers cannot interpret and respond effectively to student errors, choose appropriate examples for teaching decoding and spelling, arrange instruction in an organized and logically sequenced manner, use morphology to explain the spellings of words, and integrate important literacy components into language arts instruction. The lack of literacy-related content knowledge, Moats surmised, stems from the lack of adequate preparation at the preservice and inservice levels as well as the teachers' underdeveloped linguistic awareness and their bias to think of words in written form instead of spoken form.

Teacher Knowledge and Teacher Perceptions of Knowledge

Bos et al. (2001) extended the Moats (1994) study to assess the literacy-content knowledge of 252 inservice and 286 preservice teachers. In their study, they collected data on teachers' perceptions about early reading and spelling instruction as well as

teachers' literacy-content related knowledge. Overall, the teachers did not have an inclination toward either implicit or explicit instruction, which would enable them to use a combination of instructional approaches as dictated by student needs. However, Bos et al. found results on the measure of knowledge that were similar to Moats's study. The teachers had gaps in their knowledge of phonemes and English language structures. Bos et al. emphasized the need for more comprehensive teacher preparation.

Cunningham et al. (2004) assessed the knowledge of literacy-related content and children's literature of 722 inservice teachers as well as the teachers' perceptions of their own expertise in these areas. The researchers measured teacher knowledge of phonology, phonics, and children's literature. Results on teacher knowledge of phonology and phonics supported earlier studies (Bos et al., 2001; Moats, 1994). Teacher knowledge of children's literature was lower than expected, with only a fraction of the teachers able to identify titles of popular books. When the researchers compared the teachers' rating of their knowledge of the three areas, they found that the teachers tended to be better calibrated in their knowledge of children's literature. Cunningham et al. also found that there were significant differences in the teachers' perceptions of their knowledge of phonology and phonics and their actual knowledge.

Spear-Swerling et al. (2005) found slightly more positive but generally similar results in their study of graduate students' self-perceptions of their knowledge of literacy-related content. Cunningham et al. (2004) summarized the importance of accurate calibration:

Under the assumption that people learn better when they are relatively well calibrated as to their current level of knowledge – because they will then calibrate their knowledge acquisition accordingly – it can be assumed that we have much work to do in professional development in the domains of phonological awareness and phonics as compared to children’s literature. (p. 162)

Increased Teacher Knowledge and Student Achievement

McCutchen, Harry, et al. (2002), Moats and Foorman (2003), and Spear-Swerling and Brucker (2004) documented positive changes in teacher practice and student achievement that resulted from greater teacher knowledge of literacy-related content. McCutchen, Harry, et al. examined teacher literacy-related content knowledge, teacher practice, and student achievement of 59 kindergarten, first-, and second-grade teachers. They found a significant correlation between teachers’ knowledge of phonology and their use of explicit phonological awareness activities. In terms of student learning, the researchers found a significant correlation between a kindergarten teacher’s knowledge of phonology and use of explicit activities and students’ end-of-the-year reading on a standardized measure. There were no correlations between first- and second-grade teachers’ knowledge and practice and their students’ achievement in word reading, spelling, and comprehension, but there was a slight correlation between the teachers’ phonological awareness and students’ writing.

Moats and Foorman (2003) reported the results of a five-year study in low-performing urban schools with students at high risk for reading failure. When 194

teachers in grades K-2 were assessed for literacy-related content knowledge, large gaps in their understanding of phonology and language structures were found. The teachers participated in intensive, ongoing professional development with classroom observations and support. At the end of the study, the relationship of the teachers' knowledge and student achievement proved to be significant but modest. Teachers with greater knowledge had students with higher reading outcomes. Gains in spelling were not noted.

Spear-Swerling and Brucker (2004) studied the literacy-related content knowledge of 147 novice teachers and the achievement of the second-grade children they tutored in six 60-minute weekly sessions. The novice teachers received 18 hours of training before they began the tutoring. The training included information about phonemes and English language structures. The teachers also received ongoing training for 75 minutes a week for an additional eight weeks and supervision as they tutored. The teachers were pre- and post-tested on knowledge of literacy-related content. The students were also pre- and post-tested on reading and spelling measures. There was not a control group of untutored students. Teachers' post-test results correlated significantly but modestly, with students' post-test word decoding scores. The teachers' pre-test scores did not correlate significantly with student outcomes, suggesting that the teachers' gains in knowledge influenced their ability to teach decoding skills more effectively. There were no gains on the spelling measures.

Stages of Spelling Development

The teacher knowledge studies described above did not document gains in spelling. Student gains in reading do not guarantee gains in spelling. Teachers need to

understand the structure of English orthography and spelling development, so they will better understand students' nonconventional spellings (i.e., invented spellings or errors) and provide the most appropriate instruction (Bear & Templeton, 1998). Many researchers have seen spelling development as unfolding in stages (Bear & Templeton, 1998; Frith, 1985; Gentry, 1982). Three developmental stages are described below.

Frith's Stages

The stages of Frith's (1985) model of reading and spelling development are logographic, alphabetic, and orthographic. In the logographic stage, children can recognize words by how they look. In the alphabetic stage, children begin to understand the relationships between letters and sounds, so they can sound out words for reading and spelling. In the orthographic stage, children learn to read words as orthographic units and not as letter-sound units that need to be sounded out. They also begin to spell words as whole orthographic units and not as sound-letter units.

According to Frith's stages children learn the alphabetic code through spelling and then apply this knowledge to reading (Davis & Bryant, 2006). This is to say that early on students can spell words by sounding them out, and this skill transfers to their ability to sound out unfamiliar words when reading. As children progress through school, they recognize recurring orthographic patterns for reading that are then transferred to spelling. Even though spelling and reading may have different underlying mechanisms (Bryant & Bradley, 1980), the application of the alphabetic code from spelling to reading and the application of the orthographic code from reading to spelling demonstrate the interdependence between spelling and reading.

Gentry's Stages

Gentry (1982) outlined five stages of spelling development: precommunicative, semiphonetic, phonetic, transitional, and conventional. In the precommunicative stage, students demonstrate their understanding that writing represents spoken language. Students in this stage write with scribbles or random letters or strings of random letters. In the next stage, students demonstrate they are using a sound-based strategy and some of the salient sounds of a word are present (e.g., *en* for *enough*). The third stage demonstrates that all sounds are present and marked by a letter or group of letters (e.g., *enuf* for *enough*). Gentry's fourth stage may seem like a hodgepodge, but in truth, it is a combination of documenting every sound and incorporating salient orthographic features of a word (e.g. *enughf* for *enough*). The final stage is the accepted or conventional spelling of the word. The stages do not suggest that spelling will emerge in distinctive stages for all students. Rather, the stages suggest to teachers what a student knows about the language and what he or she still needs to learn.

Bear and Templeton's Stages

The first stages of Bear and Templeton's (1998) six-stage model of spelling development mirror Gentry's (1982) stages, but Bear and Templeton provide greater detail for the spelling of polysyllabic words and derivatives. Their first stage, approximately kindergarten to the middle of first grade, is similar to Gentry's first stage. In the second stage, students from ages 4-7 include the initial and final consonants. Students' consistent use of letter names or any vowel demarks the third stage (e.g., *cd* for *seed* or *sek* for *sick*). In the next stage, students ages 6-12 show representation of

each sound and knowledge of conventional patterns (e.g., *sede* for *seed*). In the fifth stage, ages 8-18, students spell single-syllable words well although words with multiple syllables are spelled in a phonetically correct but not in a conventionally correct manner (e.g., *plesure* for *pleasure*). The highest level, derivational consistency, should reveal that spelling and vocabulary development are reciprocal events. For example, students should understand that *recommend* is a derivative that consists of prefix *re-* and root *commend*; therefore, students should understand they should not double the *c* or forget to double the *m*.

The age ranges mentioned with each stage are meant as a guide to help teachers understand how the spellings of most students in a particular age range could or should be displayed. The ranges also illustrate that learning to spell can be a long process. As with Gentry's stages, students will rarely move through the stages in a distinct progression.

English Orthography and Spelling Instruction

Bear and Templeton (1998) surmised, "Spelling is more than a courtesy to one's reader; understanding how words are spelled is a means to more efficient and proficient reading and writing" (p. 223). Of course, for spelling to lead to more efficient and proficient reading and writing, teachers must know how to teach spelling effectively.

The orthography of a language is the way in which spoken words are represented in print. It has long been assumed that because English orthography is so complex, the only way to learn to spell it is to memorize (Joshi & Aaron, 2005). Indeed, many students are taught to spell by memorizing lists of words that are tested on weekly

spelling tests. However, Chomsky (1970) carefully unpacked the orthography of English and revealed a logical system for spelling words. The orthography, which seems as if it is a chaotic mess, is actually reliable and consistent (Kessler & Treiman, 2003). Spelling is a cognitive linguistic skill (Frith, 1980; Treiman, 1993). Students can be taught reliable recurring patterns that make the deep orthography of English more manageable for spelling.

Orthographic Depth

The depth of a language's orthography influences the rate at which it is learned (Seymour, 2006). Some languages have shallow orthographies (e.g., German, Spanish) while others have deep orthographies (e.g., French, Danish). Shallow orthographies tend to have nearly perfect grapheme-phonemes correspondences. A perfect orthography would have one phoneme for each grapheme (i.e., spelling unit) and one grapheme for each phoneme. Students are apt to learn a language with a shallow orthography much faster than a language with a deep orthography.

English falls into the category of deep orthographies. It has between 40-45 phonemes and 26 letters. This ratio seems relatively balanced until one considers that the 26 letters can represent single graphemes that represent one or multiple phonemes (e.g., *s* = /s/, /z/, /sh/) or can be combined to form multi-grapheme units (e.g., *ch*, *tch*, *th*, *dge*) that can represent one or more phonemes (e.g., *ch* = /ch/, /k/, /sh/). Add to that the fact that single phonemes can be represented by multiple graphemes (e.g., /k/ = *k*, *c*, *ck*, *ch*, or /j/ = *j*, *g*, *dge*), and English orthography becomes very complex (Venezky, 1999).

Students' Recordings of English Orthography

To extricate the complexities of English orthography for spelling, students need to learn about its sounds and structures, which can be taught by knowledgeable teachers (Moats, 1999). Young children learn to spell using phonological segments as opposed to learning to spell visually (Bryant & Bradley, 1980). As they begin to grasp the alphabetic principle, their early spellings show their use of phonology to spell although their spellings may seem nonphonetic, as in the spelling of *use* as *yuz* (Treiman, 1993). An informed teacher will understand that the initial grapheme in the word *use* actually represents /yū/, so the spelling *yuz* shows intact phonemic awareness and understanding of reasonable orthographic representations.

As young children's exposure to print increases, their spellings, while still not correct, begin to incorporate conventions of written spelling. Scoring words on a spelling test as only *right* or *wrong* denies the teacher the opportunity to evaluate students' understanding of sounds and conventional orthographic patterns, which can be assessed through qualitative analysis of the errors. The kinds of words students miss and the types of errors they make are important (Joshi, 1995). For example, the student who consistently confuses /b/ and /p/ when spelling is not aware that while /b/ and /p/ share the same visual display (i.e., the positions of the tongue, teeth, and lips) when articulated, one is voiced (i.e., *b* activates the vocal cords) and the other is unvoiced (Moats, 1993, 1994). Rarely are spelling errors that involve the confusion of *b* and *p* a visual discrimination or memory problem (Treiman, 1998).

Informed Spelling Instruction

Phonemic awareness training that helps students detect and distinguish sounds in spoken words is important to the reading success of beginning readers (Ball & Blachman, 1991; Liberman & Liberman, 1990; NRP, 2000; Stanovich, 1986). Because beginning spellers start with sounds (Frith, 1985), phonemic awareness training also benefits early spelling proficiency. It is also apparent that phonetic spelling instruction enables students to translate phonemes into written representations and develop the understanding of letter-sound correspondences. Tangel and Blachman (1992) demonstrated that low-income, inner-city kindergartners who were given 11 weeks of phonemic awareness training outperformed a control group on measures of phonemic segmentation, letter-sound knowledge, and word reading. The treatment group also produced superior invented spellings. A year later, Tangel and Blachman (1995) found that the treatment group students still produced superior invented spellings as well as produced more standard spellings. Ehri and Wilce (1987) taught kindergarten students to spell a set of phonetically regular words using letter tiles. The students who were given the spelling training had better phonemic segmentation and letter-sound knowledge and were able to read words that kindergartners without the spelling training could not read. Ehri and Wilce suggested that phonetic spelling instruction should be provided early as it does help beginning readers learn to read words.

As students progress, they rely less on phonemic awareness and phonetic spelling and more on the orthographic patterns of the language. Reading becomes a recognition skill and spelling a recall skill. Production or recall is more difficult than reception or

recognition (Bryant & Bradley, 1980). For example, students can be taught that the letter patterns *o-consonant-e*, *oa*, and *ow* are all pronounced /ō/; so if students know these patterns, they can read *bone*, *boat*, and *bow* even if they do not hold the words in memory (Ehri, 1980). If the words are read in context, students have additional support in knowing how to read the words. (Context would aid the reading of *bow*, which could also be read as /bou/.) Spelling these words is more problematic. The words sound similar: /bōn/, /bōt/, /bō/. Unless the words are held in memory as whole units, students will have difficulty in knowing whether /ō/ should be spelled *o-consonant-e*, *oa*, or *ow*. Context will not aid the spelling of the words. The introduction of reliable patterns can aid students' spelling of these words (Carreker, 2005b; Moats, 1995): 1) in medial position of a one-syllable word, /ō/ is usually spelled *o-consonant-e* (*home*, *rope*, *smoke*), 2) in medial position of a one-syllable word before final /t/, /ō/ is often spelled *oa* (*goat*, *coat*, *float*), and 3) at the end of a word, /ō/ is usually spelled *ow* (*show*, *snow*, *window*).

While there are far too many patterns in English for students to learn each one, the introduction of frequently recurring patterns is helpful as students increasingly rely on their understanding of the underlying orthographic patterns of the language and their overall word-specific knowledge to spell words correctly (Juel, Griffith, & Gough, 1986).

In addition to reliable orthographic patterns, spelling is greatly enhanced by instruction of the morphology of English (Henry, 1988; Treiman, 1993). For younger children, the introduction of inflectional ending *ed*, for example, can help students sort

through the spellings of /jümpɪ/, /sēmd/, and /lānded/ (Bryant, Deacon, & Nunes, 2006). For older students, attention to prefixes helps in the spelling of a word like *attract*, which consists of prefix *ad* and root *tract*. The *d* in the prefix changes to *t* to match the beginning of the root, making the word easier to pronounce. Furthermore, silent letters in words such as *sign* and *autumn* are better remembered when the connections to *signal* and *autumnal* are made explicit to students (Moats, 2000).

Understanding of word origins is also beneficial to spelling proficiency (Henry, 1988, 2003; Moats, 2000). For example, words that originate from Latin do not contain *k*, *ch*, or *th* and most often spell the suffix /er/ as *or* as in *actor*, *supervisor*, and *spectator*. Words derived from Greek reliably spell /f/ as *ph* as in *philosophy* and *physical*, /k/ as *ch* as in *chemistry* and *orchestra*, and medial /ī/ or /ĩ/ as *y* as in *phylum* and *chrysanthemum*.

Even though English orthography is complicated, it is not so unwieldy that it must be learned through rote memorization. Instruction of the sound structure (i.e., syllables, phonemes), reliable orthographic patterns, morphemes, and word origins can teach students how to spell.

Summary of Literature Review

Numerous studies have indicated there are gaps in teacher knowledge of literacy-related content knowledge. Some studies have shown that teachers are not well calibrated in their perceptions of their own literacy-related content knowledge. Increased teacher knowledge has resulted in gains in student achievement in reading but not in spelling.

Understanding stages of spelling development aids teachers in understanding what students understand and do not understand about sounds, letters, and letter patterns. Ehri (1992) cautioned that the stages are not tied to a maturation timetable but are inextricably tied to instruction. Teachers should not expect that students will progress or gain understanding naturally. It is important that teachers design instruction that will move students along in their spelling proficiency.

While the orthography of English may seem confused, there is a logic and reliability to it. It can be taught. Spelling is not a rote visual memory skill. It is a cognitive linguistic skill. Initially, students use their knowledge of sounds to spell, and it seems necessary for teachers to have intact phonemic awareness, so they can instruct their students in this skill. Early phonetic spelling instruction enhances students' phonemic awareness and promotes the connection of sounds to letters and helps students learn to read words. Increasingly, spelling relies more on students' knowledge of the underlying patterns of the orthography; therefore, it is necessary for teachers to know the patterns of English orthography, so they can teach them to their students. Teacher knowledge of morphology and word origins will help refine students' spelling and supports their spelling of multisyllabic words. Spelling instruction should be more than mere memorization; it should engage students in active, reflective thought about sounds, patterns, and language structures (Carreker, 2005b).

CHAPTER III

METHODS

Participants

This study investigated the effects of preservice and inservice teacher knowledge of phonemes, syllables, and morphemes on the analysis of spelling errors and choice of appropriate spelling instructional activities. The participants included 36 preservice teachers who were about to complete a 45-hour reading course at a university and 38 inservice teachers with varied teaching experiences who were attending a daylong Saturday workshop at a professional development center. All participants were female.

Study Design

Participants completed a survey that asked years of teaching experience and if English is their native language. Of the 36 inservice teachers who reported their years of teaching experience, 13 had 11 or more years of experience, 13 had between 0 and 3 years, and the remaining 10 had between 4 and 10 years. One participant indicated that English was not the native language and was not included in the study.

The survey also asked participants to calibrate their knowledge of phonemic awareness, phonics, and spelling. Using a Likert scale, the participants calibrated their level of expertise (highly knowledgeable, somewhat knowledgeable, not knowledgeable) of these three areas.

The participants also completed three measures to: 1) assess their knowledge of phonemes, syllables, and morphemes, 2) their ability to analyze student spelling errors using a rubric, and 3) their ability to analyze underlying difficulties with spelling and

choose appropriate instructional activities based on the underlying difficulties. The participants were able to complete the survey and measures within 45 minutes.

Participation in the study was voluntary and confidential. The survey and measures were identified by a number and not participant name. Each participant completed a consent form.

Measures

Knowledge of Phonemes, Syllables, and Morphemes

The participants' phonemic awareness was assessed through the counting of phonemes in 10 words (e.g., *shop* has three phonemes; *block* has four phonemes; *string* has five phonemes). To the right of each word was a blank line. The directions stated, "Read each word to yourself. Determine the number of phonemes (sounds) in each word. Write the number of phonemes in each word on the line." Two examples were given by the researcher before the measure was given.

The participants' knowledge of syllables and morphemes was assessed through the counting of syllables and morphemes in 10 words. To the right of each word were two blank lines. The directions stated, "Read each word to yourself. Determine the number of syllables (linguistic units) and morphemes (meaning-carrying units). Write the number of syllables and morphemes in each word on the lines." Two examples were given by the researcher before the measure was given.

There were 30 total items on the measure of phonemes, syllables, and morphemes. The measure had a reliability of .781 (Cronbach's alpha). The reliability of

the separate measures of phonemes, syllables, and morphemes, each with 10 items, were .771, .686, and .654 respectively.

Choosing Appropriate Instruction

Participants were asked to complete a measure of their proficiency in identifying a student's underlying difficulty with spelling and choosing the best instructional activity for remediation. To create the measure, samples of common and consistent errors of beginning and dyslexic spellers (e.g., *hv* for *have*; *efant* for *elephant*; *rip* for *rib*; *hin* for *him*) were accumulated from preexisting progress monitors. The errors were grouped by underlying difficulties (e.g., student does not hear all the sounds; student does not hear all the syllables; student cannot discriminate minimal pairs such as /b/ and /p/; student cannot discriminate similar sounds such as /m/ and /n/). Once the errors and the underlying difficulties were identified, a list of possible instructional activities was created. All the activities would improve spelling proficiency, but one activity would be the best activity to address the underlying spelling difficulty. The measure involved matching consistent spelling errors with the most appropriate instructional activity (e.g., “*gt* for *get*, *s* for *seed*, and *hv* for *have*” matched “have student segment three- and four-phoneme words, moving a counter for each sound”).

The directions for the measure read, “In the left column are examples of errors that a student consistently makes when writing. In the right column are specific activities. While all the activities improve spelling, match the errors with the best activity to remediate the underlying difficulty that has led to the student's particular spelling errors. Before choosing an answer, determine why the student is misspelling the

words. Write the appropriate letter on the line. Write only one letter on each line. You will use some letters more than once. There may be a letter or letters that will not be used.” Two examples were given before the measure.

To complete this measure, participants needed to assess whether or not the errors: 1) contained all the syllables and phonemes of the targeted words, 2) followed reliable spelling patterns and generalizations, or 3) necessitated knowledge of morphemes (e.g., spelling *looked* instead of *lookt* necessitates knowledge of the inflectional morpheme *ed*). The measure had 12 items and a reliability of .643 (Cronbach’s alpha).

Analyzing Spelling Errors

The participants were given a list of spelling errors of third-grade students and a rubric, based on Blachman (1983) and Tangel and Blachman (1992). Participants were asked to score the spelling errors using the rubric, which had a scale of 0-6. The target word was found in parentheses after each error. A score of 0 indicated that the error did not contain all the syllables or sounds in the target word. A score of 5 reflected an incorrect spelling that, nonetheless, demonstrated adequate knowledge of phonemes and spelling conventions (e.g., *coff* for *cough*, *plane* for *plain*). A correct spelling scored 6 although there were no correct spellings on the list. Five examples were given by the researcher before the measure.

This measure was included because the spelling errors were authentic and represented errors that teachers encounter in classrooms. The spelling errors on the previous measure were engineered for the specific purpose of assessing a participant’s

ability to determine a student's spelling need and to choose the appropriate instructional activity. In the classroom, students' spelling errors will be more subtle.

A list of 594 spelling errors was compiled from preexisting data of 56 third graders in a semi-rural school district in central Texas. The data represented student performance on the spelling subtest of the Woodcock-Johnson III (Woodcock, McGrew, & Mather, 2001). The list of errors included an aggregate of errors on the first 30 items on the spelling subtest. Thirty items represented the absolute ceiling of any of the third graders who took the subtest.

The reliability of the rubric was established by scoring the 594 errors. Two master teachers used the rubric to score all 594 errors. These raters worked independently of one another. The agreement between the two raters was .81 (Cronbach's alpha). A debriefing was held after the scoring was completed. Based on feedback from the two raters, the rubric was adjusted, and two other raters, also master teachers, independently scored the errors using the new rubric. The agreement between these raters was .89 (Cronbach's alpha).

The final items for the measure were chosen from the 594 errors. The raters had scored the errors the same and had no difficulty in scoring the errors because they fit agreeably with the rubric and no judgment needed to be made. Ambiguous errors were excluded.

Several errors were chosen as items because they required certain teacher knowledge about spelling patterns. For example, the error *cof* for *cough* would be scored as a 4. All the sounds are represented by conventional letters. The error *coff* for *cough*

would be scored as a 5 because a student spelling *cough* in this manner would have good understanding of sound-letter correspondences and would also understand that /f/ at the end of a one-syllable word after a short vowel is usually spelled *ff* as in *off*, *sniff*, *staff*, or *bluff*. There were 25 items on the measure, which had a reliability of .527 (Cronbach's alpha).

CHAPTER IV

RESULTS

The results of the participants' surveys and measures were analyzed to determine: 1) the self-calibrations of the participants' knowledge of literacy-related content knowledge, 2) the participants' knowledge of phonemes, syllables, and morphemes, and 3) the influence of the participants' knowledge on their ability to analyze spelling errors and choose appropriate instructional activities.

Calibration of Knowledge

The survey directed the preservice and inservice teachers to calibrate their knowledge (highly knowledgeable, somewhat knowledgeable, and not knowledgeable) in the areas of phonemic awareness, phonics, and spelling. The number of teachers who calibrated their knowledge at each level and in each area were counted and recorded. In general, the preservice teachers had higher self-perceptions of their knowledge of phonemic awareness, phonics, and spelling than the inservice teachers.

Table 1 shows the number of teachers who calibrated their knowledge at each level and in each area. A higher number of preservice teachers calibrated their knowledge of these areas at the "highly knowledgeable" level. There was little variation in numbers at the "somewhat knowledgeable" level. A higher number of inservice teachers calibrated their knowledge at the "not knowledgeable" level.

Table 1

Numbers of Teachers at Each Calibration Level and in Each Area

Area of knowledge	Highly <u>knowledgeable</u>		Somewhat <u>knowledgeable</u>		Not <u>knowledgeable</u>	
	Preservice ^a	Inservice ^b	Preservice	Inservice	Preservice	Inservice
Phonemic awareness	22	14	12	12	2	11
Phonics	21	18	13	13	2	6
Spelling	19	12	13	16	4	9

^a n = 36; ^b n = 37. One inservice teacher did not respond.

One third of the preservice teachers or 33.3% (n = 36), did not equally calibrate their knowledge in all three areas. These teachers either calibrated their knowledge of the three areas at three different levels, or they calibrated two areas at the same level and the remaining area at a different level. Of all preservice teachers, 36.2% perceived themselves as “highly knowledgeable,” and 27.7% perceived themselves as “somewhat knowledgeable” in phonemic awareness, phonics, and spelling. Only one preservice teacher or 2.8% calibrated all three areas at the “not knowledgeable” level.

Of all inservice teachers (n = 38), 36.8% did not equally calibrate their knowledge of phonemic awareness, phonics, and spelling; 28.9% calibrated their knowledge at the “very knowledgeable” level, 23.7% at the “somewhat knowledgeable”

level, and 8% at the “not knowledgeable” level in all three areas. One teacher or 2.6% did not calibrate her knowledge in any areas.

Actual Knowledge

The data from the measures were analyzed. All raw data from the different measures were converted to z scores and then to standard scores. For the most part, the actual knowledge of phonemes, syllables, and morphemes was higher for the inservice teachers than it was for the preservice teachers (see Table 2). When comparing inservice and preservice teacher performances using a MANOVA, counting syllables was the only variable that reached statistical significance, $F(1, 72) = 12.36, p = < .001, \eta^2 = .144$. Inservice teacher knowledge of syllables was higher.

Table 2
Means and Standard Deviations for Inservice and Preservice Teachers

	<u>Inservice teachers</u>		<u>Preservice teachers</u>	
	M	SD	M	SD
Phonemes	51.35	9.29	50.15	9.91
Syllables	56.10	3.77	49.99	10.00
Morphemes	50.76	9.50	49.99	10.00
Analyzing errors	51.14	9.57	49.42	10.17
Choosing activities	51.25	9.45	51.64	11.46

Five percent of inservice teachers counted the phonemes in the 10 words correctly, 29% correctly counted the phonemes in 7 to 9 words, and 26% counted the phonemes in fewer than half the words correctly. No preservice teachers counted all the phonemes correctly. Only 19.5% of preservice teachers correctly counted the phonemes in 7 to 9 words, and 50% counted the phonemes in fewer than half the words correctly.

Forty-seven percent of inservice teachers counted the syllables in the 10 words with 100% accuracy. The remaining 53% correctly counted the syllables in 7 to 9 words. Thirty-three percent of preservice teachers accurately counted all the syllables, 33% correctly counted the syllables in 7 to 9 words, and 2.8% counted syllables correctly in less than 5 words.

On the morpheme measure, 2.6% of inservice teachers counted all the morphemes correctly, 71% correctly counted the morphemes in 7 to 9 words, and 2.6% counted the morphemes in fewer than 5 words correctly. For preservice teachers, 2.8% correctly counted all the morphemes in the 10 words, 16.7% correctly counted the morphemes in 7 to 9 words, and 41.7% counted the morphemes in fewer than 5 words correctly.

Table 3 shows the individual items on the counting phonemes measure and the percentages of inservice and preservice teachers who correctly answered each item. Both inservice and preservice teachers had difficulty segmenting words with blends. Beginning blends (e.g., *br*, *bl*, *str*) were more difficult than ending blends (e.g., *mp*, *st*). Only 22% of the inservice teachers and 8% of the preservice teachers identified the word *string* as having five phonemes. The blend *str* in *string* was thought to represent one

phoneme even though it represents three distinct phonemes. The teachers had less difficulty with words that contained digraphs, such as *th* in the word *teeth*, *sh* in the word *shop*, or *ch* in the word *church*.

Only 10% of inservice teachers and 19% of preservice teachers could identify the word *fix* as having four phonemes. The letter *x* in *fix* was thought to represent one phoneme although it represents /k/ and /s/. This error confirmed Moats's (1994) finding that teachers think of words in terms of their written forms and not in their spoken forms.

Table 3

Percentages of Teachers Correctly Counting Phonemes

	Inservice teachers	Preservice teachers
1. trim (4)	51%	44%
2. jump (4)	76%	56%
3. last (4)	68%	50%
4. brush (4)	39 %	33%
5. string (5)	22%	08%
6. shop (3)	80%	75%
7. teeth (3)	95%	94%
8. block (4)	56%	44%
9. church (3)	76%	72%
10. fix (4)	10%	19%

Even though the inservice teachers' performance on syllable counting was statistically significant, they had difficulty with the words *happened* and *jumped* (see Table 4). Here again, the inservice teachers were swayed by how the words were written and thought that each vowel represented a syllable. These errors also showed that the inservice teachers did not understand that inflectional ending *ed* only represents a separate syllable after a base word that ends in the letters *d* or *t* (e.g., *landed*, *hinted*). While the preservice teachers demonstrated the same difficulty with the word *happened*, 97% of them correctly counted the syllables in *jumped*.

Table 4

Percentages of Teachers Correctly Counting Syllables

	Inservice teachers	Preservice teachers
1. keeper (2)	98%	86%
2. phonology (4)	90%	78%
3. salamander (4)	100%	94%
4. projector (3)	100 %	97%
5. rattlesnake (3)	95%	78%
6. kangaroo (3)	100%	97%
7. jumped (1)	59%	97%
8. happened (2)	56%	47%
9. inhaled (2)	68%	64%
10. supervisor (4)	95%	78%

Both inservice and preservice teachers had difficulty counting the number of morphemes in *salamander* and *supervisor* (see Table 5). They tended to count more than one morpheme in *salamander* and counted only two morphemes in *supervisor*. While many inservice teachers had miscounted the number of syllables in the words *happened* and *jumped*, they were more successful in counting the morphemes in those words.

Table 5

Percentages of Teachers Correctly Counting Morphemes

	Inservice teachers	Preservice teachers
1. keeper (2)	98%	64%
2. phonology (2)	71%	67%
3. salamander (1)	17%	25%
4. projector (3)	80 %	36%
5. rattlesnake (2)	88%	75%
6. kangaroo (1)	56 %	61%
7. jumped (2)	98%	69%
8. happened (2)	76%	64%
9. inhaled (3)	82%	33%
10. supervisor (3)	37%	16%

As evidenced from the descriptions of the inservice and preservice teachers' calibrations and their actual knowledge, neither group was realistic in calibrating their knowledge. While the preservice teachers tended to overestimate their knowledge, even the lower calibrations of the inservice teachers were high in comparison to their actual knowledge. Only one participant, an inservice teacher, correctly counted all phonemes, syllables, and morphemes; however, she calibrated herself as "not knowledgeable."

Predictability of Knowledge

To see if teacher knowledge of phonemes, syllables, and morphemes predicted teacher ability to analyze spelling errors and choose appropriate instructional activities, four regression analyses were done. The analyses demonstrated that overall knowledge of phonemes, syllables, and morphemes did not predict the preservice or inservice teachers' analysis of spelling errors or choice of appropriate instructional activities.

The regression analyses of preservice teachers did show that their knowledge of morphemes predicted their performance on analyzing spelling errors (see Table 6). However, on the analyzing spelling errors measure, 88.9% of the preservice teachers answered fewer than half of the 25 items correctly. The highest score was 68% and was achieved by only one preservice teacher. None of the independent variables predicted performance on the choosing activities measure. The highest score was 75% and was achieved by only one preservice teacher. Twenty-two percent answered 7 or 8 of the 12 items correctly, and 75% answered half or fewer correctly on the measure.

Table 6

Regression Analyses of Preservice Teacher Knowledge

Variable	B	SE B	β
Analyzing errors			
Phonemes	-.059	.161	-.058
Syllables	.107	.163	.105
Morphemes	.433	.163	.426*
Choosing activities			
Phonemes	.096	.191	.083
Syllables	.152	.192	.133
Morphemes	.362	.192	.316

Note: Analyzing errors: $R^2 = .216$; $*p < .05$. Choosing activities: $R^2 = .139$.

On the regression analyses for the inservice teachers, phonemes predicted their ability to analyze spelling errors and choose appropriate instructional activities (see Table 7). However, the highest score on the analyzing errors measure was 84% and was achieved by only one inservice teacher. Fifty percent of the inservice teachers answered fewer than half of the 25 items correctly. While 8% of the inservice teachers achieved the highest score of 92% on the measure for choosing activities, 42% answered 7 to 10 of the 12 items correctly, and 50% answered half or fewer correctly on the measure.

Table 7

Regression Analyses of Inservice Teacher Knowledge

Variable	B	SE B	β
Analyzing errors			
Phonemes	.661	.180	.632**
Syllables	.045	.395	.016
Morphemes	-.258	.170	-.259
Choosing activities			
Phonemes	.473	.192	.447*
Syllables	.190	.420	.070
Morphemes	.012	.180	.012

Note: Analyzing errors: $R^2 = .294$; ** $p < .001$. Choosing activities: $R^2 = .222$; * $p < .05$.

Summary of Results

Preservice teachers were more positive in their knowledge calibrations than inservice teachers. However, the actual knowledge of the inservice teachers was greater than the preservice teachers. Overall knowledge of phonemes, syllables, and morphemes did not predict preservice or inservice teachers' ability to analyze spelling errors and choose instructional activities. There were some variables – morphemes for preservice teachers and phonemes for inservice teachers – that were statistically significant. Generally, the preservice and inservice teachers did not do well analyzing errors and choosing instructional activities.

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary

The survey and the measures assessed preservice and inservice teachers' calibrations of their own literacy-related content knowledge, their actual knowledge, and their ability to analyze spelling errors and choose appropriate spelling instructional activities. Literacy-related content knowledge is necessary for a teacher in identifying student needs and designing instruction to meet those needs. Well-calibrated teachers will seek information they do not have and need to assess student needs and design appropriate instruction (Cunningham et al, 2004).

The results of this study support findings from previous studies. For the most part, as demonstrated in studies such as Cunningham et al. (2004) and Spear-Swerling et al. (2005), the teachers were not realistic in calibrating their literacy-related content knowledge. Additionally, there were gaps in the teachers' understanding of language structures as found in studies such as Bos et al. (2001) and Moats (1994).

The preservice teachers' calibrations of their knowledge were more positive than those of the inservice teachers; however, their actual knowledge was less than that of the inservice teachers. The preservice teachers in the study were completing a 45-hour reading course that exposed them to research-based literacy instruction. Their positive calibrations may have reflected their familiarity with topics, such as phonemic awareness, phonics, and spelling. Their limited real-world application of their

knowledge (i.e., explicitly teaching this information to students) restricted their understanding of the information.

On the other hand, many of the inservice teachers probably had not been exposed to research-based literacy instruction in their preservice preparation programs. The inservice teachers in the study voluntarily were attending a daylong Saturday workshop designed to teach information about early literacy acquisition. Their attendance at the workshop suggested that they may have identified phonemic awareness, phonics, and spelling as areas of need and were seeking more information. This might have accounted for their less positive calibrations. While their results were generally higher than the preservice teachers on all the measures, perhaps because of real-world experience, their results were not exceptionally high.

Neither the preservice nor the inservice teachers were adept in counting phonemes. It has been well documented that for students to become skilled readers, they must understand that spoken words are made up of phonemes (Ball & Blachman, 1991; Liberman & Liberman, 1990; Lundberg, Frost, & Petersen, 1988; NRP, 2000; Stanovich, 1986). Phonemic awareness is also important for spelling proficiency (Tangel & Blachman, 1992, 1995). To become proficient spellers, students must count or identify phonemes in spoken words, so they can match those phonemes to reliable orthographic patterns. Skill in phonemic awareness will help teachers heighten students' awareness of phonemes in words and facilitate students' subsequent assignment of orthographic patterns to those phonemes.

Surprisingly, while inservice teachers' performance on counting syllables was statistically significant, only 53% of the inservice teachers correctly counted the syllables in all the target words. Segmenting words into constituent syllables is one of the first phonological awareness skills that young children acquire (Adams, 1990). Their errors in counting the syllables in *happened* and *jumped* reflected the teachers' bias toward how words are written. They looked at the number of vowels in the words and assumed that there was one syllable for each vowel. Instead, they should have been attuned to the spoken equivalents of the words, /hăp ěnd/ and /jũmpt/.

Neither the inservice nor preservice teachers were overtly secure with their knowledge of morphemes. A common mistake was the miscounting *salamander* as two morphemes because the letters *er* at the end that looked like a suffix. There was much less confusion with the word *kangaroo*, which also has one morpheme but does not have letters at the end that look like an additional morpheme. The teachers' difficulty with counting morphemes in *supervisor* demonstrated their lack of knowledge of morphemes, such as *super* (above, over), *vis* (to see), and *or* (one who). While many inservice teachers incorrectly counted the syllables in *happened* and *jumped*, they had less difficulty identifying that *happened* and *jumped* had two morphemes. Here, thinking about words in their written forms was an advantage. To teach spelling effectively, however, teachers must first think of words in their spoken forms.

The measures for analyzing spelling errors and choosing appropriate instructional activity were difficult for the inservice and preservice teachers. The study presumed that higher knowledge of phonemes, syllables, and morphemes would result in better

performance on the measures of analyzing errors and choosing instructional activities: That was not the case. Phonemes predicted inservice teachers' ability to analyze errors and choose activities, and morphemes predicted preservice teachers' ability to analyze errors. Overall, the teachers as whole did not perform well on these measures. They may not have had enough knowledge to successfully analyze errors and choose activities. It is possible that the knowledge of phonemes, syllables, and morphemes is not the requisite knowledge for analyzing errors and choosing activities. Regardless of whether or not this particular knowledge is essential, the participants did not appear to have whatever knowledge is necessary to enable them to provide the informed instruction that results in increased student achievement in spelling.

Limitations of the Study

A few limitations of the study need to be made clear. First, the sample sizes of preservice and inservice teachers were relatively small. The small sample sizes made it difficult to determine if the knowledge of phonemes, syllables, and morphemes would facilitate a teacher's ability to analyze errors and choose appropriate instructional activities. Larger samples of preservice and inservice teachers would confirm if this knowledge does indeed lead to informed instruction.

Next, the samples of preservice and inservice teachers were limited in diversity. The preservice teachers were all completing the same course at the same university. The inservice teachers were from the same general geographic location and were attending the same workshop. Larger and more varied samples would provide more generalizable results.

Finally, the reliability levels of some of the measures were moderate. Larger sample sizes and additional items on the measures would increase the reliabilities of these measures and would better establish whether the knowledge of phonemes, syllables, and morphemes is sufficient to analyze spelling errors and choose appropriate instructional activities.

Conclusions

Spelling instruction provides a solid foundation for reading (Ehri, 1989; Ehri & Wilce, 1987; Frith, 1985; Joshi & Aaron, 2005), and analyzing student spelling performance is helpful in diagnosing student needs (Moats, 2000; Treiman, 1998). Continued research is needed to determine exactly what literacy-related content knowledge is tied to teachers' effective teaching of spelling and use of student spelling to provide informed instruction.

It should be noted that in the near future, the measures in this study will be given to 60 inservice teachers who will have just completed 60 hours of intensive professional development dealing with the structures of the English language. These teachers will have learned about phonemes, syllables, and morphemes through lecture and reading assignments and will have had the opportunity to practice teaching these language structures to their peers. The measures will also be given to a second group of 40 inservice teachers who: 1) completed 60 hours of intensive professional development dealing the structures of the English language the previous year; 2) explicitly taught phonemes, syllables, and morphemes to students in their classroom assignments for one school year; and 3) will have just completed 60 hours of advanced training in language

structures. All of these teachers should be well versed in phonemes, syllables, and morphemes and should do well on the measures of phonemes, syllables, and morphemes. Consequently, they should do well analyzing errors and choosing instructional activities. If the first group does not do as well as the second group on analyzing errors and choosing activities, it may indicate that real-world application and/or further study are necessary to truly understand this information. If neither group does well on the analyzing errors and choosing activities measures, then the knowledge of phonemes, syllables, and morphemes may not be the requisite knowledge for successful completion of these tasks.

The preservice teachers were positive in their self-perceived levels of knowledge. It is presumed that because they had just completed a course that explicitly introduced the components of research-based literacy instruction, they were familiar with terms and definitions. However, the preservice teachers did not have ample application or practice to develop deep understanding. Therefore, it is important that preservice teacher preparation programs include information about the most effective literacy-related content knowledge as well as provide adequate real-world application of and practice with that knowledge. Additionally, because teachers cannot teach what they do not know and those who know will teach well (McCutchen & Berninger, 1999), it is critical to provide inservice teachers with effective professional development that continually will augment their knowledge and ability to better identify what students do not understand and design instruction that will improve students' spelling and other literacy skills.

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APPENDIX A

PHONEME, SYLLABLE, AND MORPHEME ASSESSMENT

Read each word to yourself. Determine the number of phonemes (sounds) in each word. Write the number of phonemes in each word on the line.

		Phonemes
1.	trim	_____
2.	jump	_____
3.	last	_____
4.	brush	_____
5.	string	_____
6.	shop	_____
7.	teeth	_____
8.	block	_____
9.	church	_____
10.	fix	_____

Read each word to yourself. Determine the number of syllables (linguistic units) and morphemes (meaning-carrying units). Write the number of syllables and morphemes in each word on the lines.

		Syllables	Morphemes
1.	keeper	_____	_____
2.	phonology	_____	_____
3.	salamander	_____	_____
4.	projector	_____	_____
5.	rattlesnake	_____	_____
6.	kangaroo	_____	_____
7.	jumped	_____	_____
8.	happened	_____	_____
9.	inhaled	_____	_____
10.	supervisor	_____	_____

APPENDIX B

SPELLING INSTRUCTION ASSESSMENT

In the left-hand column are examples of errors that a student consistently makes when writing. In the right-hand column are specific activities. While all the activities improve spelling, match the errors with the **best** activity to remediate the underlying difficulty that has led to the student's **particular** spelling errors. Before choosing an answer, determine why the student is misspelling the words. Write the appropriate letter on the line. Write only one letter on each line. You will use some letters more than once. There may be a letter or letters that will not be used.

- | | |
|--|---|
| 1. <i>gv</i> for <i>give</i> , <i>np</i> for <i>nap</i> , <i>d</i> for <i>deep</i>
_____ | A. Teach student a specific spelling pattern or rule in order to help student spell words correctly. |
| 2. <i>baskt</i> for <i>basket</i> , <i>trombn</i> for <i>trombone</i> ,
<i>suprm</i> for <i>supreme</i> _____ | B. Have student use a mirror to help him or her spell words correctly. |
| 3. <i>hin</i> for <i>him</i> , <i>samwich</i> for <i>sandwich</i> , <i>camp</i>
for <i>camp</i> , <i>imto</i> for <i>into</i> _____ | C. Teach student inflectional endings. |
| 4. <i>sep</i> for <i>step</i> , <i>back</i> for <i>black</i> , <i>sip</i> for <i>slip</i>
_____ | D. Have student trace and copy words five times. |
| 5. <i>kook</i> for <i>cook</i> , <i>kamp</i> for <i>camp</i> , <i>kut</i> for
<i>cut</i> _____ | E. Have student place two fingers on his or her vocal cords to help student spell words correctly. |
| 6. <i>wint</i> for <i>went</i> , <i>het</i> for <i>hit</i> , <i>lig</i> for <i>leg</i> , <i>nist</i>
for <i>nest</i> _____ | F. Prepare a deck with blends. Student reads the blend on each card and gives the sounds of the blends, moving a counter for each sound in the blend. |
| 7. <i>sp</i> for <i>sip</i> , <i>mn</i> for <i>man</i> , <i>ht</i> for <i>hit</i> , <i>c</i> for
<i>seed</i> _____ | G. Engage student in practices such as, "Say <i>contest</i> without <i>con</i> ," or "Say <i>hamburger</i> without <i>bur</i> ." |
| 8. <i>interst</i> for <i>interest</i> , <i>uwearns</i> for
<i>awareness</i> , <i>fantact</i> for <i>fantastic</i>
_____ | H. Have student segment three- and four-phoneme words, moving a counter for each sound. |
| 9. <i>sede</i> for <i>seed</i> , <i>nead</i> for <i>need</i> , <i>swiet</i> for
<i>sweet</i> _____ | I. Have student close his or her eyes and make a visual image of the words. |
| 10. <i>dib</i> for <i>dip</i> , <i>sad</i> for <i>sat</i> , <i>shruk</i> for <i>shrug</i>
_____ | |
| 11. <i>lookt</i> for <i>looked</i> , <i>churchez</i> for <i>churches</i> ,
<i>campen</i> for <i>camping</i> _____ | |
| 12. <i>cuf</i> for <i>cuff</i> , <i>kis</i> for <i>kiss</i> , <i>hil</i> for <i>hill</i>
_____ | |

APPENDIX C

SPELLING ANALYSIS ASSESSMENT

Below are spelling errors. The correct spelling is in the parentheses. Use the spelling rubric on page 4 to assess the spelling errors. Write the score for each error on the line.

1. send (second) _____
2. ely (early) _____
3. sixtin (sixteen) _____
4. plane (plain) _____
5. buteyful (beautiful) _____
6. konkret (concrete) _____
7. sceen (scene) _____
8. konkete (concrete) _____
9. csept (accept) _____
10. manson (mansion) _____
11. congenyal (congenial) _____
12. carrig (carriage) _____
13. symbols (syllables) _____
14. advencher (adventure) _____
15. cofe (cough) _____
16. mensen (mansion) _____
17. ecsept (accept) _____
18. cookt (cooked) _____
19. cooks (coax) _____
20. carge (carriage) _____
21. kristtle (crystal) _____
22. coff (cough) _____
23. concreek (concrete) _____
24. cotes (coax) _____
25. cookd (cooked) _____

APPENDIX D
SPELLING RUBRIC

Schwa can be represented with any vowel. Schwa is usually found in unaccented syllables.

- 0 Not all syllables are marked or not all sounds are marked.

- 1 All syllables and sounds are marked, but two letters or letter combinations are not reasonable representations for one sound (e.g., the letter *n* is used for the sound /m/).
Example: the spelling of “*celebrate*” as “*seleprad*” (*p* represents /b/ and *d* represents /t/)

- 2 All syllables and sounds are marked but one letter or letter combination is not a reasonable representation for one sound.
Example: the spelling of “*celebrate*” as “*salebrat*” (*a* represents /ě/)

- 3 Unnecessary letters or syllables are added (e.g., doubled letter, final *e*).
Example: the spelling of “*celebrate*” as “*selebbrat*” (the second *b* is unnecessary)

- 4 All syllables and sounds are represented with reasonable letters or letter combinations, but necessary or traditional spelling conventions are not evident.
Example: the spelling of “*celebrate*” as “*selebrat*” (no final *e*)

- 5 All syllables and sounds are represented with reasonable letters or letter combinations and traditional spelling conventions are evident. This spelling may be a homophone for the target word.
Example: the spelling of “*celebrate*” as “*selebrate*” (the use of *s* instead of *c*)

- 6 Correct spelling

VITA

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