HHS Public Access

Author manuscript

J Learn Disabil. Author manuscript; available in PMC 2017 March 01.

Published in final edited form as:

J Learn Disabil. 2016 March ; 49(2): 140–151. doi:10.1177/0022219414538513.

The Contributions of Phonological and Morphological Awareness to Literacy Skills In the Adult Basic Education Population

Lucille E. Fracasso, B.A, **Kathryn Bangs, M.A.**, and **Katherine S. Binder, Ph.D**

Mount Holyoke College

Lucille E. Fracasso: fracassolu@gmail.com; Kathryn Bangs: bangs20k@mtholyoke.edu

Abstract

The Adult Basic Education (ABE) population consists of a wide range of abilities with needs that may be unique to this set of learners. The purpose of this study was to better understand the relative contributions of phonological decoding and morphological awareness to spelling, vocabulary, and comprehension across a sample of ABE students. In this study, phonological decoding was a unique predictor of spelling ability, listening comprehension and reading comprehension. We also found that morphological awareness was a unique predictor of spelling ability, vocabulary, and listening comprehension. Morphological awareness indirectly contributed to reading comprehension through vocabulary. These findings suggest the need for morphological interventions for this group of learners.

As a literate adult, you may have assisted a small child as he or she reads from a storybook. Full of focus and concentration, we often find it endearing as a child stumbles over simple words or makes those ever so common errors like saying the /k/ in knife. Fast forward to adulthood, and those errors are no longer endearing. Rather, they are painful markers of the struggle that adults with low literacy skills must face on a daily basis. If you have ever worked with any of these adults, you will notice that although they are still full of focus and concentration, their expressions also show traces of shame and frustration. In our print-focused society, navigating the world without being sufficiently literate is difficult, if not impossible. Furthermore, these adult learners have a limited amount of time for formal instruction due to work and family commitments, which indicates the need to pinpoint appropriate instructional techniques (Schwertman & Corey, 1989).

Analyses and critiques of approaches to instruction and intervention for adult learners have emphasized the need to tailor instruction to the needs of the learner, to attend more to the results of scientific research in the design of adult literacy programs (Sabatini, Venezky, Janin, & Kharik, 2000), and, at the same time, to recognize the unique skill and ability composition of adults as compared to children engaged in reading instruction (Greenberg, Ehri, & Perin, 2002). Several studies have demonstrated the crucial need for the assessment

Send Correspondence to:* Katherine S. Binder, Psychology and Education Dept., Mount Holyoke College, 50 College St., South Hadley, MA 01075, (413)538-2105, kbinder@mtholyoke.edu.

*this address may be used for all authors.

of component skills for adult learners (MacArthur, Konold, Glutting, & Alamprese, 2010; Nanda, Greenberg, & Morris, 2010; Sabatini, Sawaki, Shore, & Scarborough, 2010). Not surprisingly, studies have demonstrated that when adults are matched to children on global reading achievement, they differ in important ways on the component skills that contribute to reading ability (Greenberg, Ehri, & Perin, 1997; 2002; Thompkins & Binder, 2003). The goal of this study was to investigate the relative contributions of phonological decoding and morphological awareness to spelling, vocabulary and comprehension for Adult Basic Education (ABE) students as a step towards appropriate instruction.

Phonological Awareness

Phonological awareness refers to a conscious awareness of the individual sounds that make up words, and can be measured by an individual's ability to blend sounds together, separate and break words into individual sounds (phonemic segmentation), recombine sounds into words and judge two words as having sounds in common (Anthony & Francis, 2005). Specifically, phonemic segmentation skills have been found to be strongly related to decoding abilities which are, in turn, related to reading comprehension (Tunmer & Nesdale, 1985). In fact, Adams (1994) stated that phonemic segmentation was found to be essential to decoding ability. Given that a variety of symptoms of reading disabilities can be traced back to phonological deficits, a strong sense of phonological awareness is important to literacy development (e.g., Olson, Wise, Conners, Rack, & Fulker, 1989; Stanovich, 1986). Additionally, less skilled adult readers may have trouble building and maintaining accurate phonological representations of words because there is a weakness in the "…formation, temporary storage, and production of novel lexical items" (Dietrich & Brady, 2001, p. 384). Thus, poor phonological awareness is a comprehensive deficit affecting multiple aspects related to reading ability.

Since phonological awareness contributes to the encoding, storage, and retrieval of words, it is subsequently believed to contribute to naming ability. Dietrich and Brady (2001) measured naming ability of adult poor readers through a confrontation naming task in which participants were given a picture and a carrier sentence, which gave the participants a semantic cue. For example, if the target word was "amnesia" then the carrier sentence would be "loss of memory due to head injury". Interestingly, correlational analysis showed that the confrontation task was significantly correlated with vocabulary size and word identification ability for adult skilled readers; however, the same was not true for adult poor readers. For poor readers, the confrontation naming task was significantly related to the ability to repeat new words in the pseudoword task, but not significantly correlated to vocabulary knowledge (Dietrich & Brady, 2001).

Thompkins and Binder (2003) conducted a study that matched children to adults with low literacy skills on the basis of reading level, and found that adults did not perform as well as children on a phoneme recognition task. Interestingly, they found that adults appeared to rely less on phonological decoding to read and more on remembering specific words and patterns. However, they found phonological awareness to be a unique contributor to reading level. Similar results were obtained by Greenberg et al. (1997). This research demonstrates that adults with low literacy skills have limited phonological awareness (Binder, Snyder,

Ardoin, & Morris, 2011; Greenberg et al., 1997; Pratt & Brady, 1988; Sabatini et al., 2010; Thompkins & Binder, 2003). Venezky and Sabatini (2002) found that many adults have a double-deficit in which they struggle both with phonological processing and speed of word and nonword processing. This indicates that adults will have limited improvement from exposure to print alone and require explicit instruction in the area of phonological awareness.

In a case study involving an older university student with poor decoding skills, phonological awareness and the strengthening of visual orthographic images were targeted during thirty-three hours of intervention (Apel & Swank, 1999). The intervention was successful in grade equivalent increases of three to five years on the Word Attack and Word Identification subtests of the WRMT-R. This indicates how powerful phonological awareness intervention can be for struggling adult readers.

Morphological Awareness

Morphological awareness refers to the “conscious awareness of the morphemic structure of words and their ability to reflect on and manipulate their structure” (Carlisle, 1995, pg. 194). For example, the word, “clocks” contains two morphemes, or two units of meaning. Clock is the root, while the “s” indicates more than one clock. Root words found in both monomorphemic and morphologically complex words carry the main meaning of the word (Bowers & Kirby, 2010). Affixes (prefixes and suffixes) can change the quantity, tense, meaning, etc. of the root word. Being able to manipulate morphological structures with ease can help new readers both break up large and confusing words to better understand them and to build new words by adding other morphemes (e.g. affixes) to a root word.

There is reason to believe that morphological awareness is an important factor in terms of reading comprehension and vocabulary acquisition. Nagy and Anderson (1984) estimated that for every word learned, children can learn another one to three morphologically related words by exploiting morphological awareness. Additionally, Tighe and Binder (2014) found that morphological awareness was a significant unique predictor of reading comprehension for adults with low literacy skills and, in order to comprehend what is being read, students need to be able to decode it first. Together these findings support the contribution of morphological awareness to vocabulary and reading comprehension, respectively.

Spelling

Trouble with spelling is the most common complaint for adult less skilled readers with 80% of poor readers considering their spelling to be below average. Furthermore, 80% of poor adult readers report difficulty in writing letters and 77% report needing help. This is a pervasive problem that severely impacts not only their options for occupation but their quality of life and communication with others (Johnson, 1980). To some extent, poor readers may actually have trouble *hearing* the words accurately and then, as would be expected, spelling them accurately. As one frustrated adult learner said, “No wonder I can’t spell the words. I don’t even hear them right!” (Blalock, 1982, p. 606). This phenomenon is illustrated when less skilled native English readers are asked to repeat back tongue twisters – they are slower and less accurate than skilled readers (Catts, 1986).

There are four phases of spelling development: preliterate/precommunicative, alphabetic, phonetic spelling and orthographic (Dietrich & Brady, 2001; Stackhouse, 1990) which rely heavily on both phonological and morphological rules. Previous studies highlight how developing morphological awareness increases spelling skills in children. These studies have shown that spelling interventions that focus on morphological awareness development have increased children's spelling ability and decoding of individual words and passages (Arnbak & Elbro, 2000; Kirk & Gillon, 2009; Nagy, Berninger, & Abbott, 2006; Nunes, Bryant, & Olsson, 2003). Dyslexic children have even demonstrated spelling gains from these types of interventions by being able to "segment complex words into linguistic units they know how to spell" (Arnbak & Elbro, 2000, p. 247). Segmenting words into their morphemes helps students spell more accurately by allowing them to spell one segment at a time. Eventually, this ability becomes a valuable decoding skill. Although these studies show positive results, little research has been conducted with adult with low literacy skills and the development of their spelling skills.

Generally, adult with low literacy skills are inconsistent with their spelling errors (Dietrich & Brady, 2001; Frith, 1980; Kibel & Miles, 1994). Adults do not make the same type of mistakes and often can make different mistakes on the same words while, at other times, spell the words correctly. They also are less likely to write words they do not know how to spell. In essence, they avoid their weaknesses due to self-consciousness while children are more likely to attempt spelling a word (Schwertman & Corey, 1989). In Greenberg et al.'s study (2002), adult learners were matched with children based on reading grade level. The participants completed the same spelling test, and the authors performed an error analysis on the items. Spelling errors were categorized as non-phonetic, semi-phonetic, and phonetic, following the early stages of children's spelling development (Henderson, 1985). Adult learners made significantly more non-phonetic errors than children, whereas children made significantly more phonetic and semi-phonetic errors. These findings are congruent with adult learners' reliance on orthographic knowledge and children's reliance on phonological awareness in spelling tasks (Worthy & Viise, 1996).

Vocabulary

Researchers understand that morphology is a factor in vocabulary growth because it changes word meaning, tense, quantity, and grammar. Children first learn inflectional morphemes followed by derivational morphemes (Anglin, 1993; Carlisle, 2000; Nagy et al., 2006). Anglin (1993), Carlisle (2000), and Nagy et al. (2006) found a sharp increase in the understanding and use of derivational morphemes between the third and fifth grades, aiding in the vocabulary increases in children. An understanding of morphemes gives children a way to decipher unfamiliar words by breaking them down into various components (e.g. prefixes, suffixes, root words, etc.). As children become older, more mature readers, they are exposed to more morphologically complex words and are, therefore, more likely to use morphological awareness than phonological awareness for deciphering words. The recognition process impacts vocabulary directly and also aids in overall comprehension by limiting the number of words students cannot understand and define (Proctor, Uccelli, Dalton, & Snow, 2009). Vocabulary is linked to reading ability, but the role morphology

plays in these two aspects of literacy needs further investigation, especially for adult learners.

Several studies have identified a strong relationship between morphological awareness and vocabulary, as well as their respective importance to reading development (Fowler & Liberman, 1995; Kuo & Anderson, 2006; McBride-Chang, Tardif, Cho, Shu, Fletcher, Stokes, Wong, & Leung, 2008; Shankweiler, Crain, Katz, & Fowler, 1995). Furthermore, morphological awareness is an important factor in vocabulary development not only in English but for speakers of other languages, which is common in ABE classrooms. Kieffer (2008) found that morphological awareness and vocabulary have a reciprocal relationship for learners in which English is not spoken at home, known as Language Minority learners. McBride-Chang et al. (2008) examined morphological awareness and vocabulary development in Cantonese, Mandarin, and Korean speakers. They found that across two periods, morphological awareness in Time 1 predicted vocabulary knowledge at Time 2. Because of this relationship, Stahl and Shiel (1992) suggested that vocabulary skills would be increased by directly teaching a few prefixes and suffixes to help build word deciphering strategies.

Comprehension

Previous research has demonstrated that phonological awareness is the greatest predictor of reading ability up until the third grade, which is when other skills become more influential (Carlisle & Nomanbhory, 1993; Jarmulowicz, Hay, Taran, & Ethington, 2008). Nagy et al. (2006) found significant contributions of morphological awareness to reading comprehension, vocabulary, and spelling for children from 4th to 9th grade. For the oldest age group (8th/9th graders) phonological decoding and morphological awareness explained unique variance in reading comprehension, but morphological awareness accounted for the most variance in reading comprehension. The decoding contribution makes phonological awareness the greatest predictor in early years before other literacy components, such as morphological awareness, take over.

Many researchers have discovered that morphological awareness is a predictor of reading comprehension (Bowers, Kirby, & Deacon, 2010; Carlisle & Fleming, 2003; Carlisle & Nomanbhoy, 1993; Carlisle, 2010, 2000; Jarmulowicz et al., 2008; Larsen & Nippold, 2007; Nagy et al., 2006; Nagy, Berninger, Abbott, Vaughan, & Vermeulen, 2003; Nunes et al., 2003; Singson, Mahony, & Mann, 2000; Tong, Deacon, Kirby, & Parrila, 2011). Wu et al. (2009) found that morphological instruction helped Chinese speaking children in the 1st, 2nd, and 3rd grades with vocabulary, word dictation, reading fluency, as well as reading comprehension. In addition, Deacon and Kirby (2004) and Kuo and Anderson (2003) found that morphological awareness was a significant predictor of reading for 2nd, 4th, and 5th/6th graders even when a variety of other skills were controlled, such as phonological awareness and vocabulary. These results suggest that morphology has a direct impact on comprehension.

Furthermore, a different model for the way morphological awareness contributes to reading comprehension has also been offered. This model proposes that morphological awareness

contributes to reading comprehension by aiding vocabulary development (Keiffer, 2009; Nagy et al., 2006). Nagy et al. (2006) believe that fluent word recognition grows with the development of morphological skills and impacts reading in two ways: 1) the root of the word is most likely more frequent than the complex word, and, therefore, easier to define, and 2) the process "chunks" morphological units, resulting in fewer units to be processed. Morphological awareness provides a reading and vocabulary strategy of decoding words in which the word is broken down to known units (including roots and affixes) rather than looking it up or skipping the word completely. Thus, morphological awareness can aid in reading comprehension directly as well as by aiding vocabulary development.

However, some studies have suggested that vocabulary does not contribute to comprehension ability. Vocabulary was not found to be an independent factor in reading comprehension for low-literate adults although it is highly correlated with language comprehension (Sabatini et al., 2010). In the Simple View of reading comprehension, word recognition and language comprehension account for variation in reading comprehension in low literate adults with the language comprehension component consisting of a listening task. Because of these varying views, further research needs to be completed to understand if and how vocabulary contributes to comprehension.

The studies mentioned above focus mostly on reading comprehension, but comprehension can be conceptualized as both reading and listening comprehension. Bell and Perfetti (1994) found that for short passages there were no differences between listening versus reading comprehension between all types of readers. For long passages, however, all readers had better comprehension performance after reading rather than listening. Interestingly, group low-1 (said to mirror "garden variety" poor readers) did a much better job retaining central information when reading the text as opposed to listening to it. This finding, however, was not replicated for the low-2 group (said to mirror dyslexia). For this group, the disparity between listening and reading was not nearly as great. These findings highlight the necessity of testing *both* reading comprehension and listening comprehension since different types of poor readers show different results between the two tasks

The Present Study

The purpose of this study was to better understand the contributions of phonological decoding and morphological awareness to spelling, vocabulary, and comprehension for a population of adult learners. Two main research questions were addressed in this study: 1) are phonological decoding and morphological awareness related to spelling, vocabulary, reading comprehension, and listening comprehension? and 2) are phonological decoding and morphological awareness unique predictors of spelling, vocabulary, reading comprehension, and listening comprehension? Previous research has demonstrated the importance of phonological decoding to a number of higher level literacy skills. We wanted to assess whether morphological awareness would explain additional variance in spelling, vocabulary, and comprehension, once phonological decoding was controlled.

The first research question was explored by analyzing several literacy measures, including a phonological decoding measure, morphological awareness measures, spelling tasks, a

vocabulary measure, a reading comprehension measure, and a listening comprehension task. We hypothesized that all the measures would be positively correlated with one another. The second research question was addressed by conducting hierarchical regression analyses using spelling, vocabulary and the two comprehension measures as the outcome measure. We hypothesized that morphological awareness would explain additional variance over and above what is accounted for by phonological decoding.

Method

Participants

Sixty-three participants were recruited from three ABE Centers in Western Massachusetts. However, only 55 participants completed all of the testing sessions due to disenrollment from the program. This is not surprising as state and federal statistics report adult basic education attrition rates to be as high as 60 –70%. (Quigley, 1995)The participants included 42 women and 21 men, all between the ages of 18 and 83 years (M = 34). Sixteen participants reported having been diagnosed with a learning disability. The sample included a diverse group. There were 17 African American participants, 12 Caucasian participants and 20 Hispanic participants. The remainder of the participants identified as American Indian, Haitian, Dominican, Portuguese, Puerto Rican, biracial, Asian or other. Thirty-three of the participants were enrolled in a GED level class (approximately equivalent to 9^{th} through 12^{th} grade), while twenty participants were enrolled in a Pre-GED level class (approximately equivalent to 5^{th} through 8^{th} grade), and ten participants were enrolled in a Basic level class (approximately equivalent to kindergarten through 4^{th} grade). The participants were paid $15 for their participation.

Materials

The participants completed a battery a tasks in the following realms: phonological decoding, morphological awareness, spelling, vocabulary, and comprehension. For all of the tasks, the score is equal to the sum of the correct responses.

Phonological Decoding Task—The participants' phonological decoding was assessed using the Word Attack subtest from the Woodcock Reading Mastery Tests – Revised (Woodcock, 1987), which was normed on individuals from 2–90 years of age. This task required participants to decode non-words and has been used in several studies to measure phonological awareness and decoding (e.g., Calhoun, 2005; Hogan, 2005; Gunn, Biglan, Smolkowski, & Ary, 2000; Greenberg et al., 1997).

The participants were informed that the words in the task were non-words and were asked to pronounce them to his or her best ability after completing two practice words. If the participant pronounced the practice words incorrectly, the experimenter provided the correct pronunciation. The experimenter ended the task after the participant had pronounced six words incorrectly.

Morphological Tasks—Three tasks were used to evaluate morphological awareness. The tasks were as follows: Test of Morphological Structure: Derivation (Carlisle, 2000), Test of

Morphological Production (Carlisle, 2000) and the Suffix Choice Task (Berninger, Abbott, Billingsley, & Nagy, 2001; Berninger & Nagy, 1999). While each of these tasks was developed for use with children, they have been used to assess morphological awareness for adults with low literacy skills (Tighe & Binder, 2014).

The Test of Morphological Structure: Derivation was designed to evaluate the participant's ability to produce a derived word. The experimenter said the target word followed by a sentence with a blank. The participant was asked to change the original word so that it would fit into the sentence. For example, the experimenter would say, "Warm. He chose the jacket for its blank." In this example, the correct answer was "warmth." The experimenter ended the task when the participant answered six questions incorrectly or they completed the entire 33 item task. The Cronbach alpha for the adult learners from Tighe and Binder (2014) was .97.

The Test of Morphological Structure: Production was designed to evaluate the participant's ability to decompose or break down a derived word into its base form. Just as in the Test of Morphological Structure: Production, the experimenter said a word followed by a sentence with a blank. Only this time, the word that the experimenter said was already in derived form and the participant had to produce the root word. For example, the experimenter said, "Growth. She wanted her plant to blank." In this example, the correct answer was "grow." The experimenter ended the task when the participant answered 6 questions incorrectly or they completed the entire 33 item task. The Cronbach alpha for the adult learners from Tighe and Binder (2014) was .97.

The Suffix Choice Task is a pseudo-word task designed to evaluate the participant's ability to choose the appropriate morphemic ending based on the sentence context. Each participant was able to see the task while it was read to him or her by the experimenter. Each question consisted of a fill-in-the-blank sentence and four choices of the same pseudo-word with different morphological endings. For example, "Our teacher taught us how to blank long words." The choices for the example were the following: jittling, jittles, jittled and jittle. The experimenter first read the sentence saying the word "blank" and then read it four more times substituting each option. Then, the participant was asked which option sounded the best. Scoring was discontinued after the sixth incorrect response or after the participant completed the entire 14 item task. The Cronbach alpha for the adults learners from Tighe and Binder (2014) was .84.

Spelling Tasks—Two spelling tasks were administered to the participants. The words for both spelling tasks came from The Test of Morphological Structure: Production and Derivation (Carlisle, 2000). Part I consisted of the root words and Part II consisted of the morphologically complex words. For each part, there were 33 items and the experimenter read each item twice. Scoring was discontinued when six items were answered incorrectly.

Vocabulary Task—The Peabody Picture Vocabulary Test – Third Edition (Dunn & Dunn, 1997) was used to evaluate vocabulary, which was normed on individuals from 2.5–90 years of age. In this task, participants were shown a series of four pictures. The experimenter said the target word and the participant pointed to the picture that best fit the word. After each

set, the words became increasingly more difficult as they progressed from ages 8–9 to ages 17-adult. Since the participant's ability levels ranged from approximately 1st grade through 11th grade, the start point was aimed at the lower end of the Pre-GED level which is approximately 4th grade. Children in the 4th grade are approximately 9 years old; therefore, the researchers chose this as the starting point. The researchers chose this as the starting point, resulting in the participants successfully completing this set. The experimenter ended the task when the participant got eight questions incorrect in a set.

Comprehension Tasks—Two comprehension tasks were used. One task assessed passage comprehension and the other assessed listening comprehension. The Reading Comprehension subtest of the Woodcock Reading Mastery Tests (Woodcock, 1987) was used for passage comprehension, which was normed on individuals from 2–90 years of age, and the Test of Silent Reading Efficiency and Comprehension (TOSREC) Grade 6 Form O (Wagner, Torgesen, Rashotte & Nils, 2010) was used for listening comprehension, which used a norming sample of 3,523 individuals in the 6th grade.

In the reading comprehension assessment, there were a total of 43 items. As the participant progressed through the task, the items became increasingly difficult. At the beginning of the task, the participant pointed to the picture that the sentence or phrase described. For later items, the participant filled in the blank in the sentence using the aid of a picture. Finally, for items towards the end of the task, the participant filled in the blank without the aid of a picture. For example, the sentence might be, "The drums were pounding in the distance. We could ____ them." The experimenter ended the task when the participant answered six questions incorrectly.

The TOSREC consists of sixty items and two practice items. In each item, the experimenter read a true or false statement to which the participant would answer yes or no. For example, the experimenter might say "Crickets like to catch fish" and the participant would be expected to say "no." This task was discontinued once six items were answered incorrectly.

Procedure

After obtaining informed consent, the participants answered demographic questions. Then, the participants began part one of the two testing sessions. Each testing session took approximately 30 to 45 minutes and the testing for each participant took place over a one week period. There were four different orders of tasks, and the order was counterbalanced across participants to prevent order effects.

Results

Correlations

We first correlated our three morphology tasks to assess how well they measured the same underlying construct. They were moderately correlated: the correlations ranged from .43 – .69. Thus, we combined the three measures to have one Morphological Awareness (MA) score because the three measures reflect the same underlying construct of morphological awareness. The resulting Cronbach's alpha was .74. Morphological awareness was significantly correlated with phonological decoding, $r(53) = .623$, $p<.001$. In addition,

decoding skills and morphological awareness were positively and significantly correlated with the other literacy measures: spelling, vocabulary, reading comprehension, listening comprehension. See Table 1 for means and standard deviations for all measures and Table 3 for correlations.

Regression Analyses

We conducted a series of hierarchical regression analyses in which we assessed the independent contributions of phonological decoding and morphological awareness to spelling and vocabulary. In each of those analyses, phonological decoding was entered in the first block and morphological awareness was entered in the second block. Then, we conducted another series of hierarchical regression analyses for the two comprehension measures in which we added vocabulary skill as a predictor, along with decoding and morphological awareness. Thus, decoding was entered in the first block, morphological awareness in the second block, and vocabulary in the third block. See Table 4 for all β weights for each regression analysis.

Phonological decoding explained a significant portion of the variance in spelling ability, $F(1,53) = 69.38$, $p<.001$, accounting for 56.7% of the variance. Then, we added morphological awareness to see if this addition significantly altered R^2. An additional 5% of the variance in spelling was explained, and this increase in R^2 was significant, $F(1, 52) = 6.78$, $p = .01$. Examination of the β weights demonstrated that both phonological decoding and morphological awareness were unique predictors of spelling ability.

Phonological decoding explained a significant portion of the variance in vocabulary, $F(1, 53) = 7.10$, $p = .010$, accounting for 11.9% of the variance in vocabulary. Next, morphological awareness was added to see this if this would significantly alter R^2. An additional 41.3% of the variance in vocabulary was explained by this measure. This increase in R^2 was significant, $F(1,52) = 45.86$, $p<.001$. Examination of the β weights demonstrated that only morphological awareness was a unique contributor to vocabulary.

Reading comprehension was explained by phonological decoding, $F(1, 53) = 33.05$, $p< .001$, with decoding ability accounting for 38.4% of the variance of reading comprehension. When morphological awareness was added to the model the increase in R^2 was significant, $F(1, 52) = 11.05$, $p = .002$. An additional 10.8% of variance was accounted for by morphological awareness. Finally, when vocabulary was added to the model, the change in R^2 was significant, $F(1,51) = 11.76$, $p<.001$, and an additional 9.5% of the variance in reading comprehension was explained. Examination of the β weights for the final model, however, demonstrated that phonological decoding and vocabulary were the only unique contributors to reading comprehension.

Listening comprehension (TOSREC) was predicted by phonological decoding, $F(1, 53) = 9.97$, $p = .003$, and it explained 15.8% percent of the variance. We added morphological awareness to see if this addition significantly altered R^2. An additional 40.8% of variance in listening comprehension was explained by this measure, $F(1, 52) = 48.85$, $p <.001$. Finally, vocabulary was added to the model and an additional 14.8% of variance was explained by this measure, $F(1,51) = 26.34$, $p <.001$.Examination of the β weights demonstrated that

morphological awareness and vocabulary were unique predictors of listening comprehension.

Discussion

The purpose of this study was to examine the relative contributions of phonological decoding and morphological awareness to spelling, vocabulary, and listening and reading comprehension for adult learners. As hypothesized, phonological decoding and morphological awareness were positively correlated and both were positively correlated to spelling, vocabulary, reading comprehension, and listening comprehension. More importantly, we found that both decoding and morphological awareness were unique predictors of spelling, but only morphological awareness was a unique predictor of vocabulary skills. A very interesting pattern emerged for the two different comprehension skills. For reading comprehension, decoding and vocabulary were unique predictors, but morphological awareness was no longer significant once vocabulary was added to the regression equation. However for listening comprehension, morphological awareness and vocabulary skills were unique predictors, while decoding was not.

Contributions of Phonological Decoding and Morphological Awareness to Spelling, Vocabulary, and Comprehension

Both phonological decoding and morphological awareness were unique predictors of spelling. This is consistent with work conducted with children that demonstrates that mastery of sound-to-letter correspondence is important in the development of spelling skills (Henderson, 1985; Worthy & Viise, 1996). In addition, multiple intervention studies designed to increase morphological awareness have resulted in improvements in spelling ability (Kirk & Gillon, 2009; Nagy et al., 2006; Nunes et al., 2003). While the importance of phonological knowledge decreases during the last stage of spelling (Dietrich & Brady, 2001; Stackhouse, 1990; Stanovich & West, 1989), morphology seems to play a larger role. This last stage is important since more complex spelling patterns are determined by morphology, and adult learners tend to complain about their spelling abilities (Dietrich & Brady, 2001). For example, making the jump from spelling –ed as “t” or “d” as dictated by phonology to the correct suffix of –ed (Johnson & Bayrd, 2010) is aided by morphological awareness. The fact that adult learners tend to complain about their spelling abilities may be linked to the findings of Thompkins and Binder (2003) that adults rely less on phonological decoding to read and more on remembering specific words and patterns which limits their spelling ability.

In contrast with spelling, morphological awareness was the only unique predictor for vocabulary skills. Phonological decoding was not a significant predictor once morphological awareness was added to the regression model. This supports the strong relationship other researchers have found between vocabulary and morphological awareness (Fowler, & Liberman, 1995; Kuo & Anderson, 2006; McBride-Chang et al., 2008; Shankweiler, Crain, Katz, & Fowler, 1995). As children encounter more sophisticated language, larger words become more common. The fact that the average high school graduate holds roughly 80,000 words in their vocabulary suggests that words cannot be learned one at a time (Miller &

Gildea, 1987). Thus, the ability to break up morphologically complex words into their morphemic constituents enables a reader to use his/her knowledge of the meanings of the base morpheme and suffix to infer meanings of unfamiliar morphologically complex words. Because vocabulary growth occurs through the learning of word meanings from context during reading (Nagy & Anderson, 1984), readers who can use morphological analysis to infer word meanings can acquire a larger vocabulary through independent reading than less-skilled readers.

Depending on which comprehension skill was measured, different variables were unique predictors. When reading comprehension was the outcome measure, phonological decoding and vocabulary were unique predictors. This finding supports the notion that morphological awareness contributes to reading comprehension by aiding vocabulary, since the best predictor of vocabulary was morphological awareness (Keiffer, 2009; Nagy et al., 2006). In the current study, when vocabulary was not entered into the regression model, morphological awareness was a significant predictor of comprehension, and this finding is consistent with Tighe and Binder (2014), which was the first study to document the role of morphological awareness in reading comprehension for adults who were enrolled in ABE programs. Our finding further supports previous research that morphological awareness does aid comprehension through vocabulary (Fowler & Liberman, 1995; Kuo & Anderson, 2006; McBride-Chang et al., 2008; Shankweiler et al., 1995).

However, when we investigated listening comprehension as the outcome variable, morphological awareness and vocabulary were unique predictors, and decoding no longer explained unique variance in listening comprehension. In our study, since the target sentences were read to the participants, they did not have to rely on decoding skills to correctly respond to the items. Other studies have found that morphological awareness and listening comprehension were positively correlated with one another (Jeon, 2011; Yeung, Ho, Chik, Lo, Luan, Chan, & Chung, 2011), thus, our findings are consistent with this past work. In addition, Staehr (2009) found that vocabulary skills explained nearly 50% of the variance in listening comprehension. While vocabulary in our study only explained approximately 15% of the variance in listening comprehension, morphological awareness accounted for nearly 41% of the variance. Thus, these two variables together explained comparable amounts of variance in comparison to Staehr (2009).

Future Studies and Implications

There are several important future steps that are needed to enhance our understanding of the contributions of morphological and phonological decoding to literacy skills in the adult learner population. First, we should examine the differences between native English speakers and non-native English speakers to see if the present findings hold true. This would be especially interesting for individuals who are native Spanish speakers. Spanish is a phonologically transparent language (Davies, Cuetos, & Glez-Seijas, 2007) unlike English. Thus, the relative role of phonological and morphological awareness might be different. In addition, it would be important to separate second language learners into those who developed proficiency with their native language and those who are functionally illiterate in their native language. We could reasonably predict that students who had some knowledge

of writing and reading might have different needs than those who do not. Perhaps, students who do not know how to read or write in their native language would need additional assistance developing phonological awareness since they have little to no experience mapping sounds onto letters and decoding words.

Second, the current study included mostly adult learners who were completing work at the high school level and working towards passing their high school equivalency exam. Thus, it is still unclear whether the relationships between phonological decoding, vocabulary, spelling, and comprehension develop as adult learners progress. Deacon and Kirby (2004) found that morphological awareness made a significant contribution beyond that of phonological awareness for grades 4 and 5 but not for grade 3. Based on Deacon and Kirby's findings, some additional phonological awareness instruction is necessary for students in the basic level before moving to instruction on morphological awareness. This developmental trend should be examined for adult learners as well to assess whether less advanced adult learners need more phonological awareness instruction before moving onto morphological instruction. Further investigation into the potential unique developmental trends in adult learners would help make classroom time more productive if the instruction was focused in an area that could best meet these students' needs. Perhaps, devising a test that assesses when morphological awareness instruction should begin could help avoid students being misplaced in classes that are at an inappropriate level. Determining if a student needs more basic training before returning to higher level skill instruction could result in the most positive growth for students.

Another fruitful avenue to explore would investigate morphological intervention programs for students in ABE programs. Several intervention studies have already been conducted with child learners. Bowers and Kirby (2009) conducted an intervention study to examine how morphological training would impact vocabulary knowledge. They found that both morphological awareness and vocabulary knowledge with words that were directly taught increased significantly, but the gains were not generalized to words that were not specifically taught. Kirk and Gillon (2009) examined the effects of a morphological awareness intervention on reading and spelling for children between 8 and 11 years old who demonstrated particular spelling difficulties. Kirk and Gillon found that their intervention improved both spelling and reading accuracy, although spelling demonstrated more improvement than reading. Unlike Bowers and Kirby, they found that their participants were able to generalize their knowledge to other untaught words. Additional research has demonstrated important gains in reading ability and comprehension as a result of morphological interventions (Arnbak & Elbro, 2000; Kirk & Gillon, 2009; Nunes, Bryant, & Olsson, 2003). Thus, developing a morphological intervention program for adult learners may be similarly beneficial. Based on this study's findings, it is reasonable to hypothesize that a morphological awareness intervention would help improve students' spelling, vocabulary, listening comprehension, and reading comprehension beyond that of normal classroom instruction, especially for students in the upper levels. Our study demonstrates that morphological awareness is an important skill to master to help the development of these other higher level reading skills. An intervention focusing on morphological awareness could greatly increase adult learners' performance on these higher level skills.

In summary, the present study has provided a good foundation for understanding the relationships among reading skills for adult learners. The results have demonstrated that phonological decoding, morphological awareness, spelling, vocabulary, listening comprehension, and reading comprehension are all related. The findings suggest that it is important for ABE programs to begin integrating morphological awareness into their curriculum as a way to develop other necessary skills, but also to continue providing strong phonological awareness instruction. This study demonstrated that faster skill acquisition may be possible if more investigations on morphological awareness interventions and other literacy skill instruction are conducted to identify even more efficient methodologies.

Acknowledgments

Note: The project described was supported by Grant Number R15HD067755 from the Eunice Kennedy Shriver National Institute of Child Health & Human Development awarded to the third author. The content is solely the responsibility of the authors and does not necessarily represent the official views of the Eunice Kennedy Shriver National Institute of Child Health & Human Development or the National Institutes of Health.

References

Arnbak E, Elbro C. The effects of morphological awareness training on the reading and spelling skills of young dyslexics. Scandinavian Journal of Educational Research. 2000; 44(3):229–251.

Anglin JM. Vocabulary development: A morphological analysis. Monographs of the Society for Research in Child Development. 1993; 58(10):v-165.

Anthony JL, Francis DJ. Development of phonological awareness. Current Directions in Psychological Science. 2005; 14(5):255–259.

Apel K, Swank LK. Second Chances Improving Decoding Skills in the Older Student. Language, Speech, and Hearing Services in Schools. 1999; 30(3):231–242.

Bell LC, Perfetti CA. Reading skill: Some adult comparisons. Journal of Educational Psychology. 1994; 86(2):244.

Berninger, V.; Nagy, W. Unpublished experimental test battery. Seattle, WA: 1999. University of Washington Morphological Awareness Battery.

Berninger, V.; Abbott, R.; Billingsley, F.; Nagy, W. Processes underlying timing and frequency: Efficiency, automaticity, coordination, and morphological awareness. In: Wolf, M., editor. Dyslexia, fluency, and the brain. Baltimore: York Press; 2001. p. 383-414.

Blalock JW. Persistent auditory language deficits in adults with learning disabilities. Journal of Learning Disabilities. 1982; 15:604–606. [PubMed: 7153655]

Binder KS, Snyder MA, Ardoin SP, Morris RK. Dynamic indicators of basic early literacy skills: An effective tool to assess adult literacy students? Adult Basic Education and Literacy Journal. 2011; 5(3):150–160.

Bowers PN, Kirby JR. Effects of morphological instruction on vocabulary acquisition. Reading and Writing. 2010; 23(5):515–537.

Bowers PN, Kirby JR, Deacon SH. The effects of morphological instruction on literacy skills: A systematic review of the literature. Review of Educational Research. 2010; 80(2):144–179.

Calhoon MB. Effects of a peer-mediated phonological skill and reading comprehension program on reading skill acquisition for middle school students with reading disabilities. Journal of Learning Disabilities. 2005; 38(5):424–433. [PubMed: 16329443]

Calhoon MB, Prescher Y. Individual and group sensitivity to remedial reading program design: Examining reading gains across three middle school reading projects. Reading and Writing: An Interdisciplinary Journal. 2013:1–28.

Carlisle, JF. Morphological awareness and early reading achievement. In: Feldman, LB., editor. Morphological aspects of language processing. Hillsdale, NJ England: Lawrence Erlbaum Associates, Inc; 1995. p. 189-209.

Carlisle JF. Awareness of the structure and meaning of morphologically complex words: Impact on reading. Reading and Writing: An Interdisciplinary Journal. 2000; 12(3–4):169–190.

Carlisle JF. Effects of instruction in morphological awareness on literacy achievement: An integrative review. Reading Research Quarterly. 2010; 45(4):464–487.

Carlisle JF, Fleming J. Lexical processing of morphologically complex words in the elementary years. Scientific Studies of Reading. 2003; 7(3):239–253.

Carlisle JF, Nomanbhoy DM. Phonological and morphological awareness in first graders. Applied Psycholinguistics. 1993; 14(2):177–195.

Catts H. Speech production/phonological deficits in reading-disordered children. Journal of Learning Disabilities. 1986; 19:504–508. [PubMed: 3760705]

Davies R, Cuetos F, Glez-Seijas RM. Reading development and dyslexia in a transparent orthography: A survey of Spanish children. Annals of Dyslexia. 2007; 57:179–198. [PubMed: 18041589]

Deacon SH, Kirby JR. Morphological awareness: just "more phonological"? The roles of morphological and phonological awareness in reading development. Applied Psycholinguistics. 2004; 25:223–238.

Dietrich JA, Brady SA. Phonological representations of adult poor readers: An investigation of specificity and stability. Applied Psycholinguistics. 2001; 22(3):383–418.

Dunn, L.; Dunn, L. Peabody Picture Vocabulary Test. 3rd ed.. Circle Pines, MN": American Guidance Service; 1997.

Fowler, A.; Liberman, IY. The role of phonology and orthography in morphological awareness. In: Feldman, L., editor. Morphological aspects of language processing. Mahwah, NJ: Lawrence Erlbaum Associates, Inc; 1995. p. 189-209.

Frith, U. Unexpected spelling problems. In: Frith, U., editor. Cognitive processes in spelling. San Francisco: Academic; 1980. p. 495-515.

Greenberg D, Ehri LC, Perin D. Are word reading processes the same or different in adult literacy students and 3rd-5th graders matched for reading level? Journal of Educational Psychology. 1997; 89:262–275.

Greenberg D, Ehri LC, Perin D. Do adult literacy students make the same word-reading and spelling errors as children matched for word-reading age? Scientific Studies of Reading. 2002; 6:221–243.

Gunn B, Biglan A, Smolkowski K, Ary D. The efficacy of supplemental instruction in decoding skills for Hispanic and non-Hispanic students in early elementary school. The Journal of Special Education. 2000; 34(2):90–103.

Hogan T, Catts HW, Little TD. The relationship between phonological awareness and reading: Implications for the assessment of phonological awareness. Special Education and Communication Disorders Faculty Publications. 2005:14.

Henderson, E. Teaching spelling. Boston, MA: Houghton Mifflin; 1985.

Jarmulowicz L, Hay SE, Taran VL, Ethington CA. Fitting derivational morphophonology into a developmental model of reading. Reading and Writing. 2008; 21(3):275–297.

Jeon EH. Comprehension of morphological awareness to second-language reading comprehension. The Modern Language Journal. 2011; 95:217–235.

Johnson DJ. Persistent auditory disorders in young dyslexic adults. Bulletin of the Orton Society. 1980; 30:268–276.

Johnson, K.; Bayrd, P. Megawords decoding, spelling and understanding multisyllabic words. 2nd ed.. Cambridge, Mass: School Speciality Inc.; 2010.

Kibel, M.; Miles, TR. Phonological errors in the spelling of taught dyslexic children, in Reading. In: Hulme, C.; Snowling, M., editors. Development and Dyslexia. Philadelphia, PA US: Whurr Publishers; 1994. p. 105-127.

Kieffer MJ. Catching up or falling behind? initial english proficiency, concentrated poverty, and the reading growth of language minority learners in the united states. Journal of Educational Psychology. 2008; 100(4):851–868.

Kirk C, Gillon GT. Integrated morphological awareness intervention as a tool for improving literacy. Language, Speech, and Hearing Services in Schools. 2009; 40(3):341–351.

Kuo Y, Anderson RC. Development of morphological awareness in chinese and english. Reading and Writing. 2003; 16(5):399–422.

Kuo L, Anderson RC. Morphological awareness and learning to read: A cross-language perspective. Educational Psychologist. 2006; 41(3):161–180.

Larsen JA, Nippold MA. Morphological analysis in school-age children: Dynamic assessment of a word learning strategy. Language, Speech, and Hearing Services in Schools. 2007; 38(3):201–212.

McBride-Chang C, Tardif T, Cho J, Shu H, Fletcher P, Stokes SF, Wong A, Leung K. What's in a word? morphological awareness and vocabulary knowledge in three languages. Applied Psycholinguistics. 2008; 29(3):437–462.

MacArthur CA, Konold TR, Glutting JJ, Alamprese JA. Reading component skills of learners in adult basic education. Journal of Learning Disabilities. 2010; 43:108–121. [PubMed: 20179306]

Miller GA, Gildea PM. How children learn words. Scientific American. 1987; 257:94–99. [PubMed: 3659892]

Nagy WE, Anderson RC. The number of words in printed school English. Reading Research Quarterly. 1984; 19:304–330.

Nagy W, Berninger V, Abbott R, Vaughan K, Vermeulen K. Relationship of morphology and other language skills to literacy skills in at-risk second-grade readers and at-risk fourth-grade writers. Journal of Educational Psychology. 2003; 95:730–742.

Nagy W, Berninger V, Abbott R. Contributions of morphology beyond phonology to literacy outcomes of upper elementary and middle-school students. Journal of Educational Psychology. 2006; 98(1): 134–147.

Nanda AO, Greenberg D, Morris R. Modeling child-based theoretical reading constructs with struggling adult readers. Journal of Learning Disabilities. 2010; 43:138–153.

Nunes T, Bryant P, Olsson J. Learning morphological and phonological spelling rules: An intervention study. Scientific Studies of Reading. 2003; 7(3):289–307.

Olson R, Wise B, Conners F, Rack J, Fulker D. Specific deficits in component reading and language skills Genetic and environmental influences. Journal of Learning Disabilities. 1989; 22(6):339–348. [PubMed: 2738467]

Pratt AC, Brady S. Relation of phonological awareness to reading disability in children and adults. Journal of Educational Psychology. 1988; 80(3):319–323.

Proctor CP, Uccelli P, Dalton B, Snow CE. Understanding depth of vocabulary online with bilingual and monolingual children. Reading & Writing Quarterly: Overcoming Learning Difficulties. 2009; 25(4):311–333.

Quigley, BA. Reasons for Resistance to Attending Adult Basic Literacy. Kent: Ohio Literacy Resource Center; 1995. (ED 378 408).

Sabatini, JP.; Venezky, RL.; Janin, R.; Kharik, P. Cognitive reading assessments for low literate adults: An analytic review and new framework (TR00-01). University of Pennsylvania: National Center on Adult Literacy; 2000.

Sabatini JP, Sawaki Y, Shore JR, Scarborough HS. Relationships among reading skills of adults with low literacy. Journal of Learning Disabilities. 2010; 43(2):122–138. [PubMed: 20179307]

Schwertman K, Corey M, New York PL. Writing processes and behaviors of adult literacy students: An ethnographic case study. 1989:1–54.

Shankweiler D, Crain S, Katz L, Fowler AE, Liberman AM, Brady SA, Shaywitz BA. Cognitive profiles of reading-disabled children: Comparison of language skills in phonology, morphology, and syntax. Psychological Science. 1995; 6(3):149–156.

Singson M, Mahony D, Mann V. The relation between reading ability and morphological skills: Evidence from derivational suffixes. Reading and Writing: An Interdisciplinary Journal. 2000; 12:219–252.

Stackhouse, J. Phonological deficits in developmental reading and spelling disorders. In: Grunwell, P., editor. Developmental speech disorders. New York: Churchill Livingstone; 1990. p. 163-182.

Stæhr LS. Vocabulary knowledge and advanced listening comprehension in english as a foreign language. Studies in Second Language Acquisition. 2009; 31(4):577–607.

Stahl SA, Shiel TG. Teaching meaning vocabulary: Productive approaches for poor readers. Reading & Writing Quarterly: Overcoming Learning Difficulties. 1992; 8(2):223–241.

Stanovich KE. Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. Reading Research Quarterly. 1986; 22:360–407.

Stanovich KE, West RF. Exposure to print and orthographic processing. Reading Research Quarterly. 1989; 24(4):402–433.

Thompkins AC, Binder KS. A comparison of the factors affecting reading performance of functionally illiterate adults and children matched by reading level. Reading Research Quarterly. 2003; 38:236–258.

Tighe E, Binder KS. Original to originality: An investigation of morphological accuracy and response times in adults with low literacy. Journal of Applied Psycholinguistics. 2014

Tong X, Deacon SH, Kirby JR, Cain K, Parrila R. Morphological awareness: A key to understanding poor reading comprehension in english. Journal of Educational Psychology. 2011; 103(3):523–534.

Tunmer WE, Nesdale AR. Phonemic segmentation skill and beginning Reading. Journal of Educational Society. 1985; 77:417–527.

Venezky RL, Sabatini JP. Introduction to this special issue: Reading development in adults. Scientific Studies of Reading. 2002; 6(3):217–220.

Wagner, RK.; Torgesen, JK.; Rashotte, CA.; Nils, PA. Test of Silent Reading Efficiency and Comprehension (TOSREC) Grade 6. Seattle, WA: PRO-ED, INC; 2010.

Woodcock, RW. Woodcock Reading Mastery Tests – Revised. Circle Pines, MN: AGS Publishing; 1987.

Worthy J, Viise NM. Morphological, phonological, and orthographic differences between the spelling of normally achieving children and basic literacy adults. Reading and Writing: An Interdisciplinary Journal. 1996; 8:139–159.

Wu X, Anderson RC, Li W, Wu X, Li H, Zhang J, Zheng Q, Zhu J, Shu H, Jiang W, Chen X, Wang Q, Yin L, He Y, Packard J, Gaffney JS. Morphological awareness and chinese children's literacy development: An intervention study. Scientific Studies of Reading. 2009; 13(1):26–52.

Yeung P, Ho CS, Chik PP, Lo HL, Luan H, Chan DW, Chung KK. Reading and spelling of Chinese among beginning reading: What skills make a difference? Scientific Studies of Reading. 2011; 15:285–313.

Table 1

Sample Sizes, Means and Standard Deviations

	N	Mean	*SD*
Phonological Decoding[1]	55	20.38	8.962
Morphological Awareness Total	55	46.41	20.115
Derivation	57	15.63	10.201
Production	60	25.25	7.856
Suffix Choice	59	7.51	3.888
Spelling Total	55	29.56	19.996
Part I: Root Words	57	19.46	11.392
Part II: Complex Words	60	9.98	9.258
Vocabulary (PPVT)[1]	59	143.97	24.867
Passage Comprehension[1]	58	28.76	6.586
Listening Comprehension (TOSREC)	59	42.95	16.269

[1]: achievement measures

Table 2

Achievement Age and Grade Equivalents

	Mean Age Equivalent (*SD*)	**Mean Grade Equivalent (*SD*)**
Phonological Decoding	12.34 (*4.82*)	6.99 (*5.11*)
Vocabulary	9.96 (*2.34*)	4.02 (*2.15*)
Passage Comprehension	10.7 (*3.89*)	5.33 (*3.24*)

Table 3

Correlations between Spelling, Vocabulary, and Comprehension to Phonological and Morphological Awareness

	Phonological Decoding	Morphological Awareness
Spelling Total	.753**	.644**
Vocabulary (PPVT)	.344*	.719**
Passage Comprehension	.620**	.643**
Listening Comprehension (TOSREC)	.398*	.761**

Note.

* $p \leq 0.01$,

** $p \leq 0.001$

Table 4

Hierarchical Multiple Regression Analysis Summary for Phonological Awareness, Morphological Awareness, Spelling, Vocabulary, and Comprehension

	B	*SE B*	B	*t*	*p*
Spelling					
Phonological Decoding	1.283	.245	.575	5.242	<.001
Morphological Awareness	.301	.116	.286	2.603	.012
Vocabulary					
Phonological Decoding	−.477	.345	−.168	−1.384	.172
Morphological Awareness	1.102	.163	.822	6.772	<.001
Reading Comprehension					
Phonological Decoding	.325	.088	.434	3.706	.001
Morphological Awareness	.018	.056	.050	.315	.754
Vocabulary	.119	.035	.451	3.429	.001
Listening Comprehension					
Phonological Decoding	−.026	.161	−.016	−.165	.870
Morphological Awareness	.276	.102	.355	2.7	.009
Vocabulary	.326	.063	.562	5.133	<.001