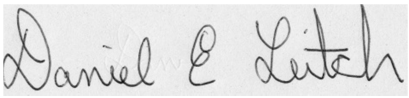
TWO WAYS TO TEACH TIER TWO VOCABULARY WORDS

Approved:  Date: May 24, 2013
Paper Advisor

Suggested content descriptor keywords:

concept mapping

academic vocabulary

Tier Two vocabulary

Thinking Maps

TWO WAYS TO TEACH TIER TWO VOCABULARY WORDS

A Seminar Paper

Presented to

The Graduate Faculty

University of Wisconsin-Platteville

In Partial Fulfillment Of the Requirement for the Degree

Master of Science

in

Education

By

Arlene W. Strikwerda

2013

ACKNOWLEDGEMENTS

I would like to extend by sincerest thanks to Dr. Daniel Leitch and to Dr. Karen Stinson for their assistance and to John Strikwerda, my husband, for his constant support.

I would also like to express appreciation to the principal, teachers and students who were so willing to cooperate in making the research for this study possible.

TWO WAYS TO TEACH TIER TWO VOCABULARY WORDS

Arlene W. Strikwerda

Under the Supervision of Dr. Daniel Leitch

Statement of the Problem

The teaching of Tier Two vocabulary words has taken on new prominence with the adoption of Common Core State Standards. Tier Two words are academic vocabulary utilized across content areas and often assumed to be known; yet, these words are sufficiently complex that many students do not have access to their meaning. According to CCSS, Tier Two words need to be addressed and specifically taught to ensure knowledge acquisition and adequate understanding (CCSS, 2010).

Methods and Procedures

To gain insight into effective ways to teach Tier Two academic vocabulary, the author conducted a research study at a large mid-western elementary school. Twenty Tier Two vocabulary words were taught to twenty third grade English Language Learners (ELL) using two different methods of vocabulary instruction and a between-groups design in two four week phases. In one method students wrote the meaning of each new vocabulary word and used the word in a sentence. In the second approach, the researcher incorporated the use of concept mapping and included word meaning, sentence writing plus antonyms, sequencing of sounds and a student drawing. The researcher asked whether teaching words using visual mapping with

multiple representations and thought processes increases vocabulary acquisition and retrieval of meaning. The visual mapping program used for this research study was Thinking Maps.

Summary of Results

Students using the Thinking Maps approach scored higher in both phases of the project than did students with meaning and sentence writing instruction. The researcher found that differences on the Knowledge Rating Scale for both phases were statistically significant; differences on a multiple choice test for the first phase were minimal and differences on the second phase of the multiple choice test were statistically significant. These findings support the hypothesis that meaningful representation of new words using the concept mapping of Thinking Maps enhances and contributes to vocabulary acquisition; although, because of small sample size, more research is needed.

TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

Figure Page

Table

Chapter I

Introduction

The teaching of Tier Two vocabulary words has taken on new prominence with the adoption of Common Core State Standards (CCSS). Tier Two words are academic vocabulary utilized across content areas and often assumed to be known; yet these words are sufficiently complex that many students do not have access to their meaning (Yeager, 2012). According to CCSS, Tier Two words need to be addressed and specifically taught to ensure knowledge acquisition and adequate understanding. This is particularly true for students who are English Language Learners (ELLs).

Statement of the Problem

Vocabulary knowledge underlies much of language expression and provides a basis for communication. As vocabulary size increases, individuals gain access to understanding within a broader range of subjects and content areas; therefore, vocabulary acquisition is an important topic in education, especially as a means of enhancing learning for students with limited vocabularies. Miller and Gildea (1987) state that by the age of 17 the average high school student has learned more than 80,000 words which averages 5,000 per year. Some students are well above that average. Although these numbers have been questioned and are thought to be inflated (D'Anna, Zechmeister, & Hall, 1991), educators are concerned with finding ways to increase vocabulary knowledge for those students who enter school with a more limited vocabulary size.

Significance of the Study

The process of learning a new word evolves from learning fragments of word meaning to a richer knowing developed from meaningful encounters with the word such as hearing and using it in conversation and comparing and contrasting it with other words. A dictionary definition does not include the subtle nuances of word knowledge that develop with practice. Carey (1978) talks about "fast mapping" and "extending mapping" indicating that initial understanding of a word deepens with additional exposure to a word including repetition and variety. Proper word use depends on context and situation. Evidence that vocabulary development is a case of situated cognition is demonstrated by student use of dictionary derived meanings in creating sentences (Brown, Collins, & Duguid, 1989). Scott and Nagy (1991) conclude that the use of dictionary meanings assumes some knowledge on the part of the students. Students limited to dictionary meanings are likely to write sentences like "Mrs. Morrow stimulated the soup" (Miller & Gildea, 1987).

Words and sentences do not exist by themselves. They are informed by a larger context that alerts a native speaker to a mismatch that someone just learning the language, such as an ELL, might not grasp. Some words have multiple meanings; some words cannot be substituted for others even though the meanings are similar. Vocabulary development is not just a matter of memorizing the various definitions of a given word. It involves awareness of how each word contributes to meaning on different levels; it requires sophisticated vocabulary use.

Much attention has been directed toward the teaching of academic vocabulary. Robert J. Marzano is a researcher who has developed a Six-step Program for vocabulary instruction

(Marzano, 2004). In the first four steps of his program, he addresses a number of strategies to provide both linguistic and nonlinguistic vocabulary instruction. Examples of this would be a verbal or written explanation of the word and a restatement of meaning by the student followed by student creation of a nonlinguistic representation and activities that create interaction with the word in a variety of ways. Marzano, also, emphasizes repeated exposures to new terms over time. His program is suited to classroom instruction where learning can be revisited.

Method

In seeking effective ways to teach academic vocabulary, the researcher conducted an experiment that incorporated some features similar to those of Marzano's Six-step Program. A concept mapping format was used that combines linguistic and nonlinguistic instruction with a number of vocabulary teaching interactions. The format used was a combination of concept maps called Thinking Maps. Some third grade ELL students were instructed using this method, and others were instructed using a definition and sentence writing method for comparison. The question addressed was whether teaching words using visual mapping, specifically Thinking Maps with multiple representations, increases vocabulary acquisition and retrieval of meaning. The hypothesize was that meaningful representation of new words using the concept mapping of Thinking Maps enhances and contributes to vocabulary acquisition. For examples of this format see Figures 1 and 2.

Delimitation of the Study

The sample size for this study was limited by the number of third grade ELL students available to the researcher. The small sample size limited the conclusions which could be drawn from this study; however, it did indicate the results which could be obtained with students in a

school environment. Thus, there is the potential for direct and practical application of this research.

The children participating in this study are all Hispanic with limited English Proficiency and various degrees of Spanish fluency. The results of this study will, therefore, not be indicative of a cross-cultural sample of all third graders.

Chapter II

Theory

In meta-analyses studies, Powell (1980) and Stahl and Fairbanks (1986) compare vocabulary instruction using linguistic-based strategies, such as definition and sentence writing with nonlinguistic forms, such as the use of graphic organizers. They found that both strategies were useful; however, Powell documents additional gains for nonlinguistic instruction over instruction focused on definition and sentence writing. Marzano suggests that one possible explanation for the gains in learning can be found in dual coding theory. He explains that in dual coding theory, as described by Paivio and Sadoski, memory packets have a bimodal aspect. According to this theory, "background knowledge is stored in bimodal packets with linguistic and nonlinguistic components…" (Marzano, 2004, p. 21). Marzano uses this theory to support the second point in his list of Characteristics of Effective Direct Vocabulary Instruction. This characteristic states that "Students must represent their knowledge of words in linguistic and nonlinguistic ways" (Marzano, 2004, p. 71). Thinking Maps provides a tool to do this while encouraging multiple ways of interacting with new vocabulary.

The use of Thinking Maps for vocabulary acquisition is based within the constructivist theory of learning (Hyerle, 1996) where learners are actively engaged in constructing meaning by connecting new information with their existing knowledge. As students construct meaningful representations for themselves, they are supported by a consistent and reliable tool that provides a structure for their thinking (Hyerle, 1996). Learning vocabulary in this way can become self-directed, and the process may eventually become internalized with the map design fading as the process becomes automatic and a pattern for vocabulary acquisition is established. According to

David Hyerle, the creator of Thinking Maps, these thinking-process maps are taught so students "can create *their own transfer* of thinking processes to content-specific tasks" (Hyerle, 1996, p. 74). In constructivist theory, students construct their own knowledge as they understand the interconnections between facts and concepts (Shepard, 1989) or in the case of vocabulary, between a word and its various meanings and use.

The scaffolding and fading aspects of Thinking Maps are parts of the apprenticeship model and Vygotsky's Zone of Proximal Development (Cole, John-Steiner, Scribner & Souberman, 1978). In these theories the learner is initially supported by interactions that scaffold the new, next step learning with a gradual fading of the visual scaffolding and an increase of student skill until total responsibility is released to the learner. This transfer of knowledge by means of scaffolded learning has been used by educators like Ann L. Brown in the development of reciprocal teaching which was built on a cognitive apprenticeship model (Brown & Palincsar, 1984). In reciprocal teaching Brown and Palincsar taught students the comprehension strategies of questioning, clarifying, summarizing and predicting by moving them by stages from modeling through supported practice to independent use. For students new to academic vocabulary learning, the scaffolding provided by a concept map format establishes a pattern of inquiry, a way to learn new words. The regulatory aspect of concept mapping is discussed in an article by Hagenmans, van der meij and de Jong (2013). They state that many students need support in regulating their learning and that scaffolds, such as concept maps, can provide that support. Initial modeling and even the scaffold itself fade as the learner becomes self-directed and the process is internalized.

Thinking Maps support learning by acting as a tool for distributed cognition. The design of each map embodies a different thinking process, implicitly asks specific questions and then

organizes and structures the student response to those questions. For example, when a student is confronted with a new word, the sequencing of the letter and sound combinations from left to right can be difficult; the word is either known or not known in its entirety. By using the boxes of a Flow Map, the student groups the symbols in order from left to right and reads these groups in sequence following the arrows located between each box (see the map in the lower right corner of Figures 1 and 2). The structure and flow of the pattern are visually represented and hold the sequence of the letters while the student transfers the symbols to sound and approximates the word. Each of the eight map designs links to a specific type of cognition and subtly directs thinking by means of the questions associated with that map and the type of response expected. By careful selection of maps in different combinations, a variety of student interactions can be stimulated and recorded. As the learner progresses from one map and to another, different ways of thinking about a word can be highlighted. For ELLs thinking this is a critical part of learning new words.

Chapter 3

Method

To gain some insight into effective ways to teach Tier Two academic vocabulary to ELLs, the researcher conducted a study at a large mid-western elementary school. School enrollment was approximately 640 students with a population of 72% Free and Reduced Lunch, 37% Hispanic and 34% English Language Learners. The researcher taught Tier Two vocabulary words to two groups of third grade English Language Learners (ELLs) using two different methods of vocabulary instruction and a between-groups design. One method was a word definition and sentence writing approach in which each word was introduced with its meaning and students wrote the meaning and used it in a sentence. In the Thinking Maps approach, the researcher incorporated the use of concept mapping and, in addition to word definition and sentence writing, used antonyms, sequence of letters and sounds and a student drawing and of the meaning.

Participants

For this study 20 third grade ELL students were selected on the basis of their English language proficiency scores and a stratified random sample process established groups. The sample was matched for the number of boys and girls and literacy levels and then individuals were randomly assigned to the two different groups. Each group consisted of ten students. Each of these groups was divided into two smaller groups for instructional purposes.

Procedures

Students were taught for 20 minutes a week over a four week cycle. During Weeks One and Two, five words were introduced in two 20 minute lessons: three words each in Week One and

two words plus review on Week Two, continuing this format for Week Three and Four. Students were assessed on these ten words. This cycle repeated for Weeks Five through Week Eight. Although the sample size was small, the four week cycle was repeated to teach a total of 20 words. With this repeated model, more data was collected and insight gained regarding student use of both formats.

The Tier Two words taught came from lists of words expected to be known by students in third grade. Both groups were instructed using the same words. One group received the instruction using the word definition followed with sentence writing; the other group received instruction using a combination of Thinking Maps to include both linguistic and nonlinguistic instruction. The purpose of the experiment was to test the hypothesis that meaningful representation of new words using concept mapping, specifically Thinking Maps, would enhance and contribute to vocabulary acquisition.

For the definition and sentence writing group, responses were generated by the group, supported by teacher input, recorded by the teacher on a white board and copied by students into a notebook. One page was dedicated to each word. The pages from the first cycle were removed from the notebook before the beginning of the second cycle.

For the Thinking Maps group the procedure was the same except the students wrote their responses on a paper with the Thinking Map format provided (see Figure 1). One sheet was used per word. In addition to recording the meaning and use of the word in a Circle Map, this group also sequenced the word in a Flow Map, sorted it from antonyms in a Tree Map and made a quick draw in a Circle Map. Although there are numerous graphic organizers available for teaching vocabulary, the combination of maps used for this project was carefully chosen by to

utilize multiple representations and thought processes and to establish a pattern of learning with the consistency of the design acting as a scaffold.

Instrumentation

To establish pretest and posttest knowledge, two tests were administered before and after instruction. The Knowledge Rating Scale (see Appendix A) was used to establish student self-assessment of their knowledge of individual words. A multiple choice test was administered to record student ability to choose the correct meaning for a word from a choice of four possible meanings. A fifth choice of "don't know" was also offered. The Knowledge Rating Scale was read to each student individually to ensure that reading ability did not interfere with vocabulary knowledge. On this scale, students responded with their current understanding of the words indicated by a check or a definition or example if they knew the meaning. The researcher served as recorder in order to eliminate any hesitancy students may have had about writing. The multiple choice test recorded any change in student ability to accurately choose word meaning. Both instructional groups received the same assessments.

As part of the Institutional Review Board (IRB) approval, all students were to receive training in the Thinking Maps approach after the study if a significant advantage was noted.

Chapter III

Analysis of the Test Results

Students in the Mapping and the Definition/Sentence Groups were instructed for two cycles of four weeks each, learning ten vocabulary words per cycle as designed. Sample size for this experiment was small with ten students per group participating in the two cycles for a total of twenty students in all. Because of small sample size, data from students with up to two absences was included in the study. Two students from each condition were absent one time each and one student from each group was absent two times making the number of absences for each group equal. No student data was excluded because of absences. Time of instruction for the first cycle was twenty minutes per session; however, once routine was established, the groups needed less time to complete the learning tasks and instruction time for the second cycle was reduced to sixteen minutes per session for each group.

Data was collected using the Knowledge Rating Scale (KRS) and a multiple choice test to consider both student confidence level and actual word knowledge gained. Results of the KRS are shown in Table 1 and 2 representing each cycle of the experiment. Test data from the multiple choice test is listed in Tables 3 and 4. Data for both groups and both cycles are shown in Table 5.

Results of the Knowledge Rating Scale

The KRS represents student perception of their word knowledge. As each word was presented visually and verbally by the tester, each student gave himself a rating using the language of the test. The scale was scored from one to four rated as follows: *no clue* = 1 point, *seen or heard* = 2 points, *know it well* = 3 points and *means* (a definition or example given) = 4

points. A rubric was designed as a coding system to provide a consistent rating for the scores (see Appendix B). If an incorrect definition or example was given, the response was coded as *seen or heard* -2. If a sentence used the word correctly but gave no indication of meaning or if a partial definition was given, the score was 3-*know it well* but not the full credit of 4. Since each word was scored at 1, the lowest pre-test score was 10, 1 for each of the 10 words; the posttest score could have been as high as 40 if a correct meaning or sentence use was given for each word. Therefore, the range of possible gain could have been from 0 to 30. The gain for each student was figured as a percentage of 30 measuring how each student ranked his knowledge of the ten words for that cycle. The results of both four week cycles show an increase in student self-rating for the experimental group.

Using an unpaired *t* test (Motulsky, 1984) comparing the KRS results of the Thinking Map Group with the Definition/Sentence Group for the first learning cycle yielded a two-tailed P value of 0.0286, a mean of 18.010 and a 95% confidence interval from 2.109 to 33.911 with t = 2.3795 and df = 18. Standard error of difference = 7.569. This difference is considered to be statistically significant. Repeating this test for the KRS results in second learning cycle yielded a two-tail P value of 0.0001, a mean of 31.350 and a 95% confidence from 17.733 to 44.967 with t = 4.83368 and df = 18. Standard error of difference = 6.482. This difference is considered to be statistically significant. These results indicate greater confidence in word recognition ability for the Thinking Maps group in both cycles with the greatest difference occurring in the second cycle. This evidence supports the hypothesis that using Thinking Maps would be beneficial in vocabulary instruction.

Results of the Multiple Choice Test

When the multiple choice pretest scores were compared with the posttest scores, words that had been correctly identified in both the pretest and the posttest were considered to be known and were not included in words learned. Words that were correctly identified in the pretest but not in the posttest were considered to be guesses and were not considered as words known or learned. The results for the first cycle did not indicate a significant difference between the groups for words learned; however, the results for the second cycle were considered statistically significant as were the results when both cycles were considered together.

In analyzing the words learned as determined by the multiple choice test for the first cycle, the difference between the two groups is considered to be not statistically significant. The unpaired *t* test (Motulsky, 1984) yielded for the two-tailed a P value of 0.3061, a mean of 0.60 and a 95% confidence interval from -0.60 to 1.60. The value of *t* = l.0534 and the df = 18. Standard error of difference = 0.570. The statistics for the results of Phase 2 using data from the multiple choice test are considered to be statistically significant. The two-tailed P value = 0.0408 with a mean of 1.90 and a 95% confidence interval from 0.09 to 3.71. The *t* = 2.2037 and the df = 18. Standard error of difference = 0.862. These statistics indicate a growing difference between word knowledge for the two groups as the cycle repeated. The first four weeks showed a minimal gain; however, the word gain in the second cycle indicated a significant difference favoring the Thinking Maps group. These results support the hypothesis.

Data from each four week cycle is presented and analyzed as two phases of the experiment in order to provide comparison between the two cycles. On the KRS the difference in gains between the groups was statistically significant during the first and second four week cycle with

the Mapping Group showing the greatest gains in both cycles. For the multiple choice test the first cycle did not present a significant difference in gains between group scores; however, the second cycle yielded differences that were considered statistically significant for the Mapping Group. This data indicates that students in the concept map approach were more confident in their knowledge of the twenty vocabulary words presented over the two cycles of instruction than those in the definition/sentences writing group with the greatest degree of confidence documented in the second phase. A difference in word knowledge between the groups was verified through the multiple choice test. The students in the Mapping Group scored approximately a half word gain over the students in the definition/sentence group on the first cycle. This difference was not significant; however, in the second cycle they increased this difference to an almost two word gain that is considered to be statistically significant. While students in the Thinking Maps group showed greater gains in all the tests, it is interesting to note that gains in confidence levels as recorded on the KRS were the greatest.

Since students in the Thinking Maps group scored significantly higher, students in the definition/sentence group received instruction in the Thinking Maps approach as a stipulation of the IRB agreement. Students knowledgeable in the Thinking Maps approach taught this approach to their peers who had participated in the definition/sentence group. Although no additional data was collected, the researcher observed that the students knew each step and could easily guide their peers through the process of learning a new vocabulary word with minimal input from the researcher.

Chapter IV

Discussion

The hypothesis for this study was that teaching words using visual mapping, specifically Thinking Maps with multiple representation, would enhance and contribute to vocabulary acquisition. The results of this experiment indicate an advantage for the students using the Thinking Maps application. Students in the Mapping Group scored themselves significantly higher in word recognition and correctly identified the meaning for .6 more words in the first cycle and 1.9 more words in the second cycle than did the Definition/Sentence Group. These gains for the Mapping Group give support to the hypothesis that using visual mapping would increase vocabulary learning; however, with a small sample size this evidence is not strong and warrants more study.

By conducting the experiment in two phases, it was possible to compare the two learning cycles and to note increasing differences in student confidence in word recognition and higher meaning identification scores with repetition. Comparing the results of the two different testing methods identified that student confidence increased even more than their ability to correctly identify word meaning. While these findings give some support to the idea of enhanced vocabulary learning and greater acquisition with Thinking Maps instruction, they also raise more questions concerning effect over time, student confidence and transfer of a learning process. The confidence and skill with which students could pass on their knowledge to other students also poses questions about the establishing of learning patterns. Emerging differences in student learning including observations of student behavior could be a future project.

FIGURES AND TABLES

Figure 1. *Thinking Map Format*

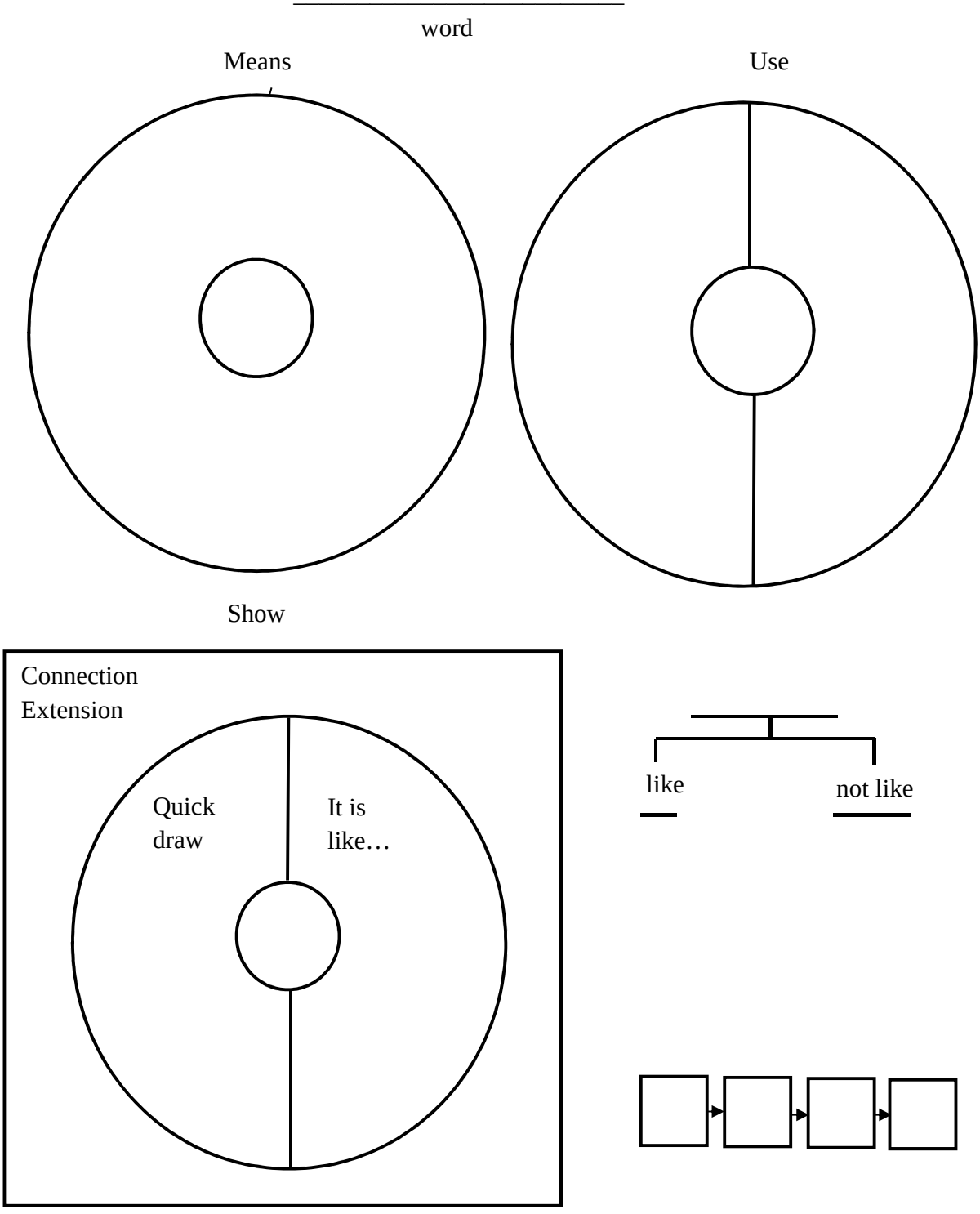


Figure 2. *Thinking Map Format with Responses*

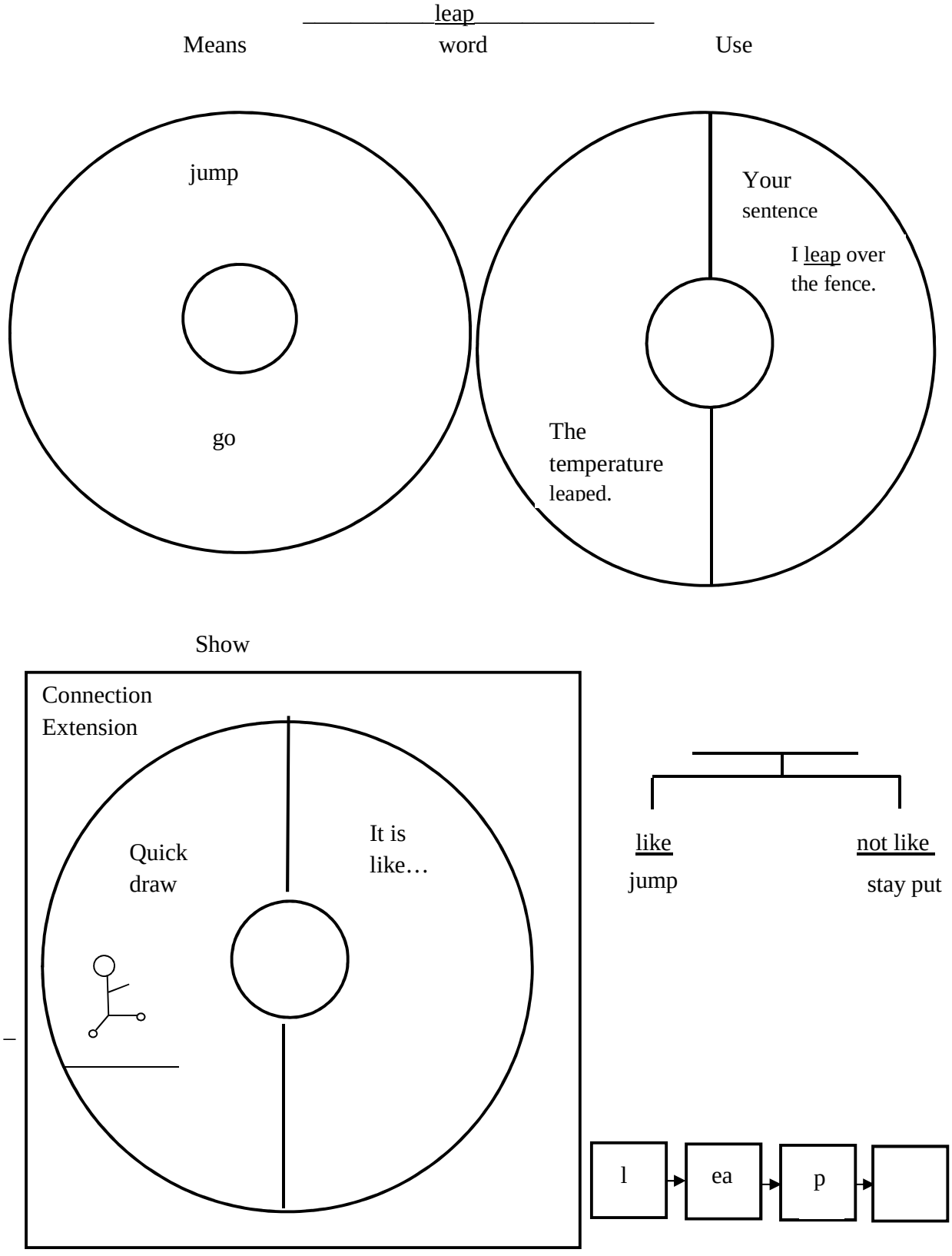


Table 1. *Knowledge Rating Scale for First Four Week Cycle for the Mapping Group and the Definition/Sentence Group*

Mapping Group					Definition/Sentence Group				
Student #	Pre-test	Post-test	Difference	% gain	Student #	Pre-test	Post-test	Difference	% gain
1	12	17	5	16.7	11	14	19	5	16.7
2	11	31	20	66.7	12	11	14	3	10
3	11	22	11	36.7	13	16	26	10	33.3
4	12	14	2	6.7	14	13	21	9	30
5	13	20	7	23.3	15	16	22	6	20
6	13	28	15	50	16	12	14	2	6.7
7	10	28	18	60	17	15	26	11	36.7
8	13	28	15	50	18	16	29	13	43.3
9	12	26	14	46.7	19	14	14	0	0
10	19	29	10	33.3	20	12	16	4	13.3
Average	12.6	24.3	11.7	39.01	Average	13.9	20.1	6.3	21

Note. The percentage gain was figured on the posttest score as compared to the 30 which is the highest possible gain. The lowest possible score was 10 and the highest was 40.

Table 2. *Knowledge Rating Scale for Second Four Week Cycle for the Mapping Group and the Definition/Sentence Group*

Mapping Group					Definition/Sentence Group				
Student #	Pre-test	Post-test	Difference	% gain	Student #	Pre-test	Post-test	Difference	% gain
1	12	22	10	33.3	11	21	19	(2)	-6.7
2	11	31	20	66.7	12	14	16	2	6.7
3	11	25	14	46.7	13	18	28	10	33.3
4	12	20	8	26.7	14	16	26	10	33.3
5	11	26	15	50	15	14	26	12	40
6	17	30	13	43.3	16	12	16	4	13.3
7	10	30	20	66.7	17	14	19	5	16.7
8	13	28	15	50	18	13	22	9	30
9	12	30	18	60	19	13	13	0	0
10	21	35	14	46.7	20	11	14	3	10
Average	13.0	27.7	14.7	49.01	Average	14.6	19.9	5.3	17.66

Note. The percentage gain was figured on the posttest score as compared to the 30 which is the highest possible gain. The lowest possible score was 10 and the highest was 40.

Table 3. *Multiple Choice Test Data for First Four Week Cycle for the Mapping Group and the Definition/Sentence Group*

Mapping Group		Definition/Sentence Group	
Student #	Difference	Student #	Difference
1	2	11	1
2	4	12	2
3	2	13	4
4	1	14	1
5	3	15	2
6	3	16	3
7	4	17	3
8	5	18	3
9	1	19	3
10	3	20	0
Mean	2.8	Mean	2.2

Table 4. *Multiple Choice Test Data for Second Four Week Cycle for the Mapping Group and the Definition/Sentence Group*

Mapping Group		Definition/Sentence	
Student #	Difference	Student #	Difference
1	2	11	2
2	4	12	4
3	7	13	2
4	0	14	2
5	3	15	3
6	7	16	1
7	3	17	2
8	6	18	4
9	8	19	3
10	4	20	2
Mean	4.4	Mean	2.5

.

Table 5. *Comparison of Mapping and Definition/Sentence Group Data for Two Cycles*

	Knowledge Rating Scale				Multiple Choice Test			
	Mapping Group		Definition/sentence Group		Mapping Group		Definition/sentence Group	
Cycle	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM
1st	39.01%	6.087	21.00%	4.499	2.8	0.42	2.2	0.39
2nd	49.01%	4.132	17.66%	4.994	4.4	0.81	2.5	0.31
Calculated Together	44.00%	4.945	19.33%	4.297	7.20	0.94	4.70	0.52

REFERENCES

Beck, I. L., McKeown, M. G. & Kucan, L. (2002). *Bringing Words to Life Robust Vocabulary Instruction.* NY, NY:Guilford Press.

Brown, J. S., Collins, A., & Dubid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, 18(1), 32-43.

Brown, A. L. & Palinscar, A. S. (1984). Reciprocal teaching of comprehension-fostering and comprehension-monitoring activities. *Cognition and Instruction*, 1(2) 117-175.

Carey, S. (1978). Child as word learner. In M. Halle, J. Bresnan, & G. Miller (Eds.). *Linguistic theory and psychological reality* (pp. 264-293). Cambridge, MA: MIT Press.

Cole, M., John-Steiner, V., Scribner, S, & Souberman, E. (1978). *Mind in Society The Development of Higher Psychological Processes*. Cambridge, MA: Harvard University Press.

CCSS. (2010). *Common Core State Standards*. Retrieved January 27, 2013, from http://www.corestandards.org/the-standards

D'Anna, C. A., Zechmeister, E. B., & Hall, J. W. (1991). Toward a meaningful definition of vocabulary size. *Journal of Literacy Research*, 23(109), 109-122.

Hagenmans, M. G., van der Meij, H., & de Jong, T. (2013). The effects of a concept map-based support tool on simulation-based inquire learning. *Journal of Educational Psychology*. 105(1), 1-24.

Hyerle, D. (1996). *Visual tools for constructing knowledge*. Virginia: ASCD.

Marzano, R. J. (2004). *Building background knowledge for academic achievement: Research on what works in schools*. Alexandria, VA: ASCD.

Miller, G. A., & Gildea, P. M. (1987). How children learn words. *Scientific American*, 257(3), 94-99.

Powell, G. (1980). *A meta-analysis of the effects of "imposed" and "induced" imagery upon word recall.* Paper presented at the annual meeting of the National Reading Conference, San Diego, CA. (ERIC Document Reproduction Service No. ED 199644)

Scott, J. A., & Nagy, W. E. (1991). Understanding definitions. *Center for the Study of Reading*. (Technical Report No. 528). Champaign, IL: University of Illinois.

Shepard, L. (April, 1989). Why we need better assessments. *Educational Leadership* 46, 7:4-9.

Stahl, S. A. & Fairbanks, M. M. (1986). The effects of vocabulary instruction: A model-based meta-analysis. *Review of Educational Research*, 56(1), 72-110.

Yeager, C. (2012) Thinking maps align with Common Core State Standards: Patterns for limitless learning. *Thinking Maps, Inc*. Retrieved January 26, 2013, from http://thinkingmaps.com/thinking_maps_common_core.php

APPENDICES

Appendix A

Knowledge Rating Scale

Word	No clue	Have seen or heard it	Know it well	Means
approach				
scatter				
theory				
absorb				
advantage				
pastime				
gradual				
ambition				
privilege				
average				

Appendix B

Rubric for Knowledge Rating Scale

1pt. No Clue	2 pts. Seen or Heard Before	3 pts. Know it well	4 pts. Means…
• Completely new • No exposure	• Awareness of word/ without meaning • "Don't Know" • "Forgot" • Incorrect definition	• Strong recognition • Knows but can't state meaning • Definition or example is a technically correct by not generally used that way • Uses word in a sentence without hinting at the meaning	• Gives an example or illustration • Uses the word in a sentence that demonstrates some understanding • Uses an analogy "like…