Preparation for the GRE

Corina Groeger

Western Michigan University

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PREPARATION FOR THE GRE

by

Corina Groeger

A Dissertation
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Doctor of Philosophy
Department of Psychology

Western Michigan University
Kalamazoo, Michigan
June 1998

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The present research consisted of two empirical studies and a literature review. The first study was a systematic replication of the studies by Miller, Goodyear-Orwart, and Malott (1996) and Vunovich and Malott (1997). Fourteen undergraduate students and one graduate student participated in four intensive, extensive, structured Graduate Record Examination (GRE) preparation courses that met for seven weeks and lasted between 99 and 140 hours. The courses offered a monetary reward for students who met a minimum of 92% for attendance and participation during the course. The results of this study showed statistically significant mean improvements of 145 points for the combined verbal and quantitative scores from pretest to posttest, and of 129 points from pretest to actual GRE test. These results combined with those of Miller et al. (1996) and Vunovich and Malott (1997) show that intensive, extensive, structured training for the verbal and quantitative portions of the GRE produces statistically and practically significant improvements.

A review of the literature on morphological analysis was performed. The focus was on the evaluation of the teaching of morphological-analysis skills as a strategy to build vocabulary and to facilitate the use of novel words. This review
evaluated the training strategies for morphological analysis, including the teaching of prefixes and offered recommendations for future research in morphological analysis.

Based on this literature review, the second study evaluated the effectiveness of training with 15 prefixes on responses to novel words containing those prefixes and on time to learn novel prefixed words. Training with only prefixes was compared to training with prefixed words and to no training (control) with eighty-eight undergraduate students. Training with prefixes transferred to the use of novel words containing those prefixes, but showed no benefits over the time to learn novel prefixed words. Training with prefixed words showed no transfer to the use of novel words containing those prefixes. The present research suggests that prefix training can be a valuable component of vocabulary training.
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Corina Groeger
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CHAPTER I

INTRODUCTION

The present research consists of two empirical studies and a literature review. The first study was the third in a series of studies begun by Miller, Goodyear-Orwart, and Malott (1996) and Vunovich and Malott (1997); it was a systematic replication of those two previous studies. The second study evaluated the effectiveness of training with 15 prefixes on responses to novel words containing those prefixes and on time to learn novel prefixed words. Both studies had as a goal the evaluation of training strategies to improve student performance on the verbal and quantitative portions of the GRE.

The review includes literature on morphological analysis with a focus on the evaluation of the teaching of morphological-analysis skills as a strategy to build vocabulary and to facilitate the use of novel words. This review evaluates the training strategies for morphological analysis, including the teaching of prefixes. It also offers recommendations for future research in morphological analysis.
CHAPTER II

STUDY 1: INTENSIVE, STRUCTURED STUDY FOR THE GRE

Introduction

Admission to graduate programs and, therefore, good performance on the Graduate Record Examination (GRE) is very important to today’s students. The level of obtained academic degree is significantly and positively correlated with three important measures of success: percentage of graduates employed full-time, percentage employed in their professional field of training, and income. See Figures 1 and 2 concerning employment (from Donny, 1977).

With respect to income, the highest earned academic degree has a significant correlation with income (p < .001) (Smart, 1988). Master’s degree graduates earn about 8 percent more than bachelor’s degree graduates from the same cohort who did not get advanced degrees. The data comparing the master’s and doctorate professionals are less striking. Starting salaries seem to be about the same for both, with differences favoring the Ph.D. holders as time passes (National Science Foundation, 1980).

There also seems to be an increase in the number of undergraduate students wanting to obtain a graduate degree. This is suggested by the increase in the number of students taking the GRE between 1981 and 1992. Over those 11 years, the number
of females taking the GRE increased by 112% and the number of males by 77% (Grandy, 1994).

![Bar chart](image)

**Figure 1.** Percentage of Professionals Employed Full-Time, Part-Time and Unemployed as a Function of Academic Degree.

**Source:** Data from “Postgraduation activities: All degree levels in Pennsylvania” by W. F. Donny, 1977, Harrisburg, Pennsylvania: Pennsylvania State Department of Education.

Furthermore, informal observation suggests that a considerable portion of graduating BA students do not apply to or are denied admission to the graduate school of their choice because of poor performance on the GRE, even for undergraduates with high grade-point averages (GPAs). This is especially important because the GRE is required or recommended for admission in 64% of all graduate
programs in the United States. Approximately 57% of over 7,000 masters programs and 75% of about 5,500 doctoral programs require the GRE (Clark, 1986). Thus, performance on the GRE, though not the only requirement for admission to graduate school, may determine students' academic as well as professional future.

![Bar chart showing the percentage of professionals employed in their field of preparation as a function of academic degree.]

Figure 2. Percentage of Professionals Employed in Their Field of Preparation, as a Function of Academic Degree.

Source: Data from "Postgraduation activities: All degree levels in Pennsylvania" by W. F. Donny, 1977, Harrisburg, Pennsylvania: Pennsylvania State Department of Education.

Despite the fact that often the GRE is one of the adopted criteria for admission to graduate school, evidence to support the predictive validity of this test is
contradictory. Three studies have reported significant validity. Huitema and Stein (1993) calculated validity coefficients on a sample of psychology students for the GRE-Total (GRE-T) scores (a combination of the verbal and the quantitative GRE scores), with four measures of academic performance: points earned on examinations from three graduate courses, and an evaluation score calculated by a faculty committee. The validity coefficients were significant and unusually high, ranging from .55 to .77 (p < .0002).

Thomell and McCoy (1985) found significant validity coefficients for the GRE-T and the graduate grade-point average (GGPA) that ranged from .48 to .36 (p < .05). The validity coefficients for the GRE-Verbal (GRE-V) ranged from .42 to .49 (p < .05), and for the GRE-Quantitative (GRE-Q) from .22 (p > .05) to .37 (p < .05).

Monahan (1991) evaluated the predictive validity of the GPA and the GRE over first year success (GGPA) in graduate school. The GPA, the GRE-Q and the GRE-T had statistically significant but weak relationships with the GGPA (.142; p < .05; .184; p < .01; and .154; p < .05).

However, a number of studies have failed to demonstrate predictive validity for the GRE. Goldberg & Alliger (1992) reported that, for psychology students, validity coefficients indicated that less than 9% of the GGPA was accounted for by the GRE, not an adequate predictive validity. House and Johnson (1993) evaluated the validity of GRE scores to predict the length of time from the beginning to end of an MA program for psychology masters students. Again, no significant relationship was observed. Morrison & Morrison (1995) on a meta-analytic review of 22 studies
found correlation coefficients of .22 between the GRE-Q and GGPA, and .28 between the GRE-V and GGPA, indicating little predictive validity for the GRE; however, the level of significance was not reported. Onasch (1994) reported that for the Master of Science degree the GPA was negatively correlated with the number of years to graduation (-.21, p < .05), indicating that the higher the GPA the fewer years the student took for graduating; however, the GRE-T was positively correlated (.22; p < .05), indicating that the higher the GRE score the longer it took for graduation.

Aside from predictive validity, the social validity (perceived value) of the GRE for students has also been questioned. A survey of a sample of 4,248 first-year graduate students showed that 96% of the black applicants indicated that these tests are oriented toward the white middle-class culture. Other aspects criticized by the students were the tests’ content, their validity, and the skills they cover (Baird, 1977). Although it was not indicated in the Baird study, evaluation of these tests to be white, middle-class oriented might well be related to the assumption that effective training for those tests is inaccessible to those who can not afford the price (Johnson & Wallace, 1989; Smyth, 1989).

Regardless of the predictive and social validity of the GRE, effective and accessible training to help students improve their scores on the GRE seems important in increasing acceptance into graduate schools of choice. However, to date most research reports small or no effect from training oriented to improve student performance on the verbal and quantitative portions of the GRE.
For example, a study by Powers and Swinton (1984) evaluated the effects of self-instruction on student performance on the GRE. Students were divided into two groups, one that received a set of instructional materials with encouragement to use them, and a control group that reviewed the same materials but with no encouragement to use them. The authors reported a significant difference (p < .05) in the amount of study time between the encouraged and the non-encouraged students for the analytical part of the GRE (3.37 and 2.80 respectively), and a significant effect (p < .01) on the analytical scores (531.8 and 509.7). No significant effects were observed for the amount of time or the scores on the verbal and quantitative portions of the GRE.

In another study, Powers (1985) evaluated the effects of coaching on GRE performance. The amount of time spent in coaching programs differed among the students, ranging from 1 to 45 hours. The mean time for the verbal portion was 8.0 hours, for the quantitative 9.4, and for the analytical 8.0. The amount of coaching students received was significantly related (p < .01) to the analytical scores but not significantly related to the verbal and quantitative scores on the GRE.

Swinton and Powers (1983) evaluated the effects of test-familiarization and testing-strategies on the analytical portion of the GRE. Students received a total of 7 hours of training. The authors found significant differences (p < .05) in the analytical performance of the students who received training and those who did not (means were 591.8 and 530.7 respectively). The verbal and quantitative portions of the test did not show significant differences.
In another study, Swinton and Powers (1985) evaluated the effects of self-test-familiarization for the verbal, quantitative and analytical portions of the GRE. Randomly selected test takers received a newly expanded “GRE Information Bulletin” and copies of disclosed forms of the GRE General Test. They were encouraged to study for all the sections of the test. Again, the performance of encouraged students was compared with that of the non-encouraged ones. Compared to the students who were not encouraged, the encouraged students spent significantly more time preparing for the verbal (p < .01) and quantitative (p < .01) portions of the GRE, but not for the analytical portion. And no significant relation was found between the amount of time spent using self-familiarization materials and the analytical scores, as well as the verbal and quantitative scores.

The training in these studies was of short duration, and in some instances there was no proof that students actually used the materials provided for the training (Powers & Swinton, 1984; Swinton & Powers, 1985). There were no significant improvements for the verbal or the quantitative portions of the GRE, and the improvements for the analytical portion were small (Powers & Swinton, 1984; Swinton & Powers, 1983).

Two recent studies reported practically and statistically significant results for training for the verbal and quantitative sections of the GRE (Miller, Goodyear-Orwat, & Malott, 1996; Vunovich & Malott, 1997). Both studies differed from the previous ones in that the training was long lasting 5.5 to 7.5 weeks, with 66 to 140 hours of self-paced study, giving the students more of an opportunity to acquire verbal and
quantitative skills necessary for an improved performance on the GRE. These studies used commercially available preparation materials and offered incentives to the participants to maintain 92% attendance and participation in the course. The combined, verbal and quantitative scores improved significantly from pretest to posttest and from pretest to actual GRE, for both studies. This showed the effectiveness of structured and intensive training for improving student performance on the verbal and quantitative portions of the GRE. The study by Vunovich and Malott (1997) included fluency training with accuracy and speed criteria for the quantitative section of the GRE, in addition to the components of the course by Miller et al. (1996). There were no significant differences between the two studies, suggesting that this form of fluency training for the quantitative section of the GRE might not add value to training. (The improvements reported for both studies can be found in Table 2, in the results section.)

The present study was the third in the series of studies begun by Miller et al. (1996) and Vunovich and Malott (1997); it was a systematic replication of those two studies, and had two major goals. The first was to determine if statistically significant results as large as the ones obtained by Miller et al. (1996) and by Vunovich and Malott (1997) could be replicated. This is important because there are no reports in the literature of improvements as large as those reported in these studies. The second goal was to determine if small changes in the course materials could affect GRE scores. These changes were made in an attempt to refine and improve the course. The fluency component used by Vunovich and Malott (1997) was not included because of
the effort of implementation and the lack of significant impact on the GRE quantitative scores.

Method

Subjects and Setting

This study included four systematic replications of an intensive, extensive, structured GRE preparation course taught during spring, summer and fall of 1996 and during spring of 1997. The Psychology department and the Office of Professional Programs at Western Michigan University sponsored the courses.

Subjects were 14 undergraduate students from advanced psychology courses at Western Michigan University and one graduate student. The undergraduate students were recruited through short presentations given in advanced psychology courses. These presentations included a description of the format and content of the GRE course and the distribution of a flyer. The flyer included information about the GRE course with respect to its content, goals, schedule and registration. It also included a graph with data from previous GRE courses (see Appendix A). The graduate student was recruited through advertisements with information about the course that were posted at different locations at the University.

A total of 22 students registered and 15 completed the courses. For 1996, 4 out of 6 students completed the spring course; all 5 completed the summer course; and 2 out of 5 completed the fall course. For spring of 1997, 4 out of 6 completed the course.
Materials

Several sets of materials were used for training on the verbal portion of the GRE. The book *Barron's How to Prepare for the GRE* (Brownstein, Weiner, Green, & Hilbert, 1994) contains a list with the 3,500 most frequent words in GRE tests. It also contains the 300 most frequent words extracted from the original 3,500 words list, and test-taking tactics for the verbal portion of the GRE. The computerized "flashcard" program *Think Fast* (Parsons, 1995 and 1996) was used to present a set of mathematical terms and formulas, prefixes and suffixes, and the 300 most frequent GRE words; for example, each term could be presented followed by its definition. Also, the computerized program *Your Personal Trainer for the GRE Test* (Computer software, 1995) provided a printout of 600 flashcards with the most frequent words in the GRE. The flashcards included the word on one side of the card and the definition of that word on the other side. Students were given the option of studying the words from any of these sources. About 80% of the students used only the flashcards from *Your Personal Trainer for the GRE Test*, 10% used only the *Think Fast* program, and 10% used both programs and the *Barron's How to Prepare for the GRE*.

Also, several materials were used for training on the quantitative portion of the GRE. The test-taking tactics for the quantitative portion of the GRE described in the *Barron's How to Prepare for the GRE* (Brownstein et al., 1994). The book *GRE-GMAT Math Review* (Frieder, 1992) includes 27 chapters with a review of mathematics skills that are evaluated in the GRE. The book begins with basic concepts and mathematical operations and ends with geometry. For each chapter, the
book presents a step-by-step explanation of each skill and provides practice exercises. These exercises are also thoroughly explained at the end of the book. Drills generated by *Exam-in-a Can* (International Publishing Services, 1995) were used to provide extra practice in each of the skills. The drills were based on material from the *GRE-GMAT Math Review* (Frieder, 1992) and covered basic math, fractions, percentages, decimals, algebra, and geometry. Each drill included 20 exercises on a particular skill; there were several drills for each skill. The answers to the exercises for each drill were available to the students. For the preparation on the quantitative portion of the GRE, approximately 70% of the students used only the *GRE-GMAT Math Review* book (Frieder, 1992). The remaining 30% of the students used this book and the drills generated by *Exam-in-a Can* (International Publishing Services, 1995).

Official disclosed versions of the GRE (Educational Testing Service, 1992) were used as pretest and posttest. The versions used were 92-1 and 92-2. The students were evaluated using only the verbal and quantitative portions of these tests. Each test consisted of four 30-minutes sections, two sections for the verbal and two for the quantitative portion of the GRE. The sections were alternated.

**Procedure**

The 1996 spring and summer courses and the 1997 spring course met Monday through Friday from 8:00 a.m. to 12:00 p.m., for seven weeks, a total of 140 hours. The 1996 fall course met Monday through Thursday from 6:00 to 9:00 p.m. and Saturday from 8:00 a.m. to 12:00 p.m., for seven weeks, a total of 99 hours. The fee
for the spring and summer courses was $400, and for the fall course was $350. This fee included all the materials students used during the course.

The procedure was the same for all the courses. On the first day of class, the students received the syllabus which included a description of the class structure and policy (see Appendix B). To encourage participation students were told that a $75 rebate would be given to those who completed the course with at least 92% of participation. Students were also offered the opportunity to make up outside of class the missed in-class hours. For this opportunity, students had to inform the instructor in advance and fill out a performance contract. Students were also allowed to miss a maximum of three unmade-up classes and still be eligible for the $75 rebate. After reading and discussing the syllabus, students were given a consent form and asked to read it along with the experimenter, to request explanations if needed, and to sign the form if they agreed with what was stated in it and wanted to allow their data to be included in the study (see Appendix C). All students agreed.

Also on the first day of class, students took an official disclosed 1992 version of the GRE (1992-1 or 1992-2) (Educational Testing Service, 1992). For this, students were randomly assigned to one of the two forms of the examination. When completed, the experimenter evaluated the tests and gave each student his or her scores for each of the sections. The scores were used as a pretest. Following the test, students were given the course materials and a schedule of goals for the class was discussed.
Training started on the second day of class. The first half of the course was dedicated to training on the quantitative section, and the second half to training on the verbal section of the GRE. Students worked at their own pace with the materials provided for both areas. For the quantitative training, students were first asked to read the test-taking tactics and then to start working with the math book and drills. They were asked to do all the exercises within every unit with 100% accuracy, before going on to the following unit, and to do so until they covered all the 27 units. Thus the training was self-paced. When the quantitative training was over, students were evaluated using only the quantitative sections of the official 1992 GRE versions. Students took the version they had not been given on the first day of class. After this, the experimenter graded the tests and gave the scores to the students. Students also received their test back and a copy of the answer key, and were encouraged to work on the questions not answered correctly. The scores on these sections were used as the posttest score for the quantitative portion of the test. In the following class, the training in the verbal portion began; and students were asked to read the verbal test-taking tactics. After this, they started to learn a list of words using the aforementioned sources. Students also took practice tests from the Barron's How to Prepare for the GRE (Brownstein et al., 1994) and the Official versions of the GRE (Educational Testing Service, 1992). On the last day of class students were evaluated using the verbal section of the official disclosed 1992 GRE that they did not take on the first day of class. The scores on these sections were used as a posttest for the verbal
portion of the test. Following this, students completed a course evaluation over course format, materials, and benefits (see Appendix D).

Results

The pooled results of the four GRE preparation courses showed a statistically and practically significant mean improvement of 145 points for the combined verbal and quantitative scores, from a pretest mean of 876 to a posttest mean of 1021, \( t (15) = 5.92, \ p < .01 \). There was also a significant mean improvement for the verbal scores and for the quantitative scores considered separately: 56 points for the verbal scores from a pretest mean of 419 to a posttest mean of 475, \( t (15) = 2.3, \ p < .05 \), and 89 points for the quantitative scores from 457 to 546, \( t (15) = 4.67, \ p < .01 \) (see Table 1).

The actual GRE scores for eight of the fifteen students were available for this analysis. The pooled results also showed a statistically and practically significant improvement of 129 points for the combined verbal and quantitative scores, from a pretest mean of 916 to an actual GRE mean of 1045, \( t (8) = 5.23, \ p = < .01 \). The quantitative scores improved significantly, a mean improvement of 96 points, from a pretest mean of 463 to an actual GRE mean of 559, \( t (8) = 3.92, \ p < .01 \). The verbal scores did not improve significantly. The results for the four courses had been pooled because there were no reliable differences between them and because the number of students completing each course was small. Of the 15 out of 22 students who completed the courses, 12 received the $75 rebate for meeting the 92% participation criterion.
Table 1

Summary of Correlated t-Test Analysis of Scores for the 1996-97 Courses

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<th>MIN</th>
<th>MAX</th>
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<td>Difference</td>
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<td></td>
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<tr>
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<td></td>
<td>8</td>
</tr>
</tbody>
</table>

Note. Difference indicates the change between the two preceding measures, for example, the difference between pretest-total and posttest total. MIN and MAX indicate the range of scores for each of the evaluations. For the difference, MIN and MAX indicate the range of improvements (or decrements) between evaluations.

* Significant at the .01 level.

** Significant at the .05 level.

*** Not significant.

There were no significant differences between the results of this study and the results presented for similar GRE preparation courses described by Miller et al. (1996) and by Vunovich and Malott (1997) (see Table 2).

Discussion

The study by Miller et al. (1996) offered students in the 1994 courses a monetary reward for meeting the 92% attendance and participation criteria. The monetary reward for students who met the 92% criteria was initially $25, and
Table 2

Mean Improvements From Pretest to Posttest, Pretest to Actual, and Posttest to Actual GRE Scores for the 1993, 1994 and 1996-97 Series of Courses

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Pretest to Posttest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>145*</td>
<td>116**</td>
<td>96**</td>
<td>186*</td>
<td>16</td>
<td>49</td>
<td>-41</td>
</tr>
<tr>
<td>Pretest to Posttest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verbal</td>
<td>56**</td>
<td>39**</td>
<td>39.5**</td>
<td>94*</td>
<td>17</td>
<td>16.5</td>
<td>-38</td>
</tr>
<tr>
<td>Pretest to Posttest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantitative</td>
<td>89*</td>
<td>76**</td>
<td>56.5**</td>
<td>92*</td>
<td>15</td>
<td>32.5</td>
<td>-3</td>
</tr>
<tr>
<td>Pretest to Actual</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRE Total</td>
<td>129*</td>
<td>103*</td>
<td>56**</td>
<td>112*</td>
<td>26</td>
<td>73</td>
<td>17</td>
</tr>
<tr>
<td>Posttest to Actual</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRE Total</td>
<td>20</td>
<td>-10</td>
<td>-43</td>
<td>-64</td>
<td>30</td>
<td>63</td>
<td>84</td>
</tr>
</tbody>
</table>


* Significant at the .01 level.

** Significant at the .05 level.

it was increased to $50. The study by Vunovich and Malott (1997), and the present study offered students a monetary reward of $75 for meeting that criteria. A larger percentage of the students that finished the GRE courses met the 92% attendance and participation criteria when the reward was $75. This may indicate that a larger
monetary incentive increases the attendance and participation of students (see Figure 3).

![Figure 3](image_url)

**Figure 3.** Percentage of GRE Students Who Received the $25, $50 and $75 Reward for Meeting the 92% Attendance and Participation Criteria.

**Note.** Data for the $25 and $50 reward are from "The effects of intensive, extensive, structured study on GRE scores," by J. M. Miller et al., 1996. *Journal of Behavioral Education, 6*, 377. Data for the $75 reward are from "The effects of intensive, extensive, structured study on GRE scores, continued," by P. L. Vunovich and R. W. Malott, 1997, manuscript in preparation, and from the present study.

Of the 22 students registered for the GRE courses in the present study, 10 did not get the rebate; and of those 10, 7 did not finish the course. It could be argued that for those 7 students who failed to complete the course, the reward was not large enough to maintain attendance. Furthermore, 60% of the students failed to complete
the fall course, while only 33.3% failed to complete the spring 1996 and 1997
courses, and all the students finished the summer course. Our informal observation
suggests that this high incidence of fall attrition may be due to students having a
heavier academic load during that semester.

The 1993 courses (Miller et al., 1996) used as pretests and posttests the
practice tests from the Barron's book, the same book used for training, while the other
courses used two official disclosed versions of the GRE. The Barron's tests could
have been more sensitive to the training effects, and this could explain the larger
improvements initially observed for the students that year. However, the differences
between pretest and posttest, pretest and actual and posttest and actual GRE scores
have been positively increasing from the 1994 to the 1996-97 series of courses, which
may indicate that the changes in course materials have had a positive impact in
students performance on the GRE.

Although the combined improvements from pretest to posttest and from
pretest to actual GRE have been statistically significant on all three studies, larger
improvements have been consistently obtained on the quantitative scores than on the
verbal scores. Future students might benefit from the inclusion of improved verbal-
training strategies. A possible strategy is teaching morphological analysis to aid
students in learning the large number of words that should be mastered in order to
improve the verbal scores on the GRE.

It is unlikely that improvements in student scores observed in this study
resulted from taking the disclosed versions of the GRE twice. Studies evaluating the
effects of GRE test-retest have reported small mean improvements of only 21 to 27 points on the GRE-V and between 23 to 30 points on the GRE-Q, for students taking the test twice (Kingston & Turner, 1984; Rock & Werts, 1980; Wilson, 1988; Yuker, 1968), and improvements of less than 20 points for students taking the test more than two times (Rock & Werts, 1980). Furthermore, those students probably studied for the GRE between the two tests. Also, studies evaluating the effects of short training reported no significant improvements on the GRE-V or the GRE-Q (Powers, 1985; Powers & Swinton, 1984; Swinton & Powers, 1983; Swinton & Powers, 1985). Thus, the significantly large improvements observed in this study and in the studies by Miller et al. (1996) and Vunovich and Malott (1997), are likely the result of training provided between test administrations rather than the result of repeatedly taking the test.

Students who participated in the present study evaluated the course materials on a 1-to-5 scale, with 5 being very useful. The materials that were evaluated as useful or very useful were the GRE GMAT Math Review book (M = 4.6), the practice GRE tests (M = 4.6), the Barron's book (M = 4.1), the flashcards from Your Personal Trainer for the GRE Test (M = 4) and the math drills (M = 3.2). The Think Fast computerized program was evaluated as less useful (M = 2.6). Overall, the students evaluated the course as helpful (M = 4.2).

In conclusion, the results of this study, combined with those of the Miller et al. (1996) and Vunovich and Malott (1997) studies, show that intensive, extensive, structured training on the verbal and quantitative portions of the GRE produces
statistically significant improvements (see Table 2). Furthermore the improvements resulting from this type of training are much greater than any other published method of preparation. In addition, these improvements are large enough that they should have practical significance and increased frequency of acceptance into graduate schools of choice.
CHAPTER III

REVIEW OF STUDIES ON MORPHOLOGICAL ANALYSIS TRAINING

Introduction

Vocabulary size is important for several interacting reasons: (a) vocabulary size is assumed to be a good predictor of academic success (Browne, 1991; Freyd & Baron, 1982); (b) vocabulary affects concept development and has a strong relationship to reading comprehension (Breen, 1960; Milligan & Ruff, 1990; Stahl & Fairbanks, 1986); (c) instructing learning-disabled junior-high school students in vocabulary knowledge led to superior reading comprehension (Snider, 1989); (d) in turn, reading skills are important: children with reading difficulties in primary school had reading difficulties throughout their educational career, and these children also had low academic performance (Boland, 1993); (e) in addition, vocabulary measures were correlated with content-based measures (Espin & Foegen, 1996); (f) vocabulary size is also associated with effective communication and common knowledge, which are necessary, but not sufficient for success at different academic levels (Hart & Risley, 1995).

From elementary school through college, students frequently encounter novel words to which they must respond. To be able to appropriately use novel words can be the difference between successful and unsuccessful performance in tests such as
the SAT, GRE and GMAT, and the scores in these tests can determine to certain extent the academic future of the student.

During grades 3 through 12, reading vocabulary grows at a rate of about 3,000 words per year (White, Power, & White, 1989). Morphological analysis (MA) taught in school is assumed to account for approximately 2,000 of those annual learned words. Two other strategies, direct instruction of responses to a word, and learning to respond through oral and written context are assumed to account for the other 1,000 learned words (Jenkins & Dixon, 1983; White, Power, & White, 1989; White, Sowell, & Yanagihara, 1989; Wysocki & Jenkins, 1987).

**Morphological Analysis**

MA involves separating a word into its parts (e.g., prefix, stem, suffix), responding to the individual parts, and then attempting to respond to the word in terms of the individual parts or morphemes. The morpheme is considered the smallest unit of grammatical analysis (Rubin & Becker, 1979). In English, there are three types of morphemes: prefixes, roots and suffixes.

According to Wysocki and Jenkins (1987) there are two main branches of morphology: inflectional and derivational. Inflectional morphology involves changes in a root word that do not affect the word's syntactic category (the function and uses of the word). For example changes that indicate case, number, gender, person or tense, such as *cat/cats, walk/walked*. Derivational morphology refers to the formation of novel words by adding affixes to base words or roots (e.g., *teach/teacher*.
ruful/unrulful). In derivational morphology the novel word is semantically related to the root, but it is a different word. The studies on MA have been mainly interested in the latter.

MA is considered a strategy to help students respond to novel configurations of previously learned morphemes, that is the recognition of novel words (Breen, 1960; Browne, 1991; Graves & Hammond, 1979; Levin, Carney, & Pressley, 1988; Milligan & Ruff, 1990; Otterman, 1955; White, Sowell, & Yanagihara, 1989). Although direct instruction and learning through oral and written context are important strategies for teaching vocabulary, several advantages of MA are mentioned in the literature, among these are the relatively small number of prefixes, suffixes and roots; the relatively few different uses, relatively constant uses, and for some morphemes, consistent spelling. Also, prefixes, suffixes and roots can be combined and re-combined to form novel words and can facilitate the learning of large number of words (Graves & Hammond, 1979; Milligan & Ruff, 1990).

This review summarizes and evaluates the research on the effectiveness of MA training, considers methodological issues and limitations, and provides suggestions for future research on MA.

Review and Evaluation

Table 3 contains an overview of aspects related to the studies on MA training reviewed in this paper, such as dependent variables, training, experimental designs and effects of training. Table 4 contains a more detailed description of the subject
<table>
<thead>
<tr>
<th>Study</th>
<th>Training</th>
<th>Dependent Variable</th>
<th>Experimental Design</th>
<th>Effects of Training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Browne, 1991</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Freyd and Baron, 1982</td>
<td>NA</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Graves and Hammond, 1979</td>
<td>NA</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Groeger and Malott, 1997</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Hoisington, 1968</td>
<td>NA</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Levin, Carney, and Pressley, 1988</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Lindquist, 1969</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Otterman, 1955</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Wysocki and Jenkins, 1987</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Note. 1 = Training related to population needs; 2 = training included exceptions; 3 = evaluated morphemes and rules; 4 = evaluated transfer of training; 5 = evaluated learning time; 6 = evaluation instruments sensitive to training; 7 = included pretest measures; 8 = participants matched and randomly assigned; 9 = independent training of components; 10 = transferred to novel words; NA = not enough information given in the study.
### Table 4

**Summary of MA Training Studies**

<table>
<thead>
<tr>
<th>Authors</th>
<th>Subjects</th>
<th>Training</th>
<th>Dependent Variables</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Browne, 1991</td>
<td>N = not reported, minority college students</td>
<td>Systematic study of prefixes, suffixes and word roots, plus study of self-generated vocabulary lists</td>
<td>Knowledge of novel words containing the morphemes taught</td>
<td>No data presented. Reported as a useful strategy to improve vocabulary</td>
</tr>
<tr>
<td>Freyd and Baron, 1982</td>
<td>N = 80, 48 eight graders and 32 fifth graders</td>
<td>Groups: (1) 10 suffixes using words as examples, (2) learning vocabulary through reading context, (3) learning vocabulary through the use of spelling regularities</td>
<td>Performance on a test containing half of simple words and half of derived words</td>
<td>Statistically significant improvement between pretest and posttest in the derived words for the trained group. No difference on posttest between simple and derived words.</td>
</tr>
<tr>
<td>Graves and Hammond, 1979</td>
<td>N = 180, seventh grade students, middle to upper middle class</td>
<td>Groups: (1) nine prefixes plus words, (2) words plus sentences, (3) no vocabulary instruction</td>
<td>Performance on pretest, posttest, and delayed posttest, including the prefixes and words taught and novel words. Time for memorization of words</td>
<td>Students in the prefixes group were able to transfer to novel words. Statistically significant differences between groups. No differences in time</td>
</tr>
<tr>
<td>Authors</td>
<td>Subjects</td>
<td>Training</td>
<td>Dependent Variables</td>
<td>Results</td>
</tr>
<tr>
<td>-------------------------</td>
<td>---------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Groeger and Malott, 1997</td>
<td>N= 88, college students</td>
<td>Groups: (1) 15 prefixes and 15 prefixed-words, (2) two sets of 15 prefixed-words each, (3) irrelevant readings and 15 prefixes</td>
<td>Performance on pretest and posttest. Posttests included the words taught and untrained words with the trained prefixes. Time for memorization of words</td>
<td>Statistically significant differences between conditions and between groups. Training with 15 prefixes transferred to novel words. No benefits for prefix training on learning time</td>
</tr>
<tr>
<td>Hoisington, 1968</td>
<td>N = 100 students, four sixth grade classes, public schools</td>
<td>Groups: (1) Vocabulary instruction with prefixes, suffixes, and root words. Some elements of sentence structure also used, (2) No vocabulary instruction</td>
<td>Performance on subtests of the Metropolitan Achievement tests: Advance Battery, to measure reading comprehension, and spelling</td>
<td>Group exposed to experimental training obtained significantly higher mean scores in reading comprehension. No significant differences in vocabulary and spelling</td>
</tr>
<tr>
<td>Levin, Carney, and Pressley, 1988</td>
<td>N = 82, college students</td>
<td>Groups: (1) free study of 10 prefixes, and 10 stems, (2) contextual examples with familiar words containing the prefixes or stems, (3) contextual examples plus keywords for learning the stems, and (4) no training</td>
<td>Performance on a post-training multiple-choice test that evaluated direct inference (items defined directly in terms of two previously learned components), and indirect-inference (items not-so-directly defined)</td>
<td>All three instructional conditions were significantly superior to control subjects on direct-inference vocabulary items - transfer to novel words containing the taught roots with the same use, but not on indirect inference items</td>
</tr>
</tbody>
</table>
Table 4 –Continued

<table>
<thead>
<tr>
<th>Authors</th>
<th>Subjects</th>
<th>Training</th>
<th>Dependent Variables</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lindquist, 1969</td>
<td>N = 23, age = 4 and 5 years</td>
<td>Groups: (1) morphology and part-whole relationships, (2) syntax and classification, (3) traditional</td>
<td>Pre- and post-training measures on nine dependent variables (not available)</td>
<td>Students were able to transfer their training to novel words</td>
</tr>
<tr>
<td>Otterman, 1955</td>
<td>N = 440, 20 seventh grade classes</td>
<td>Groups: (1) 15 prefixes and 11 word-roots exemplified in 250 words, (2) traditional</td>
<td>Pre- and post-training tests with novel words containing the morphemes taught, also spelling, and speed of visual and auditory perception</td>
<td>Significant transfer of training to novel words only for the initially high performers. Statistically significant improvements in spelling and delayed recall of prefix and word-root uses</td>
</tr>
<tr>
<td>Wysocki and Jenkins, 1987</td>
<td>N = 131, 45 fourth grade, 45 sixth grade, and 41 eight grade students</td>
<td>Vocabulary instruction with two sets of words containing stems or suffixes</td>
<td>Pre- and post-training measures on three tests containing sentences with the taught words and novel words morphologically related</td>
<td>No clear evidence regarding transfer of morphological training</td>
</tr>
</tbody>
</table>

characteristics, independent variables, dependent variables, and results for the studies on MA training. This section presents methodological considerations for the reviewed MA studies based on the features included in both tables.
Subjects

The majority of the studies on MA training have been performed on middle-class, elementary students, with only three studies conducted on college students (Browne, 1991; Groeger & Malott, 1997; Levin et al., 1988), and one on minority students (Browne, 1991). This preference for elementary students results from the assumption that MA accounts for a large percentage of the vocabulary growth that occurs during grades 3 to 12 (Jenkins & Dixon, 1983; White, Power, & White, 1989; White, Sowell, & Yanagihara, 1989; Wysocki & Jenkins, 1987). Nevertheless, to appropriately evaluate MA training, it will be of interest to identify other groups that could benefit from such training, such as high school and university students. In addition, it would be of interest to include more minority students, as well as students with low vocabulary development.

Training in Morphology

As can be seen in Table 4, training on MA skills has been performed using a variety of methods such as direct training of selected morphemes (Browne, 1991; Freyd & Baron, 1982; Graves & Hammond, 1979; Groeger & Malott, 1997; Hoisington, 1968; Levin et al., 1988; Lindquist, 1969; Otterman, 1955), training using words or sentences containing selected morphemes (Freyd & Baron, 1982; Graves & Hammond, 1979; Groeger & Malott, 1997; Otterman, 1955; Wysocki & Jenkins, 1987), training using contextual examples with familiar words containing the morphemes, and training using contextual examples plus keywords for learning the
morphemes (Levin et al., 1988). Some of the reported studies used other strategies in addition to training in morphology, and compared students’ performance. For example, Freyd and Baron (1982) compared the effectiveness of teaching vocabulary using MA training, using reading context, and using spelling regularities. Lindquist (1969) and Otterman (1955) compared MA training to “traditional” training (the training students were receiving at school).

Of the nine reported studies on MA, six described the criteria used for the selection of the morphemes taught (Browne, 1991; Freyd & Baron, 1982; Groeger & Malott, 1997; Levin et al., 1988; Otterman, 1955; Wysocki & Jenkins, 1987). Of these six, only three studies (Browne, 1991; Groeger & Malott, 1997; Wysocki & Jenkins, 1987) included among the criteria the selection of words and word parts which the students will normally be expected to read in the near future. It is important to note that, to increase the utility of the studies on MA training, the selected morphemes should be related to words that will be used by the students receiving training. This is especially important for the teaching of root uses, because the number of roots that can be taught is relatively large; so some selection may be necessary. For example, students in biology classes will benefit from training in Latin and Greek roots of words related to the biological and medical field (Browne, 1991).

It is also important to note that the teaching of morphemes, specifically prefixes, presents various problems. First, most prefixes have more than one function, for example in is used as 'not' (incorrect) and 'in or into' (insight). Second, there is a possibility of false analyses. This can occur when removal of a prefix leaves an
unrecognizable base word or a word that is unrelated in function to the whole word that existed prior to removal. For example when the prefix in is removed from the word invented, the remaining is an unrecognizable word (vented). Third, if students consider only word-part clues (affixes and roots) when dealing with unfamiliar prefixed words, they may be misled about the actual uses of the words, for example they can use indelicate as 'not fragile' instead of offensive (White, Sowell, & Yanagihara, 1989). Thus, training in MA should include the teaching of these limitations. If this training about limitations is not considered, the external validity of any MA training could be questioned, because students will find it difficult to correctly transfer their training beyond the experimental conditions. None of the reviewed studies included training in exceptions.

Dependent Variables

To be able to draw conclusions about the effectiveness of MA training, it is important to determine if the students learned the morphemes and can apply the rules that were taught during training. This is accomplished by testing the students on the specific morphemes and rules taught. Failure to do that could lead to erroneous conclusions, such as that the training was ineffective because students did not appropriately respond to words containing the morphemes taught, when is the students did not really learn the morphemes or rules in the first place. Of the studies reported, only three evaluated the morphemes taught (Graves & Hammond, 1979; Hoisington, 1968; Levin et al., 1988).
Because a supposed major advantage of MA training is the ability to accurately respond to novel words or, as traditionally stated, the ability to "unlock the meaning" of novel words (Graves & Hammond, 1979; White, Power, & White, 1989; Wysocki & Jenkins, 1987), an important aspect to include for the evaluation of MA training is the transfer to novel words. These novel words should have the morphemes taught used in ways that differ from training. All the reviewed studies evaluated transfer of training to novel words. In seven of the studies (Browne, 1991; Freyd & Baron, 1982; Graves & Hammond, 1979; Groeger & Malott, 1997; Levin et al., 1988; Lindquist, 1969; Wysocki & Jenkins, 1987) the evaluation was accomplished by presenting novel words to the students (words not previously trained) that contained the morphemes taught during training, and requesting the students to give the uses of each word (fill-in-the-blank tests) or to select an alternative from several choices presented (multiple-choice tests). The remaining two studies (Hoisington, 1968; Otterman, 1955) used standardized tests to evaluate transfer of training.

Another aspect of interest is the amount of time students need to learn novel words containing the morphemes previously taught and compare this time to what students without MA training need. This will give the opportunity to evaluate the benefits of MA training, if any, concerning facilitation of learning of novel words. Of the studies presented in this review, only two measured learning time (Graves & Hammond, 1979; Groeger & Malott, 1997); but neither reported benefits for training with prefixes with respect to learning time.
To appropriately measure the effect of MA training, the evaluation materials should be adapted to the population under study and should include the morphemes taught during training. The studies by Hoisington (1968) and Otterman (1955) used standardized tests making difficult the evaluation of training effects. The remaining seven studies used evaluation materials adapted to their particular study. The evaluation materials should also include examples and non-examples of the morphemes taught, especially when MA includes training with prefixes, because of the prefix pitfalls previously mentioned. None of the reviewed studies did that. In addition, it may be of interest to measure effects of MA training in academic performance in general, especially in areas such as reading and spelling for elementary students. These measures do not relate directly to training, but are important nevertheless. Of the reviewed studies, Hoisington (1968) measured reading comprehension and spelling, and Otterman (1955) evaluated spelling. Finally, none of the reviewed studies reported measures of students' satisfaction with MA training.

Experimental Design

An appropriate experimental design should consider the evaluation of students before training and the random assignment of those students to groups according to their performance on the pre-test. Although all studies included in this review utilized experimental group designs, only three of the studies (Graves & Hammond, 1979; Groeger & Malott, 1997; Wysocki & Jenkins, 1987) equated the groups according to performance before training. Training with multiple components implemented
simultaneously was used in some of the studies (Browne, 1991; Hoisington, 1968; Levin et al., 1988; Lindquist, 1969; Otterman, 1955; Wysocki & Jenkins, 1987), making difficult the evaluation of the contribution of individual components.

Effects of Training

Of the nine studies reviewed, six (Freyd & Baron, 1982; Graves & Hammond, 1979; Groeger & Malott, 1997; Hoisington, 1968; Levin et al., 1988; Otterman, 1955) reported statistically significant effects of training. Of these, five reported significant evidence of transfer of morphological training (Freyd & Baron, 1982; Graves & Hammond, 1979; Groeger & Malott, 1997; Levin et al., 1988; Otterman, 1955). The study by Linquist (1969) reported some evidence of transfer, although statistical significance was not mentioned. The study by Freyd and Baron (1982) reported a significant difference in students’ performance from pretest to posttest in derived words (novel words), but no significant difference between posttest scores for the direct (taught words) and the derived words. In addition, Otterman (1955) reported morphological transfer only for the students initially evaluated as high performers; the low performers showed no morphological transfer. This author also noted significant improvements in spelling and delayed recall of prefix and word-root uses. The study by Levin et al. (1988) indicated the effectiveness of all training conditions but reported no evidence on the superiority of direct MA training with respect to the other training conditions.
Of all the studies reviewed, only two failed to find transfer of training to novel words. Hoisington (1968) reported significant higher mean scores in reading comprehension for the experimental group, but no significant differences in vocabulary and spelling, and no transfer of training. It is important to notice that Hoisington evaluated the performance of students using standardized tests not designed to evaluate the specific training. Finally, Wysocki and Jenkins (1987) indicated no significant differences in students' performance regarding morphological transfer after training. A plausible explanation of the lack of transfer of training in this study could be that the authors did not give explicit training on morphological components but rather trained only using only words containing morphemes. In addition, Wysocki and Jenkins (1987) did not evaluate the learning of the morphemes. It is possible then that students learned the words used for training but did not learn the functions of the morphemes contained in those words. In the following we will present a behavioral analysis of transfer of training and some recommendations to improve the transfer of training of morphological-analysis skills.

Transfer of Training

Transfer of training from the training setting to a different setting is not a natural consequence of training (Dean, 1997). According to the stimulus-control situated-learning principle (Brethewer & Smalley, 1992) behavior is influenced by the situation in which it occurs. People failing to transfer what they learned in one situation to a different situation is an illustration of that principle. According to the
discriminative-control/conceptual-learning principle (Brethower & Smalley, 1992) people are able to identify particular differences between situations and behave appropriately as a result of discriminative learning. People can also identify similarities between situations and appropriately transfer their training. This second principle states that transfer of training is facilitated by the inclusion of a number of examples as well as non-examples, and by supplementing rules with examples and non-examples.

Shimamune and Malott (1994) analyzed definition-based concept learning in terms of stimulus-response chains. According to these authors, in simple conceptual control, an operant is controlled by a class of stimuli, and is the result of differential reinforcement. In definition-based conceptual control, an operant is controlled by a class of stimuli through intervening verbal responses. For the establishment of definition-based conceptual control, a chain of responses may occur that will link the concept name, definition, examples, and non-examples. Shimamune and Malott (1994) analyzed from a behavioral perspective a set of principles for teaching concepts developed by educational psychologists. For example, the presentation of the definition of a concept with examples and non-examples increases the accuracy of performance with respect to providing only examples and non-examples (Tennyson & Park, 1980, as cited by Shimamune & Malott, 1994). As explained by Shimamune and Malott (1994), presenting the definition before discrimination training provides the learner with the opportunity to practice the stimulus-response chain to link the different components (concept name, definition, examples and non-examples). Also,
the definition of a concept should include the critical and variable attributes of a concept, thus providing more effective prompts for intervening verbal responses in definition-based conceptual control. The examples and non-examples used for training should expose the learner to all the critical attributes of a concept. Doing this should reduce errors such as overgeneralization, undergeneralization, and misconception. In addition, related concepts should be trained together, presenting examples from each concept successively.

Following this analysis, transfer of training of morphological analysis skills should be facilitated by including the following aspects in the training. Present first the definition of concepts such as morpheme, prefix, suffix and root, and include also examples and non-examples of each concept. Also, present the definition of the specific morphemes that are going to be taught (e.g., the prefix in) with the inclusion of examples and non-examples of the use of those morphemes. Include in the definition of concepts the critical and variable attributes of each concept. For example, the definition of the concept of prefix should include a clear distinction between what constitutes a prefix and what does not, with clear explanations of exceptions to the prefix rule, and with examples and non-examples of prefixes. Finally, related concepts should be presented together, for example, the different uses of the prefix in (not/in) should be trained simultaneously.
Conclusions

The studies evaluating MA training offer evidence in support of the effectiveness of MA training as a strategy for vocabulary growth. However, some of the studies contained methodological weaknesses. Among the more relevant methodological weaknesses are lack of direct evaluation of the morphemes taught, the use of evaluation instruments not sensitive to the specific training, no pretest measures, use of groups not matched according to pretest performance, non-random assignment of participants to the experimental groups, and training with multiple components simultaneously. Although not a methodological consideration, the majority of these studies trained with morphemes and words unrelated to the population's need, and gave no training in exceptions.

We make the following recommendations to improve research in MA training. Include instruction in exceptions to prefix rules. With respect to the dependent variable three aspects should be considered: the direct evaluation of the morphemes and rules trained to measure student learning, the evaluation of transfer of training, and the use of evaluation instruments adapted to the population under study and to the morphemes and rules used for training. The experimental design should include evaluations of performance on the selected dependent variables before training, random assignment to the experimental groups and ideally, matching of groups according to pretest performance. In addition, each component of training should be presented independently.
Although not a methodological consideration, the external validity of the MA training can be improved with the inclusion of students from different educational levels, e.g., elementary through university, minority students and students with high potential for vocabulary improvement. Also, to increase the utility, MA training should include morphemes and words to which the students will be exposed. Finally, the evaluation of learning time will be of interest, as a possible benefit of MA training.
CHAPTER IV

STUDY 2: EFFECTS OF PREFIX TRAINING ON VOCABULARY BUILDING

Introduction

Traditionally vocabulary is defined as the words (or signs) available to a person or a language community and is comprised of all the words (and word parts) a person has used or is familiar with (Hart & Risley, 1995). Though not usually looked at this way, vocabulary might be considered to consist of, not only familiar words the person has previously read, heard, or used correctly, but also novel words the person can read, hear, or use correctly. Presumably, the person would deal with the novel words appropriately because of transfer of training from experience with components of those words, like prefixes and roots, as well as contexts in which the words might be encountered.

The relationship of vocabulary to different aspects of performance has been extensively evaluated in children. At age 3, vocabulary growth (rate of learning words representing new concepts and distinctions between words) and vocabulary use (functioning in interaction with daily experience) were strongly associated with general accomplishments as estimated by IQ score ($r = .70$ and $r = .73$). In addition, the rate of vocabulary growth and vocabulary use at age 3 were strongly associated with scores at age 9-10 in tests evaluating receptive vocabulary ($r = .58$ and $r = .57$).
respectively) and language development (r = .74 and .72 respectively). Vocabulary use at 3 was also strongly associated with reading comprehension scores at age 9-10 (r = .56) (Hart & Risley, 1995).

Research evaluating the relationship between vocabulary and aspects of performance in adults is not as extensive as with children. For elementary school and college students, vocabulary size appears to be strongly correlated with reading comprehension. For example, vocabulary instruction had a significant effect on the comprehension of passages containing taught words (effect size averaged .97 of a standard unit) and of passages containing words that were not taught (.30 of a standard unit) (Stahl & Fairbanks, 1986). A speech richer in vocabulary, especially nouns and modifiers, was observed in adults with more education, higher-salaried jobs, and more affluent areas of residence (Menard & Santerre, 1979; as cited by Hart & Risley, 1995). However, data to support the latter conclusion were not available. Vocabulary is also considered to play an important role in areas such as effective communication and common knowledge. These areas are necessary, but not sufficient for an adequate performance in advanced education and in professional occupations (Hart & Risley, 1995).

An estimate of 37% of the first-time freshmen enter college with deficits in reading, writing or mathematics (Browne, 1991). Although no data are presented, it is considered that the misunderstanding of scientific terms often found in college textbooks makes it difficult to read those texts. In addition, a small vocabulary can
negatively affect tasks such as paper and report writing, tasks that need to be performed frequently during college (Browne, 1991).

Just as a large vocabulary is of value, the ability to read novel words may also be of value. Students often encounter novel words from elementary school through college. The ability to read novel words might be the difference between successful and unsuccessful performance in tests such as the SAT, GRE and GMAT, which may determine the academic future of the student.

Traditional study materials for the GRE contain between 600 words (Your Personal Trainer for the GRE, 1995) and 3,500 words (Brownstein, Weiner, Green, & Hilbert, 1994) representing the most frequently used in the GRE. Students may need to learn those words in order to increase their GRE verbal scores. So, any strategy would be of value that can aid students in learning those words or that can increase the probability of an accurate response when confronted with a novel word.

Strategies for Vocabulary Building

Conservative word counts estimate the average vocabulary size for third grade students to be 2,000 basic words, and for seventh grade student 4,760 basic words (Dupuy, 1974; as cited by Jenkins & Dixon, 1983). Less restrictive word counts estimate the average third and seventh grade vocabularies at 3,600 and 7,200 words respectively (Terman, 1916; as cited by Jenkins & Dixon, 1983). The estimated average vocabulary size for college students is 16,785 words (D’Anna, 1991).
Traditional literature on vocabulary growth usually addresses strategies to build vocabulary during elementary school years. This is because it is estimated that from third through seventh grade reading vocabulary grows at a rate of about 700 to 900 words per year (White, Power, & White, 1989), increasing about 100 percent. During those years, three strategies are the most frequently used to learn new vocabulary: direct instruction of responses to a word, learning to respond through oral and written context and, morphological analysis (White, Power, & White, 1989; Wysocki & Jenkins, 1987). Here, direct instruction refers to the use of a person and/or instructional materials to explicitly teach the appropriate uses of a word\(^1\). The second strategy involves responding to new words through the oral and written context; this is an indirect method of identifying the appropriate uses of a word. In this strategy the person learns the uses of a word by the clues provided in the context. The probability of appropriately using a word is then increased by multiple clues. The last strategy involves morphological analysis; this strategy entails separating a word into its parts (e.g., prefix, stem, suffix), appropriately responding to the individual parts, and then attempting to respond to the whole word on the basis of the responses to the individual parts. We will now look at morphological analysis in more detail.

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\(^1\) This use of direct instruction differs from the use of “direct instruction” as a systematic approach to the design and delivery of procedures for building and maintaining basic cognitive skills. Features that characterize the latter approach are small-group instruction, frequent responding by students, as scripts are followed in an active, participation-oriented classroom (Becker, 1992).
Morphological Analysis

The influence these three learning strategies have on the high rate of vocabulary growth observed during grades 3 though 12 was analyzed by several authors. It was concluded that: (1) direct instruction accounts only for a small percentage of the growth, (2) learning word responses through oral and written context accounts for about 30 percent of the learned words per year, and (3) morphological generalization, or word structure analysis accounts for the other 70 percent learned words (Jenkins & Dixon, 1983; White, Power, & White, 1989; White, Sowell, & Yanagihara; 1989; Wysocki & Jenkins, 1987).

Morphological analysis has been reported as a useful strategy to help build vocabulary during elementary school (White, Power, & White, 1989; Wysocki & Jenkins, 1987), high school (Graves & Hammond, 1979; Lindquist, 1969), and undergraduate studies (Browne, 1991; Levin, Carney, & Pressley, 1988). The morpheme is defined as the smallest unit of grammatical analysis in language (Rubin & Becker, 1979). There are three types of morphemes in English: prefixes, roots and suffixes. Words that are morphologically complex are formed by a root or base morpheme with affixes (prefixes and/or suffixes) appended (Feldman, 1991). A prefix is a syllable or group of syllables that is placed in front of a base word or root and that modifies the uses of the word, or forms a new word. An example would be the prefix un appended to the word recognizable, forming the word unrecognizable. A suffix is a sound, syllable or syllables, added to the end of a word or to a root that gives it grammatical function, changes its use, or forms a new word. An example would be
the suffix _ly_ appended to the word _clear_, forming the word _clearly_. A root, stem or base morpheme is that part of the word that remains when prefixes, suffixes, inflectional endings, etc. are removed. For example the root or stem _predict_ that remains when the word _unpredictable_ is separated into its parts, removing the prefix _un_ and the suffix _able_.

Morphological analysis has several advantages over other strategies for learning vocabulary. Among these are the relatively small number of prefixes, suffixes and roots, the relatively few different uses, relatively constant uses, and for some morphemes, the consistent spelling. Another advantage is that morphological analysis can aid the student when learning a large number of words. It is also considered an advantage that prefixes, suffixes and roots can be combined and recombined forming new words (Graves & Hammond, 1979; Milligan & Ruff, 1990). Following the latter advantage, morphological analysis is thought to help students respond to novel combinations of previously learned morphemes. Responding to new combinations of word parts is traditionally described as the recognition of new words (Breen, 1960; Browne, 1991; Graves & Hammond, 1979; Levin et al., 1988; Milligan & Ruff, 1990; Otterman, 1955; White, Sowell, & Yanagihara, 1989). It is assumed that if students practice the strategies for morphological analysis, they will be able to use a large number of novel combinations of morphemes (Graves & Hammond, 1979; White, Power, & White, 1989; Wysocki & Jenkins, 1987).
Prefixes Training

In preparation for reading novel words, the learning of prefixes has some advantages over the learning of roots and suffixes. The advantages are the small number of prefixes that are used in a large number of words, uses that are usually concrete, easy to define and constant, and consistent spelling (Graves & Hammond, 1979; Stotsky, 1977). Because of these advantages it is assumed that students who learned the prefixes would appropriately use a prefix when it is placed in front of a novel root or base word. This will increase the accurate use of the novel words (Graves & Hammond, 1979).

Examples of the importance of prefixes are presented in several studies. Stauffer (as cited by Milligan & Ruff, 1990) studied the Thorndike Teacher Book of 20,000 Words. This study revealed fifteen prefixes as accounting for almost all the words containing prefixes. These prefixes were: ab, ad, be, com, de, dis, en, ex, in, in², pre, pro, re, sub, and un. A study by Hildreth (as cited by Hoisington, 1968) indicated that 25 percent of words in English are composed of base forms with varied prefixes or endings. Another example is the study by White, Sowell, and Yanagihara (1989). These authors counted the number of prefix words from the Word Frequency Book (Carroll, Davies, & Richman, 1971; as cited by White, Sowell, & Yanagihara, 1989), a book that includes the words used during grades 3 through 9. The count

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2 The prefix in has two uses: not and to or toward, therefore this author listed it twice.
revealed the prefixes *un*, *re*, in (not), and *dis*, as accounting for more than 50 percent of the total prefix words, with the prefix *un* accounting for 26 percent of that total.

**Training in Morphemes**

Although it is widely assumed that morphological analysis is an important strategy for vocabulary growth, only eight studies have systematically evaluated the teaching of morphological analysis. Of those eight, only one evaluated the effectiveness of teaching only prefixes.

Six studies evaluated training with several word elements simultaneously: prefixes, suffixes, and word roots (Browne, 1991); prefixes, suffixes, word roots, and elements of sentence structure (Hoisington, 1968); prefixes and stems (Levin et al., 1988); morphology and part-whole relationship (Lindquist, 1969); prefixes and word-roots (Otterman, 1955); and two sets of words containing stems or suffixes (Wysocki & Jenkins, 1987).

Of these six studies involving training with multiple word elements, only three reported statistically significant effects of training. Hoisington (1968) obtained significant results for training with prefixes, suffixes, word roots, and elements of sentence structure on reading comprehension (*p* < .05), but not on vocabulary (*p* = .09) and spelling (*p* = .08). Levin et al. (1988) reported significant differences between the scores of students trained with prefixes and stems, and the scores of students with no training (*p* < .05). The performance of the students in the training condition averaged about 78% correct, and the performance of non-trained students...
averaged about 50% correct responses on the post-test. Levin et al. (1988) also reported statistically significant differences in transfer to new words (p < .05). Otterman (1955) obtained statistically significant differences in transfer to new words only for students who were initially evaluated as high performers, but not for the low performers. Otterman (1955) also reported significant differences in spelling and delayed recall of prefix and word-root meanings between the participants who received instruction on prefixes and word-roots and those who received no training (the level of significance was not reported).

Two studies evaluated the effect of training with individual components. Freyd and Baron (1982) trained with 10 suffixes using words containing the suffixes as examples, and compared students’ performance in the suffixes training group with the performance of students assigned to one of two other instructional conditions: learning vocabulary through reading context and through the use of spelling regularities. The authors found a significant difference (p < .05) between pretest and posttest scores for derived words, but no significant differences on posttest scores between the instructional conditions.

The study by Graves and Hammond (1979) evaluated the performance of students randomly assigned to three groups. The first group received training in nine prefixes plus words containing the prefixes taught (prefix-word condition). Students in the second group were trained with words containing the prefixes plus sentences containing the words taught (word-sentence condition). The third group received no vocabulary instruction (control condition). The authors measured students’
performance on a pretest, posttest and delayed posttest. Measurement included the prefixes and words taught and the ability to transfer to new words. Students in the prefix-word and the word-sentence conditions obtained significantly higher scores (p < .05) on the posttest and delayed posttest than on the pretest. For the prefix-word group the pretest, posttest, and delayed posttest scores were 72%, 89% and 87% respectively. For the word-sentence group the scores were 70%, 86%, and 85%, respectively. No significant differences were observed for the control group (pretest: 70%, posttest: 73%, and delayed posttest: 74 %). For transfer to new words, the scores of the prefix-word group were significantly higher than those of the word-sentence group (p < .01). The means for the prefix-word and the word-sentence groups were: for the posttest 81% and 73% respectively, and for the delayed posttest 81% and 72% respectively.

Although five studies on morphological analysis training provide support for the effectiveness of this strategy for vocabulary growth and transfer of training to new words, the majority of these supporting studies contained methodological weaknesses. For example, all the reported studies used experimental group designs, but only one of the studies (Graves & Hammond, 1979) equated the groups according to students' performance before training. An appropriate experimental design should include the evaluation of the participants before training and their random assignment to groups according to their performance on the pre-test.
In addition, as indicated before, three of the five supporting studies evaluated training with multiple components implemented simultaneously, making difficult the evaluation of the contribution of the individual components.

Although not a methodological consideration, another element that should be included for the evaluation of the effectiveness of morphological analysis training is the transfer to new words. This is important because a supposed major advantage of this training is students' ability to accurately use new words. The new words should contain the morphemes taught, but combined in ways that differ from training. Four studies reported statistically significant evidence of morphological generalization to novel words (Freyd & Baron, 1982; Graves & Hammond, 1979; Levin et al., 1988; Otterman, 1955). The study by Linquist (1969) reported some evidence of generalization, although no indication of the significance of this result was given.

Also, it would be of interest to measure the amount of time students invest in learning new words containing the morphemes taught. This could be compared with the time students without training in word structure analysis invest in learning the same set of words. This measure would give us the opportunity to determine if the learning of new words is made rapid by morphological analysis training. Only Graves and Hammond (1979) did this, but no significant differences in time between groups were found ($p > .05$).

To increase the utility of studies on morphological analysis training, an important criterion is the inclusion of words to which the target population will be exposed and the more frequent morphemes that will be found in those words. Of the
five supporting studies, two described the criteria used for the selection of the morphemes taught (Levin et al., 1988; Otterman, 1955). Neither of these two studies considered as a criterion the inclusion of words and word parts that students were going to contact in the future.

The present study evaluated the effectiveness of training with 15 prefixes for undergraduate students prior to their taking the GRE. This study included several of the considerations previously mentioned. First, the groups were equated and randomized according to student performance before training. Second, this study included the evaluation of transfer of training to new words containing the prefixes taught. Third, the amount of time required for learning words containing the prefixes was measured, and compared between the groups with and without prefix training. Finally, the 15 prefixes used for training were selected based on their frequency of appearance in the Barron’s How to Prepare for the GRE (Brownstein et al., 1994). This book contains a list with the 3,500 most frequent words in GRE tests. In summary, the purpose of this study was to: (a) evaluate the effects of training with 15 prefixes on student responses to novel words containing those prefixes (e.g. the prefixes combined with different roots); and (b) determine if training on the 15 prefixes facilitates student learning of words containing those prefixes.
Method

Subjects and Setting

Subjects were 88 students from advanced psychology courses, and from GRE preparation courses at Western Michigan University. The students were recruited during class time. The study was presented as an opportunity to receive training for the verbal section of the GRE. In addition, some students had the opportunity to earn course points for their participation in the study. Students were required to participate in the study in its entirety to earn the course points. Participants were evaluated using a 30-item multiple-choice test with words containing the prefixes that were going to be used for training. Students were randomly assigned to three experimental groups according to their scores on this pretest, to minimize differences between groups with respect to performance on the test. Initially, an equal number of students was assigned to each condition, but some students chose not to finish the study and therefore were eliminated from the analysis. The final number of participants for each condition was for the Prefix-Words (PW) group, 34 students, for the Words-Words (WW) group, 25 students, and for the Reading-Prefix (RP) group, 29 students.

Materials

Materials included a set of 15 flashcards containing only prefixes, 2 sets of 15 flashcards with words containing those prefixes, a 30-item multiple-choice test, two
15-item multiple-choice tests, readings about the nature of the GRE, and a form to record the time spent learning the prefixes and words.

The flashcards with the 15 prefixes included a prefix on one side of the card and the definition of that prefix with an example of the use of that prefix in a word, on the other side. The prefixes used for the study were: *in, re, dis, un, pro, im, mis, a, de, pre, an, con, sub, ab, ex* (see Appendix E). These prefixes were the most frequently found in the list of words included in the *Barron's How to Prepare for the GRE* (Brownstein et al., 1994). The frequency of words containing the prefixes was: 68 for *in*, 54 for *re*, 41 for *dis*, 38 for *un*, 36 for *pro*, 34 for *im* (not), 25 for *im* (in), 24 for *a*, 23 for *de*, 23 for *pre*, 18 for *an*, 18 for *con*, 16 for *sub*, 15 for *ab*, 12 for *ex*. The 15 prefixes were used in a total of 445 words.3

The two sets of flashcards included words with the prefixes that were used for training. Each set contained 15 words with the prefixes. A word was on one side of each flashcard, and the definition of the word and an example of the use of that word in one sentence were on the other side of the flashcard. The words used were, for Set 1: *incarcerate, impervious, retaliative, dismember, unerringly, proclivity, atheistic, decrepitude, prelude, abrogate, concatenate, subaltern, expatriate, misdemeanor, and analgesic*; for Set 2 the words were: *incontinent, regeneration, unfeigned, promulgate, apocryphal, defoliate, prescience, anomalous, abstain, distend, concoct, impasse, submissive, exhume*, and *misapprehension* (see Appendix F).

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3 This count includes only words with prefixes that have the standard meaning, exceptions were excluded.
The 30-item test was a four-option, multiple-choice test that included 30 words that were not trained. The words contained the prefixes used for training (each prefix was used in two words). The test was constructed in a way that being familiar with the prefix increased the opportunity to choose the correct option. It was not necessary to be able to appropriately use the root or word in order to answer correctly. All the options, except the correct one, presented definitions of words with uses that varied from those of the prefix included in the question word. For example, for the word *anonymity* the following options were given: (a) misleading, (b) state of being nameless, (c) practical person, and (d) study of body anatomy. For all groups, this test was given as a pretest, and as a posttest 1 and posttest 2, and was used to evaluate transfer of training. The words that were included in this test were: *incongruent, immure, propensity, subjugate, disinclination, prone, aphasia, apostate, aberrant, misconstrue, unruly, ineluctable, reactionary, impromptu, recidivism, extrude, disparate, derogatory, unsightly, depose, expunge, prefatory, anonymity, confluence, abeyance, concerted, subside, preeminent, anemia,* and *misnomer* (see Appendix G).

The two 15-item tests were four-option, multiple-choice tests. Each test included one of the two 15 word sets that were used for training. The tests were used to evaluate the learning of the sets of words (see Appendix H).

Rather than prefix training, introductory readings about the GRE were given to participants in the RP group (the control group). The readings were from the *Barron's How to Prepare for the GRE* (Brownstein et al., 1994).
Design

This study used a repeated-measures design with three matched groups (see Table 5). Subjects were randomly assigned to the three groups in such a manner that the groups were equated according to subjects' performance on the pre-test, making the means for all groups similar. Each group was exposed to two experimental conditions. Participants in PW group received training in the 15 top prefixes and training in Set 2 of the words; WW group received training in Set 1 and Set 2 of the words; RP group received readings and training in the 15 top prefixes. Participants were evaluated at the beginning of the study and after each of the experimental conditions.

Table 5
Experimental Design

<table>
<thead>
<tr>
<th>Group</th>
<th>Evaluation</th>
<th>Experimental Condition</th>
<th>Evaluation</th>
<th>Experimental Condition</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prefix-Words (PW)</td>
<td>Pre-test</td>
<td>Training in 15 top prefixes</td>
<td>Posttest 1</td>
<td>Training in words (Set 2)</td>
<td>Posttest 2</td>
</tr>
<tr>
<td>Words-Words (WW)</td>
<td>Pre-test</td>
<td>Training in words (Set 1)</td>
<td>Posttest 1</td>
<td>Training in words (Set 2)</td>
<td>Posttest 2</td>
</tr>
<tr>
<td>Reading- Prefix (RP)</td>
<td>Pre-test</td>
<td>Readings</td>
<td>Posttest 1</td>
<td>Training in 15 top prefixes</td>
<td>Posttest 2</td>
</tr>
</tbody>
</table>
Procedure

All participants were evaluated using the same pretest. After the pretests were completed, they were graded and the participants were randomly assigned to the experimental conditions according to their scores on the pretest. For each group, the procedure was as follows.

Participants in the PW group were given a set of 15 prefixes and were instructed to learn those prefixes. All participants were responsible for learning the 15 prefixes and they determined when they had learned the prefixes. There was no rate requirement. Participants were given a form to record the time that they needed to learn the prefixes and were asked to record that time. After learning the prefixes, participants returned the form with time of completion to the experimenter. Then the experimenter gave the participants Posttest 1 and asked them to complete it and return it to the experimenter when done. Immediately after they finished the Posttest 1, participants were given Set 2 of the training words, and were asked to learn the words and to record the amount of time needed to learn the words. After learning the words, participants were given two tests, one to evaluate the learning of the Set 2 words, and the other was Posttest 2 used to evaluate transfer of learning.

The procedure for the WW group and RP group was similar to the one followed in PW group. Participants assigned to WW group were given Set 1, and participants in RP group were given readings. Participants in WW group were asked to learn the words and to record the time, while RP group participants were asked to read the materials. After that, students in WW group were given a test to evaluate
learning of Set 1. Both groups were given Posttest 1. Following the completion of Posttest 1, WW group participants were given Set 2 and RP group received the flashcards with the 15 prefixes. Again, students were asked to learn them and to record the time. After this, WW group participants received a test to evaluate learning of Set 2, and both groups were given the Posttest 2. The procedure for all three groups took approximately 1:00 – 1:30 hour.

Results

Training with 15 prefixes transferred to the use of novel words containing those prefixes. Both groups with prefix training scored significantly higher on the posttest immediately after training, than on the pretest. The PW group went from a mean correct of 22.1 to 25.4 out of 30 words, $F(34) = 12.25, p < .01$, and the RP group went from a mean correct of 22.0 to 24.6 words, $F(29) = 4.21, p < .05$. Furthermore, training with either 15 or 30 words containing the prefixes showed no transfer to the use of novel words containing those prefixes. [For the WW group: the mean correct on the pretest was 21.8 words, 22.6 on Posttest 1 after training with 15 words, and 22.8 on Posttest 2 after training with 15 more words, $F(25) = 0.59, p > .1$; for the PW group the mean correct on Posttest 1 was 25.4 words, and 25.5 words on Posttest 2, after training with 15 words, HSD = .16, $p > .05$].

We refer to the words in the posttest as "novel," in the sense that they were never used in a training condition, though they are not novel, in the sense that they were used in the pretest.
Also, there was no transfer of training from the experience of taking the pretest to the Posttest 1. Group RP had no relevant training between the two tests, and the improvement from pretest (M = 22.0) to posttest 1 (M = 22.3) was not significant, HSD = .44, p > .05 (see Table 6).

The superiority of prefix training was also shown with between-group comparisons. The group with prefix training (PW) scored significantly higher, F(57) = 8.92, p < .01, on Posttest 1 (M = 25.4) than did the group with word training (WW) (M = 22.6) and the control group that read irrelevant material (RP) (M = 22.3) (see Table 6).

Table 6

Summary of Statistical Analysis for the Pretest, Posttest 1. and Posttest 2 Scores and for the Learning Time, by Group

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>Median</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest score</td>
<td>22.1</td>
<td>22.5</td>
<td>4.1</td>
<td>10</td>
<td>29</td>
</tr>
<tr>
<td>Posttest 1 score</td>
<td>25.4</td>
<td>26.0</td>
<td>2.6</td>
<td>17</td>
<td>28</td>
</tr>
<tr>
<td>Prefix-Words (PW)</td>
<td>25.5</td>
<td>26.0</td>
<td>2.8</td>
<td>16</td>
<td>29</td>
</tr>
<tr>
<td>(N=34)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Posttest 2 score</td>
<td>16.5</td>
<td>14.5</td>
<td>8.4</td>
<td>8</td>
<td>41</td>
</tr>
<tr>
<td>Prefix learning time</td>
<td>11.9</td>
<td>10.0</td>
<td>9.4</td>
<td>3</td>
<td>47</td>
</tr>
<tr>
<td>Set 2 learning time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 6 –Continued

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>Median</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest score</td>
<td>21.9</td>
<td>22.0</td>
<td>3.1</td>
<td>14</td>
<td>28</td>
</tr>
<tr>
<td>Posttest 1 score</td>
<td>22.6</td>
<td>23.0</td>
<td>3.2</td>
<td>15</td>
<td>28</td>
</tr>
<tr>
<td>Posttest 2 score</td>
<td>22.8</td>
<td>23.0</td>
<td>3.1</td>
<td>16</td>
<td>28</td>
</tr>
<tr>
<td>Words-Words (WW) (N=25)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Set 1 learning time</td>
<td>8.8</td>
<td>9.0</td>
<td>3.8</td>
<td>3</td>
<td>22</td>
</tr>
<tr>
<td>Set 2 learning time</td>
<td>6.5</td>
<td>7.0</td>
<td>2.5</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>Readings-Prefix (RP) Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretest score</td>
<td>22.0</td>
<td>22.0</td>
<td>3.7</td>
<td>13</td>
<td>29</td>
</tr>
<tr>
<td>Posttest 1 score</td>
<td>22.3</td>
<td>23.0</td>
<td>3.7</td>
<td>14</td>
<td>29</td>
</tr>
<tr>
<td>Posttest 2 score</td>
<td>24.6</td>
<td>26.0</td>
<td>3.8</td>
<td>13</td>
<td>29</td>
</tr>
<tr>
<td>Prefix learning time</td>
<td>9.7</td>
<td>9.0</td>
<td>4.4</td>
<td>4</td>
<td>22</td>
</tr>
</tbody>
</table>

The pre and posttest scores were also analyzed for the half of the participants who scored the lowest on the pretest in comparison with those who scored the highest. These analyses also demonstrated the superiority of prefix training for transfer of training to novel words. The participants scoring below the 50th percentile on the pretest, had more room for improvement on the posttest than did those scoring above the 50th percentile, and the data showed that the low performers did, in fact,
improve the most. For the PW group, the low pretest performers improved from a mean of 18.9 to a mean of 24 words correct, an improvement of 5.1 words, whereas the high performers improved from 25.2 to 26.8, an improvement of only 1.6 words. The improvement for both subgroups was significant [for the low: F(17) = 15.65, p < .01; for the high: F(17) = 7.9, p < .01]. However, the improvement for the low pretest performers was significantly greater than for the high pretest performers, t(32) = 3.10, p < .01. Similarly, for the RP group, the low performers showed a significant improvement from a mean of 19.9 to 22.9 words, F(15) = 3.41, p < .05. But the high performers showed no significant improvement from 24.9 to 26.5 words, F(14) = 2.59, p > .05. And, again, for the RP group, the improvement for the low pretest performers was significantly greater than for the high pretest performers, t(27) = 2.26, p < .05.

In addition, while the low pretest performers improved the most, their posttest scores never equaled the post-test scores of the high performers. For the PW group there was a significant difference of 2.8 words, t(32) = 3.71, p < .01, between the scores of the low performers (M = 24.0) and the scores of the high performers (M = 26.8). And for the RP group there was a significant difference of 3.6 words, t(27) = 2.94, p < .01, between the low performers (M = 22.9) and the high performers (M = 26.5). Furthermore, the posttest scores of the low performers did not exceed the pretest scores of the high performers. For the PW group, the mean pretest of the high performers was 25.2 and the mean Posttest 1 for the low performers was 24.0 words, not significantly different, t(32) = 1.48, p > .1. The same was observed for RP group,
where the high performers pretest score was 24.9, while the low performers posttest score was 22.9, again not significantly different, t(27) = 1.70, p > .1. Also, no significant results were observed for the low and high performers on any of the other experimental conditions for any of the groups.

There were no benefits for training with prefixes with respect to learning time. One group with prefix training (PW) used significantly more time, t(57) = 3.2, p < .01) for learning the Set 2 words (M = 11.9), than the WW group did for learning the same Set of words (M = 6.5), without prefix training. Incidentally, the mean time for learning the prefixes themselves was 16.5 minutes for the PW group, and 9.7 minutes for the RP group (see Table 4).

In one set of comparisons, presented earlier, learning the prefixes was superior to learning words containing those prefixes, when the correct use of novel words with those prefixes was measured. However, it is important to make sure that the participants actually learned those prefixed training words, if those comparisons are to be fair. In fact, the prefixed words were learned: the mean word score on the 15 item multiple-choice test for words Set 2 was 14.9 for the PW group, and 15 for the WW group, out of 15 possible words. The mean score on the Set 1 of words for the WW group was 14.9.
Discussion

The present study showed:

1. Training with prefixes transferred to the use of novel words containing those prefixes.

2. Training with words containing those prefixes did not transfer to the use of the novel words.

3. Training with prefixes (compared to training with prefixed words) did not decrease time to learn novel prefixed words (in fact, it appears to have increased the time needed).

4. Training with prefixes had a greater impact on students most in need of such training.

5. Training with prefixes did not raise the performance of those students most in need of such training beyond the pre-training level of those students least in need.

The external validity of these findings needs to be strengthened. The first two findings are replications from earlier research (Graves & Hammond, 1979). The third finding, for unknown reasons, contradict the Graves and Hammond (1979) results, they did not find that prefix training slowed down the learning of novel words. And the final two findings concerning the high and low performers have not been addressed elsewhere.

In this study transfer of training was facilitated by following two of the recommendations made by Shimamune and Malott (1994) for the establishment of
definition-based conceptual control. First, we presented the definition of each prefix followed by words exemplifying each prefix. According to these authors, this provides the learner with the opportunity to practice the stimulus-response chain to link the different components (concept name, definition, examples and non-examples). Also, students were asked to learn 15 prefixes, increasing their opportunity to discriminate between the prefixes and between examples and non-examples of each prefix. The discrimination training was then implicit between the prefixes used for training. Second, as suggested by Shimamune and Malott (1994), we presented the related concepts together, as all prefixes are related concepts, and also presented the different uses for each prefix simultaneously.

The possibility that pretest/posttest improvements were confounded by the repeated use of the same test seems unlikely, given the lack of improvement when the RP group only read irrelevant material between the two times they took that test.

Our casual observation of various good behavioral education and training programs at the university level suggests that such programs typically help the low performers most but rarely get their performance up to the posttest level of the high performers. In this case, we were unable to get the posttest scores of the low performers to even reach the pretest scores of the high performers. It might be of value to do similar formal analyses of the differential impact of other education and training programs.

Unfortunately, the actual learning of the prefixes was not directly evaluated, so we cannot be sure all of the students learned all of the prefixes prior to the test with
the novel words. It is possible that some students failed to completely transfer the training to novel words simply because they did not learn the prefixes accurately. In that sense, the difference between the mean improvements for the groups PW and RP after prefix training (3.3 and 2.3 points respectively) could have been the result of students failing to appropriately learn all the trained prefixes. The mean learning time for the prefixes was approximately 13 minutes for the PW and the RP group, which may not be enough. Future students might benefit by the inclusion of a mastery requirement, for example, give the students the opportunity to obtain points contingent upon their performance on tests evaluating only prefixes.

The behavior that the students have when they learn the prefixes is to give the definition of a prefix in the presence of that prefix. The prefix functions then as a discriminative stimulus for that particular behavior.

This study was primarily oriented toward training students prior to their taking the GRE, but it has implications for general vocabulary learning. Important advantages of learning prefixes are the small number of prefixes used in a large number of words, with uses that are usually concrete, easy to define, constant, and consistently spelled. With these advantages, students may transfer their training with prefixes to other novel prefix words. Of course, this needs to be evaluated.

Nevertheless, the training with prefixes also has several difficulties. First, some prefixes have more than one function, for example in is used as ‘not’ (incorrect) and as ‘in’ or ‘into’ (insight). Second is a possibility of false analysis. This can occur when the removal of a prefix leaves a root or a word that is unrelated in function to
the whole word that existed prior to removal. For example, the removal of the prefix *in* from the word *invented* leaves the word *(vented)*. Third, if students consider only word part clues (affixes and roots) when dealing with novel prefixed words, they may be misled about the actual use of the word, for example they can use *indelicate* as ‘not fragile’ instead of offensive (White, Sowell, & Yanagihara, 1989). Thus, training in prefixes in particular, and in morphological analysis in general should include the teaching of these inconsistencies in order to facilitate transfer of training to a wider set of words.

In conclusion, prefix training seems to be a valuable component of vocabulary training. However, the generality of these results should be determined.
Appendix A

Flyer Describing the GRE Course
GRE Preparation Course
for Verbal and Quantitative Portions
of the Graduate Records Examination

WESTERN MICHIGAN UNIVERSITY

• Low GRE scores can severely damage your chances of being accepted in the graduate program of your choice! Many graduate programs require at least a 500 on both the verbal and quantitative sections of the exam.

• Solid preparation for the GRE improves your chances of doing well!

• It is very difficult to motivate yourself to do the studying for the GRE that you should do ... and want to do.

This course provides the structure for the hard work you need to do. It has helped other WMU students with their preparation — their actual GRE test scores showed significant improvement over pretest scores, as shown in the graph above.

YOU MUST REGISTER BEFORE THE FIRST DAY OF CLASS!

GRE Preparation Course Registration

Name________________________________________________________SS#_____________________

Address_____________________________________________________

City________________________State________________ZIP_________

Telephone________________________

Fall 1997 Course Payment (Fee: $350)

☐ Enclosed is my check or money order, payable to Western Michigan University.

☐ Please charge my ☐ Visa ☐ MasterCard ☐ Discover

account # ___________________ exp. date ___________________ authorized signature ___________________

Return form and payment to: Office of Professional Programs and Conferences, Western Michigan University, Kalamazoo, MI 49008. With credit card payment, this form may also be faxed to the Office of Professional Programs and Conferences, (616) 387-4189.

For office use only

mock # ___________________ cash __________ credit card __________ amt. received __________

date ___________________ auth/receipt # ___________________ issued by ___________________
Appendix B

GRE Course Syllabus
GRE Preparation Course  
Fall 1997

Time: Monday - Thursday  
6:00 to 9:00 p.m.

Dates: September 3 to October 30

Room: 220 (Think Fast Lab) West Hall on East Campus

Instructor: Dr. Richard Malott

Assistant: Corina Groeger (344-8975)

Rebate Policy: If you miss three or fewer classes and participate actively in all others, you will earn a $75 rebate. As an extra incentive to get to class on time, each occasion you are more than 10 minutes late, it will count as one quarter of an absence. (It really is important that you are here at 6:00 p.m. - we have a busy course ahead of us, and we don't want you to fall behind.)

Absence Policy: You can make up for missed hours at home. However, you should notify the course assistant (Corina) in advance and tell her how are you going to make up those hours. You are allowed to miss only three classes, in order to get the rebate. Special cases should be discussed in advance with the course instructor. (Include prof of accomplishments).

Course Structure: This course will provide the structure for the hard work you need to do. The class will meet Monday through Thursday from 6:00 until 9:00 p.m. (September 3 - October 30). You will not receive credit for this course; however, prompt attendance is essential. Attendance will be the key factor in putting in the requisite amount of work. Studying will take place in the Computer Lab at West Hall on East Campus off of Oakland Drive.

Details: Each of the participants will focus on the quantitative portion of the study materials for half of the course, and the verbal portion of the study materials for the other half of the course.

Course Rationale: If you receive good scores on the posttest, you should take the paper and pencil or the computerized GRE at the completion of this course. The next paper and pencil administration of the GRE is scheduled for Saturday, November 1. We recommend you schedule to take this GRE test ahead of time.

Tentative Schedule:  

September 3: GRE Pretest  
September 3 through October 1: Quantitative training  
October 2: GRE Posttest 1  
October 6 through October 29: Verbal training  
October 30: GRE Posttest 2

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Appendix C

Consent Form and Research Protocol Clearance
Western Michigan University
Department of Psychology

Principal Investigator: Corina Groeger, M.A.
Advisor: Richard W. Malott, Ph.D.

I authorize Corina Groeger to use the data collected during this GRE preparation course in professional presentations and articles as well as in her dissertation. She is collecting these data to evaluate the effectiveness of this course in helping students prepare for the GRE.

I understand that my name will not be on any of the forms and that the principal investigator will use a code number instead. Corina Groeger will keep a separate master list of names of the participants and the corresponding code numbers. That means that all the information collected from me is confidential.

I understand that I may withdraw my authorization at any time during this course without prejudice or penalty. If I have any questions or concerns about this study I may contact either Dr. Richard Malott at 372-1268 or Corina Groeger at 344-8975. I may also contact the chair of Human Subjects Institutional Review Board at 387-8293 or the Vice President for Research at 387-8298 with any concerns that I may have.

My signature below indicates that I understand the purpose and requirements of the study and that I agree to participate.

__________________________________________  ______________________________________
Signature Date
To: Richard W. Malott
    Corina Groeger

From: Richard A. Wright, Chair
      Human Subjects Institutional Review Board

Subject: HSIRB Project # 95-04-19

Date: June 10, 1996

This letter will serve as confirmation that the extension and modification of your research project “The Effects of Self Study on GRE Verbal and Quantitative Scores,” requested in your memo, has been approved by the Human Subjects Institutional Review Board.

Your project is approved for a period of one year from the above date. If you should revise any procedures relative to human subjects or materials, you must resubmit those changes for review in order to retain approval. Should any untoward incidents or unanticipated adverse reactions occur with the subjects in the process of this study, you must suspend the study and notify me immediately. The HSIRB will then determine whether or not the study may continue.

Please be reminded that all research involving human subjects must be accomplished in full accord with the policies and procedures of Western Michigan University, as well as all applicable local, state, and federal laws and regulations. Any deviation from those policies, procedures, laws or regulations may cause immediate termination of approval for this project.

Thank you for your cooperation. If you have any questions, please do not hesitate to contact me.

Project Expiration Date: June 10, 1997
Appendix D

GRE Course Evaluation
GRE Preparation Course

Evaluation

1. Which of the following courses did you attend? (Please circle one)  
   Spring  
   Fall

2. How would you rate the following materials in the course in terms of usefulness?  
   (Please check the appropriate box in the table below):

<table>
<thead>
<tr>
<th>Materials</th>
<th>How helpful was each study tool?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathworks book</td>
<td>1 (not) 2 3 4 5 (very)</td>
</tr>
<tr>
<td>Math drills (practice exercises)</td>
<td></td>
</tr>
<tr>
<td>Barron's book</td>
<td></td>
</tr>
<tr>
<td>Flashcards with words</td>
<td></td>
</tr>
<tr>
<td>Think Fast disk</td>
<td></td>
</tr>
<tr>
<td>Paper and pencil practice GRE</td>
<td></td>
</tr>
</tbody>
</table>

3. Overall, how helpful was the course?
   1  2  3  4  5  
   not at all  very

4. Are you pleased with your progress?
   1  2  3  4  5  
   not at all  very

5. Do you think that the amount of time spent studying for the GRE in this course was appropriate? (three will be just the right amount of time)
   1  2  3  4  5  
   too little  too much

6. Are you satisfied with the attendance policy? (need to attend to 92% of the classes in order to get the rebate.)
   1  2  3  4  5  
   not at all  very

7. What, if anything, would you do to improve the course? (use back of sheet if necessary)

Thank you very much for your time
Appendix E

Prefix Flashcards
<table>
<thead>
<tr>
<th><strong>IN</strong></th>
<th><strong>MEANING:</strong></th>
<th>NOT IN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>EXAMPLES:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Inefficient</em></td>
<td>not efficient</td>
</tr>
<tr>
<td></td>
<td><em>Inarticulate</em></td>
<td>not clear or distinct</td>
</tr>
<tr>
<td></td>
<td><em>Invite</em></td>
<td>call in</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>DIS</strong></th>
<th><strong>MEANING:</strong></th>
<th>NOT, APART</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>EXAMPLE:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Discord</em></td>
<td>lack of harmony</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>PRO</strong></th>
<th><strong>MEANING:</strong></th>
<th>FORWARD IN FAVOR OF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>EXAMPLES:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Propulsive</em></td>
<td>driving forward</td>
</tr>
<tr>
<td></td>
<td><em>Proponent</em></td>
<td>supporter</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>MIS</strong></th>
<th><strong>MEANING:</strong></th>
<th>BAD, IMPROPER HATRED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>EXAMPLES:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Misdemeanor</em></td>
<td>minor crime; bad conduct</td>
</tr>
<tr>
<td></td>
<td><em>Mischance</em></td>
<td>unfortunate accident</td>
</tr>
<tr>
<td></td>
<td><em>Misanthrope</em></td>
<td>person who hates mankind</td>
</tr>
</tbody>
</table>
| RE | MEANING: AGAIN, BACK  
EXEMPLARY:  
Reiterate repeat  
Reimburse pay back |
| UN | MEANING: NOT  
EXEMPLARY:  
Unkempt not combed; disheveled |
| IM | MEANING: NOT IN, ON, UPON  
EXEMPLARY:  
Impeccable not capable of sinning; flawless  
Impression effect upon mind or feelings |
| A | MEANING: WITHOUT  
EXEMPLARY:  
Amoral without moral sense |
<table>
<thead>
<tr>
<th>Pre</th>
<th>Meaning:</th>
<th>Before</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Examples:</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Preamble</em> introductory statement</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Premonition</em> forewarning</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Con</th>
<th>Meaning:</th>
<th>With, Together</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Conference</em> meeting</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ab</th>
<th>Meaning:</th>
<th>From, Away From</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Abduct</em> lead away, kidnap</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Abjure</em> renounce</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ex</th>
<th>Meaning:</th>
<th>Out</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Expel</em> drive out</td>
<td></td>
</tr>
<tr>
<td>DE</td>
<td>MEANING: DOWN, AWAY</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---------------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EXAMPLES:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Debase lower in value</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Decadence deterioration</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AN</th>
<th>MEANING: WITHOUT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EXAMPLE:</td>
</tr>
<tr>
<td></td>
<td>Anarchy lack of government</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SUB</th>
<th>MEANING: UNDER, LESS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EXAMPLE:</td>
</tr>
<tr>
<td></td>
<td>Subjugate bring under control</td>
</tr>
</tbody>
</table>
Appendix F

Sets 1 and 2 of Prefixed Words
| INCARCERATE | MEANING: V. imprison.  
EXAMPLE: The warden will *incarcerate* the felon after conviction. |
| RETALIATE | MEANING: V. repay in kind (usually for bad treatment).  
EXAMPLE: Fear that we will *retaliate* immediately deters our foe from attacking us. |
| UNERRINGLY | MEANING: ADV. infallibly.  
EXAMPLE: My teacher *unerringly* pounced on the one typographical error in my essay. |
| ATHEISTIC | MEANING: ADJ. denying the existence of God.  
EXAMPLE: His *atheistic* remarks shocked the religious worshippers. |
| **IMPERVIOUS** | **MEANING:** ADJ. not penetrable; not permitting passage through.  
**EXAMPLE:** You cannot change their habits for their minds are *impervious* to reasoning. |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| **DISMEMBER** | **MEANING:** V. cut into small parts.  
**EXAMPLE:** When the Austrian Empire was *dismembered*, several new countries were established. |
| **PROCLIVITY** | **MEANING:** N. inclination; natural tendency.  
**EXAMPLE:** The cross old lady has a *proclivity* to grumble. |
| **DECREPITUDE** | **MEANING:** N. state of collapse caused by illness or old age.  
**EXAMPLE:** I was unprepared for the state of *decrepitude* in which I had found my old friend; he seemed to have aged twenty years in six months. |
<table>
<thead>
<tr>
<th>Word</th>
<th>Meaning</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prelude</td>
<td>N. introduction; forerunner.</td>
<td>I am afraid that this border raid is the <em>prelude</em> to more serious attacks.</td>
</tr>
<tr>
<td>Concatenate</td>
<td>V. link as in a chain.</td>
<td>It is difficult to understand how these events could <em>concatenate</em> as they did without outside assistance.</td>
</tr>
<tr>
<td>Expatriate</td>
<td>N. exile; someone who has withdrawn from his native land.</td>
<td>Henry James was an American <em>expatriate</em> who settled in England.</td>
</tr>
<tr>
<td>Analgesic</td>
<td>ADJ. causing insensitivity to pain.</td>
<td>The <em>analgesic</em> qualities of this lotion will provide temporary relief.</td>
</tr>
</tbody>
</table>
| **ABROGATE** | MEANING: V. abolish.  
EXAMPLE: He intended to *abrogate* the decree issued by his predecessor. |
| **SUBALTERN** | MEANING: N. subordinate.  
EXAMPLE: The captain treated his *subalterns* as though they were children rather than commissioned officers. |
| **MISDEMEANOR** | MEANING: N. minor crime.  
EXAMPLE: The culprit pleaded guilty to a *misdemeanor* rather than face trial for a felony. |
| **INCONTINENT** | **MEANING:** ADJ. lacking self-restraint; licentious.  
**EXAMPLE:** His *incontinent* behavior off stage shocked many people and they refused to attend the plays and movies in which he appeared. |
| **UNFEIGNED** | **MEANING:** ADJ. genuine; real.  
**EXAMPLE:** She turned so pale that I am sure her surprise was *unfeigned.* |
| **APOCRYPHAL** | **MEANING:** ADJ. untrue; made up.  
**EXAMPLE:** to impress his friends, Tom invented *apocryphal* tales of his adventures in the big city. |
| **PRESCIENCE** | **MEANING:** N. ability to foretell the future.  
**EXAMPLE:** Given the current wave of Japan-bashing, it does not take *prescience* for me to foresee problems in our future trade relations with Japan. |
| **REGENERATION** | **MEANING**: N. spiritual rebirth.  
**EXAMPLE**: Modern penologists strive for the *regeneration* of the prisoners. |
| **PROMULGATE** | **MEANING**: V. make known by official proclamation or publication  
**EXAMPLE**: As soon as the Civil Service Commission *promulgates* the names of the successful candidates, we shall begin to hire members of our staff. |
| **DEFOLIATE** | **MEANING**: V. destroy leaves.  
**EXAMPLE**: In Vietnam the army made extensive use of chemical agents to *defoliate* the woodlands. |
| **ANOMALOUS** | **MEANING**: ADJ. abnormal; irregular.  
**EXAMPLE**: He was placed in the *anomalous* position of seeming to approve procedures that he despised. |
| **ABSTAIN**       | **MEANING**: V. refrain; withhold from participation.  
|                  | **EXAMPLE**: After considering the effect of alcohol on his athletic performance, he decided to *abstain* from drinking while he trained for the race. |
| **CONCOCT**      | **MEANING**: V. prepare by combining; make up in concert.  
|                  | **EXAMPLE**: How did the inventive chef ever *concoct* such a strange dish? |
| **SUBMISSIVE**   | **MEANING**: ADJ. yielding; timid.  
|                  | **EXAMPLE**: Crushed by his authoritarian father, Will had no defiance left in him; he was totally *submissive* in the face of authority. |
| **MISAPPREHENSION** | **MEANING**: N. error; misunderstanding.  
|                  | **EXAMPLE**: To avoid *misapprehension*, I am going to ask all of you to repeat the instructions I have given. |
| **DISTEND** | **MEANING:** V. expand; swell out.  
**EXAMPLE:** I can tell when he is under stress by the way the veins *distend* on his forehead. |
| **IMPASSE** | **MEANING:** N. predicament from which there is no escape.  
**EXAMPLE:** In this *impasse*, all turned to prayer as their last hope. |
| **EXHUME** | **MEANING:** V. dig out of the ground; remove from a grave.  
**EXAMPLE:** Because of the rumor that he had been poisoned, his body was *exhumed* in order that an autopsy might be performed. |
Appendix G

30-Item Multiple Choice Test
Synonym Test

Name (please print): ___________________________

Each of the questions below consists of a word in capital letters, followed by four lettered words or phrases. Choose the lettered word or phrase that is most nearly similar in meaning to the word in capital letters and CIRCLE the letter of your choice.

1. INCONGRUENT
   A) consequence; accompaniment
   B) imaginative
   C) absurd
   D) attractive

2. IMMURE
   A) begin formally
   B) imprison
   C) beg
   D) block

3. PROPENSITY
   A) the art of versification
   B) minor fight
   C) dishonest behavior
   D) natural inclination

4. SUBJUGATE
   A) conquer; bring under control
   B) clear of charges
   C) express, utter
   D) live in a monotonous way

5. DISINCLINATION
   A) trite remark
   B) preamble
   C) clever reply
   D) unwillingness

6. PRONE
   A) powerful
   B) inclined to
   C) cautious
   D) versatile

7. APHASIA
   A) loss of speech due to injury or illness
   B) consequence; accompaniment
   C) difference; condition of inequality
   D) sediment; worthless residue

8. APOSTATE
   A) Student of the history and science of humankind
   B) one who abandons his religious faith or political beliefs.
   C) ghost; phantom
   D) prudence; ability to adjust actions to circumstances.

9. ABERRANT
   A) having a common center
   B) making up for
   C) abnormal or deviant
   D) comprehensive

10. MISCONSTRUE
    A) destroy completely
    B) interpret incorrectly
    C) insert between
    D) trespass

11. UNRULY
    A) disobedient; lawless
    B) versatile
    C) perplexing
    D) solidly uniform

12. INELUCTABLE
    A) unimportant
    B) enormous
    C) irresistible
    D) attractive

13. REACTIONARY
    A) bossy; arrogant; decisively important
    B) extremely small
    C) recoiling from progress; retrograde
    D) menacing; threatening

14. IMPROMPTU
    A) expressing a low opinion
    B) contemptible
    C) harmful
    D) without previous preparation.

15. RECIDIVISM
    A) habitual return to crime
    B) bravery
    C) period of time
    D) salary

16. EXTRUDE
    A) bend the knee as in worship
    B) write; compose
    C) bring upon oneself
    D) force or push out.
<table>
<thead>
<tr>
<th>DISPARATE</th>
<th>PREFATORY</th>
<th>SUBSIDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A) spacious</td>
<td>A) introductory</td>
<td>A) fill up again</td>
</tr>
<tr>
<td>B) implying a cause-and-effect relationship</td>
<td>B) arrogant</td>
<td>B) settle down; descend; grow quiet.</td>
</tr>
<tr>
<td>C) basically different; unrelated</td>
<td>C) dissipated; wasteful; licentious</td>
<td>C) censure, rebuke</td>
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<tr>
<td>D) greedy; eager for.</td>
<td>D) perplexing; questionable</td>
<td>D) repay; revenge</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>DEROGATORY</th>
<th>ANONYMITY</th>
<th>PREEMINENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>A) expressing a low opinion</td>
<td>A) misleading</td>
<td>A) elastic; having the power of springing back</td>
</tr>
<tr>
<td>B) commonplace</td>
<td>B) state of being nameless</td>
<td>B) outstanding; superior.</td>
</tr>
<tr>
<td>C) given freely</td>
<td>C) practical person</td>
<td>C) negligent</td>
</tr>
<tr>
<td>D) ardent; hot</td>
<td>D) study of body anatomy</td>
<td>D) deserving blame</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UNSIGHTLY</th>
<th>CONFLUENCE</th>
<th>ANEMIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>A) ugly</td>
<td>A) window projecting from roof</td>
<td>A) inclination</td>
</tr>
<tr>
<td>B) stray, random</td>
<td>B) large sailing ship</td>
<td>B) refutation; response with contrary evidence</td>
</tr>
<tr>
<td>C) many-colored</td>
<td>C) flowing together</td>
<td>C) condition in which blood lacks red corpuscles</td>
</tr>
<tr>
<td>D) experienced</td>
<td>D) strong point or special talent</td>
<td>D) spiritual rebirth</td>
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</table>

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<tr>
<th>DEPOSE</th>
<th>ABEYANCE</th>
<th>MISNOMER</th>
</tr>
</thead>
<tbody>
<tr>
<td>A) investigate</td>
<td>A) any ulcerous sore; any evil</td>
<td>A) wrong name; incorrect designation</td>
</tr>
<tr>
<td>B) open widely</td>
<td>B) suspended action</td>
<td>B) change of form</td>
</tr>
<tr>
<td>C) decorate</td>
<td>C) shell or jewel carved in relief</td>
<td>C) hint</td>
</tr>
<tr>
<td>D) dethrone; remove from office</td>
<td>D) choice of two alternatives</td>
<td>D) flowing into</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EXPUNGE</th>
<th>CONCERTED</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>A) cancel, remove</td>
<td>A) mutually agreed on; done together</td>
<td></td>
</tr>
<tr>
<td>B) pretend</td>
<td>B) misleading</td>
<td></td>
</tr>
<tr>
<td>C) comprehend; investigate</td>
<td>C) feverish</td>
<td></td>
</tr>
<tr>
<td>D) decorate</td>
<td>D) suitable to debate on courts of law</td>
<td></td>
</tr>
</tbody>
</table>
Appendix H

15-Item Multiple Choice Tests
Synonym Test

Name (please print): ________________________

Each of the questions below consists of a word in capital letters, followed by four lettered words or phrases. Choose the lettered word or phrase that is most nearly similar in meaning to the word in capital letters and CIRCLE the letter of your choice.

1. INCARCERATE
   A) support
   B) imprison
   C) brighten
   D) obstruct

2. IMPERVIOUS
   A) obscure; puzzling
   B) not penetrable; not permitting passage through
   C) hollow
   D) attractive; agreeable

3. RETALIATE
   A) provide scantily
   B) pretend
   C) emancipate
   D) repay in kind (usually for bad treatment)

4. DISMEMBER
   A) work together
   B) cut into small parts
   C) recover
   D) disturb greatly

5. UNERRINGLY
   A) relating to an outline or diagram
   B) infallibly
   C) composed; grave
   D) requiring sitting

6. PROCLIVITY
   A) lack of seriousness or steadiness
   B) science of law
   C) inclination; natural tendency
   D) entire range

7. ATHEISTIC
   A) menacing
   B) expressing a low opinion
   C) having a common center
   D) denying the existence of God.

8. DECREPITUDE
   A) courtesy; civility
   B) brutal deed
   C) state of collapse caused by illness or old age.
   D) something that relieves pain

9. PRELUDE
   A) introduction; forerunner
   B) salary
   C) syllogism
   D) delicacy

10. ABROGATE
    A) fix or manipulate
    B) keep, employ
    C) go backwards
    D) abolish

11. CONCATENATE
    A) link as in a chain.
    B) settle comfortably
    C) follow
    D) make forceful and active

12. SUBALTERN
    A) narrow-minded; limited in scope
    B) prominent
    C) conscientious
    D) subordinate

13. EXPATRIATE
    A) beginning; origin
    B) people of standing
    C) beg
    D) exile

14. MISDEMEANOR
    A) implied comparison
    B) lassitude
    C) minor crime; bad conduct
    D) reading desk

15. ANALGESIC
    A) causing insensitivity to pain
    B) pertaining to soil deposits left by running water
    C) capable of using either hand with equal ease
    D) alimentary
Synonym Test

Name (please print): ____________________________

Each of the questions below consists of a word in capital letters, followed by four lettered words or phrases. Choose the lettered word or phrase that is most nearly similar in meaning to the word in capital letters and CIRCLE the letter of your choice.

1. INCONTINENT
   A) solemn
   B) loosely connected
   C) lacking self-restraint
   D) obscure

2. REGENERATION
   A) long life
   B) that which is hinted at or suggested
   C) spiritual rebirth
   D) state of being inappropriate

3. UNFEIGNED
   A) genuine; real
   B) childish
   C) powerful; strong; potent
   D) conspicuous; notable

4. PROMULGATE
   A) destroy completely
   B) abolish
   C) make known by official proclamation or publication
   D) flow smoothly

5. APOCRYPHAL
   A) antiquated; ancient
   B) untrue; made up
   C) sharp-cornered
   D) obscure and mysterious; occult

6. DEFOILATE
   A) make whole; combine; make into one unit
   B) destroy leaves
   C) begin, originate
   D) pass into or through; penetrate

7. PRESCIENCE
   A) comparison of one thing with another
   B) old age
   C) division; partition
   D) ability to foretell the future

8. ANOMALOUS
   A) hardened; unfeeling
   B) generous; showing bounty
   C) abnormal, irregular
   D) something that is normally distributed

9. ABSTAIN
   A) refrain; withhold from participation
   B) draw; outline; describe
   C) soften by soaking in liquid
   D) confuse; muddle

10. DISTEND
    A) expand; swell out
    B) collect
    C) increase or intensify
    D) relieve

11. CONCOCT
    A) commence
    B) prepare by combining; make up in concert
    C) enclose, place in something
    D) throw into confusion

12. IMPASSE
    A) predicament from which there is no escape.
    B) significance
    C) reflection; thought
    D) exaggeration

13. SUBMISSIVE
    A) loyal; unswerving
    B) yielding; timid
    C) sober, sedate
    D) lascivious; lustful

14. EXHUME
    A) bring upon oneself
    B) serve as evidence against
    C) dig out of the ground
    D) destroy completely

15. MISAPPREHENSION
    A) implied comparison
    B) fear
    C) error; misunderstanding
    D) peculiarity; eccentricity

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BIBLIOGRAPHY


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