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## Examining the Keyword Mnemonic Strategy as an Effective Academic Intervention for High School Students Labeled Emotional or Behavioral Disordered

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**EXAMINING THE KEYWORD MNEMONIC STRATEGY AS AN EFFECTIVE  
ACADEMIC INTERVENTION FOR HIGH SCHOOL STUDENTS  
LABELED EMOTIONAL OR BEHAVIORAL DISORDERED**

by

**Karen A. Kleinheksel**

**A Dissertation  
Submitted to the  
Faculty of The Graduate College  
in partial fulfillment of the  
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Degree of Doctor of Education  
Department of Educational Studies**

**Western Michigan University  
Kalamazoo, Michigan  
April 2005**

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ACADEMIC INTERVENTION FOR HIGH SCHOOL STUDENTS  
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**Karen A. Kleinheksel, Ed.D.**

**Western Michigan University, 2005**

This investigation explored whether keyword mnemonic strategies were effective for high school aged students labeled emotional or behavioral disordered (E/BD) in recalling the definitions of scientific vocabulary terms. Ten students labeled E/BD from a suburban public high school in a Midwestern state participated in this investigation. A demographic description of the subjects indicated the following information: (a) all students' ethnicities were Caucasian, (b) sixty percent of the subjects were male, (c) the average subject's age was 17 years 1 month, and (d) all students were in the tenth through twelfth grades.

In a multiple baseline across subjects design using a single probe technique, the investigator evaluated the students through written assessments covering scientific vocabulary terms based upon the district's curriculum. The investigator plotted and then visually analyzed the data collected from the written assessments on a line graph. The analysis of the data's characteristics indicated keyword mnemonic strategies were effective for these students in recalling the terms' meanings. The following characteristics of the graphed

data existed. Differences between the data points' means for the baseline and mnemonic intervention phases for all of the subjects existed. Differences between the baselines' ending value and the mnemonic intervention phases' beginning value for all subjects resulted. Trends in performance during the mnemonic intervention condition were present. Finally, no data overlapped in contiguous phases for all subjects.

This investigation's results support the findings of previous mnemonic research and extend these positive findings to high school students labeled E/BD. In addition, this investigation has implications for educational practice. Educators should teach the meanings of unfamiliar vocabulary utilizing the keyword mnemonic strategy to high school students labeled E/BD. If educators implement this strategy, then these students can successfully recall the meanings of unfamiliar vocabulary and thus have better educational outcomes.

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## CHAPTER I

### INTRODUCTION

Students with emotional or behavioral disorders (E/BD) have presented challenges to general (Heflin & Bullock, 1999; Sachs & Cheney, 1999) and special educators (Carlson, Brauen, Klein, Schroll, & Willig, 2002; Stempien & Loeb, 2002). The prevalence rate of this population and where they received services have changed (U.S. Department of Education, 2002). More and more, students identified as E/BD have received services in the general education environment (U.S. Department of Education, 2002). One of the most acute challenges for all teachers was effectively meeting the academic needs of these students. Unfortunately, the research regarding effective academic instruction was lacking (Gunter & Denny, 1998; Ruhl & Berlinghoff, 1992). However, one practice, mnemonic strategies, had positive results in the research with this population at the elementary and middle school levels (Cade & Gunter, 2002; King-Sears, 1989; Mastropieri, Emerick, & Scruggs, 1988; Nolan & Polloway, 1992). The aforementioned research indicated mnemonic strategies were effective for students labeled E/BD at those levels. No research existed investigating the effectiveness of mnemonic strategies for high school students labeled E/BD. This study's purpose was to determine if mnemonic strategies were effective for high school students labeled E/BD.



## Statement of the Problem

Students with E/BD frequently achieved below grade level in academic content areas (Blackorby, Chorost, Garza, & Guzman, 2003). Many had deficits in short term memory (STM) and long term memory (LTM), possessed weak attention skills, and had difficulty encoding and retrieving verbal information (Kamennui & Carnine, 1998). Consistent with the above characteristics, many students had difficulty learning content area vocabulary. Strategies successful with other populations receiving special education services in the elementary through middle school levels were mnemonic strategies (Scruggs & Mastropieri, 2000). These strategies helped students store and access unfamiliar content area vocabulary. Although mnemonic strategies were supported in the literature with students labeled E/BD in the elementary and middle school levels (Cade & Gunter, 2002; King-Sears, 1989; Mastropieri, Emerick, & Scruggs, 1988; Nolan & Polloway, 1992), no research existed regarding these strategies with high school aged students labeled E/BD. The purpose of this study was to explore whether keyword mnemonic strategies were effective for high school aged students identified as E/BD in recalling the definitions of scientific vocabulary terms.

### Keyword Mnemonic Strategies as an Effective Academic Intervention

Mnemonic strategies were devices for improving the memory (Mastropieri & Scruggs, 1991). Although different variations of mnemonic strategies existed, keyword mnemonic strategies increased students' memory of unfamiliar vocabulary

words and their meanings (Kleinheksel & Summy, 2003). This mnemonic method made unfamiliar vocabulary terms and their meanings more familiar through the following three-step process described by Atkinson (1975):

1. Reconstructing the term was the first step of this process. In this step, the student reconstructed the term into a keyword. A keyword was a similar sounding, familiar, and easily pictured word.
2. Relating the term was the second step. Here, the student related the selected keyword to the new information through an interactive picture or sentence.
3. Retrieving the term was the third step. The student retrieved the appropriate response through the following process: (a) the student recalled the keyword, (b) the student recalled the picture or sentence with the keyword, and (c) the student identified what occurred in that picture or sentence to recall the term's meaning (Atkinson, 1975).

### Significance of the Study

This investigation was significant for general and special educators as the most recent reauthorization of the "Individuals with Disabilities Education Act of 1997" (IDEA 97) (P.L. 94-142, 1997) indicated special education services were to be provided in general education classrooms when appropriate. The law stated:

"1) To the maximum extent appropriate, children with disabilities, including children in public or private care facilities, are educated with

children who are nondisabled: and 2) that special classes, separate schooling, or other removal of children with disabilities from the regular educational environment may occur only if the nature or severity of the disability is such that the education in regular classes with supplementary aids and services cannot be achieved satisfactory due to the nature or severity of the student's disability" (U.S. Department of Education, 1997, p. 55107).

Accompanying the above legislation, both the number of students identified as E/BD and the percentage of students identified as E/BD receiving educational services in the general education environment have increased in the United States (U.S. Department of Education, 2002). The number of students labeled E/BD increased 18.4% during 1991-1992 to 2000-2001 school years. In addition, the percentage of students serviced outside general education classrooms for less than 75 minutes of the school day increased from 14.9% in 1989-1990 to 25.8% in 1999-2000 (U.S. Department of Education, 2002).

#### Educators Lack Preparation for Students Labeled E/BD

Accompanying the increasing numbers, students with E/BD presented many challenges to educators who lack preparation to meet these challenges (Carlson, et al., 2002; Heflin & Bullock, 1999; Sachs & Cheney, 1999; Stempien & Loeb, 2002). Many students had numerous difficulties in school as demonstrated through low grade point averages (GPAs) and poor performances on standardized tests (Blackorby, et al., 2003; Wagner, D'Amico, Marder, Newman, & Blackorby, 1992).

In addition, they had high dropout rates (U.S. Department of Education, 2002) and high arrest rates (Wagner, et al., 1992).

As reported in numerous studies (Braaten, Kauffman, Braaten, Polsgrove, & Nelson, 1988; Cheney & Barringer, 1995; Heflin & Bullock, 1999; Sachs & Cheney, 1999; Turnbull & Rueff, 1997), general educators lacked preparation to teach students with E/BD. For example, Heflin and Bullock (1999) surveyed general and special education teachers from school districts in Texas. Both the general and special education teachers specified insufficient training and support from their school districts. Further, none of these schools prepared general education teachers for the inclusion of students labeled E/BD. These teachers reported they were uncertain of their abilities to provide suitable educational instruction to these students. Sachs and Cheney (1999) surveyed members of the Council for Children with Behavior Disorders regarding inclusion of students with E/BD. The respondents, mostly special education classroom teachers, indicated that general educators' skills to provide academic programs, even with the assistance from special education consultants, were inadequate. Subsequently, the authors suggested that transferring practices customarily done by special education teachers in smaller settings was problematic. General educators had difficulties applying individualized supports, especially when students exhibited complex behaviors. Furthermore, the authors recommended general educators receive inservices regarding academic instruction for this population.

Not only were general educators unprepared, but also multiple sources have indicated special educators were unprepared to meet the academic needs of this population (Carlson, et al., 2002; Maag & Katsyannis, 1999; MacMillan, 1999; Maroney, 2000; Stempien & Loeb, 2002; Whitaker, 2000). For example, Stempien and Loeb (2002) surveyed 36 teachers of students with E/BD and recommended training educators to incorporate new instructional strategies. In another example, the Study of Personnel Needs in Special Education (Carlson, et al., 2002) profiled beginning special educators that had less than three years of teaching experience. The authors found these teachers viewed their skills to be inadequate to accommodate diverse students' learning needs. Thus, these recommendations in the two above studies indicated an area of need for special education teachers to have instructional strategies for this population.

Accompanying the legislation that indicated special education services were to be provided in general education settings when appropriate, these increasing numbers of students with E/BD presented academic challenges to special and general education teachers. Multiple studies (Carlson, et al., 2002; Heflin & Bullock, 1999; Maag & Katsyannis, 1999; MacMillan, 1999; Maroney, 2000; Sachs & Cheney, 1999; Stempien & Loeb, 2002; Whitaker, 2000) indicated these teachers were unprepared to meet those needs. Thus, the research needed to address interventions pertaining to this academic underachievement of students identified as E/BD. A strong way to address this need was through research validated instructional practices for this population.

## Rationale for the Study

### Lack of Research on Academic Instruction

Appropriate educational programs for students with E/BD needed to provide effective instruction that addressed their academic needs (Johns, 2000; Johns, Crowley, & Gluetzloe, 2002; Kleinheksel & Summy, 2003; Reitz, 1994). However, academic skill instruction for these students was often left out of the research (Gunter & Denny, 1998; Ruhl & Berlinghoff, 1992) and practice (Center for Effective Collaboration and Practice, 1999; Knitzer, Steinberg, & Fleisch, 1990). For example, Gunter and Denny (1998) reviewed issues of Behavior Disorders from 1990-1996. This was a quarterly journal oriented toward practitioners of students with E/BD. Only eleven articles pertained to effective academic practices for this population. Moreover, Ruhl and Berlinghoff (1992) reviewed six special education journals that spanned over a decade. This search resulted in ten research articles pertaining to effective academic practices for this population. In a more recent review, this author reviewed issues of Behavioral Disorders from 1997-2003. This hand search found out of one hundred ninety-four articles, only seventeen pertained to effective academic practices for students labeled E/BD.

### A Gap in the Mnemonic Research

This aforementioned lack of research on academic skill instruction also included a lack of research on mnemonic strategies. Although research indicated mnemonic strategies were effective for students with E/BD at the elementary and

middle school levels (King-Sears, 1989; Mastropieri, Emerick, & Scruggs, 1988; Nolan & Polloway, 1992; Scruggs & Mastropieri, 2000), no research to date investigated the effectiveness of mnemonic strategies on the high school aged population with E/BD. Therefore, this study provided a much needed look into mnemonic strategies for high school aged students labeled E/BD. Data from this study added to the research base of effective academic strategies for this population.

### Overview of the Study

The investigator utilized a multiple baseline design across participants using a single probe technique, a single subject research design, to assess the effects of teaching ten students labeled E/BD to use a keyword mnemonic strategy to recall scientific vocabulary terms. A portion of the collected permanent product data consisted of written assessments evaluating the students' abilities to recall vocabulary terms completed in the baseline and intervention conditions. The investigator converted the written assessments, composed of matching definitions to the corresponding terms, to percentages of correct responses and then graphed these percentages using an Excel spreadsheet. Visual inspection was the primary method for analyzing the graphed data. The investigator examined the following characteristics of the graphed data through: (a) evaluating the changes in means, (b) evaluating the levels of performance, (c) evaluating the trend in performance through the quarter-intersect method, and (d) computing the percentage of overlap.

### Research Question

This investigation's design was used to determine if keyword mnemonic strategies were effective for high school aged students labeled E/BD in recalling the definitions of scientific vocabulary terms.

The four research null hypotheses corresponding to the above research question were as followed:

H<sub>01</sub> There were no differences between the data points' means for the baseline and intervention phases for each of the subjects.

H<sub>02</sub> There were no differences between the baseline's ending value and the intervention phase's beginning value for each of the subjects.

H<sub>03</sub> There were no trends in performance during the intervention conditions for each of the subjects.

H<sub>04</sub> There was no impact pertaining to the intervention as indicated by the percentage of overlapping data in contiguous phases.

### Assumptions

In order to answer the above research question and corresponding null hypotheses, this study assumed:

1. The investigator measured the students' recall of scientific vocabulary terms' definitions in quantifiable terms.
2. Students demonstrated their knowledge of scientific vocabulary terms' definitions through multiple choice written assessments.



## Summary

The increasing population of students labeled E/BD served in various settings presented educators with academic and behavioral challenges. One of the most pressing challenges for teachers was how to best meet this population's educational needs. Unfortunately, the research regarding effective instruction to meet these students' educational needs was lacking. Moreover, research indicated mnemonic strategies were effective with students labeled E/BD at the elementary and middle school levels and to date, no research investigated the effectiveness of keyword mnemonic strategies for these students' educational needs at the high school grade level. Thus, this investigation determined if keyword mnemonic strategies were effective for high school aged students labeled E/BD in recalling the definitions of scientific vocabulary terms.

A review of the literature regarding the academic characteristics of students with E/BD and keyword mnemonic strategies as effective instruction for these students was detailed in Chapter II. The study's single subject design, participants, procedures, and data analysis were explained in Chapter III. The investigation's results were reported in Chapter IV, and Chapter V integrated the results with current research and theory. Implications for educational practices and suggestions for further exploration with this population concluded the fifth chapter.

## CHAPTER II

### LITERATURE REVIEW

#### Introduction

Chapter II commenced by reviewing the characteristics of students labeled E/BD. The federal definition was presented for the purpose of defining the study's population. Then, prevalence rates and educational environments of students with E/BD were presented which indicated this increasing population of students received educational services in less restrictive educational settings (U.S. Department of Education, 2002). These students, who were primarily white males with deficits in emotional functioning, presented significant challenges to general and special educators including how to appropriately have met their academic needs. These students demonstrated numerous unmet academic needs as demonstrated by high absenteeism rates, high rates of failing classes, poor performance on standardized tests (Wagner, et al., 1992), low rates of high school completion (U.S. Department of Education, 2002), and dismal postschool outcomes (D'Amico & Blackorby, 1992).

Numerous sources (Center for Effective Collaboration and Practice, 1999; Knitzer, Steinberg, & Fleisch, 1990) indicated the education of students with E/BD lacked an academic focus and thus, highlighted the need for these students' teachers to implement effective instruction. The authors of the special education research literature on effective instruction reported mnemonic strategies were one of the most effective strategies as indicated by its high effect size. Overall, the research literature

presented three types of mnemonic strategies. These types included: (a) pegword method, (b) letter strategies, and (c) keyword method.

The research's positive results indicated mnemonic strategies were effective for students with and without disabilities. Although the majority of research involved students with learning disabilities, four empirical studies evaluating mnemonic strategy's effectiveness at the elementary and middle school levels existed. Themes from these studies were in the areas of: participants, content area taught, type of mnemonic, and reported results. However, no research existed regarding keyword mnemonic strategies, embedded in the information processing theory of memory, with high school students labeled E/BD. Therefore, this study investigated whether keyword mnemonic strategies were effective for high school aged students identified as E/BD in recalling the definitions of unfamiliar vocabulary terms.

### Characteristics of Students with E/BD

#### Federal Definition of Students with E/BD

This investigation's subjects have been labeled E/BD according to federal criteria set forth in The Education for All Handicapped Children Act, P.L. 94-142, (1975) and its subsequent reauthorizations, now Individuals with Disabilities Education Act (IDEA), P.L. 105-17, (1997). This act and its subsequent reauthorizations have used the following definition to characterize students with behavior and/or emotional disturbances:

(1) The term means a condition exhibiting one or more of the following characteristics over an extended period of time and to a marked degree that adversely affects a child's educational performance:

(A) An inability to learn that cannot be explained by intellectual, sensory, or health factors.

(B) An inability to build or maintain satisfactory interpersonal relationships with peers and teachers.

(C) Inappropriate types of behavior or feelings under normal circumstances.

(D) A general pervasive mood of unhappiness or depression.

(E) A tendency to develop physical symptoms or fears associated with personal or school problems.

(2) The term includes schizophrenia. The term does not apply to children who are socially maladjusted, unless it is determined that they have an emotional disturbance (Federal Register, 1981, p.4).

#### Prevalence of Students with Disabilities including E/BD

The U.S. Department of Education's *Twenty-fourth Annual Report to Congress on the Implementation of the Individuals with Disabilities Education Act* (2002) reported data on the number of children receiving special education services in the United States during the 2000-2001 school year under this law. Overall, the data indicated the following three points in the U.S. and the Midwestern state where the

study took place: (a) similar percentages of students with disabilities including E/BD existed, (b) the population of students with E/BD has been increasing, and (c) students with disabilities including E/BD have been educated in less restrictive environments. In 2000-2001, the number of 6-21 year old students with disabilities was 5,775,722 or 8.72% [SIC] of the U.S. population. For 6-21 year old students with E/BD, the number was 473,663 or .72% of the U.S. population (see Table 1).

Table 1

The Number and Percentage of 6-21 year old Students Served under I.D.E.A in the United States during the 2000-2001 School Year

Disability	Numbers	Percentage of population
All disabilities	5,775,722	8.72%
Emotional disturbance	473,663	.72%

In this Midwestern state, prevalence rates for students with disabilities and E/BD corresponded to those reported nationwide. In 2000-2001, the number of 6-21 year old students with disabilities was 201,519 or 8.6% of the resident population. For 6-21 year old students with E/BD, the number was 19,147 or .82% of the resident population (U.S. Department of Education, 2002) (see Table 2).

The percentage of students identified as E/BD increased 18.4% from 400,211 in 1991-1992 to 473,663 in 2000-2001 in the U.S. (U.S. Department of Education, 2002). In this Midwestern state, the percentage of students identified as E/BD

Table 2

The Number and Percentage of 6-21 year old Students Served under I.D.E.A. in this  
Midwestern State during the 2000-2001 School Year

Disability	Numbers	Percentage of population
All disabilities	201,519	8.60%
Emotional disturbance	19,147	.82%

increased 18% from 15,331 in 1991-1992 to 19,147 in 2000-2001 (see Table 3) (U.S.  
Department of Education, 2002).

Table 3

Numbers of Students Identified as E/BD in the United States and the Midwestern  
State during 1991-1992 and 2000-2001

Location	1991-1992	2000-2001	Percent change in number
United States	400,211	473,663	18.40%
Midwestern state	15,331	19,147	18.00%

### E/BD Demographics

Multiple studies and reports (Friedman, Kutash, & Duchnowski, 1996;  
Greenbaum, Dedrick, Friedman, Kutash, Brown, Lardieri, & Pugh, 1998; Quinn &  
Epstein, 1998; U.S. Department of Education, 2002) indicated students with E/BD  
were primarily white males with significant deficits in emotional functioning. White  
students composed 62.60% of students ages 6-21 years old labeled E/BD during the

2000-2001 school year (U.S. Department of Education, 2002). In addition, these authors reported African Americans were overrepresented in this disability category. For instance, 26.65% of students ages 6-21 years old labeled E/BD during the 2000-2001 school year were black (U.S. Department of Education, 2002).

### Educational Environments

The U.S. Department of Education's *Twenty-fourth Annual Report to Congress on the Implementation of the Individuals with Disabilities Education Act* (2002) reported data on the educational environments of children receiving special education services in the United States during the 1999-2000 school year under this law. The percentage of students with disabilities educated in regular school buildings increased from 94.00% in 1989-1990 to 95.92% in 1999-2000 (U.S. Department of Education, 2002). Furthermore, the number of students served in separate facilities decreased from 6.00% in 1990-1991 to 4.07% in 1999-2000 (see Table 4). In 1999-2000, only 25.80% of students with E/BD received educational services in general education environments with no more than one hour and fifteen minutes of the school day served in special education as compared to 47.32% of students with all disabilities (see Table 5).

The percentage of students with disabilities educated in regular school buildings steadily increased from 87.27% in 1989-1990 to 92.79% in 1999-2000 in this Midwestern state. Furthermore, the percentage of students served in separate facilities decreased from 12.73% in 1989-1990 to 7.21% in 1999-2000 (see Table 4)

**Table 4**

**Percentages of Students with Disabilities Educated in the Regular School Buildings during 1989-1990 and 1999-2000**

	U.S.		Midwestern state	
	1989-1990	1999-2000	1989-1990	1999-2000
Regular school	94.00	95.92	87.27	92.79
Separate school	6.00	4.07	12.73	7.21

**Table 5**

**Percentage of Students Ages 6-21 with Disabilities Served No More than One Hour and Fifteen Minutes of the School Day Served in Special Education During the 1999-2000 School Year**

	U.S.	Midwestern state
All disabilities	47.32	45.25
Emotional disturbances	25.80	30.14

Source: U.S. Department of Education, Office of Special Education Programs, Data Analysis System (DANS).

(U.S. Department of Education, 2002). In 1999-2000, only 30.14% of students with E/BD received educational services in general education environments with no more than one hour and fifteen minutes of the school day served in special education as compared to 45.25% of students with all disabilities (see Table 5). Thus, these percentages in this Midwestern state and in the U.S. indicated a trend toward students with disabilities receiving educational services in less restrictive settings. However,



the progression of serving students labeled E/BD in less restrictive settings was slower compared to other students with disabilities.

### Academic Characteristics of Students with E/BD

In addition to behavior problems, many of these students have significant academic problems (Bauer & Shea, 1999; Epstein & Cullinan, 1983; Epstein, Kinder, & Bursuck, 1989; Farrell, Critchley, & Mills, 1999; Gajar, 1980; Greenbaum, et al., 1998; Gresham, Lane, MacMillan, & Bocain, 1999; Kameenui & Carnine, 1998; Kauffman, 1997; Luebke, Epstein, & Cullinan, 1989; Maheady, Sacca, & Harper, 1988; Scruggs & Mastropieri, 1986). Many high school aged students with E/BD demonstrated these problems through (a) high absenteeism rates, (b) high rates of failing classes, (c) poor performances on standardized tests (Wagner, et al., 1992), and (d) low rates of high school completion (Lichtenstein & Zantal-Weiner, 1988; U.S. Department of Education, 2002; Wagner, et al., 1992). Furthermore, many of these students had dismal postschool outcomes such as low levels of employment (D'Amico & Blackorby, 1992).

### Rates of Absenteeism

Students with E/BD demonstrated significant academic problems through high rates of absenteeism. These students were absent from school an average of 18-20 days per year. For example, 11<sup>th</sup> grade students with E/BD averaged 19.7 absences per year while 11<sup>th</sup> grade students with other disabilities averaged 16.4 absences per

year (see Table 6 for other grade levels). The high rates of absenteeism suggested these students were disengaged from school (Wagner, et al., 1992).

Table 6  
Average Number of Days Absent by Secondary Students

Grade	Students with E/BD	Students with other disabilities
9 <sup>th</sup>	17.9	14.8
10 <sup>th</sup>	18.1	15.0
11 <sup>th</sup>	19.7	16.4
12 <sup>th</sup>	17.9	14.5

Source: Wagner, M., D'Amico, R., Marder, C., Newman, L., & Blackorby, J. (1992). *What happens next? Trends in postschool outcomes of youth with disabilities. The second comprehensive report from the National Longitudinal Transition Study of Special Education Students*. Menlo Park, CA: SRI International.

#### Rates of Failing Classes

Students with E/BD had documented significant academic problems as evidenced by high rates of failing classes. For example, 54.1% of 11<sup>th</sup> grade students labeled E/BD failed one course as compared to 37.5% of other students with disabilities (see Table 7). Failing classes resulted in these students' GPAs being lower on average as compared to other students with disabilities. For example, 9<sup>th</sup> graders' with E/BD average GPA was 1.7 as compared to 9<sup>th</sup> graders' with other disabilities average GPA was 2.0 (see Table 8 for other grade levels) (Wagner, et al., 1992).

Table 7  
Percentage of Students who Failed a Course

Grade	Students with E/BD	Students with other disabilities
9 <sup>th</sup>	56.5	42.7
10 <sup>th</sup>	56.7	43.9
11 <sup>th</sup>	54.1	37.5
12 <sup>th</sup>	30.4	23.1

Source: Wagner, M., D'Amico, R., Marder, C., Newman, L., & Blackorby, J. (1992). *What happens next? Trends in postschool outcomes of youth with disabilities. The second comprehensive report from the National Longitudinal Transition Study of Special Education Students*. Menlo Park, CA: SRI International.

#### Standardized Test Performances

Students with E/BD demonstrated significant academic problems in the area of standardized tests. According to the National Longitudinal Transition Study of Special Education Students (NLTS) (Wagner et al., 1992), students with E/BD

Table 8  
Grade Point Averages of Secondary Students

Grade	Students with E/BD	Students with other disabilities
9 <sup>th</sup>	1.7	2.0
10 <sup>th</sup>	1.7	2.0
11 <sup>th</sup>	1.9	2.1
12 <sup>th</sup>	2.2	2.3

Source: Wagner, M., D'Amico, R., Marder, C., Newman, L., & Blackorby, J. (1992). *What happens next? Trends in postschool outcomes of youth with disabilities. The second comprehensive report from the National Longitudinal Transition Study of Special Education Students*. Menlo Park, CA: SRI International.

performed below grade levels on standardized tests as reported by teachers. On average, these students tested 2.2 grade levels below their actual grade level in reading and 1.8 grade levels below their actual grade level in mathematics.

Furthermore, other research (Anderson, Kutash, & Duchnowski, 2001; Epstein & Cullinan, 1983; Maheady, Sacca, & Harper, 1988; Scruggs & Mastropieri, 1986) demonstrated deficits in basic academic achievement for students with E/BD.

Anderson, Kutash and Duchnowski (2001) studied math and reading progress of forty-two students with E/BD over a five-year period through using achievement test scores. The students, 86% of whom were male, had an average IQ score of 95.31.

The above investigators measured these students' academic achievement at two separate times, five years apart. They took the first measurement when the students were either in kindergarten or 1<sup>st</sup> grade, and took the second measurement five years later when the students were either in the 5<sup>th</sup> or 6<sup>th</sup> grades. These investigators used the following instruments: (a) Kaufman Test of Educational Achievement (Kaufman & Kaufman, 1985), (b) the Peabody Individual Achievement Test-Revised (Dunn & Markwardt, 1988), and (c) the Woodcock Johnson Test of Achievement-Revised (Woodcock & Johnson, 1989). These students' average reading test achievement scores were 85.43 and 85.67, and the average math test achievement scores were 82.43 and 84.45, when measured for the first and second time, respectively.

Therefore, the scores demonstrated deficits in academic achievement.

### High School Completion Rates

Students with E/BD had significant academic problems in the area of high school completion rates. Students with E/BD had high dropout rates (Lichtenstein & Zantal-Weiner, 1988; U.S. Department of Education, 2002; Wagner, et al., 1992). Data from the NLTS (Wagner, et al., 1992), indicated 56.3% of students with E/BD dropped out, 40% of students with E/BD graduated from high school, and 3.7% of students with E/BD aged out (Wagner, et al., 1992). Similarly, the 24th Annual Report to Congress (U.S. Department of Education, 2002) reported students with E/BD have the highest dropout rate. In the 1999-2000 school year, 51.4% or 19,032 students with E/BD dropped out of school, whereas, 40.1% or 14,842 students with E/BD graduated with a standard diploma.

### Postschool Outcomes

Academic problems of students with E/BD frequently have led to failure in later life (Meadows, Neel, Scott, & Parker, 1994; Ruhl & Berlinghoff, 1992). As reported in the NLTS, these students had low rates of post-secondary school enrollments and low levels of employment three to five years out of high school. For example, only 32.5% of the students with E/BD that graduated enrolled in a post-secondary institution as compared to 78% of students in general education (Marder, 1992). Furthermore, 47.4% of the students with E/BD were employed as compared to 69.4% of the students in general education after leaving high school (D'Amico & Blackorby, 1992). Similarly, Carson, Sitlington, and Frank's (1995) employment

data reported that 55% of the graduates with E/BD and 36% of the dropouts with E/BD were employed one year after graduation. Three years after graduation, these employment rates increased to 68% of the graduates with E/BD and 60% of the dropouts with E/BD.

### Effective Instruction for Students with E/BD

The increasing population of students with E/BD receiving educational services in more inclusive settings presented numerous challenges for both general educators (Heflin & Bullock, 1999; Sachs & Cheney, 1999) and special educators (Carson, et al., 2002; Stempien & Loeb, 2002). In addition to behavior problems, these students presented academic deficits to educators. Several reports (Center for Effective Collaboration and Practice, 1999; Knitzer, Steinberg, & Fleisch, 1990) indicated teachers were not implementing effective academic strategies for this population although it might have been possible to overcome academic deficits through the use of intervention strategies.

Numerous sources (Center for Effective Collaboration and Practice, 1999; Knitzer, Steinberg, & Fleisch, 1990; MacDonald & Speece, 2001) highlighted the need for teachers to implement effective instruction since a lack of focus on academic instruction for this population existed. In 1990, Knitzer, Steinberg and Fleish focused upon programs for students with E/BD in their report, *At the School House Door: An Examination of Programs and Policies for Children with Emotional and Behavior Problems*. Their findings indicated several disturbing patterns in these students'

programs. One major finding was the curriculum's primary focus upon behavior management and limited attention to these students' academic achievement. The authors described the lack of focus on academics as "curriculum bleakness". Nearly a decade later, the Center for Effective Collaboration and Practice (1999) reported students with E/BD received services heavily concentrated on their behavior and less focused on their academic needs. The authors questioned this focus on behavior and recommended programs addressing both the academic and behavior needs.

Although this population lacked a clear focus on academic instruction, instructional methods grounded in the literature pertaining to effective instruction were suggested (Gunter, Hummel, & Venn, 1998). Students with E/BD needed effective instructional strategies (Johns, 2000). A strong way to provide these students with successful instructional strategies was through mnemonic devices. "Mnemonic strategies are excellent candidates for use with students with E/BD precisely because they are enjoyable, engaging and highly successful" (Scruggs & Mastropieri, 2000, p. 13).

### Mnemonic Strategies

Mnemonics was defined as "a technique or device for improving or strengthening the memory" (Mastropieri & Scruggs, 1991, p. ix). This definition's authors conducted the majority of the mnemonic research in the special education research. Mnemonic strategies have been traced back to various points in history. The ancient Greeks, a culture that highly prioritized fully developed memory abilities,

utilized these strategies (Mastropieri & Scruggs, 1991). In an ancient Greek legend, an orator named Simonides developed mnemonics while he recited a poem at a nobleman's dinner party. After Simonides's recitation, part of the nobleman's roof collapsed on the dinner party, killing and disfiguring the guests beyond recognition. Simonides identified all the deceased guests because he remembered the image of the seating arrangement. Simonides gained the insight that mental imagery was useful in developing memory skills from this tragic event. Thus, he continued to develop mnemonics which were widely used in ancient times (Mastropieri & Scruggs, 1991).

Interest in memory including mnemonic strategies increased during the 20<sup>th</sup> century (Mastropieri & Scruggs, 1991). Raugh and Atkinson (1975) demonstrated the effectiveness of mnemonic strategies in teaching Russian vocabulary to college students. Numerous research studies (King-Sears, 1989; Mastropieri, Emerick, & Scruggs, 1988; Mastropieri, Scruggs, Levin, Gaffney, & McLoone, 1985; Nolan & Polloway, 1992; Pressley, Levin, & Delaney, 1982) have since validated and extended this research to other applications including classroom teaching. "Overall, three types of mnemonic strategies have been studied: (a) the keyword method, (b) the pegword method, and (c) letter strategies." (Scruggs & Mastropieri, 2000, p. 164). Each strategy had an appropriate use depending upon the type of information to be recalled.



### Pegword Method

The pegword method, appropriate for remembering ordered or numbered information, was the first strategy supported in the research (Mastropieri, Scruggs, & Levin, 1985; Mastropieri, Scruggs, & Whedon, 1997). Pegwords were brief words that rhymed with numbers such as: (a) bun was the pegword for one, (b) shoe was the pegword for two, and (c) tree was the pegword for three (Mastropieri & Scruggs, 1991). An example of the pegword method that teaches the mineral crocoite was number two on the Mohs hardness scale was provided by Mastropieri, Scruggs, and Levin (1985). These investigators combined the pegword shoe for the number two with the keyword of crocodile for crocoite. To recall that crocoite, a mineral, was number two on the Mohs scale, the above investigators provided an illustration of a crocodile wearing shoes.

### Letter Strategy

The second strategy supported in the research (Scruggs & Mastropieri, 1989) was the letter strategy. Teachers appropriately used this strategy, which included acronyms and acrostics, when familiar information needed prompting so the students successfully recalled that information. For example, Mastropieri and Scruggs (1991) provided an example of an acronym, one of the letter strategies, to prompt the student's recollection of the five Great Lakes. The acronym was HOMES. Each of the letters in HOMES represented the first letter of the Great Lakes as follows: (a) H

was for Huron, (b) O was for Ontario, (c) M was for Michigan, (d) E was for Erie, and (e) S was for Superior.

### Keyword Method

The third strategy supported in the research (Condus, Marshall, & Miller, 1986; King-Sears, 1989; Mastropieri, Emerick, & Scruggs, 1988; Mastropieri, Scruggs, & Fulk, 1990; Nolan & Pollaway, 1992; Scruggs, Mastropieri, & Levin, 1985) was the keyword method. Teachers appropriately used this method for learning and retaining unfamiliar vocabulary terms. This mnemonic method made unfamiliar vocabulary terms more familiar through the following three-step process described by Atkinson (1975).

In order to implement the keyword method with vocabulary terms, Atkinson (1975) described the three R's, a three-step process. The first R stood for reconstruction. The teacher reconstructed the term into a keyword in this step. A keyword was a similar sounding, familiar, and easily pictured word. The second R stood for relating. In the second step, the teacher related the selected keyword to the to be acquired information through an interactive picture or sentence. The third step was retrieval. Finally, the student retrieved the appropriate response through the following process: (a) the student recalled the keyword, (b) the student recalled a picture or sentence with the keyword and identified what occurred in that picture or sentence to recall the correct answer.

An example of the keyword method that teaches jettison, the unfamiliar vocabulary term, meant to throw overboard was provided by Uberti, Scruggs, and Mastropieri (2003). The selected keyword for jettison was jet. To recall the meaning of jettison was to throw overboard, the above investigators illustrated a jet having cargo thrown overboard.

#### Mnemonic Strategies for Students without Disabilities

The initial research indicated mnemonic instruction was effective for students without disabilities in recalling the meanings of foreign language vocabulary (Higbee, 1979). This research (Raugh & Atkinson, 1975) commenced at the college level with positive results. The research (Levin, Pressley, McCormick, Miller, & Shriberg, 1979) extended these positive results to elementary and high school aged populations in general education. Subsequent investigations (Hwang & Levin, 2002; Pressley, Levin, Kuiper, Bryant, & Michener, 1981) successfully employed other subject areas with students in general education classrooms.

#### Mnemonic Strategies for Students with Disabilities

Research indicated mnemonic strategies were effective for students receiving special education services in various subject areas. Although the majority of the research involved students with learning disabilities (Bryant, Goodwin, Bryant, & Higgins, 2003; Maccinni & Ruhl, 2000; Mastropieri & Scruggs, 1994; McLoone, Scruggs, Mastropieri, & Zucker, 1986; Uberti, Scruggs, & Mastropieri, 2003), other

investigations demonstrated the strategy's effectiveness for students with cognitive impairments (Hetzroni & Shavit, 2002; Mastropieri, Scruggs, Whittaker, & Bakken, 1994).

### Mnemonic Strategies for Students with E/BD

Using mnemonic strategies in the classroom had been identified as one of the most effective academic strategies for students receiving special education services including students labeled E/BD (Lloyd, Forness, & Kavale, 1998). Mnemonics strategies had withstood the dual tests of ten years' time and multiple settings as revealed by a meta-analysis of effective practices in special education (Forness, Kavale, Blum, & Lloyd, 1997). The investigators examined many studies of a particular strategy in the aforementioned meta-analysis. A numerical indicator of the relative strategy's effectiveness was averaged across all studies. This numerical indicator was specified as an effect size (ES). An ES of .40 or greater was considered significant (Cohen, 1988). For instance, mnemonic strategies earned an effect size of 1.62. This high number indicated mnemonics were not only an effective teaching practice, but also associated with the strongest effect sizes reported in the special education research literature. Some interventions resulted in low numbers indicating that the intervention has not worked. For example, special class placement resulted in a negative effect size of -.12.

### Supporting Research

Research indicated mnemonic instruction was effective for elementary and middle school aged students with E/BD (see Table 9 for a brief overview) although the majority of the mnemonic instructional research had been conducted on students with learning disabilities (Kleinheksel & Summy, 2003; Mastropieri & Scruggs, 1994). The research indicated mnemonic strategies were effective at the elementary and middle school levels (King-Sears, 1989; Mastropieri, Emerick, & Scruggs, 1988; Nolan & Polloway, 1992) as evidenced by a search utilizing the search engine ERIC (2003) and a hand search of research journals in the field of E/BD. The ERIC search, conducted through using keywords related to E/BD and mnemonics, resulted in three studies. A hand search located a fourth study. The investigator conducted this hand search over the past five years of *Behavioral Disorders* and the *Journal of Emotional Behavioral Disorders*. These two journals have high circulation rates in the field of E/BD. Keywords used were behavior disorder, emotional disturbance, mnemonic, and mnemonics. No studies regarding mnemonic instruction for high school aged students with E/BD existed. However, four studies investigated mnemonic strategies with this population at the elementary and middle school levels. Table 9 listed the investigators, subjects, type of mnemonic, content, and setting of these four studies.

Although only four studies pertaining to mnemonic strategies with this population were found, the following paragraphs described the emerging themes from these studies. These themes pertained to the participants, the content area taught, the type of mnemonic, and the reported results. First, the themes pertaining to the

Table 9

Review of Mnemonic Instruction with Students with E/BD

Investigators	Subjects	Type of Mnemonic	Content	Setting
Mastropieri, Emerick & Scruggs (1988)	8 students ages 7-11	keyword mnemonic	science vocabulary	separate school
King-Sears (1989)	37 students that included 7 with EBD ages 11-15	keyword mnemonic	science vocabulary	resource room
Nolan & Polloway (1992)	2 students ages 11.5 and 13	keyword mnemonic	science vocabulary	separate school
Cade & Gunter (2002)	3 students ages 11-14	musical mnemonics	math division facts	self-contained classroom

participants were as follows: (a) all of the participants included in these studies were classified as E/BD according to federal, state, and local criteria, (b) the number of participants in the reviewed studies ranged from two (Nolan & Polloway, 1992) to eight (Mastropieri, Emerick, & Scruggs, 1988) with an average of five participants per study, (c) 85% of the studies' participants were male, and (d) all participants were in the elementary and middle school levels.

The content area of science was the emerging second theme from these studies. Three (King-Sears, 1989; Mastropieri, Emerick, & Scruggs, 1988; Nolan & Polloway, 1992) of the four studies' content area selected were science. The fourth study's (Cade & Gunter, 2002) content area was math.

The third theme pertained to the types of mnemonic strategies used for these studies. Three (King-Sears, 1989; Mastropieri, Emerick, & Scruggs, 1988; Nolan & Polloway, 1992) of the four studies used keyword mnemonic strategies. The fourth study (Cade & Gunter, 2002) used a musical mnemonic strategy.

The fourth theme pertained to the positive results of the studies. All of the studies supported mnemonic strategies as an effective intervention for the aforementioned participants. One student's baseline score rose from 4% to 96% items correct after one mnemonic intervention was employed in Cade and Gunter's (2002) study. The participants reported positive feedback regarding the use of mnemonic strategies in the majority of studies (King-Sears, 1989; Mastropieri, Emerick, & Scruggs, 1988; Nolan & Polloway, 1992).

## Memory Theory

The aforementioned studies and themes documented the effectiveness of mnemonic strategies. These strategies were embedded in the information processing theory of memory. "Memory is the ability to encode, process and retrieve information that one is exposed to" (Swanson & Cooney, 1991, p. 104). Memory and learning in school were interrelated, and deficits in memory led to difficulties in school (Brown, 1979) given this definition. The literature contained several theories of memory, including the information processing theory of memory. The information processing theory of memory provided the theoretical basis for this investigation as it has been the most common model (Woolfolk, 1998).

### Information Processing Theory of Memory

The information processing theory described how the mind processed, stored, and retrieved knowledge (Slavin, 2003). Most of the information processing theories of memory emerging from Atkinson and Shiffrin (1968, 1971) contained three major stages: (a) sensory register, (b) short-term memory (STM), and (c) long-term memory (LTM) (see Table 10 for a brief summary of these components). This three stage model provided the setting for the ensuing studies of memory (Kosslyn & Rosenberg, 2004). "Raw information flows from the senses into the sensory registers, where it is processed in terms of existing knowledge and information. Information that is determined to be meaningful is passed on for further processing in the short term memory; the rest is discarded" (Morris, 1996, p. 231). Although the sensory



Table 10

## The Information Processing System of Memory

Store	Duration	Capacity
Sensory register	1-4 seconds	Unlimited
Short-term memory	15-20 seconds	Approximately 4 pieces of information
Long-term memory	Long	Unlimited

Source: Morris, C.G. (1996). *Psychology: An Introduction*. Upper Saddle River, NJ: Prentice Hall.

register contained an unlimited capacity for incoming information (Cowan, 1988; Ormrod, 1998), its brief retention was as followed: (a) visual information's duration was less than 1 second, (b) tactile information's duration was 2-3 seconds, and (c) auditory information's duration was up to 4 seconds (Henson & Eller, 1999). All the investigation's tactile, visual, and auditory information flowed into the subject's sensory register. The auditory information, including the investigator's verbal reading of the script, lasted up to four seconds in the subject's sensory register.

The STM received the information perceived and attended to in the sensory register (Squire, Knowlton, & Musen, 1993). With this newly entered information, the STM either: (a) disregarded the information, (b) retained the information in STM through rehearsal, or (c) transferred that information to LTM through encoding (Eggen & Kauchak, 1997). A person's STM held seven plus or minus two pieces of information according to Miller (1956). However, recent research suggested the number was about four pieces of information (Cowan, 2001). Information

disappeared in 15 to 20 seconds unless it was rehearsed or practiced once it reached the STM (Morris, 1996). The investigation's subjects transferred the mnemonic information from the sensory register into the STM. This information was in the STM when the subject verbally recalled the term's meaning during the treatment further described in Chapter III.

Finally, selected information from the STM entered the LTM, which was the last part of the human memory system. LTM was the "portion of memory that is more or less permanent and that corresponds to everything we 'know'" (Morris, 1996, p. 238). LTM had an unlimited capacity (Banikowski & Merhing, 1999) and held a large amount of information for long periods of time (Kosslyn & Rosenberg, 2004). In fact, its exact duration had not been determined (Eysenck & Keane, 1990). The investigation's subjects stored the vocabulary terms and their meanings in the LTM as demonstrated by the high percentages of terms recalled on the written assessments after the treatment further described in Chapter IV and Chapter V.

Multiple factors affected learning within the information processing theory of memory. One factor, the meaningfulness effect, stated words that were more meaningful were easier to recall than others that were less meaningful (Good & Brophy, 1995). Mnemonic strategies enhanced this meaningfulness (Deshler, Ellis, & Lenz, 1996).

## Summary

The lack of studies specific to mnemonic strategies for high school aged students with E/BD indicated a clear need for research in this area. Not only this student population increased, but also these students received educational services in less restrictive settings. The increasing population and placement trends presented challenges for both general and special education teachers including how to have met students' academic needs. These students had numerous unmet academic needs as demonstrated through high number of absences, low GPAs, poor performance on standardized tests, high drop out rates, and dismal postschool outcomes.

One method to remediate these academic deficits was for teachers to provide effective instruction to these students. Research indicated mnemonic strategies were effective for students receiving special education services in various subject areas. Although the majority of research involved students with learning disabilities, four empirical studies evaluating the effectiveness of mnemonic strategies for students with E/BD in the elementary and middle school levels existed. This study was the first to assess the effectiveness of mnemonic strategies for high school aged students with E/BD through a multiple baseline across participants design.

## CHAPTER III

### DESIGN AND METHODOLOGY

#### Introduction

This investigation explored whether keyword mnemonic strategies were effective for high school aged students labeled E/BD in recalling the definitions of scientific vocabulary terms. The research foundation section explored the investigation's design, a multiple baseline design (Alberto & Troutman, 2003; Kazdin, 2001; Zirpoli & Melloy, 2001) using a single probe technique, and included this design's advantages and disadvantages. The method section described this study's participants, investigator, and setting. Ten students labeled E/BD and one investigator, who was a doctoral candidate and a certified special education teacher, participated in this study. This investigation took place at a Midwestern high school. In addition, this method section detailed the procedures for obtaining consent and assent from the ten participants. Next, the procedures section described the implementation of the mnemonic intervention in the following three phases: (a) pretreatment baseline assessment, (b) treatment, and (c) post treatment baseline assessment. Then, the investigator delineated the investigation's data collection method, which included scoring procedures for both the written assessments completed by the participants during the intervention and time sampling data collection forms completed by the independent observers assessing treatment fidelity. Next, the investigator discussed reliability pertaining to interobserver agreement and

content validity of the vocabulary terms. Following reliability and validity, the data analysis section explained the process of graphing the data into an Excel spreadsheet and subsequent visual inspection of these graphs. Characteristics visually inspected in a multiple baseline design included: (a) evaluating the changes in means, (b) evaluating levels of performance, (c) evaluating the trend in performance through the quarter-intersect method, and (d) computing the percentage of overlap (Alberto & Troutman, 2003). Finally, the investigator discussed this study's hypothesis and limitations.

#### Research Foundation

The multiple baseline design was defined as "a single case design that involves a series of A-B designs; includes the placement of individual graphs on top of each other..." (Martella, Nelson, & Marchand-Martella, 1999, p. 559). Variations of the multiple baseline design included: (a) multiple baseline design across subjects, (b) multiple baseline design across behaviors, and (c) multiple baseline designs across situations (Alberto & Troutman, 2003; Kazdin, 2001; Zirpoli & Melloy, 2001). This study employed a multiple baseline design across subjects using a single-probe technique.

More specifically, this study utilized a multiple baseline design across subjects using a single-probe technique to examine the effects of keyword mnemonic strategies on the accuracy of recalling scientific vocabulary terms by ten students labeled E/BD. This type of design was appropriate when the participant was unable to

perform the behavior (Alberto & Troutman, 2003). "The multiple baseline design across subjects is especially suited to situations in which a particular behavior or set of behaviors in need of change is constant among different persons." (Kazdin, 1982, p. 34). Further, the design was conducive to the classroom where the target behavior was a high need for all individuals (Kazdin, 1982). The investigator conducted probe trials or single trials during baseline sessions to confirm if the student was unable to match the appropriate definitions with their corresponding terms.

Multiple baseline designs simultaneously gathered data on specific dependent variables (Alberto & Troutman, 2003; Maag, 1999). The investigator first collected data under baseline conditions for each subject. Although no agreed upon number of data points for baseline conditions existed (Krishef, 1991), the literature (Barlow & Hersen, 1984; Wolf & Risley, 1971) recommended a minimum of three baselines per subject. Subjects demonstrating a lack of competence on the pretreatment baseline assessment indicated no competence and the investigator had not gathered further pretreatment baseline measures. The investigator implemented the intervention condition only on the first subject after establishing a baseline on that subject. While this first subject received the intervention condition, the other subjects were in baseline conditions. The second subject received the intervention after the first subject reached a trend in the preferred direction of three successive data points. This succession continued until the investigator applied the intervention to all of the study's subjects (Alberto & Troutman, 2003; Kazdin, 2001; Maag, 1999).

The investigator inspected data collected from the multiple baseline design across subjects for a functional relationship within the independent and dependent variables. A functional relationship was defined as “A quasi-causative relationship between the dependent and independent variables. This relationship existed if the dependent variable systematically changes into the desired direction as a result of the introduction and manipulation of the independent variable” (Alberto & Troutman, 2003, p. 534). One may have appropriately assumed a functional relationship if each dependent variable successively changed when the investigator implemented the independent variable.

#### Design Advantages and Disadvantages

Multiple baseline designs had advantages and disadvantages (Martella et al., 1999). One advantage was these designs were well suited for classroom use since a functional relationship was established without needing to remove the intervention. Thus, restoring baseline conditions was unnecessary which made the design appropriate for acquiring skills. The design’s disadvantages included: (a) the necessity for two baselines existed, (b) subjects may have required lengthy baselines, (c) diminished experimental control as compared to other designs existed, (d) increased design considerations were necessary (Martella et al., 1999), and (e) in some cases altering the behavior of one person influenced other persons who have yet to receive the intervention (Kazdin, 1982). Several components must be considered such as having at least three stable data points during the treatment phase to overcome

these weaknesses. Additionally, if each participant's baseline changed after the introduction of the intervention in a multiple baseline across participants design, then this demonstrated the essential requirement for establishing clear effects of this intervention (Kazdin, 1982).

Multiple baseline designs have been a frequently used research design with this population. This study's investigator completed a hand search of the 2002 and 2003 issues of Journal of Applied Behavior Analysis, a quarterly journal publishing reports of research involving the experimental analysis of behavior to problems of social significance. Approximately 24% or 11 of the 46 research articles contained multiple baseline designs across participants, settings, and/or behaviors. The number of subjects ranged from 1 to 5 and the mean was approximately 2.8 subjects per study.

## Method

### Participants

In order to assess this investigation's research question as stated in Chapter I, ten students labeled E/BD attending a Midwestern suburban high school participated in this study. These subjects ranged in ages from sixteen to eighteen years old. Each subject had a signed assent (see Appendix A) and consent form (see Appendix B) in order to participate in the study.

Although not necessary within single subject research, the number of subjects reflected a sample of students labeled E/BD at the high school based upon this



population's percentages in this Midwestern state. In the 2000-2001 school year, 19,147 students were identified as E/BD or .82% of the population based upon the 2000 census in this Midwestern state (U.S. Department of Education, 2002). These students received educational services in a variety of environments in the 1999-2000 school year with 85% of them educated in their regular public schools. The educational environments of the regular public schools in this Midwestern state were as followed: (a) 5,552 students educated in regular classes, (b) 4,922 educated in resource rooms, and (c) 5,272 educated in separate classes (see Table 11) (U.S. Department of Education, 2002). The participants attended a Midwestern suburban high school which had an enrollment of 1180 students (Standard & Poor's, 2003). This investigation's population based upon the data from the U.S. Department of Education indicated approximately 10 students attending this high school were labeled E/BD. Descriptive statistics indicated the subjects' information regarding: (a) gender, (b) age, (c) ethnicity, and (d) grade level (i.e. 9<sup>th</sup> grade).

### Consent

Prior to obtaining consent and assent, Western Michigan University's Human Subjects Institutional Review Board (HSIRB) granted permission to the investigator to conduct this investigation. Participation in this study required consent and assent forms. The investigator obtained consent by the following process in order to meet requirements established by the HSIRB at Western Michigan University:

Table 11

Educational Environments of Students with E/BD in the Midwestern State

Environments	Number of Students
regular classes	5,552
resource rooms	4,922
separate classes	5,272

Source: U.S. Department of Education, Office of Special Education Programs, Data Analysis System (DANS).

- 1) The investigator identified the potential subjects who were high school grade level students labeled E/BD by a multiple disciplinary team in the school district.
- 2) The investigator individually contacted the potential subject's parent(s) and/or guardian(s) through the telephone in order to maintain confidentiality. In this telephone contact, the investigator described the study to the parent(s) and/or guardian(s). The investigator invited the potential subject's parent(s) and/or guardian(s) to read and sign a consent form indicating consent for their child to participate in the study.
- 3) The investigator mailed this consent form to the parent(s) and/or guardian(s) home address. The parent(s) and/or guardian(s) had ten days to sign the consent document. In that ten day time period, the investigator provided the parent(s) and/or guardian(s) with a telephone number to reach the student investigator in order to answer any questions. If the potential subject's parent(s) and/or guardian(s) gave permission for the student to participate, parent(s) and/or guardian(s) received two copies of the consent/permission form, one to keep and

one to sign and return. Parent(s) and/or guardian(s) returned the form in a stamped addressed envelope within ten days in the mail.

### Assent

The investigator obtained assent after receiving the consent form as described above from the potential subjects' parent(s) and/or guardian(s). The investigator obtained assent by the following process in order to meet requirements established by the HSIRB at Western Michigan University:

- 1) The investigator distributed two forms to the potential subjects, one for potential subjects to sign and return to the investigator and one for the potential subjects to keep for their records.
- 2) The investigator read the form aloud as the potential subjects read it to themselves.
- 3) The investigator summarized what was stated on the form.
- 4) The investigator allowed time for questions.
- 5) The investigator scheduled a twenty-four hour break in order to allow potential subjects to consider participation. Students who accepted the invitation to participate in the study turned in the assent forms at their convenience to the student investigator at the school before or after classes. The investigator administered the assent document in a special education classroom in the high school during study hall period. The investigator had not allowed students to participate if they had not obtained parental permission to participate.

### Investigator

This investigation's principal investigator was a certified special education teacher. The investigator had eight years of public school teaching experience, earned a Master of Science degree in education, and was a doctoral candidate at Western Michigan University. In addition, the investigator had two years of experience team teaching this curriculum in an inclusive general education ninth grade science class. The investigator's relationship to the students was a resource teacher who provided individualized instruction and extra assistance during study hall. In addition, the investigator was their classroom teacher for at least one of their special education classes while a student at the high school.

### Setting

This study took place at a suburban high school in the Midwest. Three elementary schools, one middle school, one high school, and one alternative high school composed this school district. The headcount enrollment for the district was 3,813 students of whom 95.9% were white (Standard & Poor's, 2003).

Actual administration of the study's procedures took place in one of the high school's resource classrooms for students with various disabilities. The classroom had two separate instructional areas. The first area included four rows of desks for whole group instruction. The second area consisted of two round tables for individualized instruction.

### Study Design

The investigator used a multiple baseline across participants design using a single-probe technique to demonstrate the effects of the mnemonic treatment on the ten participants' abilities to recall six scientific vocabulary terms. The literature (Alberto & Troutman, 2003) recommended a multiple baseline design in order to assess the intervention's effects on two or more students when the intervention encompassed academic learning. Probes should be administered when students were unable to execute the behavior and few exposures to unsuccessful assessments were appropriate. This investigation's dependent variable was the number of scientific vocabulary terms the student was able to recall on the written assessment. The investigator gathered the pretreatment baseline assessment on the first subject. This assessment and other assessments hereafter, measured the participants' knowledge of the meanings of six scientific vocabulary terms. The first subject received the treatment followed by the post treatment baseline assessment and outcome measures. The second subject had not received the treatment until the first subject reached a trend of at least three successive data points. This succession continued with the other participants until all had sequentially received the treatment.

### Procedures

The investigator audio taped twenty percent of the phases for the purpose of monitoring the fidelity of the investigator's implementation of the instructional strategy (see Method of Data Collection in this chapter for a description). This

investigation's procedures consisted of the following phases: (a) pretreatment baseline assessment, (b) treatment, and (c) post treatment baseline assessment. For all phases, the principal investigator instructed the subjects in a classroom during study hall using a scripted lesson format. No other students were in the room.

#### Pretreatment Baseline Assessment

The investigator used the following materials for the pretreatment baseline assessment: (a) Assessment Form A (see Appendix C), (b) Script for Baseline Conditions (see Appendix D), and (c) cassette recorder. During this phase, the investigator evaluated the student's baseline performance on the vocabulary terms' meanings using Assessment Form A. The investigator distributed the assessment and then orally read the directions to the student. This assessment served as a pretest since the instructor had not provided any instruction on these terms' meanings until the treatment phase.

#### Treatment

The investigator used the following materials for the treatment: (a) twelve 8.5 by 11 inch cards (see Appendix E), (b) Assessment Form B (see Appendix F), (c) Script for Intervention Condition, Session One (see Appendix G), and (d) cassette recorder. For the treatment, the principal investigator provided instruction over the meanings of six terms through the keyword mnemonic strategy. The components of instruction were: (a) Demonstration, (b) Modeling, (c) Guided Practice-Keyword

Phase, (d) Guided Practice-Study Phase, and (e) Evaluation. The investigator displayed two 8.5 by 11 inch cards while presenting each term. The first card of two cards contained the vocabulary term on one side and the keyword on the other side. The second of two cards contained the vocabulary term, the term's definition, the term's keyword, and a corresponding illustration.

#### Demonstration Phase

The investigator provided instruction on the definition of drumlin through the keyword mnemonic strategy during the demonstration phase. The investigator described in detail the keyword mnemonic process using two cards for the vocabulary term drumlin. The investigator first stated the term drumlin and its keyword drum to the student using the first card that had the term on one side and the keyword on the other side. The investigator then used the second card containing the vocabulary term, keyword, definition, and the corresponding illustration to demonstrate the way to recall the term's definition.

#### Modeling Phase

The modeling phase was similar to the demonstration phase except the investigator had not explained the keyword mnemonic in detail. The investigator first stated the term kettle and its keyword tea kettle to the student using the first card that had the term on one side and the keyword on the other side. The investigator then used the second card containing the vocabulary term, keyword, definition, and the

corresponding illustration to model the way to recall the term's definition. The investigator questioned the subjects regarding the term, keyword, illustration, and the term's definition throughout this phase.

#### Guided Practice-Keyword Phase

The investigator presented four terms with their corresponding keywords to the student in the guided practice-keyword phase. The investigator first stated the terms and their keywords to the student using the first card that had the term on one side and the keyword on the other side. After presenting each term, the investigator asked the student to state the term's keyword. Then, the investigator randomly mixed the cards and orally assessed the student three times for recalling the terms' correct keywords.

#### Guided Practice-Study Phase

The investigator presented the four interactive illustrations that corresponded to the keywords presented in the above guided practice-keyword phase. These cards had the illustrations of the keywords interacting with the terms' definitions. While displaying each card, the investigator described the illustration and then assessed the student for understanding.

#### Evaluation

The investigator evaluated the student's ability to recall the vocabulary terms'



meanings through Assessment Form B. The investigator distributed the assessment form and orally read the assessment's directions to the student.

#### Post Treatment Baseline Assessment

The investigator used the following materials for the post treatment baseline assessment: (a) twelve 8.5 by 11 inch cards, (b) cassette recorder, (c) Assessment Form C (see Appendix H), D (see Appendix I), and E (see Appendix J), and (d) Script for Intervention Condition Sessions Two through Four (see Appendix K). For the post treatment baseline assessment, the investigator provided a review over the meanings of six terms through the keyword mnemonic strategy. The post treatment baseline assessment consisted of the following components: (a) Guided Practice-Keyword Phase, (b) Guided Practice-Study Phase, and (c) Evaluation.

#### Guided Practice-Keyword Phase

The investigator reviewed six terms and their corresponding keywords with the student in the guided practice-keyword phase. While reviewing each term and keyword, the investigator displayed the first card in the set of two. This card had the term on one side and its corresponding keyword on the other side. The investigator asked the student to state the term's keyword after reviewing each term. Then, the investigator randomly mixed up the cards and orally assessed the student three times for recalling the terms' correct keywords.

### Guided Practice-Study Phase

The investigator presented the second card from the set in the guided practice-study phase. This type of card contained the illustration of the term's keyword interacting with the term's definition. While displaying each card, the investigator stated the term, keyword, and meaning. The investigator then described the illustration and questioned the student for understanding.

### Evaluation

The investigator evaluated the student's ability to recall the vocabulary terms' meanings through a written assessment. The investigator distributed the assessment form and orally read the assessment's directions to the student. The investigator used Assessment Form C for Intervention Condition Session 2, Assessment Form D for Intervention Condition Session 3, and Assessment Form E for Intervention Condition Session 4.

### Method of Data Collection

#### Procedures for Scoring Written Assessments

Permanent product data consisted of the written assessments completed by the students from baseline and intervention conditions. The investigator scored the response correct if the student matched the definition correctly with the corresponding scientific vocabulary term. The investigator converted the correct scores to percentages of correct responses. The investigator calculated correct

responses by the number of correct responses divided by six and then multiplied by 100. For example, if one subject scored three out of the six items correct, then the investigator converted that score to the percentage of correct response, which was 50%. The investigator converted all written assessments to the percentage of correct response. A calculator computed all scores.

### Procedures for Scoring the Audio Tapes-Treatment Fidelity

#### Training Independent Observers and Scoring the Audio Tapes

Treatment fidelity was defined as “the methodological strategies used to monitor and enhance the reliability and validity of behavioral interventions” (Bellg, Resnick, Minicucci, Ogedegbe, Ernst, Borrelli, Hecht, Ory, Orwig, & Czajkowski, 2004, p. 443). Investigating treatment fidelity gave the investigator greater confidence in the results (Bellg, et al., 2004). Permanent product data consisted of audio tapes from 20% of the baseline and intervention conditions in order to assess the fidelity of the treatment. The investigator supplied two independent observers with: (a) scripts for the intervention and baseline conditions, (b) a cassette tape, (c) time sampling data collection forms (see Appendix L), (d) directions for completing the time sampling data collection forms (see Appendix M), and (e) a stamped return envelope. The observers supplied their own tape player, writing utensil, and timer. The investigator reviewed the directions for completing the time sampling data collection form with the observers through a telephone conference. The investigator used the time sampling data collection recording form to obtain interobserver agreement regarding

the investigator's implementation of the script. The independent observers assessed the following three behaviors at thirty-second intervals: (a) following the script, (b) following the sequence of the script, and (c) fluent pacing of the script. After completing the time sampling data collection forms, the observers mailed the results to the investigator's residence.

#### Observer Qualifications

Two independent observers calculated interobserver agreement. The literature (Johnston & Pennypacker, 1993; Kelly, 1977; Tawney & Gast, 1984) stated two independent observers were needed to calculate interobserver agreement. One doctoral student from the Department of Educational Studies and one teacher from the high school where the investigation took place assessed the audio tapes through the time sampling data collection forms. The doctoral student from Western Michigan University was a certified special education provider in a Midwestern state with thirteen years of experience. The teacher was a certified special education provider in a Midwestern state with ten years of experience. The independent observers assessed the investigator's implementation of the script through the audio tape and the time sampling data collection forms.

## Reliability and Validity

### Reliability

Reliability was defined as “The consistency of data collection reports among independent observers. The coefficient of reliability is determined by the formula. Also known as interobserver agreement” (Alberto & Troutman, 2003, p. 536). Part of the permanent product data consisted of audio tapes from 20% of the baseline and intervention conditions. The independent observers assessed the audio tapes through the time sampling data collection forms. The time sampling data collection forms assessed the principal investigator’s implementation of the script.

The investigator used the time sampling data collection recording form to obtain interobserver agreement regarding the investigator’s implementation of the script. Three behaviors assessed at 30 second intervals included: (a) following the script, (b) following the sequence of the script, and (c) fluent pacing of the script. A doctoral level student and special education teacher assessed 20% of the pretreatment baseline assessment and treatment sessions through the time sampling recording form. The literature (Johnston & Pennypacker, 1993; Kelly, 1977; Tawney & Gast, 1984) stated two independent observers were needed to calculate interobserver agreement. The investigator calculated interobserver agreement according to the following procedures. The investigator divided agreements by the total number of possible agreements and then multiplied by 100 to obtain a percentage (Tawney & Gast, 1984).

### Content Validity

Content validity was defined as “The representativeness of the sample of items included in the measurement device” (Martella, et al., 1999, p. 555). The investigator based this study upon the district’s curriculum that included science academic standards for the 9<sup>th</sup> grade. The district aligned this curriculum with the state’s goals and objectives for science education and the content standards for science.

Five strands composed the state’s content and standards and benchmarks in the area of science. The investigator based this study upon the fifth strand, which was Using Scientific Knowledge in Earth Science. Four standards composed the fifth strand as followed: (a) Standard V.1 The Geosphere, (b) Standard V.2 The Hydrosphere, (c) Standard V.3 The Atmosphere and Weather, and (d) Standard V.4 The Solar System, Galaxy and Universe (Michigan State Board of Education, 1991).

At the high school where the investigation took place, one semester course covered the Earth and Space Curriculum. This curriculum contained one hundred eighteen new vocabulary terms. With approximately ninety days in the semester course, instructors introduced an average of six words per week. Therefore, the investigator provided mnemonic instruction over six science terms taken from the curriculum to the subjects.

The investigator presented the delivery of this investigation’s instructional procedures in the following phases: (a) pretreatment baseline assessment, (b) treatment, and (c) post treatment baseline assessment. The investigator orally read

from scripts for all sessions. The investigator based these scripts upon sample dialogues (Mastropieri & Scruggs, 1991) and scripted lessons (King-Sears, 1989) for using the keyword mnemonic strategy to teach vocabulary.

### Data Analysis

The investigator gathered data (percentage of correct responses) from the written assessments in order to answer the research question. Since this investigation used a multiple baseline across subjects design, the investigator implemented visual inspection of data as the primary method of analyzing data (Martella, et al., 1999). The investigator selected the computer software package of Excel since the literature (Carr & Burkholder, 1998) reported this was the most appropriate software to create graphs in single subject research. The investigator entered the data into an Excel spreadsheet and then displayed the data using the Chart Wizard function. This function created line graphs for visual inspection. The investigator plotted the data collected on a different axis for each dependent variable (Alberto & Troutman, 2003). A line of demarcation separated each dependent variable's baseline and intervention phases (Krishef, 1991). Alberto and Troutman (2003) stated "characteristics of data paths within and across phases are examined in order to judge the effectiveness of the intervention" (p. 219). These characteristics included: (a) evaluating the changes in means, (b) evaluating levels of performance, (c) evaluating the trend in performance through the quarter-intersect method, and (d) computing the percentage of overlap.

### How Analysis was Completed

The first characteristic analyzed was the mean of the data points in all baseline and intervention phases. For example, the investigator averaged all of the data points in each subject's baseline phase. A dashed horizontal line on the graph indicated this average. Thus, "visual inspection of the relationship of these means will help determine if the intervention resulted in consistent and meaningful changes in the behavior in the desired direction of the change" (Alberto & Troutman, 2003, p. 219).

The second characteristic analyzed was performance levels from one phase's ending to the next phase's beginning. The investigator evaluated performance levels through the following steps: (a) the investigator determined the data point's last value of the first condition and the data point's first value of the condition immediately following, (b) from the larger value, the investigator subtracted the smaller value, and (c) the investigator determined the change in level. Arrows indicated these changes in level. The intervention was powerful if a large, immediate change in levels occurred directly after the investigator introduced the intervention (Tawney & Gast, 1984).

The third characteristic analyzed was the trend in performance. A trend line increased visual analysis's reliability (Ottenbacher, 1993; Ottenbacher & Cusick, 1991). Through using a quarter-intersect method (White & Liberty, 1976), the investigator evaluated data trends as followed: (a) a vertical line divided the number of data points in half, (b) a vertical line divided the left hand side of the graph in half, (c) a horizontal line marked the left hand side's mid performance point, (d) the



investigator completed the second and third steps described above for the right hand side of the graph, and (e) a trend line connected the graph's left and right half side's intersections.

The fourth characteristic analyzed was the percentage of overlapping data in contiguous phases which indicated the intervention's impact. In most cases, interventions with greater impacts had lower percentages of overlapping data. The investigator calculated this percentage as followed: (a) the investigator calculated the data for the first condition, (b) the investigator calculated the total number of the second condition's data points, (c) for the second condition, the investigator determined the amount of data points in the first condition's data range, (d) the investigator divided the above value in the third step by the second condition's total amount of data points, and (e) the investigator multiplied this answer by 100 (Tawney & Gast, 1984).

In addition to analyzing these four characteristics, the investigator collected data pertaining to the subjects' attributes. The investigator used descriptive statistics for reporting the subjects' information regarding: (a) gender, (b) age, (c) ethnicity, and (d) grade level.

### Hypotheses

The four research null hypotheses listed below pertained to the investigation's research question stated in Chapter I. These hypotheses corresponded to the literature's recommendations (Alberto & Troutman, 2003; Tawney & Gast, 1984) for

analyzing the graphed data's characteristics from multiple baseline designs. These characteristics of the data included: (a) evaluating the changes in means, (b) evaluating levels of performance, (c) evaluating the trend in performance through the quarter-intersect method, and (d) computing the percentage of overlap.

H<sub>01</sub> There were no differences between the data points' means for the baseline and intervention phases for each of the subjects.

H<sub>02</sub> There were no differences between the baseline's ending value and the intervention phase's beginning value for each of the subjects.

H<sub>03</sub> There were no trends in performance during the intervention condition for each subject.

H<sub>04</sub> There was no impact pertaining to the intervention as indicated by the percentage of overlapping data in contiguous phases.

### Limitations of the Study

This investigation contained general limitations. These limitations included: (a) the comprehensiveness of the assessment instrument, (b) the representative sample of students, and (c) the single probe condition.

- 1) Comprehensiveness of the Assessment Instrument. The assessments' terms were not representative of all vocabulary terms in the 9<sup>th</sup> grade science curriculum.
- 2) Representative Sample of Students. The investigation's participants were not representative of the population of students labeled E/BD in the United States in the following areas: geographical location, ethnicity, and gender.

3) Single Probe Condition. One data point during the baseline condition for each subject in this investigation existed. The investigator felt it was more advantageous to have fewer data points in order to avoid the participant's reactivity (Horner & Baer, 1978). Avoiding reactivity was a greater advantage than the disadvantage of having a small number of data points.

### Summary

This study explored whether mnemonic strategies were effective for high school aged students identified as E/BD in recalling the definitions of scientific vocabulary terms. In a multiple baseline across subjects design, the investigator assessed the students over scientific vocabulary terms based upon the district's curriculum where the investigation took place. Visual inspection was the primary method of analyzing data. The investigator examined the following characteristics of the data: (a) evaluating the changes in means, (b) evaluating levels of performance, (c) evaluating the trend in performance through the quarter-intersect method, and (d) computing the percentage of overlap. The following chapter presented the results of the data collected.

## CHAPTER IV

### ANALYSIS OF THE DATA

#### Introduction

This investigation determined whether mnemonic strategies were effective for high school students labeled E/BD. The study's design was used to answer the following research question:

R<sub>1</sub> Were keyword mnemonic strategies effective for high school aged students labeled E/BD in recalling the definitions of scientific vocabulary terms?

The investigator determined keyword mnemonic strategies were effective for high school aged students labeled E/BD in recalling the definitions of scientific vocabulary terms as the following four null hypotheses corresponding to the above research question were rejected.

H<sub>01</sub> There were no differences between the data points' means for the baseline and intervention phases for each of the subjects.

The investigator rejected the first hypothesis since differences existed between the data points' means for the baseline and intervention phases for each of the subjects.

H<sub>02</sub> There were no differences between the baseline's ending value and the intervention phase's beginning value for each of the subjects.

The investigator rejected the second hypothesis since differences existed between the baseline's ending value and the intervention phase's

beginning value for each of the subjects.

H<sub>03</sub> There were no trends in performance during the intervention condition for each subject.

The investigator rejected the third hypothesis since trends existed in performance during the intervention condition for each subject.

H<sub>04</sub> There was no impact pertaining to the intervention as indicated by the percentage of overlapping data in contiguous phases.

The investigator rejected the fourth hypothesis since impacts existed pertaining to the intervention as indicated by the percentage of overlapping data in contiguous phases.

A description of the collected data was analyzed in this chapter in relation to the investigation's research question and null hypotheses. The following sections presented the investigation's findings: (a) A Demographic Description of the Subjects, (b) Treatment Fidelity and (c) A Summary of the Findings.

### A Demographic Description of the Subjects

Ten students labeled E/BD from a suburban public high school in a Midwestern state participated in this investigation. The students were labeled E/BD according to the federal definition (see Chapter II for this definition). All students were in the tenth through twelve grades with five students (50%) in the eleventh grade, four students (40%) in the tenth grade, and one student (10%) in the twelfth grade. The six males (60%) and four females (40%) ranged in ages from 16 years 2

months to 18 years 0 months. These subjects' ages averaged 17 years 1 month. All students were Caucasian (see Table 12).

**Table 12**  
A Description of the Study's Participants Labeled E/BD

Subject	Gender	Ethnicity	Grade Level	Age (years and months)
1	Female	Caucasian	12	18 years 0 months
2	Female	Caucasian	11	17 years 9 months
3	Male	Caucasian	11	17 years 1 month
4	Male	Caucasian	10	16 years 4 months
5	Male	Caucasian	10	16 years 11 months
6	Male	Caucasian	11	18 years 0 months
7	Male	Caucasian	10	16 years 2 months
8	Female	Caucasian	11	17 years 1 month
9	Female	Caucasian	11	16 years 11 months
10	Male	Caucasian	10	16 years 3 months

#### Treatment Fidelity

The investigator audio taped 20% of the baseline and intervention conditions in order to assess the accuracy of the investigator's implementation of the baseline and intervention conditions. The mnemonic intervention sessions ranged from approximately three and one half to five minutes in length. The estimated times for the first intervention session was Two observers, described in Chapter III, assessed the audio tapes through the time sampling data collection forms. The observers assessed the investigator's implementation of the script in regard to following the script, following sequence, and fluent pacing. The assessors marked an x for occurrence and an o for nonoccurrence at the end of each thirty-second interval. The

overall interobserver agreement was 95.2%. Table 13 presented the results for individual baseline and intervention conditions.

Table 13  
Interobserver Agreement

Condition	Script	Sequence	Pacing	Total Percentage
Baseline 1	1/1	1/1	1/1	3/3 = 100.0%
Baseline 2	1/1	1/1	1/1	3/3 = 100.0%
Intervention 1	7/7	7/7	7/7	21/21 = 100.0%
Intervention 2	7/8	7/8	7/8	21/24 = 87.5%
Intervention 3	6/7	7/7	7/7	20/21 = 95.2%
Intervention 4	6/6	6/6	6/6	18/18 = 100.0%
Intervention 5	6/7	7/7	7/7	20/21 = 95.2%
Intervention 6	5/6	6/6	6/6	17/18 = 94.4%
Intervention 7	7/7	7/7	6/7	20/21 = 95.2%
Intervention 8	6/6	6/6	5/6	17/18 = 94.4%
Overall Interobserver Agreement				160/168 = 95.2%

Source: King-Sears, M.E. (1989). Mnemonic and nonmnemonic science vocabulary instruction with mildly handicapped students (Doctoral dissertation, University of Florida, 1989). *Dissertation Abstracts International*, 51, 820.

### Summary of the Findings

The investigator presented data obtained from the written assessments utilizing guidelines for selecting, constructing, and analyzing graphic displays established by Tawney and Gast (1984). The investigator selected a line graph since this type of graph appropriately displayed serial data. The graph's ordinate scale identified the percentage of terms correctly identified, the investigation's dependent variable. The graph's abscissa scale identified the sessions, the investigation's independent variable. Circular geometric forms displayed the data points and solid lines connected these data points within each mnemonic intervention phase. A dashed vertical line separated the baseline and the intervention phases in each axis. The investigator presented the results of individual subjects and then described the investigation's overall results.

#### Subject One

Subject one was an eighteen year old Caucasian female in the 12th grade. The percentage of terms correctly identified during the baseline condition was 17%. The percentage of terms correctly identified during the mnemonic intervention averaged 93.4%. A dashed horizontal line on the graph indicated the intervention's average. The change in level was 83 as indicated by the arrow. A trend line that connects the graph's left and right half side's intersections indicated an upward trend in performance. No data overlapped in contiguous phases between the baseline and intervention condition (see Figure 1).



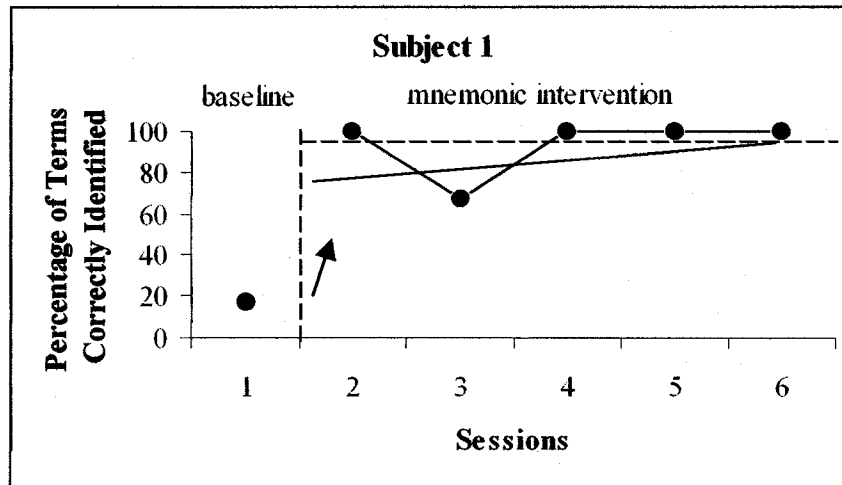


Figure 1

### Effects of the Mnemonic Intervention on the Percentage of Scientific Vocabulary Terms Recalled Correctly for Subject One

#### Subject Two

Subject two was a seventeen year old Caucasian female in the 11th grade. The percentage of terms correctly identified during the baseline condition was 0%. The percentage of terms correctly identified during the mnemonic intervention averaged 100%. A dashed horizontal line on the graph indicated the intervention's average. The change in level was 100 as indicated by the arrow. The trend line was the same as the dashed horizontal line on the graph that indicated the intervention's average. This line had a zero celeration trend in performance during the mnemonic intervention. No data overlapped in contiguous phases between the baseline and intervention condition (see Figure 2).

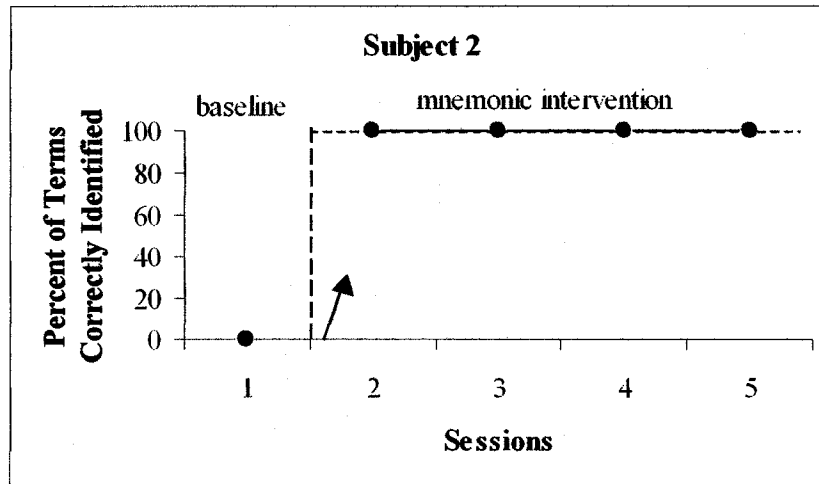


Figure 2

Effects of the Mnemonic Intervention on the Percentage of Scientific Vocabulary Terms Recalled Correctly for Subject Two

### Subject Three

Subject three was a seventeen year old Caucasian male in the 11th grade. The percentage of terms correctly identified during the baseline condition was 0%. The percentage of terms correctly identified during the mnemonic intervention was 100%. A dashed horizontal line on the graph indicated the intervention's average. The change in level was 100 as indicated by the arrow. The trend line was the same as the dashed horizontal line on the graph that indicated the intervention's average. This line had a zero celeration trend in performance during the mnemonic intervention. No data overlapped in contiguous phases between the baseline and intervention condition (see Figure 3).

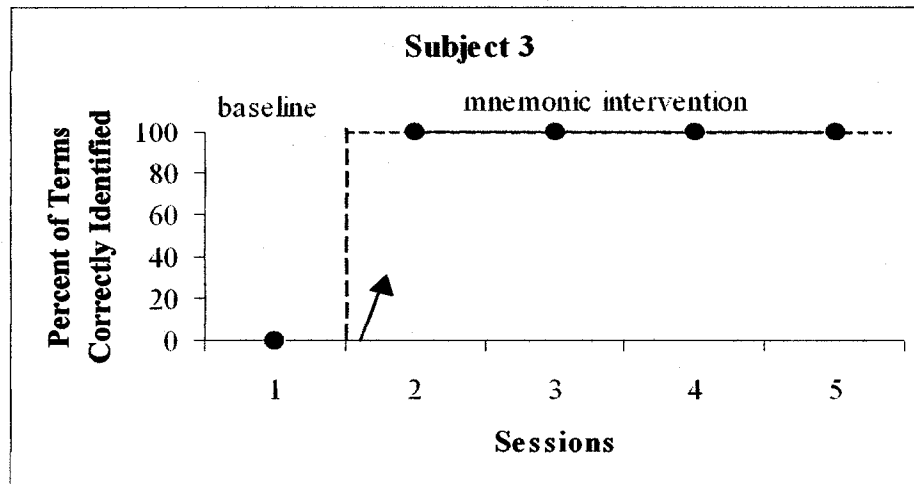


Figure 3

Effects of the Mnemonic Intervention on the Percentage of Scientific Vocabulary Terms Recalled Correctly for Subject Three

#### Subject Four

Subject four was a sixteen year old Caucasian male in the 10th grade. The percentage of terms correctly identified during the baseline condition was 0%. The percentage of terms correctly identified during the mnemonic intervention was 100%. A dashed horizontal line on the graph indicated the intervention's average. The change in level was 100 as indicated by the arrow. The trend line was the same as the dashed horizontal line on the graph that indicated the intervention's average. This line had a zero celeration trend in performance during the mnemonic intervention. No data overlapped in contiguous phases between the baseline and intervention condition (see Figure 4).

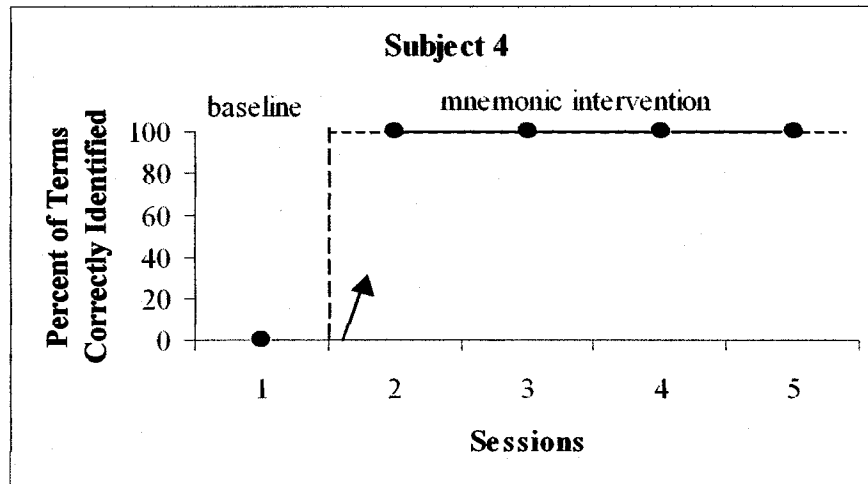


Figure 4

Effects of the Mnemonic Intervention on the Percentage of Scientific Vocabulary Terms Recalled Correctly for Subject Four

#### Subject Five

Subject five was a sixteen year old Caucasian male in the 10th grade. The percentage of terms correctly identified during the baseline condition was 0%. The percentage of terms correctly identified during the mnemonic intervention was 100%. A dashed horizontal line on the graph indicated the intervention's average. The change in level was 100 as indicated by the arrow. The trend line was the same as the dashed horizontal line on the graph that indicated the intervention's average. This line had a zero celeration trend in performance during the mnemonic intervention. No data overlapped in contiguous phases between the baseline and intervention condition (see Figure 5).

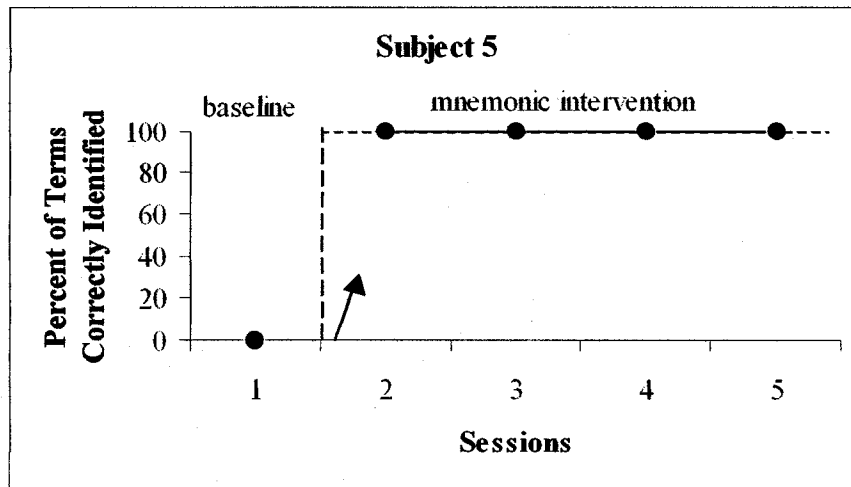


Figure 5

Effects of the Mnemonic Intervention on the Percentage of Scientific Vocabulary Terms Recalled Correctly for Subject Five

#### Subject Six

Subject six was an eighteen year old Caucasian male in the 11th grade. The percentage of terms correctly identified during the baseline condition was 17%. The percentage of terms correctly identified during the mnemonic intervention was 100%. A dashed horizontal line on the graph indicated the intervention's average. The change in level was 83 as indicated by the arrow. The trend line was the same as the dashed horizontal line on the graph that indicated the intervention's average. This line had a zero celeration trend in performance during the mnemonic intervention. No data overlapped in contiguous phases between the baseline and intervention condition (see Figure 6).

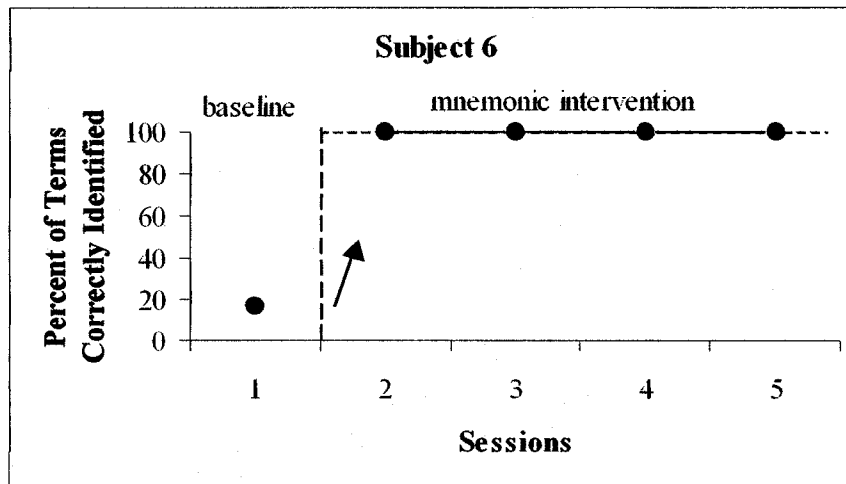


Figure 6

Effects of the Mnemonic Intervention on the Percentage of Scientific Vocabulary Terms Recalled Correctly for Subject Six

#### Subject Seven

Subject seven was a sixteen year old Caucasian male in the 10th grade. The percentage of terms correctly identified during the baseline condition was 0%. The percentage of terms correctly identified during the mnemonic intervention was 100%. A dashed horizontal line on the graph indicated the intervention's average. The change in level was 100 as indicated by the arrow. The trend line was the same as the dashed horizontal line on the graph that indicated the intervention's average. This line had a zero celeration trend in performance during the mnemonic intervention. No data overlapped in contiguous phases between the baseline and intervention condition (see Figure 7).

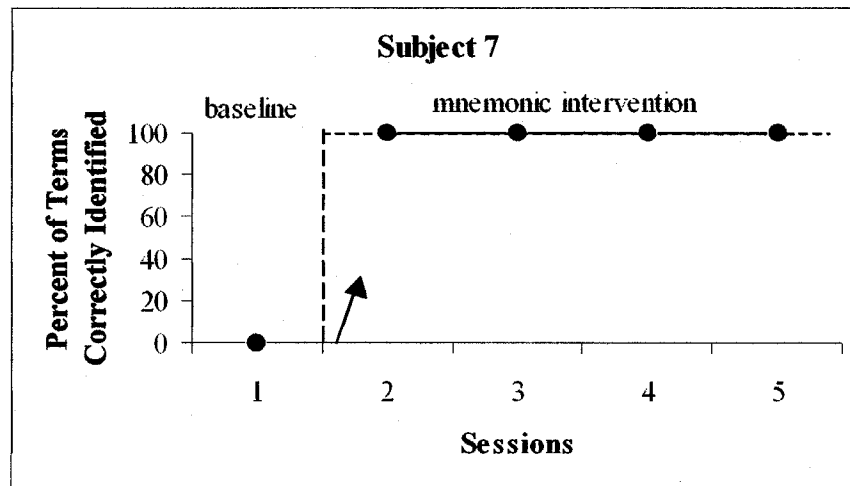


Figure 7

Effects of the Mnemonic Intervention on the Percentage of Scientific Vocabulary Terms Recalled Correctly for Subject Seven

#### Subject Eight

Subject eight was a seventeen year old Caucasian female in the 11th grade.

The percentage of terms correctly identified during the baseline condition was 17%.

The percentage of terms correctly identified during the mnemonic intervention was 100%. A dashed horizontal line on the graph indicated the intervention's average. The change in level was 83 as indicated by the arrow. The trend line was the same as the dashed horizontal line on the graph that indicated the intervention's average. This line had a zero celeration trend in performance during the mnemonic intervention. No data overlapped in contiguous phases between the baseline and intervention condition (see Figure 8).

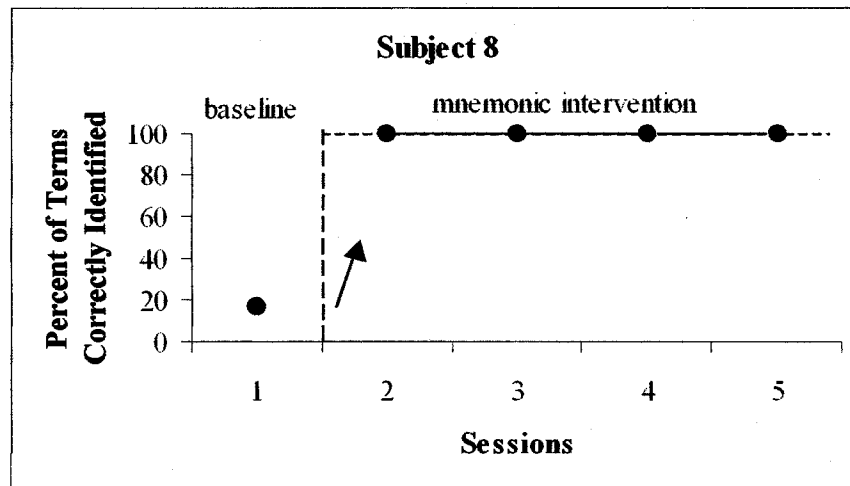


Figure 8

Effects of the Mnemonic Intervention on the Percentage of Scientific Vocabulary Terms Recalled Correctly for Subject Eight

#### Subject Nine

Subject nine was a sixteen year old Caucasian female in the 11th grade. The percentage of terms correctly identified during the baseline condition was 0%. The percentage of terms correctly identified during the mnemonic intervention was 100%. A dashed horizontal line on the graph indicated the intervention's average. The change in level was 100 as indicated by the arrow. The trend line was the same as the dashed horizontal line on the graph that indicated the intervention's average. This line had a zero celeration trend in performance during the mnemonic intervention. No data overlapped in contiguous phases between the baseline and intervention condition (see Figure 9).



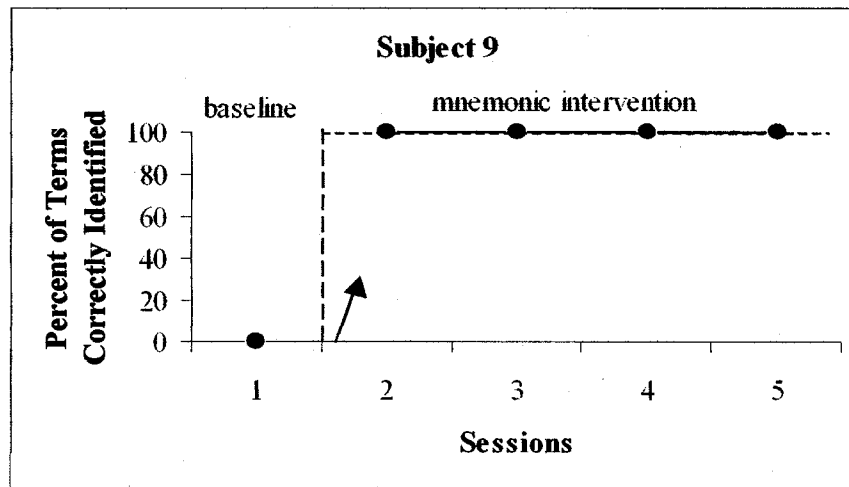


Figure 9

Effects of the Mnemonic Intervention on the Percentage of Scientific Vocabulary Terms Recalled Correctly for Subject Nine

#### Subject Ten

Subject ten was a sixteen year old Caucasian male in the 11th grade. The percentage of terms correctly identified during the baseline condition was 0%. The percentage of terms correctly identified during the mnemonic intervention was 100%. A dashed horizontal line on the graph indicated the intervention's average. The change in level was 100 as indicated by the arrow. The trend line was the same as the dashed horizontal line on the graph that indicated the intervention's average. This line had a zero celeration trend in performance during the mnemonic intervention. No data overlapped in contiguous phases between the baseline and intervention condition (see Figure 10).

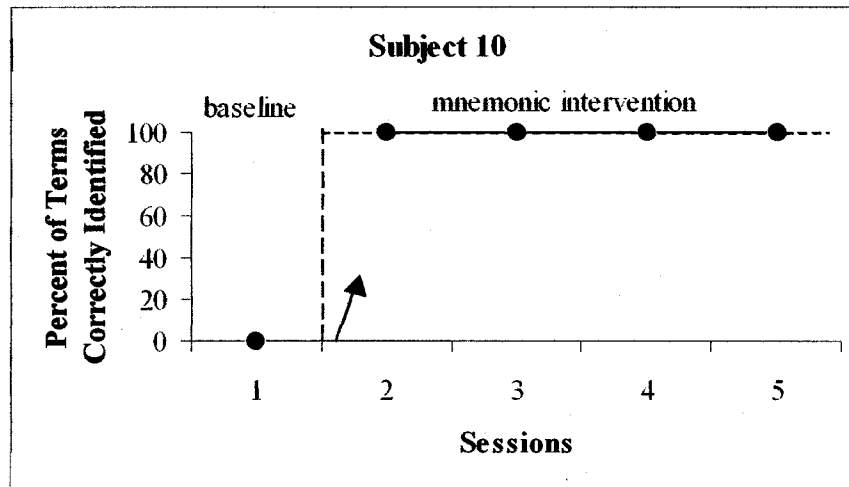


Figure 10

Effects of the Mnemonic Intervention on the Percentage of Scientific Vocabulary Terms Recalled Correctly for Subject Ten

### Overall Findings

Overall, the percentage of terms correctly identified during baseline conditions averaged 5.1%. The percentage of terms correctly identified during the mnemonic intervention conditions averaged 99.2%. The change in level averaged 94.9% as indicated by graphs' arrows. Nine of the ten subjects' trend lines had a zero celeration trend in performance during the mnemonic intervention. One of the ten subjects had an accelerating trend in performance. Finally, none of the data overlapped in contiguous phases between the baseline and intervention condition for all of the subjects.

### Hypothesis One

The investigator rejected the first hypothesis, which stated there were no differences between the data points' means for the baseline and intervention phases for each of the subjects. The averages of all subjects' baseline condition scores were 5.1% and intervention condition's scores were 99.2% indicating 94.1 % difference between the baseline and intervention conditions.

### Hypothesis Two

The investigator rejected the second hypothesis, which stated there were no differences between the baseline's ending value and the intervention phase's beginning value for each of the subjects. The change in level was 100 for seven subjects and 83 for three subjects. Upward pointing arrows on all figures contained in Chapter IV indicated the changes in level for all participants.

### Hypothesis Three

The investigator rejected the third hypothesis, which stated there were no trends in performance during the intervention condition for each subject. The trend for nine of ten subjects was zero celeration as all mnemonic intervention scores were 100. The trend for one of the ten subjects was accelerating.

#### Hypothesis Four

The investigator rejected the fourth hypothesis, which stated there was no impact pertaining to the intervention as indicated by the percentage of overlapping data in contiguous phases. No data overlapped in contiguous phases between the baseline and intervention conditions for all subjects. All baseline data was less than or equal to 17%. All mnemonic intervention data was greater than or equal to 66%.

#### Summary

This investigation determined keyword mnemonic strategies were effective for ten high school students labeled E/BD. The investigator used a multiple baseline across subjects design to address the research question and corresponding four research null hypotheses stated in the beginning of this chapter. A demographic description of the subjects indicated the following information: (a) all students' ethnicities were Caucasian, (b) sixty percent of the subjects were male, (c) the average subject's age was 17 years 1 month, and (d) all students were in the tenth through twelfth grades. The investigator presented the investigation's findings pertaining to the treatment fidelity assessed by two independent observers. The observers assessed the investigator's implementation of the script regarding following the script, following sequence, and fluent pacing. The overall interobserver agreement was 95.2%. The investigator presented data obtained from the students' written assessments through line graphs for each subject and reported the overall results of the mnemonic interventions. The investigator rejected the following hypotheses

pertaining to this investigation's research question: (a) there were no differences between the data points' means for the baseline and intervention phases for each of the subjects, (b) there were no differences between the baseline's ending value and the intervention phase's beginning value for each of the subjects (c) there were no trends in performance during the intervention condition for each subject, and (d) there was no impact pertaining to the intervention as indicated by the percentage of overlapping data in contiguous phases.

## CHAPTER V

### SUMMARY AND CONCLUSIONS

This chapter commenced by reviewing the investigation's research question and the four corresponding null hypotheses. Results indicated the investigator rejected all null hypotheses as keyword mnemonic strategies were an effective academic intervention for high school students labeled E/BD. These overwhelmingly positive results supported existing keyword mnemonic research and extended this investigation's findings of keyword mnemonic strategies to high school aged students labeled E/BD. Further, this investigation supported the information processing theory of memory as keyword mnemonic strategies enhanced the encoding, storage, and retrieval of new information in the memory. Despite these positive findings, several limitations existed within the representativeness of the study's subjects, single subject research design, and limited applications of the keyword mnemonic strategy. These limitations provided excellent opportunities for further exploration.

#### Overview of the Significant Findings of the Study

The purpose of this study was to determine if keyword mnemonic strategies were effective for high school students labeled E/BD. This study utilized a multiple baseline design across subjects using a single-probe technique to answer the following research question:

R<sub>1</sub> Were keyword mnemonic strategies effective for high school aged students labeled E/BD in recalling the definitions of scientific vocabulary terms?

The investigator rejected the four research null hypotheses corresponding to the above research question indicating keyword mnemonic strategies were an effective academic intervention for high school aged students labeled E/BD. These mnemonic strategies helped students recall the definitions of previously unfamiliar scientific vocabulary terms as demonstrated through the analysis of data collected from the multiple baseline design. This data clearly indicated the positive effects of keyword mnemonic strategies for high school students labeled E/BD.

#### Hypothesis One

The investigator rejected the first hypothesis, which stated there were no differences between the data points' means for the baseline and intervention phases for each of the subjects. This was referred to as evaluating the changes in means across phases. The extremely low averages of all subjects' baseline condition scores (5.1%) indicated the subjects were unable to recall the terms' meanings. The high averages of the mnemonic intervention condition scores (99.2%) indicated the subjects successfully recalled the terms' meanings. Thus, a large difference of averages (94.1 %) resulted between the baseline and mnemonic intervention conditions. More specifically, seventy percent of the subjects' baseline condition scores were 0% and mnemonic intervention conditions scores were 100% indicating a 100% difference between the baseline and mnemonic intervention conditions. Thirty

percent of the subjects had a greater than or equal to 76.4% difference between the baseline and mnemonic intervention conditions. These extreme differences between the baseline and mnemonic conditions indicated keyword mnemonic strategies were a successful intervention for all the investigation's participants. Visual analysis of the baseline's and mnemonic intervention's conditions means on all line graphs clearly determined keyword mnemonic strategies resulted in steady and meaningful modifications for these high school students labeled E/BD.

Rejecting the first hypothesis supported existing mnemonic research and provided implications for practice as differences between the data points means for baseline and intervention phases existed in this investigation. Previous research (Cade & Gunter, 2002; King-Sears, 1989; Mastropieri, Emerick, & Scruggs, 1988; Nolan & Pollock, 1992) contained differences between the means for baseline and intervention conditions. For example, mean scores were 58.8% correct on assessments before mnemonic strategy instruction and 94.5% correct on assessments after mnemonic strategy instruction in Mastropieri, Emerick, and Scruggs' (1988) investigation.

Rejecting this hypothesis also provided implications for educational practice. Teachers could have incorporated the keyword mnemonic strategy for high school students labeled E/BD when these students needed consistent and meaningful changes. For instance, an algebra teacher could have utilized the keyword mnemonic strategy with vocabulary needing to be consistently recalled not only in the current chapter but also in the subsequent chapters.



## Hypothesis Two

The investigator rejected the second hypothesis, which stated there were no differences between the baseline's ending value and the mnemonic intervention phase's beginning value for each of the subjects. This was referred to as evaluating the level of performance between phases. Upward pointing arrows on all line graphs contained in Chapter IV indicated abrupt changes in levels of performance for all participants. The average change in level was 94.9%. More specifically, seventy percent of the participants' change in level were 100 and the remaining thirty percent of the participants' change in level were 83. This abrupt change occurred immediately after the introduction of the mnemonic intervention. "When a large change in level occurs immediately after the introduction of a new condition, the level change is considered abrupt, which is indicative of a powerful or effective intervention" (Tawney & Gast, 1984, p. 162). These subjects immediately recalled the meanings of the curriculum's scientific vocabulary terms after one keyword mnemonic intervention. These large, immediate changes in level indicated the keyword mnemonic strategy was not only a powerful but also an effective academic intervention for high school students labeled E/BD.

Rejecting the second hypothesis supported existing mnemonic research and provided implications for practice as this investigation's intervention contained differences on performance levels from one phase's ending to the next phase's beginning. Existing mnemonic research (Cade & Gunter, 2002; King-Sears, 1989; Mastropieri, Emerick, & Scruggs, 1988; Nolan & Polloway, 1992) had similar results

after the introduction of the mnemonic strategy. In Cade and Gunter's (2002) investigation, one subject's baseline score increased from 4% to 96% correct after one mnemonic intervention. In this current investigation, seventy percent of the subjects' baseline scores increased from 0% to 100% correct after one intervention.

Rejecting this hypothesis also provided implications for educational practice. Teachers should have implemented the keyword mnemonic strategy to high school students labeled E/BD when these students needed large, immediate changes after introducing the mnemonic intervention. For instance, a general education science teacher should have utilized the keyword mnemonic strategy with a student labeled E/BD in the following situation. The teacher covered a large amount of scientific content in a brief amount of time. This content included vocabulary terms and the student needed an effective strategy to have recalled immediately these terms' meanings after one intervention. Thus, using the keyword mnemonic strategy was appropriate in this situation.

### Hypothesis Three

The investigator rejected the third hypothesis, which stated there were no trends in performance during the intervention condition for each subject. Nine of the ten subjects had a zero celeration trend in performance during the mnemonic intervention. Although the literature (Tawney & Gast, 1984) has stated the importance of noticing whether the trend's direction was improving or deteriorating, these nine subjects scored 100% of terms correctly identified for all of the mnemonic

intervention conditions. These scores indicated the mnemonic intervention was successful for these students. They earned the highest scores possible and therefore could not improve their scores. One of the ten subjects had an accelerating trend in performance as this subject had a lower score during the third session (see Figure 1).

Rejecting the third hypothesis supported the mnemonic research and provided implications for practice since this investigation's intervention contained trends in performance during the intervention condition for each subject. Previous research (Cade & Gunter, 2002) and this investigation contained similar trends in performance during mnemonic intervention conditions. One of the three subjects in Cade and Gunter's (2002) investigation exhibited a zero celeration trend in performance and nine of the ten subjects in the current investigation exhibited a zero celeration trend in performance. These subjects in the above investigations scored 100% correct on assessments during the mnemonic intervention. The research has reported the effectiveness of the keyword mnemonic strategy and strongly recommended this strategy to be used in the educational practice for students labeled E/BD.

#### Hypothesis Four

The investigator rejected the fourth hypothesis, which stated there was no impact pertaining to the intervention as indicated by the percentage of overlapping data in contiguous phases. This was referred to as computing the percentage of overlapping data for performance across adjacent phases. Baseline data values consisted of one data point since the subjects demonstrated a lack of competence on

the pre-assessment baseline. This lack of competence indicated no competence and the investigator had not gathered further pre-assessment baseline measures (see Chapter III for further description). All subjects' baseline data ranged from 0%-17%. Specifically, seventy percent of the subjects' baseline data points were 0%. Thirty percent of the subjects' baseline data points were 17%. All subjects data points ranged from 67%-100% during the mnemonic intervention. Only one subject's range of data points during the mnemonic intervention was 67%-100%. The other nine subjects' data points range during the mnemonic intervention was 100%. Thus, no data overlapped in contiguous phases between the baseline and intervention conditions for all subjects. These nonoverlapping data points indicated keyword mnemonic strategies had a great impact on the students' abilities to recall the scientific vocabulary terms.

Rejecting the fourth hypothesis supported the mnemonic research and provided implications for practice since this investigation's intervention had a large impact as indicated by the percentage of overlapping data in contiguous phases. Previous research (Cade & Gunter, 2002) and this investigation contained no overlapping data in contiguous phases. This lack of overlapping data indicated the strategy's effectiveness.

Rejecting this hypothesis also provided implications for teacher preparation programs. The literature (Carlson, et al., 2002; Maag & Katsyannis, 1999; MacMillan, 1999; Maroney, 2000; Stempien & Loeb, 2002; Whitaker, 2000) indicated special educators were unprepared to meet the academic needs of this

population. Thus, these teachers needed academic strategies that have large impacts for students with E/BD. The keyword mnemonic strategy was an academic strategy that had large impacts for this investigation's population. This strategy helped students learn and retain the meanings of previously unfamiliar vocabulary terms as indicated by no overlapping data. Teacher preparation programs needed to instruct special educators to provide effective academic strategies such as keyword mnemonic strategies for high school students labeled E/BD when they were unable to recall the meanings of vocabulary terms.

#### Consideration of the Findings in Light of Existing Research Studies

This study's findings have supported existing mnemonic research (Cade & Gunter, 2002; King-Sears, 1989; Mastropieri, Emerick, & Scruggs, 1988; Nolan & Polloway, 1992) demonstrating the effectiveness of mnemonic strategies for students labeled E/BD. In addition, this investigation has extended these positive findings to high school students with E/BD. Prior to the mnemonic interventions, the subjects incorrectly recalled the meanings of vocabulary terms as demonstrated by low percentages of terms correctly recalled on written assessments during baseline conditions. The students correctly recalled the meanings as evidenced by the high percentages of terms correctly recalled on the written assessments after the investigator provided all mnemonic interventions. Existing mnemonic research with this population has supported the effectiveness of mnemonic strategies for improving

the memories for academic content with primary and middle school students labeled E/BD.

More specifically, this investigation and the majority of the existing mnemonic research (King-Sears, 1989; Mastropieri, Emerick, & Scruggs, 1988; Nolan & Polloway, 1992) for students with E/BD have extensively supported the effectiveness of keyword mnemonic strategies in the content area of science. The investigator examined the effectiveness of keyword mnemonic strategies for high school aged students labeled E/BD in recalling the definitions of scientific vocabulary terms from a general education high school science curriculum. All subjects correctly recalled the definitions of previously unfamiliar vocabulary terms after mnemonic interventions.

Most recently, this investigation and Cade and Gunter's study (2002) demonstrated the speed for learning content with mnemonic strategies for students labeled E/BD. Cade and Gunter (2002) reported all three subjects immediately increased their baseline scores after one mnemonic intervention. Subject one's baseline score increased from 4% to 96%. Subject two's baseline score increased from 4% to 83%. Subject three's baseline score increased from 8% to 100%. In this current investigation, seven of the ten subjects increased their baseline scores from 0% to 100% after one mnemonic intervention. The other three subjects' baseline scores increased from 17% to 100% after one mnemonic intervention. Both of these recent studies supported the immediate benefits of employing mnemonic strategies after one mnemonic intervention.

This investigation supported and extended the existing mnemonic strategy research as an effective academic intervention for students labeled E/BD and other students receiving special education services. In addition, this investigation supported the meta-analysis of effective practices in special education (Forness, Kavale, Blum, & Lloyd, 1997). In this meta-analysis, mnemonic strategies earned an effect size of 1.62. Both this investigation and the meta-analysis's high effect size indicated mnemonic strategies were effective academic interventions. Mnemonic strategies, including keyword mnemonic strategies, have been utilized as a successful strategy for students with E/BD regarding the rapid recall of academic content. In addition, this investigation has extended the previously noted positive findings to high school populations labeled E/BD.

#### Implications of the Study for Theory

Teachers needed to provide effective instruction for students labeled E/BD. The literature (Forness, Kavale, Blum, & Lloyd, 1997) recognized mnemonic strategies as one of the most effective interventions in the special education research on instruction. Keyword mnemonic strategies were grounded in the information processing theory of memory as described in Chapter II. This study provided further support for this theory of memory as keyword mnemonic strategies made the new information meaningful. The three major stores in the information processing theory of memory stored and retrieved meaningful information. Information from a person's senses flowed into the sensory register where it processed this information according

to this theory of memory. If information was determined to be meaningful, it flowed into the short term memory (STM). In the STM, some of the information was transferred to the long term memory (LTM) where a person stored and retrieved information. Keyword mnemonic strategies helped link new material to information in the LTM. A person easily recalled that new piece of information when a new piece of information had several links to information in the LTM (Morris, 1996).

For example, the students in this study had difficulty matching the term “kame” to its appropriate definition prior to introducing the mnemonic intervention. The investigator reconstructed the term “kame” into a familiar, easily visualized, similar sounding word of “cane.” Then, the investigator related the keyword “cane” to its definition of “a cone shaped hill” on an 8 ½ by 11 inch illustrated card described in Chapter III. The students retrieved the illustration from their LTM. The students remembered the picture of the keyword interacting with the term's definition in order to recall the term's meaning. In this case, the cane climbed up the cone shaped hill. Thus, the students' STM processed this new piece of information as meaningful and then transferred it to the LTM where the keyword mnemonic strategy linked this new information to several pieces of "old" information.

#### Limitations

This investigation contained several limitations including a nonrepresentative sample of participants, the disadvantages of the study's single subject research design, and limited applications of the keyword mnemonic strategy. First, the



participants were not representative of the population of students labeled E/BD in the United States in the following areas: geographical location, ethnicity, and gender. This population's ethnicity was: a) 62.6% were white, b) 26.65% were black, and c) 8.11 % were Hispanic (U.S. Department of Education, 2002). All the participants were white reflecting the study's setting which was 95.9% white (Standard & Poor's, 2003).

Second, the investigation's single subject research design contained limitations. These limitations included a small sample size, which often characterized this type of research. The investigation's use of multiple baselines reduced this limitation. Furthermore, single subject designs have required larger effects that were more generalizable across individuals rather than group designs meeting weaker statistical standards (Kazdin, 1982). Another limitation of the investigation's single subject research design specifically involved the multiple baseline design and its need for repeated measurements (Martella, et al., 1999). These repeated measurements presented limitations to this investigation as its repetitiveness may have ended in reactivity during baseline conditions (Horner & Baer, 1978). The investigation's use of single probes reduced this limitation. The investigator administered a single probe during the baseline condition for each subject as it was more advantageous to have fewer data points in order to avoid the participant's reactivity. Avoiding reactivity was a greater advantage than the disadvantage of having a small number of data points.

Third, keyword mnemonic strategies have somewhat limited applications. These mnemonic strategies have been a small, however important portion of other strategies and skills students have needed for success in school. Keyword mnemonic strategies, appropriate for recalling the meanings for unfamiliar vocabulary terms, provided a structured route for retrieval. Other strategies students have needed for academic success included writing strategies such as sentence writing, paragraph writing, and editing strategies.

Although these limitations were serious, they have not diminished the study's significant findings pertaining to student achievement. The demonstration of the keyword mnemonic strategy's success consistently across students who have the poorest educational outcomes of any disability category was educationally significant. Specifically, the replicated high scores across all subjects provided evidence of a functional relationship between keyword mnemonic strategies and the ability to recall scientific vocabulary terms.

### Further Exploration

The overwhelmingly positive results of this study have provided support for keyword mnemonic strategies with high school aged students labeled E/BD. All students recalled previously unfamiliar vocabulary terms as demonstrated by the high percentages of terms correctly recalled on the written assessments during the mnemonic intervention conditions. Although successful replications occurred in other studies, several areas needed further exploration. First, future research needed

to examine the effectiveness of keyword mnemonic strategies with a larger, more representative population of high school participants labeled E/BD in the areas of geographical locations, ethnicity, and gender.

Future research needed to explore the effect of mnemonic strategies in general education settings with this population. Investigators conducted all existing research (Cade & Gunter, 2002; King-Sears, 1989; Mastropieri, Emerick, & Scruggs, 1988; Nolan & Polloway, 1992) on mnemonic strategies with students labeled E/BD including this investigation in special education settings. Since this increasing population has been receiving services in less restrictive environments (U.S. Department of Education, 2002), it was imperative to know if these students benefited from mnemonic strategies in the context of general education classrooms.

Prospective studies needed to research the effects of mnemonic strategies in different content areas including English, foreign language, math, and social studies with students labeled E/BD. Investigators conducted previous research (King-Sears, 1989; Mastropieri, Emerick, & Scruggs, 1988; Nolan & Polloway, 1992) using scientific content with these students. One study (Cade & Gunter, 2002) examined mnemonic strategies in the content area of math with students labeled E/BD. Extensive research (Bryant, Goodwin, Bryant, & Higgins, 2003; Hwang & Levin, 2002; Maccinni & Ruhl, 2000; Mastropieri & Scruggs, 1994; McLoone, Scruggs, Mastropieri, & Zucker, 1986; Uberti, Scruggs, & Mastropieri, 2003) involving students with and without disabilities has demonstrated the effectiveness of mnemonic strategies in different content areas.

Prospective investigations needed to assess the effectiveness of keyword mnemonic strategies using different research designs. For example, a multiple baseline design across settings could be used to evaluate the effects of keyword mnemonic strategies for a student labeled E/BD in different classes. The purpose of this new investigation was to determine whether the percentage of terms correctly recalled on assessments increased as a function of the introduction of the keyword mnemonic strategy in different classroom settings. The subject's classroom teachers could have presented content area vocabulary using the keyword mnemonic strategy. This mnemonic strategy could have been systemically implemented in the first class, then in the second class, and finally in the third class. The multiple baseline design across settings appropriately assessed the effectiveness of the keyword mnemonic strategy across the subject in different classes.

Future studies needed to assess different types of mnemonic strategies including letter strategies, consisting of acrostics and acronyms, and pegword methods (see Chapter II for descriptions). The majority of the four previous mnemonic studies involving students labeled E/BD utilized keyword methods. Three (King-Sears, 1989; Mastropieri, Emerick, & Scruggs, 1988; Nolan & Polloway, 1992) of these four studies used keyword mnemonic strategies. The fourth study (Cade & Gunter, 2002) used a musical mnemonic strategy. No existing research has investigated pegword methods or letter strategies with this population.

## Conclusion

The results of this investigation indicated keyword mnemonic strategies were highly effective for high school students labeled E/BD on their abilities to recall meanings of scientific terms. The investigator collected data using a multiple baseline across subjects design and analyzed the data through visual inspection pertaining to the research question stated earlier and its corresponding null hypotheses. The investigator rejected the four null hypotheses as follows. First, the investigator observed differences between the data points' means for the baseline and mnemonic intervention phases for all of the subjects. Second, the investigator observed differences between the baselines' ending value and the mnemonic intervention phases' beginning value for all subjects. Third, the investigator observed positive trends in performance during the mnemonic intervention condition for the subjects. Finally, the investigator observed impacts pertaining to the mnemonic intervention as indicated by the percentage of overlapping data in contiguous phases for all subjects. Perhaps most important, the majority of the students immediately recalled the terms' meanings after one mnemonic intervention. For example, the majority of these students increased their scores from 0% to 100% after one mnemonic intervention. Therefore, this study has provided a substantial amount of support for the effectiveness of using keyword mnemonic strategies with high school students labeled E/BD in science. Since this evidence was overwhelmingly positive, it has enhanced the research base from which future studies can commence.

## **APPENDIX A**

### **Assent**

Western Michigan University

Department of Educational Studies

Principal Investigator: Dr. Sarah Summy      Student Investigator: Karen Kleinheksel

Project Title: Keyword Mnemonic Strategies for Students with Emotional and/or Behavioral Disorders

We are doing a research study. A research study is a special way to find out about something. We want to find out if keyword mnemonic strategies help you learn new vocabulary words.

You can be in this study if you want to. If you want to be in this study, you will be asked to meet with Mrs. Kleinheksel during study hall on approximately four different occasions for about 20 minutes each time in February.

We want to tell you about some things that might happen if you are in this study. The only risks we can see are loss of study hall time and minor discomforts usually experienced by students when they are being taught and graded such as boredom. In addition, Mrs. Kleinheksel will offer extra help on what you might have missed during study hall in order to minimize the impact of the loss of study hall time.

If you decide to be in this study, some good things might happen to you. You might learn six new vocabulary words and a new strategy. But we don't know for sure that these things will happen. We might also find out things that will help other students some day.

When we are done with the study, we will write a report about what we found out. We won't use your name in the report.

You don't have to be in this study. You can say "no" and nothing bad will happen. If you say "yes" now, but you want to stop later, that's okay too. No one will be mad at you, or punish you if you want to stop. All you have to do is tell us you want to stop. If you choose not to be in this study, you will remain in study hall.

If you have any questions or concerns about this study, you may contact either Dr. Sarah Summy at 269-387-5943 or Karen Kleinheksel at 616-897-4125.

The stamped date and signature of the board chair in the upper right corner means this consent document is approved for use one year by the Human Subjects Institutional Review Board. Do not participate if the stamped date is more than one year old.

If you want to be in this study, please sign your name and turn in the form to Mrs. Kleinheksel at your convenience before or after classes.

I \_\_\_\_\_, want to be in this research study.

(write your name here)

\_\_\_\_\_  
Investigator Signature

\_\_\_\_\_  
Date



## **APPENDIX B**

### **Parent or Guardian Permission**

Western Michigan University

Department of Educational Studies

Principal Investigator: Dr. Sarah Summy

Student Investigator: Karen Kleinheksel

Your child has been invited to participate in a research project entitled "Keyword Mnemonic Strategies for Students with Emotional and/or Behavioral Disorders."

The purpose of the study is to determine if keyword mnemonic strategies are effective for high school aged students. This project is being conducted to fulfill Karen Kleinheksel's dissertation requirement.

Your permission for your child to participate in this project means that your child will be instructed to use the keyword mnemonic strategy to learn the meanings of six scientific vocabulary terms from the Kent County Collaborative Curriculum (KC4). The study will take place during February 2004 and will involve approximately four sessions of no more than twenty minutes per session. Your child will be assessed and taught the keyword mnemonic strategy individually by the student investigator who is a special education teacher Lowell High School.. In addition, several of the sessions will be audio taped to determine if the investigator is implementing the procedures correctly. Your child will be free at any time -- even during the assessment administration -- to choose not to participate. If your child refuses or quits, there will be no negative effect on his/her school programming. In addition, if your child does not participate, his or her grades or services offered at school will not be affected. Although there may be no immediate

benefits to your child for participating, there may eventually be benefits for your child to use this strategy in other classes at school.

The researchers will be provided with information pertaining to the child as followed: (a) gender, (b) age, (c) ethnicity, and (d) grade level. All assessment data and information will remain confidential. That means that your child's name will be omitted from all assessment forms and a code number will be attached. The principal investigator will keep a separate master list with the names of the children and the corresponding code numbers. Once the data are collected and analyzed, the master list will be destroyed. All other forms will be retained for at least three years in a locked file in the principal investigator's office. No names will be used if the results are published or reported at a professional meeting or journal.

The only risks anticipated are loss of study hall time and minor discomforts typically experienced by children when they are being instructed and assessed (e.g., boredom). In order to minimize the impact of losing time from study hall period, the Mrs. Kleinheksel will offer make up time to the students before or after school on an individual basis. All of the usual methods employed during instruction and assessment to minimize discomforts will be employed in this study. As in all research, there may be unforeseen risks to your child. If an accidental injury occurs, appropriate emergency measures will be taken; however, no compensation or treatment will be made available to me or your child except as otherwise specified in this permission form.

You may withdraw your child from this study at any time without any negative effect on services to your child. If you have any questions or concerns about this study, you may contact either Dr. Sarah Summy at 269-387-5943 or Karen Kleinheksel at 616-897-4125. You may also contact the Chair of the Human Subjects Institutional Review Board at 269-387-8293 or the Vice President for Research 269-387-9298 if questions or problems arise during the course of the study.

This permission document has been approved for use for one year by the Human Subjects Institutional Review Board (HISRB) as indicated by the stamped date and signature of the board chair in the upper right corner. Do not permit your child to participate if the stamped date is more than one year old.

Your signature below indicates that you, as parent or guardian, can and do give your permission for \_\_\_\_\_ (child's name): 1) to be assessed with scientific vocabulary assessments, 2) to be taught the keyword mnemonic strategy, 3) for your child's information to be released to the researchers, and 4) for the assessments' scores to be used by the researchers.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

Permission obtained by:

\_\_\_\_\_  
Initials of researcher

\_\_\_\_\_  
Date

**APPENDIX C**  
**Assessment Form A**

## Assessment Form A

Directions: Write the letter of the matching definition next to the correct vocabulary word.

### Terms

1. \_\_\_\_kettle
2. \_\_\_\_kame
3. \_\_\_\_cirque
4. \_\_\_\_drumlin
5. \_\_\_\_alluvial fan
6. \_\_\_\_esker

### Definitions

- a. cone shaped hill consisting  
of sorted material deposited  
by a melting glacier
- b. a triangular deposit of  
sediment
- c. canoe shaped hill with a  
smooth summit
- d. winding ridge of sorted  
sediment left by streams  
flowing under a glacier
- e. bowl shaped basin
- f. depression caused by  
melting blocks of ice left by  
a glacier

## **APPENDIX D**

### **Script for Baseline Conditions**

**Materials:**

1. Cassette recorder (20% of baseline conditions will be audio taped)
2. Assessment Form A

**Directions for Baseline Conditions**

You are going to complete a matching worksheet on vocabulary words and their definitions. There are six words on this page. There are some words you won't recognize and you may not know these words' definitions. Try your best. This test will not affect your grades in any classes or your relationship with me. In addition, you may withdraw from this study at anytime.

(Distribute Assessment Form A to the student).

Since this is confidential, you do not need to write your name on this paper. You have up to 5 minutes to complete this paper. Please follow along as I read the directions at the top of the paper. (Read the directions aloud to the student.) Do you have any questions?

(Answer any questions.)

You may start.

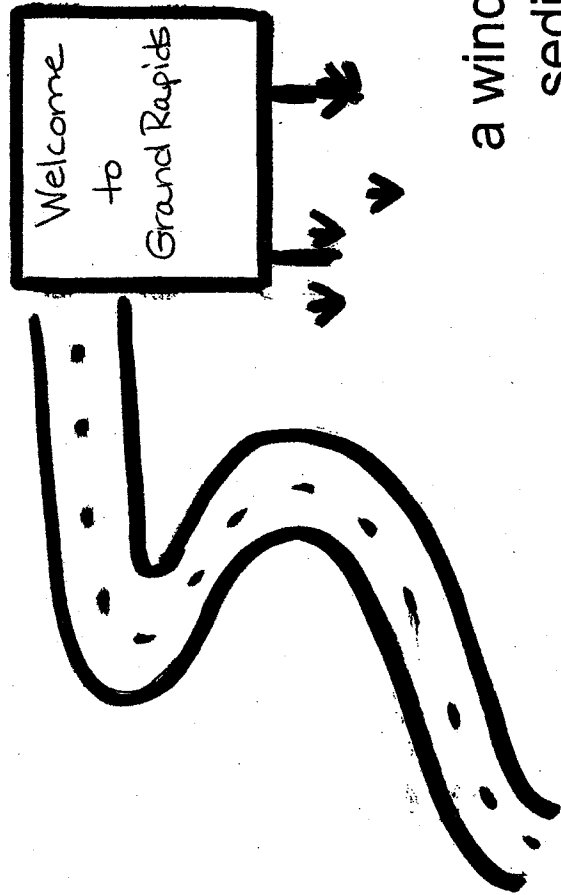


## **APPENDIX E**

### **Keyword Mnemonic Strategy Cards**

esker

(s-curve)



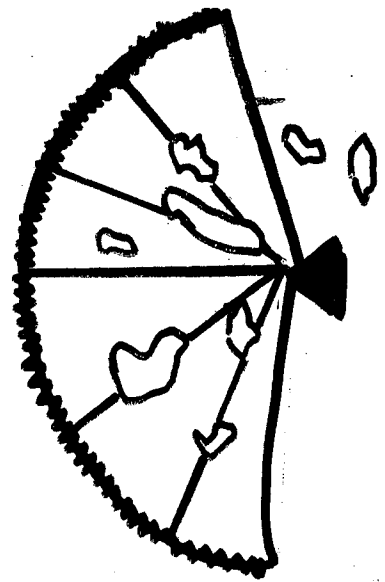
a winding ridge of  
sediment

esker

# S-curve

alluvial fan

(fan)



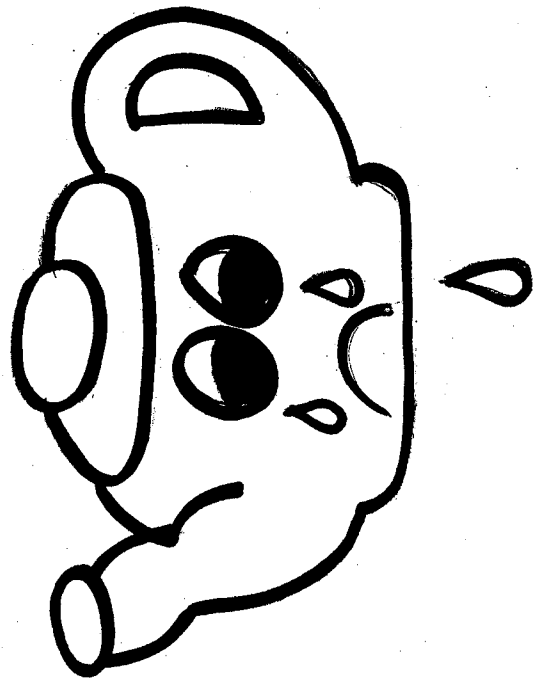
a triangular deposit of  
sediment

# alluvial fan

fan

kettle

tea kettle



a depression

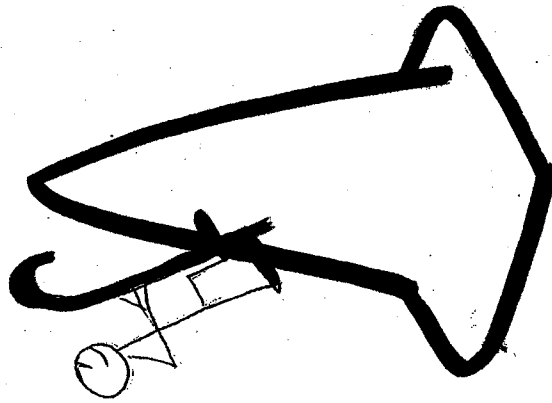


kettle

# tea kettle

kame

(cane)



a cone shaped hill

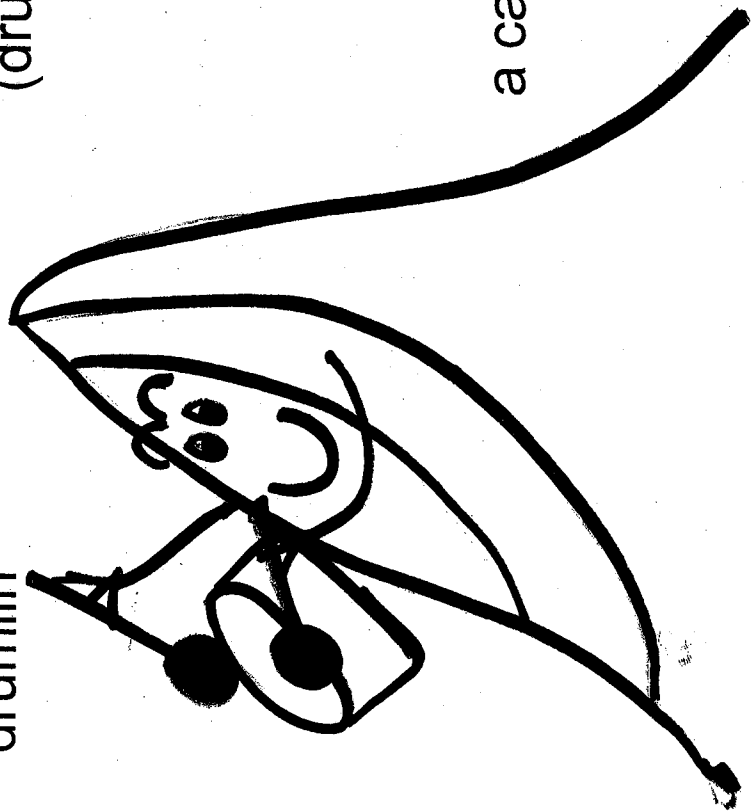
kame

cane

drumlin

(drum)

a canoe shaped hill



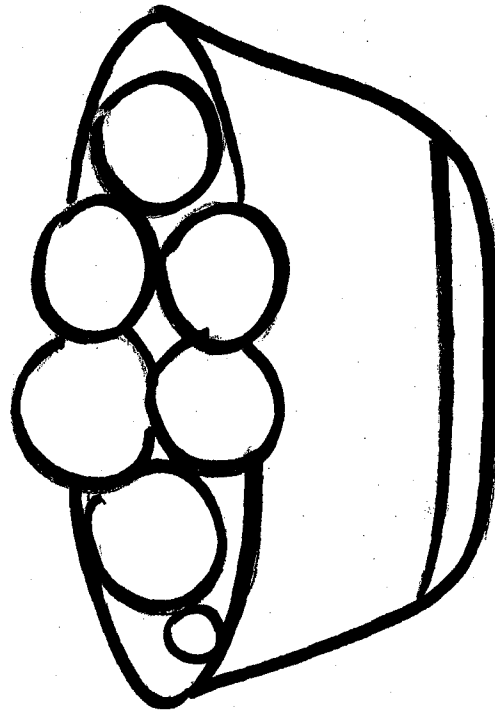
# drumlin

drum



circle

circle



a bowl shaped basin

cirque

circle

**APPENDIX F**  
**Assessment Form B**

## Assessment Form B

Directions: Write the letter of the matching definition next to the correct vocabulary word.

### Terms

\_\_\_cirque

\_\_\_kame

\_\_\_kettle

\_\_\_drumlin

\_\_\_esker

\_\_\_alluvial fan

### Definitions

cone shaped hill consisting of

sorted material deposited by a

melting glacier

a triangular deposit of sediment

canoe shaped hill with a smooth

summit

winding ridge of sorted sediment

left by streams flowing under a

glacier

bowl shaped basin

depression caused by melting

blocks of ice left by a glacier

## **APPENDIX G**

### **Script for Intervention Condition, Session One**

### Materials:

Twelve 8.5 by 11-inch cards: For each term, there are two cards. The first card in the set of two has the term on the front and its keyword on the back. The second card in the set of two has the term, its keyword, the definition, and an illustration.

Cassette recorder (20% of all intervention conditions will be audio taped)

### 3. Assessment Form B

#### Directions for Intervention Condition, Session One

Today, you are going to learn the definitions of scientific terms through a mnemonic strategy followed by a brief matching worksheet. In the following days, there will be a quick review over these same terms followed by a similar matching worksheet to see how many terms you have learned.

#### Demonstration

(Display the first card for drumlin.) You are going to learn that drumlin means a canoe shaped hill. There are two steps to help you learn this word and its meaning. First, you need to learn the keyword for this vocabulary term. A keyword is a word that you already know and sounds like a part of the vocabulary term.

The first word is drumlin. A good keyword for drumlin is drum. (Display the back of the first card for drumlin.) What is the keyword for drumlin? (Pause for answer.)

Remember, drumlin means a canoe shaped hill. The keyword is drum.

For the second step, I am going to display a picture that can help you remember the term's meaning. The picture shows the keyword for the term. In the picture, the keyword is also doing something with the meaning of the vocabulary term. (Display the second card for drumlin.) In this picture, the canoe shaped hill is playing the

drum. The keyword for drumlin is drum. Try to put this picture of the canoe shaped hill playing the drum to memory. What is this picture about? (Wait for answer, student may need prompting.) If you can remember the picture of the canoe shaped hill playing the drum, then you can remember that drum means a canoe shaped hill.

### Modeling

The next word is kettle. (Display the front side of the first card for kettle.) What is the next word? (Pause for response.) The keyword for kettle is teakettle. (Display the back side of the first card for kettle.) What is the keyword for kettle? (Pause for response.) Kettle means a depression. What does kettle mean? (Pause for response.) To remember that kettle means a depression think about the picture (display second card for kettle) of a teakettle being depressed or sad. What is the teakettle doing with kettle? (Pause for response.) What does kettle mean? (Pause for response.)

### Guided Practice-Keyword Phase

Now you are going to learn the keywords for the other terms.

The keyword for kame is cane. (Pronounce the term and keyword while displaying the first card for kame once.) Now what is the keyword for kame? (Pause for response.)

The keyword for cirque is circle. (Pronounce the term and keyword while displaying both sides of the term's first card.) Now what is the keyword for cirque? (Pause for response.)

The keyword for esker is s-curve. (Pronounce the term and keyword while displaying both sides of the term's first card.) Now what is the keyword for esker? (Pause for response.)



The keyword for alluvial fan is fan. (Pronounce the term and keyword while displaying both sides of the term's first card.) Now what is the keyword for alluvial fan? (Pause for response.)

(Randomly mixing up the cards, assess student three times for recalling the term's correct keyword.)

#### Guided Practice-Study phase

I am going to display the pictures to you that can help you remember the terms' meanings. Notice, the pictures show the keywords doing something with the terms' definitions. You will have time to study the pictures.

(Display card two for alluvial fan for 30 seconds) The word alluvial fan which sounds like fan means a triangular deposit of sediment. Here is a picture of a fan with sediment and triangles all over it. What does alluvial fan mean? (Pause for response.)

(Display card two for esker for 30 seconds) The word esker which sounds like s-curve means a winding ridge of sediment. Here is a picture of the winding S-Curve in Grand Rapids. What does esker mean? (Pause for response.)

(Display card two for cirque for 30 seconds) The word cirque which sounds like circle means a bowl shaped basin. Here is a picture of a bowl with circles floating on top. What does cirque mean? (Pause for response.)

(Display card two for kame for 30 seconds) The word kame which sounds like cane means a cone shaped hill. Here is a picture of a cane climbing up a cone shaped hill. What does kame mean? (Pause for response.)

#### Evaluation

The time for instruction on these terms has ended for today. Here is your matching worksheet over these six terms. (Distribute Assessment Form B.) You don't need to write your name on the paper since this is confidential. Follow along while I'm reading the directions located in the upper portion on the paper. (Read directions to the student.)

You have five minutes to complete this. Do you have any questions? (Pause for response.)

You may begin.

**APPENDIX H**  
**Assessment Form C**

Directions: Write the letter of the matching definition next to the correct vocabulary word.

Terms

\_\_\_kettle

\_\_\_cirque

\_\_\_kame

\_\_\_drumlin

\_\_\_alluvial fan

\_\_\_esker

Definitions

cone shaped hill consisting of sorted

material deposited by a melting

glacier

a triangular deposit of sediment

canoe shaped hill with a smooth

summit

winding ridge of sorted sediment

left by streams flowing under a

glacier

bowl shaped basin

depression caused by melting blocks

of ice left by a glacier

## **APPENDIX I**

### **Assessment Form D**

Directions: Write the letter of the matching definition next to the correct vocabulary word.

**Terms**

\_\_\_\_\_esker

\_\_\_\_\_kame

\_\_\_\_\_cirque

\_\_\_\_\_drumlin

\_\_\_\_\_alluvial fan

\_\_\_\_\_kettle

**Definitions**

cone shaped hill consisting of sorted

material deposited by a melting

glacier

a triangular deposit of sediment

canoe shaped hill with a smooth

summit

winding ridge of sorted sediment

left by streams flowing under a

glacier

bowl shaped basin

depression caused by melting blocks

of ice left by a glacier

**APPENDIX J**  
**Assessment Form E**

Directions: Write the letter of the matching definition next to the correct vocabulary word.

Terms

\_\_\_\_kettle

\_\_\_\_drumlin

\_\_\_\_cirque

\_\_\_\_kame

\_\_\_\_alluvial fan

\_\_\_\_esker

Definitions

cone shaped hill consisting of sorted

material deposited by a melting

glacier

a triangular deposit of sediment

canoe shaped hill with a smooth

summit

winding ridge of sorted sediment

left by streams flowing under a

glacier

bowl shaped basin

depression caused by melting blocks

of ice left by a glacier



## **APPENDIX K**

### **Script for Intervention Condition, Sessions Two through Four**

## Materials

1. Twelve 8.5 by 11-inch cards: For each term, there are two cards. The first card in the set of two has the term on the front and its keyword on the back. The second card in the set of two has the term, its keyword, the definition, and the illustration.
2. Cassette recorder (20% of intervention conditions will be audio taped)
3. Assessment Form C, D, or E

We will be reviewing the terms you learned like we did the last time we met. There is a short matching worksheet at the end of the review. We will now begin.

## Guided Practice-Keyword Phase

The keyword for kame is cane. (Pronounce the term and keyword while displaying both sides of the term's first card once.) Now what is the keyword for kame? (Pause for response.)

The keyword for cirque is circle. (Pronounce the term and keyword while displaying both sides of the term's first card once.) Now what is the keyword for cirque? (Pause for response.)

The keyword for esker is s-curve. (Pronounce the term and keyword while displaying both sides of the term's first card once.) Now what is the keyword for esker? (Pause for response.)

The keyword for alluvial fan is fan. (Pronounce the term and keyword while displaying both sides of the term's first card once.) Now what is the keyword for alluvial fan? (Pause for response.)

The keyword for drumlin is drum. (Pronounce the term and keyword while displaying both sides of the term's first card.) Now what is the keyword for drumlin?

(Pause for response.)

The keyword for kettle is tea kettle. (Pronounce the term and keyword while displaying both sides of the term's first card once.) Now what is the keyword for kettle? (Pause for response.)

(Randomly mixing up the cards, assess the student three times for recalling the term's correct keyword.)

#### Guided Practice-Study phase

Now, I am going to display the pictures to you that can help you remember the term's meanings. Remember, the pictures show the keyword doing something with the term's definition. You will have time to study the pictures.

(Display card two for alluvial fan for 30 seconds) The word alluvial fan which sounds like fan means a triangular deposit of sediment. Here is a picture of a fan with sediment and triangles all over it. What does alluvial fan mean? (Pause for response.)

(Display card two for esker for 30 seconds) The word esker which sounds like s-curve means a winding ridge of sediment. Here is a picture of the winding S-Curve in Grand Rapids. What does esker mean? (Pause for response.)

(Display card two for cirque for 30 seconds) The word cirque which sounds like circle means a bowl shaped basin. Here is a picture of a bowl with circles floating on top. What does cirque mean? (Pause for response.)

(Display card two for kame for 30 seconds) The word kame which sounds like cane means a cone shaped hill. Here is a picture of a cane climbing up a cone shaped hill.

What does kame mean? (Pause for response.)

(Display card two for drumlin for 30 seconds) The word drumlin which sounds like drum means a canoe shaped hill. Here is a picture of a canoe shaped hill playing a drum. What does drumlin mean? (Pause for response.)

(Display card two for kettle for 30 seconds) The word kettle which sounds like teakettle means a depression. Here is a picture of a depressed teakettle. What does kettle mean? (Pause for response.)

#### Evaluation

The time for review on these terms has ended for today. Here is your matching worksheet over these six terms. (Distribute Assessment Form C for Intervention Condition Session 2, Assessment Form D for Intervention Condition Session 3, and Assessment Form E for Intervention Session 4). You don't need to write your name on the test since this is confidential. Follow along while I'm reading the directions located in the upper portion on your test. (Read directions to the student.)

You have five minutes to complete this. Do you have any questions? (Pause for response.)

You may begin.

## **APPENDIX L**

### **Time Sampling Data Collection Form**

Time Sampling Data Collection Form

Student: \_\_\_\_\_

Date: \_\_\_\_\_

Code: x=occurrence o=nonoccurrence (note at the end of each interval)

	.5	1	1.5	2	2.5	3.0	3.5	4.0	4.5min
1. following script									
2. following sequence									
3. fluent pacing									

Source: Adapted from Alberto & Troutman (2003)

## **APPENDIX M**

### **Directions for Completing the Time Sampling Data Collection Form**

**Materials:**

scripts for intervention and baseline conditions

cassette tape

tape player

writing utensil

time sampling data collections forms

timer

**Procedure:**

Gather all of the materials on the list.

Make sure the cassette tape is started at the beginning of the tape.

Begin the timer when the investigator begins speaking on the tape.

At the end of each 30 second interval, record the appropriate data in the boxes representing intervals.

If the behavior was occurring at the end of the interval, write an X in the appropriate box.

If the behavior was not occurring at the end of the interval, write an O in the box. Each box should only have one notation. The behaviors are defined as followed: 1) following the script is defined as did the investigator follow the script, 2) following sequence is defined as did the investigator follow the sequence of the script, and 3) fluent pacing is defined as did the investigator have a fluent pace for high school students.

There are approximately ten seconds between each condition.

Repeat steps 3-5 for subsequent interventions.



## **APPENDIX N**

### **HSIRB Approval Letter**

# WESTERN MICHIGAN UNIVERSITY



Human Subjects Institutional Review Board

Date: January 27, 2004

To: Sarah Summy, Principal Investigator  
Karen Kleinheksel, Student Investigator for dissertation  
Francesca Bartocci, Student Investigator  
Laura Getty, Student Investigator

From: Mary Lagerwey, Ph.D., Chair

A handwritten signature in cursive script that reads "Mary Lagerwey".

Re: HSIRB Project Number: 03-12-11

This letter will serve as confirmation that your research project entitled "Keyboard Mnemonic Strategies for Students Labeled Emotional and/or Behavioral Disordered" has been approved under the expedited category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note that you may only conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: January 27, 2005

Walwood Hall, Kalamazoo, MI 49008-5456  
PHONE: (269) 387-8293 FAX: (269) 387-8276

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