EMOTION SELF-REGULATION: A MIXED-METHODS INTERVENTION STUDY OF SOCIOEMOTIONAL AND READING OUTCOMES OF HIGH SCHOOL STUDENTS WITH READING DIFFICULTIES

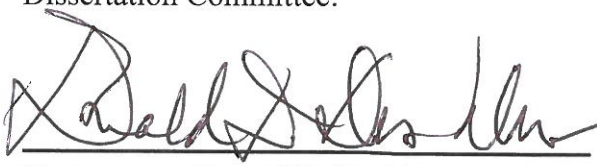
By

Leslie C. Novosel

B.S., Illinois State University—Normal, 1980
M.Ed., University of Texas at Austin—Austin, 2006

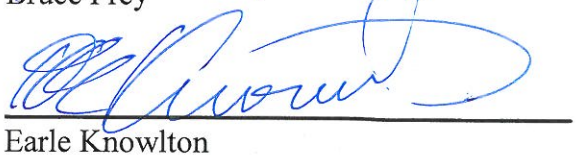
Submitted to the Department of Special Education and the Faculty of the Graduate School of the University of Kansas in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

Dissertation Committee:



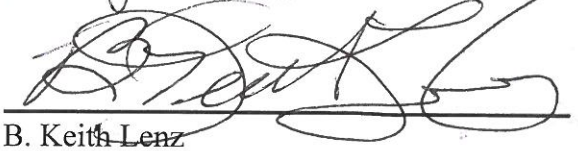
Chairperson, Donald D. Deshler

Bruce Frey



Earle Knowlton

Suzanne M. Robinson



B. Keith Lenz

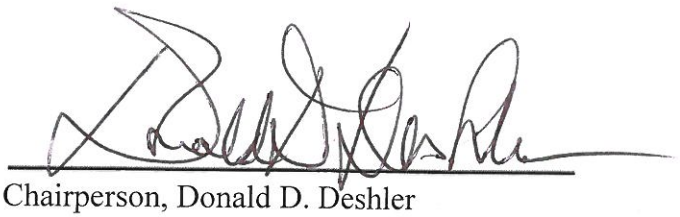
Dissertation defended: June 28, 2012

ProQuest LLC.
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106 - 1346

ACCEPTANCE PAGE:

The Dissertation Committee for Leslie C. Novosel certifies that this is the approved version of the following dissertation:

EMOTION SELF-REGULATION: A MIXED-METHODS INTERVENTION STUDY OF SOCIOEMOTIONAL AND READING OUTCOMES OF HIGH SCHOOL STUDENTS WITH READING DIFFICULTIES



Chairperson, Donald D. Deshler

Date Approved: June 28, 2012

ABSTRACT

Employing multiple methods, including a comparison group pre/posttest design and student interviews and self-reflections, this study represents an initial attempt to investigate the efficacy of a social and emotional learning self-regulation strategy relative to the general reading ability, reading self-concept, and social and emotional well-being of adolescents, with and without disabilities, enrolled in a reading course in urban high schools. This intervention was based on psychophysiological theory accounting for cognitive, behavioral, and emotional processes, including physical systems, involved in learning and performance. The instructional features of this intervention integrate the foundational elements shown to improve outcomes for adolescents who struggle with reading. The results of this study suggest that students with reading difficulties can self-generate a positive emotion refocusing self-regulation strategy associated with achieving a highly coherent state, optimal for learning and performance.

DEDICATION

To my husband, whose bigheartedness and undying faith helped me to achieve what I never thought possible. I love you, *Gary Novosel*.

ACKNOWLEDGMENTS

First and foremost, I would like to thank my advisor, Dr. Donald D. Deshler, for the countless hours of guidance and remarkable learning opportunities. By far the busiest person I know, he always made himself available. Most importantly, he modeled how to collaborate with colleagues, effectively solve problems, and think and write like a scholar and scientist. I am truly grateful that his interest in his students' wellbeing and future aspirations that extends far beyond the years of graduate school and take great comfort in knowing he will be there as a colleague and friend. Lastly, I would be remiss in not mentioning the time he and his dear wife, Carol, made the long trek to visit my daughter when she was hospitalized over the Christmas holidays. I hold this act of kindness close to my heart and promise to uphold my commitment to pay-it-forward.

In addition, I had the good fortune of being blessed with an extraordinary co-advisor, Dr. Keith Lenz. His experience and expertise were most significant to my growth and development as a professional. Even more, he possessed a deep desire to share his knowledge and perspectives with your students. His enthusiasm and passion for preparing the next generation of teacher educators and research scientists is most laudable.

I want to express my sincere appreciation to the members of my doctoral committee, Drs. Bruce Frey, Mike Hock, Jim Knight, Earle Knowlton, Jennifer Ng and Suzanne Robinson. Their accessibility, timely responses to my questions, comprehensive review, and thoughtful suggestions assisted me in navigating the dissertation process and permanently shaped my thinking. It was a pleasure working with and learning from each of them.

A most heartfelt thanks goes out to the lifeline of the University of Kansas Center for Research on Learning support team, Barb Babcock, David Gnojek, Dr. Patricia Graner,

Jeannie Heil, Toby Jennings, Joshua Luthi, Pete Mynsted, Mona Tipton, Julie Tollefson, Lance Wessell, Shanna Williams, and the late Mary Briek. Each came to my rescue during times of crisis and never made me feel like I was inconveniencing them. I am deeply indebted for all that they did.

I want to thank each and every member of my cohort for their friendship and sharing this exciting, memorable journey with me. I wish all of you the best.

Thank you to the staff, students, and teachers who made this study possible. I am humbled by your kindness, support, and willingness to participate. To Jeff Goelitz and Rollin McCraty of the Institute of HeartMath. I appreciate the great amount of personal time they devoted to educating me on the theory and science of emotion self-regulation. Thank you to Dr. Nancy Tobia for giving so much time and energy to assist me with implementing this study.

To my professors and colleagues at the University of Texas at Austin, Drs. Shernaz Garcia, Kristie Hotchkiss, Deborah Reed, Sylvia Linan-Thompson, and Mary Jo Worthy. To Dr. Brock Boudreaux, champion bull-rider and stats professor, for his patience and scholarly guidance.

Thank you to my parents, Ernest Fogg and Claire Hymel for taking a vested interest in my education and instilling in me the virtues of selflessness and civic responsibility. To my siblings, Melanie Serra and Ernie Fogg, their unconditional love and encouragement meant the world to me. To my nephew, Kyle Serra, for the countless hours spent editing my interview footage.

Most especially, I would like to thank my beautiful children, Kristen Pealer and David Clauss. I deeply appreciate their graciousness and willingness to give up so much of

our precious time together. My children are my inspiration and I am so very proud to be their mother.

Last but not least, I am genuinely beholden to my mentor, colleague, and lifelong friend, Dr. Martha Hougen. Her infinite wisdom, indomitable spirit, and fierce dedication to educating practitioners and faculty of reading are admirable. I am infinitely grateful to her for her guidance, generosity of time and resources, and believing in my potential. Her support has been nothing short of life changing.

TABLE OF CONTENTS

Acceptance Page ii
Abstract iii
Dedication iv
Acknowledgements v
Table of Contents vi
List of Figures vii
List of Tables ix
List of Appendices x

CHAPTER I: INTRODUCTION 1
Risk Factors 5
Gender 5
Race and Ethnicity 7
Household Income 7
Disability Status 8
Literacy Deficits 10
Protective Factors 10
Social and Emotional Learning and Academic Achievement 11
Purpose of the Study 14

CHAPTER II: LITERATURE REVIEW 16
Cognition and Affect in Psychology and Education 19
Social and Emotional Learning 24
Background and Emergence of SEL 24
SEL Studies 27
The HeartMath Program 36
Psychophysiological Theory 37
Physiological Coherence 40
HeartMath Studies 42
High School Study 43
Middle School Study 47
Explicit Reading Instruction for Adolescents 51
Summary of Literature on the Effects of SEL Programs 53

CHAPTER III: METHODS 57
Setting 57
Selection Criteria 58
Classroom Configuration 59
Participants 59
Teachers 59
Students 60

Instructional Materials 64
Professional Development Materials 65
SSRI Materials 66
Quantitative Measurement Instruments 79
Psychophysiological Measure (6 minutes) 80
Reading Measures 82
Affect Measures 84
Qualitative Measurement Instruments 86
Student Interviews 87
emWave Handheld Tracker Form 89
Procedures 90
Recruitment of Teachers and Students 90
Professional Development Procedures 90
Coaching Sessions 91
Pretest Procedures 91
Instructional Procedures 92
Treatment Fidelity 96
Posttest Procedures 96
Scoring Procedures 96
Research Design 97

CHAPTER IV: RESULTS 98
Quantitative Results 98
Group Differences on Heart Rate Variability 99
Group Differences on TOWSRF 101
Group Differences on the Reading Self-Concept Scale 101
Group Differences on the Student Opinion Survey. 102
Qualitative Results 103
Pre-Intervention Interview 105
Post-Intervention Interview 108
Treatment Fidelity 112

CHAPTER V: DISCUSSION 113
Quantitative Conclusions 114
Qualitative Conclusions 115
Relation to Previous Research 118
Limitations 119
Future Research 121
Implications 122

REFERENCES 123

LIST OF FIGURES

Figure 1. The Inner Weather Report activity 68

Figure 2. Emotional Window activity 69

Figure 3. Pulse sensor 72

Figure 4. Heart rhythm patterns 72

Figure 5. The HRV screen 73

Figure 6. SSRI lesson plans 74

Figure 7. emWave portable device. 75

Figure 8. emWave Personal Tracker form 89

Figure 9. Estimated marginal means of HRV results. 100

Figure 10. Summary of respondents' ways of coping with tasks of reading 106

Figure 11. Summary of respondents' feelings about their reading abilities. 106

Figure 12. Summary of respondents' feelings about positive teacher feedback 107

Figure 13. Summary of respondents' feelings about negative teacher feedback. 107

Figure 14. Summary of respondents' feelings about SSRI. 108

Figure 15. Summary of respondents' feelings on generalizing the SSRI 109

Figure 16. Summary of respondents' feelings on utility of SSRI for others 110

LIST OF TABLES

Table 1: Treatment and Control Groups..... 62

Table 2: Demographic Data 63

Table 3: Instructional Minutes 93

Table 4: Psycho-physiological Results..... 100

Table 5: Test of Silent Word Reading Fluency Results 101

Table 6: Reading Self-Concept Scale Results..... 102

Table 7: Student Opinion Survey (SOS) Results 104

LIST OF APPENDICES

Appendix A: Student Activity Guide 149

Appendix B: SSRI Lesson Plans 154

Appendix C: emWave Handheld Device Tracker Form 163

Appendix D: SSRI Teacher Manual Example Lessons 165

Appendix E: Implementation Checklists 169

CHAPTER I

INTRODUCTION

High schools in the United States have historically faced the challenge of having to provide all students with the knowledge and skills essential for academic achievement, social and emotional well-being, and capacity for success in life. With one in four U.S. public school students leaving high school before graduation, America continues to face a grave problem. A report published by the Alliance for Education revealed that approximately 1.2 million students (7,000 per school day) dropped out of high school in 2008 (Alliance for Excellent Education, 2012). Looking at the nation's 50 largest school districts, the analysis shows that, in 39 of them, graduation rates are below the national average. Notably, urban districts occupy the lowest rungs on the 50-district ranking, often graduating no more than half their students (EPE Research Center, 2011). Furthermore, the report determined these figures represent a lifetime earning deficit of $1.54 billion for the class of 2011 alone.

Dropping out of high school leads to a multitude of difficulties, making it harder for these young people to experience success in life. To clarify, higher levels of unemployment, lower earnings, and increased health problems have been linked to early withdrawal from school (Jimerson, Egeland, Sroufe, & Carlson, 2000). Moreover, our economy loses hundreds of billions of dollars in productivity and our communities suffer massive social costs.

Another consequence of school failure is the increased probability of involvement in the juvenile justice system. Indeed, youth who drop out of high school are 63 times more likely to be incarcerated than those who complete college (Sum, Khatiwada, McLaughlin, &

Palma, 2009), resulting in staggering social and economic costs. The United States spends an average of $80,000 per year to incarcerate one juvenile, equating to $5.7 billion annually (Sum et al.). Recent data reveal that approximately three million youth under the age of 18 are arrested in the United States each year (Puzzanchera, Sladky, & Kang, 2011). A disproportionate number of these youth exhibit reading and writing deficits.

One risk factor contributing to the likelihood of adolescents dropping out of school is illiteracy. Disproportionate numbers of adolescents with reading deficits stand at risk of school failure and involvement in the juvenile justice system; however, this tragic loss of human potential, not to mention taxpayers' dollars, has been largely disregarded by the field of education (Krezmien, Mulcahy, & Leone, 2008; Williams, Wexler, Roberts, & Carpenter, 2011). Thus, instead of addressing this serious issue, the high prevalence of students with disabilities and reading deficits among incarcerated youth has led to the U.S. juvenile justice system being referred to as the "default system" for students who have dropped out of school and students who have reading and writing deficits, as well as mental health problems (Nelson, 2000).

While illiteracy is not the only indicator placing students at risk for school failure and involvement in the juvenile justice system, it is the most common (Baltodano, Harris, & Rutherford, 2005; Brunner, 1993; Drakeford, 2002; Leone et al., 200; Leone, Krezmien, Mason, & Meisel, 2005; Leone, Quinn, & Osher, 2002; Moffitt, 1990). Sadly, this is nothing new. Illiteracy rates among youth in confinement were initially recorded over 30 years ago. A study conducted by Project READ, Inc. found that the typical youth offender in confinement was in the ninth grade (15.6 years old) and typically read five years below grade level ("To Make a Difference," 1978).

Gilligan (2010), a clinical professor of Psychiatry, Law, and Medicine at New York University, documented that juvenile crime rates in the United States are greater than those of any developed nation in the world, attributing discrimination against poor and minorities as the underlying principle. Regardless of cause, these findings leave no question concerning the urgency to address the literacy needs of adolescents.

A recent report published by the Alliance for Excellent Education reviewed the state of adolescent literacy in the United States (Haynes, 2011). Among other things, the report revealed that America's 15-year-olds rank only 14th among developing nations in reading. Although fourth-grade students in the United States scored higher in reading than any other nation in the world, by 10th grade they placed close to the bottom among students in developed nations.

Undeniably, a large number of adolescents enter secondary school lacking the skills requisite for mastering curriculum demands and understanding complex text (Faggella-Luby, Sampson Graner, Deshler, & Valentino, 2012; Hock & Deshler, 2003). Moreover, many students are in need of explicit instruction in basic reading skills. For example, a descriptive study of 345 high school students revealed that 61% had significant deficits within the domains of word identification, fluency, vocabulary, and comprehension (Hock et al., 2009), indicating that a substantial number of adolescents require instruction at the basic word reading level.

According to the most recent statistics from the Data Accountability Center for the Individuals With Disabilities Education Act (2011), schools reported that approximately 2.5 million students aged 3-21 years were identified with a specific learning disability (LD) during the 2010-2011 school year. Further, 80% of students with LD have a disability in the

area of reading; indeed, 90% identify reading as their primary difficulty ("A New Era," 2002).

Moreover, it has been documented that LDs often co-exist with emotional and behavioral disorders (EBD). For example, Coleman and Vaughn (2000) found a reciprocal link between academic and social behaviors, with failure in one domain causing failure in the other. The ramifications are complex. According to Coleman and Vaughn, students with LD and social and emotional difficulties have fewer opportunities to experience school success and instructional interactions with their teachers, receiving less exposure to the core curriculum and experience greater difficulties in mastering academic content.

These findings further support and highlight the urgent need to focus on improving the literacy outcomes, as well as the social and emotional skills, of adolescents to prevent placing them at risk of dropping out of school and, thereby, greatly increasing their chances of being involved with the juvenile justice system.

Recommendations to improve educational outcomes frequently include three components: (a) instructional techniques to ensure students understand course content; (b) supplemental classes to ensure students are reading at grade level; and (c) embedded systems of support for social and emotional growth and development (Alliance for Excellent Education, 2007; Bridgeland, DiIulio, & Burke Morison, 2006). The third component, embedded systems of support for high school students' socio-emotional needs, is focused on efforts to ensure students acquire the skills requisite to dealing with stressful, real-life situations. In effort to meet state standards of achievement, this component is often neglected in the work of secondary school-wide reform efforts.

The following three sections of this chapter are structured according to three central

themes: (a) risk factors, (b) protective factors, and (c) social and emotional learning. Lastly, an intervention study designed to improve the reading outcomes and social and emotional well-being of high school students at risk for school failure is proposed as a way to address the needs of high school students at risk for school failure.

Risk Factors

Risk factors, within the context of education, do not cause school failure. Rather, they serve to inform education professionals and policy makers of where the nation needs to focus resources to ensure schools are graduating students who are socially literate, intellectually thoughtful, and prepared for postsecondary success (Greenberg et al., 2003). U.S. high schools have failed to meet the academic and social needs of subgroups of students at exceptional risk of school failure and involvement in the juvenile or adult criminal justice systems (Haynes & Levin, 2009; Leone et al., 2003; Skiba, Michael, Nardo, & Peterson, 2000).

To illustrate, high school dropouts and incarcerated youth are disproportionately male, minority, economically disadvantaged, read below grade level, and receive services under the Individuals With Disabilities Education Improvement Act of 2004 (Federal Advisory Committee on Juvenile Justice, 2006; Quinn, Rutherford, & Leone, 2001; Sickmund, Sladky, Kang, & Puzzanchera, 2008). As such, any one of the following five indicators increased the likelihood of school failure and involvement in the juvenile justice system: (a) gender, (b) racial and ethnic status, (c) family income, (d) disability status, and (e) literacy deficits ("Caught in the Crisis," 2012).

Gender

The first indicator found to place students at risk for school failure and involvement

in the juvenile justice system is gender. A definitive link between formal schooling and gender was established in a report published by the Center for Civic Innovation (Greene & Winters, 2006). For example, an examination of high school graduation rates in 100 of the largest school districts in the United States revealed that female students graduated at higher rates than male students. According to one analysis, only 59% of Black females graduated from high school, with Black males graduating at rate of only 48% (a difference of 11 percentage points). Similarly, only 58% of Hispanic females graduated from high school, compared with 49% of Hispanic males (a difference of 9 percentage points) (Greene & Winters, 2006). A more recent report revealed that in 2009, males between 16 to 24 years old had a higher dropout rates than females, 9.1 vs. 7.0% (a difference of 2.1%) (Chapman, Laird, Ifill, & KewalRamani, 2011).

Gender gaps in graduation rates were even larger for minority students. For example, Chapman and his colleagues (2011) documented that 95.1% of White females and 88.9% of Black females had completed high school in 2009 (a difference of 6.2%), compared to 92.4% of White males and 85.0% of Black males, respectively (a difference of 7.4%). Furthermore, Chapman et al. documented gender differences between those who left high school and those hold a high school diploma.

For example, 6.3% of White males were identified as dropouts in 2009, compared to only 4.1% of females (a difference of 2.2%). Hispanic males had higher dropout rates than their female counterparts, 19.0 vs. 16.1%, respectively (a difference of 2.9%). Black males also had higher dropout rates than their female counterparts, 10.6 vs. 8.1%, respectively (a difference of 2.5%). Moreover, according to state averages, only 33% of Black males graduated with a high school diploma, a disturbing trend considering that all Blacks (male

and female) make up only 5.7% of the population in the U.S. (Chapman et al., 2011).

In addition, gender placed students at greater risk for involvement in the criminal justice system. A report sponsored by the U.S. Office of Juvenile Justice and Delinquency Prevention (OJJDP) revealed disproportionate numbers of males (73%) versus females (27%) were involved in the juvenile justice system (Puzzanchera, Adams, & Sickmund, 2011).

Race and Ethnicity

The second indicator found to place students at risk of school failure and involvement in the juvenile justice system is race and ethnicity. A causal link between formal schooling and racial and ethnic status was documented in a report published by the Center for Civic Innovation (Greene & Winters, 2006). In a more recent report, the Alliance for Excellent Education revealed disproportionate graduation rates between White students and minority students (Alliance for Excellent Education, 2012). For example, graduation rates for White students in 2008 were 78%, for Black students, it was 57%, and for Hispanic students, it was 58%.

In addition, race and ethnicity placed students at greater risk for involvement in the criminal justice system. Thus, according to the OJJDP, minorities made up 65% of all youth in custody, with Black youth accounting for 40%, followed by Hispanic youth, accounting for 20% (Mukasey, Sedgewick, & Flores, 2008).

Household Income

The third indicator placing students at risk of school failure and involvement in the juvenile justice system is household income. A definitive link between formal schooling and poverty was established in a report conducted by the Center for Labor Market Studies at

Northeastern University (Sum et al., 2009). Poverty rates were highest among high school dropouts, with almost 37 of every 100 dropouts living in low-income families.

In addition, the report documented that household income placed students at greater risk for involvement in the criminal justice system. Limited schooling and low academic proficiency lead to difficulty finding employment, thereby increasing the risk of poverty and involvement with the criminal justice system. The U.S. Department of Education attempted to address economic disparities through enactment of the No Child Left Behind (NCLB) Act (2001).

Thus, the primary goal of NCLB was to close the gap in achievement among students from varying social and economic backgrounds. Since enactment of NCLB, the Council of Chief State School Officers (CCSSO) has been tracking data and analyzing academic achievement trends. In an analysis of state assessment data and results from the National Assessment of Educational Progress (NAEP), the CCSSO found the gap continued to exist for economically disadvantaged students across all U.S. states (Blank, 2011). For example, although data show gains were realized between the years 2004 and 2009, one third to one half of economically disadvantaged students in each state scored Below Basic on NAEP grade 4 Reading. In sum, it is imperative that states continue efforts to close the achievement gap, specifically for students from high-poverty families.

Disability Status

The fourth indicator placing students at risk of school failure and involvement in the juvenile justice system is disability status. A causal link between school failure and disability status was established in a report conducted by the National High School Center. During the 2005-2006 school year, 26.2% of students with disabilities dropped out of high

school (U.S. Department of Education, Office of Special Education and Rehabilitative Services, Office of Special Education Programs, 2008). Further, the report revealed that during the 2003-2004 school year 54.6% of students served under IDEA graduated with a standard diploma, as compared to 3.5% in 2005-2006.

In addition, a link between disability status and the likelihood of involvement in the criminal justice system has been documented (Quinn, Rutherford, & Leone, 2001; Quinn, Rutherford, Leone, Osher, & Poirier, 2005). To illustrate, a panel of representatives from the OJJDP, the Office of Special Education Programs (OSEP), and various agencies and organizations was formed to account for the high number of youth offenders with disabilities (Coordinating Council of Juvenile Justice and Delinquency. Office of Juvenile Justice and Delinquency Prevention, U.S. Department of Justice. 1997). In 2000, the panel surveyed data from juvenile and adult corrections facilities to obtain a snapshot of the number of individuals with disabilities under the age of 22 who were incarcerated on one given day in the United States.

Examining the panel's findings, Quinn et al. (2005) noted that populations of incarcerated youth with disabilities varied widely from state to state. As such, the results demonstrated that the percentages of incarcerated students with disabilities ranged across states from 9.1 to as high as 77.5, with a median of 33.4%. Remarkably, the total number of students aged 6-21 receiving services under IDEA during 2010-2011 school year was only 8.8% (U.S. Department of Education, Office of Special Education and Rehabilitative Services, Office of Special Education Programs, 2001). In effect, the average number of youth with disabilities in confinement well exceeded the overall number of students receiving services under IDEA.

Literacy Deficits

The fifth indicator found to place students at risk of school failure and involvement in the juvenile justice system is literacy deficits. Of all the characteristics that placed students at risk for school failure and involvement in the juvenile justice system (gender, racial/ethnic status, family income, disability, and literacy deficits), illiteracy was the most common (Leone et al., 2003). Correspondingly, reading difficulties are primary among individuals identified with an LD (Handler & Fierson, 2011). Finally, an LD often coexists with socio-emotional difficulties.

Coleman and Vaughn (2000) showed the presence of a LD frequently co-occurs with emotional and behavioral problems, poor self-concept, and negative affect (Nelson, Benner, & Rogers-Adkinson, 2003). According to Osher, Woodruff, and Sims (2002), LD, EBD, and cognitive impairments are directly related to a negative sense of self, which leads to school failure and dropping out of school.

A survey conducted by Seidel and Vaughn (1991) measured the attitudes and social alienation of students with LD who completed high school as well as students with LD who dropped out. The findings indicated the students with LD who dropped out of high school reported greater feelings of social alienation from their teachers and peers than the completers. Nonetheless, individuals can achieve academic and life success despite exposure to risk, adversity. The following section includes an overview of protective factors that guard against being at risk for school failure.

Protective Factors

Variables that mitigate or eliminate risk for school failure and involvement in the juvenile justice system are known as protective factors (Luthar & Zigler, 1991). Protective

factors may serve to safeguard individuals from the effects of risk factors and have been found to enhance resiliency (tendency to cope with stress or adversity). For example, cognitive skills, especially oral language, written expression, and comprehension, act as protective factors in a culture that demands transmission and processing of information (Luthar & Zigler). Additional cognitive factors such as emotional competence and moral development also have been found to protect against antisocial behavior (Leone et al., 2003; Spekman, 1993). Finally, youth who have demonstrated high levels of self-regulation are better able to resist negative influences from peers and pursue long-term goals despite opportunities for short-term high intensity social rewards (Dishion, Nelson, Winter, & Bullock, 2004).

These conclusions suggest that social and emotional learning (SEL) programs, focused on identifying and managing emotions, may shield students from risk factors associated with school failure and involvement in the juvenile justice system, as further discussed in the following.

Social and Emotional Learning and Academic Achievement

Empirical studies have found that adolescents with LD face a distinctive set of challenges that emerge during various phases of development and as setting expectations change (Brinckerhoff, Shaw, & McGuire, 1992; Deshler, 2005; Lenz & Deshler, 2005; Spekman, 1993). Findings from a qualitative study with high school dropouts conducted by the Bill and Melinda Gates Foundation confirmed that students felt the support they needed to be successful in school was lacking (Bridgeland et al., 2006). For example, more than half of the respondents in the Gates study believed their school had not done enough to help them with problems outside of class, and almost two thirds believed that extra time with

teachers and supplementary instruction would have increased their chances of graduating.

Many high school students have career goals and strive to do well in school. However, life circumstances and schools' inadequate response to these circumstances may be causal to school failure (Bridgeland et al., 2006). SEL programs have been documented to act as a protective measure, fostering the development of self-awareness, self-management, empathy, perspective taking, and cooperation (Zins, Bloodworth, Weissberg, & Walberg, 2004). Scholars have advocated that SEL programs were essential to improved academic outcomes and social/emotional well-being (Eccles & Appleton, 2002; Weissberg & O'Brian Utne, 2004; Zins et al.).

Zinns, Bloodworth, Weissberg, and Walberg (2007) conducted a comprehensive literature review of the empirically based research on the efficacy of SEL on academic outcomes. Additional research has documented evidence supporting a causal link between prosocial behavior and academic outcomes (DiPerna & Elliott, 1999; Feshbach & Feshbach, 1987; Haynes, Ben-Avie, Ensign, 2003; Pasi, 2001). Ultimately, SEL skills can be infused into the curriculum so learning and prosocial skills reinforce one another and enhance academic engagement ("Safe and Sound," 2003; Zins et al.).

The Collaborative for Academic, Social, and Emotional Learning (CASEL) is a national organization that provides guidance for educators, researchers, and policy makers in an effort to forward the science and practice of promoting SEL programs in schools. According to CASEL, effective SEL programs begin at an early age and continue through high school ("Safe and Sound," 2003). Thus, a meta-analysis of school-based SEL interventions revealed improvements in students' social, emotional, attitudinal, and behavioral performance and an 11th percentile gain in academic achievement. Of the 213

SEL programs included in the analysis, only 13 were in high schools.

One SEL intervention that has been tested with high school students was developed at the Institute of HeartMath (Bradley, McCraty, Atkinson, Arguelles, & Rees, 2007). The program includes tools and techniques that teach positive emotional refocusing and restructuring and skills to self-regulate stress, test anxiety, and other emotional impediments to learning and performance. Comprised of two primary components, (a) the HeartMath® curriculum (social emotional self-regulation tools) and (b) emWave® technology, the ultimate goal of the program is to foster the development of social emotional self-regulation skills requisite to achieving psycho-physiological coherence (Institute of HeartMath, 2012). In this case, coherence is characterized by increased emotional stability, synchronization, and harmony in the functioning of physiological systems.

Bradley and his team of researchers (2010) established that training and psychophysiological feedback on the ability to monitor heart rhythms reduced high school students' stress and text anxiety. Students also improved their emotional well-being, quality of relationships, and academic performance. In addition, research on sustained practice in the HeartMath program has revealed reduced levels of stress and anxiety, higher resilience, and improved athletic performance, self-awareness, self-concept, as well as ability to develop and maintain interpersonal relationships (Bradley et al., 2007; Markham, 2004).

Given the limited research on SEL interventions for high school students and the urgent need to address the high number of students at risk for school failure and involvement in the criminal justice system, a specifically developed SEL and Self-Regulation Intervention (SSRI) was designed to address the needs of these students. Considering the greatest risk factor for dropping out of school and becoming involved in the

juvenile justice system is illiteracy (Leone et al., 2003), the SSRI was designed for instructional delivery in a reading intervention class for high school students.

The SSRI is informed by the literature on affect and learning, as well as recent analyses documenting a causal link between SEL programming and improved academic achievement (Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011; Payton et al., 2008). In addition, the SSRI is principled on psychophysiological theory, which accounts for behavioral, emotional, and cognitive processes, as well as physical systems, involved in learning (Thayer & Lane, 2000; 2009). Furthermore, the SSSRI incorporates research documenting the efficacy of the HeartMath program on emotional and academic outcomes for secondary students with and without disabilities (Bradley et al.., 2010; Lloyd, Brett, & Wesnes, 2010). Finally, the existing study integrated theory and research on explicit reading instruction for adolescents with reading difficulties.

To summarize, the SSRI is built upon five foundational elements: (a) theory on affect and learning; (b) the causal link between SEL and improved socio-emotional skills and academic performance; (c) psychophysiological theory (including research on heart-brain communication, positive emotional refocusing, and psycho-physiological feedback); (d) efficacy studies of the HeartMath program; and (e) the evidence base on explicit literacy instruction for adolescents with literacy difficulties.

Purpose of the Study

The general purpose of this mixed-methods intervention study was to develop and test the efficacy of an SEL self-regulation intervention that teachers might implement with adolescents, with and without disabilities, prior to instruction in an explicit literacy curriculum. Specifically, the study was designed to investigate the effects of the SSRI

relative to improving the reading outcomes, psycho-physiological coherence, reading self-concept, and social and emotional well-being of high school students at risk for school failure.

In addition, qualitative data were gathered on students' feelings about tasks of reading, ways of coping, and teacher feedback. Finally, data were collected on how students reported their feelings before and after applying the self-regulation strategy, as well as satisfaction and utility of the strategy. As such, this study extends the research on SEL self-regulation and academic outcomes for high school students with reading difficulties at risk of school failure.

CHAPTER II

LITERATURE REVIEW

Addressing the academic and emotional needs of high school students at risk of school failure is a civic and social responsibility. All students are deserving of a quality education that will prepare them for college and a career, and to be productive members of society (Alliance for Excellent Education, 2012). However, educational statistics elicit grave concern. Recently released data from the National Assessment of Educational Progress (NAEP) report revealed that approximately two-thirds of incoming ninth-grade students were not prepared to meet the literacy demands of high school curricula (National Institute of Educational Statistics, 2011). Additionally, 1.2 million youth dropped out of high school during the 2010-2011 school year (Alliance for Excellent Education, 2012). Moreover, according to a report published by the Alliance for Excellent Education, high school dropouts were far more likely to be periodically unemployed, receive government assistance, or become involved in the criminal justice system than peers who graduated high school (Alliance for Excellent Education, 2011).

Considering the number of youth who enter high school with substandard literacy skills and the million-plus students who drop out of high school each year, a causal link between reading attainment and school completion is highly probable. Indeed, based on a comprehensive literature review, Stanovich (1986) established a reciprocal relationship between beginning reading skills and later cognitive development. Derived from sociology and a parable from the New Testament (Matthew 25:29), the so-called Matthew Effect Model (the rich get richer and the poor get poorer) exemplifies how early success in reading leads to later scholastic attainment. For example, students who experience early reading

difficulties often evidence deficits in social skills. In adolescence, these social deficits may manifest as antisocial behaviors and emotions that are characteristic of youth offenders (Hazel, Schumaker, Sherman, & Sheldon, 1982).

In effect, good and poor readers tend to head towards divergent pathways during their educational years (Reschly, 2009). Thus, difficulty with early reading can have detrimental effects on students' socio-emotional well-being, capacity for academic engagement, behavior, and motivation to learn (Guthrie & Wigfield, 2000; Snow, Burns, & Griffin, 1998; Zins et al., 2007). For example, elementary students with impaired social and emotional skills are far less likely to become proficient in reading during adolescence (Chapman & Tunmer, 2003).

Reschly (2009) proposed a theory to account for the cascading effects of early reading difficulties. For example, she asserted that a series of cycles of engagement and withdrawal culminates in and accounts for the processes of school completion and dropout. Further, engagement is the link between reading competence and school completion, and reading is most salient academic skill in these cycles of engagement and withdrawal. Therefore, students' reading skill development serves as protective factor for maintaining engagement and school completion. Reschly also presented an integrated model to account for the cascading, or Matthew, effects across reading competence, student engagement and motivation, and eventual high school completion or dropout.

To exemplify, reading proficiency, engagement, motivation, and context (e.g., instruction, school/peer/family support) dynamically influence good and poor readers' potential for educational achievement. As such, Reschly (2009) claimed reading achievement was the most likely predictor of emotional withdrawal, school failure, or

dropout. One approach to addressing this problem incorporates an SEL program, based on positive emotional refocusing and self-regulation, into the school curriculum (Bradley et al., 2010; Goelitz & Lloyd, 2012; Lloyd et al., 2010). A potential point of entry would be reading intervention classes in urban high schools with large numbers of students, with and without disabilities, at risk of school failure.

In the present study, to better understand how to improve the reading outcomes of high school students at risk for school failure, five broad categories of studies were reviewed. The first group of studies included the literature on cognitive theory, grounding the relationship between affect, learning, and performance. The second group included the literature on the impact of SEL programming on students' socio-emotional skills and academic performance. These studies span the years 1990-2007 and included 304,237 students in grades K-12. Included are (a) a meta-analysis on the impact of SEL programs for students in kindergarten through 12th grade (K-12) (Durlak et al., 2011) and (b) a synthesis of three meta-analyses on the impact of SEL programs for students in grades K-8 (Payton et al., 2008). The third group of studies included theory and literature focused the tools and technology developed at the Institute of HeartMath, while the fourth group of studies embodied a general treatment of the theory and research grounding explicit reading instruction, particularly for adolescents with reading deficits. The fifth and final group was comprised of a summary of the findings related to theory, SEL programming (including the HeartMath program), and explicit reading instruction for adolescent students at risk of school failure.

Based on a search of the following electronic bibliographic databases, Educational Resources Information Center (ERIC), PsycINFO, WilsonWeb, and Google Scholar,

research studies conducted from 1970 to 2012 were selected for this review. The following search terms and their variants were used to identify the studies: “adolescent literacy,” “affect and learning,” “cognition and learning,” “explicit reading instruction,” “heart-rhythm coherence,” “HeartMath,” “heart-rate variability,” “self-regulation,” “social and emotional learning,” and “reading and emotion.” A secondary search involved accessing national resource centers, including the Alliance for Excellent Education, Center on Instruction (COI), Collaborative for Academic, Social, and Emotional Learning (CASEL), National Center on Learning Disabilities (NCLD), National Institute for Family Literacy (NIFL), and Institute of HeartMath. Finally, the reference lists of each identified study, review, and report were examined until all relevant sources were exhausted. Studies that met certain criteria were selected for review.

To be selected for review, a study had to meet the following criteria: (a) focus on SEL and academic outcomes, (b) include secondary students, (c) use an experimental or quasi-experimental research design, (d) report empirical data on the academic performance of students, and (e) appear in a peer-reviewed publication. Once selected, studies were then reviewed to identify the purpose, demographic information of the participants, measures, and significant findings for all students (including subgroups of students with disabilities), as well as any identified limitations.

Cognition and Affect in Psychology and Education

Until the mid-twentieth century, psychological research on emotion and affect was scarce (Pekrun, Goetz, & Wolfram, 2002). Instead, behaviorism, which eschewed affective states, was at the forefront of psychological theory (Davidson & Cacioppo, 1992). Established by John B. Watson (1913), behaviorism is the science of behavior based on the

psychological precept that behaviors can be measured and are acquired through conditioning or interacting with the environment (Skinner, 1963). Behavioral theory, as asserted by B.F. Skinner, ruled out cognitive, emotional, and motivational mediators behavior. A critique by Chomsky (1959) of Skinner's behavioral approach has been credited with launching a cognitive revolution in psychology. Thus, Chomsky's assessment of Skinner put behaviorism to the test and paved the way for an era of research in the cognitive sciences.

For example, Neisser (1967) explained cognitive science as "all the processes of how sensory input is transformed, reduced, elaborated, stored, recovered, and used" (p. 4). Famed Soviet psychologist Lev Vygotsky further refined the science of cognitive psychology (1987). For example, Vygotsky questioned the separation of intellectual and affective aspects of cognition and accounted for the role of emotion in cognition when he proposed, "Every idea contains some remnant of the individual's affective relationship to that aspect of reality which it represents" (p. 50). Although Vygotsky's work was published as early as 1978, it had to be translated from Russian into other languages before widespread dissemination was possible. Therefore, investigations of how social and emotional factors interplayed with how learners construct and understand knowledge did not emerge in the United States until the early 1980s (Lipsett, 2011).

While the emergence of cognitive psychology put new emphasis on emotion, certain scientists digressed. For example, neurobiologist Joseph E. LeDoux (1994) critiqued the discipline of cognitive psychology, claiming that it does not account for emotion. According to LeDoux, emotions can occur without the involvement of the cognitive system, and, moreover, can significantly affect the cognitive process and its output. Bradley et al. (2010) postulated that LeDoux's assertions account for why cognitive interventions,

focusing primarily on changing thought processes, often fail to create sustained change in underlying emotional patterns. As documented by educational psychologist Gerald Coles (1998), clinical and research psychology had adopted divergent approaches, the former taking emotions into account and the later focused solely on behavior.

These conflicting approaches were also evident in schools. According to Beane (1990), schools functioned on the theory that cognition and academics were synonymous, and independent of emotion. For example, curriculum tended to focus exclusively on knowledge and skills, related to content within various disciplines, and were void of social and emotional intelligences (Lepola, 2000). Although the relationship between emotion and academics was documented in the late 1990s (Elias, Bruene-Butler, Blum, & Schuyler, 1997; Goleman, 1995; Pasi, 1997), theory on cognition was still emerging and in the preliminary stages of development (Matthews, Roberts, & Zeidner, 2003; Zeidner, Roberts, & Matthews, 2002). Therefore, studies of affect and learning were less prominent.

Until the early 21st century, research on affect and education were largely disregarded (Pekrun et al., 2002). To demonstrate, exhaustive literature reviews of studies of academic emotions published from 1974 to 2000 revealed that over 1,000 studies addressed the negative emotion of achievement-related anxiety (Pekrun & Frese, 1992; Pekrun et al.). Only nine studies focused on positive affect, the emotion of hope.

Nonetheless, contrary to what the researchers reported, two studies examined affect and the attainment of literacy skills (Coles, 1998). A study on the effect of emotions on language, memory, and story learning found that fifth-grade students recalled more adjectives when they were in a positive state, as opposed to a sad one (Nasby & Yando, 1982). In support of these findings, Potts, Morse, Felleman, and Masters (1986) noted that

children who exhibited a positive affect demonstrated superior memory of televised story narratives, as well as detailed information about the characters in the stories. Thus, these studies back the notion that reading instruction, cognition, and affect are interwoven, rather than isolated processes.

During the same period, others documented the relationship between reading, cognition, and emotion. For example, Stanovich (1986) theorized that early reading difficulties were manifested in generalized learning deficits because of the "behavioral/cognitive/motivational spinoffs from failure at such crucial tasks as learning to read" (p. 389). To demonstrate, low self-concept is often accompanied by feelings of incompetence in learning (Coles, 1998), and thereby negatively affects the capacity to process information. Moreover, feelings of inadequacy are further magnified in students with reading difficulties (Stanovich, 1986).

As noted, adverse outcomes for poor readers proliferate and may result in emotional withdrawal, failure to complete school, or dropout entirely (Reschly, 2009). Given the important role that affective/emotional factors play in the overall learning process, it is important to determine the probability of lessening the impact of these factors on learning outcomes.

For example, some research has shown that difficulties associated with learning to read negatively affect students' future achievement in reading development, as well as reading self-perception (Chapman & Tunmer, 1995; Pressley, 1998). Further, the compounding effects of a negative self-concept are demonstrated in students who find it difficult to draw upon the level of motivation requisite to maintaining a commitment to learning. For these students, an emotional shift in self-perception is fundamental to

attaining literacy skills.

Educational psychologist Gerald Coles (1998) drew from Vygotsky's (1978) construct, the zone of proximal development (ZPD), to account for the critical nature of students' emotional development in association with literacy attainment. Vygotsky explained ZPD as

> … the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers. (p. 86)

Rather than solely applying ZPD to a child's cognitive development, Coles (1998) examined ZPD within the framework of affect and literacy attainment. Thus, students' negative emotions about difficulty with reading (i.e., fear of failure, apprehension) could be transformed into positive emotions (i.e., self-confidence, self-assuredness) through a teacher's scaffolding and guidance. Of note, studies documented that negative attitudes toward different content areas (i.e., reading, math) do not appear to impede achievement for students with LD (Chapman & Boersma, 1980; Chapman & Tunmer, 1995). Instead, it is their attitudes about themselves as learners, the belief that they are incompetent, and feelings of learned helpless that are associated with ongoing failure (Chapman & Boersma; Pressley, 1998). In conclusion, these findings support the notion that educational systems should focus on developing students' socio-emotional competencies in addition to academic skills.

Schools that are successful in bringing students to high levels of educational attainment are those that guide and scaffold learning in academics and in developing SEL skills (Elias et al., 1997. In effect, positive emotions can enhance learning and achievement,

while negative emotions act to impede the potential to acquire knowledge (Flemming & Bay, 2004). As stated by affective neuroscientist and human development psychologist Immordino-Yang and neurologist and neuroscientist Damasio, "The more educators come to understand the nature of the relationship between emotion and cognition, the better they may be able to leverage this relationship in the design of learning environments" (2007, p. 128).

Unfortunately, most educators are not aware that teaching social-emotional skills will improve academic performance (Macklem, 2010). According to Zins et al. (2007), a solid evidence base documents how SEL programs may facilitate emotional and cognitive development and thereby improve academic achievement.

The next section of this literature review is comprised of an introduction to SEL, studies supporting a possible causal link between SEL and academic attainment, as well as the results of studies on the efficacy of SEL programs on outcomes for students in grades K-12.

Social and Emotional Learning

To succeed in school, students need to be engaged, interested, and motivated to learn. The capacity of a child to focus attention on instruction, persist in the face of adversity, collaborate well with others, communicate effectively, and become a capable problem-solver is foundational to life success (Collaborative for Academic and Social and Emotional Learning, 2007). Curricula designed to enhancing students' capacity to develop interpersonal attributes are referred to as SEL programs.

Background and Emergence of SEL

In general, SEL is "the capacity to recognize and manage emotions, solve problems effectively, and establish positive relationships with others" (Zins & Elias, 2006, p. 1). The

field of SEL drew from theory developed by Waters and Sroufe (1983) almost three decades ago, suggesting that competent people are those who have the ability to "generate and coordinate flexible and adaptive responses to challenges and stressors and to create and capitalize on opportunities in the environment'' (p. 80).

However, research on SEL was not prominent until the late twentieth century. Today, scientific evidence exists that links social and emotional skill development to a variety of positive outcomes (to be discussed in the next section of this literature review). As result of the growing documentation of the possible benefits of SEL programming, policy makers and educators have taken notice (Durlak et al., 2011). In fact, a nonprofit organization was created to forward SEL research and practice.

One such organization, founded in 1994, the Collaborative for Social and Emotional Learning (CASEL) works with educators, researchers, philanthropists, state and federal policy makers, and child advocates to advance research and foster the development of SEL practices and programs in the United States and around the world. The overarching aim of CASEL is to enhance schools' capacities to deliver high-quality, evidence-based SEL programming in early childhood through grade 12. Moreover, CASEL has established interrelated competencies related to cognitive, affective, and behavioral proficiency.

According to a CASEL-sponsored report, the five competencies of SEL are (a) self-awareness (identifying emotions, self-confidence, self-efficacy); (b) self-management (impulse control, stress management, self-discipline, motivation, goal setting, organizational skills); (c) social-awareness (perspective taking, empathy, appreciating diversity, respect for others); (d) relationship skills (communication, social engagement, relationships, cooperation, resolving conflicts, seeking help or helping); and (e) responsible decision

making (problem-solving skills, ethical responsibility) (Dusenbury, Zadrazil, Mart, & Weissberg, 2011, p. 2). The outcomes for students who master these competencies involve a developmental shift or progression that leads to self-regulation.

Another function of the CASEL organization is to provide technical assistance for states in developing and implementing standards for SEL. At the local level, for example, many states have established, or are in the process of developing, standards for SEL. Recently, CASEL conducted an investigation to better understand how states were addressing SEL in their achievement standards (Dusenbury et al., 2011). Results indicated that while every state and territory in the United States had integrated SEL goals or benchmarks into their state K-12 state standards, the only state with freestanding comprehensive K-12 SEL standards was Illinois. Additionally, the report revealed that more states are moving in the direction of creating standards solely devoted to developing SEL skills. To further support SEL program development in the United States, federal legislation was instituted. Bipartisan legislation supporting SEL was introduced to the 112th Congress, leading to the enactment of the Academic, Social, and Emotional Learning Act of 2011 (HR 2437).

The intent of HR 2437 is to provide schools with access to SEL programs that focus on teaching students to problem solve, resolve conflicts, make responsible decisions, build relationships, set goals, and learn self-discipline. The primary aim of HR 2437 is to promote evidence-based SEL practices and ensure all students achieve their full potential and leave school prepared for life success in the 21st century (Academic, Social, and Emotional Learning Act of 2011).

In addition, the benefits of SEL programming are increasingly being recognized at

an international level. For example, SEL programs have been launched in nine other countries, Australia, Canada, Germany, Israel, Spain, Singapore, Sweden, The Netherlands, and the United Kingdom. In 2008, the Marcelino Botín Fundación at the University of Cantabria, Spain, published an analysis that encompassed an internationally representative sample of 76 empirically based studies on SEL (*Social and emotional education. An international analysis*). Overall, the results indicated that SEL programs significantly improved students' social, emotional, and academic skills. Further, SEL programs functioned as a protective strategy for students at risk for short and long periods of time.

In addition to these findings, over the last 25 years, a number of research syntheses on SEL programming were published in the United States. Their results are summarized in the following.

SEL Studies

Literature reviews on SEL are typically in the form of program evaluations with an emphasis on schoolwide delivery of SEL interventions (Durlak et al., 2011). For example, several seminal reviews were published from 1997 to 2007 reporting on the following SEL outcomes: academic performance (Wang, Haertel, & Walberg, 1997; Zins et al., 2004); aggressive and antisocial behavior (Lösel & Beelman, 2003; Wilson & Lipsey, 2007); depression (Horowitz & Garber, 2007); substance abuse (Tobler et al., 2000); mental health (Durlak & Wells, 1997; Greenberg, Domitrovich, & Bumbarger, 2001); problem behaviors (Wilson, Gottfredson, & Najaka, 2001); and positive youth development (Catalano, Hawkins, Berglund, Pollard, & Arthur, 2002). According to Durlak et al., the results of these reviews strongly demonstrated that schoolwide SEL interventions are effective in improving socio-emotional and academic outcomes. More recently, Durlak and his

colleagues examined impact of SEL programming across a variety of student outcomes, rather than a single indicator (i.e., academic achievement, substance abuse, anti-social behavior).

SEL meta-analysis. The first large-scale meta-analysis of universal SEL programs for students in grades K-12, *The impact of enhancing students' social and emotional learning: A meta-analysis of school-based universal interventions* (Durlak et al., 2011), is important because it consisted of a wide variety of student outcomes, including social and emotional skills, attitudes, prosocial behavior, behavior problems, emotional distress, and academic performance. The majority of the studies (88%) selected for Durlak et al.'s review had not been included in any previous analyses. In addition, former syntheses and literature reviews on SEL programming had focused primarily on externalized behaviors, rather than internalized social and emotional competencies (i.e., self-regulation, self-confidence, self-management). Furthermore, previous reviews did not include outcomes related to students' physical health and development.

For a study to be selected for the Durlak et al. (2011) meta-analysis, it had to meet the following criteria: (a) emphasize the development of one or more SEL skills; (b) involve students between the ages of 5 and 18 without any identified adjustment or learning problems; (c) integrate a universal school-based SEL program that was implemented during the academic school day; (d) include a control group; (e) report an effect size that could be calculated at the posttest phase; and (f) be written in English. The final sample consisted of 213 intervention studies published from 1970 to 2007 and involving 270,034 students.

The studies were analyzed and coded using the SAFE method (Durlak, Weissberg, & Pachan, 2010). The SAFE method involves a process of dichotomously coding (yes or

no) SEL programs according to four indicators: (a) Sequenced – a connected and coordinated set of activities; (b) Active – active forms of learning new skills; (c) Focused – focused on social and emotional skill development; and (d) Explicit – targeted specific SEL skills, rather than positive development in general. In addition, methods and procedures were dichotomously coded according to three variables: (a) randomization of conditions; (b) use of reliable outcome measures; and (c) use of valid outcome measures. Finally, attrition was coded as a continual variable.

The dependent variables were based on six student outcomes: (a) social and emotional skills, (b) attitudes toward self and others, (c) positive social behaviors, (d) conduct problems, (e) reduced emotional distress, and (f) academic performance (standardized reading or math achievement scores, GPA or grades in reading or math). One effect size (EF) per study was coded for each outcome variable. A probability level of .05 used to determine statistical significance. All EFs were calculated as positive values, indicating a favorable result for the intervention group over controls. When means and standard deviations were not available, the estimation procedures recommended by Wilson and Lipsey (2007) were used. If the study's results were not significant, ES was set at zero.

The results of the meta-analysis indicated statistically significant results across all six outcome variables. Specifically, the grand study-level mean for all 213 interventions was significant, 0.30 (CI = 0.26-0.33). In addition, the six outcome means were significantly greater than zero (range = 0.22 to 0.57). This indicates that compared to controls, students who participated in a schoolwide SEL program significantly improved their social and emotional skills (i.e., emotions recognition, stress-management, empathy, and problem-solving and decision-making skills), attitudes, behavior, and academic

performance. Although only a subset of studies collected data on academic performance, the investigations contained large sample sizes, involving 135,396 students. Improvements in the academic variable reflected an 11-percentile-point gain in achievement.

In sum, SEL programming enhanced students' prosocial behaviors, reduced internalized and externalized negative behaviors, and improved academic performance on achievement tests and grades. Moreover, studies that included follow-up measures showed that these outcomes remained statistically significant for a minimum of 6 months after the intervention study was over. For example, the mean follow-up ESs remained significant across all six outcomes, including SEL skills (ES = 0.26; k = 8), attitudes (ES = 0.11; k = 16), positive social behavior (ES = 0.17; k = 12), conduct problems (ES = 0.14; k = 21), emotional distress (ES = 0.15; k = 11), and academic performance (ES = 0.32; k = 8). Other relevant findings demonstrated that SEL programs were effective at all school-age levels (K-12) and all geographical settings (urban, rural, and suburban).

Finally, all four SAFE variables predicted implementation problems and moderated outcomes. For example, SEL programs that integrated all four SAFE indicators produced significant effects on six outcome variables, whereas SEL programs that failed to implement all four SAFE variables achieved significant effects in only three areas (i.e., attitudes, conduct problems, and academic performance).

Despite promising outcomes, several limitations were identified, however. First, only 33 (16%) of the studies included in the meta-analysis collected data on academic achievement from pre- to posttest. Second, the researchers claimed they did not include studies on the effects of SEL programming for subgroups of students, including those with emotional impediments or students identified with a disability. For example, "We excluded

studies targeting students who had preexisting behavioral, emotional, or academic problems" (Durlak et al., 2011, p. 409). To the contrary, two articles targeting students with exceptionalities were included in the bibliographical list of studies for the analysis, Ciechalski and Schmidt (1995) and Rotheram (1982). Moreover, this discrepancy was not noted in the final analysis. For example, because the majority of students with LD spend most of the academic day in the general education classroom, it is highly unlikely that students with disabilities were not included in the analysis (Cortiella, 2009). Third, the primary authors of the meta-analysis are the primary authors on a significant number of SEL studies included in the analysis. Therefore, bias should have been addressed. For these reasons, the results must be viewed with caution.

In sum, the findings from the large-scale meta-analysis on SEL build on earlier reviews and analyses of SEL programming pointing to positive student outcomes. In addition, the results support promoting, adopting, and implementing evidence-based SEL programs in grades K-12. Furthermore, the findings provide research-supported theory to assist state departments of education in developing SEL standards. Finally, the researchers suggested integrating the provisions of HR 4223 into the reauthorization of the Elementary and Secondary Education Act (ESEA).

Considering that students with students with disabilities were not included in the meta-analysis, a diverse population sample was included in a synthesis of three large-scale meta-analyses (Payton et al., 2008).

SEL literature synthesis. A summary report, *Social and emotional learning: A framework for promoting mental health and reducing risk behavior in children and youth* (Payton et al., 2008), consisted of a synthesis of three large-scale meta-analyses focused on

the impact of SEL programs for elementary and middle school students. Of note, both Payton and Durlak (authors of this synthesis) were listed as authors on all three meta-analyses reviewed for this synthesis.

The first analysis, by Durlak, Weissberg, Dymnicki, Taylor, and Schellinger (2008) focused on universal SEL interventions designed for general education students without identified behavioral or emotional difficulties. The universal review included 180 school-based studies involving 277,997 students. The second analysis, or indicated review, was a meta-analysis of SEL programs targeting students who showed early signs of social, emotional, or behavioral problems (in press at time of review). Nonetheless, the study participants had not been identified for special services. The literature selected for this meta-analysis was comprised of 80 studies involving 11,337 students. The third meta-analysis, or after-school review, was comprised of studies on SEL programming for students in after-school settings. SEL studies selected for this analysis demonstrated that one or more of the students' interpersonal or social skills were targeted (Durlak et al., 2010). The literature encompassed 57 studies involving 34,989 students.

In summary, the sample for the synthesis was comprised of three meta-analyses (universal, indicated, and after-school) involving 317 studies published from 1990 to 2007. In total, the studies were representative of 324,303 student participants. The SAFE method was used to code the studies, and mean EFs were calculated.

The data from these three meta-analyses were grouped according to three broad areas: (a) social and emotional skills and attitudes (including self-perceptions and attitudes toward school and others); (b) indicators of behavioral adjustment (e.g., positive social behaviors, problem behaviors, and emotional distress); and (c) aspects of school

performance (e.g., achievement on standardized tests and school grades). Next, the standardized mean differences or ESs were calculated to determine the impact of a student outcome variable. To do so, the control group mean was subtracted from the intervention group mean at posttest, and the remainder was divided by the pooled standard deviation of the two groups. Usually, only one ES was calculated for each analysis.

Further, individual ESs were averaged to calculate a single overall ES for a study. To account for the unique features of each SEL program, and to make the findings more generalizable, a random-effects model was applied by adding an error term to the calculation. A two-tailed test set at a .05 probability level was used to calculate statistical significance. Similar to the meta-analysis presented in the previous section, the researchers used the SAFE method, which is comprised of evidence-based indicators of SEL programming, to code the studies. The findings from each of the three reviews (universal, indicated, and after-school) were reported separately. Each review described characteristics of the SEL programming, participant populations, and significant findings across outcome variables.

Results from the universal review revealed that, compared to students in the control group, students participating in school-based SEL programs demonstrated significantly improved social-emotional skills, attitudes, and positive social behavior, reduced conduct problems and emotional distress, and improved academic performance at post-intervention. The mean ESs for these outcomes ranged from 0.23 for reduced conduct problems and emotional distress and improved attitudes to 0.60 for enhanced social and emotional skills. Additional findings revealed a 9-10% gain in positive attitudes, social behaviors, conduct problems, and emotional distress, an 11% gain in academic performance, and a 23% gain in

social-emotional skills. The second review also indicated that students benefited significantly from SEL programming.

Results from the indicated review revealed that, compared to students in the control groups, students in school-based SEL programs demonstrated significant improvement across all six outcome variables, including significant mean effect sizes ranging from 0.38 for improved attitudes toward self, school, and others to 0.77 for improved social and emotional skills. Percentiles were not reported. Finally, the third review also showed that students benefited significantly from SEL programming.

Results from the after-school review revealed that, compared to students in the controls groups students in school-based SEL programs demonstrated significant improvement on the five outcome variables, with SEL skills being the exception. Significant mean EFs ranged from a 0.08 for increased academic performance to 0.22 for attitudes toward self and others and positive social behaviors. Percentiles were not reported.

In summary, significant effects were found across all outcome variables for all three reviews (universal, indicated, and after-school). Specifically, across all three reviews, SEL programs offered during the school day and in after-school settings significantly impacted a wide range of outcomes across multiple domains in children with and without identified emotional or behavioral problems. Significant effects were found across the five outcome variables analyzed for the universal and indicated reviews: (a) attitudes toward self and others; (b) positive social behaviors; (c) reduced conduct problems; (d) reduced emotional distress; and (e) improved academic performance. In addition, significant effects were found across the five variables analyzed for the after-school review.

Overall, the results of the three meta-analyses revealed that SEL programs were

effective for students in grades K-8 during the academic day and in after-school settings, and for students with and without identified emotional or behavioral difficulties. SEL programs improved students' social-emotional skills, self-concept, attitudes about themselves and others, connection to school, prosocial behavior, and academic performance. Moreover, students' conduct-related problems and reports of emotional distress were significantly reduced among racially and ethnically diverse students across urban, rural, and suburban settings. Furthermore, SEL programming improved students' academic performance by 11 to 17 percentile points across the three reviews, suggesting that SEL programs provided students with an educational benefit. In spite of such positive findings, the syntheses are subject to several limitations.

First, similar to Durlak et al. (2011), only a small percentage of the studies reported student achievement data, universal (16%), impact (33%), and after-school (15%). Second, similar to Durlak et al., the researchers failed to report demographic information on participants' disability status. To illustrate, Payton et al. (2008) noted, the analyses selected for the universal and after-school review "… focused on children who showed signs of social, emotional, or behavioral problems, but had not been diagnosed with a mental disorder or need for special education" (p. 17). Thus, the researchers' claim that students with disabilities were not included in the synthesis is unlikely, given that the majority students with LD spend the most of the academic day in the general education classroom (Cortiella, 2009). Conversely, a bibliographical review revealed that several studies in the analysis were implemented with students with disabilities (Ciechalski & Schmidt, 1995; Ialongo, Poduska, Werthamer, & Kellam, 2011; Joyce & Showers, 1981; Lynch & McCracken, 2001; Neufeld, Smith, Estes, & Hill, 1995; Phillips, 1999; Rotheram, 1982).

Third, several of the researchers authored the meta-analyses that were reviewed for this report. Because the researchers reviewed their own work, bias should have been addressed. Fourth, the researchers made the broad claim that SEL programs are "among the most effective development programs offered to school-aged students" (p. 4). However, data were not presented to support this claim. As such, the findings should be viewed with caution.

In summary, the results of the above meta-analysis (Durlak et al., 2011) and syntheses (Payton et al., 2008) suggest that SEL programming has the potential to positively impact multiple socio-emotional variables and academic development for a diversity of students. Moreover, they support the need to extend research and policy so SEL programming and to develop SEL state standards. Furthermore, state departments of education may integrate SEL program implementation into the core curriculum. Finally, the findings might serve to advance the field of neurological research and SEL. Indeed, Payton et al. suggested the findings might advance neurological research that "will lay a strong neurocognitive foundation for [students'] future learning, social functioning, and ability to emotionally self-regulate" (p. 17). As such, the next section of the literature review includes theory and research on a promising socio-emotional self-regulation program principled on neuro-physiogical research.

The HeartMath Program

The literature presented thus far has focused on SEL studies confirming the relationship between affect and learning. Next, we turn to research in neuroscience to support this relationship. Educational neuroscientists such as David Sousa (Sousa, 2011a) have advanced the evidence base for the strong role of emotion in learning. That is,

neuroscience has validated that the brain is more likely to remember emotion over any other information it processes (Sousa, 2011b). Furthermore, Sousa found curriculum content that evokes emotion enhances memory and learning.

While the role played by emotion with regard to learning has been emphasized since the 1960s, within the last decade research on emotion in neuroscience and psychology has grown exponentially. For example, neurobiologist Joseph LeDoux (2012) documented that a search of PubMed citations from the 1960s yielded 100 papers with the word *emotion* in the title. By comparison, in 2011, a similar search yielded more than 2,000 hits.

Nonetheless, emotional regulation is seldom discussed in educational forums on education policy, school reform, or even best teaching practices (Lipsett, 2011; Mayer, Roberts, & Barsade, 2008). Neuroscientists and researchers at the Institute of HeartMath developed an SEL self-regulation program consisting of strategies, computerized games, and physiological feedback. The program was designed to help individuals develop the ability to identify and manage emotions, increase resilience to stress and anxiety, and enhance optimal learning and performance (McCraty, Atkinson, Tomasino, & Bradley, 2005). The HeartMath program is grounded in the theory of psychophysiological coherence (McCraty & Tomasino, 2006).

Psychophysiological Theory

Broadening the theory accounting for physiological processes, emotions, learning, and cognitive performance, research conducted at the Institute of HeartMath advances the principles of psychophysiological theory (Bradley et al., 2010; McCraty, Atkinson, & Bradley, 2004). In contrast to the cognitive model, the psychophysiological perspective holds that emotions are central, and physiological processes are viewed as contributing

dynamically to emotional and cognitive experience (Damasio, 2001, 2003). French psychologist Claude Bernard (1867) established the heart-brain connection approximately 140 years ago. More recently, studies in neuroscience have demonstrated that signals from the heart play a uniquely central role in the process of generating emotion (McCraty & Tomasino, 2006; Thayer & Lane, 2009). Indeed, with an independent functioning nervous system (Armour & Ardell, 1994) and a far more extensive communication system with the brain than other chief organs (Cameron, 2002), the heart operates as a primary generator of information patterns that affect the function of the brain and the body's physical systems as a whole (Bradley et al., 2010).

To illustrate, afferent (ascending) neurological signals from the heart affect the autonomic regulatory centers in the brain stem, and also affect higher brain centers involved in emotional and cognitive processing, including the thalamus, amygdala, and cortex (Bradley et al., 2010). Information originating from the heart influences processes that determine perceptual and emotional experiences (Lane et al., 2009; McCraty & Tomasino, 2006; Pribram & Melges, 1969; Thayer & Lane, 2009; van der Molen, Somsen, & Orlebeke, 1985).

The naturally occurring beat-to-beat changes in heart rate, known as heart rate variability (HRV), work to encode information about heart-brain interactions and autonomic nervous system (ANS) dynamics (Friedman & Thayer, 1998; McCraty et al., 2005; McCraty, Atkinson, Tomasino, & Bradley, 2006). Accordingly, HRV is recommended as an objective measure of the regulatory processes involved in emotional stability, cognitive function, and cardiac health (Appelhans & Luecken, 2006; McCraty et al., 2006; Porges, Doussard-Roosevelt, & Maiti, 1994; Thayer & Brosschot, 2005; Thayer & Lane, 2000; Thayer &

Sternberg, 2006).

Recent meta-analyses have confirmed the role of HRV as a marker of stress and health (Thayer, Åhs, Fredrikson, Sollers III., & Wager, 2012). Additionally, research on the neurocorrelates of HRV during emotion has demonstrated that higher levels of HRV were positively related to superior performance on tasks of executive function (Lane et al., 2009). To explain, the heart is dually stimulated by the ANS such that increases in sympathetic activity are associated with heart rate increases and increases in parasympathetic activity are associated with heart rate decreases. Therefore, sympathetic increases cause the time between heartbeats to become shorter and parasympathetic increases cause the time between heartbeats to become longer (Thayer & Brosschot, 2005).

Individuals with greater capacity to regulate emotion have been shown to have greater levels of resting HRV (Appelhans & Luecken, 2006; Thayer & Lane, (2009). Furthermore, Sergerstrom and Solberg Nes (2007) concluded that HRV contributes to resisting negative peer influences, strengthening tenaciousness, and improving emotion self-regulation. This is an important finding, given that the capacity to persist, despite self-regulatory fatigue, is a skill required when faced with tasks that demand higher order cognitive skills (Bradley et al., 2010).

Research conducted by the Institute of HeartMath emphasizes the relationship between HRV, emotional states, and cognitive function (McCraty et al., 2006). To illustrate, heart rhythm patterns have been found to respond to changes in emotional state (McCraty, Atkinson, Tiller, Rein, & Watkins, 1995). Moreover, McCraty and his colleagues found that as individuals experience negative emotions (i.e., stress, anxiety, frustration), heart rhythms become more irregular or incoherent. During a state of

incoherence, neurological signals traveling from the heart to the brain produce a desynchronization of brain and ANS activity. As a result, higher cognitive functions are inhibited and feelings of emotional stress and uncertainty are reinforced (McCraty et al., 2006; McCraty & Tomasino, 2006). Thus, as students engage in tasks that produce stress and anxiety, cognitive resources relative to attention, memory, and academic performance are impaired (Arguelles, McCraty, & Rees, 2003; Bradley et al., 2007; McCraty, 2005).

On the other hand, research has demonstrated that positive emotions (i.e., appreciation, compassion) are related to enhanced cognitive function and improved perception, attention, memory, decision making, creativity, and problem solving (Fredrickson, 2002; Isen, 1999). Highly ordered heart rhythm patterns (coherence) reflect synchronization between the ANS and physiological efficiency (Bradley et al., 2010; Thayer et al., 2012). When the heart sends a coherent signal to the centers in the brain, higher cognitive function and emotion regulation capabilities are facilitated (McCraty et al., 2006; McCraty, Barrios-Choplin, Rozman, Atkinson, & Watkins, 1998; McCraty & Tomasino, 2006).

The research described above has led to the depiction of a distinct physiological state related to activating and sustaining positive emotions. This will be further discussed in the following section.

Physiological Coherence

According to Tiller, McCraty, and Atkinson (1996) the intentional process of focusing attention in the physical area of the heart and activating and sustaining positive emotions (i.e., compassion, appreciation) is referred to as physiological coherence. The state of coherence represents a smooth wavelike heart rhythm pattern and produces afferent

cardiac signals to the brain (McCraty et al., 2006; Tiller, McCraty, & Atkinson, 1996). These signals reinforce self-activating a positive emotional shift, making it easier to sustain (Bradley et al., 2007).

The physiological correlates of a coherent state include (a) increased heart-brain synchronization (the brain's alpha rhythms are harmonized with cardiac systems); (b) increased synchronization between the two branches (parasympathetic and sympathetic) of the ANS[1]; (c) decreased sympathetic nervous system activation; and (d) increased para-sympathetic activity; and (e) entrainment between diverse physiological oscillatory systems (synchronization and control of cardiac rhythm) (McCraty et al., 2006; Tiller et al., 1996). In short, these physiological changes create a highly efficient state, in which the body, brain, and nervous system work together in harmony. Additionally, measures of cognitive function and task performance indicate psychophysiological coherence is directly correlated with improvements in attention, speed and accuracy of response, and long-term memory (McCraty et al., 2006). Finally, coherence is associated with enhanced emotional stability, diminishing perceptions of stress and negative emotions, and the development of sustained positive emotions (McCraty et al., 2006; McCraty et al., 1998; McCraty & Childre, 2004; Tiller et al., 1996). Most critical to this work is the discovery that psychological coherence is a state that can be self-generated (Childre & Martin, 1999).

The HeartMath program is comprised of strategies and techniques designed to foster emotion self-regulation (Childre & Martin, 1999; Childre & Rozman, 2005). As documented by McCraty and Tomasino (2006) and Pribram (1991), repeated practice of the

---

[1] The sympathetic nerves function to accelerate heart rate, while the parasympathetic, or vagus nerves, slow it down (Goelitz & Lloyd, 2012).

coherence-building self-regulation techniques results in more efficient and harmonious physiological systems. As physiological patterns become increasingly familiar to the brain, the system strives to maintain these healthy psychophysiological functions through a feed-forward process (how neural networks process patterns and recall data). Evidence of this process is documented in studies on health, hormonal balance, psychological well-being, and socio-emotional function in individuals who used coherence-building strategies over several months (McCraty, Atkinson, & Tomasino, 2003; McCraty et al., 1998). The next section includes a review of two studies that are relevant to the current study.

HeartMath Studies

Studies on the efficacy of the HeartMath program have been conducted in a variety of settings, including educational settings (early childhood through postsecondary), police departments, hospitals, colleges, correctional institutions, sports, the arts, and the military. The literature dedicated to studies of the HeartMath program in educational settings consists of 16 articles and reports published from 1999 through 2012. Of these, seven studies were published in peer-reviewed journals; nine are institutional reports. Independent institutions published five of the reports, and the remaining four were published by the Institute of HeartMath. Two experimental studies on the efficacy of a socio-emotional self-regulation intervention for secondary students are relevant to the current study.

The first study investigated the effects of a classroom-based emotion self-regulation program designed to mitigate test anxiety in high school students in grade 10 (Bradley et al., 2010). The second study investigated the effects of self-regulation training on behavioral changes and cognitive functioning in students with attention deficit hyperactivity disorder (ADHD) in grades 6, 7, and 8 (Lloyd et al., 2010). Both studies used group designs and

involved fostering socio-emotional self-regulation skills with secondary school students, with and without disabilities.

High School Study

The first intervention study (Bradley et al., 2010) investigated the effects of a classroom-based emotion self-regulation program (*TestEdge*®, 2002) on measures of test anxiety, socio-emotional function, test performance, and HRV in high school students. The *TestEdge* intervention was developed to build students' aptitude for self-generating psychophysiological coherence to improve learning and performance. To illustrate, the self-activation of a positive emotion, such as love, compassion, or appreciation, initiates a distinct shift to coherence in the heart's pattern of rhythmic activity. In turn, this produces a change in the pattern of afferent cardiac signals sent to the brain and reinforces the self-generated positive emotional shift, making it easier to sustain. Students learned to apply the self-activated positive emotion refocusing strategy before and during test taking.

As noted, a psychophysiological coherent state has been shown to improve nervous system function, emotional stability, and improve cognitive performance (McCraty et al., 2006). Results of pilot studies investigating the efficacy of the *TestEdge* program indicated improvements in standardized test scores and psychosocial functioning (Arguelles et al., 2003).

Moreover, a large-scale investigation (N = 980) funded by the U.S. Department of Education examined the *TestEdge* program (Bradley et al., 2007). The TestEdge National Demonstration Study (TENDS) used a quasi-experimental pre- and posttest design test the efficacy of *TestEdge* with 900 high school students in the 10th grade, in regular and advanced level classes. Data were collected using teacher questionnaires, classroom

observations, and student performance on two California standardized tests (CST). Results demonstrated that a coherence training curriculum (*TestEdge*) significantly reduced test anxiety and negative affect, emotional discord, and interactional difficulty while also significantly increasing positive class experience and increasing English test scores. In addition, students were more cognizant of others' feelings and better able to avoid arguments and fights after completing training.

As part of this larger study, a smaller study was conducted to investigate the effects of a self-regulation strategy on nervous system function, emotional stability, and cognitive performance (Bradley et al., 2010). A pre- and posttest control group design was employed with a subpopulation of students (N = 136) in the TEND study, from both intervention and control schools. (A randomized stratified procedure was used to select students.)

The intervention was comprised of three components involving both teachers and students in the intervention school: (a) a version of the *Resilient Educator® Qualified Instructor* program (2002) for teachers; (b) a version of the *TestEdge* (2002) program for students; and (c) heart rhythm coherence training for both teachers and students via the HeartMath program. Following training in the *TestEdge* program, English teachers delivered instruction in the *TestEdge* program twice a week for approximately one semester (January through May). The HeartMath computer technology, emWave, was installed in the intervention school's computer lab to afford students additional opportunities for practice before or after school. Three pre- and posttest measures were used to collect data: (a) Student Opinion Survey (SOS; Bradley & Atkinson, 2004); (b) heart-rate variance (HRV); and (c) English language arts (ELA) test scores from the CST.

The SOS is comprised of 14 multivariate constructs covering a broad range of

students' perceptions of their relationships and connections to teachers, peers, family, and school; positive and negative affect; emotional discord; ability to manage stress; and level of test anxiety (Bradley & Atkinson, 2004). The HRV is a noninvasive measurement of pulse (McCraty, 2005). The system displays the user's changing heart rhythm patterns in real time and quantifies the level of heart rhythm coherence achieved. To obtain a measure of HRV during a stressful condition, the participants took a simulated version of a high-stakes standardized test of achievement. Named after John Ridley Stroop (1935), the Stroop Test is a standard protocol used to induce psychological stress. For example, the name of a color (e.g., "blue," "green," or "red") is printed in a color not denoted by the name (e.g., the word "red" printed in blue ink instead of red ink). As a result, naming the color of the word takes longer and is subject to more error. During the test, continuous data on students' HRV were collected. Finally, the third measure (ELA CST scores) designated students' scores from the previous school year for the pretest and end-of-year scores for the posttest.

The analysis of covariance (ANCOVA) revealed significant pre- and posttest differences of a mostly large effect size between groups on all measures of HRV. Students in the experimental group had a lower mean heart rate (76.21 vs. 79.62 beats per minute [BPM]), suggesting that they were less stressed (*p* value was not given). The experimental groups also evidenced greater high-frequency power (5.59 vs. 4.93 BPM; ES 0.72, $p < 0.001$), indicating a higher level of parasympathetic activity, which is consistent with the lower heart rate. The experimental group's low frequency power was also much larger (809.23 vs. 289.70; 6.17 vs. 5.37, ES 0.82, $p < 0.001$) which, when combined with the increased high-frequency power, indicated that they were in a more calm, yet highly aware, state associated with the psychophysiological coherence mode. The findings are confirmed

by the significantly larger heart rhythm coherence ratio observed in the experimental site students (4.61 vs. 2.79, ES 1.26, $p < 0.001$). In sum, the HRV data present convincing evidence that the students in the experimental group had learned how to manage their stressful emotions when preparing for a challenging task, such as taking an important test.

Next, the ANCOVA revealed significant pre- and posttest differences of a low to moderate effect size on all three measures of test anxiety, whereby mean test anxiety was lower for the experimental group than it was for the control group (Global, 1.94 vs. 2.30, ES 0.37, $p < 0.01$; Worry, 2.03 vs. 2.29, ES 0.26, $p < 0.05$; Emotionality, 1.82 vs. 2.29, ES 0.48, $p < 0.001$). On the SOS scales, a large pre- and posttest difference in Negative Affect for the experimental group was observed (2.00 vs. 2.35, ES 0.50, $p < 0.01$). No significant pre- and posttest difference was found on the measure of test performance, the 9^{th}- and 10^{th}-grade mean score change on the CST ELA. Overall, the findings suggest that the emotion self-regulation strategies helped students reduce negative emotions and test anxiety. Nevertheless, the study had several limitations.

First, the large difference between the academic level of the experimental and comparison groups limited the ability to construct a statistically adequate matched-pairs comparison in which test performance and test anxiety were controlled at baseline measurement. Second, information to identify students for whom English is a second language (ESL) was lacking. Therefore, the researchers were unable to control for the effect of ESL on test performance. Third, the study attempted to simulate the stressful conditions of taking a standardized academic test by having students perform the Stroop Test. However, the Stroop Test is not an achievement test. Therefore, consideration must be given to how closely the test represents a student's actual experience of taking a high-

stakes test of achievement. Fourth, the study was directed by the developers of the intervention, thereby being subject to possible bias on the part of the researchers. Finally, the amount of time students in the treatment groups spent learning and practicing the self-regulation strategies was not indicated, making it difficult to replicate the experiment. Nevertheless, the study represents an important endeavor because it is directly related to theory on cognitive function, emotion, and test anxiety, thereby extending theory on psychophysiological function. Moreover, the research promotes new understandings of the critical relationship between psychophysiological processes, emotions, learning, and academic performance. Next, we turn to the second study selected for this review.

Middle School Study

A randomized controlled clinical trial investigated the effects of the HeartMath program on behavioral changes and cognitive functioning in 36 students with ADHD in grades 6, 7, and 8 (ages 9 to 13 years) in Liverpool, England (Lloyd et al., 2010). All students met the criteria for ADHD according to the Diagnostic and Statistical Manual of Mental Disorders, 4th edition (American Psychiatric Association, 2000), and agreed to follow their existing medication protocols. The researchers claimed that the groups were not equal because of scheduling and logistics.

The control group of 21 students (group 1) participated in an active placebo (playing with LEGOs® construction bricks) for the first six weeks. The experimental group of 15 students (group 2) received instruction in the HeartMath program for 20 minutes a day for six weeks. As in the high school study described above, training included practice using the self-regulation strategies and emWave computer technology. After six weeks, group 1 received instruction in the HeartMath intervention, and group 2 received the active

intervention for another six weeks.

A teaching assistant supervised the experimental group's practice and taught the positive emotion refocusing strategies. All of the strategies involved shifting the focus of attention to the area around the heart and breathing easily and slowly as if breathing through the chest area for 5-10 minutes. In addition, the students learned to evoke a positive emotion while participating in the focused heart breathing activity. Students were also provided with one-to-one opportunities to practice the techniques with the teaching assistant and prompted to use the strategies in school and at home.

The emWave computer program was introduced to help students achieve coherence. Students' coherence levels drive the games. That is, as students' coherence increases, success in the games increases. During the emWave sessions, students receive real-time visual feedback of their coherence levels via a noninvasive pulse sensor that is attached to the earlobe. Coherence ratios, the amount of time in a coherent state (or not) during a given session, were tracked and monitoring using the emWave computer program's data storage system. To help generate positive emotions, the students created vision boards by placing photographs of positive images (i.e., superheroes, pets, sports) on a large board. Finally, bookmarks and pocket cards were provided to help students remember the emotion regulation strategies. Pre- and posttest measures were administered to both groups following each six-week intervention (either HeartMath or the active intervention).

The cognitive drug research (CDR) system was used as the first primary outcome measure. The CDR system is a computerized battery of cognitive tests designed in the late 1970s by Keith Wesnes at the University of Reading in Berkshire, England (1979). Respondents answer yes/no to questions presented on a computer screen, and the program

records both the respondent's accuracy and reaction time.

The Strengths and Difficulties Questionnaire was the second primary outcome measure, aimed at assessing children's emotional well-being. Both teachers and students completed the 25-item questionnaire (Goodman, 1997). Finally, qualitative data from participants, teachers, and parents were collected via interviews. The following statistical methods and results were reported.

The data for group 1 (active control) were subject to a mixed-model ANOVA. The data for group 2 (HeartMath) was subject to a split-plot repeated measures mixed-model ANOVA. A 5% level of significance was adopted for all assessments, and 2-tailed testing was applied. The ANCOVA test revealed a significant difference between groups in word recognition sensitivity ($p < .01$) and in quality of verbal episodic secondary memory ($p < .057$), with group 2 performing better on both assessments.

No significant differences were found between before and after the six weeks of Lego sessions for group 1. However, significant differences for group 1 were found following six weeks of the HM intervention: Delayed word recall (long-term memory) ($p < .01$), immediate word recall (short-term memory) ($p < .01$), and quality of verbal episodic memory ($p < .01$) all improved. A mixed-model ANOVA for group 2 also revealed significant differences after the HM intervention sessions: Delayed word recall ($p <. 05$), word recognition sensitivity (speed and accuracy) ($p <. 001$), quality of episodic secondary memory ($p < .001$), and quality of verbal episodic secondary memory ($p < .001$) all improved.

Further, the mixed-model ANOVA results for the combination of students from groups 1 and 2 who participated in the HM intervention revealed significant posttest

differences. That is, delayed word recall ($p < .01$), immediate word recall ($p < .01$), word recognition sensitivity ($p < .001$), quality of episodic secondary memory ($p < .001$), and quality of verbal episodic secondary memory ($p < .001$) all improved. The Mann-Whitney U test was used to determine differences between groups 1 and 2 on the Strengths and Difficulties Questionnaire. The results indicted significant differences in difficulties scores in both student ($p = .044$) and teacher ($p = .001$) reported data.

Qualitative data revealed that 100% the parents noticed improvements in their children's sleep patterns. Feedback from both teachers and parents indicated that improvements in behavior were more evident following the HM intervention. Some of the parents noted that their child continued to practice the positive emotion self-regulation strategy after they had finished the program.

Despite these very positive findings, several limitations were identified. First, the self-reported questionnaire assessments of student behaviors completed by teachers and students are subjective and do not control for variables such as adverse life events. Second, there was inconsistency across the school sites relating to the capture of data on HRV coherence ratios. Therefore, it was not possible to assess whether a relationship existed between the changes in individual coherence scores and cognitive function scores. Finally, the sample population was relatively small, and groups were not equivalent, making it difficult to prove a causal relationship between the intervention and outcome variables.

In summary, participants demonstrated significant improvements in various aspects of cognitive functioning (i.e., delayed word recall, immediate word recall, word recognition, and episodic secondary memory), along with significant improvements in behavior. The results suggest that a physiologically based intervention to improve cognitive functioning in

children with ADHD and improve behaviors is appropriate to implement in a school setting.

In short, the studies extended psychophysiological theory positing that physical systems and cognitive processes are interrelated. Similar to the findings of McCraty et al. (2006), students who practiced a self-directed positive emotion refocusing strategy were significantly less stressed during demanding cognitive tasks (i.e., test-taking), improved cognitive functions (i.e., delayed word recall, immediate word recall, word recognition, episodic secondary memory), and experienced improved behavior in school and at home. In addition, students were able to generalize the strategy to settings outside of school. Unfortunately, the studies did not include a direct measure of academic performance (other than annual standardized achievement scores). Hence, the studies did not substantiate the causal relationship between the HeartMath intervention and improved academic outcomes. Nonetheless, the findings hold promise for students suffering from test anxiety, ADHD, and impaired cognitive function.

The significant outcomes underscore the need for further research on positive emotion refocusing and academic skills or achievement, especially in the area of literacy. Considering the sizeable number of adolescent youth with substandard literacy skills at risk of school failure, the next section of this review is devoted to the research base on effective reading instruction for adolescents.

Explicit Reading Instruction for Adolescents

Students, with and without LD, who experience reading failure beyond elementary school, benefit from literacy instruction that is delivered via a structured, explicit process (Deshler & Hock, 2007). Adolescents with reading deficits respond to explicit instruction encompassing all components of reading, including (a) phonics and word recognition; (b)

fluent reading of words in text; (c) comprehension; and (d) vocabulary (National Institute of Child Health and Human Development, 2000).

A number of research reports, analyses, and book chapters have pointed to the critical importance of teacher-directed, scaffolded, cumulative, systematic, and explicit teaching for struggling adolescent learners (Biancarosa & Snow, 2006; Bulgren, Schumaker, Deshler, Lenz, & Marquis, 2002; Deshler, Palincsar, Biancarosa, & Nair, 2007; Rosenshine & Stevens, 1984; Swanson & Deshler, 2003). As demonstrated by the research cited below, adolescents benefit from explicit instruction in all components of reading.

For example, reading instruction adopting teacher-directed, scaffolded, cumulative, systematic, and explicit instructional methods has been shown to (a) build phonemic awareness and phonics skills (Curtis, 2004); (b) improve aptitude for word identification and retrieval (Curtis, 2004; Curtis & Longo, 1997); (c) enhance speaking and writing proficiencies (Graham & Hebert, 2010; Torgesen et al., 2001); (d) cultivate listening and reading comprehension abilities (Faggella-Luby & Deshler, 2008; Vaughn, Klingner, & Bryant, 2001); and (e) close the vocabulary gap between high- and low-performing students (Kamil, 2004).

An intervention program, *LANGUAGE!* Comprehensive Literacy Curriculum, developed by Greene (1996), incorporates the reading components and instructional methods mentioned previously. These components show promise for improving the language and literacy skills of adolescent struggling readers (Deshler & Hock, 2007). A review of the literature on the *LANGUAGE!* curriculum is presented in Chapter III. To follow is a summary of the findings and limitations from the literature on psychophysiological theory and the effects of SEL programs for adolescents with reading

difficulties at risk of school failure.

Summary of Literature on the Effects of SEL Programs

The literature suggests that universal SEL programs are likely to improve students' socio-emotional development and academic achievement. For example, analyses comprised of 530 studies involving more than half a million students indicate that SEL programming has the potential to positively impact multiple socio-emotional and academic outcomes for a diversity of students, with and without disabilities, in a variety of school settings (Durlak et al., 2011; Payton et al., 2008). Nonetheless, certain common threads across analyses suggest that, for the purposes of studying SEL programming for high school students with reading difficulties, may be considered limitations.

First, the majority of the studies in the meta-analyses focused on elementary or middle school students. Only one meta-analysis examined the efficacy of SEL studies with high school-aged students (Durlak et al., 2011). Of the 213 studies Durlak and his colleagues included in their analysis, a mere 13% addressed high school students. Second, the bulk of studies included in both of the meta-analyses (M = 20%) did not collect data on academic achievement from pre- to posttest, making it difficult to infer that SEL programming is causal to improved learning (Durlak et al.; Payton et al., 2008). Finally, none of the analyses specifically addressed high school students with LD or reading difficulties. Therefore, the analyses fail to highlight the specific features of SEL programming required to improve the social and emotional skills and academic performance of secondary students with LD or reading difficulties.

In addition to the analyses, two studies examining the efficacy of the HeartMath program were reviewed. Studies on a self-generated positive emotion refocusing strategy

developed at the Institute of HeartMath demonstrate that a highly efficient state (coherence) may significantly impact behavior, cognitive function, perceptions of stress and negative emotions, and the capacity to sustain positive emotions (Bradley et al., 2010; Lloyd et al., 2010). Similar to SEL meta-analyses, however, certain elements across studies pose limitations for investigating the effects of SEL programming with high school students with LD and reading difficulties.

First, groups were not equivalent, thereby limiting the ability to construct a statistically adequate matched-pairs comparison. Second, the amount of time students in the treatment groups spent learning and practicing the self-regulation strategies was not indicated. Third, comparable to the large-scale SEL meta-analyses conducted by Durlak et al. (2011) and Payton et al. (2008), data were not collected on academic achievement from pre- to posttest, nor did the studies address high school students with LD or reading difficulties. In conclusion, sound experimental research employing a pre- and posttest design is needed to validate the instructional features of SEL programming that improve academic achievement, specifically for high school students with LD and reading difficulties who are deemed to be at risk for school failure.

To conclude, difficulties with early reading can have detrimental effects on students' socio-emotional well-being, capacity for academic engagement, behavior, and motivation to learn (Guthrie & Wigfield, 2000; Snow et al., 1998; Zins et al., 2007). Additionally, elementary students with impaired social and emotional skills are far less likely to achieve proficiency in reading in adolescence (Chapman & Tunmer, 2003). In turn, impaired socio-emotional skills can potentially manifest in antisocial behaviors and emotions that are characteristic of youth offenders (Hazel et al., 1982). Indeed, reading difficulties are the

most salient predictor of emotional withdrawal, school failure, or dropout (Reschly, 2009).

Schoolwide SEL programming has helped adolescents develop socio-emotional skills and improve academic achievement (Durlak et al., 2011; Payton et al., 2008). HeartMath is an SEL program that is based on neuro-physiological theory. Research on this program has demonstrated significant improvements in adolescents' (with and without disabilities) socio-emotional and cognitive development (Bradley et al., 2010; Lloyd et al., 2010). However, the literature on HeartMath has focused on general education students with ADHD, excluded students with LD and reading difficulties, and yielded inconclusive results on improving academic outcomes. Therefore, more research is needed on the efficacy of the HeartMath program for adolescents with LD and reading difficulties.

The general purpose of this mixed-methods intervention study was to investigate the efficacy of an SEL self-regulation intervention (SSRI) that teachers might implement prior to explicit instruction in reading. Specifically, the study investigated the effects of the SSRI relative to improving the psycho-physiological coherence, reading outcomes, reading self-concept, and socio-emotional well-being of high school students deemed at risk of school failure. Thus, the research questions pursued in this study were the following:

1. Is the performance of high school students, with and without disabilities, who receive explicit instruction in a scientifically based reading intervention significantly different from those who learn a social and emotional self-regulation strategy on the following five outcomes: (a) heart rate variability (HRV), (b) reading ability, (c) reading self-concept, and (d) social and emotional affect?
2. What emotional and behavioral responses will high school students, with and

without disabilities, report on tasks of reading, ways of coping, and teacher feedback?

3. What will high school students, with and without disabilities, report on the utility and satisfaction with the social and emotional self-regulation strategies?

CHAPTER III

METHODS

This intervention study employed a mixed-methods approach using a comparison group pre-/posttest design, student interviews, and student reflections. A combination of quantitative and qualitative research methods provided for triangulation of data and strengthened the validity of the study (Fraenkel & Wallen, 2006).

The study represents an initial attempt to investigate the efficacy of a social and emotional learning (SEL) self-regulation strategy relative to the general reading ability, reading self-concept, and social and emotional well-being of high school students, with and without disabilities, enrolled in a reading intervention course. During the spring semester of 2011, quantitative and qualitative data were gathered from four treatment and four comparison classrooms in two high schools located within a large urban school district in the southwestern United States. The data were collected by means of district reports, electro-physiological measures, standardized assessments, survey instruments, semi-structured interviews, and self-reports. Treatment fidelity of the intervention was measured via formal classroom observations.

Setting

The participating school district is located in a community of more than one million residents and is designated a majority-minority city (i.e., the majority of the residents in the area belong to a minority group). In this case, the majority-minority group was classified by district demographics as Hispanic. During the 2010-2011 school year the school district reported a total enrollment of 84,000 students. Enrollment is aggregated according to the following racial/ethnic groups: (a) 59.7% Hispanic; (b) 24.6% White; (c) 9.5% Black; (d)

3.3% Asian/Pacific Islander; (e) 2.5% other (2 or more races); and (f) 0.6% Native American. More than one quarter (28.6%) of students in the district is identified as English language learners (ELLs), with Spanish being the most common foreign language. More than half (63.6%) of students in the district qualified to receive free or reduced-price lunch.

Selection Criteria

The researcher met with district leaders to determine high schools that met the following criteria and, therefore, were eligible to participate in the study: (a) the school offered a credited reading intervention course; (b) the instructor of record was credentialed to teach special education and/or English language arts (ELA); and (c) the instructor of record had successfully completed training in the same supplemental reading program. Out of 13 high schools, only 2 (one instructor from each school) met the criteria.

High School 1. According to 2010-2011 state accountability data, High School 1 (HS1) had been rated as a low-performing school for 11 consecutive years. Placed under a state-mandated redesign plan for the second year in a row, it was one of three small high schools housed within one building. HS1 served approximately 450 students with ethnic/racial backgrounds reported as Hispanic (79.83%), Black (18.20%), and White (1.97%). Twenty-eight percent of students were reported as limited English proficient (LEP) and received academic instruction in classes designed to serve ELLs. Eighty-nine percent of students received free or reduced-price lunch. HS1 followed a block schedule scheme. Thus, classes were scheduled every other day for 90 minutes per class.

High School 2. According to 2010-2011 state accountability data, students enrolled in High School 2 (HS2) achieved academically proficient scores on the state tests of achievement for six consecutive years. HS2 served approximately 1,771 students with

ethnic/racial backgrounds reported as White (45.90%), Hispanic (30.57%), Black (20.15%), Asian (2.82%), and American Indian (0.56%). In HS2, 6.5% of students were reported as LEP and received academic instruction in classes designed to serve ELLs. Thirty-nine percent of students received free or reduced-price lunch. HS2 followed a traditional schedule scheme. Thus, classes were scheduled every day for 50 minutes per class.

Classroom Configuration

The reading intervention classrooms at HS1 and HS2 were equipped with technology stations positioned at the front of the room. Stations included a computer, projector, and document camera. In addition, each classroom had a retractable presentation screen, two whiteboards, and one chalkboard. Desks or round tables were arranged to allow students to work in small groups. Because the technology station at HS1 was in disrepair, the teacher used an overhead projector to provide instruction in the SEL Self-Regulation Intervention (SSRI) and the *LANGUAGE!* The Comprehensive Literacy Curriculum (*LANGUAGE!)* (Greene, 1996).

Participants

One reading intervention teacher from each high school and 50 students, with and without disabilities, participated in this study.

Teachers

The researcher recruited reading teachers from HS1 and HS2 who expressed interest in improving academic outcomes for struggling adolescent readers, hereafter referred to as Teacher 1 (T1) and Teacher 2 (T2). Both teachers held undergraduate degrees in education, licensures in secondary English language arts (grades 6-12), and had practical experience in their area of specialization (31 years and 11 years, respectively). In addition, T2 held

licensure to teach special education in grades early childhood through 12th grade. Each teacher instructed four sections of a credited reading intervention course designed to improve the reading and writing skills of students with and without disabilities. District leaders selected the *LANGUAGE!* curriculum as the supplemental reading program for both schools.

In August and September of the 2010 school year, the intervention teachers attended two days of a district-sponsored workshop to become trained to deliver instruction in *LANGUAGE!*. Representatives of the publishing company, who were certified to deliver professional development in the *LANGUAGE!* curriculum, facilitated the workshops.

Students

Prior to the 2011 spring semester, school administrators randomly assigned students with and without disabilities to sections of a credited reading intervention course. The researcher met with school administrators to determine if criteria were used to make these placement decisions. According to the administrators, placement decisions were not based on established criteria. Instead, any of myriad factors was used (e.g., disability status, grade-point average, teacher recommendation, behavior, and scores on the state test of achievement). Throughout the span of this study, students were assigned to sections of the reading intervention course as a consequence of negative behavior. Although data were not collected on these students, those enrolled in classes assigned to treatment conditions were invited to participate in the SEL Self-Regulation Intervention (SSRI).

At the time of the study, administrators, teachers, and counselors had already assigned students to a reading intervention class. First, one or more of the following criteria were used to identify students in need of supplemental reading instruction: (a) scores on

state tests of achievement (failing or close to failing); (b) teacher recommendation; (c) grades; (d) absenteeism; (e) disability status; and (f) behavior (i.e., chronic absenteeism, acting-out in class). Because classes of students had already been randomly assigned, the researcher flipped a coin to assign classes of students, with and without disabilities, to treatment or wait-list control conditions.[2]

The intervention teachers delivered direct instruction in *LANGUAGE!* to students in both the treatment and control conditions. The students assigned to treatment conditions were taught and practiced the SSRI on a daily basis throughout the study. In addition, the researcher delivered two program overview sessions, 50 minutes and 20 minutes long, respectively, on the SSRI to students assigned to the treatment group. During these sessions, students in the control group participated in a class-wide guided reading activity for two sessions of 50 and 20 minutes, respectively.

The initial sample population across both conditions consisted of a total of 59 high school students in grades 9-12. A relatively high rate of attrition (n = 9) contributed to a 15% reduction, bringing the final number of participants to 50. Various factors attributed to the reduction in sample size: (a) chronic absences of 10 days or more (n = 2); (b) moved out of district (n = 2); (c) reported as a runaway (n = 1); (d) received in-school suspension for the entire semester (n = 1); (e) sentenced to residential drug rehabilitation program (n = 1); (f) sentenced to state school for youth offenders (n = 1); and (g) dropped the course (n = 1). Of the students who dropped out of the study, 100% were controls. As a result, disparate numbers of students were assigned to the two conditions (see Table 1).

---

[2] Students were assigned to the wait-list control group, allowing an opportunity to receive the intervention at a later date (Kazdin, 2003).

Table 1

Treatment and Control Groups

Teacher	Treatment	Control	Total
T1	17	10	27
T2	12	11	23
Total	29	21	50

Note. Student attrition contributed to the unequal number of participants in the treatment and control conditions.

Demographic data. Demographic data on student participants were collected from the district and are displayed in Table 2. The final sample consisted of 35 males (70%) and 15 females (30%) in grades 9-12. More than half of the participants were in grade 9 (56%), with the remaining in grades 10 (24%), 11 (12%), and 12 (8%). Nearly two thirds of the student participants were reported as being Hispanic (62%) with the remaining (38%) being Black. None of the participants were reported as being White, Asian, Native American, or Other.

Two subgroups of students participated in the study: (a) students determined to have a disability (SWDs), receiving special education services under the Individuals With Disabilities Act (IDEA), and having an Individualized Education Plan (IEP); and (b) students without disabilities (NSWDs). More than two thirds of the total student participants were identified with a disability and had an IEP (68%). The majority of SWDs, more than one third (68%), were determined to have a specific learning disability (SLD) and an IEP with reading as a designated area of remediation (i.e., phonemic awareness, phonics,

Table 2

Demographic Data

	Treatment Group *n* = 29		Control Group *n* = 21	
Teacher	1	2	1	2
Grade				
Ninth	9	6	6	7
Tenth	5	3	0	4
Eleventh	2	3	1	0
Twelfth	1	0	2	1
Total	17	12	9	12
		SWD		
SLD	7	5	1	10
OHI	0	5	0	0
ED	0	0	0	1
ASD	0	0	1	0
Mild II	0	2	2	0
Total	7	12	4	11
		NSWD		
Total	10	0	6	0
		Race/Ethnicity		
Hispanic	14	5	7	5
Black	3	7	3	6
Total	17	12	10	11

Note. 100% of the students received free lunch.

fluency, vocabulary, or comprehension). The remaining one third (32%) of SWDs was determined to have a disability under the classification of other health impaired (OHI), emotionally disturbed (ED), mild intellectual impairment (MII), and autism spectrum disorders (ASD). All student participants received free lunch, as opposed to reduced-price lunch (see Table 2).

Instructional Materials

The SEL self-regulation techniques investigated in this intervention study were developed at the Institute of HeartMath, and are grounded in over 20 years of empirical research (Bradley et al., 2007; Luskin, Reitz, Newell, Quinn, & Haskell., 2003; McCraty et al., 1995; Rozman, Beckman, Jones, & Whitaker, 1996). The programs and self-regulation techniques are designed to facilitate the skills requisite to effectively managing emotional impediments to learning and performance. A review of the research and theory grounding these programs and self-regulation techniques is provided in Chapter II.

Specifically, materials from two programs, the *Resilient Educator* (for educators) and *TestEdge* (for students), were used to design the SSRI for the study (*TestEdge: Getting in sync for test success*, 2002). The first program, the *Resilient Educator*, was designed as a professional development tool for teaching the self-regulation techniques. Materials from the *Resilient Educator* were used to design and deliver professional development to the intervention teachers.

The second program, *TestEdge*, is a curriculum designed to teach students self-regulation techniques that promote acquisition of skills requisite to managing stress, anxiety, and negative emotions. The primary aim of the program is to improve students' learning, performance, and social and emotional well-being. Using the *TestEdge* program, students

engage in classroom activities that promote social and emotional self-reflection and development.

To achieve proficiency in delivering professional development to educators in the *Resilient Educator* and *TestEdge* programs, the researcher participated in training at the Institute of HeartMath in Boulder Creek, California. In the fall of 2010, the researcher attended a 32-hour training course and achieved certification as a Qualified Resilient Educator Instructor. Next, the researcher collaborated with HeartMath program developer and facilitator Jeff Goelitz to design the professional development sessions for teachers and the SSRI for students. In addition, Mr. Goelitz assisted in presenting the initial professional development and coaching sessions via teleconference. The instructional materials for the professional development sessions, SSRI, and the reading intervention, *LANGUAGE!* curriculum are described in the following section.

Professional Development Materials

Materials gleaned from the *Resilient Educator* training manual, including slide presentations and presenter notes, were customized to create two professional development sessions for the intervention teachers in the current study.

The first session was structured to provide teachers with instruction and training on the following components: (a) an introduction to theory, research, and science supporting electrophysiological coherence and the self-regulation techniques; (b) the SSRI techniques Neutral Tool® and Quick Coherence®; (c) the use of the emWave coherence-training computer program and emWave portable device; and (d) the SSRI implementation procedures. A detailed summary of the SEL self-regulation techniques is presented later in this chapter under the section “Program Overview Part I.”

The second professional development session consisted of a review of the above-mentioned components, as well as guided practice using the SEL self-regulation techniques and emWave coherence-training computer program and the emWave portable device. Next, an introduction to the SSRI was provided, and the following materials were presented for review: (a) program overview part I; (b) lesson plans (including program overview part II); and (c) teachers' manual. The introduction to the SSRI and accompanying documents are presented the following section.

SSRI Materials

The aim of the *TestEdge* program is to improve learning and performance by providing students with self-regulation techniques to reduce stress, anxiety, and negative emotions. As noted in the introduction of this section, the *TestEdge* curriculum materials (i.e., slide presentations, presenter notes, interactive classroom activities, and student activity workbooks) served as one of the resources for designing the SSRI.

Program overview part I (50 minutes). Part I of the program overview for students was delivered using an interactive PowerPoint presentation designed to introduce students to the SSRI. The presentation was organized into four sections: (a) New Words (terminology specific to the techniques and technology) and Concepts (physiology of emotion); (b) Getting to Know Your Emotions (identifying vocabulary to express feelings and recognize emotions); (c) Techniques for Success (self-regulation strategies); and (d) emWave coherence-training computer software program (emWave PC).

The first section of program overview part I, New Words and Concepts, involves an introductory lesson on the terminology requisite to understanding instruction in the SEL self-regulation strategies. Definitions, as well as examples and non-examples, of the

following terms are presented: (a) *appreciation* (an emotional state in which a person has a clear understanding and strong feeling of what he or she is thankful for); (b) *in-sync* (when two or more things work in harmony with one another); (c) *electrophysiological coherence* (when the heart, brain, and emotions work together to increase the likelihood of making good decisions, solving problems, building relationships, and getting along with others); and (d) *heart-breathing* (how to breathe in a feeling of appreciation and imagine air entering and leaving the center of the chest). Once students demonstrated an understanding of the terminology via choral and individual response, a more in-depth explanation of the concepts was presented.

The concepts presented in the first section of program overview part I included an introduction to the three-part brain (cerebrum, cerebellum, brain stem) and their functions, the heart-brain connection (how nerve impulses are first received in the heart and then sent to brain pathways that influence emotion), and the physiology of the autonomic nervous system (ANS) (how the ANS regulates the body's involuntary functions). At this point in the session, each student received an activity guide (see Appendix A). The student activity guides included an introduction to scientific concepts related to SEL self-regulation, a list of adjectives describing feelings and emotions, and copies of the Emotional Window® activity. The following part of program overview part I was comprised of interactive activities for recognizing feelings and emotion. Finally, the researcher checked for understanding by reviewing the concepts and questioning and eliciting answers from students via choral response.

Section two of program overview part I, Getting to Know Your Emotions, was comprised of exercises that enhance developing the capacity to become self-aware of one's

feelings and emotions. The first activity prompted students to identify words to express feelings and emotions. Students were presented with slides of photographs of adolescents displaying various facial expressions and used adjectives to subjectively describe the feeling or emotion being depicted in the photographs. Next, the Inner Weather Report® activity was introduced (see Figure 1).

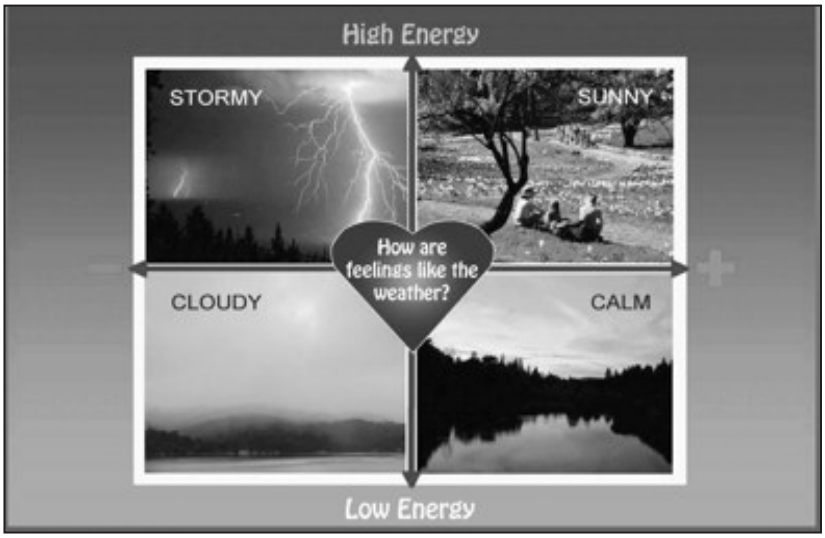


Figure 1. The Inner Weather Report activity.

At this point, students were introduced to the concept of using weather as a metaphor for explaining how feelings, just like the weather, frequently change (e.g., stormy, cloudy, calm, sunny). In addition, they participated in an activity to enhance emotional self-awareness, the Emotional Window.

The Emotional Window activity was introduced to prompt students to take a self-inventory of their current emotional state (see Figure 2). First, the teacher modeled how to identify an emotion, selected an adjective to describe the feeling, and recorded it within the Emotional Window. Next, using the student activity guide, students identified a feeling or

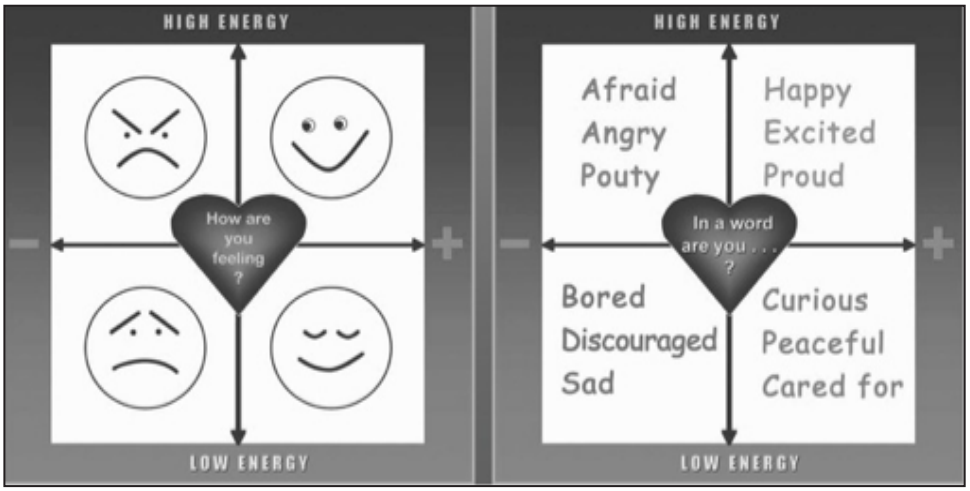


Figure 2. Emotional Window activity.

emotion (may refer back to the list of adjectives used to describe feelings) and recorded the feeling word within one of four quadrants of the Emotional Window continuum. Finally, the students were asked to share and discuss their feelings, as well as where the feeling would be placed on an emotional continuum. Multiple copies of the Emotional Window were included in the student activity guide, so students could complete them at different points during the intervention phase of the study.

The third section of program overview part I, Techniques for Success, provided students with explicit instruction on the SEL self-regulation techniques, Neutral Tool and Quick Coherence (Childre & Rozman, 2005). The first technique, Neutral Tool, involved breathing slowly and calmly, focusing attention on the area around the heart and shifting energy away from stressful thoughts and feelings. The second technique, Quick Coherence, involved applying the Neutral Tool, as well as recalling a positive feeling or emotion such as caring, compassion, or appreciation towards a person, pet, place, or activity.

The three steps of the Quick Coherence technique included:

Step 1 (Heart Focus)**:** Focusing attention in the area of the heart, in the center of the chest.

Step 2 (Heart Breathing)**:** Using the emWave Screen, Coherence Coach, or emWave portable, visualize breathing flowing in and out of the area in the center of the chest.

Step 3 (Appreciation)**:** Recalling a positive feeling of appreciation, care, or compassion for a person, pet, place or activity and continuing to breathe through the area of the heart.

The aim of the Quick Coherence technique is to train students to create a shift in attention from a negative state to one of appreciation and compassion. Such a shift of emotion has been found to facilitate the emergence of a coherent electrophysiological state known as heart rhythm coherence (Childre & Martin, 1999; Childre & Rozman, 2005). Heart rhythm coherence is a term used by scientists to describe when the autonomic nervous system (ANS), cardiovascular, hormonal, and immune systems are working efficiently and harmoniously (Bradley et al., 2007). Consistent use of the HeartMath software and the Neutral Tool and Quick Coherence self-regulation strategies, combined with an active focus on positive thoughts, promotes a highly physiological coherent state (McCraty, 2005; McCraty & Tomasino, 2006).

The fourth section of program overview part 1 included activities designed to provide students with instruction and practice using the emWave coherence-training computer software program. Students were introduced to the software via interactive presentations that included instructor modeling of the SEL self-regulation techniques, student demonstrations, and guided and independent practice. During the final phase of instruction (independent practice), the instructor checked for understanding by asking each

student to individually demonstrate command of the techniques and coherence-training software. As students practiced the SEL self-regulation techniques using the emWave coherence-training software as part of an effort to shift from a negative emotional state to a more positive one by improving levels of physiological coherence.

The emWave coherence-training computer software system embodied five essential components, including (a) the Heart Rate Variability Screen® (HRV screen) providing real-time visual feedback on beat-to-beat changes in heart rate as well as coherence levels; (b) data storage to document coherence levels achieved during each session and track progress over time; (c) a Coherence Coach® tutorial to help participants learn to regulate their heart rhythms; (d) interactive games to challenge participants' ability to achieve electrophysiological coherence; and (e) a USB module with an Earlobe Pulse Sensor® to measure pulse rate. These pulse data were used to calculate heart rate variability (HRV).

The overall function of the emWave computer program was to enhance the capacity to self-regulate emotional blocks to learning and performance. To review, electrophysiological coherence is achieved when physical, cognitive, and emotional systems are synchronized. As noted in Chapter II, the primary marker of physiological coherence is HRV (McCraty, Tomasino, Atkinson, Aasen, & Thurik, 2000). The emWave computer coherence-training software program also includes a function that provides real-time feedback on levels of physiological coherence on the HRV screen.

To measure HRV, a pulse sensor was plugged into the universal serial bus (USB) port of a computer. The pulse sensor was in the form of a lightweight ear sensor that is clipped to the earlobe during a session using the emWave technology (see Figure 3). Pulse data (beat-to-beat changes in heart rate) were collected and translated into graphics, which

Figure 3. Pulse sensor.

were displayed on the HRV screen. As higher levels of electrophysiological coherence were achieved, heart rhythm patterns become smoother and more wavelike (see Figure 4). Following a session using the emWave software, the degree of coherence attained was displayed in a tri-colored bar graph: (a) red = low to normal coherence; (b) blue = medium to improved coherence; and (c) green = high-optimal coherence (see Figure 5).

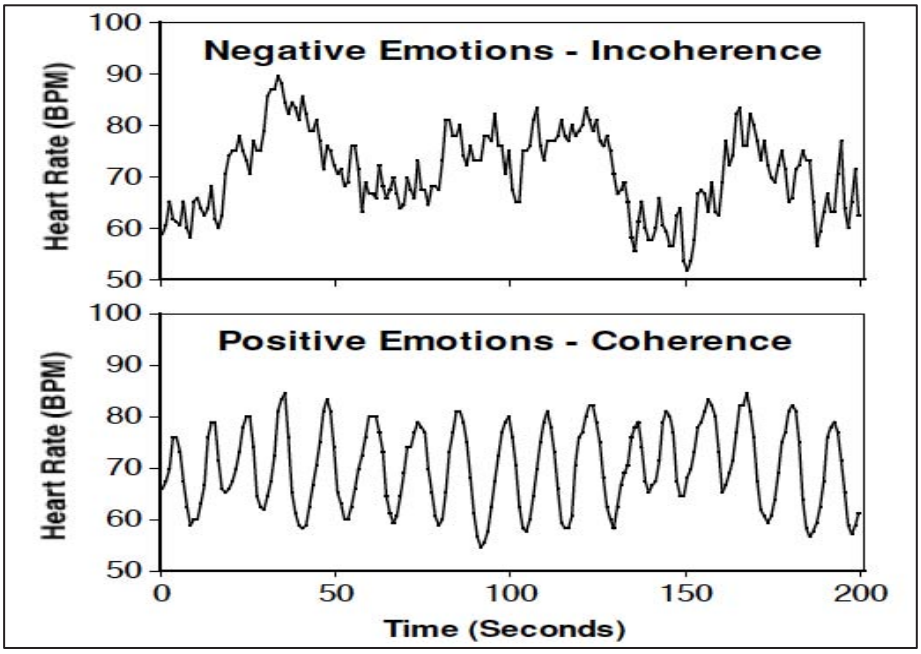


Figure 4. Heart rhythm patterns.

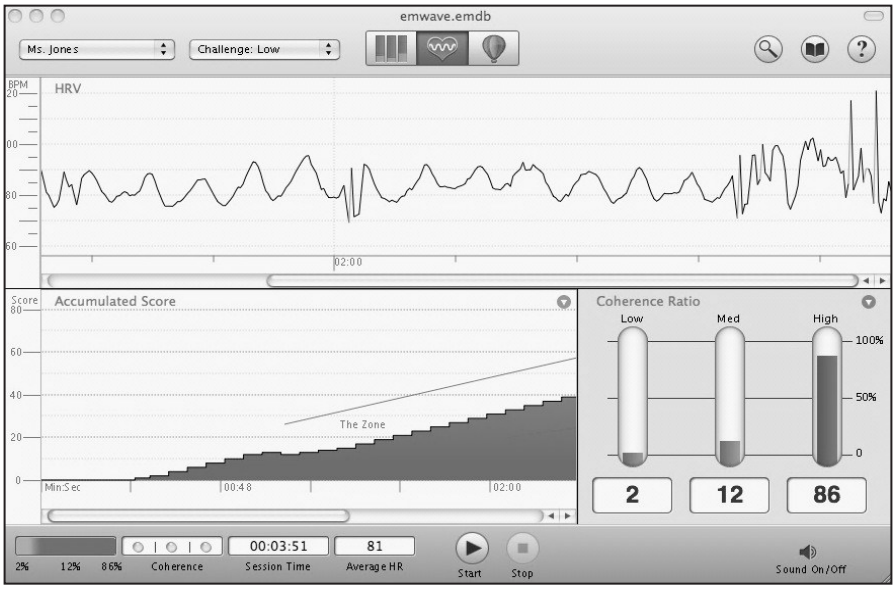


Figure 5. The HRV screen.

In summary, part I of the program overview provided students with direct instruction in vocabulary, concepts, emotional awareness activities, self-regulation techniques, with time for guided practice using the emWave coherence-building software program. Following program overview part I, daily lessons were implemented according to an instructional sequence. Part II of the program overview was embedded in the SSRI lesson plans, and is described in the next section.

Lesson plans. The SSRI lesson plans were designed to progressively build on developing students' capacity to recognize and manage emotions via daily activities aligned with specific objectives. Opportunities for practice and class discussion were provided. A 30-day implementation schedule of SSRI lesson plans was created for the schools operating on a traditional schedule structure. Likewise, a 15-day implementation schedule of SSRI lesson plans was developed for schools operating on a block schedule structure (see Appendix B). Examples of the lessons, activities, and objectives for the 30-day

implementation schedule are listed in Figure 6. Of note, part II of the program overview was delivered approximately midway through the intervention schedule. Therefore, program overview part II was delivered on day 14, according to the 30-day schedule, and on day 7, according to the 15-day schedule.

Lesson	Activity	Objective
3	Guided practice: HRV screen & Coherence Coach (5 mins)	The students will demonstrate steps of Neutral Tool and functions of HRV screen via individual checkouts.
4	Group practice: Inner Weather Report & Neutral Tool (5 mins)	The students will identify feelings and where they fall on an emotional continuum via partner checkouts, and name the steps of Neutral Tool via oral response.
5	Modeling and guided practice: Garden Game (5 mins)	Students will demonstrate the steps of Neutral Tool and how to interpret feedback on the HRV screen via individual checkouts.
14	Program Overview: Part II (20 minutes). Modeling and guided practice using emWave handheld	The students will identify terminology and concepts, demonstrate command of the emWave handheld device, and practice recording emotions on the Personal Tracker form.

Figure 6. SSRI lesson plans.

Program overview part II (20 minutes). Part II of the program overview was comprised of a review session on the vocabulary, concepts, and SEL self-regulation techniques. Similar to program overview part I, part II was presented via an interactive PowerPoint slide presentation. Following the review session, the students were introduced to the emWave portable device. The instructor modeled how to use the device and provided time for guided practice.

A portable coherence-building device, the EmWave portable device, incorporates a function for displaying HRV ranges by means of a multi-colored light-emitting diode (LED) strip. Similar to the emWave coherence-training computer program's function of the HRV screen, real-time feedback on coherence scores is provided by illuminated bars of light via the LED strip. That way, each time electrophysiological coherence was achieved, a reward bar lit up (see Figure 7). Because the emWave portable device does not include a built-in data-tracking function, students' self-reported data by means of the Personal Tracker form (Emwave personal stress reliever practice plan, 2008) (see Appendix C). An example of the Personal Tracker form is displayed in Figure 8. In addition to the program overview sessions and lesson plans, a teachers' manual was created to serve as a guide for delivering explicit instruction in the SSRI.

Figure 7. emWave portable device.

Teachers' manuals. The researcher designed two teachers' manuals using a systematic, sequential, explicit instructional approach to implementing the SSRI. The manuals were aligned with the 30- and 15-day SSRI lesson plans, respectively. Examples

of lesson plans for schools operating on block and traditional scheduling schemes are presented in Appendix D. Each lesson plan included a section for the teacher sign his or her name indicating that instruction was delivered in the SSRI and/or the *LANGUAGE!* curriculum. As a measure of fidelity of implementation, the researcher also created implementation checklists for the SSRI and the *LANGUAGE!* curriculum.

Implementation checklists. The implementation checklists for the SSRI and the *LANGUAGE!* curriculum were created for several purposes. First, they provided teachers with a structured guideline for implementing the steps of the SSRI and the *LANGUAGE!* curriculum (see Appendix E). Second, they served as instruments for conducting classroom observations, ensuring fidelity of implementation, and providing teachers with feedback and time for reflection. Observational guidelines and scoring procedures are provided in the section titled "Treatment Fidelity." What follows is a description of the literacy curriculum employed.

Literacy curriculum materials. The district coordinator of special education reading programs had selected the *LANGUAGE!* curriculum for the primary intervention for students enrolled in the intervention course. This curriculum, authored by Jane Fell Greene (1998), was designed to meet the needs of SWD, NSWD, as well as ELLs who needed to improve skills in reading, spelling, writing, grammar, and speaking.

The curriculum is comprised of scripted lesson plans that systematically guide teachers through a progression of instruction on skills targeting phonemic awareness; phoneme-grapheme associations; word recognition; comprehension; spelling, grammar and usage; syntax and sentence structure; semantic relationships; and morphology. A placement test is administered to gauge a student's present level of performance and to assist the

instructor in forming homogenous student learning groups. Daily lessons incorporate teacher-delivered direct instruction, as well as small-group and independent practice activities. Progress monitoring instruments and pacing guides support teachers in making data-informed decisions and planning for instruction (Florida Center for Reading Research, 2004).

Two empirically validated studies have documented the impact of *LANGUAGE!* on the reading achievement of adolescent poor readers (Greene, 1996; Moats, 2004). The first study, by Jane Fell Greene (developer of the *LANGUAGE!* curriculum) presents findings from a pilot study to test the program's efficacy (1996).

Green conducted a six-month pre-/posttest study with 96 middle and high school juvenile offenders (ages 13 through 17 years). Following 22.7 weeks of instruction in the *LANGUAGE!* curriculum, the treatment group had gained an average of three grade levels in word identification, spelling, comprehension, and composition. Dependent measures included subtests of the Gray Oral Reading Test (GORT-3) on rate, accuracy, and comprehension and total oral reading standard scores, subtests of the Wide Range Achievement Test (WRAT-R) on reading and spelling, and a subtest of the Peabody Individual Achievement Test (PIAT-R) on written expression.

Technical reports revealed the GORT-3 showed internal consistency across all ages, ranging from .87 for the comprehension subtest to .97 for the oral reading quotient (Wiederholt & Bryant, 1992). Internal consistency reliability coefficients for the GORT-3 subtests ranged from .87 to .93. According to the WRAT-R test manual, split-half reliability values of .98 (Reading) and .96 (Spelling) were reported, with an overall alternative-form reliability of .90 (Jastak & Wilkinson, 1984). Technical information on the

PIAT-3 demonstrated split-half reliability coefficients for the subtest of written expression in the low to mid .90s, with composite scores in the upper .90s. With reference to validity, PIAT-3 subtests showed appropriate patterns of correlations with other achievement measures (Markwardt, 1997). Although the pretest scores of the comparison group were significantly higher than those of the treatment group, results demonstrated greater gains for the treatment group across all three dependent measures.

To demonstrate, a *t*-test for dependent means revealed that following 22.7 weeks of instruction in the *LANGUAGE!* curriculum, the treatment group had made significant gains across the three standardized measures of reading (p = > .0001). Although the gains were demonstrated by the comparison group on the accuracy, comprehension, and total oral reading subtests of the GORT-3 (p = >.03), they were not as large as those realized by the treatment group. These findings were supported in later research (Moats, 2004).

A descriptive study by Cambium program developer Lousia Moats involved 552 students in grades 6, 7, 8, and 10. Following one year of instruction in the *LANGUAGE!* curriculum, students, who were poor readers, non-readers, and ELLs, had achieved significant gains in the areas of basic word recognition, word attack, and passage comprehension across all grade levels. For purposes of this study, only the results from grade-10 students will be reported.

Subtests from three standardized instruments were used as pre- and posttest measures: (a) Multilevel Academic Survey Test (MAST) (a test of silent reading comprehension, short and long forms); (b) Word Attack (WA) and Letter-Word Identification (LW) subtests from the Woodcock-Johnson Tests of Achievement—Revised (WJIII-R); and (c) Wide Range Achievement Test—3rd Edition (WRAT-R). Tests of

criterion validity and reliability of the MAST were conducted with students in grades 3-8 (Howell, Zucker, & Morehead, 1985).

Since the current study was implemented with students in grades 9-12, the MAST tests of validity and reliability did not apply. Tests on the validity of the WJ III-R are based primarily on clusters of tests, rather than a single ability, and show strong reliabilities, ranging from .80 to .90 or higher (Woodcock, McGrew, & Mather, 2001). As reported previously, tests of the WRAT-R revealed split-half reliability values of .98 (Reading) and .96 (Spelling) and an overall alternative form reliability of .90 (Jastak & Wilkinson, 1984). Tests of significance comparing pre- and post-test data were significant ($p = < .05$) across all grades on at least two comparisons.

Results indicated that students in grade 10 made significant gains, .56 on the short form of the MAST, and .48 and .58 on the WJ III-R on tests of LW and WA, respectively. Results of the WRAT spelling subtest were not significant.

In summary, two studies conducted on the effects of the *LANGUAGE!* curriculum revealed significant effects for high school students who struggle in reading in the areas of word identification and passage comprehension. In addition, the findings from the first study (Greene, 1996) suggest additional benefits in the areas of spelling and written composition.

The current study used quantitative and qualitative methods to measure reading outcomes, as well as heart rate variability, affect, and satisfaction with the SSRI program.

Quantitative Measurement Instruments

Data were collected to determine students' pre- and posttest performance on measures of physiological coherence, general reading ability (i.e., word identification, word

comprehension, word fluency), oral reading fluency, reading self-concept, and social and emotional affect. The following section presents content, psychometrics, administration, and scoring procedures for each instrument.

Psychophysiological Measure (6 minutes)

A measure of heart rate variability (HRV) provided data on students' ability to achieve electrophysiological coherence. Electrophysiological coherence is characterized by increased synchronization in autonomic nervous system (ANS) and was measured by a spectral analysis of HRV (Luskin et al., 2003). The HRV instrumentation, derived from electrocardiogram technology (ECG), served to collect data on the amount of time between heartbeats (Kautzner & Camm, 1997; Luskin et al., 2003). The beat-beat changes in heart rate are generally influenced by interactions between the heart and the brain, and can be related to anxiety level, emotional state, cognitive and behavioral function, and task performance (Friedman, 2007; McCraty & Tomasino, 2006; Porges et al., 1994; Thayer & Lane, 2009).

Interactions between the heart and the brain (heart-brain connection) are moderated by the flow of neural signals through branches of the ANS. To illustrate, signals flow between the heart and the brain by means of efferent (descending) and afferent (ascending) pathways, referred to as the sympathetic and parasympathetic branches of the ANS (Bradley et al., 2007; McCraty, 2005). Therefore, HRV data provide a measure of neurocardiac function, which represents the ANS and the parasympathetic and sympathetic pathways involved in cognitive and emotional processing.

Data collected on electrophysiological correlates of coherence are illustrated by a smooth sine wave-like pattern in HRV. Measures of HRV can detect negative emotions

(e.g., frustration, anxiety) through a recording of irregular or incoherent heart rhythm patterns. An irregular heart rhythm pattern indicates that the two branches (parasympathetic and sympathetic) of the ANS are out of synch. A positive emotion (e.g., appreciation, compassion, care), on the other hand, creates a smooth heart rhythm pattern, indicating the two branches of the ANS are in sync (working in harmony) (McCraty, 2005). When the heart operates in a coherent mode, synchronization occurs between the heart rhythm waveform and electrophysiological systems (e.g., blood pressure, respiratory rhythms).

Data on HRV should be collected individually, in a private, quiet setting using a computer software program and a lightweight pulse sensor that attaches to the respondent's earlobe. To administer the measure, the examiner sits across from the respondent, with the computer screen facing away from the examinee. Examinees are told to sit comfortably for 6 minutes with their arm resting on the table and feet flat on the floor (resting position). Activities such as chewing gum, reading, listening to music, singing, or tapping fingers or feet are discouraged. If the examinee carries a cellular phone, the test administrator requests that it be turned to the off-position. If the examinee sneezes or coughs excessively during the examination, the testing is stopped and re-administered.

The HRV screen includes a power spectrum (graph) representative of the percentage of time during which a respondent achieves physiological coherence in each testing session. Electrophysiological coherence scores are depicted in three frequency ranges (low, medium, and high). To compute the percentage of time an individual achieves coherence, the test administrator calculates the average between the medium and the high coherence scores. The resulting score represents the total amount of time the respondent achieved physiological coherence. The data are coded according to the respondent's identification

number and are stored in a database.

Reading Measures

The pre- and posttest standardized measures of reading included two instruments: (a) Test of Silent Word Reading Fluency (TOSWRF) and (b) Reading Fluency Measure (RFM).

Test of Silent Word Reading Fluency (3 minutes). The Test of Silent Word Reading Fluency (TOSWRF; Mather, Hammil, Allen, & Roberts, 2004) is reported to measure general word reading ability, including word comprehension, word identification, and word reading fluency (rate and accuracy). The authors report the TOSWRF's utility in monitoring individual or group progress, comparing the effectiveness of instructional settings, validating other measures of reading, and identifying students with reading deficits.

TOSWRF test protocols are comprised of words that are unrelated in meaning. The words are printed in rows without spaces between them and are ordered by reading difficulty (the words progressively get more difficult). Students have 3 minutes to draw lines between as many words as possible. To illustrate, students are presented with a string of letters (e.g., *dimhowfigblue*) and are instructed to draw lines between groups of letters that form words (e.g., dim/how/fig/blue).

A group- or individually administered timed test (3 minutes), TOSWRF is appropriate for students age 6 years, 6 months through 17 years, 11 months. Two equivalent forms (A and B) are available. Test forms are scored according to the procedure described in the manual; raw scores were converted to percentiles, standard scores, as well as age and grade equivalents.

A study conducted by the test developers (Mather et al., 2004) to determine TOSWRF validity and reliability estimates showed moderate mean test-retest correlations

ranges (0.69). Alternate-form reliability coefficients were acceptable, ranging from 0.77 to 0.91, with an average coefficient of 0.86. Further, inter-rater reliability coefficients were acceptable, at 0.99 for both Form A and Form B.

The test design was informed by Guilford's structure of intellect model (Guilford & Hoepfner, 1971), which employed word search tasks to assess cognitive abilities as well as a timed word-find or word-strings-without-spaces (i.e., Wordchains) format to measure speed of word recognition (Meeker & Meeker, 1975; Miller-Guron, 1996). The developers of the TOSWRF built on Miller-Guron's Wordchains measure by ordering the words in increasing difficulty as determined by a leveled word frequency list.

Validity studies correlating TOSWRF scores with scores on other assessments of word identification, reading fluency, and word comprehension demonstrated that students' performance on the TOSWRF differed by age, exceptionality category, and reading competency (Mather et al., 2004). Specifically, TOSWRF scores increased with age, and age scores on Forms A and B were highly correlated at 0.77 and 0.76, respectively. By comparison, students with disabilities achieved below-average standard scores. Scores on the Test of Word Reading Efficiency (TOWRE) (Torgesen, Wagner, & Rashotte, 1999) and Wordchains discriminated between students identified as poor readers. Reported sensitivity indices ranged from 0.62 to 0.80, specificity indices from 0.91 to 0.93, positive predictive values of 0.70 to 0.75, and percent agreement rates from 84 to 89% on scores on the two forms. These results provided evidence that the TOSWRF is a valid and reliable instrument for determining general reading ability or for screening students for reading difficulties.

Reading Fluency Monitor (1 minute). The validity and reliability of using measures of oral reading fluency (ORF) to determine overall reading competence is well

documented (Fuchs, 2004; Fuchs & Deno, 1991; Fuchs, Fuchs, Hosp, & Jenkins, 2001; Stahl & Kuhn, 2002). The Reading Fluency Monitor (RFM) instrument was designed to measure oral reading fluency rates (Read Naturally, 2002). However, a representative from the RFM test publisher revealed that validity and reliability estimates were not accurately calculated (K. A. Hunter, personal communication, May 26, 2011). Therefore pre- and posttest scores could not be analyzed for the present study (see Chapter IV).

Affect Measures

The pre- and posttest standardized measures of emotional discord and affect reading included two instruments: the Reading Self Concept Scale and the Student Opinion Survey.

Reading Self-Concept Scale (10 minutes). The Reading Self-Concept Scale (RSCS; Chapman & Tunmer, 1995) is based on the theory that self-concept is a consequence, rather than a cause, of reading performance. The RSCS is comprised of 30 items designed to measure students' feelings about reading within three domains: (a) competence in reading; (b) difficulty with reading; and (c) attitudes towards reading. The RSCS takes approximately 10 minutes to administer, and is designed for individual administration. A script is provided for the examiner and listed on the test form. All items are read aloud to the examinee, and responses are recorded according a 5-point Likert scale (1 = yes, always; 2 = yes, usually; 3 = undecided or unsure; 4 = no, not usually; 5 = no, never). Response 3 ("undecided" or "unsure") is represented by an indication the student understood the item, but was unable to select a definite response. The answer choice "sometimes" was not included in the scoring key. Consequently, the examiner marked response 3 when the examinee responded to an item with the answer "sometimes."

The RSCS met acceptable criteria for both construct and face validity. Slightly

lower correlations were found for the three subscales (competence, difficulty, and attitudes); however, all reached acceptably high levels. Several factor analyses models were conducted, confirming the scale's three-factor structure. The test developers found interaction effects for reading ability (reading accuracy, reading comprehension, and oral vocabulary) and students' reading self-concept. Specifically, self-concept began to appear after two years of formal reading instruction, thus supporting the theory that reading self-concept is a consequence of reading ability (Chapman & Tunmer, 1995).

The RSCS was developed in New Zealand; therefore, the wording of some of the test questions diverges from Standard American English. To accommodate for cultural differences, the researcher obtained permission from the test developer to revise the wording of select questions. For example, the question "Do you like reading to your Mum and Dad?" was changed to "Do you like reading to your family?"

Student Opinion Survey (25 minutes). The Student Opinion Survey (SOS; Bradley & Atkinson, 2004) is comprised of 80 items constructed to measure students' perceptions of their relationships with teachers, peers, family, and school; positive and negative affect; emotional discord; and aptitude for managing stress, including test anxiety For the present study, the five questions focused on collecting background information on the respondents and the self-portrait drawing activity was not included in the test administration. Therefore, the total number of test items was 74.

The SOS is group administered, and takes approximately 25 minutes to complete. To accommodate for students with reading difficulties, the test administrator read the questions and answer choices aloud to the class. Some students required individual assistance from the teacher to complete the survey. Test forms are sent to the publisher for

scoring. Raw and standard scores for each subscale are converted to mean scores and are averaged to compute an overall mean score.

SOS scales were constructed from test items with a 4-point Likert-scale response format, with the exception of one item, "feelings about school," which employed a 5-point Likert response. Of the 14 subscales developed from the SOS, six measure various aspects of the examinee's life hopes as well as school and home experiences, specifically: (a) feelings about school, (b) teacher support, (c) life preparedness, (d) parental support, (e) positive class experience, and (f) extent of friendship. The remaining eight scales measure respondents' feelings and emotions, social relations, and ability to manage stress and anxiety: (a) positive affect, (b) negative affect, (c) emotional discord, (d) interactional difficulty, (e) stress management, (f) test anxiety-global, (g) test anxiety-worry subscale, and (h) test anxiety-emotionality subscale.

Of the 14 subscale constructs, 12 exceeded the technical criterion for adequacy, with alpha coefficients of ≥ 0.80, ranging from 0.80 for Life Preparedness, Positive Class Experience, and Emotional Discord, to 0.92 for the Test Anxiety-Global scale. For the remaining two constructs, the alpha coefficient was high (0.72) for Interactional Difficulty, and moderate (0.62) for Feelings About School. Further, a factor analysis performed to ensure construct validity demonstrated that the classification of items in their assigned constructs was acceptable.

Qualitative Measurement Instruments

Pre-intervention interview data were collected from students assigned to both conditions. Semi-structured interview questions were focused on experiences in school and with tasks of reading and teacher feedback. Post-intervention interview data were collected

only from students assigned to the treatment group. These students completed self-report forms documenting feelings before and after a session with the emWave portable device, as well the number of times they achieved coherence.

Student Interviews

The researcher created two individually administered semi-structured student interview protocols. In an effort to encourage respondents to reflect and elaborate on their experiences, questions primarily used an open-ended response format.

The pre-intervention protocol questions, which focused on experiences related to school and tasks of reading, were administered to students in both conditions. The post-intervention interview protocol questions, which focused on utility and satisfaction with the SSRI, were administered only to students in the treatment group. All interview sessions were videotaped and conducted in a quiet, private setting, outside of the classroom. Data were transcribed and coded using an open coding system (Strauss & Corbin, 1990, 1998).

A process of mining data from the informants' responses, looking for patterns, examining variables in field notes, and developing constructs or themes to account for the patterns was applied. For example, adjectives used by respondents to describe feelings, emotions, and reactions were grouped, categorized, and tallied to identify units of meaning. In addition, the units of meaning were compared and redefined into constructs. Finally, as suggested by Gall, Gall, and Borg (2003), the researcher made inferences, interpretations, and structured the data to be able to present the findings within the social context of the study.

Pre-interview protocol (5 minutes). The following interview questions were administered during the pre-intervention phase to students assigned to both the treatment

and the control groups. The interview protocol included four open-ended questions targeting respondents' experiences with reference to school, reading, and teachers, as follows:

1. Think about a time when you became upset, nervous, or frustrated with your reading. Can you describe how you reacted or how you handled it?
2. Think about a time when you felt frustrated with reading. Can you describe how you felt?
3. Thinking back to all of your experiences in school, was there a time when you received feedback that was encouraging? Do you want to talk about what happened? How did it make you feel?
4. Thinking back to all of your experience in school, was there a time when your received feedback that was discouraging? Do you want to talk about what happened? How did it make you feel?

Post-interview protocol (5 minutes). The following interview questions were administered during the post-intervention phase of the study to students assigned to treatment conditions. The interview protocol included four open-ended questions targeting respondents' experiences with reference to the utility of the SSRI and their propensity to generalize the SEL self-regulation techniques across settings, both in and outside of school, as follows:

1. What are your thoughts about the self-regulation intervention?
2. Have you ever used the self-regulation techniques outside of reading class? *If the student answers "Yes," say,* Can you like tell me what happened? How did it make you feel?

3. Would you recommend the self-regulation techniques to students, friends, or family members? Can you tell me why or why not?

emWave Handheld Tracker Form

As noted earlier in this chapter, the emWave portable device does not include a built-in data-tracking function. Therefore, data were self-reported on the emWave Handheld Tracker form (see Figure 8). Students entered the following data: (a) date; (b) challenge level (1, 2, 3, or 4); (c) feelings or emotions *before* a session; (d) number of reward bars (accumulated coherence score); and (e) feelings or emotions *after* a session. Different from the Personal Tracker form mentioned above, the students had the option of writing a sentence or drawing a picture to represent how they were feeling (e.g., calm, happy, relaxed, angry, frustrated, relaxed).

Date	Challenge Level	Reward Bars	What I noticed… 
2/21/11	1	3	Before session: *Had a bad morning. Don't want to be in school today. Reading class makes me feel stressed out.* After Session: *Feeling better. Relaxed and calm.*
2/23/11	1	6	Before session: *I feel tired and sleepy.* After Session: *My energy is back and I feel ready to learn.*

Figure 8. emWave Personal Tracker form.

Procedures

Recruitment of Teachers and Students

Permission to conduct the research study was secured from the University of Kansas Internal Review Board and from the participating school district's research and evaluation board. In addition, informed consent was obtained from the two building principals and two reading course instructors.

All students in the targeted classrooms were invited to participate in the study. The researcher delivered a 20-minute orientation on the SSRI to students in nine sections of a reading intervention course, including four classes at HS1 and five classes at HS2. Next, parental informed consent forms, written in English and Spanish, were distributed to the students, who were asked to bring them home and return them within five days. In the meantime, the intervention teachers contacted parents via email and phone to answer questions and address any concerns (per student or parent request). After obtaining parental approval, the researcher obtained oral assent from the students who were willing to participate in the study.

Finally, classes of randomly assigned students were assigned to one of two groups: control condition or treatment condition. Following the posttest, the researcher delivered program overview part I and part II to the students assigned to the control group. All materials and equipment were donated to the school sites.

Professional Development Procedures

Approximately three weeks prior to introducing the intervention to the student participants, the researcher delivered two professional development sessions attended by both of the intervention teachers. The structure of the sessions involved modeling,

interactive demonstrations, guided practice, and time for reflection and feedback. Each session was scheduled after school for approximately 1.5 hours. The sessions were held in the reading intervention classrooms at HS1 and HS2, respectively.

One day prior to delivering the teacher professional development sessions, campus technology administrators downloaded the emWave coherence-training software onto the teachers' classroom computers. To provide opportunities for the teachers to become familiar with the programs and allow sufficient time for practice, the intervention teachers also received a copy of the emWave coherence-training computer software to install on their personal computers, as well an emWave portable device. In addition, they received individual researcher-facilitated support via ongoing coaching.

Coaching Sessions

The researcher facilitated six individual coaching sessions with the intervention teachers. The sessions were scheduled on a weekly basis, before or after school hours, via classroom visits or teleconference. During these sessions, the researcher reviewed the steps of the SEL self-regulation techniques and offered opportunities for practice using the emWave coherence-training computer program and portable device. Moreover, the sessions allowed time for the intervention teachers to ask questions, reflect, and share feedback on the implementation of the SSRI.

Pretest Procedures

Students assigned to treatment and control conditions were administered pretest measures to determine baseline performance on general reading ability, reading self-concept, and social and emotional well-being. To assist with administering the individual assessments, the researcher recruited a recently retired high school administrator with a

Ph.D. in education and teaching experience as a secondary reading instructor. In addition, this individual helped to conduct classroom observations and score the following standardized measures: Heart Rate Variability (HRV), Test of Silent Word Reading Fluency (TOSWRF), Reading Self-Concept Scale (RSCS), and Reading Fluency Monitor (RFM).

Group measures. The researcher administered the group measures in the reading classroom. The group measures included the TOSWRF (3 minutes) and the SOS (25 minutes). The total amount of time required to administer the group measures was approximately 30 minutes.

Individual measures. To administer the individual measures, the researcher and former administrator/teacher escorted individual students from the reading classroom to a quiet, private setting. In one room, the former administrator/teacher administered the measure of (HRV) (6 minutes). In another room, the researcher administered the RFM (1 minute), the RSCS (10 minutes), and videotaped semi-structured student interviews (5 minutes). The total amount of time required to administer the individual measures was approximately 22 minutes per student. Testing took place over two consecutive days at HS1 (block schedule) and four consecutive days at HS1 (traditional schedule).

Instructional Procedures

Although HS1 and HS2 were on different scheduling schemes, students in both conditions received the same number of instructional minutes in the *LANGUAGE!* curriculum. Similarly, students assigned to the treatment conditions received approximately the same amount of instructional minutes in the SSRI (see Table 3). Specifically, students in the treatment and control conditions at HS1 (block schedule) received approximately 90 minutes of instruction per class period in the *LANGUAGE!* curriculum for 15 days, whereas

Table 3

Instructional Minutes

	HS1 (*L!*) Traditional	HS2 (*L!*) Block	HS1 SSRI Traditional	HS2 SSRI Block
Treatment	22.5 hrs	22.5 hrs	3.5 hrs	3.5 hrs
Control	22.5 hrs	22.5 hrs	X	X

Note. Treatment and controls at both high schools received an equal amount of instructional time in the *LANGUAGE!* curriculum. Controls at both high schools received an equal amount of instructional minutes in the SRRI.

the students assigned to the treatment and control groups at HS2 (traditional schedule) received approximately 45 minutes of instruction per class period in the *LANGUAGE!* curriculum for 30 days. Finally, students assigned to the treatment conditions at HS1 and HS2 received approximately 3.5 hours of instruction and practice in the SSRI for 15 and 30 days, respectively.

The researcher created the program overview sessions using the Microsoft PowerPoint software program. Prior to implementing the *LANGUAGE!* curriculum and SSRI, students assigned to the treatment conditions received a 50-minute overview of the science and theory grounding the SSRI. The sessions included instruction in vocabulary, the physiology of emotion, interactive demonstrations of the emWave technology, and class activities. Time was also built in for modeling and guided and independent practice (see Appendix B). Program overview part II (20 minutes) was embedded in the SSRI lesson plans, and was designed to introduce the emWave portable device. HS1 received program overview part II on day 7 of implementing the SSRI and HS2 received the program

overview part II on day 14.

Time constraints prevented the researcher from providing sufficient training for the intervention teachers to deliver the program overview sessions to the students; consequently, the researcher delivered the sessions. During implementation of the program overview parts I and II, the intervention teachers actively monitored the sessions by assisting the students in learning the SEL self-regulation techniques and technology and demonstrating the hardware and software. Instruction in the SSRI was implemented according to the following sequence.

The SSRI program overview, parts I and II, and subsequent lesson plans were structured using an instructional sequence similar to that developed at the University of Kansas Center for Research on Learning (KU-CRL). The framework, referred to as the stages of instruction, is grounded in more than 30 years of research demonstrating its benefits for students at risk of academic failure (Ellis, Deshler, Lenz, Schumaker, & Clark, 1991). The framework involves delivering instruction according to the following stages: (a) *Pretest* students to obtain a baseline level of performance; (b) *Describe* the intervention, provide a rationale, and deliver the intervention via explicit instruction*;* (c) *Model* metacognitive processes, thinking aloud while demonstrating the intervention; (d) *Advanced practice and feedback* provided when students apply the intervention independently; (e) *Posttest* to measure progress; and (f) *Generalization* to promote transfer of skills to other settings.

Program overview part I encompassed introducing the intervention and describing the benefits of employing the SEL self-regulation strategies. Next, explicit instruction on the SEL self-regulation strategies was provided through modeling the steps of the Neutral

Tool and Quick Coherence technique. Likewise, explicit instruction and modeling of the procedures were provided when delivering instruction on the emWave software program and emWave portable device.

First, the researcher provided guided practice for individual students who volunteered to demonstrate the technology and self-regulation strategies for the class. Following the student demonstrations, the students used their assigned laptop computers to become familiar with using the emWave computer program and applying the Neutral and Quick Coherence self-regulation techniques. Finally, the students engaged in the advanced practice and feedback stages of instruction by using the technology, applying the self-regulation strategies, and reviewing their HRV data independently.

A similar instructional approach was employed for implementing the program overview part II. Following the six-week intervention period, posttest measures were administered to students assigned to the treatment and control groups. Finally, individual interviews were conducted with members of the treatment group to determine whether student participants transferred and generalized the SEL self-regulation techniques to other settings.

Laptop computers were available for student use in the reading classrooms of HS1 and HS2. Each student in the treatment group was assigned to a laptop computer, on which the coherence-training software had been installed, and an emWave portable device. To ensure confidentiality, students were required to log on to their assigned laptop computer using a secure user identification number and password. Laptop computers and emWave portable devices were marked with student identification numbers and stored with the SSRI student activity guides in a locked file cabinet in the classroom (only the intervention

teachers possessed a key to the file cabinet).

Treatment Fidelity

According to Chen (1990), fidelity refers to the difference between the intended program model and the implemented model. Together, the researcher and the research assistant conducted eight classroom observations (four observations at each school) to ensure the SRRI and the curriculum were implemented with fidelity. Following each observation, a side-by-side analysis indicated the scorers were within two points of each other 100% of the time.

The scoring procedure for the classroom observation protocols was formulated according to a 3-point scale: (a) attribute observed = 1 point; (b) attribute observed and implemented correctly = 2 points; (c) attribute not observed = 0 points. Following each classroom observation session, the researcher met with the respective teacher to provide feedback and time for reflection on implementing the SSRI.

Posttest Procedures

The measures and administration procedures for the posttests were similar to those used for the pretests with the following exceptions: (a) an alternate form of the TOSWRF (Form B) was administered, and (b) the control group did not participate in student interview sessions on feelings about satisfaction with the SSRI.

Scoring Procedures

The standardized measures were scored by the administrator/teacher recruited to assist the researcher. The measures included the TOSWRF, RSCS, and RFM. To check for accuracy, the researcher rescored 90% of these protocols. If an error was found, the researcher rescored the measure and requested that the testing assistant review. Since a

Scantron service was required to score the SOS measure, the results were calculated by the test publisher, entered into a spreadsheet, and emailed to the researcher. The researcher subsequently entered results of the above-mentioned measures (TOSWRF, RSCS, RFM, and SOS) as well as HRV data into a spreadsheet. Together, the researcher and testing assistant reviewed 100% of the scores and checked for accuracy.

Research Design

The study employed an embedded mixed-methods comparison group pre/posttest design combining quantitative and qualitative research methodology. The quantitative portion used a series of repeated-measures analysis of variance to test the pre- and posttest differences between groups. The between-subject factors included performance on the following measures: (a) electrophysiological assessment of HRV; (b) TOSWRF; (c) RFM; (d) RSCS (overall and subscales); and (e) SOS (subscales). A grounded theory method of open coding was used to analyze qualitative data from semi-structured student interviews and self-reports (Strauss & Corbin, 1990, 1998). Data were categorized according to code and percentages were computed.

CHAPTER IV

RESULTS

The purpose of this mixed-methods intervention study was to determine the efficacy of a social and emotional learning (SEL) Self-Regulation Intervention (SSRI) for adolescents, with and without disabilities, receiving explicit instruction in a reading intervention course. Fifty adolescents from two urban high schools were enrolled in a reading intervention course. Classes of students were randomly assigned to one of two conditions, wait-list control ($\eta = 21$) and treatment ($\eta = 29$).

Both treatment and wait-list control groups received instruction in a scientifically validated reading program, *LANGUAGE!* Comprehensive Literacy Curriculum *(LANGUAGE*!) (Greene, 1996). In addition, students in the treatment group received instruction in the SSRI.

Quantitative and qualitative methods were used to determine the efficacy of the SEL SSRI. The quantitative portion of the study addressed the first research, question related to students' pre- and posttest performance on heart rate variability (HRV), reading outcomes, reading self-concept, and social and emotional affect. The qualitative portion of the study addressed the second research question, related to students' emotional and behavioral responses to tasks of reading and teacher feedback. Finally, the third research question focused on the utility and satisfaction with the SSRI.

Quantitative Results

The quantitative portion of the study addressed the first research question:

1. Is the performance of high school students, with and without disabilities, who receive explicit instruction in a scientifically based reading intervention significantly

different from those who learn a social and emotional self-regulation strategy on the following five outcomes: (a) heart rate variability; (b) reading ability; (c) reading self-concept; (d) and social and emotional affect?

To establish whether the observed differences could be inferred to the population, the study employed a series of one-way analysis of variance (ANOVA) tests. The between-subject factors included (a) a two-level intervention group variable (treatment or control). The within-subject variables included pre- and posttest performance (time) on (a) a psycho-physiological measure of heart rate variability (HRV) and coherence ratios; (b) the Test of Silent Word Reading Fluency (TOSWRF; Mather et al., 2004); (c) the Reading Self-Concept Scale (RSCS; Chapman & Tunmer, 1995); and (d) the Student Opinion Survey (SOS; Bradley & Atkinson, 2004). Means and standard deviations for the measures are presented in Tables 3, 4, and 5.

To obtain a valid and reliable pre- and posttest measure of students' oral fluency rates, the readability levels of the passages must be equal. Following the pre- and posttest administration of the RFM, the researcher detected a discrepancy between the readability levels of the passages and consequently contacted the test publisher. The response was that an outside company had developed the RFM (K. A. Hunter, personal communication, May 26, 2011) and that Read Naturally, Inc. had conducted an internal analysis and discovered the passages were not similar in readability levels. As a result, Read Naturally, Inc. discontinued publication of the RFM. Therefore, scores on the pre- and posttest measure of oral reading fluency rate were not included in the analysis.

Group Differences on Heart Rate Variability

A one-way analysis of variance was conducted to determine group differences on a

measure of heart rate variability (HRV). This analysis revealed a significant interaction effect between time and group, $F(1,48) = 7.11$, $\rho = .01$, partial $\eta^2 = .129$. Thus, on average, the scores across comparison and experimental groups differed significantly on the measure of HRV. Figure 9 represents a profile plot for the estimated marginal means of HRV data. Means and standard deviations of the HRV measure are presented in Table 4.

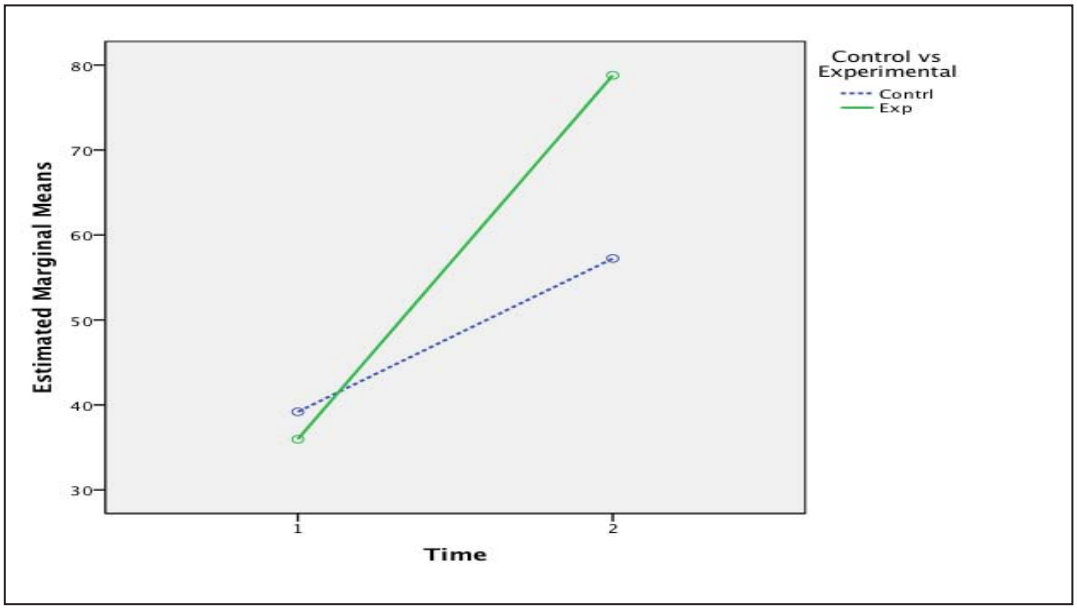


Figure 9. Estimated marginal means of HRV results.

Table 4

Psychophysiological Results

	Pretest		Posttest	
	Mean	*SD*	Mean	*SD*
Control				
HRV coherence ratio	39.19	24.45	57.24	27.12
Treatment				
HRV coherence ratio	35.97	26.35	78.79	11.60

Group Differences on TOWSRF

A one-way analysis of variance was conducted to determine group differences on a measure of general reading ability. This analysis yielded no significant interaction between time and group, $F(1,48) = 1.76$, $\rho = .191$, partial $\eta^2 = .035$. The means and standard deviations for the TOWSRF are presented in Table 5.

Table 5
Test of Silent Word Reading Fluency Results

	Pretest		Posttest	
	Mean	*SD*	Mean	*SD*
Control				
TOWSRF	78.86	27.88	82.90	101.28
Treatment				
TOWSRF	90.34	31.67	101.28	21.25

Group Differences on the Reading Self-Concept Scale

A one-way analysis of variance was conducted to determine group differences on a measure of overall reading self-concept and three subscales: (a) competency in reading, (b) difficulty with reading, and (c) attitude towards reading. This analysis revealed a significant interaction effect between time and group on overall self-concept, $F(1,48) = 4.50$, $\rho = .04$, partial $\eta^2 = .086$. However, the results were significant, the differences between the means and standard deviations of the groups differed by two-tenths of a percent and were inversely related (see Table 6). Thus, the outcomes are potentially spurious. No significant differences were found between time and group on the following

Table 6

Reading Self-Concept Scale Results

	Pretest		Posttest	
	Mean	*SD*	Mean	*SD*
Control				
RSCS (Overall)	3.40	.47	3.29	.45
RSCS (Competence)	3.60	.61	3.45	.61
RSCS (Difficulty)	3.31	.55	3.48	.53
RSCS (Attitude)	3.30	.89	2.10	.82
Treatment				
RSCS (Overall)	3.28	.63	3.34	.58
RSCS (Competence)	3.60	.77	3.60	.67
RSCS (Difficulty)	3.04	.63	3.48	.71
RSCS (Attitude)	3.18	1.12	3.00	1.04

subscales of reading self-concept: (a) competency in reading, $F(1,48) = 1.06$, $\rho = .30$, partial $\eta^2 = .022$; (b) difficulty with reading, $F(1,48) = 1.75$, $\rho = .19$, partial $\eta^2 = .035$; and (c) attitude towards reading, $F(1,48) = 1.19$, $\rho = .27$, partial $\eta^2 = .024$. The means and standard deviations for the RSCS are presented in Table 6.

Group Differences on the Student Opinion Survey

A one-way analysis of variance was also conducted to determine the between- and within-group differences for the SOS. This analysis revealed a significant interaction effect between time and group on the test anxiety-worry scale, $F(1, 48) = 4.614$, $p = .037$, partial $\eta^2 = .088$, and the educational plans scale, $F(1, 48) = 4.190$; $p = .046$, partial, $\eta^2 = .080$.

However, no significant differences were found between time and group on the following subscales of the SOS: (a) feelings about school $F(1, 48) = 0.37$, $p = .849$, partial $\eta^2 = .001$; (b) teacher support $F(1, 48) = .699$, $p = .407$, partial $\eta^2 = .014$; (c) life preparedness, $F(1, 48) = .693$, $p = .409$, $\eta^2 = .014$; (d) parental support, $F(1, 43) = 3.423$, $p = .071$, $\eta^2 = .074$; (e) positive class experience, $F(1, 43) = .082$, $p = .776$, $\eta^2 = .002$; (f) extent of friendship, $F(1, 48) = .002$, $p = .969$, $\eta^2 = .000$; (g) positive affect, $F(1, 48) = 1.614$, p = .210, $\eta^2 = .033$; (h) negative affect, $F(1, 48) = 3.07$, $p = .086$, $\eta^2 = .060$; (i) emotional discord, $F(1, 48) = .468$, $p = .497$, $\eta^2 = .010$; (j) stress management, $F(1, 48) = 1.173$, $p = .284$, $\eta^2 = .024$; (k) test anxiety-global, $F(1, 48) = 3.50$, $p = .07$, $\eta^2 = .068$; (l) test anxiety-worry, $F(1, 48) = 4.614$, $p = .037$, $\eta^2 = .088$; and (m) test anxiety-emotionality, NS; $F(1, 48) = .749$, $p = .391$, $\eta^2 = .015$. The means and standard deviations for the SOS subscales are presented in Table 7.

Qualitative Results

The qualitative portion of the study was guided by the second and third research questions:

2. What emotional and behavioral responses do high school students, with and without disabilities, report on tasks of reading, ways of coping, and teacher feedback?

3. What do high school students, with and without disabilities, report on the utility and satisfaction with the social and emotional self-regulation strategies?

The first research question included both the treatment and the control group ($n = 50$). The second and third research questions addressed only the treatment group ($n = 29$). A line-by-line open coding system, grounded theory, was used to analyze qualitative data from semi-structured student interviews and self-reports (Strauss & Corbin, 1990, 1998).

Table 7

Student Opinion Survey (SOS) Results

	Pretest		Posttest	
	Mean	*SD*	Mean	*SD*
Control				
SOS (Feelings About School)	3.57	.84	3.57	.85
SOS (Teacher Support)	2.92	.92	3.08	.68
SOS (Educational Plans)	3.17	.92	3.59	.42
SOS (Life Preparedness)	2.88	.76	3.19	.53
SOS (Parental Support)	3.35	.68	3.60	.43
SOS (Positive Class Exp.)	2.80	.60	2.94	.42
SOS (Extent of Friendship)	2.52	.80	2.60	.75
SOS (Positive Affect)	2.94	.59	2.88	.53
SOS (Negative Affect)	2.00	.82	1.75	.58
SOS (Emotional Discord)	1.96	.58	2.14	.63
SOS (Stress Management)	2.28	.62	2.36	.64
SOS (Test Anxiety-Global)	2.06	.66	2.25	.68
SOS (Test Anxiety-Worry)	2.14	.74	2.40	.80
SOS (Test Anx.-Emotionality)	1.10	.72	2.10	.70
Treatment				
SOS (Feelings About School)	3.57	.85	3.57	.73
SOS (Teacher Support)	3.00	.86	2.99	.85
SOS (Educational Plans)	3.47	.61	3.43	.56
SOS (Life Preparedness)	3.05	.74	3.21	.66
SOS (Parental Support)	3.33	.83	3.21	.69
SOS (Positive Class Exp.)	2.83	.71	2.91	.67
SOS (Extent of Friendship)	2.56	.68	2.63	.65
SOS (Positive Affect)	2.65	.71	2.79	.69
SOS (Negative Affect)	2.13	.73	2.19	.67
SOS (Emotional Discord)	1.96	.58	2.32	.67
SOS (Stress Management)	2.31	.62	2.56	.69
SOS (Test Anxiety-Global)	2.27	.83	2.16	.72
SOS (Test Anxiety-Worry)	2.34	.82	2.18	.70
SOS (Test Anx.-Emotionality)	3.53	.80	3.57	.73

Data were transcribed, and participant responses were broken down into words, phrases, and sentences that represented meaningful units. As suggested by Strauss and Corbin, similar units of meaning were collapsed to form more general categories or constructs. The researcher independently coded the responses. To strengthen the validity of the analysis, a graduate student with extensive experience in qualitative research reviewed the student responses and the researcher's codes. Following discussion, the final list of codes was agreed to with 100% reliability between the researcher and colleague.

Pre-Intervention Interview

The pre-intervention interview consisted of three questions that were administered to students assigned to both the treatment and the control group. The first pre-interview question addressed ways of coping with difficult tasks of reading. Next, the responses were independently coded into 20 units of meaning. Following further analysis, the 20 units of meaning were collapsed to form 5 constructs (see Figure 10).

The second pre-interview question addressed respondents' feelings about their reading abilities. The responses were independently coded into 14 units of meaning. Following further analysis, the 14 units of meaning were collapsed to form 5 constructs (see Figure 11).

The third pre-interview question addressed reactions to positive teacher feedback. Participants' responses were independently coded in to 11 units of meaning. Following further analysis, the 11 units of meaning were collapsed to form 5 constructs (see Figure 12).

The fourth pre-interview question addressed negative teacher feedback. Responses were coded into 14 units of meaning. Following further analysis, the 14 units of meaning were collapsed to form 6 constructs (see Figure 13).

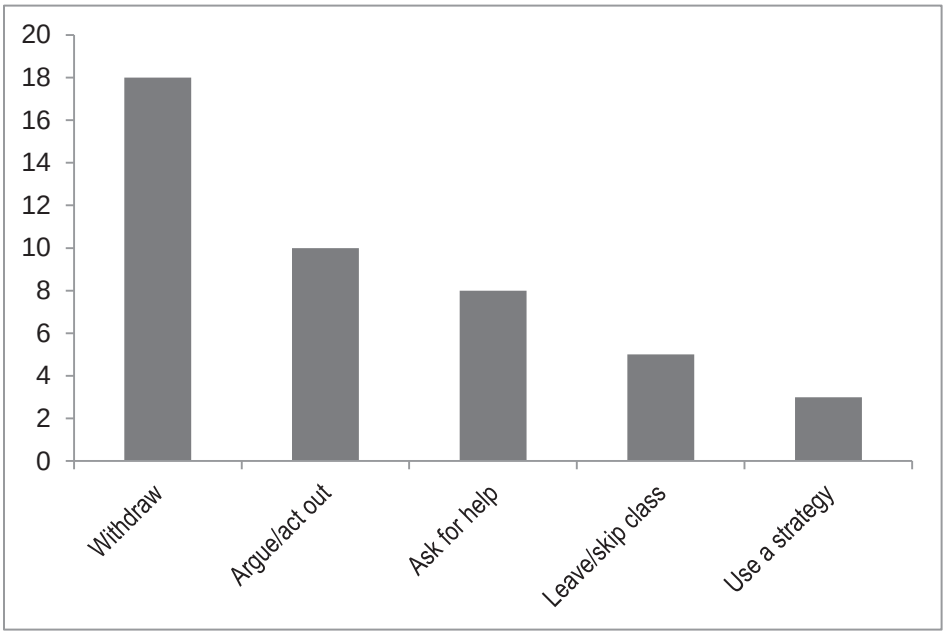


Figure 10. Summary of respondents' ways of coping with tasks of reading.

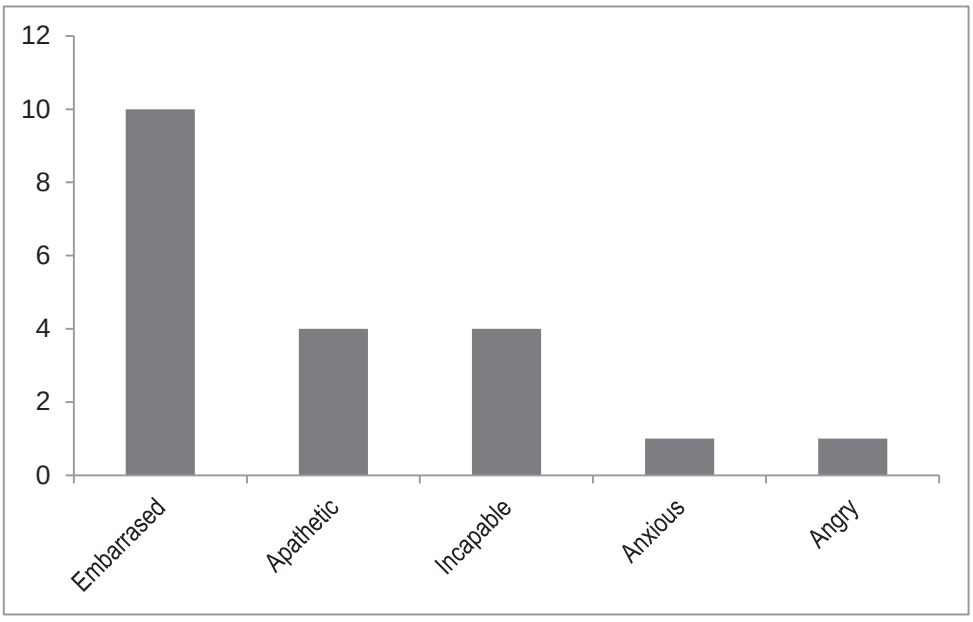


Figure 11. Summary of respondents' feelings about their reading abilities.

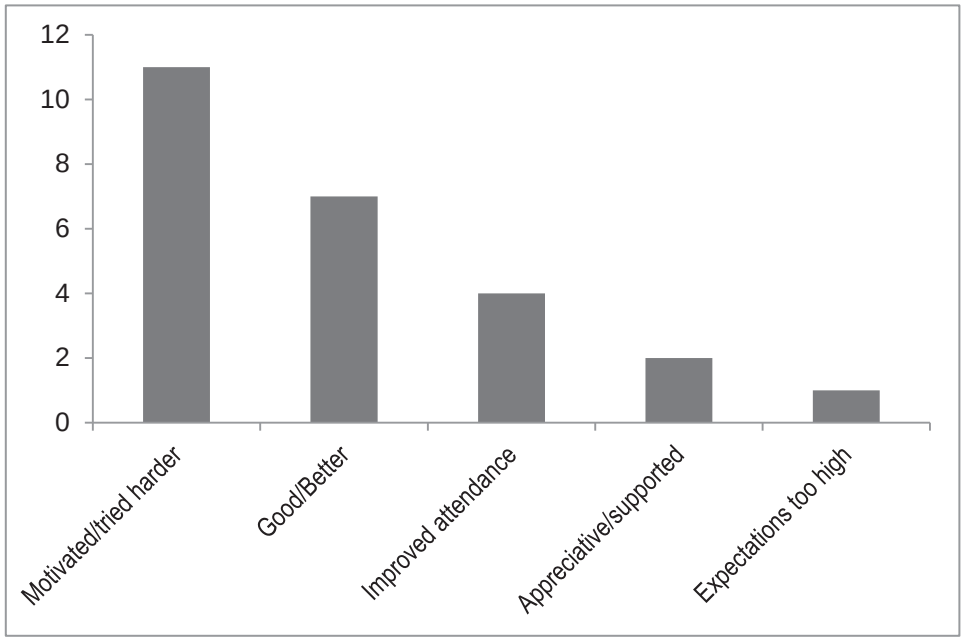


Figure 12. Summary of respondents' feelings about positive teacher feedback.

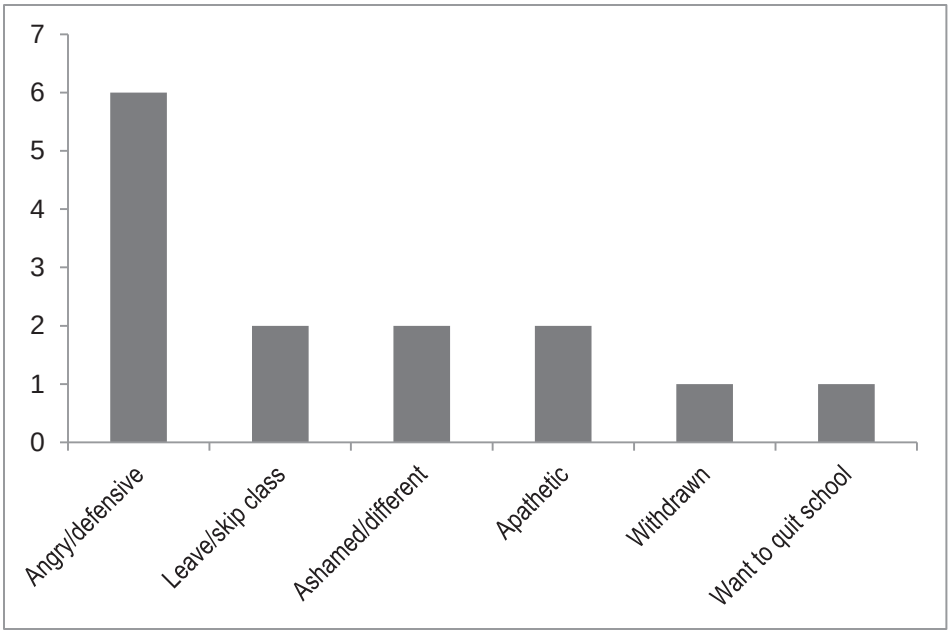


Figure 13. Summary of respondents' feelings about negative teacher feedback.

Post-Intervention Interview

The post-intervention interview consisted of three questions that were administered only to students assigned to the treatment group. The first question addressed utility and satisfaction with the SSRI. All respondents reported satisfaction with the self-regulation strategy, emWave computer program, and handheld device. Respondents' elaborations on the utility of the SSRI were coded into 51 units of meaning. Following further analysis, the 51 units of meaning were collapsed to form 8 constructs (see Figure 14).

The second post-intervention interview question addressed generalizing the SSRI to settings outside of reading class. Responses were coded into 13 units of meaning. Following further analysis, the 13 units of meaning were collapsed to form 6 constructs (see Figure 15).

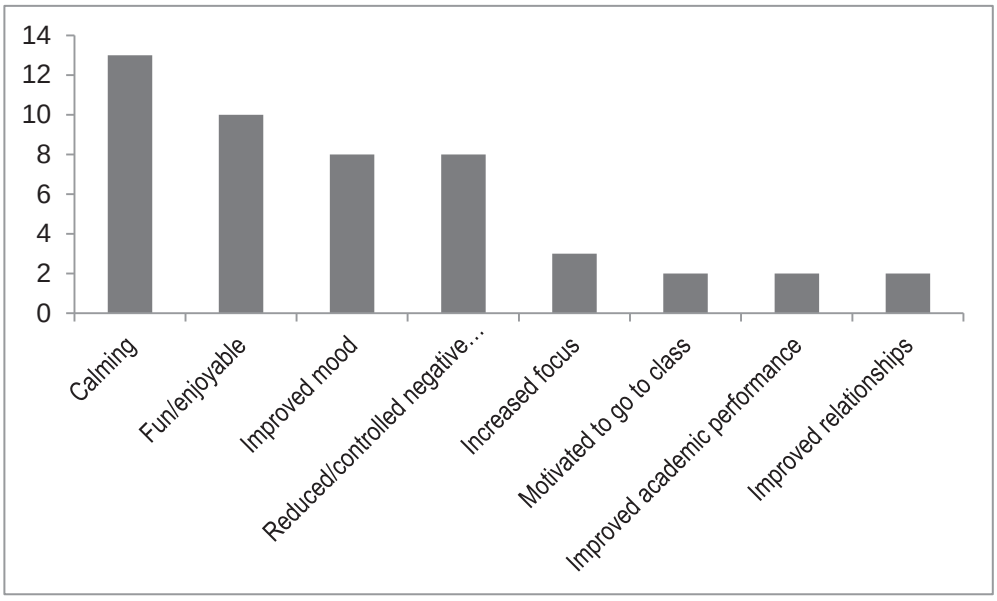


Figure 14. Summary of respondents' feelings about SSRI.

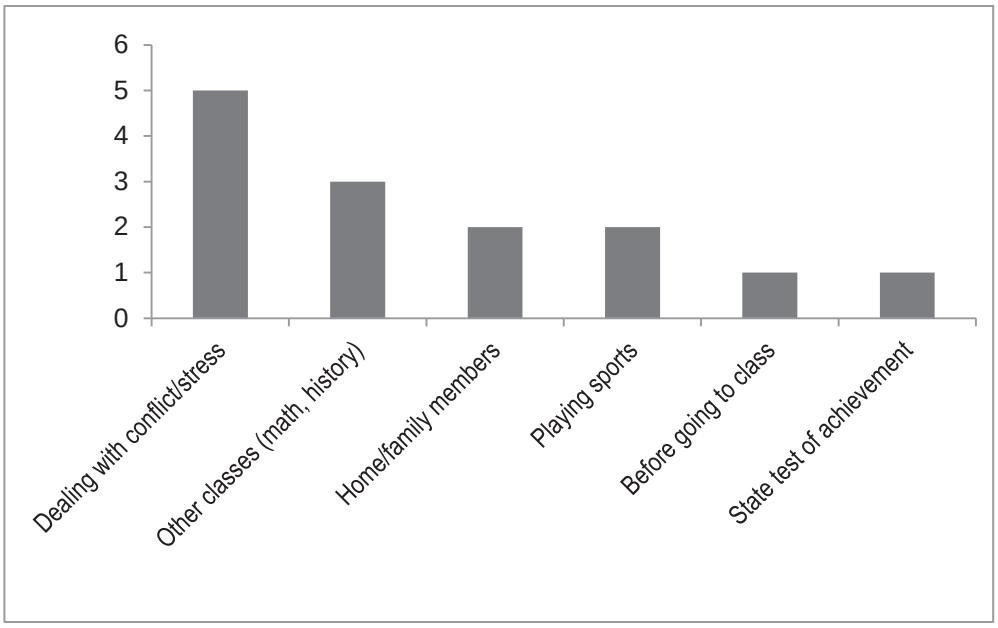


Figure 15. Summary of respondents' feelings on generalizing the SSRI.

The third post-interview question asked if respondents would recommend the SSRI to classmates, friends, and family. All respondents responded positively to this question, with nine choosing to elaborate their answer. Responses were coded in to nine units of meaning. Following further analysis, the nine units of meaning were coded in to four constructs (see Figure 16). With the exception of two, all respondents reported that they would continue using the self-regulation strategy after the intervention study ended.

Self-reports on EmWave handheld device. All but two students in the treatment group (n = 27) completed self-reports documenting their emotional state before and after sessions with the emWave handheld device. In total, self-reports from 182 sessions were coded into 24 units of meaning. Following further analysis, the 24 units of meaning were collapsed into 12 constructs representing the pre-session responses and 12 constructs representing the post-session responses.

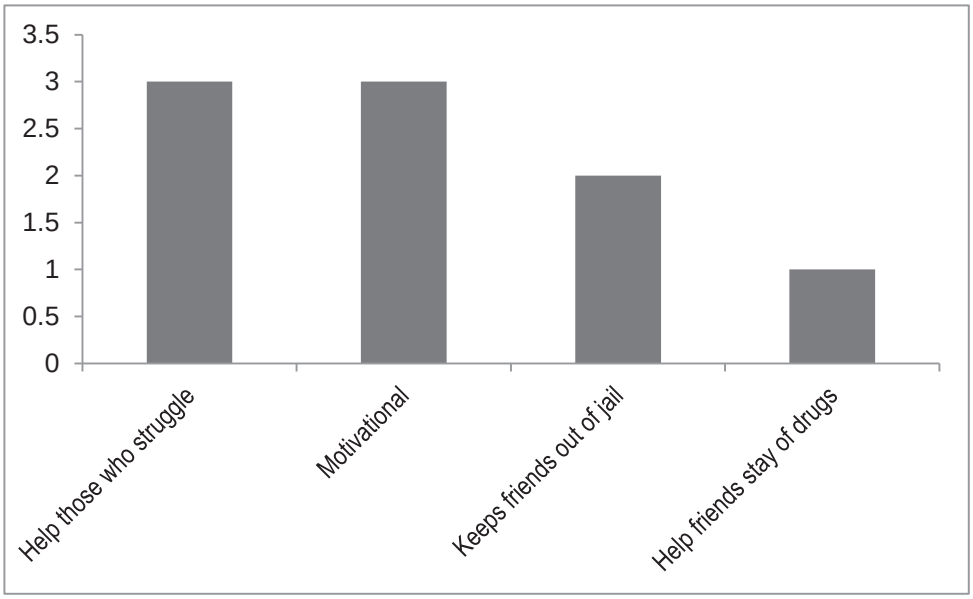


Figure 16. Summary of respondents' feelings on utility of SSRI for others.

The respondents reported predominantly negative or neutral emotions prior to a session with the emWave handheld device. The most common responses are listed below:

"I was [very upset] when I started …"
"Before I walked in [class}, I was mad …"
"I was agitated …"
"I felt angry before …"
"Stormy, I don't feel good."
"When I came in I felt down …"
"In a bad mood …"
"I came in stressed …"
"I was worried about something …"
"I felt sad when I came in [to class] …"
"I felt sleepy …"

Following a session with the emWave handheld device and applying the self-regulation strategy, emotions generally improved. The corresponding post-session responses are listed below:

"… now I'm just a little mad."
"… and I left the class calm."

"… then I went in to neutral phase and now I'm okay."
"… and I feel relaxed after."
"… I feel focused and in a peaceful place."
"… but as I used the emWave I felt calm."
"… then I was happy."
"… and now I feel refreshed."
"… but I'm happy now."
"… I listened to my heart and now I feel better."
"… now I am better and don't feel sleepy anymore."

Approximately 96% of the respondents reported that they were able to shift from a negative or neutral emotion to a positive state following one or more sessions using the emWave handheld device and applying the self-regulation strategy.

Many reported learning something about themselves after a session with the emWave handheld device and applying the self-regulation strategy. The most common responses were similar to the following:

"I listened to my heart, and now I feel better."
"I really like doing this. It helps me with a lot of stuff. It makes me feel much better than I was earlier."
"When I [do] the HeartMath I am calm and chilled and in a very positive mood."
"I got three [reward] bars! I am excited and I feel good."
"I noticed that being off task took my points away."
"I noticed I feel good when I'm in my zone."
"I noticed when I think of my home, I feel better."
"I noticed I've been really down lately. But after [I use my emWave], I felt kind of calm."
"What I noticed is that I was jumpy, and now I'm calm."
"I noticed that it helps me relax and feel better than I did in the morning."
"I noticed that when I think of something I like to do outside, it makes me blue [coherent].
"I feel happy that I got three [reward] bars and I stayed focused and in a peaceful place."
"I was on red [and out of coherence] for some reason. I guess I was worried about something."

Only one respondent reported being unable to shift from a negative or neutral state to a positive one. Specifically, the respondent self-reported pre- and post-session emotions as

tired, mad tired, really tired, or sad.

Treatment Fidelity

The researcher and research assistant conducted eight classroom observations (four observations at each participating school) to ensure the SRRI and the *LANGUAGE!* curriculum were implemented with fidelity. Following each observation, the researcher provided the intervention teacher with feedback and time for reflection. To establish reliability between the researcher and colleague, a side-by-side analysis of each observation session indicated the scorers were within two points of each other, 100% of the time.

Teacher 1 completed a mean of 96% of the instructional steps across four observed lessons for the SSRI, with a range from 93 to 98% for individual lessons. In addition, Teacher 1 completed a mean of 91% of the instructional steps for the *LANGUAGE!* curriculum, with a range from 89 to 93% for individual lessons. Teacher 2 completed a mean of 99% of the instructional steps across four observed lessons for the SSRI with a range from 96 to 100% for individual lessons. Furthermore, Teacher 2 completed a mean 98% of the instructional steps for the *LANGUAGE!* curriculum, with a range from 97 to 100% for individual lessons.

CHAPTER V

DISCUSSION

The purpose of this mixed-methods intervention study was to build on the existing literature base on strategies and interventions to improve outcomes for adolescents at risk of school failure. Specifically, the study was designed to develop and test the efficacy of a social and emotional (SEL) self-regulation intervention (SSRI) program that teachers might implement with adolescents, with and without disabilities, prior to instruction in an explicit literacy curriculum. The SSRI was tested relative to the following outcome measures: (a) students' capacity to use a positive emotion-refocusing strategy as measured by heart rate variance (HRV); (b) reading outcomes (TOWSRF; Mather et al., 2004); (c) reading self-concept (RSCS; Chapman & Tunmer, 1995); and (d) social and emotional well-being (SOS; Bradley & Atkinson, 2004). In addition, qualitative data were gathered on (a) students' feelings about tasks of reading and ways of coping; (b) teacher feedback; (c) emotions before and after implementing a self-generated positive emotion-refocusing strategy; and (d) utility and satisfaction of the SSRI.

Introducing the SSRI required an average of 90 minutes of instructional time. In addition, an average of 120 minutes was dedicated to applying and practicing the strategies over a period of six weeks. Instruction of the SSRI included detailed descriptions of the program, modeling of the strategies, guided and independent practice, real-time feedback, and self-reflection. Furthermore, explicit instruction in the evidence-based literacy program (*LANGUAGE!*) required an average of 22.5 hours of instructional time. The findings relative to the efficacy of the SSRI are summarized and discussed below.

Quantitative Conclusions

To determine group differences, a pre- and posttest design was used to determine the impact of the SSRI on adolescents with reading difficulties. Participants were assigned to one of two groups: (a) explicit instruction in a literacy curriculum and (b) explicit instruction in a literacy curriculum and an SEL self-regulation intervention. The quantitative results of the study were somewhat inconsistent, with the SSRI yielding no significant effects for general reading ability, reading self-concept, and the majority of the indicators for social and emotional well-being.

In contrast, an examination of the marginal means by group on reading outcomes revealed growth in the expected direction for the treatment group; in addition, the control group also improved. Indeed, explicit instruction of a literacy curriculum indicated improvement for both groups, but students assigned to the treatment condition exhibited reading scores that were twice as high as those of the control group. To illustrate, the average posttest grade equivalent (GE) score for the treatment group were 5 years and 4months (5.4), whereas the control group averaged a GE score of 4 years and 5 months (4.5).

When looking at these findings, numerous limitations to using GE as a reading metric must be kept in mind. For example, GE scores are established on the assumption that students will be performing at the 50^{th} percentile for their grade level. But this is an unrealistic assumption, since almost all students score either above or below their grade level. Several significant results suggest the utility of the SSRI to improve the social and emotional well-being of adolescents with reading difficulties.

The results of the study support instruction in the SSRI as an effective

instructional intervention for improving students' ability to self-generate a positive emotion self-regulation refocusing strategy. Several conclusions can be drawn from the results of the quantitative portion of this study. First, compared to their pretest scores, the students' posttest scores on the measure of HRV following instruction in the SSRI showed a significant improvement in their ability to self-generate a positive emotion-refocusing strategy to achieve a highly coherent state. Second, according to the results of the SOS, instruction in the SSRI produced a change in students' thought processes and emotions related to test anxiety/worry, which includes feelings of negative self-concept and fear of failure (Bradley et al., 2010). Additionally, the SOS test-anxiety worry scale has shown to be strongly correlated with inferior test performance in students with high test anxiety (Cizek & Burg, 2006). The results indicate the SSRI may positively impact test performance for students with high levels of test anxiety.

Below, the results from the qualitative data collected for this study will be presented.

Qualitative Conclusions

The pre-intervention semi-structured interview consisted of three questions, which were administered to students assigned to both the treatment and the control group. The first question addressed ways of coping with difficult tasks of reading. The students reported emotions such as disengagement and withdrawal (i.e., sleeping, putting head down on desk) more often than acting-out behaviors (i.e., leaving class), when presented with a difficult reading task. This finding is similar to that of Reschly (2009), who noted that adolescents with LD and reading difficulties might withdraw emotionally and fail to complete school, or dropout entirely.

The second pre-interview question addressed respondents' feelings about their reading abilities. As posited by Chapman and Tunmer (1995), the compounding effects of a negative self-concept due to difficulties with early reading impede a level of motivation requisite to maintaining a commitment to learning. Correspondingly, the students in this study reported feelings of low self-worth more often than feelings of anger and resentment.

The third pre-interview question addressed reactions to positive teacher feedback. Most of the students recalled receiving praise from elementary school teachers, rather than secondary teachers. The most commonly reported student responses to teacher praise involved internalized positive emotions (i.e., motivation, feeling good), rather than overt behaviors (i.e., increased attendance). Students' recollections of negative feedback from their teachers were not as frequent as their memories of teacher praise. Nevertheless, similar to their responses on teacher praise, students' reactions to negative teacher feedback involved internalized negative emotions (anger, rage), rather than overt behaviors (i.e. leaving class).

The post-intervention semi-structured interview consisted of three questions that were administered to students assigned the treatment group. The first question addressed utility and satisfaction with the SSRI. All respondents reported satisfaction with the SSRI, including the emotion SSRI, emWave computer program, and EmWave handheld device. When prompted to elaborate on their experiences, the students responded that the strategy, software, and hardware were calming, fun, and enjoyable. Some reported improved mood, enhanced capacity to deal with negative emotions, and improved focus. In addition, a few students reported increased motivation to attend reading class,

improved grades, and more positive relationships:

> [The SSRI] is something I really enjoyed and liked doing. If you're angry or have problems during the day you can slowly breathe and calm yourself down and look at the right situation, instead of going the wrong way all the time.

The third post-intervention interview question addressed generalizing the emotion self-regulation strategy in stressful situations and in settings outside of reading class. Some students reported using the strategy at home, with other family members, during athletic activities, before going to class, and during the state test of achievement.

The third post-interview question also asked students whether they would recommend the SSRI to classmates, friends, and family. All participants responded in the affirmative. Some students chose to elaborate on their responses, stating that the SRRI would benefit those who struggle and serve as a motivational tool. A few students commented that using the emotion self-regulation strategy and emWave might keep their friends out of jail and off drugs. For example, one student commented on how the SSRI helped his classmates:

> [The SSRI] can be used on a lot of people because some people do have anger management [issues] and just need some time to sit down ... Other class members, I see them come in and they're struggling and they …just go to their laptop and next thing you know they're all calm and happy and just ready to be in class. And that's what I really enjoyed about this.

In addition to the semi-structured interviews, students completed self-reports documenting their emotional state before and after sessions using the emWave handheld device. Most reported negative or neutral emotions prior to engaging in emWave handheld sessions (i.e., upset, mad, angry, sad, tired). However, the post-session self-reports indicated that students were able to shift from a negative to a positive state (i.e., calm, relaxed, peaceful, happy, refreshed). Many students reported enhanced self-

actualization of emotion. For example, one student reported, “I noticed I’ve been really down lately. But after [I use my emWave], I felt kind of calm.”

In summary, responses to the pre-intervention interviews suggest that high school students with reading difficulties (a) tend to disengage or withdraw when presented with a difficult reading task rather than act out; (b) experience diminished feelings of self-worth rather than anger or resentment; (c) recall receiving praise from elementary school teachers, rather than secondary teachers; and (d) remember teacher praise more often than negative teacher feedback. Furthermore, the classroom observations suggest that high school teachers of students enrolled in a reading intervention class can deliver instruction of the SSRI and literacy curriculum.

Students who participated in the SSRI reported that the program (a) was calming and enjoyable; (b) improved their mood, focus, and ability to counteract negative emotions; and (c) enhanced their motivation to attend reading class, grades, and relationships with others. Additionally, the students used the positive emotion self-regulation strategy outside of reading class and in stressful situations and at home, during athletic activities, before going to class, and while taking a high-stakes test of achievement. All of the students also indicated the SSRI would benefit others, and some shared how to use the strategy with friends and family members. Moreover, students were able to recognize their emotions and shift from a negative to a positive emotional state. Finally, the evidence suggests that the SSRI can be delivered effectively by high school teachers of students enrolled a reading intervention class.

Relationship to Previous Research

As suggested by Bradley et al. (2010) and Lloyd, Brett, and Wesnes (2010),

students can self-generate a positive emotion-refocusing self-regulation strategy associated with achieving a highly coherent state, optimal for learning and performance. Similar to McCraty and Tomasino (2006) and Pribram (1991), findings of the present study suggest that repeated practice of the coherence-building self-regulation techniques results in more efficient and harmonious physiological systems.

The study also extends previous investigations in several ways. For example, in earlier investigations, studies of the HeartMath program with secondary students did not include those identified with LD or reading difficulties (Bradley et al., 2010; Lloyd et al., 2010). The present study was the first to include high school students with LD or difficulties in the area of reading. While the intervention in the present study focused on teaching students with LD or reading difficulties to recognize and manage emotional impediments to learning and performance, students also received explicit instruction in an evidence-based literacy curriculum. Furthermore, in previous studies, participants' reading skills, ability to generalize the self-regulation strategy to other settings, pre- and post-session experiences with the emWave handheld device, and the utility and satisfaction with using the self-regulation tools and emWave technology were not measured. The current study included measures for the preceding dependent variables.

Limitations

Several limitations and concerns apply to this study. First, although classes of students were randomly assigned to treatment or control conditions, true random assignment was not possible due to scheduling issues. If the study had been approved prior to the beginning of the semester, random assignment might have been feasible and groups might have been more equally matched.

A second limitation involves the instructional time suggested for students performing below their peers. Students in the present study were performing four to five years below their expected grade level; they received 3.5 hours of instructional time in the SSRI and 22.5 hours of instruction in the literacy intervention. However, it has been acknowledged that adolescent readers who are performing several years below their peers may require 60 to 100 hours of intervention to show meaningful gains (Torgesen, Rashotte, Alexander, Alexander, & MacPhee, 2003). These findings were further substantiated in a study by Fielding, Kerr, and Rosier (2007), establishing that 240 minutes of reading instruction is required to make up for every two years of deficit. Therefore, ameliorating the reading gaps of adolescents requires a substantial portion of the instructional day. Thus, to address this limitation, future research should study the impact of altering the time and other instructional condition variables.

A few additional concerns remain. While two pre- and posttest measures of reading were administered, scores from only one measure were used to determine outcomes. Following the posttest administration of the measure of oral reading fluency (ORF), it was determined that readability levels of the passages were unreliable and had, in fact, been deemed invalid by the test publisher. The same applies to the life preparedness scale of the SOS. Consequently, scores from the ORF and the life preparedness scale of the SOS were not considered in the analysis.

Finally, bias is always a concern in studies using qualitative methods of analysis. As a former reading specialist for the county's juvenile justice system and a special education coordinator for the district selected for this study, the researcher had first-hand knowledge of the overrepresentation of Hispanic and Black students with LD, ED, and reading

difficulties from low-income families involved in the criminal justice system. Therefore, it was not possible for the researcher to remain neutral, as sympathies had been cultivated for these students and their families. Additionally, one of the participating schools had historically been ranked as the lowest performing in the district.

At the time of the study, one of the two participating schools had never met the criteria for Adequate Yearly Progress (AYP) under The No Child Left Behind Act of 2001. As a result, it became the first in the state to be shut down due to chronic failure. All administrators and teachers had been fired, and the school was under the second year of a redesign plan. The present study was launched during the spring semester when it was announced that the school had once again failed to meet AYP requirements. Consequently, the school climate was contentious as media reports of school closure began to surface. Inevitably, the researcher was privy to teacher, student, and administrator discussions of concern for the future of the school. Again, empathy for teachers and students influenced the capacity for the researcher to remain neutral throughout the study.

Future Research

To address the limitations noted above, further research should be conducted to study the effects of instruction of the SSRI, including: (a) employing a random selection pre- and posttest group design, (b) increasing the size of the sample population, and (c) implementing the intervention at the start of the school year. In addition, future research should address multiple measures of academic achievement, specifically in the area of reading development and skills. A relevant extension of this study would also to collect attendance and school completion data. Finally, once the intervention has been shown to be effective, it would be interesting to examine implementation by teachers under typical

classroom conditions in general education classrooms, with diverse populations of students.

Implications

To summarize, the results of this intervention study show that instruction in an emotion-focused intervention can improve students' ability to self-generate a positive emotion-refocusing strategy to achieve a highly coherent state and lessen emotional impediments related to test anxiety, motivation to learn, engagement, and self-regulation. Thus, instruction in the SSRI has the potential of impacting education in the following ways. First, for adolescents with LD and reading difficulties, such instruction can serve to lessen the compounding social and emotional consequences of early reading failure, thereby enabling students to better identify and manage emotional impediments to learning and social success. Second, for educators, providing instruction in the SSRI may help alleviate students' text anxiety, thereby improving outcomes on high-stakes tests of achievement. Third, educators may be able to integrate the SSRI in combination with explicit instruction in reading. Fourth, for teacher educators, instruction in SEL may be beneficial as preservice teachers need to be prepared for addressing all aspects of a child's cognitive development (i.e., emotional, behavioral, academic). Lastly, for policy makers, supporting the advancement of the science and practice of school-based SEL programming may increase the likelihood that students at risk of school failure will receive instruction in SEL. In conclusion, to sufficiently meet the needs of all youth, including those at risk of school failure, it is critical that both academic and socio-emotional programming is included in educational policy, teacher preparation programs, and within the curriculum.

REFERENCES

Academic, social, and emotional learning act of 2011, H.R. 2437, 112th Congress § 20 U.S.C. 6601 and 7801 (2011, July).

American Psychiatric Association. (2000). *American psychiatric association. Diagnostic and statistical manual of mental disorders IV-TR* (4th ed., text rev.). Washington, DC: Author.

Appelhans, B. M., & Luecken, L. J. (2006). Heart rate variability as an index of regulated emotional responding. *Review of General Psychology in the Schools, 10*(3), 229-240.

Alliance for Excellent Education. *The nation's high schools.* (2012). Retrieved from www.all4ed.org database

Alliance for Excellent Education. (2007). *The high cost of high school dropouts: What the nation pays for inadequate high schools.* Retrieved from http://www.all4ed.org/publication_material/fact_sheets/high_cost

Arguelles, L., McCraty, R., & Rees, R. A. (2003). The heart in holistic education. *ENCOUNTER: Education for Meaning and Social Justice, 16*(3), 13-21.

Armour, J. A., & Ardell, J. L. (1994). *Neurocardiology*. New York, NY: Oxford University Press.

Collaborative for Academic and Social and Emotional Learning. (2007). Background on social and emotional learning. *CASEL Briefs,* 1-2.

Baltodano, H. M., Harris, P. J., & Rutherford, R. B. (2005). Academic achievement in juvenile corrections: Examining the impact of age, ethnicity and disability. *Education & Treatment of Children, 28*(4), 361-379.

Beane, J. A. (1990). *Affect in the curriculum: Toward democracy, dignity, and diversity*.

New York, NY: Teachers College Press.

Bernard, C. (1867). Lecture on the physiology of the heart and its connections with the brain (J. S. Morel, Trans.) *Delivered at the Sorbonne, the 27th March, 1865*. Savannah: Purse.

Biancarosa, G., & Snow, C. E. (2006). *Reading next: A vision for action and research in middle and high school literacy.* New York, NY: Carnegie Corporation.

Blank, R. K. (2011). *Closing the achievement gap for economically disadvantaged students? Analyzing change since no child left behind using state assessments and the national assessment of educational progress.* Washington, DC: Council of Chief State School Officers.

Bradley, R., & Atkinson, M. (2004). *Student opinion survey.* Boulder Creek, CA: Institute of HeartMath.

Bradley, R., McCraty, R., Atkinson, M., Arguelles, L., & Rees, R. (2007). *Reducing test anxiety and improving test performance in america's achools: Results from the testedge national demonstration study.* Boulder Creek, CA: HeartMath Research Center, Institute of HeartMath.

Bradley, R., McCraty, R., Atkinson, M., Tomasino, D., Daugherty, A., & Arguelles, L. (2010). Emotion self-regulation, psychophysiological coherence, and test anxiety: Results from an experiment using electrophysiological measures. *Applied Psychophysiology & Biofeedback, 35*(4), 261-283.

Bridgeland, J. M., DiIulio, J. J., & Burke Morison, K. (2006). *The silent epidemic: Perspectives of high school dropouts*. Washington, DC: Civic Enterprises.

Brinckerhoff, L. C., Shaw, S. F., & McGuire, J. M. (1992). Promoting access,

accommodations, and independence for college students with learning disabilities. *Journal of Learning Disabilities and Gifted Education, 25*(7), 417-429.

Brunner, M. S. (1993). *Reduced recidivism and increased employment oportunity through research-based reading instruction.* Washington, DC: Office of Juvenile Justice and Deliquency Prevention.

Bulgren, J. A., Schumaker, J. B., Deshler, D. D., Lenz, B. K., & Marquis, J. G. (2002). The use and effectiveness of a comparison routine in diverse secondary content classrooms. *Journal of Educational Psychology in the Schools, 94*, 356-371.

Cameron, O. G. (2002). *Visceral sensory neuroscience: Interoception*. New York, NY: Oxford University Press.

Carnegie Corporation of New York and the Charles Stewart Mott Foundation. (2011). *Diplomas count 2011: Beyond high school, before baccalaureate.* Retrieved from http://www.edweek.org/ew/toc/2011/06/09/index.html?intc=EW-DC11-FL1

Catalano, R. F., Hawkins, J. D., Berglund, M., Pollard, J. A., & Arthur, M. W. (2002). Prevention science and positive youth development: Competitive or cooperative frameworks? *Journal of Adolescent Health, 31*(6), 230-239.

Caught in the crisis: Students of color and native students in U.S. high schools. (2012). *Alliance for Excellent Education: Issue Brief*. Retrieved from http://www.all4ed.org/publication_material/fact_sheets/caught_crisis_students_color_and_native_students_u_s_high_schools

Chapman, C., Laird, J., Ifill, N., & KewalRamani, A. (2011). *Trends in high school dropout and completion rates in the United States: 1972-2009*. Washington, DC: National Center for Education Statistics.

Chapman, J. W., & Boersma, F. J. (1980). *Affective correlates of learning disabilities*. Lisse, The Netherlands: Swets & Zeitlinger.

Chapman, J. W., & Tunmer, W. E. (1995). Development of young children's reading self-concepts: An examination of emerging subcomponents and their relationship with reading achievement. *Journal of Educational Psychology, 87*(1), 154-167.

Chapman, J. W., & Tunmer, W. E. (2003). Reading difficulties, reading-related self-perceptions, and strategies for overcoming negative self-beliefs. *Reading & Writing Quarterly, 19*(1), 5.

Chen, H. (1990). *Theory-driven evaluations*. Newbury Park, CA: Sage.

Childre, D., & Martin, H. (1999). *The heartmath solution*. San Francisco, CA: Harper.

Childre, D., & Rozman, D. (2005). *Transforming stress: The heartmath solution for releiving worry, fatigue, and tension*. Oakland, CA: New Harbinger Publications.

Chomsky, N. A. (1959). *Syntactic structures*. The Hague: Mouton.

Ciechalski, J. C., & Schmidt, M. W. (1995). The effects of social skills training on students with exceptionalities. *Elementary School Guidance and Counseling, 29,* 217-222.

Cizek, G. J., & Burg, S. S. (2006). *Addressing test anxiety in a highstakes environment: Strategies for classrooms and schools*. Thousand Oaks, CA: Corwin Press.

Coleman, M., & Vaughn, S. (2000). Reading interventions for students with emotional/ behavioral disorders. *Behavioral Disorders, 25,* 93-105.

Collaborative for Academic, Social, and Emotional Learning (CASEL). (2003). *Safe and sound: An educational leader's guide to evidence-based social and emotional learning (SEL) Programs.* Chicago, IL: Author.

Coles, G. (1998). *Reading lessons: The debate over literacy*. New York, NY: Hill & Wang.

Coordinating Council of Juvenile Justice and Delinquency. Office of Juvenile Justice and Delinquency Prevention, U.S. Department of Justice. (1997, March). *Youth with learning and other disabilities in tbe juvenile justice system:* Focus group report. Washington, DC: Author.

Cortiella, C. (2009). *The state of learning disabilities.* New York, NY: Center for Learning Disabilities.

Curtis, M. E. (2004). Adolescents who struggle with word identification: Research and practice. In T. Jetton & J. Dole (Eds.), *Adolescent literacy research and practice* (pp. 119-134). New York: Guilford.

Curtis, M. E., & Longo, A. M. (1997). Reversing reading failure in young adults. *Focus on Basics, 1*(B), 18-22.

Damasio, A. R. (2001). Emotion and the human brain. *Annals of the New York Academy of Sciences, 935*(1), 101-106.

Damasio, A. R. (2003). *Looking for spinoza: Joy, sorrow and the feeling brain*. Orlando, FL: Harcourt.

Data Accountability Center for the Individuals with Disabilities (IDEA) Act. 2011. Retrieved from https://www.ideadata.org/TrendData.asp

Davidson, R. J., & Cacioppo, J. T. (1992). New developments in the scientific study of emotion: An introduction to the special section. *Psychological Science, 3*(1), 21-22.

Deshler, D. D., Palincsar, A. S., Biancarosa, G., & Nair, M. I. (Eds). (2007). *Informed choices for struggling adolescent readers: A research-based guide to instructional programs and practices*. Newark, DE: International Reading Association.

Deshler, D. D. (2005). Adolescents with learning disabilities: Unique challenges and reasons

for hope. *Learning Disability Quarterly, 28*(2), 122-124.

Deshler, D. D., & Hock, M. F. (2007). Adolescent literacy: Where we are, where we need to go. In M. Pressley, A. K. Billman, K. H. Perry, K. E. Reffitt & J. M. Reynolds (Eds.), *Shaping literacy achievement: Research we have, research we need* (pp. 98-128). New York, NY: Guilford Press.

DiPerna, J. C., & Elliott, S. N. (1999). The development and validation of the academic competence evaluation scales. *Journal of Psychoeducational Assessment, 17,* 207-225.

Dishion, T. J., Nelson, S. E., Winter, C., & Bullock, B. M. (2004). Adolescent friendship as a dynamic system: Entropy and deviance in the etiology and course of male antisocial behavior. *Journal of Abnormal Child Psychology, 32,* 651-663.

Drakeford, W. (2002). The impact of an intensive program to increase the literacy skills of youth confined to juvenile corrections. *Journal of Correctional Education, 53*(4), 139-144.

Durlak, J. A., Weissberg, R. P., Dymnicki, A. B., Taylor, R. D., & Schellinger, K. B. (2008). *Enhancing students' social and emotional learning promotes success in school: A meta-analysis*. Unpublished manuscript.

Durlak, J. A., Weissberg, R. P., Dymnicki, A. B., Taylor, R. D., & Schellinger, K. B. (2011). The impact of enhancing students' social and emotional learning: A meta-analysis of school-based universal interventions. *Child Development, 82*(1), 405-432.

Durlak, J. A., Weissberg, R. P., & Pachan, M. (2010). A meta-analysis of after-school programs that seek to promote personal and social skills in children and adolescents. *American Journal of Community Psychology, 45*, 294-309.

Durlak, J. A., & Wells, A. M. (1997). Primary prevention mental health programs for children and adolescents: A meta-analytic review. *American Journal of Community Psychology, 25,* 115-152.

Dusenbury, L., Zadrazil, J., Mart, A., & Weissberg, R. (2011). *State learning standards to advance social and emotional learning: The state scan of social and emotional learning standards, preschool through high school.* Chicago, IL: The University of Illinois at Chicago Social and Emotional Learning Research Group. Collaborative for Academic and Social and Emotional Learning.

Eccles, J., & Appleton, J. A. (2002). *Community programs to promote youth development*. Washington DC: National Academy Press.

Elias, M. J. (2004). The connection between social-emotional learning and learning disabilities: Implications for intervention. *Learning Disability Quarterly, 27*(1), 53-63.

Elias, M. J., Bruene-Butler, L., Blum, L., & Schuyler, T. (1997). How to launch a social and emotional learning program. *Educational Leadership, 54,* 15-19.

Elias, M. J., Zins, J. E., Weissberg, K. S., Greenberg, M. T., Haynes, N. M., Kessler, R., Schwab-Stone, M. E., & Schriver, T. P. (1997). *Promoting social and emotional learning: Guidelines for educators*. Alexandria, VA: Association for Supervision and Curriculum Development.

Ellis, E. S., Deshler, D. D., Lenz, B. K., Schumaker, J. B., & Clark, F. L. (1991). An instructional model for teaching learning strategies. *Focus on Exceptional Children, 3*(6), 1-24.

HeartMath. (2008). *Emwave personal stress reliever practice plan.* Retrieved from http://www.heartmath.com/downloads/personal-use/practice_plan_08.pdf

Faggella-Luby, M. N., & Deshler, D. D. (2008). Reading comprehension in adolescents with LD: What we know; what we need to learn. *Learning Disabilities Research & Practice, 23*(2), 70-78.

Faggella-Luby, M. N., Sampson Graner, P., Deshler, D. D., & Valentino, S. D. (2012). Building a house on sand why disciplinary literacy is not sufficient to replace general strategies for adolescent learners who struggle. *Topics in Language Disorders, 32*(1), 69-84.

Feshbach, N. D., & Feshbach, S. (1987). Affective processes and academic achievement. *Child Development, 58*, 1335-1347.

Fielding, L., Kerr, N., & Rosier, P. (2007). *Annual growth for all students, catch-up growth for those who are behind*. Kennewick, WA: New Foundation Press.

Flemming, J. E., & Bay, M. (2004). Social and emotional learning in teacher preparation standards. In J. E. Zins, M. R. Bloodworth, R. P. Weissberg, & H. J. Walberg (Eds.), *Building academic success on social and emotional learning: What does the research say?* (pp. 94-111). New York, NY: Teachers College Press.

Florida Center for Reading Research. (2004). *Language.* Retrieved from http://www.fcrr.org/FCRRreports/PDF/Language.pdf

Fraenkel, J. R., & Wallen, N. E. (2006). *How to design and evaluate research in education* (6th ed.). New York: McGraw Hill.

Fredrickson, B. L. (2002). *Positive emotions*. New York, NY: Oxford University Press.

Friedman, B. H. (2007). An autonomic flexibility-neurovisceral integration model of anxiety and cardiac vagal tone. *Biological Psychology, 74*(2), 185-199. doi: 10.1016/j.biopsycho.2005.08.009

Friedman, B. H., & Thayer, J. F. (1998). Anxiety and autonomic flexibility: A cardiovascular approach. *Biological Psychology, 49*(3), 303-323.

Fuchs, L. S. (2004). The past, present, and future of curriculum-based measurement research. *School Psychology Review, 33*(2), 188-192.

Fuchs, L. S., & Deno, S. L. (1991). Curriculum-based measurement: Current applications and future directions. *Exceptional Children, 57*, 466-501.

Fuchs, L. S., Fuchs, D., Hosp, M. K., & Jenkins, J. R. (2001). Oral reading fluency as an indicator of reading competence: A theoretical, empirical, and historical analysis. *Scientific Studies of Reading, 5*, 239-256.

Fundación Marcelino Botín. (2008). *Social and emotional education. An international analysis.* Santander, Spain: Author.

Gall, M. D., Gall, J. P., & Borg, W. R. (2003). *Educational research: An introduction* (7th ed.). Boston, MA: Pearson Education, Inc.

Gilligan, J. (2010). Spare the rod: Why are more American children victims and perpetrators of violence than those of any other developed country? In J. Garbarino & G. Sigman (Eds.), *A child's right to a healthy environment* (Vol. 1, pp. 75-104). New York, NY: Springer.

Goelitz, J., & Lloyd, A. (2012). *Using emwave® technology for children with ADHD: An evidence-based intervention.* Boulder Creek, CA: Institute of HeartMath.

Goleman, D. (1995). *Emotional intelligence*. New York, NY: Bantam Books.

Goodman, R. (1997). The strengths and difficulties questionnaire: A research note. *Journal of Child Psychology and Psychiatry, 38*(5), 581-586.

Graham, S., & Hebert, M. A. (2010). *Writing to read: Evidence for how writing can improve*

reading. Washington, DC: Alliance for Excellent Education.

Greene, J. F. (1996). Effects of an individualized structured language curriculum for middle and high school students. *Annals of Dyslexia, 46*, 97-121.

Greenberg, M. T., Domitrovich, C., & Bumbarger, B. (2001). The prevention of mental disorders in schoolaged children: Current state of the field. *Prevention & Treatment, 4*, 1-62.

Greenberg, M. T., Weissberg, R. P., Utne O'Brien, M., Zins, J. E., Fredericks, L., Resnik, H., & Elias, M. J. (2003). Enhancing school-based prevention and youth development through coordinated social, emotional, and academic learning. *American Psychologist, 58*(6/7), 466-474.

Greene, J. F. (1996). Effects of an individualized structured language curriculum for middle and high school students. *Annals of Dyslexia, 46*, 97-121.

Greene, J. P., & Winters, M. A. (2006). *Leaving boys behind: Public high school graduation rates.* (Civic Report no. 48). New York, NY: Manhattan Institute for Policy Research.

Guilford, J. P., & Hoepfner, R. (1971). *The analysis of intelligence*. New York, NY: McGraw Hill.

Guthrie, J. T., & Wigfield, A. (2000). Engagement and motivation in reading. In M. L. Kamil, P. B. Mosenthal, P. D. Pearson, & R. Barr (Eds.), *Handbook of reading research* (Vol. 3, pp. 403-422). New York, NY: Longman.

Handler, S. M., & Fierson, W. M. (2011). Learning disabilities, dyslexia, and vision. *Pediatrics, 127*(3), 818-856.

Haynes, M. (2011). *Engineering solutions to the national crisis in literacy: How to make good on the promise of the common core state standards.* New York, NY: Alliance

for Excellent Education.

Haynes, M., & Levin, J. (2009). *State actions to improve adolescent literacy: Results from NASBE's state adolescent literacy network.* Arlington, VA: National Association of State Boards of Education.

Haynes, N. M., Ben-Avie, M., Ensign, J., & (Eds.). (2003). *How social and emotional development add up: Getting results in math and science education* New York, NY: Teachers College Press.

Hazel, J. S., Schumaker, J. B., Sherman, J. A., & Sheldon, J. (1982). Application of a group training program in social skills and problem solving to learning disabled and non-learning disabled youth. *Learning Disability Quarterly, 5*, 398-408.

Hock, M. F., Brasseur, I. F., Deshler, D. D., Catts, H. W., Marques, J., Mark, C. A., & Wu Stribling, J. (2009). What is the reading component skill profile of adolescent struggling readers in urban schools? *Learning Disability Quarterly, 32*(1), 21-38.

Hock, M. F., & Deshler, D. D. (2003). Adolescent literacy: Ensuring that no child is left behind. *Principal Leadership, 13*(4), 55-61.

Horowitz, J. L., & Garber, J. (2007). The prevention of depressive symptoms in children and adolescents: Meta-analytic review. *Journal of Consulting and Clinical Psychology in the Schools, 74*, 401-415.

Howell, K. W., Zucker, S. H., & Morehead, M. K. (1985). *Mast: Multilevel academic survey test.* Columbus, OH: Charles E. Merrill.

Ialongo, N., Poduska, J., Werthamer, L., & Kellam, S. (2011). The distal impact of two first-grade preventive interventions on conduct problems and disorder in early adolescence. *Journal of Emotional & Behavioral Disorders, 9*(3), 146–161.

Immordino-Yang, M. H., & Damasio, A. (2007). We feel, therefore we learn: The relevance of affective and social neuroscience to education. *Mind, Brain, and Education, 1*(1), 3-10.

Individuals with Disabilities Education Improvement Act of 2004, 20 U.S. §1400 (2004).

Institute of HeartMath. (2012). *Theoretical basis of heartmath programs.* Retrieved from http://www.heartmath.org/education/education-research/theoretical-basis-of-heartmath-programs.html

Isen, A. M. (1999). Positive affect. In T. Dalgleish & M. Power (Eds.), *Handbook of cognition and emotion* (pp. 522-539). New York, NY: Wiley.

Jastak, S., & Wilkinson, G. S. (1984). *The wide range achievement test-revised.* Wilmington, DE: Jastak Associates, Inc.

Jimerson, S., Egeland, B., Sroufe, L., & Carlson, B. (2000). A prospective longitudinal study of high school dropouts examining multiple predictors across development. *Journal of School Psychology, 38,* 525-549.

Jimerson, S., Egeland, B., Sroufe, L., & Carlson, B. (2000). A prospective longitudinal study of high school dropouts examining multiple predictors across development. *Journal of School Psychology, 38,* 525-549.

Joyce, B. R., & Showers, B. (1981). Transfer of training: The contribution of "coaching." *Journal of Education, 163*(2), 163-172.

Kamil, M. (2004). *Adolescents and literacy: Reading for the 21st century.* Washington, DC: Alliance for Excellent Education.

Kautzner, J., & Camm, A. J. (1997). Electrophysiology, pacing, and arrhythmia: Clinical relevance of heart rate variability. *Clinical Cardiology, 20,* 162-168.

Kazdin, A. E. (2003). *Research design in clinical psychology* (4th ed.). Boston, MA: Allyn & Bacon.

Krezmien, M. P., Mulcahy, C. A., & Leone, P. E. (2008). Detained and committed youth: Examining differences in achievement, mental health needs, and special education status. *Education & Treatment of Children, 31*(4), 445-464.

Lane, R. D., McRae, K., Reiman, E. M., Chen, K., Ahern, G. L., & Thayer, J. (2009). Neural correlates of heart rate variability during emotion. *NeuroImage, 44,* 213–222.

LeDoux, J. (2012). *Rethinking the emotional brain.* New York, NY: New York University, Center for Neural Science and Department of Psychology.

LeDoux, J. E. (1994). Emotion, memory and the brain. *Scientific American*, 50-57.

Lenz, B. K., & Deshler, D. D. (2005). Adolescents with learning disabilities: Revisiting the educator's enigma. In B. Y. Wong (Ed.), *Advances in learning disabilities* (pp. 301-322). New York, NY: Guilford.

Leone, P. E., Christle, C. A., Nelson, C. M., Skiba, R., Frey, A., & Jolivette, K. (2003). *School failure, race, and disability: Promoting positive outcomes, decreasing vulnerability for involvement with the juvenile delinquency system.* College Park, MD: The National Center on Education, Disability, and Juvenile Justice.

Leone, P. E., Krezmien, M., Mason, L., & Meisel, S. M. (2005). Organizing and delivering empirically based literacy instruction to incarcerated youth. *Exceptionality, 13*(2), 89-102. doi: 10.1207/s15327035ex1302_3

Leone, P. E., Quinn, M. M., & Osher, D. M. (2002). *Collaboration in the juvenile justice system and youth serving agencies: Improving prevention, providing more efficient services, and reducing recidivsm for youth with disabilities.* Washington, DC:

American Institutes for Research.

Lepola, J. (2000). The development of motivational orientations as a function of divergent reading careers from pre-school to the second grade. *Learning and Instruction, 10*(2), 153-177.

Lipsett, A. B. (2011). *Supporting emotional regulation in elementary school: Brain-based strategies and classroom interventions to promote self-regulation.* Quebec, CA: LEARN.

Lloyd, A., Brett, D., & Wesnes, K. (2010). Coherence training in children with attention-deficit hyperactivity disorder: Cognitive functions and behavioral changes. *Alternative Therapies in Health and Medicine, 16*(4), 34-32.

Lösel, F., & Beelman, A. (2003). Effects of child skills training in preventing antisocial behavior: A systematic review of randomized evaluations. *Annals of the American Academy of Political and Social Science*, 84-109.

Luskin, F., Reitz, M., Newell, K., Quinn, T. G., & Haskell., W. (2003). A controlled pilot study of stress management training of elderly patients with congestive heart failure. *Preventive Cardiology, 5*(4), 168-172.

Luthar, S. S., & Zigler, E. (1991). Vulnerability and competence: A review of research on resilience in childhood. *American Journal of Orthopsychiatry, 61*(1), 6-22. doi: 10.1037/h0079218

Lynch, K. B., & McCracken, K. (2001). *Highlights of findings of the al's pals intervention Hampton city public schools.* Virginia Beach, VA: Virginia Institute for Developmental Disabilities.

Macklem, G. (2010). *Practitioner's guide to emotional regulation in school-age children.*

New York, NY: Springer.

Markham, T. (2004). *Effects of positive emotional refocusing on emotional intelligence and autonomic recovery from stress in high school students.* Retrieved from ProQuest digital dissertations. (ATT 3148830)

Markwardt, F. C. (1997). *Peabody individual achievement test - revised/normative update.* Bloomington, MN: Pearson Assessments.

Mather, N., Hammil, D., Allen, E., & Roberts, R. (2004). *The test of silent word reading fluency*. Austin, TX: Pro-Ed Inc.

Matthews, G., Roberts, R. D., & Zeidner, M. (2003). Development of emotional intelligence: A skeptical – but not dismissive – perspective. *Human Development, 46,* 109-114.

Mayer, J. D., Roberts, R. D., & Barsade, S. G. (2008). Human abilities: Emotional intelligence. *Annual Review of Psychology, 59,* 507-536.

McCraty, R. (2005). Enhancing emotional, social, and academic learning with heart rhythm coherence feedback. *Biofeedback, 33*(4), 130-134.

McCraty, R., Atkinson, M., & Bradley, R. (2004). Electrophysiological evidence of intuition: Part 1. The surprising role of the heart. *The Journal of Alternative and Complementary Medicine, 10*(1), 133-143.

McCraty, R., Atkinson, M., Tiller, W. A., Rein, G., & Watkins, A. D. (1995). The effects of emotions on short-term power spectrum analysis of heart rate variability. *The American Journal of Cardiology, 76*(14), 1089-1093.

McCraty, R., Atkinson, M., & Tomasino, D. (2003). Impact of a workplace stress reduction program on blood pressure and emotional health in hypertensive employees. *Journal*

of Alternative & Complementary Medicine, 9(3), 355.

McCraty, R., Atkinson, M., Tomasino, D., & Bradley, R. (2005). *The coherent heart: Heart–brain interactions, psychophysiological coherence, and the emergence of system-wide order.* Boulder Creek, CA: HeartMath Research Center, Institute of HeartMath.

McCraty, R., Atkinson, M., Tomasino, D., & Bradley, R. T. (2006). *The coherent heart: Heart–brain interactions, psychophysiological coherence, and the emergence of system-wide order.* Boulder Creek, CA: HeartMath Research Center, Institute of HeartMath.

McCraty, R., Barrios-Choplin, B., Rozman, D., Atkinson, M., & Watkins, A. (1998). The impact of a new emotional self-management program on stress, emotions, heart rate variability, DHEA and cortisol. *Integrative Psychological and Behavioral Science, 33*(2), 151-170.

McCraty, R., & Childre, D. (2004). The grateful heart: The psychophysiology of appreciation. In R. A. Emmons & M. E. McCullough (Eds.), *The psychology of gratitude* (pp. 230-225). New York, NY: Oxford University Press.

McCraty, R., & Tomasino, D. (2006). Emotional stress, positive emotions, and psychophysiological coherence In B. B. Arnetz & R. Ekman (Eds.), *Stress in health and disease* (pp. 360-383). Weinheim, Germany: Wiley-VCH.

McCraty, R., Tomasino, D., Atkinson, M., Aasen, P., & Thurik, S. J. (2000). *Improving test-taking skills and academic performance in high school students using heartmath learning enhancement tools*. Boulder Creek, CA: HeartMath Research Center, Institute of Heart Math. Retrieved from http://www.heartmath.org/research/research-

Meeker, M. N., & Meeker, R. (1975). *Structure of intellect learning abilities test.* El Segundo, CA: Structure of Intellect Institute.

Miller-Guron, L. (1996). *Wordchains: A matched english version of the Swedish Wordchains Test.* Goteborg, Sweden: University of Goteborg.

Moats, L. C. (2004). Efficacy of a structured, systematic language curriculum for adolescent poor readers. *Reading & Writing Quarterly*, *20*(2), 145-159.

Moffitt, T. E. (1990). Juvenile delinquency and attention deficit disorder: Boys' developmental trajectories from age 3 to age 15. *Child Development Perspectives, 61*(3), 893-910.

Mukasey, M., Sedgewick, J., & Flores, J. (2008). *How OJJDP is serving children, families, and communities.* Washington, DC: Office of Justice and Delinquency Prevention.

Nasby, W., & Yando, R. (1982). Selective encoding and retrieval of affectively valent information: Two cognitive consequences of children's mood states. *Journal of Personality and Social Psychology, 43*, 1244-1255.

National Institute of Educatonal Statistics. (2011) *The nation's report card: Reading 2011* (NCES 2012-457). Washington, DC: U.S. Department of Education, Institute of Education Sciences.

National Institute of Child Health and Human Development. (2000). *Report of the National Reading Panel. Teaching children to read: an evidence-based assessment of the scientific research literature on reading its implications for reading instruction: Reports of the subgroups* (NIH Publication No. 00-4754). Washington, DC: U.S. Government Printing Office.

Neisser, U. (1967). *Cognitive psychology*. New York, NY: Meredith.

Nelson, R. J., Benner, G. J., & Rogers-Adkinson, D. L. (2003). An investigation of the characteristics of k-12 students with comorbid emotional disturbance and significant language deficits served in public school settings. *Behavioral Disorders, 9*(1), 25-33.

Neufeld, J., Smith, M. G., Estes, H., & Hill, G. C. (1995). Rural after school child care: A demonstration project in a remote mining community. *Rural Special Education Quarterly, 14*, 12-16.

No Child Left Behind Act of 2001, 20 U.S.C. § 6301, et seq. (2007).

Office of Juvenile Justice and Deliquency Prevention. (2006). *Federal advisory committee on juvenile justice: Annual report 2006*. Retrieved from www.ncjrs.gov/pdffiles1/ojjdp/218367.pdf

Osher, D., Woodruff, D., & Sims, A. (2002). Schools make a difference: The relationship between education services for African American children and youth and their overrepresentation in the juvenile justice system. In D. Losen (Ed.), *Minority issues in special education* (pp. 93-116). Cambridge, MA: The Civil Rights Project, Harvard University and the Harvard Education Publishing Group.

Pasi, R. J. (1997). Success in high school and beyond. *Educational Leadership, 54*, 40-42.

Pasi, R. J. (2001). *Higher expectations: Promoting social emotional learning and academic achievement in your school*. New York, NY: Teachers College Press.

Payton, J., Weissberg, R. P., Durlak, J. A., Dymnicki, A. B., Taylor, R. D., Schellinger, K. B., & Pachan, M. (2008). *The positive impact of social and emotional learning for kindergarten to eighth-grade students: Findings from three scientific reviews.* Chicago, IL: Collaborative for Academic, Social, and Emotional Learning.

Pekrun, R., & Frese, M. (1992). Emotions in work and achievement. In C. L. Cooper & I. T.

Robertson (Eds.), *International review of industrial and organizational psychology* (Vol. 7, pp. 153-200). Chichester, England: Wiley.

Pekrun, R., Goetz, T., & Wolfram, T. (2002). Academic emotions in students' self-regulated learning and achievement: A program of qualitative and quantitative research. *Educational Psychologist, 32*(7), 91-105.

Phillips, R. S. (1999). Intervention with siblings of children with developmental disabilities from economically disadvantaged families. *Families in Society, 80,* 569-577.

Porges, S. W., Doussard-Roosevelt, J. A., & Maiti, A. K. (1994). Vagal tone and the physiological regulation of emotion. *Monographs of the Society for Research in Child Development, 59*(2), 167-186.

Potts, R., Morse, M., Felleman, E., & Masters, J. C. (1986). Children's emotions and memory for affective narrative content. *Motivation and Emotion, 10*, 39-57.

Pressley, M. (1998). *Reading instruction that works: The case for balanced teaching*. New York, NY: Guilford Press.

Pribram, K. H. (1991). *Brain and perception: Holonomy and structure in figural processing*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Pribram, K. H., & Melges, F. T. (1969). Psychophysiological basis of emotion. In P. J. Vinken & G. W. Bruyn (Eds.), *Handbook of clinical neurology* (Vol. 3, pp. 316-341). Amersterdam, The Netherlands: North-Holland Publishing Company.

Puzzanchera, C., Adams, B., & Sickmund, M. (2011). *Juvenile court statistics 2008.* Pittsburgh, PA: National Center for Juvenile Justice.

Puzzanchera, C., Sladky, A., & Kang, W. (2011). *Easy access to juvenile populations: 1990-2010.* Retrieved from http://www.ojjdp.gov/ojstatbb/ezapop/

Resilent Educator (2002). *Qualified instructor training manuel.* Boulder Creek, CA: Institute of HeartMath.

Quinn, M. M., Rutherford, R. B., & Leone, P. E. (2001). *Students with disabilities in correctional facilities.* Arlington, VA: ERIC Clearinghouse on Disabilities and Gifted Education, Council for Exceptional Children.

Quinn, M. M., Rutherford, R. B., Leone, P. E., Osher, D. M., & Poirier, J. M. (2005). Youth with disabilities in juvenile corrections: A national survey. *Exceptional Children, 71*(3), 339-345.

Read Naturally. (2002). *Reading fluency monitor:* St. Paul, MN: Author.

Reschly, A. L. (2009). Reading and school completion: Critical connections and Matthew Effects. *Reading & Writing Quarterly, 26*(1), 67-90.

Rosenshine, B., & Stevens, R. (1984). Classroom instruction in reading. In P. D. Pearson, P. Mosenthal, M. Kamil, & R. Barr (Eds.), *Handbook of reading research* (Vol. 1, pp. 745-798). New York, NY: Longman.

Rotheram, M. J. (1982). Social skills training with underachievers, disruptive, and exceptional children. *Psychology in the Schools, 19,* 532-539.

Rozman, D., Beckman, T., Jones, D., & Whitaker, R. (1996). A pilot intervention program that reduces psychological symptomatology in individuals with human immunodeficiency virus. *Complementary Therapies in Medicine, 4*(4), 226-232.

Segerstrom, S., & Solberg Nes, L. (2007). Heart rate variability reflects self-regulatory strength, effort, and fatigue. *Psychological Science, New Series, 18*(3), 275-281.

Seidel, J. F., & Vaughn, S. (1991). Social alienation and the learning disabled school dropout. *Learning Disabilities Research & Practice, 6*(3), 152-157.

Sickmund, M., Sladky, T., Kang , W., & Puzzanchera, C. (2008). *Easy access to the census of juveniles in residential placement*. Retrieved from http://www.ojjdp.gov/ojstatbb/ezacjrp/

Skiba, R. J., Michael, R. S., Nardo, A. C., & Peterson, R. (2000). *The color of discipline: Sources of racial and gender disproportionality in school punishment. Urban review*. Bloomington, IL: University of Indiana Center for Evaluation & Education Policy.

Skinner, B. F. (1963). Behaviorism at fifty. *Science, New Series, 140*(3570), 951-958.

Snow, C. E., Burns, M., & Griffin, P. (Eds.). (1998). *Preventing reading difficulties in young children*. Washington, DC: National Academy Press.

Sousa, D. A. (2011a). *Educational neuroscience on the science of teaching.* Quebec, CA: LEARN.

Sousa, D. A. (2011b). *How the brain learns* (Vol. 4). Thousand Oaks: Corwin Press.

Spekman, N. J. (1993). An exploration of risk and resilience in the lives of individuals with learning disabilities. *Learning Disabilities Research and Practice, 8*(1), 11-18.

Stahl, S. A., & Kuhn, M. R. (2002). Making it sound like language: Developing fluency. *The Reading Teacher, 55*, 582-582.

Stanovich, K. E. (1986). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly, 21*(4), 360-407.

Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. Newberry Park, CA: Sage.

Strauss, A., & Corbin, J. (1998). *Basics of qualitative research: Grounded theory procedures and techniques* (2nd ed.). Thousand Oaks, CA: Sage.

Stroop, J. R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology, 18,* 643-662. doi: 10.1037/h0054651

Sum, A., Khatiwada, I., McLaughlin, J., & Palma, S. (2009). *The consequences of dropping out of high school: Joblessness and jailing for high school dropouts and the high cost for taxpayers.* Boston, MA: Northeastern University, Center for Labor Market Studies.

Swanson, L. H., & Deshler, D. (2003). Instructing adolescents with learning disabilities: Converting a meta-analysis to practice. *Journal of Learning Disabilities, 36*, 124-135. doi: 10.1177/002221940303600205

TestEdge: Getting in sync for test success. (2002). Boulder Creek, CA: Institute of HeartMath.

Thayer, J. F., Åhs, F., Fredrikson, M., Sollers III., J. J., & Wager, D. W. (2012). A meta-analysis of heart rate variability and neuroimaging studies: Implications for heart rate variability as a marker of stress and health. *Neuroscience & Biobehavioral Reviews, 36*(2), 747-756.

Thayer, J. F., & Brosschot, J. F. (2005). Psychosomatics and psychopathology: Looking up and down from the brain. *Psychoneuroendocrinology, 30,* 1050-1058.

Thayer, J. F., & Lane, R. D. (2000). A model of neurovisceral integration in emotion regulation and dysregulation. *Journal of Affective Disorders, 61*, 201-216.

Thayer, J. F., & Lane, R. D. (2009). Claude Bernard and the heart-brain connection: Further elaboration of a model of neurovisceral integration. *Neuroscience & Biobehavioral Reviews, 33*(2), 81-88.

Thayer, J. F., & Sternberg, E. M. (2006). Beyond heart rate variability: Vagal regulation of

allostatic systems. *Annals of the New York Academy of Sciences, 1008,* 361-372.

Tiller, W. A., McCraty, R., & Atkinson, M. (1996). Cardiac coherence: A new, noninvasive measure of autonomic nervous system order. *Alternative Therapies in Health and Medicine, 2*(1), 52-65.

Tobler, N. S., Roona, M. R., Ochshorn, P., Marshall, D. G., Streke, A. V., & Stackpole, K. M. (2000). School-based adolescent drug prevention programs: 1998 meta-analysis. *Journal of Primary Prevention, 30,* 275-336.

Torgesen, J., Rashotte, C., Alexander, A., Alexander, J., & MacPhee, K. (2003). Progress towards understanding the instructional conditions necessary for remediating reading difficulties in older children. *Preventing and remediating reading difficulties: Bringing science to scale,* 275-298.

Torgesen, J. K., Alexander, A. W., Wagner, R. K., Rashotte, C. A., Voeller, K., Conway, T., et al. (2001). Intensive remedial instruction for children with severe reading disabilities: Immediate and long-term outcomes from two instructional approaches. *Journal of Learning Disabilities, 34,* 33-58.

Torgesen, J. K., Wagner, R. K., & Rashotte, C. A. (1999). *TOWRE: Test of Word Reading Efficiency*. Austin, TX: Pro-Ed.

U.S. Department of Education, Office of Special Education and Rehabilitative Services, Office of Special Education Programs. (2001). *23rd annual report to congress on the implementation of the Individuals with Disabilities Education Act*. Washington, DC: Author.

U.S. Department of Education, Office of Special Education and Rehabilitative Services, Office of Special Education Programs. (2008). *30th annual report to congress on the*

implementation of the Individuals with Disabilities Education Act. Washington, DC: Author.

van der Molen, M. W., Somsen, R. J. M., & Orlebeke, J. F. (1985). The rhythm of the heart beat in information processing. In P. K. Ackles, J. R. Jennings & M. G. H. Coles (Eds.), *Advances in psychophysiology* (Vol. 1, pp. 1-88). London, England: JAI Press.

Vaughn, S., Klingner, J. K., & Bryant, D. P. (2001). Collaborative strategic reading as a means to enhance peer-mediated instruction for reading comprehension and content-area learning. *Remedial and Special Education, 22*, 66-74.

Vygotsky, L. S. (1987). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Vygotsky, L. S. (1978), Mind in Society. *The Development of Higher Psychological Processes.* Cambridge, MA: Harvard University Press.

Wang, M. C., Haertel, G. D., & Walberg, H. J. (1997). Learning influences. In H. J. Walberg & G. D. Haertel (Eds.), *Psychology and educational practice* (pp. 199-211). Berkeley, CA: McCatchan.

Waters, E., & Sroufe, L. A. (1983). Social competence as a developmental construct. *Developmental Review, 3*, 79-97.

Watson, J. P. (1913). Psychology as the behaviorist views it. *Psychological Review, 20*, 158-177.

Weissberg, R. P., & O'Brian Utne, M. (2004). What works in school-based social and emotional learning programs for positive youth development. *The ANNALS of the American Academy of Political and Social Science*, *591*(1), 86-97.

Wesnes, K. (1979). *Cognitive drug research computerized assessment system*. Berkshire, England: University of Reading.

Wiederholt, J. L., & Bryant, B. R. (1992). *Gray oral reading tests* (3rd ed.). Austin, TX: Pro-Ed.

Williams, J. L., Wexler, J., Roberts, G., & Carpenter, C. (2011). Intensive reading instruction in juvenile correctional settings. *Exceptionality, 19*(4), 238-251. doi: 10.1080/09362835.2011.614499

Wilson, D. B., Gottfredson, D. C., & Najaka, S. S. (2001). School-based prevention of problem behaviors: A meta-analysis. *Journal of Quantitative Criminology, 17*, 247-272.

Wilson, S., & Lipsey, M. (2007). School-based interventions for aggressive and disruptive behavior: Update of a meta-analysis. *American Journal of Preventive Medicine, 33 (Suppl. 2)*, 130-143.

Woodcock, R. W., McGrew, K. S., & Mather, N. (2001). *Woodcock-Johnson III.* Itasca, IL: Riverside Publishing.

Zeidner, M., Roberts, R. D., & Matthews, G. (2002). Can emotional intelligence be schooled? A critical review. *Educational Psychologist, 37*, 215-231.

Zins, J. E., Bloodworth, M. R., Weissberg, R. P., & Walberg, H. J. (2007). The scientific base linking social and emotional learning to school success. *Journal of Educational and Psychological Consultation, 17*(2), 191-210.

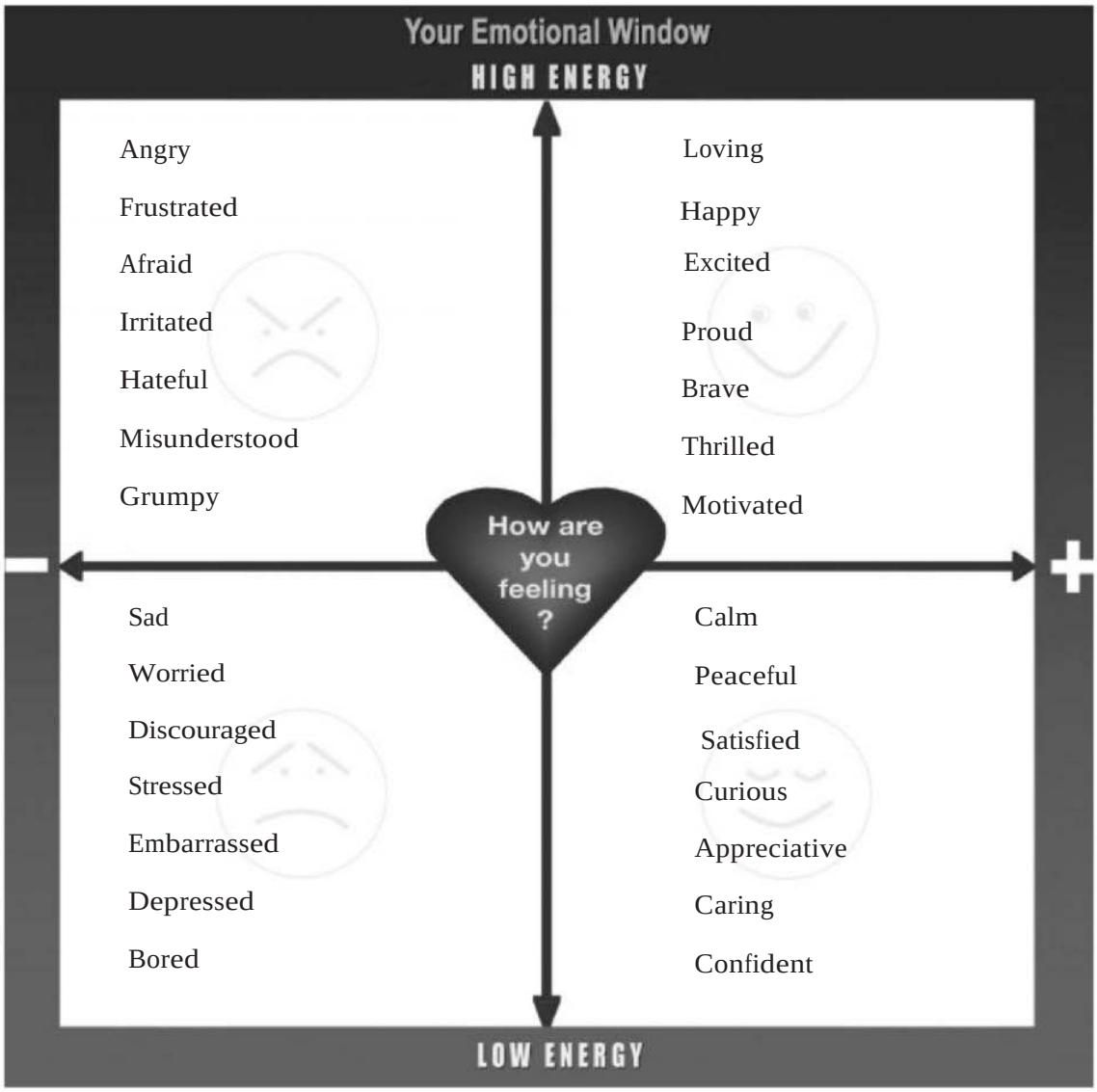
Zins, J. E., Bloodworth, M. R., Weissberg, R. P., & Walberg, H. J. (Eds.). (2004). *Building academic success on social and emotional learning: What does the research say?* New York, NY: Teachers College Press.

Zins, J. E., & Elias, M. J. (2006). Social and emotional learning. In G. G. Bear & K. M. Minke (Eds.), *Children's needs: Development, prevention, and intervention* (Vol. 3, pp. 1-14). Bethesda, MD: National Association of School Psychologists.

Appendix A:

Student Activity Guide

Your Emotional Window



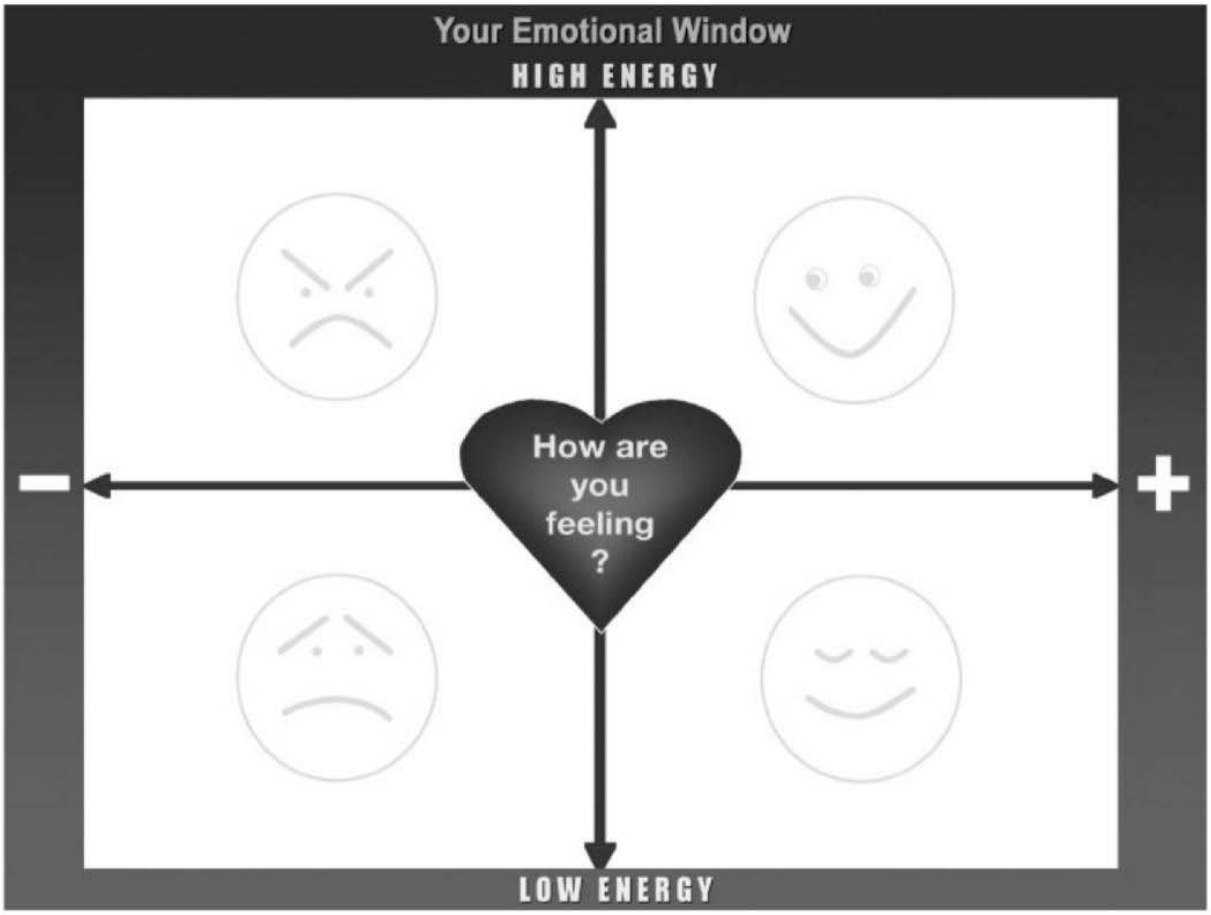
Reading aloud class	Doing homework	Playing computer games
Writing a paper	Texting	Arguing with parents or guardians
Taking a test	Playing sports	Taking class you enjoy
Working out a math problem	Watching a movie	Hanging out with friends
		Working or doing chores

Your Emotional Window

We all experience a wide range of emotions that change from week to week, day to day, and minute by minute. Some emotions are low-energy, (sadness or peacefulness). Some emotions are high energy (anger or excitement). Some emotions are positive (happiness). And some emotions are negative (depression). Some emotions help us think more clearly and help us get along better with others (appreciation, love). Other emotions can get in the way of performing or affect our relationships with others (rage, anxiety).

Assignment:

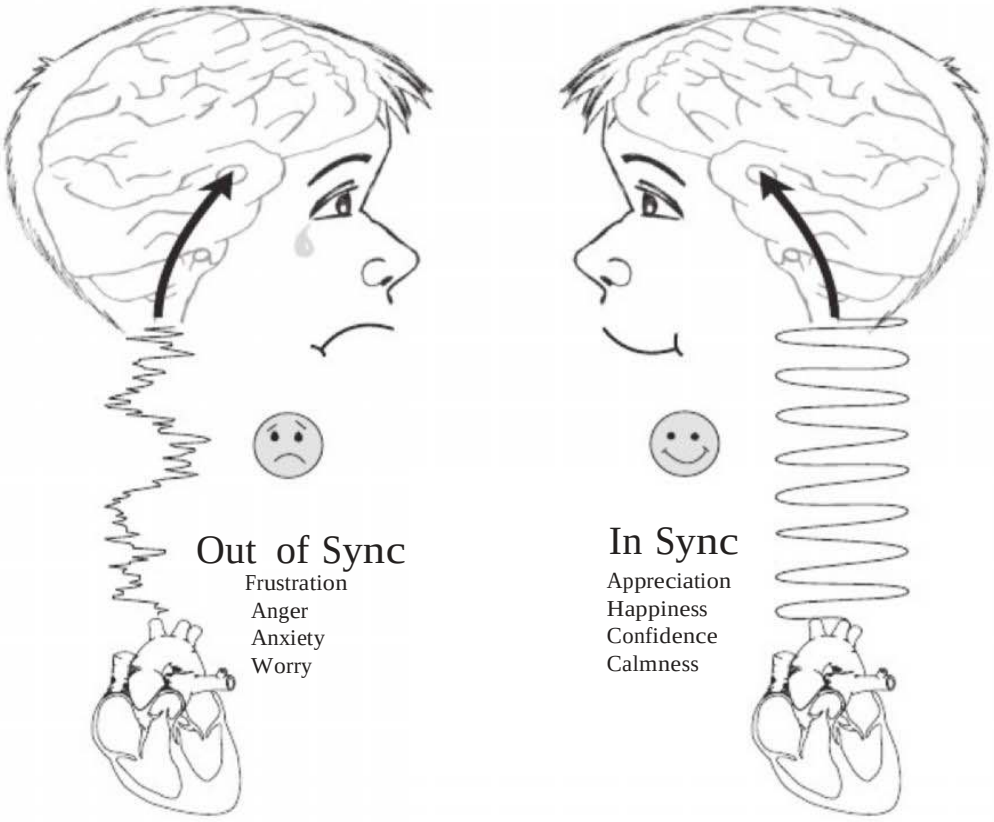
Think of the range of emotions you experience during a typical school week. Write down at least two emotions in each one of the grids or small squares below. Begin with high-energy negative emotions, followed by low-energy negative. Next, write down low-energy positive emotions. Complete your grid by writing down your high-energy positive emotions.



Are you In Sync or Out of Sync?

In sync means that two or more things in harmony. For example, you are **in sync** when your thinking brain and your emotional brain are working together. You are also In Sync when the signals between your heart and brain are working together. When someone is **in sync**, it means he or she is performing well, thinking clearly, and feeling good.

Emotions Affect How We Feel



When to Practice?

- On the way to school
- Before reading instruction
- Before making an important decision
- Before a test
- Before approaching someone with a problem
- Before an athletic event
- When you are tired, stressed, or angry
- While riding the bus
- When the teacher is taking attendance
- When you are having difficulty concentrating
- In the cafeteria

Think of a few more places/situations when you might be able to practice using the Quick Coherence Tool?

_____

_____

Appendix B:

SSRI Lesson Plans

SSRI Lesson Plans: 15-day schedule*

Lesson	Activity	Objectives
Program Overview: Part I	Introduction to program terminology, science, and modeling of techniques and tools (50 mins).	The students will demonstrate command of terminology, techniques, and tools via oral response.
1a	Modeling & guided practice: HRV Screen (5 mins)	The students will demonstrate an understanding of pulse sensor and HRV data via oral response and individual checkouts.
1b	Guided practice: Coherence Coach (5 mins)	The students will demonstrate steps of Neutral & Quick Coherence via oral response and practice controlling their breathing rhythms and heart-focused breathing using the Coherence Coach.
2a	Guided practice: HRV Screen Coherence Coach (5 mins)	The students will demonstrate steps of Neutral Tool and functions of HRV screen via individual checkouts.
2b	Group practice: Inner Weather Report & Neutral Tool (5 mins)	The students will identify feelings and where they fall on an emotional continuum via partner checkouts. The students will name the steps of Neutral Tool via oral response.
3a	Modeling and guided practice: Garden Game (5 mins)	The students will apply the steps of Neutral Tool and demonstrate understanding of real-time HRV feedback via individual checkouts.
3b	Group practice: Inner Weather Report. Modeling: Garden Game (5 mins)	The students will identify their feelings and where they fall on an emotional continuum via partner checkouts and identify the steps of Quick Coherence via group response.
4a	Independent practice: Garden Game (5 mins)	The students will practice achieving coherence via the Quick Coherence technique and reviewing real-time HRV data.
4b	Modeling and guided practice: Introduce Rainbow Game (5 mins)	The students will practice achieving coherence via the Quick Coherence technique and reviewing real-time HRV data.

*Lesson plan (a) is delivered at the beginning of class and lesson plan (b) is delivered at the half-way point of the class period.

SSRI Lesson Plans: 15-day schedule*

Lesson	Activity	Objectives
5a	Independent practice: Rainbow Game (5 mins)	The students will practice achieving coherence via the Quick Coherence technique and reviewing real-time HRV data.
5b	Guided review of techniques. Independent practice: Rainbow Game (5 mins)	The students will demonstrate command of the steps of Neutral and Quick Coherence techniques via group response, practice achieving coherence, and reviewing real-time HRV data.
6b	Guided discussion, check-in, review.	The students will identify and discuss feelings and emotions that occur when taking a high-stakes test of achievement, and identify the steps of Neutral and Quick Coherence.
7a	Independent practice: Rainbow Game (5 mins)	The students will practice achieving coherence via the Quick Coherence technique, and reviewing real-time HRV data.
7b	**Program Overview: Part II** Modeling and guided practice using emWave handheld (20 minutes)	The students will identify terminology and concepts, demonstrate command of the emWave handheld device, and practice recording emotions on the Personal Tracker form.
8a	Guided practice: emWave Handheld (5 mins)	The students will practice Quick Coherence and review and record emotions on the Personal Tracker form.
8b	Independent practice: emWave Handheld	The students will practice Quick Coherence and review and record emotions on the Personal Tracker form.
9a	Independent practice: Rainbow Game (5 mins)	The students will practice achieving coherence via the Quick Coherence technique and reviewing real-time HRV data.
9b	Independent practice: emWave Handheld (5 mins)	The students will practice Quick Coherence and review and record emotions on the Personal Tracker form.

*Lesson plan (a) is delivered at the beginning of class and lesson plan (b) is delivered at the half-way point of the class period.

SSRI Lesson Plans: 15-day schedule*

Lesson	Activity	Objectives
10a	Group and Independent practice: Inner Weather Report & Coherence Coach (5 mins)	The students will identify their feelings and where they fall on an emotional continuum via partner checkouts. Next, the students will practice controlling their breathing rhythms and heart-focused breathing using the Coherence Coach.
10b	Independent practice: Garden Game (5 mins)	The students will practice achieving coherence via the Quick Coherence technique and reviewing real-time HRV data.
11a	Independent practice: emWave handheld (5 mins)	The students will practice Quick Coherence and review and recording emotions on the Personal Tracker form.
11b	Independent practice: Rainbow Game (5 mins)	The students will practice achieving coherence via the Quick Coherence technique and review real-time HRV data.
12a	Independent practice: Balloon Game (5 mins)	The students will practice achieving coherence via the Quick Coherence technique and reviewing real-time HRV data.
12b	Independent practice: Inner Weather Report *&* Free Practice on the emWave Screen, Coherence Coach, or Games (5 mins)	The students will identify their feelings and where they fall on an emotional continuum, practice achieving coherence via the Quick Coherence technique using the tool of their choice.
13a	Independent practice: emWave Handheld (5 mins)	The students will practice Quick Coherence and record emotions on the Personal Tracker form.
13b	Independent practice: Inner Weather Report *&* Free Practice on the emWave Screen, Coherence Coach, or Games (5 mins)	The students will identify their feelings and where they fall on an emotional continuum, and practice achieving coherence via the Quick Coherence technique and the tool of their choice.

*Lesson plan (a) is delivered at the beginning of class and lesson plan (b) is delivered at the half-way point of the class period.

SSRI Lesson Plans: 15-day schedule*

Lesson	Activity	Objectives
14a	Independent practice: emWave Handheld (5 mins)	The students will practice Quick Coherence and record emotions on the Personal Tracker form.
14b	Independent practice: Inner Weather Report *&* Free Practice on the emWave Screen, Coherence Coach, or Games (5 mins)	The students will identify their feelings and where they fall on an emotional continuum, and practice achieving coherence via the Quick Coherence technique and the tool of their choice.
15a	Independent practice: Inner Weather Report and emWave Handheld (5 mins)	The students will identify their feelings and where they fall on an emotional continuum, practice Quick Coherence, and review and record emotions on the Personal Tracker form.
15b	Teacher guided culminating Activity (10 mins)	The students will demonstrate knowledge of terminology, techniques, and tools via class discussion with the intervention teacher and the researcher and have opportunities for free practice.

*Lesson plan (a) is delivered at the beginning of class and lesson plan (b) is delivered at the half-way point of the class period.

SSRI Lesson Plans: 30-day schedule

Lesson	Activity	Objectives
Program Overview: Part I	Introduction to program terminology, science, and modeling of techniques and tools (50 mins).	The students will demonstrate command of terminology, techniques, and tools via oral response.
1	Modeling & guided practice: HRV Screen (5 mins)	The students will demonstrate an understanding of pulse sensor and HRV data via oral response and individual checkouts.
2	Guided practice: Coherence Coach (5 mins)	The students will demonstrate steps of Neutral & Quick Coherence via oral response and practice controlling their breathing rhythms and heart-focused breathing using the Coherence Coach.
3	Guided practice: HRV Screen Coherence Coach (5 mins)	The students will demonstrate steps of Neutral Tool and functions of HRV screen via individual checkouts.
4	Group practice: Inner Weather Report & Neutral Tool (5 mins)	The students will identify feelings and where they fall on an emotional continuum via partner checkouts. The students will name the steps of Neutral Tool via oral response.
5	Modeling and guided practice: Garden Game (5 mins)	The students will apply the steps of Neutral Tool and demonstrate understanding of real-time HRV feedback via individual checkouts.
6	Group practice: Inner Weather Report. Modeling: Garden Game (5 mins)	The students will identify their feelings and where they fall on an emotional continuum via partner checkouts and identify the steps of Quick Coherence via group response.
7	Independent practice: Garden Game (5 mins)	The students will practice achieving coherence via the Quick Coherence technique and reviewing real-time HRV data.
8	Modeling and guided practice: Introduce Rainbow Game (5 mins)	The students will practice achieving coherence via the Quick Coherence technique and reviewing real-time HRV data.

SSRI Lesson Plans: 30-day schedule

Lesson	Activity	Objectives
9	Independent practice: Rainbow Game (5 mins)	The students will practice achieving coherence via the Quick Coherence technique and reviewing real-time HRV data.
10	Guided review of techniques. Independent practice: Rainbow Game (5 mins)	The students will demonstrate command of the steps of Neutral and Quick Coherence techniques via group response, practice achieving coherence, and reviewing real-time HRV data.
11	Guided discussion, check-in, review.	The students will identify and discuss feelings and emotions that occur when taking a high-stakes test of achievement, and identify the steps of Neutral and Quick Coherence.
12	Guided discussion, modeling and guided practice: Balloon Game (5 mins)	The students will participate in a class discussion about how they managed emotions when taking the state test, practice achieving coherence, and reviewing HRV data.
13	Independent practice: Rainbow Game (5 mins)	The students will practice achieving coherence via the Quick Coherence technique, and reviewing real-time HRV data.
14	**Program Overview: Part II** Modeling and guided practice using emWave handheld (20 minutes).	The students will identify terminology and concepts, demonstrate command of the emWave handheld device, and practice recording emotions on the Personal Tracker form.
15	Guided practice: emWave Handheld (5 mins)	The students will practice Quick Coherence and review and record emotions on the Personal Tracker form.
16	Independent practice: emWave Handheld	The students will practice Quick Coherence and review and record emotions on the Personal Tracker form.
17	Independent practice: Rainbow Game (5 mins)	The students will practice achieving coherence via the Quick Coherence technique and reviewing real-time HRV data.

SSRI Lesson Plans: 30-day schedule

Lesson	Activity	Objectives
18	Independent practice: emWave Handheld (5 mins)	The students will practice Quick Coherence and review and record emotions on the Personal Tracker form.
19	Group and Independent practice: Inner Weather Report & Coherence Coach (5 mins)	The students will identify their feelings and where they fall on an emotional continuum via partner checkouts. Next, the students will practice controlling their breathing rhythms and heart-focused breathing using the Coherence Coach.
20	Independent practice: Garden Game (5 mins)	The students will practice achieving coherence via the Quick Coherence technique and reviewing real-time HRV data.
21	Independent practice: emWave handheld (5 mins)	The students will practice Quick Coherence and review and recording emotions on the Personal Tracker form.
22	Independent practice: Rainbow Game (5 mins)	The students will practice achieving coherence via the Quick Coherence technique and review real-time HRV data.
23	Independent practice: Balloon Game (5 mins)	The students will practice achieving coherence via the Quick Coherence technique and reviewing real-time HRV data.
24	Independent practice: Inner Weather Report *&* Free Practice on the emWave Screen, Coherence Coach, or Games (5 mins)	The students will identify their feelings and where they fall on an emotional continuum, practice achieving coherence via the Quick Coherence technique using the tool of their choice.
25	Independent practice: emWave Handheld (5 mins)	The students will practice Quick Coherence and record emotions on the Personal Tracker form.
26	Independent practice: Inner Weather Report *&* Free Practice on the emWave Screen, Coherence Coach, or Games (5 mins)	The students will identify their feelings and where they fall on an emotional continuum, and practice achieving coherence via the Quick Coherence technique and the tool of their choice.

SSRI Lesson Plans: 30-day schedule

Lesson	Activity	Objectives
27	Independent practice: emWave Handheld (5 mins)	The students will practice Quick Coherence and record emotions on the Personal Tracker form.
28	Independent practice: Inner Weather Report *&* Free Practice on the emWave Screen, Coherence Coach, or Games (5 mins)	The students will identify their feelings and where they fall on an emotional continuum, and practice achieving coherence via the Quick Coherence technique and the tool of their choice.
29	Independent practice: Inner Weather Report and emWave Handheld (5 mins)	The students will identify their feelings and where they fall on an emotional continuum, practice Quick Coherence, and review and record emotions on the Personal Tracker form.
30	Teacher guided culminating Activity (10 mins)	The students will demonstrate knowledge of terminology, techniques, and tools via class discussion with the intervention teacher and the researcher and have opportunities for free practice.

Appendix C:

emWave Handheld Device Tracker Form

emWave Handheld Tracker Form **Student ID _____**

Date	Challenge Level	# of Reward Bars	What I noticed… 
2/21/11	1	3	**Before session:** Had a bad morning. Forgot to set alarm. Late for class. **After session:** Feeling better. Now, I feel relaxed and calm.
			Before session: **After session:**
			Before session: **After session:**
			Before session: **After session:**
			Before session: **After session:**
			Before session: **After session:**
			Before session: **After session:**
			Before session: **After session:**

Appendix D:

SSRI Teacher Manual Example Lessons

Day 16:

Independent practice on the **emWave PSR Handheld Device** (5-mins)

Distribute emWave PSR Handheld Personal Tracker Forms

Before session say:

Today, you will practice **Quick Coherence** with the emWave Handheld device *(5 mins)*

Do you remember how to raise your challenge level and review your scores?

Before we begin, write briefly about how you are feeling on the Personal Tracker form

Sit quietly and take a few deep breaths to help yourself get focused and relaxed.

Clip the pulse sensor to your earlobe.

Check that the sensor is reading your pulse.

Think of a positive emotion, something or someone you appreciate *(e.g., pet, person, activity)*

Use the Quick Coherence tool and focus on your heart breathing *(plac your hand on your heart if it helps you to focus)*.

After session say:

Did you have more bars on the low or high end?

Count and record how many reward bars you have in the middle and high ends.

Record what you noticed about your feelings and emotions.

☑ Implemented SSRI for students assigned to treatment groups

☑ Implemented explicit instruction in *Language!* Instruction for students assigned to both treatment and control groups

---------- ----------

Date *Teacher signature*

Day 10:

Independent practice: emWave Handheld (5 mins)

Independent practice: Inner Weather Report & Free Practice on the emWave Screen, Coherence Coach, or Games (5 mins)

Say:

Let's reflect on our experiences over the weekend. Did you found yourself in the *stormy* quadrant of the *Inner Weather Report* (angry, frustrated, etc)? Remember, everyone experiences strong feelings and negative emotions. That is why *Neutral* is such an important tool.

It is okay to be in the *stormy* quadrant! That is part of life. But if we stay there too long, we can't think clearly or make good decisions. When you use the *Neutral Tool*, no one needs to know you are doing it. It is your little secret.

What did you experience when you were in the lower left quadrant of the *Inner Weather Report* (sad, disappointed, low, etc)?

What did you experience when you were in the lower right quadrant of the *Inner Weather Report* (calm, peaceful, kind, etc)?

What did you experience when you were in the upper right quadrant of the *Inner Weather Report* (happy, excited, etc)?

Do:

Remind Students that *Neutral* is to be done before a challenging event (e.g., before an exam, sporting event, difficult situation)

Distribute Student Activity Booklets

Say:

Please open you **Activity Booklet** and write down two feelings you experienced over spring break (if time allows, share student stories).

Before session say:

Today you may select either the *Garden Game* or the *Rainbow Game*. (cont…)

Do you remember how to raise your challenge level and review your scores?

Sit quietly and take a few deep breaths to help yourself get focused and relaxed.

Clip the sensor to your earlobe.

Check that the sensor is reading your pulse.

Think of a positive emotion, something or someone you appreciate *(e.g., pet, person, activity.)*

Use your heart focused breathing *(place your hand on your heart if it helps you to focus)*.

☑ Implemented SSRI for students assigned to treatment groups

☑ Implemented explicit instruction in *Language!* Instruction for students assigned to both treatment and control groups

---------- ----------

Date *Teacher signature*

Appendix E:

Implementation Checklists

Implementation Checklist: SEL Self-Regulation Intervention

Evaluator Initials: _____ Date: _____

Start: _____ Stop: _____ Teacher (circle): A B

	Observed 1	Observed & implemented correctly 2	Not Observed 0	Comments
Followed steps in teachers' manual				
Before **the session the teacher prompted the students to:**				
Sit quietly and take a few deep breaths to help them get focused and relaxed				
Clip the sensor to their earlobe and check that the sensor is reading their pulse				
Think of a positive emotion, something or someone they appreciate (pet, person, (e.g., pet, person, activity)				
Use their heart focused breathing & Suggested placing a hand on their heart to help them focus				
During **the session the teacher:**				
Assisted students with technical issues				
Walked around room to encourage and assist students				
Reminded students to breathe calmly and deeply from the area around their heart				
After **the session the teacher:**				
emWave Desktop- asked students to review their coherence ratios and accumulated coherence scores				
emWave Handheld PSR- assisted students with completing Tracker form – *OR*-				
Asked students about their experiences with the emWave				
Reinforced students to use the Neutral Tool when they get frustrated, upset, or anxious.				
TOTAL points possible = 22				

Implementation Checklist: *LANGUAGE!*

Evaluator Initials: _____ Date: _____

Start: _____ Stop: _____ Teacher (circle): A B

Teacher Attributes	Observed 1	Observed & implemented correctly 2	Not Observed 0	Comments
Accurate and clear explanation of concepts and content				
Connections between activities and steps clearly articulated				
Transitions from activity to activity are efficient and rapid				
High level of teacher-student interaction				
Instruction differentiated as needed				
Small group work used				
Effective use of manipulatives and multisensory techniques				
Student Behaviors	Observed 1	Observed & implemented correctly 2	Not Observed 0	Comments
Actively engaged and on task				
Displays knowledge of procedures and routines				
High level of student-teacher interaction				
Variety of peer interactions				
Total points possible = 22				

Adapted from *LANGUAGE!* Comprehensive Literacy Curriculum
www.voyagerlearning.com/language