

# Teaching morphemic and contextual analysis to fifth-grade students

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For every word a child learns, we estimate that there are an average of one to three additional related words that should also be understandable to the child, the exact number depending on how well the child is able to utilize context and morphology to induce meanings. (Nagy & Anderson, 1984, p. 304)

**O**n the basis of their analysis of printed school English in 1984, Nagy and Anderson argued that if students are equipped with the ability to infer word meanings by scrutinizing surrounding context clues and analyzing the meaningful parts of words (morphology), they have the

power to expand their reading vocabulary significantly. Also in 1984, Johnson and Baumann concluded their review of instructional research on word identification by noting that conventional wisdom and belief suggested that instruction in word identification strategies, including structural (morphemic) and contextual analysis, “can significantly help children independently expand their vocabularies” (p. 602). They further noted, however, that “empirically, we have been unable to document strong support for such belief” (p. 603).

Unfortunately, there remains no compelling body of research evidence for the efficacy of instruction in contextual and morphemic analysis. Although there has been

### Teaching morphemic and contextual analysis to fifth-grade students

This study explored the effects of instruction in morphemic analysis (select prefixes) and contextual analysis (select context clue types). Four classes of fifth-grade students were assigned to a morphemic-only, context-only, or combined morphemic-context experimental group or to an instructed control group. Following twelve 50-minute lessons, students were tested on their ability to recall the meanings of words used to teach the morphemic and contextual analysis skills (lesson words), to infer the meanings of uninstructed words that contained taught morphemic elements or words that were embedded in text that included taught context clues (transfer words), and to

comprehend text containing transfer words. The results indicated that (a) there was an immediate and delayed effect of morphemic and contextual analysis instruction for lesson words; (b) there was an immediate effect of morphemic and contextual analysis instruction for transfer words; (c) there was no evidence that instruction in morphemic or contextual analysis, either in isolation or combination, enhanced students' text comprehension; and, (d) students were generally just as effective at inferring word meanings when the morphemic and contextual analysis instruction was provided in combination as when the instruction was provided separately.

### La enseñanza de análisis morfológico y contextual a estudiantes de quinto grado

Este estudio exploró los efectos de la enseñanza de análisis morfológico (seleccionar prefijos) y análisis contextual (seleccionar pistas contextuales). Cuatro cursos de estudiantes de quinto grado fueron asignados a tres grupos experimentales: morfológico, contextual o morfológico-contextual combinado, o a un grupo de control. Luego de 12 clases de 20 minutos, se evaluó a los estudiantes en la capacidad para recordar los significados de las palabras usadas para enseñar habilidades de análisis morfológico y contextual (palabras de la lección), para inferir los significados de palabras no enseñadas que contenían elementos morfológicos ya vistos o palabras contenidas en textos que incluían pistas contextuales enseñadas (palabras de transferencia) y por último, comprender textos que con-

tenían palabras de transferencia. Los resultados indicaron que (a) hubo un efecto inmediato y diferido de la enseñanza de análisis morfológico y contextual para las palabras de la lección, (b) hubo un efecto inmediato de la enseñanza de análisis morfológico y contextual para las palabras de transferencia, (c) no se obtuvo evidencia de que la enseñanza de análisis morfológico o contextual, ya sea en forma aislada o combinada, mejorara la comprensión de textos y (d) los estudiantes fueron igualmente eficaces para inferir los significados de las palabras cuando la enseñanza de análisis morfológico y contextual se impartió en forma aislada, que cuando se realizó en forma combinada.

### Unterrichten morphemischer und kontextualer Analyse von Schülern der fünften Klasse

Diese Studie untersuchte die Unterrichtsauswirkungen in morphemischer Analyse (Vorwort-Auswahl) und kontextualer Analyse (Kontexthinweis-Auswahl). Vier Klassen der fünften Stufe wurden entweder nur morphemischen, nur kontextualen, oder einer kombiniert morphemisch-kontextualen Experimentier-Gruppe oder einer Anweisungen befolgenden Kontrollgruppe zugeteilt. Nach 12 jeweils 50-Minuten dauernden Unterrichtsstunden wurden die Schüler auf ihre Fähigkeit überprüft, sich an Bedeutung und Sinn der zuvor im Unterricht benutzten morphemischen und kontextualen Analysekenntnisse (Unterrichtswörter) zu erinnern, auf die Bedeutung nicht erklärter Wörter zu schließen, welche die unterrichteten morphemischen Elemente enthielten, oder die im Text verankerten Wörter, die unterrichtete Zusammenhangshinweise

(Transferwörter) enthielten, zu erkennen und Text mit Transferwörter inhaltlich zu verstehen. Die Ergebnisse ließen darauf schließen, daß (a) es einen sofortigen und verzögerten Effekt der morphemischen und kontextualen Analyseanweisung für Unterrichtswörter gab; (b) es einen Sofort-Effekt der morphemischen und kontextualen Analyseanweisung für Transferwörter gab; (c) es keinen Beweis gab, daß die Anweisung in morphemischer oder kontextualer Analyse entweder in der Isolation oder als Kombination das Textverständnis der Schüler verbesserte; und, (d) die Schüler allgemein ebenso erfolgreich beim Einfügen von Wortbedeutungen waren, wenn die morphemische und kontextuale Analyseanweisung als Kombination vorgegeben wurde, genau wie bei der separaten Vorgabe der Anweisung.

## 形態素分析と文脈分析を5年生に教える

この研究は形態素分析（接頭辞を選ばせる）と文脈分析（文脈の鍵になるタイプを選ばせる）における教育効果を明らかにすることである。5年生の4クラスの生徒を、形態素分析だけの実験群、文脈分析だけの実験群、形態素と文脈分析を組み合わせた実験群と統制群にふり分ける。50分授業を12回行ったあと、生徒たちは、形態素と文脈分析技術を教えるのに用いられた単語（単語の練習）の意味を思い出す能力、既習の形態素を含む未習単語の意味や既に習った文脈の鍵を含むテキストに生め込まれた単語（単語の入れ替え）の意味を解釈する能力、単語が

入れ替えられているテキストを理解する能力についてテストされた。その結果から、次のことが示唆される。(a)単語練習に対して、形態素や文脈分析教育の直接的および延期的効果があった。(b)単語入れ替えに対して、形態素や文脈分析の直接的な効果があった。(c)形態素あるいは文脈分析における教育が、単独であろうと組み合わせであろうと、生徒のテキスト理解を強化する証拠は見られなかった。(d)形態素および文脈分析教育を単独で行っても組み合わせで行っても、単語の意味を解釈することに関して生徒たちには概して全く同じ効果が見られた。

## L'enseignement de l'analyse morphémique et contextuelle à des élèves de 5<sup>e</sup> année

Cette étude explore les effets de l'enseignement de l'analyse morphémique (sélection de préfixes) et de l'analyse contextuelle (sélection de types d'indices de contexte). On a assigné quatre classes de d'élèves de 5<sup>e</sup> année à un groupe expérimental, soit morphémique uniquement, soit contextuel uniquement, soit présentant une combinaison de morphémique et de contextuel, soit à un groupe contrôle avec enseignement. Après 12 leçons de 50 minutes, les élèves ont été testés sur leur capacité à rappeler la signification des mots utilisés pour enseigner les compétences d'analyse morphémique et contextuelle (mots des leçons), à inférer la signification de mots non enseignés mais contenant des éléments morphémiques ou de mots insérés dans un texte comportant les indices contextuels en-

seignés (mots transfert), et de comprendre un texte contenant les mots transfert. Les résultats montrent a) un effet immédiat et différé de l'enseignement de l'analyse morphémique et contextuelle pour les mots des leçons; b) un effet immédiat de l'enseignement de l'analyse morphémique et contextuelle pour les mots transfert; c) qu'il n'y a pas de preuve que l'enseignement de l'analyse morphémique et contextuelle, isolée ou combinée, facilite la compréhension de texte par les élèves; et, d) que les élèves sont en général aussi efficaces pour inférer la signification de mots après un enseignement de l'analyse morphémique et contextuelle conduit de façon isolément qu'en combinaison.

## Обучение морфологическому и контекстному анализу учащихся пятого класса

Исследованы результаты обучения морфологическому анализу (выбор приставок) и контекстному анализу (выбор типов контекстуальных ключей). Пятиклассникам из трех классов были предложены: только морфологический, только контекстуальный или объединенный морфологически-контекстуальный анализ. Четвертый класс являлся стандартной контрольной группой. После двенадцати 50-минутных уроков учащиеся были проверены на способность *вспомнить* значения слов, которые использовались на уроке в процессе выработки навыков морфологического и контекстуального анализа; *определить* значение слов, на уроке не звучавших, но содержащих изученные морфологические элементы, или слов, которые были вкраплены в текст, в том числе – контекстуальных

ключей (слов «толкователей»), и *понять* текст, содержащий контекстуальные ключи. Результаты показывают, что (а) в отношении слов, употреблявшихся на уроке, обучение морфологическому и контекстному анализу имеет как непосредственный, так и отсроченный эффект; (б) в отношении слов «толкователей» был отмечен непосредственный эффект обучения морфологическому и контекстному анализу; (в) нет свидетельств того, что обучение морфологическому или контекстному анализу, по отдельности или в сочетании, повышает уровень понимания учащимися текста; и, (г) в целом, учащиеся одинаково успешно определяли значения слов при обучении морфологическому и контекстному анализу в сочетании, и по отдельности.

considerable research on instructional strategies for teaching specific vocabulary items (e.g., Baumann & Kame'enui, 1991; Beck & McKeown, 1991; Blachowicz & Fisher, 2000; Nagy & Scott, 2000), the intervention research on teaching students to use generalizable linguistic cues such as morphemic elements and context is limited and sometimes equivocal (Baumann, Bradley, Edwards, Font, & Hruby, 2000). The purpose of this study was to extend the knowledge base on teaching linguistic cues to expand word knowledge by evaluating the efficacy of teaching fifth-grade students morphemic and contextual analysis abilities as strategies to promote vocabulary learning and comprehension.

## *Theoretical background*

### **The fertility/futility debate**

There has been an ongoing argument regarding reading vocabulary growth and instruction. One point of view is that, given the unreliability of context clues (Beck, McKeown, & McCaslin, 1983; Schatz & Baldwin, 1986), specific vocabulary can be taught in effective, *fertile* ways through direct instruction of specific words (Beck, McKeown, & Omanson, 1984). Indeed, numerous studies indicate that students can be effectively taught the meanings of specific new words through a variety of instructional strategies (see reviews by Anderson & Nagy, 1991; Baumann & Kame'enui, 1991; Beck & McKeown, 1991; Blachowicz & Fisher, 2000; Calfee & Drum, 1986; Graves, 1986; Miller & Gildea, 1987; Stahl & Fairbanks, 1986). The counterargument is that it is *futile* to attempt to teach words individually because of the vast number of words students must learn and limited instructional time (Nagy & Herman, 1984). Instead, it is argued that students' growth in vocabulary can be best accounted for by independent reading (Nagy, Anderson, & Herman, 1987), listening to stories read aloud (Elley, 1989), and exposure to enriched oral language (Dickinson, Cote, & Smith, 1993).

Missing from the fertility/futility debate, however, is the acknowledgment that vocabulary growth can occur through the application of generalizable linguistic knowledge in the form of morphemic and contextual analysis. *Morphemic analysis* involves unlocking a word's meaning by examining its morphemes, or meaningful parts, such as base words, prefixes and suffixes, inflected endings, and Latin or Greek roots. *Contextual analysis* involves inferring a word's meaning by scrutinizing surrounding text, which includes syntactic and semantic linguistic cues provided by preceding and succeeding words, phrases, and sentences. Nagy and Scott (2000) acknowledged the prevalence of linguistic cues by noting that "context and morphology (word parts) are the two major sources of in-

formation immediately available to a reader who comes across a new word" (p. 275). Although morphemic or contextual analysis is not as effective for vocabulary learning when compared to direct instruction in the meanings of *specific* words (Baumann & Kame'enui, 1991), instruction in morphemic and contextual analysis has the potential to equip a learner with the ability to infer the meanings of *numerous* words in an independent manner.

### **Research on teaching morphemic analysis**

The meanings of many words can be inferred through morphemic analysis (Harmon, 1998; Nagy, Anderson, Schommer, Scott, & Stallman, 1989), and students above the fourth grade are likely to benefit from such instruction (Nagy, Diakidoy, & Anderson, 1993; Tyler & Nagy, 1989; White, Power, & White, 1989). The research on teaching morphemic analysis, however, is inconclusive regarding the effects of such instruction on independent vocabulary learning and comprehension.

Several early studies revealed mixed results regarding the effects of instruction in morphemic elements. Otterman (1955) reported that seventh-grade students who received thirty 10-minute lessons on prefixes and roots outperformed controls on a test of morphemic elements (instructed prefixes and roots) and a spelling test. Only high-ability students, however, were able to interpret the meanings of novel words made from the taught morphemic elements, and there were no group differences on measures of general vocabulary and reading comprehension. Thompson (1958) provided college students instruction in 20 prefixes and 14 roots and reported that students learned the meanings of these morphemic elements, were able to identify them in words, and were able to recognize words that contained taught prefixes; however, this study suffered from the lack of an adequate control group. In a study by Hanson (1966), first-grade students who were provided 18 lessons in inflections (verb tense, comparatives, superlatives) outperformed controls on a specially constructed variant ending test, although there were no group differences on a general reading test. Freyd and Baron (1982) reported that eighth-grade students who received five 45-minute lessons on specific suffixes did not demonstrate greater pretest to posttest gains on a measure of derived words (words with suffixes) when compared to pretest to posttest gains on a measure of simple words (words without suffixes).

Additional research conducted in the 1980s provided some evidence of the positive effects of instruction on morphemic analysis. Graves and Hammond (1980) reported that seventh-grade students who were provided three 20–25-minute lessons on nine commonly occurring prefixes outperformed instructed and uninstructed controls on a test of transfer words that contained the taught prefixes.

White, Sowell, and Yanagihara (1989) provided 14–16 lessons on nine prefixes to high-ability, third-grade children, who outperformed controls on tests of root and prefix meanings and on transfer tests of unfamiliar prefixed words. White, Sowell et al. also described similar findings for a study by Nicol, Graves, and Slater (1984) in which fourth-, fifth-, and sixth-grade students who were taught eight prefixes in three 30-minute lessons outperformed uninstructed controls on immediate and delayed transfer tests. Finally, Wysocki and Jenkins (1987) conducted an experiment in which fourth-, sixth-, and eighth-grade students were provided three 15–20-minute lessons that included instruction in the definitions of low-frequency words in isolation and sentence contexts. Each word that was taught was paired with a morphological derivative; for example, the definition of *gratuity* was taught and the derivative *gratuitous* was used to assess transfer. Results revealed that students were more likely to define correctly morphologically derived words, whether presented in weak or strong context, for the set of words they had been taught.

What do the extant studies reveal about the efficacy of instruction in morphemic analysis? Although there is some evidence to support the conventional wisdom regarding the power of morphemic analysis, the studies are limited in several ways. Many of the studies are presented in abbreviated reports or provide limited information about the experimental design, methodology, and analyses. Due to the variety of morphological features that have been taught (e.g., prefixes, suffixes, inflections, roots, general morphological derivatives), there are no clear trends regarding which morphological elements are most efficient for promoting transfer and generalization. Also, variation in the nature and duration of the interventions provides little insight into the type and intensity of instruction most effective for enhancing students' morphological analysis ability. In 1955 Otterman noted that "research in this area [study of affixes and stems] is rather scanty, and the studies which have been made are not consistent in their findings" (p. 611). Unfortunately, 46 years later, similar limitations persist in the literature.

### **Research on teaching contextual analysis**

Research on the power context plays in incidental word learning by reading and listening is compelling (Nagy & Scott, 2000; Swanborn & de Glopper, 1999). We have less information, however, about whether teachers can enhance this natural effect by instructing students on how to employ context clues.

Several early studies provided inconclusive evidence on the effects of contextual analysis instruction. Hafner (1965) reported that fifth-grade students who received context clue instruction did not outperform controls on

ability to apply contextual analysis. Askov and Kamm (1976) reported that third-, fourth-, and fifth-grade students who were provided 4 hours of instruction in cause and effect and description context clues outperformed controls, but the dependent measure was a criterion-referenced measure highly sensitive to the instructed content. In another study (Sampson, Valmont, & Allen, 1982), third-grade students who received indirect teaching in the use of context clues through the use of instructional cloze exceeded control-group students in performance on a postintervention cloze test and a comprehension test, but the study provided no index of students' ability to infer the meanings of specific, untaught words.

Other studies tend to support the power of instruction in contextual analysis. Carnine, Kame'enui, and Coyle (1984) reported that fourth-, fifth-, and sixth-grade students who were provided brief instruction in either a rule-and-practice treatment or a practice-only treatment in how to use synonym and contrast context clues outperformed a no-intervention control group on experimenter-constructed posttests. Extending the work of Carnine et al., Patberg, Graves, and Stibbe (1984) provided fifth-grade students *active teaching* in synonym and contrast context clues; results favored the active-teaching group over both a context-practice group and an uninstructed control group. However, a follow-up to this study (Patberg & Stibbe, 1985) failed to demonstrate an effect of context instruction. Sternberg (1987) described a study in which tenth- and eleventh-grade students who received six lessons on six context clue types outperformed controls on measures that included neologisms (newly coined words) and cloze items. Sternberg also described a study in which adults who received context clue instruction outperformed controls. Sternberg's studies, however, were reported only in summary form and produced weak effects for context clue instruction. Jenkins, Matlock, and Slocum (1989) taught fifth-grade students a general strategy for deriving word meanings from context, and experimentals outperformed controls who received word definition instruction on measures requiring them to infer the meanings of untaught words from context. Buikema and Graves (1993) reported that seventh- and eighth-grade students taught to use descriptive context clues outperformed students who followed the standard language arts curriculum on measures that evaluated the ability to infer the meanings of uninstructed words.

What does the instructional research on contextual analysis reveal? Similar to the research on morphemic analysis, there are limits to both the internal and external validity of the research base (Baumann & Kame'enui, 1991). However, following a meta-analysis of intervention research on contextual analysis, Fukkink and de Glopper (1998) concluded that,

it makes sense to teach students how to derive word meaning from context. As this meta-analysis shows, deliberately deriving word meaning from context is amenable to instruction and the effect [mean  $d = 0.43$ ] of even relatively short instruction is rewarding. (pp. 461–462)

In a synthesis of the literature on teaching children to learn word meanings from context, Kuhn and Stahl (1998) noted that several studies suggested that simple practice in deriving word meanings from context may be just as effective as instruction in specific context clue types. Fukkink and de Glopper (1998) noted, however, that their meta-analysis suggested that “clue instruction appears to be more effective than other instruction types or just practice” (p. 450). Further research is warranted to tease out these and other issues related to instruction in contextual analysis in what remains an under-researched topic. As Kuhn and Stahl (1998) noted, “Given the frequent recommendations that children be taught the use of context clues, the paucity of research evidence is disappointing” (p. 129).

### **Research on combined morphemic and contextual analysis instruction**

The only study we could identify that included instruction in both morphemic and contextual analysis, and hence approximates this inquiry, was conducted by Tomesen and Aarnoutse (1998) with children in the Netherlands. Tomesen and Aarnoutse devised an instructional program that incorporated direct instruction and reciprocal teaching. They taught 31 Grade 4 average and poor readers to derive word meanings within informational Dutch text. The children were provided twelve 45-minute, small-group lessons that included instruction in contextual analysis (illustration, synonym, antonym, and general description context clues) and morphological analysis (instruction in unspecified familiar part(s) of a word). Results indicated that experimental-group children outperformed uninstructed controls on two measures that evaluated students’ ability to derive the meanings of unfamiliar words, with a slight advantage for the poor readers on one measure. Groups did not differ on a general measure of reading comprehension. The authors noted, however, that a possible Hawthorne effect due to the absence of instruction for the control group limited their inquiry.

### **Research on vocabulary instruction and text comprehension**

The relationship between vocabulary and comprehension has been known for quite some time through various correlational and factor analytic studies (e.g., Davis, 1944, 1968; Singer, 1965; Spearitt, 1972). The assertion that there is a causal relationship between vocabu-

lary and comprehension has been referred to as the *instrumentalist hypothesis*, which “claims that vocabulary knowledge is directly and importantly in the causal chain resulting in text comprehension” (Anderson & Freebody, 1981, p. 81). In other words, the instrumentalist hypothesis suggests that word knowledge causes comprehension, or “Vocabulary Knowledge → Reading Comprehension” as Stahl (1999, p. 4) has expressed.

The exact nature of vocabulary and comprehension connections, however, has been both theoretically and empirically elusive and troublesome (Beck, McKeown, & Omanson, 1987; Becker, 1977; Chall, 1958; Jenkins & Pany, 1981). Anderson and Freebody (1981) challenged the field to document experimentally the importance of word knowledge to text comprehension.

To prove that knowing the meaning of individual words has an important instrumental role in understanding text would require more than correlational evidence. It would need to be shown: (a) that the substitution of easier or more difficult words in a text makes that text easier or more difficult to comprehend, and (b) that people are helped to comprehend a text if they learn the meanings of the unfamiliar words it contains. (p. 83)

In the 20 years since Anderson and Freebody (1981) posed their challenge, a number of researchers have documented the vocabulary and text comprehension connection (see Baumann, Kame’enui, & Ash, in press). For example, Kame’enui, Carnine, and Freschi (1982) addressed Anderson and Freebody’s first issue by demonstrating that students’ text comprehension was superior when familiar words were substituted for more difficult words in short, experimenter-constructed passages. Anderson and Freebody’s second challenge has been addressed in a series of studies by Beck, McKeown, and colleagues (Beck, Perfetti, & McKeown, 1982; McKeown, Beck, Omanson, & Perfetti, 1983; McKeown, Beck, Omanson, & Pople, 1985) who established that instruction in specific words can enhance the comprehension of texts containing taught words, but such instruction must be frequent and rich in order to effect comprehension gains. Kame’enui et al. also reported superior text comprehension by students who were taught the meanings of difficult vocabulary through synonyms or short definitions. The meta-analysis by Stahl and Fairbanks (1986) confirmed that instruction in specific vocabulary, particularly when programs contained both definitional and contextual information, enhances the comprehension of text containing taught words with some influence on more global measures of comprehension.

There is very little research, however, exploring the transfer effects of instruction in morphemic or contextual analysis to reading comprehension. Otterman (1955) and

Hanson (1966) reported that experimental students who were taught specific morphemic elements could demonstrate knowledge of them, but they found no group differences on general reading or comprehension measures. With the exception of the study by Sampson et al. (1982), who reported that experimental students who engaged in cloze exercises outperformed controls on a standardized comprehension test and a cloze test, the transfer of context clue instruction to reading comprehension has not been explored. In the only study we identified that examined instruction in deriving word meaning through morphology and context clues, Tomesen and Aarnoutse (1998) reported that experimentals did not outperform controls on a measure of general reading comprehension. Thus, it remains an open question whether instruction in generalizable word-learning strategies can enhance the comprehension of text, or to extend Stahl's (1999) representation of the instrumentalist hypothesis, whether morphemic/contextual analysis ability → vocabulary knowledge → reading comprehension.

### **Rationale and research questions**

As has been demonstrated, much of the extant research on the effects of morphemic and contextual analysis instruction is reported in abbreviated form, limited methodologically, or inconclusive. This assertion is supported by the National Reading Panel's (2000) inability to identify any vocabulary studies that met their criteria for inclusion in their formal meta-analysis. Further, although some research suggests that morphemic and contextual cues operate independently (Wysocki & Jenkins, 1987), other analyses suggest that context is important in identifying the appropriate root meaning for affixed words (White, Power et al., 1989). However, no studies have examined the independent and combined effects of instruction in morphemic and contextual analysis. Finally, although the connection between elaborate instruction in specific vocabulary and reading comprehension has been established (McKeown et al., 1985; Stahl & Fairbanks, 1986), the impact of morphemic and context clue instruction on students' comprehension of texts containing words that are morphemically and contextually decipherable has yet to be fully explored.

The purpose of this study was to address the preceding issues by examining the effects of teaching students morphemic and contextual analysis to promote vocabulary learning and comprehension. The study compared the effect of instruction in morphemic analysis only (selected prefixes), contextual analysis only (selected context clue types), and combined morphemic-contextual analysis (both selected prefixes and context clues) to students in an instructed control group. Dependent measures evaluated students' ability to learn words presented

during instruction, to infer the meanings of uninstructed transfer words, and to comprehend texts containing morphologically and contextually decipherable words. Four research questions were posed:

1. What are the immediate and delayed effects of morphemic and contextual analysis instruction on students' learning of words presented during instruction?
2. What are the immediate and delayed effects of morphemic and contextual analysis instruction on students' ability to infer the meanings of uninstructed transfer words?
3. What effect does morphemic and contextual analysis instruction have on students' comprehension of texts containing morphologically and contextually decipherable words?
4. What is the relative effectiveness of morphemic and contextual analysis instruction when provided in isolation versus in combination?

## *Method*

### **Design**

The overall design involved a mixed method of quantitative and descriptive design. Specifically, one of Tashakkori and Teddlie's (1998) "dominant-less dominant mixed method designs" was employed, "in which one paradigm and its methods are dominant, while a small component of the overall study is drawn from an alternative design" (p. 44). The dominant design was quantitative and involved a between-subjects, pretest-posttest, control-group, quasi-experiment (Campbell & Stanley, 1966), with the student as the unit of analysis. The independent variable was group membership, which had four levels: morphemic-only instruction (MO), context-only instruction (CO), combined morphemic-context instruction (MC), and instructed control (IC). The less-dominant design involved descriptive data on students' vocabulary learning gathered through individual interviews with students selected from each treatment group.

### **Procedure**

Data were gathered by the first four authors: a university professor, two reading education doctoral candidates, and one of the fifth-grade teachers at the participating elementary school. All four experimenters were experienced elementary teachers. As a courtesy to her fifth-grade colleagues, the teacher-participant volunteered her class to be assigned to the IC group; the MO, CO, and MC interventions were randomly assigned to the remaining three fifth-grade classes.

To control for teacher instructional effects, the experimenters rotated among the four intervention classes in a counterbalanced order such that each experimenter taught each of the four intervention groups for three consecutive days across the four-week intervention period. Instruction was provided on consecutive days in order to avoid the discontinuity that would occur with daily experimenter rotations among treatments.

Data were gathered by the researchers on 20 days over a 5-week period. Following 2 days of pretesting were 12 days of intervention (3 days for each of 4 consecutive weeks). Four days of immediate posttesting followed the intervention: 3 days of whole-group posttesting and 1 day for student interviews. Delayed posttests were administered on 2 days 5 weeks later. All pre- and posttests were administered in the same order to all intervention groups. To control for teacher assessment effects, a counterbalancing schedule distributed the experimenters across the intervention classes for pre- and posttesting. All intervention lessons and group assessment sessions were approximately 50 minutes in length. Each student interview, all conducted by the first author, lasted approximately 20 minutes.

### Participants

The study was conducted with students from four heterogeneously grouped fifth-grade classes in a diverse public elementary school (56% African American, 35% European American, and 9% Latino/a, Asian, or Native American students) in a middle-sized community in the Southeastern United States. Ninety-two students returned signed permission forms. Data were not analyzed for four students: one MC student who moved during the intervention period, one IC student who became ill during posttesting, and two MC students who each missed one of the pretests. Thus, the final sample consisted of 88 participants (MO = 24, CO = 22, MC = 21, IC = 21).

### Target vocabulary

Students' ability to apply morphemic and contextual analysis vocabulary strategies was evaluated by assessing their ability to learn 60 low-frequency target words: 30 morphemic (prefixed) and 30 context words selected from the *American Heritage Word Frequency Book* (WFB) (Carroll, Davies, & Richman, 1971), a corpus of American school English for grades 3–9. Morphemic and context words were matched for frequency according to the WFB Standard Frequency Index (SFI), which is a measure of estimated word frequency adjusted for dispersion (i.e., how often a word appears across the various texts included in the WFB corpus). Each set of 30 morphemic and context words consisted of 10 lesson words (words students in specific experimental groups were exposed to

during the interventions) and 20 transfer words (words no students were exposed to during the interventions). Table 1 lists target vocabulary and their SFI values. As a frame of reference, an SFI value of 50 indicates an estimated occurrence of a word once in every 100,000 words, 40 SFI once in every million words, 30 SFI once in every 10 million words, and 20 SFI once in every 100 million words.

### Interventions

The independent variable, which was instructional intervention, consisted of three experimental groups and one control group.

*Morphemic-only group.* MO students received twelve 50-minute lessons on eight frequently occurring prefix families, which were identified by surveying 14 empirically and descriptively based lists of prefixes (e.g., Allen, 1999; Bear, Invernizzi, Templeton, & Johnston, 1996; Blachowicz & Fisher, 1996; Breen, 1960; Cunningham, 1995; Durkin, 1981; Johnson & Pearson, 1978; White, Sowell et al., 1989). Nine of the lessons (1, 2, 3, 5, 6, 7, 9, 10, 11) provided instruction in the eight prefix families (there were two lessons on the *Not* family), and the remaining three lessons (4, 8, 12) were cumulative reviews. Ten morphemic lesson words were presented as instructional examples within the 12 lessons. Table 2 presents the MO lesson content, the eight prefix families, the 10 lesson words, and the corresponding 20 transfer words that appeared only on morphemic posttests.

*Context-only group.* CO students received twelve 50-minute lessons on contextual analysis. There were nine instructional lessons, one that presented a generic context clue strategy (Lesson 1) and eight that presented specific context clue strategies (Lessons 2, 3, 5, 6, 7, 9, 10, 11) that were based upon Johnson and Pearson's (1978, pp. 117–118) nine categories of semantic context clues. The remaining three lessons (4, 8, 12) were cumulative reviews. Ten context lesson words were presented as instructional examples within the 12 lessons. Table 2 presents the CO lesson content, the 10 lesson words, and the corresponding 20 transfer words that appeared only on context posttests.

*Morphemic-context group.* MC students received twelve 50-minute lessons on combined instruction in morphemic and contextual analysis. The same instructional framework used in the MO and CO groups was employed (i.e., nine lessons that introduced new content and three review lessons). MC students, however, were taught both the MO and CO strategies, and they were exposed to both the MO and CO lesson words (see Table 2). By *combined* instruction we mean that students were taught both morphemic and contextual content and



**Table 1** Target vocabulary with standard frequency indices (SFI)

Morphemic target word	Morphemic SFI	Context target word	Context SFI
<i>antifreeze</i>	23.2	<i>lubricants</i>	23.2
<i>monorail</i>	24.8	canny	23.9
<i>superheated</i>	26.0	<i>competence</i>	25.6
unappetizing	29.2	fidgets	29.6
inactive	36.0	deluge	28.5
monotone	30.2	<i>chortle</i>	30.2
antisocial	30.5	squander	30.5
underestimated	30.6	<i>obliterated</i>	30.5
<i>disloyalty</i>	30.7	feline	30.6
postgraduate	30.8	stealth	32.0
reconsider	30.8	sequel	31.0
preshrunk	30.9	leviathan	31.0
overpopulation	31.5	admonished	31.3
mistreatment	33.2	<i>ostentatious</i>	33.7
bilingual	33.5	<i>gawk</i>	33.9
counterattack	33.9	pellets	34.0
mistrust	34.0	cantankerous	35.0
<i>retell</i>	35.5	ordinance	35.1
decode	35.7	ravenous	35.7
<i>underweight</i>	37.2	<i>teak</i>	37.2
<i>malnutrition</i>	39.0	hindrance	38.2
<i>postwar</i>	39.2	legacy	38.3
impure	39.6	<i>scorching</i>	41.2
subset	41.3	sage	41.9
dissimilar	41.6	eccentric	41.5
outrun	41.8	<i>quaint</i>	43.8
<i>improper</i>	42.7	embrace	42.5
superhighway	42.8	arid	43.0
<i>overflow</i>	43.7	<i>eroded</i>	43.3
semicircle	43.9	appliances	43.9
Morphemic Lesson mean SFI	34.2	Context Lesson mean SFI	34.3
Morphemic Transfer mean SFI	35.1	Context Transfer mean SFI	34.9
Total Morphemic mean SFI	34.8	Total Context mean SFI	34.7

Note. Lesson words are shown in *italic* and transfer words are shown in roman. SFI = Standard Frequency Index (Carroll et al., 1971).

strategies but in a consecutive manner rather than an integrated manner. In other words, MC students received separate, abbreviated versions of the lessons provided to the CO and MO groups. To ensure that instructional time was equivalent across treatments, fewer instructional examples and practice items were provided to MC students than those provided to students in the MO and CO groups.

The three experimental groups followed an explicit instruction model (Pearson & Gallagher, 1983) that included a release of responsibility dimension for strategy use (Pearson & Fielding, 1991). All lessons followed a three-part format: (a) an introduction that included an overview and examples of the morphemic or contextual analysis content; (b) an explicit instruction segment that included verbal explanation, modeling, and guided practice of the morphemic or contextual analysis content; and (c) a practice component that included independent practice of the morphemic or contextual analysis content. To illustrate how the experimental lessons were constructed and taught, the lesson plan for MC Lesson 5 is included in the Appendix. It was selected because, as one of the com-

bined morphemic-context group lessons, it provides examples of both morphemic and contextual analysis instruction.

*Instructed control.* An IC group was included to control a possible Hawthorne effect. IC students met for equivalent twelve 50-minute sessions, during which they read, discussed, and responded to the young-adult trade book *Yellow Bird and Me* (Hansen, 1986). The IC periods included no explicit instruction on vocabulary strategies. Vocabulary was addressed only through informal discussions of words from the trade book as such words came up naturally in the lessons.

### Fidelity of treatment

Fidelity of treatment was established in two ways. First, three graduate students in reading education not affiliated with the study evaluated how well the experimenters implemented the three-part, experimental-group instruction plan. They each observed two lessons, using a 5-point scale to evaluate compliance with the lesson plans. The scale asked whether "Critical components of the lessons plan" were (1) "not completed," (2) "completed

**Table 2** Instructional content for morphemic-only and context-only instructional groups

Morphemic-only lessons			Context-only lessons	
Lesson	Prefixes	Target words	Lesson	Target words
1. Introduction to morphemic analysis and the not family #1	dis (not, opposite, reversal) un (not)	<i>disloyalty</i> , dissimilar unappetizing	1. Context clue introduction	<i>competence</i> <i>eroded</i> sequel fidgets
2. Not family #2	in (not) im (not)	inactive <i>improper</i> , impure	2. Word definitions	<i>teak</i> sage canny
3. Number family	mono (one) bi (two) semi (half, partly)	<i>monorail</i> , monotone bilingual semicircle	3. Synonyms	<i>gawk</i> ordinance embrace admonished
4. Review lesson 1	all prefixes in lessons 1–3		4. Review lesson 1	all context clues in lessons 1–3
5. Below or part family	sub (below, part of) under (below, not enough)	subset <i>underweight</i> , underestimated	5. Appositives	<i>obliterated</i> leviathan stealth
6. Again and remove family	re (again) de (remove, reverse)	<i>retell</i> , reconsider decode	6. Mood, tone, setting	<i>ostentatious</i> ravenous legacy
7. Before and after family	pre (before) post (after)	preshrunk postgraduate, <i>postwar</i>	7. Antonyms	<i>quaint</i> arid squander hindrance
8. Review lesson 2	all prefixes in lessons 1–7		8. Review lesson 2	all context clues in lessons 1–7
9. Against family	anti (against, stopping) counter (against, opposite)	<i>antifreeze</i> , antisocial counterattack	9. Examples	<i>lubricants</i> appliances feline
10. Excess family	over (too many or much) super (more, better, higher) out (better, more than)	overpopulation, <i>overflow</i> superhighway, <i>superheated</i> outrun	10. Summary	<i>chortle</i> cantankerous eccentric
11. Bad family	mis (bad, wrongly) mal (bad)	mistrust, mistreatment <i>malnutrition</i>	11. Figurative language	<i>scorching</i> deluge pellets
12. Final review	all prefixes in lessons 1–11		12. Final review	all context clues in lessons 1–11

Note. Lesson words in *italic* and transfer words in roman.

to a low degree,” (3) “completed partially,” (4) “completed to a high degree,” or (5) “completed fully.” Observers’ scores from a total of six observations ranged from 4–5 for each of eight observation criteria.

Second, the three regular classroom teachers for the experimental groups, who were not study participants but were present for all interventions, evaluated the degree of instructional consistency across the four experimenters. Using a similar 5-point scale, ranging from “The four teachers were not at all consistent” (score of 1) to

“The four teachers were completely consistent” (score of 5), the regular classroom teachers rated the experimenters with scores ranging from 4–5 for each of six observation criteria.

### Pretests

Two pretests enabled the researchers to evaluate treatment groups for possible preexperimental differences in vocabulary ability. They also served as covariates in posttest analyses. Pretest 1, Degrees of Word Meaning

**Figure 1** Descriptions of pretests and posttests

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Pretests
1. <i>Degrees of Word Meaning (1993), Form M-5</i> : a 40-item, 9-option, standardized, multiple-choice vocabulary test that provided a norm-referenced general index of students' preexperimental vocabulary knowledge.
2. <i>Lesson and Transfer Words</i> : a 40-item, experimenter-constructed, multiple-choice test that assessed students' preexperimental knowledge of a subset of 14 lesson words (7 morphemic and 7 context out of 10 total for each) and 26 transfer words (13 morphemic and 13 transfer out of 20 total for each).

  

Posttests
1. <i>Immediate Morphemic Production Posttest</i> : a 30-item production test (i.e., write a word's meaning) that included the 10 morphemic lesson (ML) words and 20 additional morphemic transfer (MT) words (words the students had not seen previously) presented in isolation (i.e., no context provided). For analysis purposes, this test was broken down into two dependent measures: a 10-item Morphemic Lesson Words Production Test and a 20-item Morphemic Transfer Words Production Test.
2. <i>Immediate Morphemic Recognition Posttest</i> : a 30-item, 5-option, multiple-choice test that examined students' knowledge of same ML and MT words, presented in isolation, that were assessed in Posttest 1. For analysis purposes, this test was broken down into two dependent measures: a 10-item Morphemic Lesson Words Recognition Test and a 20-item Morphemic Transfer Words Recognition Test.
3. <i>Immediate Context Production Posttest</i> : a 30-item production test (i.e., write a word's meaning) that included the 10 context lesson (CL) words and 20 additional context transfer (CT) words (words the students had not seen previously) presented in short, context-rich texts that exemplified the context clue types that were taught to the CO and MC groups. For analysis purposes, this test was broken down into two dependent measures: a 10-item Context Lesson Words Production Test and a 20-item Context Transfer Words Production Test.
4. <i>Immediate Context Recognition Posttest</i> : a 30-item, 5-option, multiple-choice test that examined students' knowledge of the same CL and CT words presented in the same texts as Posttest 3. For analysis purposes, this test was broken down into two dependent measures: a 10-item Context Lesson Words Recognition Test and a 20-item Context Transfer Words Recognition Test.
5. <i>Immediate Vocabulary in Passages Posttest</i> : a 31-item, true or false test that assessed students' MT and CT word knowledge in experimenter-written, narrative passages. There were two passages. The first passage (409 words) included 15 of the 20 MT words. The second passage (494 words) included 15 of the 20 CT words, which were embedded in surrounding linguistic context similar to the instructional context contained in Posttests 3 and 4. All questions probed students' understanding of the passage and were dependent upon vocabulary knowledge. For analysis purposes, this test was broken down into two dependent measures: a 16-item Morphemic Transfer Words in a Passage Test and a 15-item Context Transfer Words in a Passage Test.
6. <i>Delayed Morphemic Recognition Posttest</i> : This was a readministration of Posttest 2. For analysis purposes, this test was broken down into two dependent measures: a 10-item Morphemic Lesson Words Delayed Recognition Test and a 20-item Morphemic Transfer Words Delayed Recognition Test.
7. <i>Delayed Context Recognition Posttest</i> : This was a readministration of Posttest 4. For analysis purposes, this test was broken down into two dependent measures: a 10-item Context Lesson Words Delayed Recognition Test and a 20-item Context Transfer Words Delayed Recognition Test.

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(1993), Form M-5, was a standardized, multiple-choice vocabulary test that provided a norm-referenced score (scaled score), which was used as a general benchmark of students' vocabulary knowledge prior to the study. Pretest 2, Lesson and Transfer Words, was an experimenter-constructed, multiple-choice test that assessed students' preexperimental knowledge of a subset of lesson words and transfer words. Figure 1 presents more detailed descriptions of the two pretests.

### Posttests

Seven group-administered posttests—five immediate and two delayed—assessed students' knowledge of words presented during instruction (lesson words), students' knowledge of words whose meaning could be inferred as a result of instruction (transfer words), and students' comprehension of passages containing transfer words. Figure 1 presents descriptions of the seven posttests, each of which produced two scores, resulting in 14 dependent measures for quantitative data analysis.

### Interviews

Individual interviews were conducted with 12 purposively selected (Patton, 1990) students, three from each of the four treatments. Students were selected such that one each per treatment represented students with low, average, and high preexperimental vocabulary as determined by Pretest 1, the Degrees of Word Meaning. Each interview consisted of two parts: a morphemic analysis portion and a contextual analysis portion. Each portion included tasks that required students to demonstrate morphemic or contextual analysis skill, followed by open-ended questions in which they were asked about morphemic and contextual analysis strategies they employed.

*Morphemic analysis portion.* In this portion, students were asked to read and analyze eight transfer morphemic words: four that had prefixes the MO and MC had been taught but had roots that had not been presented in prior lessons (*discontinue*, *semiretired*, *underachiever*, *misjudge*) and four that had prefixes and roots that had not been presented in prior lessons (*intercity*, *coauthor*, *illogical*, *transpolar*). The morphemic portion

of the interview consisted of five steps: (a) students were asked to read the eight words (the interviewer provided word pronunciation assistance as needed) and tell what each meant—either the entire word or word parts; (b) students were asked to select one or two words from the lists and describe any strategies they used to figure out the meanings of the words (“Say out loud the thinking you were doing as you figured out the meanings of the words.”); (c) students were asked to tell if they knew what a root word was and to use a yellow highlighter to mark any root words they saw; (d) students were asked to tell if they knew what a prefix was and to use a blue highlighter to mark any prefixes they saw; and (e) students were asked to explain if they knew what structural analysis was.

*Contextual analysis portion.* In this portion, students were presented with four context sentences that included context clue types taught to the CO and MC groups but with transfer words not previously used in instruction or in pre- or posttesting. For example, the item, *Erica was confused about how to subtract fractions. She was usually excellent in math, but this topic had her befuddled*, included a synonym context clue (*befuddled* = *confused*). The context portion of the interview consisted of four steps: (a) students were asked to read each context item (the interviewer provided word pronunciation assistance as needed) and tell what the dark word meant; (b) students were asked to select one or two dark words and describe any strategies they used to figure out the word meanings (“Say out loud the thinking you were doing as you figured out the meanings of the words.”); (c) students were asked if they knew what context clues were and to use a highlighter to mark any context clues they saw; and (d) students were asked to explain if they knew what contextual analysis was.

### Scoring

Pretests 1 and 2 and Posttests 2, 4, 5, 6, and 7, which involved multiple-choice or true and false formats, were scored objectively using answer keys. Posttests 1 and 3, both production measures, were scored according to a four-step process. First, a 3-point scale (0 = no credit, 1 = partial credit, 2 = full credit) with response criteria for each point was established. Second, two of the researchers independently applied the rubric twice on two sets of randomly selected tests, modifying the rubric as necessary after each scoring. Third, a third set of randomly selected tests was scored independently by the two researchers, resulting in an 83% agreement score for each posttest, with disagreements resolved in conference. Fourth, the remaining posttests were divided equally between the two researchers who scored them independently. Raters were blind to participants' group

membership throughout the process of scoring Posttests 1 and 3.

Scoring of the student interviews followed a five-step process. First, all tapes were marked with an identification code that masked group identity. Second, an interview scoring rubric was prepared, which provided various subscores for each of the morphemic and context portions of the interview. Third, the first researcher transcribed to audiotapes four randomly selected interviews and scored each according to the rubric. Fourth, a second researcher independently listened to the same four tapes and checked the first researcher's transcriptions and rubric scores. This resulted in a 96% agreement score, with disagreements resolved in conference. Fifth, the first researcher transcribed and scored the remaining eight interviews with the second and third researchers coscoring each and resolving disagreements in conference.

### Analyses

Data from the dominant-less-dominant design were analyzed according to a sequential quantitative-qualitative data analysis process (Tashakkori & Teddlie, 1998, p. 127). This involved first analyzing the dominant quantitative data by conducting five planned, directional contrasts on the 14 dependent variables that emanated from the seven immediate and delayed posttests (see Figure). These contrasts were conducted within a univariate analysis of covariance model that used both pretests as covariates. A univariate, as opposed to multivariate, approach was chosen so that differential treatment effects could be explored by dependent variable, a process not permissible had multivariate cluster vectors been established. All analyses were conducted using SPSS for Windows 10.0. The five planned contrasts were as follows:

A.  $(MO + MC)/2 - (CO + IC)/2$ : This complex contrast compared the two intervention groups who received instruction in morphemic analysis clues (MO, MC) to those who did not receive morphemic analysis instruction (CO, IC). It was hypothesized that  $MO + MC > CO + IC$  for all measures of morphemic analysis.

B.  $(CO + MC)/2 - (MO + IC)/2$ : This complex contrast compared the two intervention groups who received instruction in context clues (CO, MC) to those who did not receive instruction in context clues (MO, IC). It was hypothesized that  $CO + MC > MO + IC$  for all measures of contextual analysis.

C.  $MO - CO$ : This pairwise contrast compared context-only instruction to morphemic-only instruction. It was hypothesized that  $CO > MO$  for all contextual analysis measures and  $MO > CO$  for all morphemic analysis measures.

D. CO – MC: This pairwise contrast compared context-only instruction to combined morphemic-context instruction. It was hypothesized that CO > MC for all contextual analysis measures and MC > CO for all morphemic analysis measures.

E. MO – MC: This pairwise contrast compared morphemic-only instruction to combined morphemic-context instruction. It was hypothesized that MC > MO for all contextual analysis measures and MO > MC for all morphemic analysis measures.

Following quantitative analysis, data from the less-dominant, descriptive interview data were analyzed according to a two-stage process. First, interview data were “quantitized” (Miles & Huberman, 1994; Tashakkori & Teddlie, 1998, p. 127); that is, students’ responses to specific interview tasks and questions were categorized and tallied. Second, narrative responses to the open-ended questions were examined for trends.

## Results

Quantitative results are presented first, including descriptive statistics, analysis of possible preexperimental group differences, reliability data, data assumptions, and inferential statistics for each of the four research questions. Interview results are presented second, including findings for the morphemic and context portions of the interviews. A results summary concludes this section.

### Quantitative results

Table 3 presents descriptive statistics by intervention group for the two pretests and 14 dependent measures (see Figure). Dependent measures are grouped according to measures that evaluated students’ ability to (a) identify the meanings of morphemic and context lesson words, (b) infer the meanings of morphemic and context transfer words, and (c) comprehend texts containing morphemically and contextually decipherable transfer words. Means, standard deviations, and reliability indices (coefficient alpha) are presented for all pretests and dependent measures; means adjusted by the two pretest covariates are presented for all dependent measures.

Table 4 presents inferential statistics for the five planned contrasts across the 14 dependent measures, which are grouped in the same manner as in Table 3. Because we were interested not only in the statistical significance of the observed differences but also in the magnitude of those differences, we report results in Table 4 using .95 confidence intervals (.95 CI) and standardized mean differences (*d*) as recommended by Wilkinson and The Task Force on Statistical Inference (1999, p. 69). Because we hypothesized a specific direction for the

treatment differences, we report directional confidence intervals (Marascuilo & Serlin, 1988, p. 182). For hypotheses where positive differences were predicted, the .95 CI values in the table are the lower limits for the estimated population differences; for hypotheses where negative differences were predicted, the .95 CI values in the table are the upper limits for the estimated population differences. The lower and upper limits can be interpreted to mean that we are 95% confident that the difference in population means are at least as large as the value provided. Bold values in the table identify those contrasts that are statistically significant at the .05 level or less. Standardized mean differences were computed using the pooled standard deviation of the posttest measures unadjusted for the covariates. Using the unadjusted standard deviations allows us to compare our effect sizes to previous effect sizes that did not use the same covariates (Olejnik & Algina, 2000).

*Preexperimental group differences.* To determine whether the four treatment groups were generally equivalent at the preexperimental stage, a one-way analysis of variance (ANOVA) was conducted for each pretest. Results indicated that the groups did not differ on Pretest 1,  $F(3, 84) = .197, p < .898$ , or on Pretest 2,  $F(3, 84) = .385, p < .764$ . This suggests that the four participating classrooms in the quasiexperiment did not differ prior to intervention in general vocabulary knowledge (Pretest 1, Degrees of Word Meaning) or in knowledge of a sample of target vocabulary (Pretest 2, Lesson and Transfer Words).

*Test reliability.* Pretest and posttest measures indicated strong internal consistency. Coefficient alpha for the 16 pretest and posttest measures (see Table 3) ranged from .749 to .933, with a mean of .860 and a median of .871 across all tests.

*Data assumptions.* Before proceeding with the estimation of treatment effects, data plots were examined to identify outliers. None were found. The equality of population variances was tested for each outcome measure with the use of Levene’s (1960) procedure. The results of these tests provided no evidence that the population variances differed at the .05 level of statistical significance except for the Context Lesson Words Delayed Recognition Test,  $F(3, 83) = 3.17, p < .028$ . Because only one of the 14 tests was statistically significant and because the sample sizes only differed by three individuals (24 vs. 21), we concluded that this assumption violation would not invalidate our statistical conclusions on this measure.

The assumption of homogeneity of regression planes was tested according to Huitema’s (1980, p. 165) procedure. We found one statistically significant interaction involving the Context Lesson Words Recognition Test,  $F(6, 76) = 2.96, p < .05$ . Because we conducted 14

**Table 3** Descriptive statistics for pretests and dependent measures

Pretest and dependent measures	Morphemic only			Context only			Morphemic-context			Instructed control			$\alpha$
	M	SD	AM	M	SD	AM	M	SD	AM	M	SD	AM	
Pretests													
Degrees of Word Meaning	519.58	49.32	–	512.73	61.35	–	525.00	50.87	–	519.29	47.26	–	.900
Lesson and Transfer Word Test (40)	19.42	7.29	–	21.27	7.39	–	20.19	8.33	–	19.05	6.59	–	.868
Lesson Word Dependent Measures													
Morphemic Lesson Words Production Test (20)	15.92	4.43	16.07	8.68	5.11	8.47	13.48	5.10	13.25	7.90	4.53	8.18	.873
Morphemic Lesson Words Recognition Test (10)	8.29	2.37	8.40	6.27	2.53	6.05	7.76	2.43	7.68	5.71	2.24	5.90	.790
Morphemic Lesson Words Delayed Recognition Test (10)	6.79	3.23	6.90	6.14	2.47	5.83	7.19	3.16	7.06	6.05	2.58	6.39	.833
Context Lesson Words Production Test (20)	8.29	5.72	8.52	14.05	5.79	13.85	13.14	5.13	12.89	8.70	4.65	8.92	.853
Context Lesson Words Recognition Test (10)	6.00	3.04	6.07	8.27	2.41	8.23	7.14	2.56	6.98	6.33	2.76	6.47	.827
Context Lesson Words Delayed Recognition Test (10)	6.08	3.13	6.15	8.45	2.42	8.30	7.81	2.06	7.65	6.35	2.89	6.61	.840
Transfer Word Dependent Measures													
Morphemic Transfer Words Production Test (40)	25.75	10.98	26.02	15.64	9.79	15.39	23.43	9.66	22.88	12.95	8.87	13.45	.923
Morphemic Transfer Words Recognition Test (20)	13.04	4.60	13.36	11.95	5.09	11.24	12.48	5.59	12.34	10.81	4.95	11.33	.876
Morphemic Transfer Words Delayed Recognition Test (20)	12.33	5.92	12.52	11.95	5.48	11.46	12.86	5.71	12.55	11.65	4.82	12.30	.901
Context Transfer Words Production Test (40)	18.17	12.25	18.65	21.82	11.69	21.41	19.57	9.66	19.02	15.50	9.33	15.96	.913
Context Transfer Words Recognition Test (20)	12.92	6.74	13.19	14.50	5.00	14.00	12.86	6.51	12.59	13.10	6.11	13.57	.924
Context Transfer Words Delayed Recognition Test (20)	12.96	6.79	13.16	13.68	5.58	13.16	13.24	6.64	12.86	12.05	6.48	12.76	.933
Comprehension Dependent Measures													
Morphemic Transfer Words in a Passage (16)	11.83	3.29	11.92	12.32	2.48	12.20	11.81	3.36	11.67	12.05	3.38	12.20	.756
Context Transfer Words in a Passage (15)	11.04	3.01	11.08	10.55	3.28	10.64	11.14	2.76	10.93	10.71	3.45	10.79	.749

*Note.* –  $\alpha$  coefficient alpha; M = unadjusted mean; SD = standard deviation of unadjusted mean; AM = mean adjusted for Pretests 1 and 2. Parenthetic numbers in Pretest and Dependent Measures column are total possible scores on each subtest.

hypothesis tests, the probability of at least one rejection by chance was .51. We concluded that the one statistically significant interaction may have been a chance event and that the assumption of homogeneous regression planes was met for the 14 dependent measures. The failure to reject these interaction hypotheses indicated that the differences between the interventions were consistent across students having different preexperimental vocabulary abilities.

*Research question 1: What are the immediate and delayed effects of morphemic and contextual analysis instruction on students' learning of words presented during*

*instruction?* Quantitative results addressing this question can be found in the unshaded sections in the top portion of Table 4 under the spanner heading Lesson Word Dependent Measures. All contrasts evaluating this question were statistically significant in the hypothesized direction, indicating that students receiving instruction in morphemic analysis in some form (MO or MC) outperformed students who did not (CO or IC); likewise, students receiving instruction in contextual analysis (CO or MC) outperformed students who did not (MO or IC). Effect sizes ( $d$ ) were large (approximately .8 or higher, Cohen, 1988) for both the Morphemic Lesson Words

**Table 4** Directional confidence intervals and standardized mean differences for planned contrasts

Dependent measures		Contrasts				
		A. (MO+MC)/2 – (CO+IC)/2	B. (CO+MC)/2 – (MO+IC)/2	C. MO – CO	D. CO – MC	E. MO – MC
Lesson Word Dependent Measures						
Morphemic Lesson Words Production Test	.95 CI <i>d</i>	<b>5.2</b> <b>1.32</b>		<b>6.0</b> <b>1.58</b>	<b>–3.1</b> <b>–1.00</b>	<b>1.2</b> <b>.59</b>
Morphemic Lesson Words Recognition Test	.95 CI <i>d</i>	<b>1.5</b> <b>.87</b>		<b>1.5</b> <b>.99</b>	<b>–0.8</b> <b>–.69</b>	–0.1 .30
Morphemic Lesson Words Delayed Recognition Test	.95 CI <i>d</i>	<b>0.2</b> <b>.30</b>		<b>0.1</b> <b>.37</b>	<b>–0.2</b> <b>–.43</b>	–1.1 –.06
Context Lesson Words Production Test	.95 CI <i>d</i>		<b>3.6</b> <b>.87</b>	<b>–3.8</b> <b>–.99</b>	<b>–0.6</b> <b>.18</b>	<b>–2.9</b> <b>–.81</b>
Context Lesson Words Recognition Test	.95 CI <i>d</i>		<b>0.8</b> <b>.49</b>	<b>–1.3</b> <b>–.80</b>	<b>0.4</b> <b>.46</b>	<b>–0.1</b> <b>–3.3</b>
Context Lesson Words Delayed Recognition Test	.95 CI <i>d</i>		<b>1.0</b> <b>.60</b>	<b>–1.3</b> <b>–.80</b>	<b>–0.2</b> <b>.24</b>	<b>–0.7</b> <b>–.56</b>
Transfer Word Dependent Measures						
Morphemic Transfer Words Production Test	.95 CI <i>d</i>	<b>7.7</b> <b>1.01</b>		<b>7.4</b> <b>1.07</b>	<b>–4.1</b> <b>–.76</b>	–0.1 .32
Morphemic Transfer Words Recognition Test	.95 CI <i>d</i>	<b>0.6</b> <b>.31</b>		<b>0.8</b> <b>.42</b>	0.3 –.22	–0.3 .20
Morphemic Transfer Words Delayed Recognition Test	.95 CI <i>d</i>	–0.5 .12		–0.5 .19	0.5 –.20	1.5 –.01
Context Transfer Words Production Test	.95 CI <i>d</i>		<b>1.0</b> <b>.27</b>	<b>–0.1</b> <b>–.25</b>	<b>–0.4</b> <b>.22</b>	2.3 –.03
Context Transfer Words Recognition Test	.95 CI <i>d</i>		–1.3 –.01	0.9 –.14	–0.3 .24	–1.1 .10
Context Transfer Words Delayed Recognition Test	.95 CI <i>d</i>		–1.4 .01	–2.0 .00	–1.8 .04	–1.7 .04
Comprehension Dependent Measures						
Morphemic Transfer Words in a Passage Test	.95 CI <i>d</i>	–1.3 –.13		–1.5 –.09	–0.7 .17	–0.9 .08
Context Transfer Words in a Passage Test	.95 CI <i>d</i>		–0.9 –.05	–0.6 .14	<b>–1.4</b> <b>–.09</b>	–0.9 .05

Note. All contrasts were conducted within a univariate analysis of covariance model using both Pretest 1 and Pretest 2 as covariates. Statistics reported are .95 directional confidence intervals (.95 CI) and standardized mean differences (*d*). **Bold** values identify contrasts that are statistically significant at the .05 level or less. Contrasts addressing the four research questions are as follows: Question 1: unshaded sections in the Lesson Word Dependent Measures portion of the table; Question 2: unshaded sections in the Transfer Word Dependent Measures portion of the table; Question 3: unshaded sections in the Comprehension Dependent Measures portion of the table; Question 4: shaded sections of the table.

Production Test (contrast A = 1.32, C = 1.58, D = –1.00) and the Context Lesson Words Production Test (B = .87, C = –.99, E = –.81). The effect sizes were in the medium (approximately .5, Cohen, 1988) to large range for the Morphemic Lesson Words Recognition Test (A = .87, C = .99, D = –.69) and in the high to low range (approximately .2 or lower, Cohen, 1988) for the Context Lesson Words Recognition Test (B = .49, C = –.80, E = –.33). Effect sizes were in the medium to low range for the Morphemic Lesson Words Delayed Recognition Test (A = .30, C = .37, D = –.43) and in the medium to large range for the Context Lesson Words Delayed Recognition Test (B = .60, C = –.80, E = –.56). Overall, the results for ques-

tion 1 indicated that students who received the morphemic or contextual analysis instruction either in isolation or in combination outperformed students who received either the alternate intervention or no vocabulary instruction on measures of lesson words that were morphemically and contextually decipherable to meaning. This effect was evident for both the immediate and delayed measures.

*Research question 2: What are the immediate and delayed effects of morphemic and contextual analysis instruction on students' ability to infer the meanings of uninstructed transfer words?* Quantitative results addressing this question can be found in the unshaded sections

in the middle portion of Table 4 under the spanner heading Transfer Word Dependent Measures. Regarding morphemic instruction, there was evidence of an immediate effect on the Morphemic Transfer Words Production Test, with all three contrasts attaining statistical significance with generally large effect sizes (A = 1.01, C = 1.07, D = -.75). There were also statistically significant effects in the medium to low range for the Morphemic Transfer Words Recognition Test for contrasts A (.31) and C (.42) but not for contrast D. There was no evidence of persistence of transfer word learning as measured by the Morphemic Transfer Words Delayed Recognition Test. Regarding context instruction, there was a statistically significant effect in the low range on the Context Transfer Words Production Test for contrasts B (.27) and C (-.25) but not for contrast E. There was no evidence of an effect of context instruction for transfer words on the Context Transfer Words Recognition Test or the Context Transfer Words Delayed Recognition Test. Interview data, as presented in the next section, support the trend for an immediate effect of morphemic instruction, but interview findings were somewhat equivocal for the effect of context instruction. In general, results for question 2 indicate a strong immediate effect of morphemic instruction on students' ability to decipher the meanings of untaught morphemic transfer words, with a less robust effect of context instruction on students' ability to infer the meanings of transfer words in context. There was no evidence of persistence of these effects on the delayed measures.

*Research question 3: What effect does morphemic and contextual analysis instruction have on students' comprehension of texts containing morphologically and contextually decipherable words?* Quantitative results addressing this question can be found in the unshaded sections in the bottom portion of Table 4 under the spanner heading Comprehension Dependent Measures. No contrasts for either the Morphemic Transfer Words in a Passage Test or the Context Transfer Words in a Passage Test attained statistical significance. Thus, there is no evidence that morphemic or contextual analysis instruction enhanced students' comprehension of passages that contained morphologically or contextually decipherable transfer words.

*Research question 4: What is the relative effectiveness of morphemic and contextual analysis instruction when provided in isolation versus in combination?* Quantitative results addressing this question can be found in the shaded sections of Table 4 under contrasts D and E. Only 2 of the 14 contrasts comparing combined versus isolated morphemic or context instruction attained statistical significance: contrast D for the Context Lessons Words Recognition Test and contrast E for the Morphemic Lesson Words Production Test, both with effect sizes in

the medium range (D = .46, E = .59). All other lesson word contrasts as well as all transfer word and comprehension contrasts failed to attain statistical significance. Thus, in general, it may be just as effective to provide students a combination of instruction in morphemic and contextual analysis as it is to provide such instruction separately.

### Interview results

Table 5 displays 10 interview subscores (see table note for the derivation of each subscore) in proportion correct. Scores are presented by treatment group and achievement level for the 12 students interviewed. Results are presented separately for the morphemic and context interview items.

*Morphemic items.* Numerical interview data for the morphemic tasks produced two trends, both of which reinforced quantitative findings. First, MO and MC students demonstrated greater morphemic analysis skills than did CO and IC students. For example, the average total morphemic performance across the three interview students in each treatment (i.e., the TOTM column and Average rows) shows that considerable proportions of MO (.76) and MC (.79) students responded appropriately to the morphemic items, whereas smaller proportions of CO (.23) and IC (.37) students provided appropriate responses. This overall effect was evident consistently within each of the four morphemic item subcategories (cf. TMM, TMS, TSD, TPR morphemic item proportions for MO and MC treatments versus CO and IC treatments).

Second, there appeared to be no differential effects between the MO and MC groups. Students who received morphemic analysis instruction combined with contextual analysis instruction were just as successful at interview tasks as students who received morphemic analysis instruction in isolation (cf. TOTM Average MO proportion correct of .76 versus TOTM Aver. MC proportion correct of .79). Thus, it appears that combined instruction (MC) is just as effective as separate instruction (MO) in morphemic analysis.

Students' actual responses to the interview questions were consistent with the preceding numerical analysis. The top portion of Table 6 presents student responses to the question about the strategies they used when figuring out the meanings of the transfer morphemic words presented to them. As can be seen, MO and MC students' responses tended to reflect the content of their morphemic analysis instruction (e.g., MC-Middle student: "Dis means not and continue to go on, so it means dis is not and continue means not to continue.") whereas CO and IC students' responses tended to not be as strategic (e.g., CO-Middle student: "Dis means to, to continue to do it... Continue just means to continue, but if you say dis, it means to continue



**Table 5** Proportion correct of students' interview responses by interview category and treatment group

Achievement Level	Morphemic items					Context items				
	TMM (16)	TMS (2)	TSD (3)	TPR (16)	TOTM (37)	TCM (4)	TCC (4)	TCS (2)	TDC (2)	TOTC (12)
Morphemic-Only Group						Morphemic-Only Group				
Low	.31	.00	.67	1.00	.62	1.00	.75	1.00	.00	.75
Middle	.63	1.00	.67	.88	.76	.75	1.00	1.00	.50	.83
High	.75	1.00	1.00	1.00	.89	1.00	.75	1.00	1.00	.92
Average MO	.56	.67	.78	.96	.76	.92	.83	1.00	.50	.83
Context-Only Group						Context-Only Group				
Low	.00	.00	.00	.13	.05	.50	.75	.50	.00	.50
Middle	.38	.50	.00	.00	.19	1.00	1.00	.50	1.00	.92
High	.56	.50	.00	.44	.46	1.00	1.00	1.00	1.00	1.00
Average CO	.31	.33	.00	.19	.23	.83	.92	.67	.67	.81
Morphemic-Context Group						Morphemic-Context Group				
Low	.50	1.00	1.00	1.00	.78	1.00	1.00	1.00	.50	.92
Middle	.50	1.00	.67	.88	.70	1.00	.75	1.00	.00	.75
High	.75	1.00	1.00	1.00	.89	1.00	1.00	1.00	1.00	1.00
Average MC	.58	1.00	.89	.96	.79	1.00	.92	1.00	.50	.89
Instructed Control Group						Instructed Control Group				
Low	.31	.50	.00	.13	.22	.50	.50	.50	.00	.42
Middle	.25	.00	.00	.06	.14	.50	.75	1.00	.00	.58
High	.56	1.00	.33	1.00	.76	1.00	1.00	.50	.00	.75
Average IC	.38	.50	.11	.40	.37	.67	.75	.67	.00	.58

Notes. Parenthetic numbers indicate total possible scores. TMM is the total score for morphemic word meanings identified correctly (0–2 scoring for 8 words = 16 possible total score); TMS is the score for morphemic analysis strategies described (0–2 scoring = 2 possible total score); TSD is the total score for structural analysis definitions provided for *root word*, *prefix*, and *structural analysis* (0/1 scoring for 3 definitions = 3 possible total score); TPR is the total score for prefixes and roots highlighted correctly (0/1 scoring for 8 prefixes and 8 roots = 16 possible total score); TOTM = TMM + TMS + TSD + TPR = 37 total possible score; TCM is the total score for context word meanings identified correctly (0/1 scoring for 4 words = 4 possible total score); TCC is the total score for context clues highlighted correctly (0/1 scoring for 4 context clues = 4 possible total score); TCS is the score for contextual analysis strategies described (0–2 scoring = 2 possible total score); TDC is the total score for contextual analysis definitions for *context clue* and *contextual analysis* (0/1 scoring for 2 definitions = 2 possible total score); TOTC = TCM + TCC + TCS + TDC = 12 possible total score.

again.”). It should be noted, however, that the higher performing CO and IC students seemed to have either intuited the concept of prefixes and their meanings or learned this through prior instruction (e.g., IC-High student: “The things in front of the words.... *Dis*, and that means *not*. And *continue* means to keep going.”).

*Context items.* As predicted, the average total context performance across the three interview students in each treatment (i.e., the TOTM column and Average rows) shows that considerable proportions of CO (.81) and MC (.89) students responded appropriately to the context items, whereas a smaller proportion of IC (.58) students provided appropriate responses. The corresponding performance for the MO (.83) students, however, was unexpectedly high and comparable to that of students who received instruction in contextual analysis, perhaps suggesting some generalization of vocabulary contextual analysis strategies by MO students. With regard to the relative effectiveness issue, it appears that combined instruction (MC = .89 overall) is at least as ef-

fective as separate instruction (CO = .81 overall) in promoting contextual analysis ability.

Although MO, CO, and MC students were all skillful at identifying the meanings of words presented in context, their actual responses provide some insight into group differences (see bottom portion of Table 6). For instance, even though the MO students were able to infer word meanings from context, CO and MC students revealed evidence of instruction in specific context clue types. For example, the three CO and MC students who selected *fortitude* to describe their thinking provided evidence that they had learned in Lesson 5 how punctuation (use of commas) and signal words (use of *or*) can cue appositive context clues (CO-Low student: “Because it said *fortitude, or courage*.”; CO-High student: “Here it says *or courage*....That the mouse had courage, cause this says *or*....”; MC-High student: “After I read the sentence, I noticed that it had a comma and then it said *or courage*, and...I just used *courage* from what you taught us...and that was one of the context clues.”) In contrast, the two MO and IC students who also selected *fortitude*

**Table 6** Students' interview responses to the meaning-based morphemic and context strategies questions

MO	CO	MC	IC
Morphemic question: "Can you pick one or two words from either list and tell me how you went about figuring out their meanings?"			
<p><i>LOW: discontinue:</i> "Sometimes if you're doing an activity, and you might stop and tell the teacher that you don't want to continue doing what you were doing...."</p> <p><i>MIDDLE: misjudge:</i> "You judge somebody by what they do and how they look and not what's really inside.... I know the prefix <i>mis</i> and <i>judge</i> is...like a judge on TV like how you get information...."</p> <p><i>HIGH: semiretired:</i> "I figured out, like I knew what <i>retired</i> means, so I just had to figure out what <i>semi</i> means. <i>Semi</i> means like part or half, so you're almost or half-way retired."</p>	<p><i>LOW: coauthor:</i> "It's got author in it."</p> <p><i>MIDDLE: discontinue:</i> "<i>Dis</i> means to, to continue to do it....<i>Continue</i> just means to continue, but if you say <i>dis</i>, it means to continue again."</p> <p><i>HIGH: illogical:</i> "<i>Il</i> means not, and then not logical, so maybe it means like it can't happen or something because <i>il</i> means not."</p>	<p><i>LOW: discontinue:</i> "I know that <i>dis</i> means <i>not</i>, so it means not continuing what you're doing."</p> <p><i>MIDDLE: discontinue:</i> "<i>Dis</i> means <i>not</i> and <i>continue</i> to go on, so it means <i>dis</i> is not and <i>continue</i> means not to continue."</p> <p><i>HIGH: discontinue:</i> "<i>Continue</i> means to succeed or to reach a goal, and <i>dis</i>, I know, means not, and you put those together and it means not to reach a goal or not to achieve or succeed to the next part or something."</p>	<p><i>LOW: discontinue:</i> "I thought about <i>continue</i>...You can continue something and not continue."</p> <p><i>MIDDLE: discontinue:</i> "It like dislike.... It said like discontinue."</p> <p><i>HIGH: discontinue:</i> "The things in front of the words.... <i>Dis</i>, and that means <i>not</i>. And <i>continue</i> means to keep going."</p>
Context question: "Can you pick one or two words and tell me how you went about figuring out their meanings?"			
<p><i>LOW: fortitude:</i> "When I saw great fortitude or courage, like courage means like being brave or standing up to someone...."</p> <p><i>MIDDLE: haughty:</i> "Cause it says he got 100 on the spelling test and he told everybody at recess, and the other girl just felt happy inside and she didn't tell her classmates."</p> <p><i>HIGH: haughty:</i> "Well, I just used haughty, then at first I didn't know what it meant really, and then I read down, and when it said "Sonja felt modest, she didn't tell anyone about her test," so I thought haughty, well that's the opposite of <i>modest</i>, so it's kind of just not like...showing off?"</p>	<p><i>LOW: fortitude:</i> "Because it said <i>fortitude</i>, or <i>courage</i>."</p> <p><i>MIDDLE: haughty:</i> "I said, since he had told everyone about it at recess, and she didn't mention her perfect score that he was being haughty, and that showed me what it was."</p> <p><i>HIGH: fortitude:</i> "Here it says <i>or courage</i>.... That the mouse had courage, cause this says <i>or</i>...."</p> <p><i>haughty:</i> "This tells you that Sam was bragging because it said got 100 on the spelling test, and she didn't tell anybody, so that meant that he was bragging."</p>	<p><i>LOW: befuddled:</i> "It said that she was excellent in math, but when she was subtracting fractions, she got confused."</p> <p><i>MIDDLE: haughty:</i> "When it says another person and then he had 100 on his spelling test and Sonja did too but she didn't go telling the class that she got 100 and Sam did so that means he was bragging."</p> <p><i>HIGH: fortitude:</i> "After I read the sentence, I noticed that it had a comma and then it said <i>or courage</i>, and from the part after that it when it said <i>the little mouse showed great fortitude</i>.... I just used <i>courage</i> from what you taught us...and that was one of the context clues."</p>	<p><i>LOW: fortitude:</i> "I looked at this word.... I looked at <i>courage</i>."</p> <p><i>MIDDLE: melancholy:</i> "It said like Josh was feeling very melancholy when his cat ran away.... Because he would probably be sad when his cat ran away. He would feel bad."</p> <p><i>HIGH: befuddled:</i> "Um, I really did have problems with the fractions, like subtracting them, and it's like confusing at first and you don't know how to figure it out. And she said she was usually excellent in math."</p>

to demonstrate their thinking, although successful in inferring its meaning, did not articulate explicit knowledge of how appositive context clues function (see Table 6).

### Results summary

Results of the study, organized by the four research questions, can be summarized as follows:

1. There was a strong immediate and delayed effect of morphemic and contextual analysis instruction for lesson words.
2. There was an effect of morphemic and contextual analysis instruction for transfer words, although this was not as robust as it was for lesson words and was restricted to immediate dependent measures. Interview data supported this trend for

morphemic analysis but was somewhat equivocal for contextual analysis.

3. There was no evidence that instruction in morphemic or contextual analysis, either in isolation or combination, enhanced students' comprehension of text that had embedded morphemically decipherable words or words that were in rich context.
4. In general, students were just as effective inferring word meanings when the morphemic and contextual analysis instruction was provided in combination as when the instruction was provided separately.

There were several additional trends worth noting. First, the intervention effects did not interact with students' preexperimental vocabulary ability as measured by

the pretests; that is, students of all ability levels benefited equally (or did not) from the instruction in morphemic or contextual analysis. Second, the treatment effects for the morphemic analysis instruction were, in general, stronger than they were for contextual analysis instruction; for example, the mean effect size for the 15 statistically significant morphemic contrasts was .78 versus .60 for the 12 statistically significant context contrasts. Third, the production measures were generally more sensitive to treatment effects than were the recognition measures, as evidenced by the following mean effect size comparisons for statistically significant contrasts: Morphemic Lesson Words Production Test (1.30) versus Morphemic Lesson Word Recognition Test (.85); Context Lesson Words Production Test (.89) versus Context Lesson Words Recognition Test (.54); Morphemic Transfer Words Production Test (.94) versus Morphemic Transfer Words Recognition Test (.37); Context Transfer Words Production Test (.26) versus Transfer Words Recognition Test (no statistically significant contrasts).

## Discussion

### Question 1: Lesson word effect

As predicted, students in the experimental groups were more likely to demonstrate knowledge of morphemic or context lesson words than students in the instructed control group. This finding is consistent with the literature on teaching words explicitly through a variety of definitional, associational, contextual, and other instructional strategies (Baumann & Kame'enui, 1991; Beck & McKeown, 1991; Blachowicz & Fisher, 2000; Graves, 1986; Miller & Gildea, 1987; National Reading Panel, 2000; Stahl & Fairbanks, 1986). Clearly, even though the objective of the experimental groups was to teach students transferable morphemic and contextual linguistic cues they could use to identify untaught words, experimental-group students learned the meanings of words used within lessons. It is likely that this immediate and delayed effect was due to both the students' exposure to the words in the lessons and their ability to apply the prefix meaning and context clue type knowledge they gained from the lessons.

### Question 2: Transfer word effect

As hypothesized, the students who were provided morphemic analysis instruction outperformed students who were not provided such instruction on immediate production and recognition transfer word measures. Specifically, MO and MC students were able to generalize their knowledge of prefix meanings and their ability to disassemble and reassemble morphemically analyzable

words to untaught, morphemic transfer vocabulary. This finding was particularly strong for the Morphemic Transfer Words Production Test, for which the mean effect size was .95 for the three significant contrasts.

These results support and extend some of the classic (Otterman, 1955; Thompson, 1958) and more recent (Graves & Hammond, 1980; Nicol et al., 1984) research on the efficacy of teaching students prefixes as a means to enhance vocabulary knowledge. Our study is most similar to the work of White, Sowell et al. (1989), who taught high-ability third-grade students nine prefixes, six of which overlapped with those we taught (*dis, un, in, re, over, mis*). White, Sowell et al. reported that experimentals outperformed controls on two transfer measures. One measure required students to apply knowledge to unfamiliar words ("If *scrupulous* means 'lawful or honest,' then *unscrupulous* means...", p. 306), on which experimentals scored 82% correct versus 54% for controls. The second transfer measure had students define low-frequency prefixed words in context (e.g., *irreversible, rekindle*), on which experimentals scored 23% correct versus 6% for controls. This latter measure is similar to our morphemic transfer words production test, on which the MO students scored 64% correct versus 32% correct for IC students. Thus, the present study demonstrates that students can be taught specific morphological elements and analysis procedures to infer the meanings of morphologically derivable transfer words on immediate production and recognition measures.

As was also hypothesized, the students in this study who were provided contextual analysis instruction outperformed students who were not provided such instruction on an immediate production transfer word measure. Specifically, students in the CO or MC group were able to apply what they learned about context clue types and the ability to apply contextual analysis to infer the meanings of untaught, transfer vocabulary embedded in short linguistic contexts. This finding, however, was restricted to two contrasts for the Context Transfer Words Production Test. Further, the MO students' performance on the student interviews suggested that they were able to infer the meanings of context-rich words, perhaps due to a heightened sensitivity to vocabulary as a result of the intensive MO instruction.

These results are consistent with several extant intervention studies that involved teaching fifth-grade students to use select context clues (Askov & Kamm, 1976; Carnine et al., 1984; Jenkins et al., 1989; Patberg et al., 1984), as well as studies involving adolescents (Buikema & Graves, 1993) and young adults and adults (Sternberg, 1987). The present findings also are congruent with Fukkink and de Glopper's (1998) meta-analysis on the effects of instruction in deriving word meanings from

context, although their generalized effect size of .43 for 21 instructional treatments across 12 studies is close to Cohen's (1988) definition of a medium effect, whereas our study revealed a low mean effect size of .26 for the two statistically significant contrasts.

Although Fukkink and de Gloppe (1998) noted accurately that "research of instruction in deriving word meaning from context is still in its infancy" (p. 462), their meta-analysis begins to shed some light on the efficacy of various kinds of context clue interventions. Fukkink and de Gloppe reported that an exploratory multilevel regression analysis revealed that instruction in some form of specific context clue typology, similar to that employed in the present study, was superior to other kinds of interventions, such as cloze exercises, definition construction, generalized context clue strategy instruction, or simple practice only. Thus, there appears to be emerging evidence for Sternberg's (1987) argument that "if, indeed, most vocabulary is learned from context, then what we most need to do is not to teach vocabulary from context, but to teach students to use context to teach themselves" (p. 97).

The absence of statistically significant effects on either the Morphemic Transfer Words Delayed Recognition Test or the Context Transfer Words Delayed Recognition Test suggests that students' skills acquired in morphemic and contextual analysis degrade with time. Unfortunately, the intervention studies in teaching morphemic and contextual analysis provide little information about delayed effects, so it is not possible to interpret the present findings in relation to the broader literature.

In addition to a degradation-over-time explanation, it is possible that measurement factors contributed to the failure to detect delayed effects. One involves a possible practice effect. The delayed transfer word measures were readministrations of the immediate recognition morphemic and context transfer word measures, so students had multiple exposures to the same transfer words and items. This may have enhanced students' performance, particularly for those who had not received the morphemic or contextual analysis instruction. A second possible measurement explanation involves the sensitivity of the delayed measures. As noted previously, the production measures were more responsive in detecting treatment effects, so the use of recognition measures for the delayed tests may have masked students' ability to generalize morphemic and contextual analysis knowledge. Additional research is needed to determine whether such measurement factors influence students' ability to demonstrate generalized morphemic and contextual analysis abilities.

### **Question 3: Comprehension effect**

The predicted effects of the MO, CO, and MC interventions on the comprehension of text that contained morphologically or contextually decipherable transfer words were not manifest in this study. There are at least three possible explanations for this finding: insufficient transfer power; measurement limitations; and the implementation of a limited-scope, short-term intervention.

One potential reason for the lack of a comprehension effect is that instruction in the generalizable linguistic cues from morphemic elements and context has insufficient transfer power alone to influence reading comprehension. The only documented effects of vocabulary instruction on reading comprehension have involved intensive instruction in specific vocabulary (e.g., Kame'enui et al., 1982; McKeown et al., 1985; see Stahl & Fairbanks' 1986 review). In contrast, the few extant studies that have provided instruction in morphemic analysis alone (Hanson, 1966; Otterman, 1955) or morphemic and contextual analysis in combination (Tomesen & Aarnoutse, 1998) have failed to demonstrate text comprehension effects. Thus, it may not be reasonable to expect effects of morphemic and contextual analysis instruction on comprehension in a once-removed manner. In other words, the extended instrumentalist hypothesis (i.e., morphemic/contextual analysis ability → vocabulary knowledge → reading comprehension) may not be valid.

Demonstrating that using morphemic and context strategies to learn the meanings of unfamiliar words helps readers comprehend a text requires careful attention to the development and alignment of text comprehension measures with the design of vocabulary interventions. Tomesen and Aarnoutse (1998) surmised that the lack of an intervention effect on general reading comprehension could have been the result of a mismatch between the instruction and dependent measure; that is, the reading comprehension measure required strategies beyond those taught in their intervention program (e.g., text structure knowledge and main idea comprehension). Measurement issues may also have come into play in our study. Although the comprehension questions in the vocabulary-in-passages tests were intended to be vocabulary dependent, undoubtedly other text-based factors besides vocabulary were operational as students responded to the comprehension questions. Also, the true or false response format resulted in a chance score of 50% on these tests, perhaps reducing the sensitivity of the instruments in detecting possible treatment effects (the adjusted mean performances for the two comprehension dependent measures across the four treatments ranged from 71% to 76% correct).

Tomesen and Aarnoutse (1998) also speculated that the duration and scope of their intervention may have

diminished the chance of detecting a comprehension effect: "The instructional programme is probably too limited in length and breadth to produce a transfer effect on reading comprehension" (p. 124). The number and duration of lessons in Tomesen and Aarnoutse's intervention (twelve 45-minute lessons) were almost identical to ours (twelve 50-minute lessons), so the same explanation, if valid, may apply to the present study. Additionally, vocabulary development programs designed ultimately to promote reading comprehension must possess multiple dimensions that include wide independent reading, instruction in specific vocabulary and text-related concepts, as well as teaching transferable vocabulary strategies such as morphemic and contextual analysis (Nagy, 1988). Attempting to isolate just one of those factors in the present study may have diminished the possibility of detecting effects of morphemic and contextual analysis instruction on text comprehension.

In sum, results of the present study do not support the extended instrumentalist hypothesis that teaching morphemic and contextual analysis strategies promotes vocabulary knowledge, which, in turn, enhances reading comprehension. Nevertheless, in the absence of more conclusive studies, we believe that researchers should neither abandon the empirical challenge Anderson and Freebody posed in 1981 nor assume that morphemic and contextual analysis instruction does not play a role in enhancing students' comprehension of text.

#### **Question 4: Relative effectiveness of instruction**

It was hypothesized that students who received CO instruction would surpass MC students on measures of contextual analysis and that students who received MO instruction would surpass MC students on measures of morphemic analysis, but results, in general, did not support this prediction. How might this be explained? Unfortunately, extant intervention research provides little insight on this matter. Tomesen and Aarnoutse (1998) included a hybrid of morphemic and contextual analysis instruction, which appears to be similar to our MC group, and their results paralleled ours: immediate effects for combined instruction on students' ability to derive word meanings with no effect on reading comprehension. They did not explore, however, the relative componential effects of the morphemic and contextual aspects of their instructional program, and we could not identify any other studies that compared isolated versus combined instruction in morphemic and contextual analysis.

As noted previously, Wysocki and Jenkins (1987) reported that fourth-, sixth-, and eighth-grade students who were provided definitional instruction in words were able to infer the meanings of morphological derivatives. They also explored the impact of context on students' ability to

derive word meanings and found that morphemic and contextual information did not have an additive effect. In other words, students, in general, were not much more likely to derive word meanings when words were in rich context than when the context was lean. Wysocki and Jenkins surmised that "for semantically transparent word pairs about which subjects have some morphological information, context may be superfluous" (p. 79).

The nonadditive relationship between morphology and context clues that Wysocki and Jenkins (1987) noted may partially explain the general lack of differences between instruction in morphemic and contextual analysis in isolation or in tandem in our study (i.e., the generally statistically nonsignificant differences for shaded contrasts in Table 4). In contrast, White, Power et al. (1989) proposed and tested a stage model of morphological analysis and asserted that context comes into play in morphological analysis at several points: when ascertaining the meanings of suffixes (Stage 1) and base words (Stage 2) and when checking the hypothesized meaning during root/affix recombination (Stage 3). Because most of the dependent measures in our study did not include both morphological and contextual information (the Morphemic Transfer Words in a Passage Test being the exception, with no group differences reported), however, it is difficult to ascertain whether or how morphemic and contextual instruction interacted. Further research is needed to explore this issue in depth.

Based on our design and analysis, it appears that students' performance did not vary, in general, whether they received hybrid MC instruction or separate MO or CO instruction. One explanation is that students in the MO and CO groups reached an instructional threshold after which additional instruction had negligible effects. In contrast, students in the MC group, who received half the instruction in morphemic and contextual analysis, performed as well as their MO and CO counterparts. Additional research will be needed to examine these and other issues surrounding combined or separate instruction.

#### **Conclusions, limitations, and implications**

Results of the study lead to six conclusions:

1. Students can be taught the meanings of select morphemic elements, and this morphemic knowledge enables them to infer the meanings of untaught words immediately following instruction.
2. Students can be taught contextual analysis strategies, and this context clue knowledge enables them to infer word meanings from context immediately following instruction.

3. When morphemic and contextual analysis instruction is provided in combination, the effects appear to be just as powerful as when it is provided in isolation.
4. The effect of instruction in morphemic and contextual analysis seems to degrade with time.
5. The morphemic and contextual analysis instruction as provided in this study and measured through the vocabulary in passages posttest does not appear to positively affect comprehension of texts that have embedded morphemically decipherable words or context-rich words.
6. These effects do not vary as a function of students' preexperimental vocabulary ability.

The preceding conclusions need to be tempered by several limitations of the study. First, to enhance experimental control and, hence, internal validity, the interventions were taught by experimenters who, with one exception, were outsiders to the school. It remains to be determined whether results could be replicated when regular classroom teachers provide all the instruction. Second, the number of morphemic elements and context clue types were limited, so we cannot speculate about the effects of instruction in other morphemic and contextual analysis content. Third, the experimental treatments involved separate, add-on instructional periods. It remains to be determined whether this kind of instruction can be successfully integrated into the regular elementary school curriculum. Fourth, because the MC lessons provided morphemic and contextual analysis content in a consecutive manner, further research is needed to evaluate the efficacy of teaching students morphemic and contextual analysis strategies in an integrated fashion. Finally, measurement limitations, especially in relation to the text comprehension measure, need to be considered when interpreting results.

In spite of these limitations, the present study reinforces and extends the limited extant empirical base regarding the efficacy of teaching morphemic analysis alone (Graves & Hammond, 1980; White, Sowell et al., 1989; Wysocki & Jenkins, 1987), contextual analysis alone (Buikema & Graves, 1993; Carnine et al., 1984; Jenkins et al., 1989; Patberg et al., 1984; Sternberg, 1987), and morphemic and contextual analysis in combination (Tomesen & Aarnoutse, 1998). Thus, there is support for the traditional practice of teaching middle- to upper-elementary students to employ morphology (structural analysis) and context clues to infer word meanings.

Further research is clearly needed. Additional studies are warranted that examine the relative efficacy of instruction in different types of morphemic elements and

context clue types. For example, we need to explore the effects of instruction in additional prefixes, suffixes, and Latin and Greek roots, as well as the effects of instruction in other context clue typologies. We need to establish the optimal duration and intensity of instruction and tease out the effects of teaching morphemic and contextual analysis separately and in combination. For instance, can students be taught rules or strategies for integrating the use of morphemic information and context clues to decipher the meanings of unknown words? Future studies must include regular classroom teachers as providers of instruction, and we need to evaluate whether and how morphemic and contextual analysis instruction can be incorporated into the extant language arts or subject matter curriculum. Additional research is needed to explore more thoroughly the potential effects of morphemic and contextual analysis instruction on text comprehension. In particular, more sensitive comprehension measures are required, and it would be useful to examine the relationships among instruction in morphemic and contextual analysis and other components of a balanced vocabulary program such as wide reading and explicit instruction in comprehension-critical vocabulary.

In the last 20 years, several researchers have called for promoting independent vocabulary learning strategies that will allow students to access the sheer volume of vocabulary they are likely to encounter in school texts (e.g., Baumann, Kame'enui, & Ash, in press; Nagy, 1988; Nagy & Anderson, 1984). Getting to scale in vocabulary development that permits meaningful access to this immense vocabulary during critical developmental periods is not easy and not without costs. Much work needs to be done. In 1988, Nagy argued that there is value in teaching morphemic and contextual analysis: "Two widely used methods of helping students learn to deal with unfamiliar words on their own are context and structural [morphemic] analysis. There is no doubt that skilled word learners use context and their knowledge of prefixes, roots, and suffixes to deal effectively with new words" (p. 38). Nagy also contended that "much more research is necessary to determine how best to teach the use of context clues and word structure analysis" (p. 38). This study is a first step in addressing that challenge.

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## APPENDIX

### Lesson plan for morphemic-context group lesson #5

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#### Background

- Lesson Topic: Teach morphemic Below or Part Family [*sub* (below, part of), *under* (below, not enough)] and Appositive Context Clue strategy.
- Lesson words to include in instruction: morphemic (*underweight*) and context (*obliterated*).
- Transfer word to *avoid* using: morphemic (*subset*, *underestimated*) and context (*leviathan*, *stealth*).

#### Introduction

1. Inform the students that today we will be learning about one new structural analysis family and one new context clue strategy.
2. Present the root words on Transparency MC5A and have volunteers read them and discuss their meanings.

#### Transparency MC5A

zero	feed
soil	weight
conscious	arm

3. Then present the overlay, which contains the prefixes *sub* and *under*. Have the students read the words with the prefixes attached, define them, and see if they can infer how the addition of the word beginnings changed the meanings of the words. Tell the students that today they will be learning about the Below or Part Family, which includes the prefixes *sub* and *under*.

#### Transparency MC5A with overlay

<i>sub</i> zero	<i>under</i> feed
<i>sub</i> soil	<i>under</i> weight
<i>sub</i> conscious	<i>under</i> arm

4. Present the word *obliterated* on Transparency MC5B (mask the rest of the transparency for now), and ask the students if they know what it means. Then reveal the definition sentence for *obliterated* on Transparency MC5B and see if the students can infer the meaning of it.

#### Transparency MC5B

#### **obliterated**

The tornado completely **obliterated**, or destroyed, the quiet little town called Pineville.

**obliterate**: to completely wipe-out, demolish, destroy, or annihilate something

5. See if the students can make the connection between the bold word on the transparency and its context clue, which, in this lesson, involves appositives. Circle *destroyed* and draw an arrow back to *obliterated* to demonstrate the context clue present in this sentence. Then reveal the dictionary definition of *obliterated*.
6. Tell the students that this is an example of an Appositive Context Clue, which we will be learning about today.

#### Explicit instruction

1. *Structural Analysis: Below or Part Family*

- a. Display the “8 Prefix Families” Chart and discuss the entries for the Below or Part Family.

#### Excerpt From “8 Prefix Families” Chart

<i>Family</i>	<i>Prefix</i>	<i>Meaning</i>	<i>Examples</i>
Below or Part	sub	below, part of	<i>sub</i> soil, <i>sub</i> continent
Family	under	below, not enough	<i>under</i> weight, <i>under</i> feed

(continued)

## APPENDIX

### Lesson plan for morphemic-context group lesson #5 (continued)

- b. Explain the meanings of the prefixes *sub* and *under*, that is, that they refer to being *below something*, being *part of a larger whole*, or meaning *not enough*. Have the students read the example words and explain their meanings. You may return to Transparency MC5A and overlay to demonstrate again how these prefixes change meaning, specifically by changing a word so that it conveys the meaning of below or part.
- c. To provide guided practice in using the Below or Part Family prefixes, display Transparency MC5C, which contains *sub* and *under* words that are (a) actual prefixed words, (b) made-up words that logically follow the prefix rule, or (c) exceptions to the rule (i.e., they begin with the spellings of the two prefixes but actually are not prefixes and roots).
- d. Explain what this transparency is about and think aloud for the first one or two. Then have the kids join in volunteering to come up and check the column they think is correct.

Transparency MC5C: The Below or Part Family

Word	Real	Made-up	Exception
subplot			
subject			
subrunning			
understand			
underprepared			
underocean			

- e. As a possible extension (time permitting), you could have the students offer additional *sub* and *under* words that fit each of the 3 categories.

#### 2. Appositive Context Clues:

- a. *Note:* According to IRA's *The Literacy Dictionary* (Harris & Hodges, 1995) an appositive is "a word or phrase that restates or modifies an immediately preceding nominal.... An appositive is often useful as a context clue for determining or refining the meaning of the word(s) to which it refers" (p. 11).
- b. Present transparency MC5D, which contains a more colloquial definition of *appositive*. Read it to the students and discuss the important parts. Discuss that signal words (*or*, *a*) can denote an *appositive* context clue. Also discuss that punctuation signals may also denote an Appositive Context Clue (appositive set off by commas, dashes, or a colon).
- c. Model the use of appositive context clues by marking the first few items on Transparency MC5D. This should be a three-step process: (a) identify the *hard word* by underlining it in blue; (b) identify any signal words or signal punctuation by underlining them in red; (c) identify the appositive context clues by underlining them in green.

Transparency MC5D

Appositive: a word or phrase that restates or explains a word that comes before it. Appositives are usually set off by commas, dashes, or colons. They may include signal words such as *or* or *a*.

1. The hillside was completely eroded, or washed away.
2. The boat deck was made out of teak, a strong, hard yellowish wood.
3. The path through the woods was so craggy—or rough—that I had a difficult time walking.
4. So they don't slip on ice, mountain climbers use crampons: spiked iron plates attached to boots.
5. I couldn't go back to school until my temperature stopped fluctuating, or changing.
6. The Giant's wrath—or anger—really scared Jack as he climbed down the beanstalk.
7. To trick the substitute teacher, Josh used a pseudonym, a fake name.

(continued)

## APPENDIX

### Lesson plan for morphemic-context group lesson #5 (continued)

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- d. Invite the students to join in, having volunteers come up to the transparency and following the procedure in step c. Have them think aloud as they're engaging in this process.

#### Practice

1. Distribute the student journals. Have them copy the information from the Appositive section of the context instructional chart onto the appropriate page in their journal (p. 2). Likewise have them copy the Below and Part Family information from that chart onto page 7 of their journals.
2. Have students complete the work paper. The top has practice on the Below and Part Family, and the bottom has practice on Appositive Context Clues. Students may work independently or collaboratively at your discretion.

#### Work Paper

Figure out the meaning of the Below or Part Family words and write them. Find other words for the last two blanks and write their meanings. Use a dictionary if you need help.

Word	Meaning
underweight _____	_____
underinflated _____	_____
subsonic _____	_____
suburban _____	_____
under _____	_____
sub _____	_____

The sentences have Appositive Context Clues. Use them to figure out which word fits in each blank. Answers are in the box. Use a dictionary if you need help.

vacuous	oration	perplexed	renowned
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1. The athlete was very \_\_\_\_\_, or famous.
  2. The look on her face so was \_\_\_\_\_, or empty, that you couldn't tell what she was feeling.
  3. The math problem so \_\_\_\_\_, or confused, Molly that she didn't know where to begin.
  4. The \_\_\_\_\_, or speech, was very moving or powerful.
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