Learning Vocabulary Through Morpheme Word Family Object Boxes

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Vocabulary instruction is an important part of literacy. This paper reports the results of a small pilot study that investigated two instructional approaches to the use of morpheme or root word families in teaching vocabulary to third grade students. Twelve students randomly divided into two groups at a high-needs urban school in central New York State participated in the investigation. Students learned eight word families in a repeated measures counterbalanced pretest/posttest design. The groups alternated learning vocabulary words through two conditions, traditional worksheet versus object boxes with word cards. The morphemic families studied contained the morphemes: oct, ped, tele, quad, cycle, man, meta, and dict. Students made gains in both conditions. Mean gains for all participants were somewhat higher in the object box condition, but this was not statistically significant because of the small number of students. This study shows that object boxes can produce the same or perhaps even better gains in vocabulary acquisition than traditional worksheet methods, with greater student motivation.

Vocabulary instruction is an important part of most state curricula for reading and language arts and has been identified as one of the five essential components of literacy by the No Child Left Behind Act, along with phonemic awareness, phonics, fluency, and comprehension.

Unfortunately, not all children are developing strong vocabularies. Biemillar (2001) and Biemillar and Slonim (2001) identified a large discrepancy between the acquired vocabularies of the different quartiles of second graders, with students in the top quartile knowing 3000 more root words than those in the lowest quartile, and with the gap continuing to widen as students progressed to middle school. Students from low socio-economic backgrounds had a greater chance of being in the lowest quartile because vocabulary acquisition depends heavily on parental instruction. The current study explores a small pilot study in one classroom that examines two approaches to how teachers might best help students from a low socio-economic background learn new vocabulary.

Theories of Vocabulary Acquisition

There are many viewpoints concerning how children learn vocabulary. Armbruster, Lehr, and Osborn (2001) claim that a child learns most vocabulary through reading or listening to words being used in context. In other words, children are able to develop vocabulary through their experiences with the words. This *experiential learning* depends upon the child's exposure to the words and nothing else.

However, Levin, Levin, and Glasman, (1992) believe that students learn new words by memory. If students are able to connect words to a familiar image or visualization, they are more likely to be able to remember, retrieve, and use the words in sentences. For example, one way to aid a student's memory would be to connect the word "wedge" with a picture of the letter w squashed between two other letters.

A third view of vocabulary acquisition is that students learn by repeated use of words. Traditional methods focus on this aspect when providing students with practice worksheets.

All three viewpoints are valid; children probably use each of these methods to learn new words. In this study, however, two specific methods of vocabulary instruction will be examined: traditional methods of written exercises and a new type of object box conceptualized by the first author, morpheme word family object boxes.

Object Boxes

"Object boxes" are an instructional tool based upon the Montessori technique of using three-dimensional concrete materials to represent language concepts such as phonemes or word definitions. An "object box" is a box of objects with corresponding word or letter cards. Montessori (1964) originated the idea when she used small children's toys and miniature items to represent letter sounds through initial sounds of the words.

Rule (2001), Rule and Barrera (2003), Rule, Barrera, and Stewart (2004) expanded on this idea by developing many different sets of object boxes for teaching phonological awareness, and vocabulary.

This study will expand the field of research for this hands-on method of instruction. Students use two types of morphemic word family object boxes in the study. The first type presents six words containing the same morpheme along with cards of definitions and cards showing parts of speech. The student matches each of six objects with the corresponding word card, definition card, and part of speech card.

The second type of object box again presents six new objects for the same six morpheme-related words, along with cards for each morpheme in the words and corresponding cards that define the meaning of each morpheme. Students carefully analyze each word through the process of matching word parts with meanings.

The concrete nature of object boxes makes them potentially superior to written exercises. Object boxes provide a student hands-on interaction with new vocabulary in context, whereas traditional methods of completing worksheets are more abstract. Objects are real representations of words; a student filling in a worksheet must imagine what the sentences or pictures represent.

Object boxes support all three theories of language acquisition. Object boxes allow students to experience vocabulary independently through manipulation of real objects. The use of two different types of boxes containing two different representations for the same vocabulary word enriches the students' understanding. The interest students have in object boxes compels them to return to them multiple times, reviewing the words on each occasion. The objects in the boxes serve as mnemonic devices that allow students to make many synaptic brain connections, facilitating retrieval of information.

Literature Review

Mnemonic Devices

Eeds and Cockrum (1985) found that memory plays a large part in the learning of vocabulary. Vocabulary should be taught in a way that activates the student's schema, or prior knowledge and experiences, and enabling the new word to be fit into a previously developed web of words. This enhances memory and the retrieval of the word.

A mnemonic device is any strategy that helps a person remember something. Levin et al. (1992), started with the premise that vocabulary acquisition requires the ability to retrieve the information from

memory. They conducted a study using a mnemonic device, a visual image that the researchers described to the subjects to aid them in their memory of the vocabulary words. An example from their study is the word "carlin". The word carlin is an ancient Scottish word meaning an old woman. The researchers asked the subjects to visualize an old woman driving a *car* to help them remember the meaning of the word.

Levin and colleagues found that students who were given a mnemonic strategy for words learned up to twice as many words as those who read vocabulary in context and were taught the words through direct instruction.

Learning Vocabulary Through Word Morphology

Words are made of morphemes, the "minimal meaningful linguistic unit that contains no smaller meaningful linguistic unit" (Anglin, 1993, p.17). There are five major types of words: root words, inflected words, derived words, literal compounds, and idioms. Of the five different types of words, using morphological analysis to break words into suffixes, prefixes, and roots will address four of these types (all except idioms).

Anglin (1993) studied cross sections of students in 1st, 3rd, and 5th grades to discover the process of vocabulary development, the speed of vocabulary development, and the order of acquisition of the five different types of words. He discovered that students in the 1st grade used morphological analysis or problem solving 40% overall and 56% of the time when trying to learn the meaning of complex words. He also showed that the use of morphological analysis or the breaking down of the words increases as the students became older or increased in grade level. By 5th grade, students were using problem solving 51% of the time overall and 65% of

the time to determine the meaning of complex words. This supports the hypothesis that the use of morphological analysis is essential for sufficient vocabulary development (Lewis & Windsor, 1996; Swisher & Snow, 1994).

Anglin's study indicated that the students used problem solving to determine word meaning more often than any other way. This indicates that direct instruction and learning words in context may not be the most efficient and effective way for students to learn new words.

In addition to the study of the process of language acquisition, Anglin (1993) also studied word acquisition order. He found that between grades 3 and 5 students learn about 28 words a day, with only about 4 of these being root words. This significant growth in vocabulary was attributed mainly to the acquisition of derived and inflected words. Derived words contain one or more affixes (suffixes or prefixes) that change the part of speech of the root word. Inflected words contain one or more affixes that change the aspect, person, number, gender, or case of the root word.

To determine the amount of vocabulary growth on average a student had per day, Anglin used systematic sampling of 434 words from an unabridged dictionary to test students' knowledge. He then divided these words into various categories (i.e. root words, derived words, inflected words, literal compounds, and idioms) and different complexities (monomorphemic, bimorphemic, multimorphemic) to determine the growth of vocabulary in each of the areas. He found that between 1st and 5th grade, the average student learns about twelve words per day. Nine of the words that the student learns are derived words, about 2 are inflected words, and 1.5 are idioms. Between the grades of 3 and 5, the average student learns about 28 words per

day. Fourteen of the words learned are bimorphemic (contain two morphemes), seven are multimorphemic (contain more than two morphemes), 4 are root words, and 2.4 are idioms. This shows that vocabulary increases rapidly in grades 1 through 5.

In comparison, children between the ages of one and one-half and 1st grade learn, on average, about 1.64 words per day. That means that the bulk of words that children learn are acquired during their school days. Anglin concluded that direct instruction and learning in content could not account for the vast number of words that the students attain in a short period of time.

Using Objects for Vocabulary Acquisition

Gersten and Baker (2002) used visuals to reinforce vocabulary acquisition. If visuals were helpful in vocabulary development, how much more would a three-dimensional object aid in the acquisition of new words?

Rule, Barrera, and Stewart (2004) used descriptive adjective object boxes as an instructional strategy for teaching science vocabulary. A descriptive adjective object box consists of three parts: the box (often a theme-related container), ten or more related objects that vary widely in physical characteristics, and a corresponding set of cards with four descriptive adjectives printed on the front of each and a representation of the correct object on the back". They found that although both their control group and the experimental group were on the same level of vocabulary at the commencement of the study, the experimental group made significantly greater progress in vocabulary acquisition. In another study (Rule and Barrera, 2003), the use of object boxes of words with multiple meanings resulted in greater vocabulary growth than the use of direct instruction with pictorial worksheets. In addition, the students were found to be highly motivated and were drawn to the object boxes repeatedly.

Other Variables in Learning Vocabulary

The process of vocabulary development is complex. Harmon (1998) states that there are eight techniques for assisting students in their understanding of vocabulary. These are the use of synonyms, brief descriptions, examples and non-examples, rephrasing, repetition, associations, and unique expression. In addition, vocabulary instruction is most effective when students are positively and actively involved in their learning; they are allowed to use their own strategies to learn the vocabulary; and the structure of the learning allows for individual growth over a long period of time (Carr & Wixson, 1986; Ruddell, 1986).

Morphological analysis is a widely used skill among school age students to gain meaning from vocabulary words. It has also been demonstrated that mnemonic devices area more effective and efficient way of teaching vocabulary than learning the words in context and through direct instruction. The use of object boxes in vocabulary development increases a student's ability to understand words, results in substantial growth in vocabulary words, and increases the grade level of a student's vocabulary (Rule, Barrera, and Stewart, 2004).

All of these strategies have been found to be effective in the teaching vocabulary. Therefore, the integration of several of these strategies in morpheme family object boxes should result higher gains in vocabulary. The current study will compare this method to typical traditional methods of vocabulary instruction.

Methods and Procedures

Subjects and Setting

The study was conducted in a high-needs urban school in a large city in central New York State. Third grade students were randomly divided into two groups, A and B. Demographics of the sample population are shown in Table 1.

TABLE 1. Demographics of the sample population.

Group	Gender		Race/ Ethnicity		
	M	F	W	B	H
A	4	2	2	3	1
B	1	5	0	6	0

Research Design

This study was repeated measures counterbalanced design with pretest and posttest assessments. Each week one group used object boxes to study the root word set and the other group used worksheets (comparison condition). Then the next week, the groups switched positions for the next morphemic set, as shown in Table 2. Morpheme sets were assigned randomly to the weeks of the study. Each morpheme set contained six targeted words shown in Table 3.

TABLE 2. Experimental set-up of groups, conditions, and word sets.

Week No.	Experi-mental Condition	Control Condition	Vocabulary Root Words
1	Group A	Group B	oct, ped
2	Group B	Group A	tele, quad
3	Group A	Group B	oct, ped
4	Group B	Group A	tele, quad
5	Group A	Group B	cycle, man
6	Group B	Group A	meta, dict
7	Group A	Group B	cycle, man
8	Group B	Group A	meta, dict

TABLE 3. List of words used in the study.

Words of Root Word Families for Study	
Root word "ped" (meaning: foot)	Root word "man" (meaning: hands)
peddler	manuscript
biped	manipulatives
pedicure	manacle
pedal	manicure
pedestrian	mannequin
pedestal	manufacture
Root word "cycle" (meaning: circle)	Root word "dict" (meaning: to speak)
cyclical	dictionary
motorcycle	predict
tricycle	dictate
bicycle	dictator
cyclone	verdict
recycle	indicate
Root word "oct" (meaning: eight)	Root word "qua," (meaning: four)
octopus	quadrilateral
octogenarian	quadruplets
octagon	quartet
octahedron	quarter
octave	quart
octet	quadruped
Root word "tele" (meaning: distance)	Root word "meta" (meanings: beyond, change)
television	metamorphic
telephone	metamorphosis
telegram	metaphor
telephoto	metaphysical
telemarketing	metastasis
telescope	metatarsals

Object Box Materials

Object boxes were of two types, with each type being present for each morpheme family. The first type of box contained vocabulary word cards, definition cards, part of speech cards, and objects that represented the vocabulary words. The student was directed to produce a layout of the objects

and word cards to indicate an understanding of how these related to each other. Figure 1 shows an example object box of this type for the "man" morpheme family.

The second type of box contained vocabulary word cards, each morpheme in each word had a card, and the definitions of each morpheme were also put onto separate cards. Figure 2 shows an example object box of this type for the "meta" morpheme family. Students completed the first type of object box before working with the second type of object box.

Assessment Instrument

Identical paper and pencil tests were administered before the unit as well as two weeks after the completion of the eight-week vocabulary unit. The concepts taught in each condition have been carefully correlated with the assessment instrument to ensure that students in both conditions have access to the concepts assessed on the pretest/posttest. Table 4 shows this alignment of concepts.

TABLE 4. Alignment of concepts taught in both conditions and assessed on the pretest/ posttest

Control Group Using Traditional Worksheets	Experimental Group Using Object Boxes	Concepts	Test
Look up definition in dictionary, write definition, tell part of speech.	Box with objects and cards: match object to word, match definition using a dictionary, match part of speech.	Part of speech, definition, using dictionary, recognizing word.	Part 2. Find correct word for blank to make sense in sentence. Part 3. Find correct synonym for word. Part 6. Find the part of speech for the word.
Write a sentence with the word explaining how the meaning of the root word contributes to the meaning of the word.	Box with objects and cards: match word to object, match word parts to word, match meanings to parts of word.	Root word meaning, recognizing spelling.	Part 4. Find the meaning of the root word. Part 5. Find the root word for a given meaning.
Unscramble the words.	Movable Alphabet and objects: Use letters to spell object name, check word with word cards.	Spelling the words.	Part 1. Find correct spelling when word is read.
Fill in the blank with the correct word.	Match the word with the object to develop context.	Using a word in context.	Part 7. Fill in the correct word in context.

FIGURE 1. Layout of objects and word cards for the "man" root word family.

Results and Discussion

Gain Score Observations

Student performance data under different conditions are presented in Table 5. Group B made higher overall gains than Group A (27.1 % to 16.7). Considering all participants in the study (both groups), mean gains were somewhat higher in the object box condition, but the number of participants in the study was small (N=12), so the difference between the mean gain scores is not statistically significant. An analysis of variance (ANOVA) was conducted on the individual raw scores on each test question compiled for words studied through the object box condition versus the worksheet condition for all twelve participants. This analysis shows no significant difference in performance (as measured by individual gain scores on each test item) related to words learned under the two conditions (F=0.66, df=1/646, p=0.41). The primary indication is that the P-value (0.41) is much larger than alpha, which was set at 0.05, or the 95% confidence interval.

Both groups showed little variation in gains on different parts of the test. Students scored well in all areas (range was 20.8 to 25.0) with a mean gain of 23.5 percentage points. However, in the mean scores of both groups for the worksheet condition, there is considerable variation in gains for different parts of the test, from 8.3 to 33.3 percentage points, with a mean gain of 19.9 percent. This indicates an inconsistency in the effectiveness of worksheets overall.

FIGURE 2. Layout of objects, word cards, and morphological word parts for the "meta" root word family.

Root Word Family: meta

Metamorphosis	meta	morph	osis
	change	shape	process of
Metamorphic	meta	morph	ic
	change	shape	relating to
Metatarsals	meta	tarsal	s
	beyond	ankle bone	more than 1
Metaphysical	meta	physical	
	beyond	matter	
Metaphor	meta	phor	
	change	form	
Metastasis	meta	stasis	
	beyond	staying in one place	

You are my sunshine.

Students made gains in both conditions. Worksheets have traditionally been used to teach vocabulary concepts with good results. This study shows that object boxes can produce the same or improved results.

Teacher Observations

Many of the students preferred the object boxes to the traditional methods of learning vocabulary because the hands-on activities were more engaging and interesting. Some students thought that they learned more when they completed worksheets, however, this could be caused by the fact that the teacher had to help

TABLE 5. Mean gain scores as percent correct for groups on different test parts

Test Part	Both Conditions		Object Box Condition			Traditional Condition		
Group: A	B	A	B	Both	A	B	Both
1. Find the correct spelling for the dictated word.	14.6	27.1	20.8	25.0	22.9	8.3	29.2	18.8
2. Identify word that makes sense for a blank in a sentence.	20.8	27.1	33.3	16.7	25.0	8.3	37.5	22.9
3. Identify a synonym for the word.	8.3	25.0	4.2	45.8	25.0	12.5	4.2	8.3
4. Find the meaning of the root word or morpheme.	18.8	16.7	33.3	8.3	20.8	4.2	25.0	14.6
5. Find the root word or morpheme for a given meaning.	10.4	31.3	20.8	20.8	20.8	0.0	41.7	20.8
6. Identify the part of speech for a word.	10.4	37.5	16.7	33.3	25.0	0.0	41.7	20.8
7. Fill in the correct word in context.	33.3	25.0	20.8	29.2	25.0	45.8	20.8	33.3
Mean of All Parts	16.7	27.1	21.4	25.6	23.5	11.3	28.6	19.9

students more in the traditional condition because they needed assistance in looking up words in the dictionary. Also, the pleasure and joy of using the object boxes may have given students the false impression that the activity was merely fun.

The data show, however, that students learned the vocabulary concepts through the object boxes as well as through traditional methods. The teacher observed that students were more engaged with the vocabulary development activities when they used the object boxes than when they were completing worksheets. Students also demonstrated greater enthusiasm for using the object boxes, indicating that they enjoyed examining objects and creating layouts of objects and cards, rather than completing written exercises of the traditional condition.

Discussion of Generalizability of Results

Although this study has not shown a significant difference between the posttest scores of the students using object boxes and those using traditional methods of instruction, it has provided information for further studies. First, this study was undertaken with a small number of subjects (n=12), thereby limiting generalization. Secondly, the students had much difficulty at this age with looking up words in the dictionary for the worksheet condition and, therefore, as a result, received more instructor help and contact than those students who used the object boxes. This may have affected scores. As the students received more teacher attention, the experience may have become more meaningful and memorable.

Conclusion

Morpheme word family object boxes, although not shown to be superior to traditional methods in this limited study, were shown to be as effective for vocabulary acquisition. With regard to student motivation, the object boxes were clearly superior. The authors recommend that further studies with larger groups of students of various grade levels be conducted to determine the strengths of this promising new approach to vocabulary instruction that teaches vocabulary through concrete representations and morpheme analysis.

Acknowledgement

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Project SMART at SUNY Oswego

Project SMART is a 16 year long New York State Sharing Success-validated professional development model, formerly Dwight D. Eisenhower funded, and currently funded through the Teacher/Leadership Quality Partnership of the No Child Left Behind Act, several local businesses, and the Oswego County Workforce Development Board. Project SMART supports building-based study groups and a week-long summer institute to develop equity-based teaching. Teachers interested in Project SMART can contact the Project SMART office at 315-312-4024. For further information, see www.oswego.edu/prosmart

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