The Impact of a Growth Mindset Intervention on the
Reading Achievement of At-Risk Adolescent Students

A Dissertation

Presented to

The Faculty of the Curry School of Education

University of Virginia

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy

By

Stephen Allan Saunders, B.A., M.A., M.Ed., Ph.D.

May, 2013

© Copyright by
Stephen Allan Saunders
All Rights Reserved
May, 2013

ABSTRACT

The lack of academic success by American adolescents has been of grave concern for both researchers and practitioners for many decades. While many American adolescents struggle in school, some students are at a greater risk than their peers based on personal characteristics such as race, socioeconomic status, and motivation. The low levels of academic achievement, particularly in the area of reading, are a serious problem for school leaders and teachers working with adolescent students.

Decades of research has established the relationship between motivation and academic achievement. Self-theories or mindsets have been offered as one motivational framework to describe individuals' beliefs about their own traits, such as their intelligence. Individuals tend to fall along a continuum from a growth to a fixed mindset. At-risk students who adopt a fixed mindset may become trapped in a recursive pattern of low achievement, low motivation, and low effort.

There is a convergence of several events that occurs when adolescents transition to middle school during sixth grade. These events, which include psychological and physiological changes as well as normative declines in motivation and academic achievement, make sixth grade an exceptionally important year for the future success of at-risk students. Prior research has suggested that adolescent students who prefer a

growth mindset have higher academic achievement than their peers who prefer a fixed mindset.

This pilot study used a mixed methods research design which combined a quasi-experimental pre-posttest assessment and a focus group component. The participants were thirty public middle school at-risk sixth grade students who had experienced reading difficulties. The purpose of this study was to examine the impact of a computer-based growth mindset intervention (Brainology™) on these students' reading achievement as well as their attitudes toward reading. This study was the first to explore at-risk adolescent students' mindsets and to examine the impact of Brainology™ on reading achievement.

There were non-significant results for four research questions. The focus group interviews indicated that the experimental group students believed that the Brainology™ influenced their beliefs about their intelligence. These results are discussed relative to the topics of adolescent development, motivation, and adolescents' academic environment. Implications for school leaders and future research are also offered.

Department of Leadership, Foundations & Policy
Curry School of Education
University of Virginia
Charlottesville, Virginia

APPROVAL OF THE DISSERTATION

This dissertation, "The Impact of a Growth Mindset Intervention on the Reading Achievement of At-Risk Adolescent Students," has been approved by the Graduate Faculty of the Curry School of Education in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

Pamela D. Tucker, Chair

Sara L. Dexter

Marcia A. Invernizzi

Tonya R. Moon

November 27, 2012 Date

DEDICATION

I dedicate this work to my children and my wife.

Eliza (4) & Owen (2):

I started this journey before either of you was born. It was always hard to spend time working on this paper instead of playing with you and watching you grow up, but Dad is finally done with his “dish-ah-tration.” Now we can play all the time!

Rebekah:

Since our relationship started in 2004 I’ve always been in graduate school or writing this dissertation. During these nine long years there has been a recurring theme of the number *two*: in our 2nd year of marriage I left my job and went back to school full-time to pursue this degree, you supported me through two years of full-time graduate studies, we’ve raised two puppies, and we’ve been blessed with our two children. Thank you for making this degree possible by maintaining our home and lives while I was researching and writing. Thank you also for giving me the freedom to finish this work, and for the many diapers you changed while I was away writing.

I know that I am blessed. While all men marry up, few have done so as well as I.

ACKNOWLEDGEMENTS

Sara Dexter, your insightful comments and suggestions have been very helpful throughout this process. You helped me stay focused on both clarity and simplicity in my writing, and this dissertation reads better because of your comments. Perhaps most importantly, you helped me look at this work through the lens of school leadership, which made this dissertation remain honest to its original intended audience.

Marcia Invernizzi, your thought-provoking questions and insightful comments, particularly surrounding reading, made this work significantly better. Thank you for the ways that you shaped this work to include students' attitudes toward reading as well as the key components of successful reading interventions. Thank you also for the helpful advice you offered throughout this entire process.

Tonya Moon, you have shaped my knowledge and abilities as an educational researcher. From my first class with you (fittingly 'Introduction to Educational Research' in 2006) until even after my dissertation defense, you have provided exceptionally useful advice for me for seven years. You have given yourself selflessly, and you have never stopped teaching or, more importantly, making sure that I was learning. Thank you for the ways that you have supported me with your comments, suggestions, and guidance for so many years.

Pam Tucker, it would not be an exaggeration to say that the opportunity to work with and to learn from you is one of the primary reasons I pursued this degree. You have shepherded me through two degrees over the past nine years.

There is a good reason why graduate students flock to you: the countless ways that you support, guide, challenge, encourage, and inspire your students is unique and makes you beloved by so many.

Please know that you represent the type of educational leader and person that I aspire to be one day. I would write more, but you've taught me to be pithy and to say more with less...

Heather Dow & Holly Faulconer, thank you for both who you are first as persons and then for what you mean to some many at-risk students. My hope has always been that this dissertation may one day be able to augment the phenomenal work you do every day for so many students. Your energy, drive, passion, and belief that you can help change your students' lives is awe-inspiring. You represent the very finest of our profession; our students are lucky to have you, and I am blessed to know you.

India Haun, for the ways that you inspire me every day with your consistent focus on excellent instruction and strong relationships with students and staff. Thank you for your continued support of me and my family as I've finished this degree. I am grateful to have such a warm, caring and supportive role model in my life. If one day I can ever be viewed to be successful as a school leader, I sincerely believe it will be a result of the lessons I've learned with and from you.

Kathryn Baylor, thank you for taking a chance on me. Your support of me and this degree means more than I can express. When I think of how our at-risk students need a strong, organized, inspirational leader, you are the one whom I'm envisioning. Thank you for living out on a daily basis what we both believe: students are the most important part of any school. You continue to inspire me, and I will always value our professional and personal relationships.

And finally, to my mom & dad, **Georgia & Jerry Saunders**, I thank you. Your belief and support of me and my ever-growing family over these years has been tremendous. You have shown me that hard work is the "secret" to success.

I take special joy in receiving this Ph.D. this year, as it marks the 50th anniversary of my dad's college graduation. My dad, one of the first in his family to go to college, went to school at night as he worked full-time to put himself through school. He worked hard and he became the valedictorian of VCU in 1963. He and my mom are living examples of the American dream and for hoping for a better life for their family. Thank you both.

Table of Contents

	Page
DEDICATION.....	iv
ACKNOWLEDGEMENTS.....	v
LIST OF TABLES.....	xiii
LIST OF FIGURES.....	xiv
CHAPTER	
I. Introduction and Background of the Study.....	1
School Leadership.....	2
Factors Affecting Student Achievement	4
Discrepancies in Educational Attainment and Achievement.....	7
Motivation.....	9
Statement of the Problem.....	11
Purpose of the Study.....	12
Research Questions.....	13
Rationale and Justification.....	14
Definition of Terms.....	16
Organization of the Study.....	18
II. Review of the Literature.....	19
Adolescent Development.....	19
Importance of Adolescent Development.....	20

Changes during Adolescence	21
Physiological Changes.....	21
Sociological Changes	23
Psychological Changes.....	25
Theories of Motivation.....	30
Importance of Motivation during Adolescence.....	30
Overview of Relevant Theories of Motivation.....	32
Achievement Goal Theory.....	33
Attribution Theory	34
Self-Theories.....	36
Academic Environment for Adolescents.....	48
Importance of Academic Environment.....	49
Middle Schools.....	51
Organization of Middle Schools.....	51
Differences between Elementary and Middle Schools.....	52
Classroom Teachers.....	54
Discrepancies in Achievement.....	55
High school dropout rates.....	55
Underachievement based on Poverty.....	58
Underachievement of Racial Subgroups.....	60
Declines in Motivation and Achievement.....	62
Declines in Motivation.....	63
Declines in Achievement.....	63
Academic Interventions.....	64
Interventions at the National Level.....	65

	Interventions at the School Level	66
	Interventions at the Student Level.....	70
	Conclusion.....	72
III.	Methods.....	74
	Research Questions.....	75
	Research Design and Sampling	75
	Context.....	76
	Participants.....	77
	Intervention.....	79
	Read180 reading intervention program	79
	Brainology™ computer program.....	80
	Experimental Group	81
	Comparison Group.....	81
	Instrumentation.....	81
	Mindset Questionnaire.....	81
	Elementary Reading Attitude Survey.....	82
	Reading MAP Test.....	83
	Data Collection.....	84
	Prior to the intervention.....	84
	After the intervention.....	84
	Data Analysis.....	85
	Limitations.....	87
IV.	Results.....	89
	Descriptive Analysis of the Dependent Variables.....	89
	Descriptive Analysis of the Covariates	91

Reliability Analysis of the Dependent Variables	93
Reliability Analysis of the Covariates	94
Research Questions and Results.....	95
Research Question One Results	95
Research Question Two Results.....	97
Research Question Three Results.....	98
Research Question Four Results.....	99
Research Question Five Results	100
Summary of Findings.....	104
V. Discussion.....	105
Discussion of Findings.....	105
Quantitative Findings	105
Adolescent Development.....	106
Motivation.....	110
Academic Environment.....	111
Other Possible Explanations.....	115
Qualitative Findings.....	119
Adolescent Development.....	119
Motivation.....	121
Academic Environment.....	122
Other Possible Explanations.....	123
Limitations and Implications for the Research Design.....	127
Intervention.....	127
Instruments.....	130
Sample Size.....	135

Social Pressure.....	136
Systems Ecology.....	137
Implications for School Leaders.....	137
Curricular Alignment and Fidelity of Implementation.....	137
Timing of the Intervention.....	138
Teacher Effectiveness.....	139
Student Motivation.....	139
Conclusion.....	140
REFERENCES.....	145
APPENDICES.....	170
Appendix A: Mindset Questionnaire.....	175
Appendix B: Elementary Reading Attitude Survey (ERAS).....	184
Appendix C: Measures of Academic Progress (MAP) Reading test.....	190
Appendix D: Focus Group Protocol.....	191
Appendix E: Focus Group A Transcript.....	192
Appendix F: Focus Group B Transcript.....	199
Appendix G: Focus Group C Transcript.....	205
Appendix H: University of Virginia IRB-SBS Approval Letter.....	211
Appendix I: Researcher's Parental Notification Letter.....	212

LIST OF TABLES

TABLE	Page
3.1 Demographics of Sixth-Grade Students at Bailey Middle School and the Copper Ridge system	78
3.2 Demographics of Sixth-Grade Students in Reading Intervention Classes.....	79
3.3 Selected 2011 Normative Data RIT Values for Secondary Reading MAP Test.....	83
4.1 Descriptive Analysis of the Dependent Variables.....	90
4.2 Descriptive Analysis of the PreTest Covariates.....	91
4.3 Reliability Analysis for ERAS and Mindset Questionnaire PostTest.....	93
4.4 Reliability Analysis for ERAS and Mindset Questionnaire PreTest.....	94
4.5 Selected Treatment Students' MAP PostTest RIT Scores.....	96
4.6 Pearson Correlation between MAP PostTests and Mindset Questionnaire PostTests and ERAS PostTests.....	98

LIST OF FIGURES

FIGURE	Page
1.1 Factors Impacting Student Achievement.....	6
1.2 National Grade 8 NAEP Reading Scores: 1992-2009.....	8
2.1 Differences between Fixed and Growth Mindsets.....	38
2.2 2009 Grade 8 Virginia Reading NAEP Scores by Racial Subgroups.....	61
2.3 2010-11 Grade 8 Virginia Reading SOL Pass Rates by Racial Subgroups.....	61

CHAPTER ONE:

INTRODUCTION AND BACKGROUND OF THE STUDY

Students' achievement in school is the result of a complicated equation that includes their schools, their teachers, their personal characteristics, and other factors such as motivation (Hanushek, 2010, 2011). While many students are successful, a substantial percentage of American students struggle academically (Carnegie Council on Adolescent Development, 1989; Gardner, 1983; Spellings, 2008). The lack of success by some students in school has been a topic of grave concern and considerable discussion for many years (Bennett et al., 1998; Coleman, 1966; Gardner, 1983; Gordon & Jablonsky, 1968).

The National Assessment of Educational Progress (NAEP) assessment scores and high school dropout rates clearly document that “not all children succeed in school” (Uline & Johnson, 2005, p. 1). Discrepancies in educational attainment (e.g., graduation rates) and achievement (e.g., test scores) are substantiated by indicators such as high rates of referral for special education services (Fuchs, Fuchs, & Stecker, 2010), high rates of dropping out of school (Chapman, Laird, & Kewal-Ramani, 2010), low levels of literacy (Aud et al., 2011; Stanovich, 1986), low classroom grades (Balfanz & Herzog, 2005), and low levels of achievement on international, national and state assessments (Dowrick & Crespo, 2005). As one example, on the 2009 Programme for International Student

Assessment (PISA) the reading performance of fifteen-year-olds in the United States tied with Poland and Iceland for eleventh place out of thirty-three countries, and the United States' score of 500 was significantly lower than China's first place score of 556 (Fleischman, Hopstock, Pelczar, & Shelley, 2010). Each year the United States spends more on education (\$599 billion) than any other service except health care (McKinsey & Company, 2009), yet on the 2011 NAEP exam only 38% of American 12th grade students scored at least *proficient* in reading (Aud et al., 2011). In addition, on the 2006 PISA exams American fifteen-year-olds ranked twenty-fifth in math, twenty-first in science, fifteenth in reading, and twenty-fourth in problem solving out of thirty industrialized countries (National Governors Association, Council of Chief State School Officers, & Achieve, Inc., 2008). While American students in general struggle, specific students are at a greater risk of school failure than their peers based on certain personal characteristics, and students' academic achievement can often be predicted by "income, race, language background, and other demographic variables" (Uline & Johnson, 2005, p. 1). The lack of academic success by American students in general as well as certain students in particular is a significant problem facing school leaders today.

School Leadership

While the concept of *leadership* may have numerous potential definitions and meanings (Stogdill, 1974), in general leadership refers to "the process whereby an individual influences a group of individuals to achieve a common goal" (Northouse, 2012, p. 3). The goal for school leaders, be they building level administrators (e.g., principals) or central office leaders (e.g., superintendents), is to ensure that all students learn and achieve at high levels (Cotton, 2003). School leadership is complex (Hallinger, 1996), and while there has been some debate over a principal's direct impact on student

achievement (e.g., Murphy, 1988), most researchers agree that effective school leadership is typically associated with high levels of student achievement (Marks & Printy, 2003; Reeves, 2008; Schmoker, 2006). While central office leaders certainly have an influence on student achievement through designing and implementing curricular programs, providing adequate funding, and monitoring division goals for achievement and instruction (Waters & Marzano, 2006), building level administrators typically have more influence on students' achievement because of their closer proximity to students, teachers and student learning (Andrews, 1987). In fact, principals have been described as "secondary only to classroom teachers as an influence on pupil learning" (Leithwood, Harris, & Hopkins, 2008, p. 27). One example of principals' influence on student learning can be seen in the area of increasing students' achievement in reading (Robinson, Hohepa, & Lloyd, 2007).

Reading is "foundational for all other learning" (US Department of Education, 2004, p. 20), and therefore school leaders must provide structure and support to increase their students' reading achievement (Biancarosa, 2012), including extended time for literacy, professional development time for teachers, and a "comprehensive and coordinated literacy program" for all students (Biancarosa & Snow, 2004, p. 12). When students struggle in school, it is the duty of the principal as the instructional leader of the school (Fullan, 2008; Glickman, Gordon, & Ross-Gordon, 2001) to provide resources, such as reading intervention programs, to increase their students' achievement (Marks & Printy, 2003). While reading interventions have long been known to be critical at the elementary level (Chall, 1983; Stanovich, 1986) and in particular for low-income and minority students (Balfanz, 2009; Chall, Jacobs, & Baldwin, 1990; Stringfield & Datnow,

2002), there is also as compelling evidence for their need in middle school because many students leave elementary school without basic reading skills (Showers, Joyce, Scanlon, & Schnaubelt, 1998) and reading is typically not a direct focus of instruction in middle school (Irvin, 1998). There is convincing evidence (e.g., Waters, Marzano, & McNulty, 2003) that suggests that principals can help these struggling students in reading by influencing components of two of the three levels of factors that impact student achievement.

Factors Affecting Student Achievement

There are three levels of factors that affect student achievement: school, classroom, and individual (Carroll, 1963; Darling-Hammond, 2000; Sanders, Wright, & Horn, 1997). School leaders are primarily responsible for factors at the school and classroom levels (Scheerens & Bosker, 1997; Teddlie & Reynolds, 2000). School-level factors include a consistent curriculum, effective feedback, parental involvement, and a safe and orderly environment (Sammons, Hillman, & Mortimore, 1995). Compelling research on the differences between effective and ineffective schools (e.g., Scheerens & Bosker, 1997) clearly shows that the “differential effectiveness of schools...contributes to differences in achievement” (Madaus, Kellaghan, Rakow, & King, 1979, p. 223). *Effective schools* increase academic achievement by “more than one full year” when compared to ineffective schools (Chubb & Moe, 1990, p. 140) and do so regardless of the individual student’s demographics and background (Edmonds, 1979; Edmonds, 1981; Reeves, 2003; Stringfield, 1997; Stringfield & Datnow, 2002; Teddlie & Stringfield, 1993). While the school environment is certainly important, a larger effect on students’

achievement exists at the classroom level, particularly in regards to the effectiveness of the classroom teacher (Darling-Hammond, 2000; Hanushek, 2011).

Classroom-level factors that impact achievement include instructional strategies, classroom management, and classroom curriculum design (Cotton, 1995). Specific teachers have been shown to have a significant impact on their students' academic achievement (Sanders & Horn, 1994; Sanders, Wright, & Horn, 1997), as effective teachers can account for up to more than one year's academic growth when compared to their ineffective peers (Hanushek, 2010, 2011; Rivkin, Hanushek, & Kain, 2005).

Effective teachers are those teachers who consistently demonstrate larger gains in student achievement when compared to their peers (Hanushek, 2006). This is important because, as Hanushek (2011) has noted, two students starting at the "same level of achievement can know vastly different amounts at the end of a single year due solely to the teacher to which they're assigned" (p. 3). As one example, effective teachers accounted for more than 50 percentile points difference in the cumulative achievement gains of their students, which is a "stunning" amount than can "represent the differences between a 'remedial' label and placement in the 'accelerated' or even 'gifted' track" (Haycock, 1998, p. 4). While school-level and classroom-level factors do impact student achievement, the largest influence exists at the individual student level.

Factors at the individual student-level that influence achievement include demographic characteristics, home environment, background knowledge, and motivation (Carroll, 1963; Fraser, Walberg, Welch, & Hattie, 1987). While there have been some discussions of the exact percentages amongst the levels (e.g., Coleman, 1966), individual

student level variables have typically been shown to have around 80% of the overall influence on achievement (Bloom, 1976) as shown in Figure 1.1.

Figure 1.1. Factors Impacting Student Achievement. Adapted from “Visible learning: a synthesis of over 800 meta-analysis relating to achievement” by J. Hattie, 2009, New York: Taylor & Francis. Copyright 2009 by Taylor & Francis.

Student demographics such as race/ethnicity and socioeconomic status influence achievement. On average Black and Hispanic students have reading, writing and mathematics skills lower than those of their White peers (Stringfield, 1997), and Black students as a group are approximately two to three years behind White students in reading and math in America (Spellings, 2008). Educational attainment is also correlated with the home environment, including family income and exposure to poverty. Students from poorer families have a higher rate of dropping out of high school (32%) than their peers with no family poverty experiences (6%) (Chapman et al., 2010; Hernandez, 2011). Another individual student level factor that influences achievement is motivation, which has been shown to have a significant impact on student achievement (Tobias, 1994), accounting for 37% of the overall variance in student achievement (Willingham, Pollack, & Lewis, 2002). Students who are motivated typically achieve at a higher level than their non-motivated peers (Dweck & Master, 2009; Eccles & Roeser, 2009; Hodis, Meyer,

McClure, Weir, & Walkey, 2011), and in general motivation enhances and supports achievement (Yeung & McInerney, 2005).

Discrepancies in Educational Attainment and Achievement

As noted, academic achievement is a result of many factors at the school, classroom and individual student levels (Hanushek, 2011), and at each of these levels the components' variability results in tremendous differences in student achievement (Hattie, 2009). For example, students who attend an effective school are almost twice as likely to pass a test as those students who attend an ineffective school (65.8% to 34.2%, respectively) (Coleman, 1966). In addition, at the individual student level, background knowledge has accounted for up to 55% of the variance in achievement (Bloom, 1976). These differences at the three levels cause substantial discrepancies in student achievement that can be substantiated by indicators such as high school dropout rates (Rumberger, 1995, 2001), underachievement based on poverty (Jenson, 2009), and underachievement of demographic subgroups of the population (Fryer & Levitt, 2004).

Dropping out of school is a problem at both the national and state level. One recent study stated that nationally only 69% of an entering 9th grade class graduated within 4 years; in comparison, the high school completion rate in the Commonwealth of Virginia in the school year 2007-2008 was slightly higher at 77% (Chapman, Laird, & Kewal-Ramani, 2010). This means that approximately nationally 1.2 million students drop out of high school each year (Alliance for Excellent Education, 2011). A second indicator of discrepancies in achievement is students' exposure to poverty, which has a substantial influence on student's academic achievement (Hernandez, 2011). Students exposed to poverty typically score lower on academic achievement tests, develop weaker academic skills, and drop out more frequently than students who do not attend high-poverty schools

(Borman & D’Agostino, 1996; Hernandez, 2011; Ruby, 2006). A third indicator of these differences in achievement can be seen in the inconsistencies in educational achievement by racial subgroups of the population, which have been documented for several decades (Coleman, 1966; Rampey, Dion, & Donahue, 2009) and are depicted in Figure 1.2.

Figure 1.2. National Grade 8 NAEP Reading Scores 1992-2009. Adapted from “NAEP 2008: trends in academic progress” by B. Rampey, G. Dion, & P. Donahue, 2009, National Center for Education Statistics, Washington, D.C. Copyright 2009 by National Center for Education Statistics.

These racial achievement gaps have improved only slightly despite substantial efforts and tremendous financial resources (Dufour & Marzano, 2011), and the differences represented by these gaps have been described as causing a “permanent deep recession in terms of the gap between the actual and potential output of the economy” (McKinsey & Company, 2009, p. 18) due to the underachievement and low educational attainment of minority students.

Altogether, this clear evidence of long term inconsistencies and discrepancies in the achievement of American students suggests school leaders need to intervene to address these issues. Since individual student-level factors account for 80% of the

variance in student achievement (Bloom, 1976), school leaders should consider addressing factors at this level. Among these factors, motivation has been shown to have a large impact on achievement (Tobias, 1994) and it is an area that can be modified and enhanced to increase achievement (Dweck, 1986; Dweck & Master, 2009; Linnenbrink & Pintrich, 2002).

Motivation

Motivation is significantly associated with achievement (Dweck, 1986; Dweck & Elliott, 1983; Dweck & Molden, 2007; Willingham et al., 2002), and this relationship can be described either as one directional (Weiner, 1974) or as cyclical (Deci, Koestner, & Ryan, 2001). The relationship between motivation and achievement often is described as one directional, with motivation influencing achievement (McCaslin, 2006; Roeser, Urda, & Stephens, 2009; Wentzel, 2007; Wigfield & Wagner, 2007). However, if the relationship between motivation and achievement is considered to be reciprocal (e.g., Dweck & Master, 2009), then academic success or failure would also influence motivation (McCaslin, 2006). In this example, motivation impacts achievement, which then influences motivation, with the pattern repeating in a continuous cycle.

Considering the relationship as cyclical, then generally there are two potential cycles of academic achievement and motivation. Motivation could be seen to aid and to support academic achievement and success, and then this success in turn increases motivation (Weiner, 1985). This potentially results in a continuous cycle of high motivation and positive achievement. In contrast, there is also a potential recursive cycle of low motivation and failure. Students who are not motivated typically have lower achievement and lower effort than their peers (Morgan, Fuchs, Compton, Cordray, & Fuchs, 2008; Urda & Turner, 2007). As one example, frequent reading practice is

critical to “increasing sight word recognition, vocabulary, verbal fluency, reading comprehension, and general knowledge skills” (Morgan, 2008, p. 387), yet less motivated students typically read only one third the amount of their motivated peers, which results in lower reading achievement for the poorly-motivated students. In this scenario an academic failure or lower achievement would hinder motivation, which would lead to decreased motivation, which in turn would result in decreased achievement again (Roeser, Urdan, & Stephens, 2009), which potentially results in a negative cyclical pattern of low motivation and low achievement.

Some students often suffer a repeating cycle of failure and low motivation (Dweck, 2000; Morgan et al., 2008; Pintrich & de Groot, 1990). The term “Matthew Effect” (Stanovich, 1986), whereby the rich get richer and the poor get poorer, describes the phenomenon in education by which good students gain exponentially more exposure to new words and ideas than their peers who are struggling. Stanovich (1986) posited that some students’ repeated failures “initiate a causal chain of escalating negative side effects” (p. 364), and one of these “negative Matthew effects” from failure is decreased motivation, which leads students to put forth less effort and to read less than their peers. As Morgan (2008) has stated, decreased motivation as a result of past failure can result in a “cascade of ‘poor-get-poorer’ effects” (p. 388), including negative impacts on the students’ motivation, academic achievement and behavior in school. Low motivation has been shown to be associated with avoiding work in school and not being actively engaged in classroom lessons (Fulk, Brigham, & Lohman, 1998). Therefore, the potential result for struggling students is a recursive pattern of low motivation and failure and a belief

that they cannot improve their abilities through effort, which is a devastating problem for the most academically vulnerable students.

Statement of the Problem

Students can begin to struggle academically in elementary school, yet some students do not experience academic difficulties until they enter middle school in the sixth grade (Blackwell, Trzesniewski, & Dweck, 2007; Eccles & Wigfield, 1993; Eccles & Roeser, 2003; Eccles & Roeser, 2009; Roeser et al., 2009). Similar to the impact of motivation on achievement, other relevant factors that influence middle school students' achievement include the developmental stage of adolescence (Elmore, 2009) and the academic environment (Maehr & Fyans Jr., 1989). It is important to note the convergence of several events, such as the transition to a new school and the onset of puberty, that typically occur during the sixth grade year, which is when most American adolescents start middle school (Anderman & Maehr, 1994; Anderman & Mueller, 2010; Balfanz & Herzog, 2005; Balfanz & Byrnes, 2006; Balfanz, 2009; Heller, Calderon, & Medrich, 2003; Ruby, 2006). Many students suffer a decrease in their achievement during their transition year to middle school (Anderman & Mueller, 2010; Byrnes & Ruby, 2007). As one example of this decline, in an examination of over 500,000 Florida public school students' scores over an eight-year period, Schwerdt & West (2011) found that when students entered middle school in the sixth grade their relative performance in math achievement declined by 0.124 standard deviations and their reading achievement fell by 0.086 standard deviations ($p < .01$). There is widespread agreement among researchers that motivation and achievement decline in middle school and that this is a serious problem for American school leaders (Carnegie Council on Adolescent

Development, 1989; Dweck & Master, 2009; Eccles & Roeser, 2009; Elmore, 2009; Roeser et al., 2009; Simmons, Blyth, Van Cleave, & Bush, 1979; Simmons & Blyth, 1987).

Dweck (2009) has suggested that one way of aiding struggling adolescent students is through influencing their *self-theories*, which are individuals' beliefs about themselves (Erdley & Dweck, 1993; Dweck, 2000). Self-theories are also known in the literature as *mindsets* (Dweck, 2007) or *implicit theories* (Dweck, Chiu, & Hong, 1995a). Within this theoretical framework, individuals tend to prefer either a *growth mindset*, which is the belief that traits such as intelligence are malleable, or a *fixed mindset*, which is the belief that these traits are unchangeable or fixed (Dweck, 1986; Dweck & Leggett, 1988). Self-theories govern individuals' reactions to failures and challenges and provide a motivational framework that associates the role of effort vis-à-vis achievement (Nussbaum & Dweck, 2008). Dweck (2007) has stated that interventions, such as the Brainology™ computer program, that were designed to encourage students to adopt a growth mindset have resulted in higher academic achievement. The Brainology™ computer program, designed by researchers Dweck and Blackwell, is an intervention designed to influence individuals to prefer a growth mindset through a series of computer activities and lessons (Blackwell et al., 2007; Dweck & Master, 2009).

Purpose of the Study

There are five goals for the present study: (a) to examine the reading achievement of struggling adolescent students as a result of a growth mindset intervention, (b) to determine if there is a difference in the self-theories of struggling adolescent students following a growth mindset intervention, (c) to explore the relationship between

academic achievement and the self-theories of struggling adolescent students, (d) to examine the reading attitudes of struggling adolescent students as a result of a growth mindset intervention, and (e) to explore struggling adolescent students' experiences with the Brainology™ computer program.

Over the past forty years self-theories have been studied in a variety of settings and contexts (see Dweck & Master, 2009, for a further review), yet there appear to be two gaps in the existing literature. The first perceived gap concerns the exploration of the self-theories specifically of at-risk adolescent students. For example, do students who have personal characteristics that predict a potential discrepancy in educational achievement, such as being poor or having failed a prior assessment, belong primarily to the fixed or growth mindset? A second gap in the existing literature concerns the impact of a growth mindset intervention on the academic achievement of at-risk adolescent students who are involved in a reading intervention program. For example, can adopting a growth mindset influence the reading achievement of these at-risk adolescent students? Briceno, who works with researchers Dweck and Blackwell, has shared that there is currently no research concerning either of these two areas (E. Briceno, personal communication, November 11, 2010; February 5, 2012).

Research Questions

The purpose of the present pilot study is to explore these two gaps in the existing literature of self-theories. Therefore, the following five research questions guide the present study:

1. Is there a difference in the reading achievement of at-risk adolescent students in a reading intervention program after a growth mindset intervention?

2. What is the relationship between reading achievement and self-theories of at-risk adolescent students?
3. Is there a difference in the self-theories of at-risk adolescent students after a growth mindset intervention?
4. Is there a difference in at-risk adolescent students' attitudes about reading after a growth mindset intervention?
5. What were at-risk adolescent students' experiences with the Brainology™ computer program?

Rationale and Justification

Considerable differences exist in the educational attainment of American students, and student-level factors account for a significant amount of this variance (Hanushek, 2010; Tobias, 1994; Willingham et al., 2002). It is therefore appropriate to explore interventions at this level to increase achievement. Among the student-level factors, motivation is an area that schools can influence, unlike race or exposure to poverty. Dweck & Leggett (1988) have posited that self-theories create a “whole motivational framework” for students and place a particular value on effort. According to Dweck & Molden (2007), students' beliefs about the nature of their intelligence can often predict failure in academic situations during middle school. Students with a growth mindset typically outperform their peers during middle school, yet schools typically do not explore their students' mindsets (Dweck & Master, 2009). These beliefs are particularly important during adolescence because it is a “time when motivation, goals and sense of self are being defined, redefined, challenged, adopted, changed, and abandoned” (Yeung & McInerney, 2005, p. 539).

There is convincing evidence that schools need to intervene to increase student achievement. As DuFour & Marzano (2011) have written, the current American educational system

has 30% of its students drop out of high school, has one-third of its graduates who enter higher education requiring remediation, has one of the highest college dropout rates in the world, contributes to enormous gaps in achievement for minority and poor students, and has seen its relative success in educating its population plummet compared to other nations. (p. 9)

In Virginia during the 2010-11 school year, only 3% of school divisions (4 out of 132) and only 38% of schools (697 out of 1839) made Adequate Yearly Progress (AYP), which is the minimum amount of improvement that must be made annually in students' math and reading scores under the existing benchmarks for No Child Left Behind. This failure was particularly noticeable at the middle school level in Virginia, as only 9% (29 out of 308) of middle schools made AYP; this success rate was significantly lower than those at the elementary (47%) and high school (35%) levels (Pyle, 2011). Thus middle school students struggle even relative to their elementary and high school peers.

Yet it is possible to identify, and to intervene with, many at-risk students while they are still in middle school (Balfanz & Herzog, 2005; Balfanz, 2009). As an example, early predictors for 6th grade students who eventually drop out of high school include poor school attendance, negative classroom behavior, and failing courses in math or reading (Balfanz & Herzog, 2005). These easily-tracked predictors could be used to identify struggling students while they are in middle school at a time when their self-theories are malleable and amenable to intervention. This window of opportunity allows for school leaders to provide targeted interventions to enhance the success of struggling students. Because the primary role of school leaders is to ensure that all students achieve at high levels (Cotton, 2003; Fullan, 2008), if specific interventions were to have an

impact on struggling students' reading achievement this would be of considerable interest and utility to both researchers and practitioners.

Definition of Terms

The following terms are used repeatedly throughout this study, and they are defined here for the purpose of clarity for the reader.

1. *Adolescence*: While there is not a universally-agreed upon definition of adolescence (Adams, 2005), the majority of researchers describe adolescence as starting with the beginning of the physiological changes associated with puberty and ending with the transition to adulthood (Cote, 2009). Erikson (1994) described adolescence as a stage of development occurring between roughly the ages of 12 and 18.
2. *Motivation*: Ryan and Deci (2000) defined the term, *motivation*, as being “moved to do something...someone who is energized or activated toward an end is considered motivated” (p. 55). Covington (1992) stated that motivation “deals with the why of behavior: why, for example, do individuals choose to work on certain tasks and not on others...why do some people persist until the task is completed, whereas others give up before they really start” (pp. 12-3).
3. *Identity*: Erikson defined *identity* as “persistent sameness within oneself” (Erikson, 1994a; 1994b) . The Eriksonian definition of identity refers to the “sameness and continuity of the person’s psychological functioning, interpersonal behavior and commitments to roles, values and beliefs...sameness and continuity are the *sine qua non* of identity” (Cote, 2009, p. 267). Erikson further defined identity as a “feeling of being at home in one’s body, a sense of knowing ‘where one is going,’ and an inner

- assuredness of anticipated recognition from those who count” (Erikson, 1994b, p. 165).
4. *At-risk*: Students who are at risk of experiencing school failure, such as dropping out of high school, or experiencing underperformance in achievement or attainment (Pinkus, 2008). In the present study *at-risk* and *struggling* are synonymous.
 5. *Self-theories*: Self-theories are individuals’ beliefs about themselves (Erdley & Dweck, 1993; Levy, Stroessner, & Dweck, 1998). The terms *self-theories*, *implicit theories*, and *mindsets* are used interchangeably in the literature (Dweck & Master, 2009). These beliefs strongly impact what people want, how they try to obtain it, and how successful they are at obtaining it (Dweck, 2007). In the school setting, self-theories refer to students’ beliefs about “what intelligence is and how it works” (Dweck & Master, 2009, p.123). Self-theories further describe students’ beliefs about the “fixedness” or “malleability” of their intelligence (Dweck & Molden, 2007; Dweck, 2007).
 6. *Growth Mindset*. A growth mindset is the belief that traits such as intelligence are malleable and can increase with effort (Dweck, 2007). A growth mindset is the same concept as an *incremental theory* (Dweck, 1986) and these terms appear interchangeably in the literature (Dweck & Master, 2009).
 7. *Fixed Mindset*. A fixed mindset is the belief that traits such as intelligence are fixed or uncontrollable (Dweck, Chiu, & Hong, 1995b). A fixed mindset refers to the same concept as an *entity theory* (Dweck, 1986), and these terms also appear interchangeably in the literature (Dweck, 2007).

Organization of the Study

Chapter two presents an overview of the literature, providing a background on adolescence as a developmental stage, relevant motivational theories, and the academic environment for adolescent students. The methodology used for this study is described in chapter three. Chapter four presents the results of the study. Chapter five provides a discussion of the findings, a review of the findings and their relationship to the relevant literature, recommendations and implications for practice and research, a review of the limitations of this study, and conclusions.

CHAPTER TWO

REVIEW OF THE LITERATURE

The purpose of this chapter is to examine the pertinent literature for the present research study. Research concerning the topics of adolescent development, academic motivation, self-theories, and adolescents' academic environment will be discussed.

Adolescent Development

Adolescence is one of the most significant stages in human development (Adams, 2005) and a period of time of profound changes (Erikson, 1994b). During adolescence individuals develop their identity (Erikson, 1994a) and they make choices that typically influence the path of their lives as adults (Wigfield & Wagner, 2007). Adolescence is an “intriguing” stage (Blackwell et al., 2007) and a critically important developmental period with its own “unique set of challenges” (Curran-Neild & Nash, 2009).

Adolescence has been called a period of “storm and stress” (Hall, 1904) largely due to the rapid physiological, sociological and psychological changes that occur during these years (Adams, 2005; Anderman & Maehr, 1994; Anderman & Mueller, 2010; Eccles & Roeser, 2009; Kroger, 2003). Many of these changes converge during the 6th grade year (Eccles & Wigfield, 1993; Eccles & Roeser, 2009; Wentzel, 2007), making the transition from elementary school to middle school not only a seminal event (Eccles & Roeser, 2009; Wigfield, Eccles, & Pintrich, 1996) but also a topic worthy of further exploration

(Anderman & Mueller, 2010; Balfanz & Herzog, 2005; Balfanz & Byrnes, 2006; Byrnes & Ruby, 2007; Ruby, 2006).

Importance of Adolescent Development

The early adolescent years are an important determinant of future academic success or failure for many individuals (Bradshaw, O'Brennan, & McNeely, 2008; Dowrick & Crespo, 2005; Erdley, Cain, Loomis, Dumas-Hines, & Dweck, 1997; Perez-Johnson & Maynard, 2007; Richman, Rosenfeld, & Bowen, 1998). Students' academic achievement during middle school has a significant impact on their future opportunities and careers (Wigfield & Wagner, 2007), yet during adolescence many formerly-successful students begin to experience a decline in both their academic achievement and motivation (Dweck & Master, 2009; Eccles & Roeser, 2009; Roeser et al., 2009; Simmons, Blyth, Van Cleave, & Bush, 1979; Simmons & Blyth, 1987). Negative academic experiences during middle school can have "deleterious effects" on students' motivation to learn (Anderman & Mueller, 2010). While adolescence is an important developmental stage for all students (Allen & Allen, 2009; Cote, 2009; Simmons & Blyth, 1987), it is especially critical for at-risk students because for many of them it can be "a turning point towards a diminishing future" (Carnegie Council on Adolescent Development, 1989, p. 20).

In addition to the long term impact(s) of students' achievement in middle school, another critically important element of adolescent development is the development of an individual's identity (Erikson, 1994b). Dweck (2009) has suggested that one component of an identity is an individual's mindset, and that the discrepancies in academic achievement may also emanate from students' self-theories about the nature of their intelligence. As one example, Blackwell et al. (2007) found that students who believed

that their intelligence was malleable had higher academic achievement throughout middle school than those students who believed that their intelligence was fixed. This is important to consider with the context of the changes that occur during adolescence.

Changes during Adolescence

Changes during adolescence include enormous physiological, sociological, and psychological transformations (Elliot & Dweck, 2007) as well as changes in adolescents' academic environment (Eccles & Roeser, 2009). Adams (2005) has noted that adolescence is a "period of transformation, change and advancement" (p. 8) and Wigfield (1996) has posited that very few developmental periods are marked by as many changes as those occurring during adolescence. The changes that occur in early adolescence typically converge at the same time, particularly during 6th grade (Balfanz & Herzog, 2005), thereby increasing their individual impact (Anderman & Mueller, 2010; Dweck & Molden, 2007; Eccles & Wigfield, 1993; Eccles & Roeser, 2003; Eccles & Roeser, 2009; Simmons et al., 1979; Simmons & Blyth, 1987; Urdan & Turner, 2007; Wigfield et al., 1996; Wigfield & Wagner, 2007). The transformations during adolescence include physiological changes such as puberty, sociological changes such as the growing importance of peer relationships, and psychological changes such as identity formation (Erikson, 1994b).

Physiological changes. The rapid physiological changes that occur during adolescence are an exceptionally significant developmental milestone (Jackson & Davis, 2000). These changes and the timing of their onset are believed to have a substantial impact on adolescents' academic achievement as well as their sociological and psychological development (Eccles & Roeser, 2009; Simmons et al., 1979). Noteworthy

physiological changes that occur during adolescence include puberty and the continuous development of the brain.

Puberty and pubertal timing. The biological changes that occur during puberty are dramatic and life-changing (Wigfield & Wagner, 2007). Outside of prenatal development, these biological changes are the most intense physical transformations that occur during an individual's lifetime (Adams, 2005). During puberty individuals physically transition from children to adults and develop secondary sex characteristics (Anderman & Mueller, 2010).

While puberty itself is a normative event, the timing of the onset of puberty can vary dramatically (Wigfield et al., 1996; Wigfield & Wagner, 2007). Simmons and Blyth (1973, 1979, 1987) have posited that the primary impact of puberty on adolescent development concerns the timing of pubertal changes, which is typically quite different for adolescent boys and girls (Anderman & Mueller, 2010; Wigfield et al., 1996). Since girls enter puberty about 18 months before boys do (Adams, 2005), this means that during early adolescence boys and girls of the same age typically are in quite different stages in their physical development (Wigfield et al., 1996). This difference is important because for both boys and girls pubertal timing accounts for "substantial differences" in the sociological and psychological impacts of puberty (Adams, 2005). Similar to the continuous physical changes associated with puberty, during adolescence individuals' brains and intelligence continue to change and to develop (Ramsden et al., 2011).

Brain development. While many researchers over the past century previously believed that the brain did not develop after childhood and that intelligence was a fixed, unchangeable trait (Giedd et al., 2009; Jensen, 2009; Paus, 2005), emerging evidence

indicates that the brain continues to develop well into adulthood and that an individual's intelligence increases during the adolescent years (Kleim & Jones, 2008; Ramsden et al., 2011). Advancements in technology, including magnetic resonance imaging (MRI) and functional magnetic resonance imaging (fMRI), have clearly established that the brain continues to grow grey and white matter during adolescence (Durstun et al., 2001; Paus, 2005; Shaw, 2007). These changes during adolescence are similar to the profound changes to the brain that occur during fetal development (Giedd, 2004; Giedd et al., 2009). In addition, recent evidence (Ramsden et al., 2011) has linked these physical changes in the brain's development to increases in adolescents' intelligence as measured by their scores on IQ tests. Intelligence is a "changing and transforming ability" (Adams, 2005, p. 10) and it therefore has been described as a dynamic, not fixed, attribute by several recent scientific studies (see Dweck & Master, 2009, for a further review).

Sociological changes. In general most adolescents experience sociological changes concerning their relationships with peers and adults (Eccles & Roeser, 2003). Compared to children, adolescents rate social activities as very important and they typically enjoy them more than academic activities (Wigfield et al., 1996). As part of their increasing desire for autonomy, adolescents begin to orient themselves with their friends more than younger children do (Ryan, 2001) and the amount of time that they spend with their friends or peers increases (Adams, 2005). Adolescents' relationships with adults have also been shown to be important and influential on their achievement during this developmental stage (Hamre & Pianta, 2001).

Relationships with peers. Adolescents' relationships with their peers are exceptionally important to them (Urdu & Turner, 2007) and these relationships provide

a sense of “companionship and entertainment, help in solving problems, personal validation and emotional support, and...a foundation for identity development” (Wentzel, 2007, p. 279). Adolescent peer groups are believed to aid in the formation of individuals’ self-concepts and identities, and adolescent students who have positive peer relationships have been found to be more engaged in school than and outperform those students who have peer relationship problems (Wentzel, 2007). Negative peer pressure is a concern during adolescence, especially as it relates to academic achievement (Dowrick & Crespo, 2005), and students who have suffered from negative peer pressure have been found to perform poorer academically than their peers (Adams, 2005). Conversely adolescents who have positive relationships with their peers have higher levels of “emotional well-being” and self-esteem (Wentzel, 2007) and higher academic achievement (Wentzel, 2003) than their peers who do not have positive social relationships. Peer relationships have also been shown to influence academic motivation (Ryan, 2001). Students’ engagement and their desire to put forth extra effort on academic tasks may be enhanced by the ability to work with their friends and peers in school (Urdan & Turner, 2007), which suggests that external factors can influence student achievement.

Relationships with adults. In general, adolescent students desire positive relationships with adults including their parents and teachers (Anderman & Mueller, 2010). As they progress through school, students need to form positive relationships with their teachers, especially if they are students at-risk of discrepancies in educational achievement (Hamre & Pianta, 2001, 2005). Teachers’ beliefs about their students’ abilities have long been known to impact their students’ achievement (Cimpian, Arce, Markman, & Dweck, 2007; Dweck & Molden, 2007; Rosenthal, 1991; Strahan, 2008),

and Rosenthal (1968) found that teachers who believe that their students' intelligence could increase had higher student achievement than those teachers who believed that their students' intelligence was fixed. In addition to influencing their students' achievement, teachers have also been shown to impact their students' self-theories (Aronson et al., 2002; Good, Aronson, & Inzlicht, 2003). For example, teachers who praised students for their ability instead of their effort influenced their students to adopt a fixed mindset (Cimpian et al., 2007). Similar to the physiological and sociological changes that occur during adolescence are the profound psychological changes that also take place during this developmental stage.

Psychological Changes. Adolescence is also a period of noteworthy psychological changes (Cote, 2009; Erikson, 1994b; Wigfield & Wagner, 2007). During adolescence individuals desire autonomy and independence (Allen & Allen, 2009), and they begin the process of forming an identity. Adolescents want to make their own decisions and they wish to be in control of their own life and daily choices, including while they are at school (Adams, 2005); this means that typically they want to choose how to react to successes or failures at school (Allen & Allen, 2009). Autonomy is important because Dweck (2009) has posited that students who believe in a growth mindset typically choose to work harder when they have academic struggles, while students with a fixed mindset may choose to give up. In addition to the increased desire for autonomy, two other psychological changes during adolescence include the formation of adolescents' self-concepts as well as their identities.

Self-concepts. Adolescence is a critical period for the development of self-concept beliefs such as *self-esteem* (Rosenberg, 1989), *self-confidence* (Bénabou &

Tirole, 2002) and *self-efficacy* (Bandura, 1977). Self-concepts, which are individuals' collective self-perceptions (Schunk, 1991), can be a "powerful motivational force" (Adams, 2005) in school. While there is evidence that self-concepts decline during adolescence (Blackwell et al., 2007; Simmons & Blyth, 1987), recent research suggests that at-risk students are particularly vulnerable to this decline (Cote, 2009). Self-efficacy is particularly relevant to the present study because it refers to individuals' beliefs about their own ability to accomplish a task (Bandura, 1977, 1997), as well as individuals' "judgments of their capabilities to perform specific tasks in specific situations" (Urduan & Turner, 2007, p. 301). Self-efficacy beliefs are a powerful predictor of academic achievement, particularly during adolescence (Bandura, 1977; Pajares & Urduan, 2006; Schunk, 1991; Zimmerman, Bandura, & Martinez-Pons, 1992).

Adolescents typically feel more self-efficacious than elementary age students (Schunk & Meece, 2006) and middle school students who reported high levels of self-efficacy have been shown to have higher levels of academic achievement and longer task persistence than their peers with low self-efficacy (Dweck & Leggett, 1988; Lent, Brown, & Larkin, 1984). Self-efficacy beliefs and achievement are linked because students are more likely to "engage and to persist in an activity, and they exert more effort during the activity, when they believe they are able to succeed at the activity" (Urduan & Turner, 2007, p. 301). Dweck (2000, 2006, 2009) has suggested that individuals who prefer a growth mindset have a higher level of self-efficacy than their peers with a fixed mindset. In addition to self-efficacy, other noteworthy psychological changes during adolescence concern the psychosocial developmental stages as well as the formation of individuals' identity.

Latency stage and identity formation. Erikson dominates the human development and identity fields (Anderman & Mueller, 2010; Kroger, 2003) and is the “recognized pioneer of identity theory” (Cote, 2009, p.267). Erikson’s work has been described as “groundbreaking” (Wigfield et al., 1996), “paradigmatic” (Weigert, Teitge, & Teitge, 1986) and as a “springboard” for empirical research (Grotevant, 1987). Erikson (1994a) posited that individuals undergo psychological changes as they pass through eight stages of psychosocial development during their lives. Erikson (1994b) believed that the growth of personality and the formation of an identity occurred during these stages, and two of these stages, latency and adolescence, are particularly pertinent to this study because they coincide with the ages (11-14) of students who are in middle school. Latency was described as occurring between the ages of 7 and 12, while adolescence is described as generally occurring between the ages of 12 and 18 (Erikson, 1994b).

The dominant theme during the latency stage is the search for competence, specifically the battle of industry vs. inferiority. Erikson defined *industry* as “being busy doing something, learning to complete something, doing a job” (Evans, 1967, pp. 27-28), while *inferiority* was defined as the belief that one “will never be any good” (Erikson, 1994a, p. 125). Students who feel inferior give up and do not put forth effort on academic tasks. Dweck (2009) has suggested that students who believe in a fixed mindset may avoid challenges because they do not want to feel inferior to their peers, while those students who believe in a growth mindset embrace challenges as new opportunities to learn and to acquire competency.

According to Erikson (1994a), during the latency stage most children are motivated to be industrious and to create or to complete a task or project to its end.

Dweck & Leggett (1988) have suggested that there is an innate desire to acquire and to exercise competence, and competence beliefs have been linked to academic performance and the effort spent on academic tasks (Wigfield & Wagner, 2007). Competence is important for adolescents because it becomes a part of their self-concept, the basis upon which other people measure them and the reason other people respect them (Dweck & Molden, 2007). Dweck (2009) has theorized that students' beliefs about competence vary based on their self-theories concerning their intelligence. As one example, students who hold an entity theory believe that their competence is based on their ability to succeed immediately, whereas students who hold an incremental theory believe competence is something that develops over time. According to Erikson (1994b), these competence beliefs provide a foundation for the next developmental stage and the formation of individuals' identities.

Adolescence and identity formation. According to Erikson (1994a), the fifth phase of development is the adolescent stage, which occurs from roughly ages 12 to 18. Perhaps the most significant psychological change during adolescence is the development of an individual's identity (Anderman & Mueller, 2010; Erikson, 1994a; Wigfield et al., 1996). Identity is a "psychological construct that refers to how individuals make meaning for themselves through discovery and psychological construction" (Adams, 2005, p. 8) as well as a "conscious sense of individual's uniqueness as well as an unconscious striving for continuity of experience" (Kroger, 2003, p. 206). Erikson (1994a) posited that an identity provides a link or connection between one's past and future. Since identities are typically stable over time (Wigfield et al., 1996), they govern patterns of behavior and responses in academic settings (Cote, 2009; Dweck & Elliott, 1983; Dweck & Molden,

2007). Adolescents' identity development has critical implications for the development of their academic motivation (Wigfield & Wagner, 2007).

Erikson believed that identity formation was a normative event of adolescence because it typically happened for the large majority of the population (Cote, 2009). Adolescents negotiate and explore opportunities and different roles in order to synthesize these experiences into a "coherent sense of self" (Wigfield & Wagner, 2007). As one example, adolescents begin to judge themselves by their accomplishments and failures in school (Elmore, 2009; Roeser et al., 2009).

The Eriksonian viewpoint would therefore suggest that many students develop their academic identity during adolescence and that students' successes and failures can contribute to their identities as well as their motivation at school (Dweck & Master, 2009). During the adolescent years there is an increasing attention paid to the "winners and losers" in terms of academic work as compared to elementary school (Elmore, 2009), and for students who are already at-risk of school failure, these years are particularly important as they develop their beliefs about their academic identities and abilities (Roeser et al., 2009). As Elmore (2009) has noted, most students first experience of "unqualified, public failure-- academic failure, failure to make the team, failure to make friendships with the most popular group of peers, and so on" (p. 194) occurs during the middle grades. The tendency to view students by what they have accomplished can have negative impacts on students' identities and effort because it can influence students to adopt an entity theory. Dweck (2007) has suggested that those students who believe that their intelligence is a fixed entity may desire to appear smart instead of working hard,

while those students who believe in an incremental theory eschew looking smart and instead focus on learning.

Theories of Motivation

Motivation is a “catalyzing ingredient” for academic success (Christensen, Johnson, & Horn, 2008). As previously noted, students’ motivation and their academic achievement are closely associated (Yeung & McInerney, 2005), and motivation theorists like Dweck (2007) posit that students’ competence beliefs and goals are related to their performance and the amount of effort that they put into academic activities (Wigfield & Wagner, 2007). Wigfield (1996) has stated that, according to the Eriksonian viewpoint, individuals’ self-worth develops from their sense of competence at an activity as well as that activity’s importance to them. Students who struggle in school often have a diminished sense of self-worth and self-esteem which, in turn, reduces their motivation to engage in academic tasks and can result in a recursive pattern of low motivation and low achievement (Morgan et al., 2008).

Importance of Motivation during Adolescence

Adolescent students’ achievement beliefs have been extensively researched (Blackwell et al., 2007; Dweck & Molden, 2007; Eccles & Roeser, 2009; Mok, Kennedy, & Moore, 2011; Roeser et al., 2009; Weiner, 1985; Weiner, 1991; Wentzel & Wigfield, 2009). As previously noted, there are discrepancies among students in their educational achievement and attainment (Hanushek, 2011), and an individual student’s motivation is largely considered to be one “causal factor” in these differing levels of academic achievement (Yeung & McInerney, 2005). Researchers have studied the relationships between motivation and students’ academic achievement, particularly in the areas of eliminating racial achievement gaps (Aronson et al., 2002; Good et al., 2003) and gender

achievement gaps (Ceci & Williams, 2007). Motivation has been shown to account for variance in student achievement (Willingham et al., 2002), and it is widely considered to be a “potentially modifiable predictor of academic achievement” (Hodis et al., 2011, p. 313). Dweck (1986, 1988, 2007) has suggested that differences in levels of motivation and achievement can be attributed to the individuals’ mindset about the malleability of personal qualities such as their intelligence.

While motivation is important during every period of life, it is critical during adolescence because of that stage’s significance in human development (Erikson, 1994a; Erikson, 1994b). In general, students’ level of motivation and achievement declines during the adolescent years (Anderman & Maehr, 1994; Anderman & Mueller, 2010; Dweck & Master, 2009; Maehr & Meyer, 1997; Simmons & Blyth, 1987). The relationship between students’ motivation and their academic achievement is cyclical, as it is believed that if students are interested in the content then they generally do well in that subject, and if they are not interested in the content and not motivated then they usually will not achieve at a high level. Students who are not motivated may reject and abandon a learning task before they have succeeded (Christensen et al., 2008). Abandoning a task before completion is one component of the “learned helplessness” response, which has been shown to be learned rather than innate behavior (Abramson, Seligman, & Teasdale, 1978). Learned helplessness consists of both low motivation and low achievement (Dweck, 1986; Dweck & Leggett, 1988), and it is negatively associated with academic success (Dweck, 1975). Rattan, Good & Dweck (2012) have suggested that students who believe that their intelligence is fixed typically have a learned helplessness response when they encounter failure or challenging situations in school.

This potentially sets up a recursive pattern of low motivation, low effort and low achievement.

Motivation is critically important in education, especially in the area of improving achievement for struggling students who may be trapped in a recursive pattern of failure and low motivation (Anderman & Mueller, 2010; Blackwell et al., 2007; Dweck & Master, 2009). Terrel Bell, former U.S. Secretary of Education, posited that motivation was the single most important variable in education, particularly in regards to helping at-risk students raise their achievement and attainment (Covington, 2000; Maehr & Meyer, 1997). It has been a growing concern for many researchers that adolescence is a period when many formerly-successful students begin to experience reduced motivation and interest in school (see Yeung & McInerney, 2005, for a review). These declines, however, are not inevitable, and it has been suggested (Dweck & Master, 2009) that increased motivation and achievement can come from a change in individuals' self-concepts or theories of their own abilities (Bouffard, Vezeau, & Bordeleau, 1998).

Overview of Relevant Theories of Motivation

Theoretical frameworks concerning students' beliefs about their academic achievement include the drive theory of motivation (Atkinson, 1957), achievement goals (Dweck & Leggett, 1988), attributions for failure and success (Weiner, 1985), perceptions of self-efficacy (Bandura, 1997), intrinsic and extrinsic motivation (Deci, Koestner, & Ryan, 2001), and self-theories of intelligence (Dweck & Master, 2009).

The drive theory of motivation (Atkinson, 1957; McClelland, 1965) is foundational to modern theories of academic motivation. According to drive theory, motivation is an "internal state, need, or condition that impels individuals toward action" (Covington, 2000, p. 171) and motivation arises from two opposing forces: the drive for

success and achievement and the drive to minimize pain by avoiding failure. Dweck (2007) has hypothesized that these drives are similar to individuals' self-theories concerning the nature of their intelligence. Many of the emerging theories since McClelland (1965) (see Weiner, 1985) have been based on the idea of a "motives-as-goals" tradition (e.g., Dweck, 1986) in which students are actively engaged in thinking about their own learning (Covington, 2000). Two of these motivational theories that are relevant to the present study include Achievement Goal Theory and Attribution Theory.

Achievement Goal Theory. Achievement goals describe students' beliefs about the reasons that they choose to participate in academic tasks (Ames & Archer, 1988). The Achievement Goal theoretical framework suggests that individuals have different purposes that cause them to engage or not to engage in certain activities, and these purposes are known as goals or goal orientations (Urdu, 2007). Within achievement goal theory, motivation is powered by a "valuing of both competence acquisition (learning goals) and competence validation (performance goals)" (Dweck & Molden, 2007, p. 122). Learning goal orientation, which is also known as "task mastery" or "mastery goals," concerns students' desire to master the material and to learn new things (Wigfield & Wagner, 2007). Dweck (1986) has posited that learning goals are connected to incremental self-theories or a growth mindset.

In contrast, competence validation, also known as "performance goals" or "ego-involving orientation," concerns students' desire to outperform their peers and to be perceived as successful at tasks by others (Dweck, 2007; Wigfield & Wagner, 2007) or to avoid appearing incompetent as compared to their peers (Urdu & Turner, 2007). Dweck (1986, 2009) has suggested that performance goal orientation is similar to an entity self-

theory or a fixed mindset. Performance orientation has also been associated with reduced effort and task persistence (Covington, 2000).

Adolescents often believe that their academic performance defines their identity (Cote, 2009). Perhaps because many middle school environments are focused on comparisons of students relative to their peers (Elmore, 2009), adolescent students have reported that they are less mastery-oriented and more performance-oriented than they were in elementary school (Anderman & Mueller, 2010). Researchers have suggested that performance-goals are more prevalent in middle school than in elementary schools (Wigfield et al., 1996). This is important because it means the adolescent academic environment can set the stage for adolescent students to be primed to adopt an entity theory of intelligence.

Attribution Theory. The Attribution Theory of motivation (Weiner, 1974, 1985) is also a cognitive model that incorporates both students' self-efficacy and their perceptions of the causes of their successes and failures. According to this theory, students attribute their academic achievement to one of four causes: effort, luck, task difficulty, or ability (Weiner, 1985). Based on this theory, students' beliefs about their failures and successes have important consequences for "subsequent feelings, expectancies, and behavior" (Andrews & Debus, 1978, p. 154). As an example, Covington & Omelich (1979) found that students who attributed success to effort and who failed at a task into which they put high effort believed that others judged them to be low in innate ability. As Covington (1992) has explained, one of the most significant components of Attribution Theory is the focus on the importance of effort in academic

achievement because it provides a theoretical framework in which success is associated with effort.

Based on the Attribution Theory, students perceive the reasons for their academic success or failure, and when they describe these reasons to others they typically use styles that are either “learned helplessness,” one’s actions will never result in success (see Abramson et al., 1978), or “learned optimism,” one can overcome failures by hard work and effort (see Seligman & Nathan, 1998). As Dweck (1986) has noted, the negative helplessness trait is learned, and more importantly, it is one that can be modified by experiences. It is believed that students are motivated to put more effort into academic tasks when they believe that they have control over the outcome (DeCharms & DeCharms, 1968). Attribution theorists posit that if students believe their academic achievement is a result of factors they can control they will be more motivated and they will generally achieve at a higher level than if they feel they do not have a sense of control over their own learning (Covington, 1992; Covington, 2000; Urdan & Turner, 2007; Weiner, 1995). As one example, in some academic subjects, such as mathematics, males and females have been found to differ in their attributions for their successes and failures. Male students typically attribute their success to ability, while females generally attribute their success to effort (Nicholls, 1978). Female students have also been shown to be more likely to respond with learned helplessness than their male peers in challenging academic situations (Dweck, Davidson, Nelson, & Enna, 1978; Rattan et al., 2012)

Attribution Theory suggests that teachers can encourage their students to develop a sense of control over their academic successes and failures by helping them to connect their performance, especially their struggles in school, as attributable to the amount of

effort put forth on the task (Urdan & Turner, 2007). This is important because when academic tasks are difficult or when students experience failure, Dweck (2009) has suggested that these beliefs govern the students' reactions and their perceptions of what caused the failure. Emerging out of the Achievement Goal and Attribution Theories is the "self-theories" or mindset work of Dweck (e.g., 2009), which has fundamentally changed traditional beliefs about the relationships among students' motivation, intelligence and achievement (Wigfield & Wagner, 2007).

Self-Theories. Researchers have long debated what intelligence is and whether or not it can be increased or if it's a fixed attribute (Aronson et al., 2002; Binet, 1984; Ramsden et al., 2011). One point in this debate that often has been overlooked is the impact on achievement of students' beliefs about their own intelligence (Mangels, Butterfield, Lamb, Good, & Dweck, 2006). Individuals' beliefs about their intelligence and, more specifically, whether or not they believe that they can increase their intelligence and achievement through effort have a strong influence on their success in school (Dweck & Leggett, 1988).

In a school setting *self-theories* or *mindsets* describe students' beliefs about the nature of their intelligence and how it works (Dweck, 1986). Self-theories concerning intelligence have been built upon several decades of empirical research (e.g., Diener & Dweck, 1978), including studies in which the stereotype threat (see Steele & Aronson, 1995) was eliminated (Aronson et al., 2002; Good et al., 2003) and the gender gap in science and math performance was reduced (Dweck, 2006). Self-theories have been validated in empirical research studied across cultures (e.g. university students in Hong Kong), developmental stages (PK-12, college students, graduate students) and across

demographics (gender and ethnic groups) (see Dweck & Master, 2009, for a further review). Yeager & Walton (2011) have described the effect of self-theories on student achievement as “robust.”

Growth vs. fixed mindset. Students who believe that intelligence is a fixed trait agree with the *entity theory* or *fixed mindset*; they support statements such as that if “individuals have a lot of intelligence, then they are in good shape, but if they don’t, there is not really anything they can do about it” (Dweck & Master, 2009, p. 124). In contrast, students who believe that intelligence is malleable or can be increased through effort agree with the *incremental theory* or *growth mindset*; these students believe statements such as “the more effort they put in, the more they will learn and the better their ability will be” (Dweck & Master, 2009, p. 124). Students’ mindsets therefore set up different patterns of responses to challenges, obstacles, failure and effort, as can be seen in Figure 2.1.

Figure 2.1. Differences in Fixed and Growth Mindsets. Reprinted with permission of the illustrator.

Self-theories lead to different patterns of motivation, which create different frameworks for students to respond to academic tasks, how much effort they will put into the tasks, and how successful they will be at the task (Dweck & Leggett, 1988). Binet (1984), who developed the IQ test, was a strong supporter of the incremental or growth theory of intelligence (Dweck & Master, 2009). Binet stated that some people assert

that an individual's intelligence is a fixed quantity which cannot be increased. We must protest and react against this brutal pessimism...with practice, training, and above all method, we manage to increase our attention, our memory, our judgment, and literally to become more intelligent than we were before. (Binet, 1984, pp. 106-107)

It is important to note that believing in an incremental theory does not mean believing that all individuals have the same potential, but instead means that individuals can continue to increase their intelligence (Blackwell et al., 2007).

Measurement. Self-theories can be assessed with questionnaires (Hong et al., 1999) that measure individuals' responses to statements that support specific examples of a particular self-theory. The influence of individuals' self-theories on their motivation and behavior can be assessed in domains outside intellectual settings (Dweck, 1995a). For example, the impact of self-theories has been evaluated in athletic situations (Jourden, Bandura, & Banfield, 1991), interpersonal relationships (Kammrath & Dweck, 2006), and in business situations (Wood & Bandura, 1989).

In a school setting students who believe in a fixed mindset or an entity self-theory agree with statements such as "Your intelligence is something very basic about you that you can't really change" (Dweck & Master, 2009, p. 124). Students who believe in a growth mindset or an incremental self-theory agree with statements such as "Everyone, no matter who they are, can substantially increase their intelligence" (Dweck & Master,

2009, p. 125). Individuals' responses to these statements are marked on a 6 point Likert scale with Cronbach alphas in the .90-.96 range, indicating a high level of internal consistency (Dweck, Chiu, & Hong, 1995a). Students may agree with some aspects of both beliefs (Dweck, Chiu, & Hong, 1995b), but typically they will support one theory over the other. As an example, individuals could believe that their ability in reading is fixed but that they could improve their math ability (Dweck & Master, 2009). It is important to note that students' mindset in a particular domain, such as reading, will impact their motivation in that area, particularly in their reaction(s) to failure and difficult tasks.

It has been suggested that there is an even distribution in the population between individuals who hold entity theories and incremental theories, with about 20% of the population undecided between the two theories (Dweck & Molden, 2007). Self-theories are consistent over time (Robins & Pals, 2002), yet it is possible to influence students' self-theories. Studies have demonstrated that students have adopted a growth self-theory based on reading a scientific article (Hong et al., 1999), by watching a movie or lecture (Aronson et al., 2002; Blackwell et al., 2007), or through the use of a computer program called Brainology™ (Dweck & Master, 2009).

Different learning goals and outcomes. Self-theories have been connected to achievement goals (Dweck, 2000; Robins & Pals, 2002), and students' patterns of response to academic tasks (Dweck & Elliott, 1983). Dweck (1986, 2002, 2007) has argued that in general students have two separate patterns of responding to situations that are challenging: they may show a "helpless pattern" or a "mastery-oriented pattern." Dweck, Davidson, Nelson, & Enna (1978) discovered that those students who had

performance goals, who wanted to demonstrate their ability or intelligence, usually had a helpless response to a challenging situation, while those students who had learning goals, who desired to improve their ability or intelligence, typically had a mastery-oriented pattern. Dweck found that the differences in students' goals were related to their beliefs about the nature of intelligence (Dweck & Leggett, 1988): whether they believed that intelligence was something that was fixed or if it were a trait that could be increased.

Experimental research has shown that students who had a fixed view of intelligence were more likely to have performance goals and a helpless pattern or response to difficult tasks, while those who believe that intelligence was something that could change were likely to have learning goals and a mastery-oriented response pattern (Dweck & Molden, 2007; Dweck & Leggett, 1988; Erdley et al., 1997). An incremental theory was significantly associated with positive learning strategies ($r = .45, p < 0.01$), learning goals ($r = .34, p < 0.01$), low helpless attributions ($r = .44, p < 0.01$) and positive effort beliefs ($r = .54, p < 0.01$) (Blackwell et al., 2007). This is important because it suggests that students who hold an entity theory are less likely to attribute success with effort and they are more likely to give up on difficult tasks than their peers who hold incremental theories. As one example, adolescent students ($n = 28$) who held an entity theory spent less time working on their academic weaknesses and more time worrying about their performance, $F(1,24) = -2.71, p < .01, \beta = -.48$, as compared to their peers who held an incremental theory; the achievement of students who endorsed an entity theory was also shown to be less than their incremental theory peers, $F(1,24) = 6.45, p < .001, \beta = .49$ (Da Fonseca et al., 2008). In another example, college engineering students ($n = 26$) who held an incremental theory were significantly more likely to be interested in

a voluntary help session to improve an identified area of weakness than their entity peers, $t(24) = -2.32, p < .05, d = 0.90$. Almost 91% of the incremental theory students but only 54% of their entity peers attended the voluntary tutorial, $\chi^2(1, N = 26) = 4.21, p < 0.05$ (Nussbaum & Dweck, 2008). Therefore students who hold an entity theory choose different learning goals for academic tasks and have different responses to difficult task or failure than their incremental peers.

Role and value of effort. Adolescents can be taught to attribute their academic success to their effort on a task (Tollefson, Tracy, Johnsen, Farmer, & Buening, 1984) and students' motivation can place restrictions on their effort in school (Yeung & McInerney, 2005). Middle school students, particularly those students who are at-risk of school failure, need to attribute success to effort and vice versa (Balfanz, 2009). As noted, self-theories provide two different frameworks concerning the importance and value of effort. (Blackwell et al., 2007). Students who hold an incremental theory believe that their success is associated with the amount of effort they dedicate to the task; these students typically will choose to work harder so that they can succeed on a given task. When students hold an entity theory, however, they believe that effort will not help them improve since their ability is fixed and that “no amount of effort can bridge the gap between smart and not smart” (Dweck & Master, 2009, p. 127). Entity theorists believe that students interpret failure as “low ability, and that the need for effort implies [that students have] low ability” (Dweck, Chiu, & Hong, 1995b, p. 325). In a study involving 97 undergraduate students, students with an incremental theory were significantly more likely to attribute their success to effort while entity theory students attributed their success to ability, $F(1, 76) = 5.02, p < .05$. Entity-oriented students were also

significantly more likely to believe that poor performance was a result of poor ability rather than a lack of effort, $r(29) = 3.39, p = <0.01$ (Hong et al., 1999). Students who are at-risk of school failure in reading and hold an entity theory are therefore in double jeopardy: they need to put forth more effort to improve, but they believe that their ability cannot improve with effort and that their effort will not impact their achievement. Dweck (2007) has posited that this situation may be the reason why so many adolescent students struggle in middle school. In elementary school these students did not have to put forth effort to appear smart, and now that they need to work hard to achieve they choose not to work harder because they believe it will not aid their achievement.

Failure. As Dweck (2009) has noted, self-theories may not have a tremendous amount of impact on students' achievement as long as they are succeeding in school. When students are faced with challenges, such as low achievement, however, their self-theories provide the framework for their response. Students with an entity theory associate failure with a lack of competence or ability (Dweck, 2007), and students may also believe their failure to be related to reasons outside their control, such as the unfairness of the test. When adolescent students with an entity theory failed at a task in school, they have responded with negative strategies that avoided effort (Blackwell et al., 2007). Adolescents with a fixed view of intelligence have been more discouraged during academic challenges than their growth mindset peers (Dweck, 2000). Students who held an incremental theory, in contrast, believe that their failure is associated with their lack of effort (Dweck & Master, 2009). These students have been more resilient after an academic failure and more motivated to increase their effort in order to succeed in the future than their fixed mindset peers (Dweck, 2000).

Achievement and performance. Self-theories are correlated with adolescents' achievement (Dweck & Molden, 2007), and Rattan, Good and Dweck (2012) have written that students' implicit theories of ability "affect their motivation, learning and achievement outcomes" (p. 731). As an example, when students entered middle school, their theories of intelligence predicted math achievement in 7th grade ($r = .12, p < .05$) and in 8th grade ($r = .20, p < .05$) (Blackwell et al., 2007). Self-theories can also be used to predict students' reactions to negative stereotypes about their ability (Dweck & Master, 2009). Bright female students typically underperform in school, particularly in math classes during adolescence (Spencer, Steele, & Quinn, 1999). While researchers have often posited that this diminished achievement may be the result of stereotype threats (Steele & Aronson, 1995) concerning females in math and science (Good et al., 2003), Dweck (2006) has also argued that students' self-theories influence their reactions to these perceived threats and thus their achievement. Collegiate female math students who believed that others held negative beliefs about females and math were found to differ in their reactions to this gender threat. Those students who began the course believing

that math was a gift (an innate ability) began to feel more and more uncomfortable as the course went on, and afterwards many chose not to pursue math courses in the future. In contrast, those who believed that ability could be improved were far less affected by the negative stereotypes. Thus, having an entity theory can make students more vulnerable to negative stereotypes about their group, and may even help perpetuate the stereotypes by keeping otherwise well-qualified women from pursuing careers in math and science. (Dweck, 2006, p.133)

Students can be influenced to adopt a growth mindset (Mueller & Dweck, 1998) to overcome stereotype threats, and female students who adopted a growth mindset had higher math achievement than their female entity peers (Cohen's $d = 1.13$) for their math

scores (Good, Aronson, & Inzlicht, 2003). This large effect size means that the growth mindset intervention had a significant impact on the female students' math scores.

Students with equal intellectual ability have different responses to academic tasks and challenges, and these responses are shaped by their theories of intelligence (Dweck, 1988). The impact of self-theories on achievement exists both on single item assessments and over time during middle school. As an example, differences in achievement between the two theories can be seen on a single assessment (Da Fonseca et al., 2008), as students who held an incremental theory outperformed students with an entity theory on an IQ test when both groups were given time to prepare and to practice before taking the test. Entity theory was positively associated with an increased amount of worrying about ability and relative performance, $F(1, 44) = 12.18, p < .01 (R^2 = .47)$, and it was negatively associated with practice time, $F(1, 44) = 8.20, p < .01 (R^2 = -.40)$ and overall IQ performance, $F(1, 44) = 13.18, p < .01 (R^2 = -.41)$. Students who endorsed an entity theory thus worried more about their performance, practiced less and ultimately scored lower than their incremental theory peers (Cury, Da Fonseca, Zahn, & Elliot, 2008).

In a five year longitudinal study, Blackwell et al. (2007) found that adolescent students ($n=373$) who held an incremental theory had higher math achievement over a two year period in middle school than their peers who held entity theories. There was a significant effect of self-theory on math grades from students' fall 7th grade scores to spring 8th grade scores, $\beta = .53, t = 2.93, p < .05$. In a follow up study, students in the experimental condition ($n=48$) received eight class sessions on topics such as brain plasticity and how individuals could increase their intelligence, while students in the control group ($n=41$) received eight class session on topics like mnemonic strategies and

how memory works. A significant effect of the treatment was found on changes in math grades, $b = .53$, $t = 2.93$, $p < .05$ (Blackwell et al., 2007). It is important to recognize that the intervention and class lessons used in this five year longitudinal study later provided the foundation and framework for the Brainology™ computer program (Blackwell et al., 2007; E. Briceno, personal communication, November 11, 2010).

Developing and influencing self-theories. Students' self-theories can be influenced, and even a small intervention can change students' self-theories and thereby lead to improved academic achievement because it increases students' "values of learning and improvement, and their belief in the efficacy of their efforts" (Dweck & Molden, 2007, p. 136). Self-theories are malleable and can be changed or manipulated, particularly by classroom teachers. Teachers' classroom behaviors have long been extensively examined (e.g., Brophy & Good, 1984), including in the area of teachers' feedback to students (Hamre & Pianta, 2001; Hamre & Pianta, 2005). One component of teacher feedback is praise (Corpus & Lepper, 2007; Mueller & Dweck, 1998), which is particularly important because it impacts young students' motivation (Cimpian et al., 2007). As one example, kindergartners ($n=135$) were randomly-assigned to five different treatment conditions involving generic or nongeneric praise. Generic praise, such as "you are a good drawer," was designed to influence or to confirm an entity theory, while nongeneric praise, such as "you worked hard on that drawing," was designed to influence or to confirm an incremental theory. There was a significant linear trend for persistence, $F(1, 130) = 28.21$, $p < .001$, and for self-evaluations, $F(1, 130) = 18.79$, $p < .001$, which suggests that when young children were exposed to high levels of nongeneric praise, they developed a mastery goal orientation and higher level of task persistence (Zentall &

Morris, 2010). Mastery goal orientation and task persistence are components of an incremental theory (Dweck, 2007), which means that nongeneric praise influenced students in this study to adopt a growth mindset.

Dweck (2007) has stated that changing a self-theory or belief has a tremendous influence on student learning because it is “at the heart of students’ motivation” (p. 136).

As Dweck (2009) explains, self-theories have enormous implications for students

they (a) affect their goals in school-whether students are interested in looking smart or learning; (b) their belief in the usefulness of effort-viewing effort as something negative or something positive; (c) the way that they explain their failures-as conveying a lack of ability or simply a lack of effort or a poor strategy; and (d) the strategies they use after a setback- giving up or persevering. (p. 124)

Self-theories are not necessarily fixed, and it is possible to prime or to teach individuals to hold different self-theories (e.g., Aronson et al., 2002). Because self-theories create an entire motivational framework, academic interventions that “carefully target these beliefs have had a meaningful impact on how enthusiastic children are about learning and how successfully they learn” (Dweck & Master, 2009, p. 130). One way of influencing students’ mindsets is at the classroom level, particularly through the classroom teacher (Cimpian et al., 2007; Mueller & Dweck, 1998; Zentall & Morris, 2010) or a growth mindset intervention (Blackwell et al., 2007; Dweck, 2007, 2009).

Teachers have a significant impact on students’ achievement (Hattie, 2009) and they can influence their students’ self-theories (Mueller & Dweck, 1998; Rattan et al., 2012). As an example, researchers demonstrated that praising students ($n = 24$) for their ability leads students to adopt a fixed view of intelligence and a helpless response to difficulty, $t(22) = 2.86$, $p_{\text{rep}} = .953$, $d = 1.17$, while praising students for their effort leads them to adopt the incremental theory that their intelligence is malleable and more task

persistence, $t(22) = 2.28$, $p_{\text{rep}} = .903$, $d = 0.93$ (Cimpian et al., 2007). In addition to teachers' impact in the classroom, it is also possible to influence students' mindsets directly. A computer-based program called Brainology™ can influence students to adopt an incremental self-theory or a growth mindset (Dweck & Master, 2009).

The Brainology™ program teaches students to adopt a growth mindset, in particular the idea that intelligence is malleable and that effort is positively associated with success. The Brainology™ program uses a blended learning environment that includes a computer program as well as classroom lessons with a teacher. There are five computer lessons that use animated characters to take a tour of the human brain to learn about topics such as intelligence, brain plasticity, and effort. As previously noted, adolescent students who adopted a growth mindset as a result of an intervention similar to Brainology™ had higher grades and higher levels of effort compared to their fixed mindset peers (Blackwell et al., 2007).

Academic Environment for Adolescents

Adolescents spend a significant amount of their lives in school (Eccles & Roeser, 2009). The average adolescent student in America spends over 7,000 hours in school between the ages of 11 and 18, not including extracurricular activities, homework, or other school activities (Elmore, 2009). In the Commonwealth of Virginia school attendance is compulsory during adolescence (VA Code § 22.1-254). What happens during the school day and over the years has a significant influence on student achievement (Byrnes & Ruby, 2007; Dufour & Marzano, 2011; Hanushek, 2010).

In examining the academic environment for adolescent students, it is important to note the role of *systems ecology* (Odum & Barrett, 1971) as it pertains to student achievement. One component of systems ecology relevant to education is the concept of

nesting, which is the idea that in a multilevel system “each level is made up of groups of lower-level units (populations are composed of groups of organisms, for example)” (Odum & Barrett, 1971, p. 7). In the academic environment this means that school districts are composed of groups of schools, schools are composed of groups of classrooms, and classrooms are composed of groups of individual students. Therefore individual students are nested with teachers within classrooms, within schools and also within school districts, all of which can have an impact on their academic achievement (Waters & Marzano, 2006). School leaders who desire to improve student achievement must therefore consider this “multilevel organizational structure in which schooling occurs” (Hill & Rowe, 1996, p. 1).

Importance of Academic Environment

There is strong research support for the influence of the school environment, particularly the classroom environment and instructional practices, on adolescent students’ motivation to learn and their achievement (see Cleary, 2009, for a review). School level factors, including time, monitoring, school climate, and school leadership (Scheerens & Bosker, 1997), have been determined to account for 20% of the variance in student achievement. Effective schools can have an effect on achievement regardless of students’ personal characteristics such as race or exposure to poverty (Stringfield, 1997; Stringfield & Datnow, 2002; Teddlie & Stringfield, 1993). Effective schools have been found to “increase the achievement of its students by more than one full year” over a four year period, which is a “substantial school effect” (Chubb & Moe, 1990, p. 140).

Two primary components of effective schools include a consistent curriculum and a safe and orderly environment (Edmonds, 1979; Sammons et al., 1995; Scheerens & Bosker, 1997). Students need to have an opportunity to learn the curricula (McDonnell,

1995) and an adequate amount of daily instructional time to cover the curricula (Marzano, Kendall, & Gaddy, 1999) in order for them to achieve at a high level. There is a strong support that a safe and orderly academic environment is critical for student achievement (Chubb & Moe, 1990; Edmonds, 1979; 1981; Hanushek, 2011), yet the evidence clearly demonstrates that even in the most effective schools some students do not achieve at high levels (Dufour & Marzano, 2011).

School is a struggle for some students (Dweck & Master, 2009). While there are students who do struggle in elementary school, adolescence is a period during which many formerly successful students begin to experience declining achievement and declining motivation (Balfanz & Herzog, 2005; Balfanz et al., 2007; Blackwell et al., 2007; Eccles & Wigfield, 1993). These declines in middle school achievement can predict discrepancies in educational attainment such as dropping out of high school (Eccles & Roeser, 2009) or even dropping out of middle school (Bonsteel, 2011; Rumberger, 1995).

Balfanz (2009) has stated that middle schools are the “launching pad” for success in secondary school and beyond, meaning that middle schools are particularly important in identifying and intervening with at-risk students. The adolescent academic environment is important in fostering a supportive network for students to achieve success in school, especially for minority students and students who attend school in high-poverty areas (Anderman & Mueller, 2010; Balfanz & Herzog, 2005; Balfanz et al., 2007; Byrnes & Ruby, 2007; Ruby, 2006). Key components of adolescents’ academic environment include the organization and structure of middle schools, discrepancies and declines in achievement, and academic interventions to help struggling students.

Middle Schools

Middle school students have been called the “underperformers of the U.S. educational system” (Balfanz, 2007, p. 223) because their achievement is lower than both their elementary and high school peers. The majority of American adolescent students attend a middle school that is comprised of grades six, seven and eight (Anderman & Mueller, 2010; Byrnes & Ruby, 2007; Schultz, Evans, & Serpell, 2009). When students begin middle school they encounter a system that is vastly different from elementary school (Eccles & Wigfield, 1993; Eccles & Roeser, 2003; Eccles & Roeser, 2009) and they discover that “real school” has begun (Elmore, 2009). Key components of middle schools include their organization, their differences from elementary schools, and the effectiveness of the classroom teacher.

Organization of middle schools. The current typical American middle school contains grades six, seven and eight, which is a configuration that has grown substantially from the 1970’s to the present day (Elmore, 2009). There is some emerging evidence that students in schools with grades K-8 achieve better than their peers in schools with grades 6-8 (Elmore, 2009) and that some states are shifting back to K-8 schools (Byrnes & Ruby, 2007), yet the clear majority of American students currently attend a grades 6-8 middle school (Balfanz et al., 2007). While junior high schools that contained grades 7, 8 and 9 were the primary organizational model during the early to mid-1900’s in America (Curran-Neild & Nash, 2009), middle schools were later formed as a response to the developmental needs of adolescents (Anderman & Mueller, 2010; Byrnes & Ruby, 2007; Elmore, 2009; Jackson & Davis, 2000; Ruby, 2006). One goal of the reform movement was to use specific pedagogical strategies and other “best practices” such as team

teaching to increase achievement at the middle school level (Jackson & Davis, 2000; Midgeley, 1995; Midgley, Anderman, & Hicks, 1995).

A second goal of the middle school reform movement was to isolate early adolescents to focus specifically on their unique developmental and behavioral needs (Byrnes & Ruby, 2007). Adolescents tend to desire an increasing amount of autonomy and independence (Eccles & Roeser, 2003; Simmons & Blyth, 1987; Wigfield et al., 1996), so middle schools were intended to increase opportunities for students to have more autonomy in middle school than in elementary schools (Jackson & Davis, 2000). While there have been efforts to make middle schools more developmentally appropriate, there is strong evidence that middle schools as they are currently operated are not a good developmental fit for early adolescents (see Eccles & Roeser, 2009, for a further review). As an example, currently middle schools are designed to emphasize competition and social comparison between and among students, which occurs during a time of heightened social awareness (Wentzel, 2007; Wentzel, 2003; Wentzel & Wigfield, 2009; Wigfield & Wagner, 2007). These instructional and grading practices can encourage students to adopt performance goals in lieu of mastery goals (Maehr & Midgley, 1996), which can lead students to adopt a fixed mindset (Dweck & Elliott, 1983; Dweck & Leggett, 1988; Mueller & Dweck, 1998). The result of developmental mismatches and middle schools' reliance on performance goals is that there is an increased "risk of negative motivational outcomes, especially for adolescents who are having difficulty succeeding in school academically" (Eccles, 2009, p. 140).

Differences between elementary and middle schools. There are substantial differences between elementary and middle schools. The size of a typical American

middle school (600 students) is significantly larger than an elementary school (400 students) (Elmore, 2009). Adolescents are exposed to multiple teachers each day because secondary teachers in American schools, such as those in middle schools, are specialists (Anderman & Mueller, 2010; Byrnes & Ruby, 2007; Ruby, 2006). As a result, middle school students transition between teachers throughout the day, and they must keep up with multiple teachers, teaching styles, and classrooms (Anderman & Mueller, 2010; Jackson & Davis, 2000). This is also important to consider within the framework of systems ecology with multiple influences on individual students each day.

Another difference between elementary and middle schools can be seen in the secondary schools' focus on performance instead of mastery goals. Elementary and secondary schools are distinct organizationally and they have a different "ethos" (Midgley, Feldlaufer, & Eccles, 1989). These differences influence students' achievement and motivation, because the learning environment has been shown to have a direct link to students' motivation in early adolescence (Midgley et al., 1995). Since learning environments demonstrate which achievement goal is valued as important (Maehr & Midgley, 1991), it is important to note that middle schools do more ability or performance ranking and less task mastery activities than elementary schools (Maehr & Anderman, 1993). The prevalence of performance goals in middle schools influences students' motivation (Maehr & Fyans Jr, 1989; Maehr & Midgley, 1991) and their mindset (Dweck & Master, 2009). This is important because the reliance on performance goals in middle schools can prime students to adopt a fixed mindset, which has been shown to be associated with decreased task persistence, effective learning strategies, belief in the value of effort, and academic performance (Blackwell et al., 2007; Cimpian

et al., 2007; Dweck & Leggett, 1988; Eccles & Roeser, 2003; Elliot & Dweck, 2007; Grant & Dweck, 2003; Mangels et al., 2006; Midgley et al., 1995; Midgley, 1995).

Classroom teachers. While school-level factors are important, the effectiveness of the classroom teacher has a larger influence on student achievement (Darling-Hammond, 1997; Darling-Hammond, 2000; Hattie, 2009). In fact, the quality of the teacher has the most influence on student achievement of any other controllable attribute in a school (Barber & Olsen, 2004; Hanushek, 2011). While there has been some discussion about the conceptual and methodological issues of some large-scale studies of teacher effectiveness (Rowan, Correnti, & Miller, 2002), there is clear evidence that the effectiveness of the classroom teacher has a significant impact on student achievement (Brophy & Good, 1984; Darling-Hammond, 2000). As one example, in a large scale study of Title 1 elementary student achievement, Rowan et al. (2002) found that teachers accounted for 60% of the reliable variance in students' reading achievement after controlling for students' background variables with a *d*-type effect size of .77.

Teachers' beliefs about their students also have an impact on student achievement (Cimpian et al., 2007; Dweck & Molden, 2007; Strahan, 2008). *Teacher expectations effects* (Rosenthal & Jacobson, 1968) is the phenomenon by which teachers' beliefs about their students' ability affects students' performance. Teachers who had been told that certain students' intelligence would increase during the year influenced these students to make significantly greater increases in IQ scores when compared to the control students (Rosenthal, 1968). This is important because as DuFour (2011) has written, effective teachers "believe that the ability of students to learn is changeable rather than fixed, and they are able to foster that effort that leads to achievement" (p. 17). Therefore, both at the

school and classroom level there are differences in the academic environment between elementary and middle schools, and these differences have been used to explain the discrepancies and declines in achievement as students begin middle school (Anderman & Maehr, 1994; Anderman & Mueller, 2010; Blackwell et al., 2007; Eccles & Wigfield, 1993; Eccles & Roeser, 2003; Eccles & Roeser, 2009; Maehr & Meyer, 1997).

Discrepancies in Achievement

There is “substantial evidence” of declines in motivation and achievement during the early adolescent years (see Eccles & Wigfield, 1993, for a further review).

Adolescent students are typically believed to be at-risk of these discrepancies in achievement if they fall into demographic or functional categories (or both) (Hamre & Pianta, 2005). As one example, one of the strongest demographic predictors of academic risk is a low level of maternal education (Alexander, Entwisle, & Kabbani, 2001; Christian, Morrison, & Bryant, 1998). Another definition of at-risk is functional, such as behavioral problems in the classroom (Alexander et al., 2001; Hamre & Pianta, 2001) or poor attendance (Balfanz, 2009). Some of these discrepancies in educational achievement include high school dropout rates, underachievement based on poverty, underachievement of racial subgroups, and the academic declines that occur during adolescence.

High school dropout rates. Although it is, at best, only a very basic indicator of overall student academic success, the high school graduation rate is nevertheless important because it is the “barometer of the health of American society and the skill level of its future workforce” (Heckman & LaFontaine, 2010, p. 244). There are certain demographic characteristics, such as gender and race, associated with dropping out of high school, and it is possible to identify students who are in danger of dropping of high

school while they are in 6th grade (Balfanz, 2005, 2009). Nationally the average high school graduation rates for Asian (80%) and White (77%) students are significantly higher than the rates for their Hispanic (58%) and Black (53%) peers (Swanson, 2008). Similar to the national trends, in Virginia the average on-time graduation rates for Asian (95%) and White (90%) students were also higher than the rates for their Hispanic (79%) and Black (80%) peers (Virginia Department of Education, 2011). Boys are generally more likely to drop out of school than girls (Chapman et al., 2010), and minority students are at a greater risk of dropping out of high school than white students (Borman & D'Agostino, 1996; Puma, 1993; Puma et al., 1997; Stringfield, 1997). Poverty is also linked with dropping out of high school, as students in the bottom 20% of family incomes are six times more likely to drop out of high school than their peers in the top 20% of family incomes (Jensen, 2009; Uline & Johnson, 2005).

Dropping out of high school can have a tremendous influence on the quality of individuals' lives, particularly in regards to their earning potential and career opportunities. Nationally students who drop out of high school earn on average \$22, 000, which is less than their peers who graduated high school (\$31,000) and those who graduated from college (\$51,000) (Swanson, 2011). Over their lifetime high school drop-outs will earn \$1 million less than their college graduate peers (Spellings, 2008). The economic impact of school failure is not simply in annual salary differences, as students who do not graduate from high school are at an increased risk of receiving public assistance or being unemployed, poor, incarcerated, unhealthy, a single parent, or on death row when compared to their peers who did graduate (Baum & Ma, 2007) . As Swain-Bradway (2009) notes, students who do not graduate from high school are also at

an increased risk of drug use or homelessness compared to their peers who graduate from high school, and they are more prone to be sick and to die earlier than their peers who did graduate (Kolata, 2007). In addition to impacts at the individual level, these differences cause a serious burden on the general public and local communities (Balfanz, 2009; Zvoch, 2006). Students who drop out of high school are significantly more likely to need public services such as food stamps, unemployment benefits, welfare and housing assistance (Pinkus, 2008; Zachry, 2010). These services are expensive to provide, and it has been suggested that the U.S. government would see a lifetime savings of \$45 billion from providing these services if all students currently in high school were to graduate (Levin, Belfield, Muennig, & Rouse, 2007). On a state level, it has been estimated that the students who dropped out of the class of 2008 will cost the Commonwealth of Virginia \$7.6 billion in lost wages alone over the course of their lifetime (Alliance for Excellent Education, 2009).

There have been some improvements in the national graduation rate over the past thirty years (Swanson, 2011), yet the United States has recently slipped from 1st to 10th place internationally in its percentage of adults with a high school diploma (Spellings, 2008). While there is disagreement about the methodologies for calculating graduation rates and the accuracy of the data (Alan & Viadero, 2005; Greene & Winters, 2002), states do consistently acknowledge that not every student who begins 9th grade will graduate from high school. Perhaps more concerning, many states and districts are now acknowledging that students drop out of middle school and never even begin high school (Bonsteel, 2011; Rumberger, 1995). In addition to the United States' comparative low

levels of graduation, there are noticeable discrepancies in the achievement of students according to their exposure to poverty.

Underachievement based on poverty. Students' exposure to poverty means that they may come to school hungry, perhaps with chronic or acute health issues, and without having had the solid foundation that a high quality preschool program provided their age-appropriate peers (Jensen, 2009). Balfanz (2007, 2009) has found that students who attend a high poverty middle school have a significantly greater chance of dropping out of school than students who do not attend middle school in a poor environment. Obtaining a high school diploma is a "good predictor of economic well-being and earnings" (Ou & Reynolds, 2006, p. 193), but it is a particularly important achievement for poor, urban minority students because it permits social mobility and changes in occupations; unfortunately minority students who live in poor, urban areas have only a 50% chance of graduating from high school (Swanson, 2008). Students with exposure to poverty underachieve on national and state exams. For example, on the 2009 NAEP Grade 8 Reading exam in Virginia, students with exposure to poverty scored significantly lower than the overall average (251 to 266, respectively), and on the 2010-11 Virginia SOL Reading exam, students with exposure to poverty had a pass rate (80%) that was lower than the average pass percentage (88%).

Students who have exposure to poverty have lower levels of achievement and brain functioning when compared to their non-poor peers. As Jensen (2009) has noted, students' socioeconomic status (SES) is "strongly associated" with IQ tests, literacy, and achievement tests. A low level of SES has accounted for IQ scores that were 6 to 13 points lower than students' non-poor peers (Brooks-Gunn & Duncan, 1997), which is a

“very large difference” that may account for the difference between being placed in a special education class or a regular education class. Using a 20-year set of longitudinal data in Baltimore, Baydar, Brooks–Gunn, and Furstenberg (1993) reported that among 250 mothers, family income had a significant effect on mean literacy scores of their children, with the low income score (72.4) significantly lower than the higher income score (78.1). Gottfried, Gottfried, Bathurst, Guerin, and Parramore (2003) found a correlation of + .40 between academic achievement and aspects of SES, such as father’s occupation and mother’s education; the level of SES also accounted for up to 20% of the variance in student achievement. Children with exposure to poverty also have significantly worse cognitive control and language development than their non-exposed peers (Noble, Norman, & Farah, 2005). In a study of 60 kindergarteners in Philadelphia with both low SES and middle SES students, there was a significant main effect for low SES on cognitive performance, $F(1, 57) = 13.6, p < .0005$. There was also a significant effect of SES on language development, $t(58) = -4.3, p < .0001$ (Noble et al., 2005).

Schools can help students who are exposed to poverty succeed (Reeves, 2003), yet most students who are poor “lack access to high-quality, well-resourced schools” (Datnow et al., 2010, p. 2) and effective teachers. Most poor and/or urban students are assigned mostly beginning or unlicensed teachers (Hanushek, 2010) who produce significantly weaker results in terms of student achievement as compared to their licensed colleagues who have taught for at least three years (Curran-Neild & Nash, 2009). The result of these factors is that students exposed to poverty typically score lower on academic achievement tests, develop weaker academic skills, and drop out more frequently than students who do not attend high-poverty schools (Borman & D’Agostino,

1996; Hernandez, 2011; Ruby, 2006). In addition to high school dropout rates and the underachievement of students with exposure to poverty, discrepancies in educational achievement can also be seen in the underperformance of racial subgroups of the population.

Underachievement of racial subgroups of the population. It is often difficult to disentangle race and exposure to poverty as variables when examining student achievement because students who attend high-poverty schools are predominantly Black and Hispanic (Ruby, 2006), yet there are notable examples of underachievement by racial subgroups of the population. Beginning at the start of kindergarten and throughout the first few years of school, Black students underachieve relative to their White peers of the same socioeconomic status (Fryer & Levitt, 2004). These racial achievement gaps continue throughout students' time in school (Hanushek, 2010; McKinsey & Company, 2009). As an example, a comparison of mean test scores generally finds "Black students scoring 1 standard deviation below White students on standardized tests" (Fryer, 2004, p. 447). Minority students, such as Black students, are on average two years behind their White peers in reading and mathematics (Stringfield, 1997; Stringfield & Datnow, 2002). Within schools, Black students generally have lower classroom grades than their White or Asian peers (Aronson et al., 2002; Good et al., 2003).

In the Commonwealth of Virginia, national and state assessments clearly document the existence of this underachievement of racial subgroups. The 2009 Grade 8 Reading National Assessment of Educational Progress (NAEP) data for Virginia show noticeable achievement gaps by race (Figure 2.2).

Figure 2.2. 2010-2011 Grade 8 Virginia Reading NAEP scores by racial subgroups. Adapted from “NAEP 2008: trends in academic progress” by B. Rampey, G. Dion, & P. Donahue, 2009, National Center for Education Statistics, Washington, D.C. Copyright 2009 by National Center for Education Statistics.

Although the percentages are more positive for the 2010-11 Virginia Standards of Learning (SOL) exams, they also show comparable racial achievement gaps (Figure 2.3).

Figure 2.3. 2010-11 Grade 8 Virginia Reading SOL pass rates by racial subgroups. Adapted from the “2011 Virginia State Report Card.”

The evidence, therefore, shows that there is underachievement by racial subgroups of the population in Virginia on both the national and state assessments. This is particularly concerning because the United States is projected to be a “minority-majority” country in the coming decades (Bernstein, 2008), meaning that this underachievement by subgroups will have a serious impact for many decades. As McKinsey & Company (2009) has reported, this underachievement will have the equivalent of a “permanent, deep recession in terms of the gap between actual and potential output of the economy” (p. 18).

Since Coleman (1966) reported this underachievement by racial subgroups, there have been numerous reasons posited to explain these achievement gaps, including factors at the school (Hanushek & Rivkin, 2006), classroom (Rivkin, Hanushek, & Kain, 2005) and individual student (Dweck & Master, 2009) levels. Possible explanations have included “differences in genetic make-up, differences in family structure and poverty, differences in school quality, racial bias in testing or teachers’ perceptions, and differences in culture, socialization, or behavior” (Fryer & Levitt, 2004, p. 447). Regardless of its precise cause(s), however, racial achievement gaps remain a substantial concern despite decades of research and interventions (Cohen, Garcia, Apfel, & Master, 2006; Coleman, 1966; Dufour & Marzano, 2011; McKinsey & Company, 2009; Uline & Johnson, 2005).

Declines in Motivation and Achievement

The transition from elementary school to middle school is particularly difficult and problematic for many students (Anderman & Mueller, 2010; Blackwell et al., 2007; Carnegie Council on Adolescent Development, 1989; Dweck, 2006; Dweck, 2007; Dweck & Master, 2009; Eccles & Wigfield, 1993; Eccles & Roeser, 2009; Elmore, 2009; Jackson & Davis, 2000; Simmons et al., 1979; Simmons & Blyth, 1987). The transition

to middle school is when many students begin to struggle academically for the first time (Blackwell et al., 2007), and the decline is often significant for minorities (Aronson et al., 2002; Steele & Aronson, 1995) and girls in the areas of math and science (Good et al., 2003). Wigfield (1996) has written that there is evidence that the middle school years, and in particular the 6th grade year, is the start of a “downward spiral” for some students and that this spiral typically leads to “behavioral and emotional disengagement from school” (Balfanz, 2007, p.223). Two examples of these declines during adolescence can be seen in the areas of motivation and achievement.

Declines in motivation. There is strong evidence of declines in motivation as early adolescent students enter middle school (Anderman & Maehr, 1994; Anderman & Mueller, 2010; Dweck & Elliott, 1983; Dweck, 1986; Eccles & Wigfield, 1993; Eccles & Roeser, 2009; Maehr & Anderman, 1993; Wigfield & Wagner, 2007). The transition to middle school has been described as having a “harmful” (Eccles & Roeser, 2003) impact on motivation. Motivational constructs that decline during early adolescence include intrinsic motivation (Cameron & Pierce, 1994; Deci et al., 2001; Hodis et al., 2011), self-efficacy (Cleary, 2009; Lent et al., 1984; Schunk & Meece, 2006), mastery goals (Byrnes & Ruby, 2007; Grant & Dweck, 2003; Hodis et al., 2011), and interest in school (Wigfield et al., 1996; Wigfield & Wagner, 2007). The impact of these declines in motivation are particularly harmful to low-performing students, who may choose to respond with either learned helplessness or other ego-protecting strategies that will ultimately decrease their achievement in school (Covington & Dray, 2002).

Declines in achievement. Similar to the declines in motivation, there is strong evidence that there are substantial declines in academic achievement when students

transition to middle school (Balfanz & Byrnes, 2006; Blackwell et al., 2007; Byrnes & Ruby, 2007; Curran-Neild & Nash, 2009; Heller et al., 2003; Henderson & Dweck, 1990; Hodis et al., 2011; Maehr & Fyans Jr, 1989; Mok et al., 2011; Rivkin et al., 2005; Ruby, 2006; White, 1982). Declines in academic achievement can be seen on national and state standardized assessments (Eccles & Roeser, 2009), as well as with increased test anxiety (Wigfield et al., 1996; Wigfield & Wagner, 2007) and middle and high school dropout rates (Anderman & Mueller, 2010; Balfanz et al., 2007; Balfanz, 2009). These declines are typically worse for poor and/or minority students (Edmonds, 1979; Hernandez, 2011; Jensen, 2009) as well as those students who have a fixed mindset (Blackwell et al., 2007; Dweck, 2007; Robins & Pals, 2002).

The declines in adolescents' motivation and achievement as students enter middle school are substantial and concerning. As previously noted, middle schools have been described as the “underperformers” of American schools, and only 9% of Virginia middle schools made AYP during the 2010-11 school year. There is “sufficient evidence of declines in various indicators of academic motivation, behavior and self-perception over the early adolescent years to make one wonder what is happening” (Eccles, 2009, p. 419) in middle schools. These declines, coupled with the discrepancies in educational achievement that already exist in schools, strongly support the need for academic interventions.

Academic Interventions

When students struggle, school leaders must ensure that the school intervenes to increase their achievement (Blackwell et al., 2007; Dufour & Marzano, 2011; Fuchs et al., 2010; Kavale, Kauffman, Bachmeier, & LeFever, 2008; Lee, Gomez, Baird, & Keramidas, 2008; Morgan et al., 2008). These academic interventions help students to

access and, hopefully, to master the curriculum (Brozo, 2009; Fuchs & Fuchs, 2009), and they should be designed so that these services can eliminate unnecessary academic failure (Hale, Kaufman, Naglieri, & Kavale, 2006). Effective interventions can support students who have exposure to poverty and/or who are racial minorities (Stringfield & Datnow, 2002). For example, students who received Title 1 services and who participated in the Chicago Child-Parent (CPC) Preschool Program were later found to have had more years of education (11.33 vs. 10.93, $p < .001$), higher levels of graduating from high school or earning a General Equivalency Diploma (GED) (67% vs. 55%, $p < .001$), and a higher rate of college attendance (23% vs. 18%, $p = 0.055$) than their peers (Ou & Reynolds, 2006). Seventh grade Black students who participated in a brief in-class writing assignment as an intervention designed to reduce the stereotype threat (Steele & Aronson, 1995) had a 40% lower performance gap in their grade point average (GPA) following the intervention compared to the control group (0.30 compared to 0.75, $t(31) = 2.74$, $p < 0.01$) (Cohen, Garcia, Apfel, & Master, 2006). These academic interventions exist at several levels, including at the national, school, and classroom levels.

Interventions at the national level. American students have received a free public education since the 1860's (Uline & Johnson, 2005), and several notable federal laws and court cases have attempted to increase students' equal access to this education regardless of their race, level of poverty, native language, or disability status. The landmark Supreme Court case *Brown v. Board of Education* (1954) stated that separated schools were inherently unequal, thereby ending racially-segregated schools in America. The Elementary and Secondary Education Act of 1965, and in particular Title 1 (1965), has provided additional resources to help schools serve students who are in low-income

schools. The Supreme Court case *Lau v. Nichols* (1974) has required schools to serve non-native English speakers' needs in school. The Education of All Handicapped Children Act of 1975, now known as the Individuals with Disabilities Education Act (IDEA) (1997), has safeguarded students with disabilities by ensuring that they would still receive a free and public education.

The revised Individuals with Disabilities Education Improvement Act (IDEIA) of 2004 required schools to have a “structured and timely approach to students who experience difficulty in school” (DuFour, 2011, p.175); this approach is known as Response to Intervention (RTI). The RTI model is currently the dominant academic intervention program in the United States (Fuchs & Deshler, 2007; Fuchs et al., 2010), and it provides early academic interventions to all children who were considered to be at risk of school failure (Fuchs & Fuchs, 2006). While national policies can offer a structured framework for intervention services for students at-risk of school failure (Ardoin et al., 2005; Barnett, Daly, & Jones, 2004; Brozo, 2009; Fuchs & Fuchs, 2006; Fuchs et al., 2010; Gersten & Dimino, 2006; Kavale et al., 2008), academic interventions that occur at the school level are important in increasing student achievement, particularly in the area of improving reading achievement (Chall, 1983).

Interventions at the school level. The task of summarizing all of the academic interventions suggested to be effective is beyond the scope of a single paper (Good et al., 1998), yet there are several factors at the school level that are especially relevant to this study. At the school level, opportunity to learn, monitoring, and time are aspects of the intervention process (Fuchs & Fuchs, 2006). In regards to opportunity to learn, students should receive quality initial instruction before an academic intervention is deemed

necessary (Ardoyn et al., 2005; Kavale, Holdnack, & Mostert, 2005; Wodrich, Spencer, & Daley, 2006) because without quality initial instruction, it is impossible to determine if the student needs an academic intervention (Fuchs et al., 2010). In terms of monitoring, systematic and continued efforts to identify and to monitor struggling students is critical (Sammons et al., 1995; Scheerens & Bosker, 1997). Finally, time must be devoted to the intervention process, as students who struggle in school must be provided sufficient classroom time for both initial instruction and interventions (Dufour & Marzano, 2011; Morgan et al., 2008).

It is important to note that brief psychological interventions have been shown to have an impact on academic achievement. Walton & Cohen (2011) reported on a 3 year longitudinal student in which a brief social-psychological intervention increased Black college students' GPA and reduced the achievement gap between Black and White students' GPA, $B = 0.30$, $t(65) = 2.54$, $P = 0.014$. Yeager & Walton (2011) reviewed 11 empirical research studies in which brief psychological interventions had significant effects on student achievement. As they noted, these interventions worked because they "targeted students' experiences in school from the students' perspectives and deployed powerful...persuasive tactics to deliver the treatment message" (Yeager & Walton, p. 285).

Perhaps the most important intervention that can be made in a school is to ensure that every teacher is effective (Darling-Hammond, 1997; Hanushek, 2011). Teacher effectiveness is an "elusive concept to define" (p. 340) when considering the complex world of teaching, including teachers' qualifications, instructional practices, and effects on student learning, or a combination of these three elements (Stronge, Ward, & Grant,

2011). While it may be difficult to define, the difference in teachers' effectiveness is a "strong determinant of differences in student learning, far outweighing the effects of differences in class size and heterogeneity" (Darling-Hammond, 2000, p. 2). The most effective teachers can account for a 54 –percentile point difference in achievement (83% to 29%) when compared to their least effective peers (Sanders & Horn, 1994; Sanders et al., 1997). Teacher effectiveness was estimated to explain between 7-21% of the variance in student achievement by a meta-analysis of 18 studies over 25 years (Nye, Konstantopoulos, & Hedges, 2004). As Stronge (2011) has noted, the "differences in student achievement in mathematics and reading for effective teachers and less effective teachers were more than 30 percentile points" (p. 348). In one year, the difference in gains was .59 standard deviations, as the most effective reading teachers' students improved from the 43rd percentile to the 54th percentile, while the least effective reading teachers' students declined from the 43rd percentile to the 21st percentile, $n = 1,984$, $p < 0.05$ (Stronge, 2011). There is therefore sufficient evidence that the quality of the teacher influences student achievement and in particular reading achievement. Yet it is important to note that it is not just an issue of *whom* struggling students receive as a teacher as much as it is *what* they do in the intervention process that influences their reading achievement.

The majority of reading interventions occur during the elementary years (Clay, 1985; Foorman, Francis, Shaywitz, Shaywitz, & Fletcher, 1997), primarily because of the impact that Matthew effects (Walberg, 1983) have on students' reading achievement (Stanovich, 1986). However, despite the intense focus many schools provide to promote early literacy, many adolescent students still struggle to read (Rampey, Dion, & Donahue,

2009; Slavin, Cheung, Groff, & Lake, 2008), and there is a clear need for reading interventions to improve adolescents' literacy (Moore, Bean, Birdyshaw, & Rycik, 1999). Allington (2001) has suggested that components of research-based reading interventions include improving initial classroom instruction, increasing access to intensive, expert instruction and daily instructional time, and expanding the interventions to be a part of students' entire school careers. It is important to note that "no single intervention will ever meet the needs of all struggling readers" (Biancarosa & Snow, 2004, p. 19), yet one reading intervention program that has been suggested as increasing adolescent students' reading achievement is Read180 (Slavin, Cheung, Groff, & Lake, 2008).

Read180 is a reading intervention program designed for students in elementary through high school who are struggling to meet grade level proficiency (Haslam, White, & Klinge, 2006). Since its initial deployment in 1999, Read180 has been used in over 10,000 classrooms in all 50 states (What Works Clearinghouse, 2009). According to the What Works Clearinghouse (WWC) (2009), Read180 met WWC evidence standards "with reservations" and was found to have "potentially positive effects on comprehension and general literacy achievement" (p. 1).

The primary purpose of the Read180 program is to help struggling students to "improve their word reading efficiency, reading comprehension and vocabulary, and oral reading fluency (Kim, Samson, Fitzgerlad, & Hartry, 2010, p. 1111). Read180 utilizes a "mixed methods approach" (Slavin, Cheung, Groff, & Lake, 2008) composed of three primary components: an individualized computer program, independent and leveled books for independent reading, and direct instruction in reading skills (What Works Clearinghouse, 2009). Students typically rotate through these three components in small

groups of 5-6 students during each class session (Haslam et al., 2006). The Read180 software program includes “videos, mostly about science and social studies topics...and [then] students read about the video content and engage in comprehension, vocabulary, fluency, and word-study activities around this content” (Slavin et al., 2008, p. 295). During the independent reading component, students read leveled paperbacks in various genres, and they may choose to read audiobooks that “model comprehension, vocabulary, and self-monitoring strategies used by good readers” (Slavin et al., 2008, p. 295). During the small group direct instruction, teachers use resource books to help teach effective reading strategies, word study, vocabulary, spelling, and comprehension (Haslam et al., 2006).

While there have been discussions regarding the research supporting the Read180 program, and in particular the absence of peer-reviewed research (Campbell, 2006) as well as the “dearth of rigorous studies by independent evaluators” (Kim et al., 2010, p. 1112), there is some evidence that suggests that this intervention has improved at-risk adolescents’ reading comprehension (Lawson, 2011; Nave, 2007; U.S. Department of Education, 2011).

Interventions at the student level. Despite these substantial efforts at the national and school levels, discrepancies in educational attainment and achievement remain. As Uline (2005) has shared, “state assessment scores, college entrance exams, dropout rates, advanced placement enrollments, reading inventories, and many other indicators generally confirm that some groups of students were more likely to succeed and other students groups were more likely to fail” (p. 1). It is important to note that current inventions such as RTI do not take into account individual students’

characteristics, such as their motivation or belief in the value of effort, that may have an impact on their struggles in school. There is clear evidence that motivation and effort are associated with academic achievement (Yeung & McInerney, 2005) yet this relationship is not accounted for within the RTI framework. Dweck (1986, 1988, 2009) has suggested that students' mindsets govern their levels of motivation and their responses to challenges such as academic failures. Since factors at the student level, including motivation, account for 80% of the variance in student achievement, this is an appropriate area to explore in order to increase student achievement. One student-level intervention that has been suggested to impact student's motivation is the Brainology™ computer program developed by researcher Dweck (2009).

The Brainology™ program is designed to encourage students to adopt a growth mindset. The program consists of 2.5 hours of online instruction on how the brain functions and how it develops, with a particular emphasis on how students can apply this information to their school work. The online instruction, which includes interactive lessons and videos, is broken into five sessions. There are also up to 10 hours of additional classroom activities with this program. These activities include lessons on brain plasticity, effort, and intelligence that are conducted within students' classrooms by their teachers as one way to extend the computer program's impact. There is currently no published information about the validity or reliability of the Brainology™ program (E. Briceno, personal communication, September 4, 2011).

In addition to students' beliefs about their intelligence, another critical component of reading achievement concerns students' attitudes towards reading. Reading achievement and students' attitudes toward reading have long been associated (Purves &

Beach, 1972; Walberg & Tsai, 1985). Smith (1988) has posited that students' attitudes towards reading influence the amount that they read since the "emotional response to reading...is the primary reason most readers read, and probably the primary reason most nonreaders do not read" (p. 177). Students who have a negative attitude towards reading, be it academic reading, recreational reading, or both, typically read less frequently than their peers with positive attitudes towards reading (Lazarus & Callahan, 2000). Since students' attitudes toward reading typically influence the amount that they read, and the amount and breadth of what children read predicts their reading achievement (Wigfield & Guthrie, 1997), students' attitudes towards reading can be considered to be critical to reading achievement. The Elementary Reading Attitude Survey (ERAS) (McKenna & Kear, 1990) is an instrument that is designed for teachers to use to "estimate the attitude levels of their students and initiate informal assessment efforts into the role attitude plays in students' development as readers" (p. 629). This is important because as Wixson & Lipson (1992) have shared, the "student's attitude toward reading is a central factor affecting reading performance" (p. 141).

Conclusion

The research summarized in this chapter has included the topics of adolescence, motivation, and the middle school academic environment, with the goal of exploring the factors and components related to the academic achievement of middle school students. For many students motivation and achievement decline during their adolescent years (Elliot & Dweck, 2007; Yeung & McInerney, 2005), yet these declines are not inevitable (Arnett, 1999). Students' beliefs about their intelligence have been suggested as providing a motivational framework for their academic motivation and achievement (Dweck & Master, 2009). A framework by Dweck (2009) describes students' belief in

the usefulness and value of effort vis-à-vis achievement. Students with a growth mindset typically have learning goals, and in general they also have high levels of task persistence. In contrast, students with a fixed mindset typically have performance goals, and they have been shown to have task-avoidance or other ego-protecting responses to difficult tasks. Students who believe in a fixed mindset can suffer from a recursive pattern of low motivation and low effort after suffering an academic failure at school.

Furthermore, adolescent students who have equal intellectual ability have had distinctly different responses to academic challenges based on their mindsets (Blackwell et al., 2007; Dweck, 2002; Dweck & Master, 2009). Experimental research has demonstrated that students with an incremental or growth mindset earn higher grades than their peers (Aronson et al., 2002), and an incremental theory or growth mindset intervention has led to “significant academic improvement in adolescents’ achievement test scores” (Good et al., 2003). Adolescent students who have a growth mindset generally have higher achievement than their peers, including in areas such as gender threats in math and science (Dweck 2002, 2006) and over several years in middle school (Blackwell et al., 2007). While there have been studies that have shown the impact of a growth mindset on academic achievement in several areas (Dweck & Master, 2009), there is currently no research concerning the impact of adopting a growth mindset on the reading achievement of at-risk sixth grade students who are involved in a reading intervention program.

CHAPTER THREE

METHODS

The purpose of this research study was to examine the impact of a growth mindset intervention on at-risk adolescent 6th grade students' self-theories, their attitudes about reading, and their academic achievement. To achieve this purpose, data were collected by instruments that permit quantitative analysis of the students' self-theories, their attitudes about reading, and their academic achievement.

The preceding review of the relevant literature demonstrates that adolescence is a significant stage of human development due to tremendous physiological, sociological, and psychological changes. Sixth-grade is a particularly difficult year for many students because of the convergence of variables, such as the beginning of puberty and the formation of an identity, that typically occur when students begin middle school (Eccles & Roeser, 2009). While many students are considered to be at-risk for school failure based on personal characteristics, such as race or exposure to poverty (Hanushek, 2010; Hernandez, 2011), it is also believed that many students are also at-risk to underachieve based on their tendency to adopt a fixed mindset, which governs their motivation and responses to failures in school (Dweck & Leggett, 1988). It has been suggested by Dweck (2009) that when students begin to struggle in school their mindset will guide their reaction(s) to difficult academic tasks and failure. Students who believe that their

intelligence is a fixed entity primarily adopt a “helpless response” reaction to difficulty in school, including giving up and abandoning the task before it is completed (Abramson et al., 1978; Blackwell et al., 2007). These students typically believe that their effort is not connected with their achievement (Dweck, 2007). In contrast, students who believe that intelligence is a malleable quality are more likely to adopt a “mastery-oriented” reaction to difficulty and failure at school (Dweck & Molden, 2007). These students largely equate failure with not having employed the right strategy or enough effort in order to be successful.

Research Questions

There were five research questions that guided the present study:

1. Is there a difference in the reading achievement of at-risk adolescent students in a reading intervention program after a growth mindset intervention?
2. What is the relationship between reading achievement and self-theories of at-risk adolescent students?
3. Is there a difference in the self-theories of at-risk adolescent students after a growth mindset intervention?
4. Is there a difference in at-risk adolescent students’ attitudes about reading after a growth mindset intervention?
5. What were at-risk adolescent students’ experiences with the Brainology™ computer program?

Research Design and Sampling

The design for this pilot study was a mixed methods research design which combined a quasi-experimental pre-posttest component and a focus group component.

There were three instruments that served as the pre and posttests: the Mindset questionnaire, the Elementary Reading Attitude Survey (ERAS), and the NWEA Measures of Academic Progress (MAP) Secondary Reading test. All students ($n=30$) took the Mindset questionnaire, the ERAS and the MAP Reading test two times: once before treatment and once after the treatment.

Students who participated in this study had been previously scheduled into one of five sixth-grade reading intervention classes. Because students could not be randomly assigned to the intervention classes, this precluded the use of a true experimental research design. Students who were in these reading intervention classes previously failed the fifth-grade Virginia Reading SOL. The students in three of the classes ($n= 18$) were randomly assigned to receive the treatment and the students in two of the classes ($n=12$) were randomly assigned to serve as the comparison group.

Context

The Copper Ridge¹ public school system in central Virginia was selected as the site for this study. The system serves over 13,000 students in over 25 different schools. With an annual budget of over \$142 million, Copper Ridge spends approximately \$11,000 per pupil. There are approximately 1,200 teachers in the district, 99.5% of whom are “highly-qualified” as designated by the No Child Left Behind Act of 2001 and who have an average of 15 years of experience. Copper Ridge follows the predominant model of American middle school education with its five middle schools containing grades six, seven and eight. Copper Ridge has not made Adequate Yearly Progress (AYP) for several

¹ All names used in this study are pseudonyms.

years, partly because of the achievement of its middle school students. Only one of the five middle schools in Copper Ridge made AYP during the 2010-2011 school year.

Within the Copper Ridge system there are noticeable gaps in the achievement of its students by personal characteristics such as race and exposure to poverty. As one example, in this district during the 2010-11 school year on the Virginia English SOL exams, White students (94%) outperformed Black students (78%) by 16 points and outperformed Hispanic students (85%) by 9 points in terms of the overall percentage of students who passed the exams. On the same English exams, students with exposure to poverty scored 13 points lower than the overall pass rate for all students (78% compared to 91%). Similar to national trends, in Copper Ridge during the 2010-11 school year White students (90%) had a higher on-time graduation rate than their Black (78%) and Hispanic (65%) peers. Students with exposure to poverty had a significantly lower on-time graduation rate (66%) than the overall percentage of all students (88%). Therefore, similar to the patterns at the national and state levels, Copper Ridge had discrepancies in educational achievement and attainment.

Participants

Participants in this pilot study were the students enrolled at Bailey Middle School, one of five middle schools within the Copper Ridge system. Bailey Middle School did not make AYP during the 2010-2011 school year. During the 2011-2012 school year Bailey Middle School served approximately 230 sixth-grade students, a figure that represented about 24% of the division's 959 sixth-grade students. The demographics of all sixth-grade students for both Bailey Middle School and the Copper Ridge district can be seen in Table 3.1.

Table 3.1

Demographics of Sixth-Grade students at Bailey Middle School and the Copper Ridge System

	Total	White		Black		Hispanic		Other		Poverty		ESOL	
		N	%	N	%	N	%	N	%	N	%	N	%
Bailey	230	104	45%	81	35%	35	15%	10	5%	92	40%	35	15%
Copper Ridge	959	684	71%	116	12%	70	7%	89	9%	234	24%	68	7%

There were 30 students enrolled in the five reading intervention classes who were purposefully sampled for this study. To select the treatment and comparison groups, each of the five reading intervention classes was assigned a number from 1 to 5. A random number generator (<http://www.random.org/>) was used to select three groups, which were then relabeled Experimental Groups A, B, and C ($n=18$). Students assigned to the remaining two groups, Groups D and E, became the Comparison group ($n=12$).

Among the five groups in this study there were 15 boys, 15 girls, 13 Black, eight White, three Hispanic, and six Asian students. Table 3.2 displays the demographics of all five reading intervention classes.

Table 3.2

Demographics of Sixth-Grade Students in Reading Intervention Classes

Group	Boys		Girls		Black		White		Hispanic		Asian	
A	4	67%	2	33%	4	67%	2	33%	0	0%	0	0%
B	2	29%	5	71%	2	29%	3	43%	1	14%	1	14%
C	3	60%	2	40%	2	40%	0	0%	2	40%	1	20%
Experimental Total	9	50%	9	50%	8	44%	5	28%	3	17%	2	11%
D	4	57%	3	43%	2	29%	1	14%	0	0%	4	57%
E	2	40%	3	60%	3	60%	2	40%	0	0%	0	0%
Comparison Total	6	43%	8	57%	5	36%	3	21%	0	0%	6	43%
Overall Total	15	47%	15	53%	13	43%	8	26%	3	10%	6	20%

Intervention

The present pilot study was conducted during a daily homeroom period that occurred each school day. No students lost any initial instruction time in their core language arts class or any time in their reading intervention class during the course of this study.

Read 180 reading intervention program. Sixth-grade students ($n = 30$) involved in the Read 180 reading intervention program in 2011-2012 were purposefully sampled for this study. At Bailey Middle School, students considered to be at risk of school failure based on past academic performance were automatically scheduled into a year-long reading intervention program.

Any student who failed the previous year's Virginia Reading SOL exam (a score below 400) was automatically scheduled into a reading intervention course. In this course, students received 45 minutes of additional reading support every other day during their exploratory period, with the reading intervention section replacing one exploratory class such as Art or Spanish. This reading intervention class occurred in addition to the 90 minutes of language arts instruction that all students in the school received daily.

Bailey Middle School used Read180 for its reading intervention program. Read 180 is designed for adolescent students who are reading two or more years below grade level. The program's components include an adaptive computer program, independent reading and direct instruction. While there have been discussions regarding the effectiveness of the Read 180 program (Campbell, 2006), there is evidence that suggests that the Read 180 program can increase struggling adolescent students' reading achievement (Lawson, 2011). The present study was not designed to examine or to evaluate the effectiveness of the Read180 program.

Brainology™ computer program. Brainology™ is a computer program that teaches students how their brains work, how they learn, and how they can apply this information to their school work (Dweck & Master, 2009). The program is also designed to encourage students to adopt a growth mindset and to work harder in school. Brainology™ is specifically intended for adolescent students in grades five through nine, including students in gifted programs and those students with a range of learning disabilities. After all students ($n=30$) took the Mindset questionnaire, the ERAS and MAP Reading tests, students who participated in the treatment group ($n=18$) used the

Brainology™ computer program once a week during the homeroom period for five weeks.

Experimental group. Students who were in reading Groups A, B and C ($n=18$) received the Brainology™ computer program treatment for five class sessions over a five-week period. These students completed one module on the computer each week for approximately 30 minutes per module. This treatment was in addition to their regular instruction in their daily 90-minute language arts class as well as their 45-minute every other day reading intervention class.

Comparison group. Students who were in reading Groups D and E ($n=12$) were the comparison group. These students did not participate in the Brainology™ computer program. They continued to participate fully in the Read180 reading intervention program as well as their daily 90-minute language arts class during this research study.

Instrumentation

There were three instruments that were used during this study: the Mindset questionnaire (Blackwell et al., 2007), the Elementary Reading Attitude Survey (ERAS) (McKenna & Kear, 1990), and the Measures of Academic Progress (MAP) test (Cizek, Gierl, & Alves, 2005). Both the Mindset questionnaire and the MAP test were administered by computer; the ERAS was administered by paper copy.

Mindset Questionnaire. All participants completed the Mindset questionnaire (Appendix A) to determine their preference for either fixed or growth mindsets, or neither. As previously noted, the terms *self-theories*, *implicit theories*, and *mindset* refer to the same concepts and are used interchangeably in the literature (Dweck & Master, 2009); as an example, a fixed mindset refers to the same concept as an entity theory. The responses to statements on the Mindset instrument had a range of 1 to 6, with 1 = *pure*

growth mindset and 6 = *pure fixed mindset*. There are 31 statements in the survey, and they are grouped into three domains: (a) Self-theories of intelligence, (b) Mistakes/Failure, and (c) Effort/Working Hard. The internal reliability of this questionnaire was reported to be .78, with $M = 4.45$ and $SD = .97$, $n = 373$ (Blackwell et al., 2007). The test-retest reliability was reported to be .77, $n = 52$ (Blackwell et al., 2007). There have been discussions surrounding the validity of the Mindset survey (Dweck, Chiu, & Hong, 1995a; Dweck, Chiu, & Hong, 1995b), however, there is currently no published information about the validity of the survey (E. Briceno, personal communication, September 4, 2011).

Elementary Reading Attitude Survey. Students took the Elementary Reading Attitude Survey (ERAS) (Appendix B) to determine their attitudes toward reading. There are 20 statements on the ERAS that provide quantitative estimates of students' attitudes toward reading. For each question students chose a pictorial response of the cartoon character Garfield, ranging from very happy (4 points) to very upset (1 point). The ERAS yields a composite score as well as subdomain scores for recreational reading and academic reading. The Cronbach's alpha of the ERAS at the 6th grade level was reported to be .87, with $M = 27.9$, $SD = 6.2$, $n = 2,442$ (McKenna & Kear, 1990). Construct validity of the ERAS was shown by examining the amount of television students watched as well as their use of a public library. Students who reported watching more than two hours of television each night had a lower recreational reading mean score (28.6) than their peers who reported watching less than one hour of television per night (31.5), $p < 0.001$. Students who frequently used a library had a higher academic reading mean score

(29.2) than their peers who did not frequently use a library (27.3), $p < 0.001$ (McKenna & Kear, 1990).

Reading MAP Test. Students also took the secondary Reading MAP test (Appendix C) to determine their level of academic achievement in reading. The MAP test is an instrument designed by the Northwest Evaluation Association (NWEA) to measure academic growth over a period of time (NWEA, 2007). The MAP tests are computer-administered and adaptive, and students receive a set of questions that is optimal for their individual ability level. MAP tests can be used to determine students' instructional level based on different grade levels and periods of the academic year (NWEA, 2007).

The MAP test generates a composite score, called a Rasch UnIT (RIT) score, for each student. The possible RIT range for the Secondary Reading MAP test is 155.1 (end of year Kindergarten) to 223.9 (end of year 10th grade). According to the 2011 Normative Data Reference Report (NWEA, 2011), the 6th grade end of year mean is 216.2 (see Table 3.3).

Table 3.3

Selected 2011 Normative Data RIT Values for Secondary Reading MAP Test

GRADE	Beginning of Year Mean	Middle of Year Mean	End of Year Mean
4	199.6	203.0	206.3
5	207.1	209.9	212.4
6	212.5	214.2	216.2

There is no published information specifically for the secondary Reading MAP test, yet the MAP tests as a whole have reliability estimates for total scores ranging from .92 to .96 with a test-retest reliability range of .77 to .94 (Cizek et al., 2005). The MAP tests' concurrent validity comes primarily from the alignment between the curriculum and the test content, with concurrent validity coefficients that range from .78 to .88. The MAP tests are highly-correlated with the Iowa Test of Basic Skills (ITBS) as well as the Stanford Achievement Tests, 9th Edition (SAT-9) (Cizek et al., 2005).

Data Collection

Data were collected on students' self-theories, attitudes toward reading, and academic achievement through the use of pre- and posttests.

Prior to the intervention. All students ($n=30$) took three pretest instruments: the Reading MAP test, the ERAS, and the Mindset survey. These instruments were administered during the homeroom period. The secondary Reading MAP test established a baseline for students' current academic achievement. The ERAS established a baseline for students' attitudes towards recreational reading and academic reading. All students also completed the Mindset survey to determine if they preferred a growth or fixed mindset.

After the intervention. All students ($n =30$) completed three posttests: the reading MAP test, the ERAS and the Mindset survey. Similar to the pretest, the MAP program generated a composite RIT score for each student. The ERAS provided data on students' attitudes toward recreational reading and academic reading. The Mindset survey also yielded a composite score and domain subscore for each student.

Data Analysis

Data were collected to permit quantitative analysis of students' attitudes about reading, their academic achievement, and their self-theories. The experimental-wise alpha was set at .05, and in order to control for Type 1 error due to multiple statistical tests being conducted, a Bonferroni adjustment was made setting alpha at .0167 for each test (.05/3). Since there are no published data on the reliability and validity of the Mindset survey, a reliability analysis on these Mindset survey data was also run.

Research questions one and three were addressed through analysis of covariance technique (ANCOVA). The ANCOVA determined whether there were differences in the posttest scores of the groups after controlling for differences in the pre-MAP assessment (research question 1) and the pre-Mindset survey (research question 3). The dependent variable was the post-MAP assessment and the post-Mindset survey, respectively. According to Borm, Fransen, & Lemmens (2007), ANCOVA has the same power as a t-test comparing groups of n subjects, where n is as small as 11 subjects. Assuming a moderate effect size of .60 (Cohen, 1988), a minimum sample size of 34 is required.

Research questions one and three also included descriptive statistics of both the MAP data and Mindset survey. As previously noted, all students ($n = 30$) took the MAP test at the beginning and end of the study. Descriptive statistics, including the mean RIT, standard deviation, and median RIT, were calculated for both the treatment ($n = 18$) and comparison ($n = 12$) groups. Both the pre and post MAP tests yielded a RIT score (e.g., 217) and a nationally normed percentile rank (e.g., 24) for each student. RIT scores also includes an estimated standard error of measurement (SEM) that is used to determine the RIT Range; as an example, a RIT score of 214 with a SE of 3.5 yields a RIT range of 211-218 (NWEA, 2007). For the purpose of research question one, students who had pre

and post MAP test RIT scores with different RIT ranges were determined to have made academic growth. As an example, a student whose pretest RIT range was 193-199 and whose post RIT range was 202-208 was determined to have shown academic growth.

Research question two was addressed by determining the relationship between students' responses to the Mindset and their MAP posttest. Pearson correlations were run to explore the relationship between the MAP posttest scores and the Mindset questionnaire composite score as well as the five subdomains of the Mindset questionnaire (Theory of Intelligence, Beliefs about Effort, Performance Goals, Learning Goals, and Performance Avoidance Goals).

Research question four was addressed through an ANCOVA technique, where the covariate was the pre-ERAS and the dependent variable was the post-ERAS. The ANCOVA determined if there were differences in the posttest scores of the groups after controlling for differences in the pre-ERAS scores.

Finally, research question five was addressed through the use of a focus group interview (Appendix D). Focus groups are interviews with a small group of people, usually ranging from four to six individuals. These interviews are used to collect views from specific people as well as "shared understandings" from several individuals (Creswell, 2005). According to Creswell (2005), focus groups are "advantageous when the interaction among interviewees will likely yield the best information and when interviewees are similar to and cooperative with each other" (p. 215).

Students in the experimental group ($n = 18$) participated in the focus group to explore their experiences and perceptions of the Brainology™ computer program. The experimental group was divided into three sets of students for the focus group interviews

based on the students' reading intervention classes. This yielded three focus groups of six, seven, and five students. Each focus group participated in one 30 minute interview during their homeroom period. Students were audiotaped during the session, and the researcher also took handwritten notes during the interviews. The students responded questions concerning their perceptions of the Brainology™ program, including topics such as the computer program's tools and components, their favorite units of study, and whether or not they believed the program influenced their beliefs about their intelligence (see Appendices E, F, and G for transcripts of these interviews).

Limitations

The primary limitation of this pilot study involved the selected sample. Only sixth-grade students who were in a reading remediation program at Bailey Middle School ($n = 30$) were chosen to participate. Since the results may be different for seventh or eighth graders, or for students who are not at risk of school failure, such as advanced level students, these results cannot be generalized to other grade or ability levels.

The selected sample was not representative of all students in the population at Bailey Middle School. The sixth grade students who were selected to participate in this study had been placed into the school's academic remediation program because they did not pass the fifth grade Virginia Reading SOL exam. Any students who passed the previous year's SOL exam and/or who were not involved in the reading remediation program were not eligible to be included in this study. This limitation resulted in a significant difference in the number of participants selected ($n = 30$) when compared to the total number of 6th grade students ($N= 230$), all students at Bailey Middle School ($N = 580$), and all sixth-grade students ($N=959$) in the Copper Ridge Public Schools district.

The small sample size used in this study was further divided into two groups. Only 30 sixth-grade students who failed the previous year's Virginia Standards of Learning (SOL) Reading exam were placed in the academic intervention program for reading, and this group was randomly-divided into a treatment group ($n=18$) and a comparison group ($n=12$), with the result that neither group had an n of 30 or more students. The small sample size meant that these results could not be generalized to the population (Creswell, 2005). In addition, it was unlikely that there would be enough statistical power to detect differences if they existed.

Another limitation was the assumption made regarding the effect size of the intervention. There may have been an effect size that was too small to be accounted for with the sample size in this study. Finally, an insufficient number of students prohibited using Hierarchical Linear Modeling (HLM) to account for the nesting of students within classrooms.

CHAPTER FOUR

RESULTS

This chapter presents the results of this pilot study is organized around the five research questions:

1. Is there a difference in the reading achievement of at-risk adolescent students in a reading intervention program after a growth mindset intervention?
2. What is the relationship between reading achievement and self-theories of at-risk adolescent students?
3. Is there a difference in the self-theories of at-risk adolescent students after a growth mindset intervention?
4. Is there a difference in at-risk adolescent students' attitudes about reading after a growth mindset intervention?
5. What were at-risk adolescent students' experiences with the Brainology™™ computer program?

Descriptive Analysis of the Dependent Variables

Data pertaining to research questions one, three, and four were analyzed using descriptive statistics. The variables were the posttests of the MAP reading test, the ERAS, and the Mindset questionnaire. A summary of the descriptive statistics for these variables is presented in Table 4.1.

Table 4.1

Descriptive Analysis of the Dependent Variables

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	<i>Scale</i>
MAP Reading RIT Score				
Treatment	18	200.28	13.89	155- 223
Comparison	12	196.42	14.77	155- 223
ERAS – Treatment				
Composite	18	44.11	10.20	0 - 80
Recreational	18	21.17	5.62	0 – 40
Academic	18	22.94	5.27	0 – 40
ERAS – Comparison				
Composite	12	46.83	16.00	0 – 80
Recreational	12	22.75	8.82	0 – 40
Academic	12	24.08	8.09	0 – 40
Mindset Questionnaire – Treatment				
Composite	18	3.66	.47	1 – 6
Theory of Intelligence	18	4.33	.88	1 – 6
Beliefs about Effort	18	3.78	.52	1 – 6
Performance Goals	18	2.69	1.14	1 – 6
Learning Goals	18	3.29	.80	1 – 6
Performance Avoidance goals	18	3.57	1.29	1 – 6

Mindset Questionnaire – Comparison

Composite	12	3.81	.36	1 – 6
Theory of Intelligence	12	4.24	.64	1 – 6
Beliefs about Effort	12	3.95	.63	1 – 6
Performance Goals	12	3.2	.83	1 – 6
Learning Goals	12	3.33	.48	1 – 6
Performance Avoidance goals	12	3.78	1.4	1 – 6

Descriptive Analysis of the Covariates

The covariates in this pilot study were the pretests of the MAP reading test, the ERAS, and the Mindset questionnaire. A summary of the descriptive statistics for these covariates can be found in Table 4.2.

Table 4.2

Descriptive Analysis of the Pretest Covariates

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	<i>Scale</i>
MAP Reading RIT Score				
Treatment	18	200.00	11.60	155- 223
Comparison	12	199.58	14.42	155- 223
ERAS – Treatment				
Composite	18	41.61	13.87	0 - 80
Recreational	18	20.78	7.34	0 – 40

Academic	18	12.83	7.3	0 – 40
ERAS – Comparison				
Composite	12	46.00	12.39	0 – 80
Recreational	12	22.58	6.23	0 – 40
Academic	12	23.41	6.73	0 – 40
Mindset Questionnaire – Treatment				
Composite	18	3.40	.33	1 – 6
Theory of Intelligence	18	3.80	.81	1 – 6
Beliefs about Effort	18	3.44	.45	1 – 6
Performance Goals	18	2.86	.53	1 – 6
Learning Goals	18	3.34	.60	1 – 6
Performance Avoidance goals	18	3.09	.99	1 – 6
Mindset Questionnaire – Comparison				
Composite	12	3.73	.38	1 – 6
Theory of Intelligence	12	3.86	.74	1 – 6
Beliefs about Effort	12	4.01	.57	1 – 6
Performance Goals	12	2.81	1.11	1 – 6
Learning Goals	12	3.75	.64	1 – 6
Performance Avoidance goals	12	3.28	1.56	1 – 6

Reliability Analysis

A separate reliability analysis was conducted using Cronbach's alpha for each dependent variable. Results indicated that the overall reliability of the ERAS posttest was .93, while the overall reliability of the Mindset questionnaire posttest was .59. See Table 4.3 for a summary of these results.

Because the MAP reading test yielded only an overall RIT score and there were no item level data, a reliability analysis could not be run. However, as previously noted, the MAP tests as a whole have reported reliability estimates that range from .92-.96 with a test-retest reliability range of .77 to .94 (Cizek et al., 2005).

Table 4.3

Reliability Analysis for the ERAS and the Mindset Questionnaire Posttests

Variable	# of Items	Cronbach's alpha
ERAS		
Composite	20	.93
Recreational	10	.87
Academic	10	.90
Mindset		
Composite	31	.59
Theory of Intelligence	6	.50
Beliefs about Effort	14	.46
Performance Goals	4	.23
Learning Goals	4	.28

Performance Avoidance Goals	4	.23
-----------------------------	---	-----

A separate reliability analysis was conducted using Cronbach's alpha for each covariate. The covariates were the pretest scores for the ERAS and the Mindset questionnaire. As noted, no reliability analysis could be run on the MAP data. Results indicated that the overall reliability of the ERAS pretest was .93, while the overall reliability of the Mindset questionnaire pretest was .50. See Table 4.4 for a summary of these results for the covariates.

Table 4.4

Reliability Analysis of the ERAS and Mindset Questionnaire Pretests

Variable	# of Items	Cronbach's alpha
ERAS		
Composite	20	.93
Recreational	10	.87
Academic	10	.89
Mindset		
Composite	31	.50
Theory of Intelligence	6	.50
Beliefs about Effort	14	.46
Performance Goals	4	.23
Learning Goals	4	.28
Performance Avoidance Goals	3	.54

Research Questions and Results

The purpose of the present pilot study was to examine the impact of a growth mindset intervention on at-risk adolescent students' reading achievement, their self-theories, and their attitudes toward reading, as well as to explore their experiences using the Brainology™ computer program. The analyses and results of each of the five research questions are provided below.

Research Question One

Data were collected and analyzed in order to answer the following research question:

1. Is there a difference in the reading achievement of at-risk adolescent students in a reading intervention program after a growth mindset intervention?

Analysis. Data pertaining to research question one were examined using an analysis of covariance (ANCOVA) technique. This procedure allowed for an analysis of the extent to which the students' MAP posttest differed from the students' MAP pretest.

Results. A between-subjects analysis of covariance was performed on the MAP RIT posttest score. The independent variables were the treatment and comparison groups. The covariate was the MAP reading pretest RIT score.

Analyses were performed using IBM Statistics 20. Results of the evaluation of the assumptions of normality, linearity, and homogeneity of variance were satisfactory. As shown in Table 4.3, the covariates were on the lower end of reliability for the Mindset survey.

After adjustment by the covariate, the MAP RIT posttest score did not vary between the two groups. That is, no statistically significant main effect of treatment was

found. Nor was there a significant interaction between treatment group and MAP RIT posttest score after adjustment for the covariate.

According to Northwest Evaluation Association (NWEA), on the secondary reading MAP test individuals are expected to increase approximately 3-4 RIT points each academic year (NWEA, 2007). While analysis of covariance did not detect significant differences between the means of the two groups, a number of individuals in the treatment group did increase their scores during this study. Seven of the 18 individuals in the treatment group increased their scores at least three points during the study, as can be seen in Table 4.5.

Table 4.5

Selected Treatment Students' MAP Posttest RIT scores

Student	MAP 1	MAP 2	Increase
Student 2	197	214	17
Student 6	209	212	3
Student 7	184	190	6
Student 11	220	232	12
Student 12	199	208	9
Student 16	197	201	4
Student 17	200	220	20

While the group mean for the MAP posttest RIT scores was not significantly different than the pretest scores, it is worth noting that these seven students in the treatment group ($n = 18$) increased their scores during this study. In the comparison group only two out of 12 students increased their scores by at least three points during this pilot study. It is also interesting to consider that, according to NWEA (2007), a gain of three to four points represents the expected gain during an academic year. The gains made by the seven students in the treatment group, therefore, represent an increase of more than one academic year that occurred over the course of just eight weeks. The average gain of these seven students was 10 points, which represents approximately two academic years' worth of growth.

Research Question Two

Data were collected and analyzed in order to answer the following research question:

2. What is the relationship between reading achievement and self-theories of at-risk adolescent students?

Analysis. Data pertaining to research question two were analyzed using Pearson correlations to explore the relationship between the MAP posttest scores and the Mindset questionnaire composite score as well as the five subdomains of the Mindset questionnaire (Theory of Intelligence, Beliefs about Effort, Performance Goals, Learning Goals, and Performance Avoidance Goals).

Results. Analysis was performed using IBM Statistics 20. As can be seen in Table 4.6, the correlations between MAP posttest scores and the Mindset questionnaire were low. There was not a significant relationship between the MAP posttest scores and either the Mindset questionnaire composite score or five of the Mindset subdomains.

There was a significant relationship between MAP posttest scores and Beliefs about Effort.

Table 4.6

Pearson Correlation between MAP posttests and Mindset questionnaire posttests and ERAS posttests

Variable	Pearson Correlation
MAP Posttest and Mindset Composite Posttest	.27
MAP Posttest and Theory of Intelligence Posttest	.34
MAP Posttest and Beliefs about Effort Posttest	.42*
MAP Posttest and Performance Goals Posttest	-.17
MAP Posttest and Learning Goals Posttest	-.23
MAP Posttest and Performance Avoidance Goals Posttest	.00

* Significant at $p < .05$ level

Research Question Three

Data were collected and analyzed in order to answer the following research question:

3. Is there a difference in the self-theories of at-risk adolescent students after a growth mindset intervention?

Analysis. Data pertaining to research question three were analyzed using an ANCOVA technique. This procedure allowed for an analysis of the posttest differences between groups after controlling for initial differences.

Results. Six between-subjects analysis of covariance were performed on the Mindset questionnaire data. The independent variable was the group (treatment and comparison). Each of the six ANCOVA had one covariate. The covariate for the first ANCOVA was the Mindset composite score. The covariates for the remaining five analyses were Theory of Intelligence, Beliefs about Effort, Performance Goals, Learning Goals, and Performance Avoidance Goals.

Analyses were performed using IBM Statistics 20. Results of the evaluation of the assumptions of normality, linearity, and homogeneity of variance were satisfactory. As shown in Table 4.3, the covariates were on the lower end of reliability.

After adjustment by the covariate, no statistically significant effects were found for the composite score or for the five subdomains of the Mindset questionnaire.

Research Question Four

Data were collected and analyzed in order to answer the following research question:

4. Is there a difference in at-risk adolescent students' attitudes about reading after a growth mindset intervention?

Analysis. Data pertaining to research question four were analyzed using an ANCOVA technique. This procedure allowed for an analysis of the posttest differences between groups after controlling for initial differences.

Results. Three between-subjects analysis of covariance were performed on the ERAS scores. The independent variables were the treatment and comparison groups. Each of the three ANCOVA had one covariate. The covariates were the ERAS composite score as well as the scores of the subdomains of Recreational reading and Academic reading.

Analyses were performed using IBM Statistics 20. Results of the evaluation of the assumptions of normality, linearity, and homogeneity of variance were satisfactory. As shown in Table 4.3, the covariates were on the higher end of reliability.

After adjustment by the covariate, the ERAS composite score and the subdomains of Recreational reading and Academic reading did not vary by group. No statistically significant main effect of treatment was found. Nor were there significant interactions between treatment group and the ERAS composite score or the two subdomain scores after adjustment for the covariate.

Research Question Five

Data were collected and analyzed in order to analyze the following research question:

5. What were at-risk adolescent students' experiences with the Brainology™ computer program?

Analysis. Students who received the Brainology™ computer program as a growth mindset intervention ($n = 18$) participated in focus group interviews. The treatment group was divided into three sets of five, six, and seven students for the focus group interviews. Students were audiotaped during the session, and they answered questions concerning their perceptions of the Brainology™ program. Topics that were further explored with students included the computer program's components, their favorite unit(s) of the

program, and whether or not they believed that the program had influenced their beliefs about their brain and their intelligence.

Results. The participants in the focus groups responded to seven questions designed to determine their perceptions of the Brainology™ computer program. These questions were primarily designed to gather information about two general areas: students' experiences with the computer program as well as whether or not they believed that the program influenced their self-theories. See Appendix D for the focus group protocol. The focus group interviews were audiotaped. See Appendices E, F, and G for the interview transcripts.

The students' experiences with the Brainology computer program were positive. All 18 students reported that they understood how to use the program. Of the 18 students in the treatment group, 16 students indicated that they liked the program. Sixteen students stated that they would recommend the Brainology™ computer program to their friends.

Students' Experiences of the Brainology™ Program. Of the 18 students, 16 students indicated that they enjoyed using the program. Jim² shared that “it was good because it helped me learn about the brain. I liked it.” Trina stated that the program was good because “it taught me brain stuff that I can use a lot.” Peter said that the program was “kinda fun and it teaches us about our brain.” The two students who did not enjoy the program shared that they thought it was “boring.”

All 18 students indicated that they understood how to use the program and how to move through the different features of the computer program. Jacob indicated that it was

² All names used are pseudonyms.

“easy to memorize how to use the program” and that the characters in the program were helpful.

Sixteen students shared that the tools that accompanied the program were helpful. All 16 students indicated that both the e-journal and the map were helpful. Matthew shared that the e-journal was helpful because “you could write down what you learned and [it] helped you remember it. And you could go back. And you could use some of that information for [later].” Heather stated that the e-journal allowed her “to go back and read what you wanted and read what you had written down.” Amy shared that the map was very useful because it allowed her to know “how far you’ve gone and gotta go and know where you are in the program.” Shaun stated that the map was helpful because you “see this big thing on top and you’re like ‘oh, I wanna get there.’ And I wanted to know what it is about. So it like kept you focused on learning to get there...to the top.” Chris shared that the map allowed him to “navigate and move around the chapters” and “review the chapters.”

The students shared their favorite units of the Brainology™ program. Cheri shared that she liked the chapter “with the steam...the one where you gotta turn on the stove or something. And you touch it and it went to your brain and you were like ‘AHHHH!’” Chris, Jim and Bess agreed with Cheri. Natalie stated that she liked the “one where it’s about how your brain takes over your body and how your brain works.” Sam, Mark and Amy agreed with Natalie.

Sixteen of the students shared that they would recommend the program to another student. Students’ responses ranged from “yes” to “definitely” and “totally.” Heather shared that she would recommend this program to a friend “because it will help them

learn more.” Elaine stated that she would suggest that a friend use this program because “it will help them not to be nervous.” Jonathon indicated he would recommend it because it would “help people learn more about their brain.” Trina said it would be good “for people because they might not know anything about their brain.” Jake said that it would “help people learn what they did and what they can do.” The two students who would not recommend it to a friend shared that it was “boring” and it contained “obvious stuff.”

Students’ Perceptions of their Self-Theories. Seventeen of the 18 students shared that they believed that the Brainology™ computer program changed the way that they think of their mental abilities. Mark stated that he used to get “nervous when I took a test. But Brainology™ helped me to know to calm down. And how to use my brain. And that helps me do better.” Peter stated that the program “probably helped us to read better...because it taught us how to remember easier things.” Elaine shared that

“before when I took tests I would get nervous and my palms would get sweaty and I’d get hot and stuff like that. But now it’s like this thing that they say to count up and then to count down and hold your breath or something like that. And like my heart used to pump really fast. And now I count up and breath and then it will help you slow your heart down and it won’t beat that fast. And that’s how I got more A’s on my tests...Cause when I get like nervous I tend to get a bad grade.”

Sam stated that the program changed the way he thinks of his brain, as he now thinks that “you have to be ready [to learn] and eat your breakfast and get a good night’s sleep. It’s like charging a phone, you know? Plugging it in.”

Sixteen of the 18 students stated that they thought that the program taught them that the harder they work the smarter or more successful they could be. Two students shared that they believed this already before they started the program. Jonathon stated that now he thought that if students got a good grade on a test

they must have studied a lot. But people might be like ‘oh they so smart.’ But I’m like ‘no, it ain’t because they’re so smart. It’s not because they are smart. They must have studied.’”

Natalie shared that the program taught her that the harder she worked the more successful she could be:

cause it was like you’ve got to work, and work, and work until you get it right. So if you like study some math for like 5 days and if the quiz is like on Monday then you’re going to remember it because your brain is used to it now.”

Jim said that he “think of it with basketball. The harder I work the more playing time I will get. And then I’ll end up starting every game...cause the harder I work the more I get better.”

Summary of Findings

The purpose of this pilot study was to explore the impact of a growth mindset intervention on the reading achievement, self-theories, and attitudes about reading of at-risk 6th grade students. In addition, students’ experiences with the Brainology™ computer program were also examined. Quantitative data were collected and analyzed for four of the five research questions. Non-significant results were found for research questions one, two, three, and four. Qualitative data were collected for research question five through the use of focus group interviews. Results from the focus group interviews indicated that the students’ experiences with the Brainology™ program were positive.

CHAPTER FIVE

DISCUSSION

The purpose of this pilot study was to determine the impact of a growth mindset intervention on students' reading achievement, their mindsets, and their attitudes towards reading.

Discussion of Findings

The results of the present study will be summarized and discussed based on the quantitative and qualitative data.

Quantitative Findings

The quantitative data yielded non-significant results for research questions one, two, three, and four. Research question one explored the impact of the Brainology™ intervention on reading achievement as measured by the MAP posttest, and research question two examined the relationship between reading achievement and students' self-theories. Research question three explored the impact of the Brainology intervention on students' self-theories, and research question four examined the impact of the Brainology™ intervention on students' attitudes about reading. Potential reasons for these results will be discussed through the lenses of the previously-reviewed literature of adolescent development, motivation, and the academic environment of middle grade

students. Other possible explanations for the non-significant results not directly related to these three areas will also be explored.

Adolescent development. Adolescence is a critical developmental period (Adams, 2005; Erikson, 1994b) and it is a period of profound physiological, sociological, and psychological changes (Anderman & Maehr, 2010; Eccles & Roeser, 2009). The impact that these changes, such as the physiological changes associated with puberty, potentially had on the quantitative results of the present study will be discussed.

Physiological changes. One physiological change during adolescence is puberty (Adams, 2005), which may have led to a developmental mismatch during this study and therefore lessened the impact of the intervention.

While puberty is a normative event, the beginning of puberty can vary dramatically (Simmons & Blyth, 1973), particularly between girls and boys (Anderman & Mueller, 2010), and this timing can account for “substantial differences” in puberty’s sociological and psychological impacts (Adams, 2005). The reviewed literature suggests that it is possible that not all of the students in the treatment group ($n = 18$) had begun puberty at the time of this study. According to Erikson (1994a), if these students had not yet begun puberty then they would not have been ready for *abstract thought*. Whereas *concrete thinking* represents the known and visible world, *abstract thinking* includes concepts and relationships (Erikson, 1994b). Examples of abstract thought include adolescents’ thoughts about their intelligence and understanding the relationship between effort and success (Dweck, 1986), as well as thinking about concepts such as justice or intelligence or hypothetical situations (Piaget, 1952). While the responses and behaviors associated with these different mindsets have been observed in very small children (e.g.,

Zentall & Morris, 2010), individuals are not developmentally able to think abstractly about these topics until they reach adolescence (Dweck & Master, 2009; Erikson, 1994b). The Brainology™ program was designed to use with adolescent students between the 5th and 9th grades (Dweck & Master, 2009), yet within the context of the present study the impact of pubertal timing could have meant that the participants would not have been developmentally ready to receive the intervention used in the present study, which would have minimized or restricted its influence on these students and thus the results of this study.

Sociological changes. During adolescence individuals experience sociological changes (Eccles & Roeser, 2003), including the increasing importance of their social relationships with their peers (Ryan, 2001) which have been shown to be influential and important (Hamre & Pianta, 2001). These peer relationships may have influenced the findings in the present study by limiting the impact of the intervention for individual students due to the presence of their peers during the intervention sessions as well as during the three posttests.

Relationships with peers. Because adolescents are highly aware and sensitive to their social environment (Wentzel, 2007; Wigfield & Wagner, 2007), their peer relationships impact their actions in school (Ryan, 2001). One example of the potential impact of this social environment may have been the amount of time that students spent on the reading MAP tests. On average the students in the treatment group ($n = 18$) spent between 15 – 20 minutes on the MAP posttest, yet three students in the treatment group finished the MAP posttest very quickly relative to the rest of the treatment group. Madeline, the student who gave the Brainology™ program a ranking of 1 out of 2

million, finished the MAP posttest within eight minutes and she loudly exclaimed “I’m done!” to the rest of the class, who were still silently working. The two girls who were sitting next to her then proceeded to click quickly through the rest of their answers and they finished a few minutes after Madeline and before any other students.

According to the theory of *social pressure* (Festinger, 1954), individuals may feel pressure to conform to other group members’ actions or statements, and they feel more confident when their opinions or choices match the consensus of the group, but when their opinions or choices are different then they feel a burden to conform to the group’s preferences or decisions (Festinger, 1963). While social pressures exist throughout individuals’ lives (Festinger, Gerard, Hymovitch, Kelley, & Raven, 1952), they are particularly powerful during adolescence due to the importance of social influences during that developmental stage (Adams, 2005). Because of the students’ heightened social environment, it is possible that Madeline’s loud public statement that she was finished pressured the other students to finish quickly as well. Perhaps not surprisingly based on the time they spent and their perceived effort on the test, Madeline and the three other students all scored far lower ($M = 10$ pts) on their MAP posttest than they did on their MAP pretest, which ultimately influenced the results of the treatment group’s MAP posttests. It is possible that if these adolescent students had worked longer and had tried harder on the MAP test then they would have scored higher on the test; that potential increase may have influenced the group’s overall score on the MAP posttest. Therefore, the potential impact of social pressure on adolescents in an already sensitive social environment may have lessened their effort and performance on the reading MAP posttest and thus the results of this study.

Psychological changes. The dramatic psychological changes that occur during adolescence (Allen & Allen, 2009; Cote, 2009; Erikson, 1994b), include the development of self-concepts (Schunk, 1991) and the formation of an identity (Erikson, 1994a), both of which are associated with academic achievement (Bandura, 1977; Dweck & Master, 2009; Zimmerman, Bandura, & Martinez-Pons, 1992). Because students' self-efficacy and identities govern their responses to failures and challenging situations, it is possible that these psychological changes may have influenced the findings in the present study.

Self-concepts. Self-concepts are individuals' collective self-perceptions (Schunk, 1991) and include self-efficacy (Bandura, 1977) and self-theories (Dweck, 1986). It is possible that the students in the treatment group did not feel very efficacious when they took the MAP posttest because of their past history of academic and reading failure. These at-risk 6th grade students, all of whom have experienced previous academic failure in reading, may have not felt efficacious enough to increase their achievement on the MAP test and they may not have tried to their full potential. These students may have felt trapped in a recursive pattern of failure and thus low effort on reading tests based on their previous struggles. Since self-efficacy beliefs have a significant relationship with academic performance (Multon, Brown, & Lent, 1991; Pajares & Urdan, 2006), the students' perceived lack of self-efficacy could have led to a "learned helplessness" response when they took the MAP posttest, which would have influenced the results of the present study because they would have given up instead of persevering through a difficult activity.

Identity formation. Most students typically develop their identities during their time in middle school (Erikson, 1994b; Simmons & Blyth, 1987). Similar to self-concept

beliefs, identity formation is important for at-risk students because identities typically govern students' patterns of behavior and responses to failure in school (Cote, 2009; Dweck & Elliot, 1983), which could have influenced the effort students put forth on the posttests and thus the results of the present study.

As previously suggested, it is possible that some or all of the students in the treatment group had not moved into the adolescent stage of development. One component of the adolescent stage is the movement from concrete to abstract thought (Erikson, 1994b; Piaget, 1952), specifically as it relates to formation of adolescent students' identity. Identities govern behavior and help students make meaning of the ideas and concepts of effort, success and failure (Dweck, 2006). However, if the students in the present study had not yet entered the adolescent stage, then they were most likely developmentally unable to receive the mindset intervention because they not able to think about their self-theories or their beliefs about work, effort, and failure (Erikson, 1994b). This developmental mismatch would have potentially impacted the quantitative results for the MAP test and the Mindset Questionnaire because they were unable to think abstractly about these concepts and thus receive the full influence of this treatment.

Motivation. The findings of the present study showed that the Brainology intervention did not impact the mindsets of the individuals in the treatment group, which was surprising because past research had suggested that it is possible to influence students' self-theories through either the classroom teacher (Cimpian et al., 2007; Mueller & Dweck, 1998; Zentall & Morris, 2010) or through a mindset intervention such as the Brainology computer program (Blackwell et al., 2007; Dweck, 2007, 2009). As

previously discussed, it is possible that these results may have occurred because of a developmental mismatch.

Academic environment. The adolescent academic environment has a strong influence on students' motivation to learn and their academic achievement (Cleary, 2009). Four components of the academic environment that may have lessened the effectiveness of the Brainology intervention program include systems ecology, curricular alignment, interventions at the student level, and classroom teachers.

Systems ecology. Systems ecology (e.g., Odum & Barrett, 1971) within the context of schools refers to the idea that students are nested with teachers. As students in an American middle school, the participants in this pilot study had multiple teachers each day (Anderman & Mueller, 2010; Byrnes & Ruby, 2007; Ruby, 2006). This is important to note in the present study as it suggests that students may have been exposed to different messages from their other teachers during the experiment.

As a point of reference, the students spent approximately 15 times the amount of time with their language arts teacher each week than they did with the researcher receiving this intervention. In total, for every 30 minutes a week that the students spent with the researcher receiving the intervention, they also spent 450 minutes with their language arts teacher, 450 minutes with their math teacher, 450 minutes with their social studies or science teacher, 225 minutes with their physical education teacher, and 225 minutes with their exploratory teacher. Each week therefore the students spent 1,800 minutes with these 5 teachers but only 30 minutes with the researcher, which was a difference of 60 times the amount of minutes they spent receiving the intervention. The various and different messages and influences that the participants received from these

five other teachers during the study could have diluted, lessened or even contradicted the treatment, which would have influenced their MAP, ERAS, and Mindset posttests.

Curricular alignment. The curriculum that students experience at school should be structured and ordered to augment their learning and achievement (McDonnell, 1995), and the term *curricular alignment* means that what students are taught is the same as what is assessed or measured (English & Steffy, 2001). One reason that curriculum alignment is important is because it allows for researchers to “understand the differences in the effects of schooling on student achievement” (Anderson, 2002, p. 259), such as the differences that may result following an academic intervention. Based on the results of this pilot study, it is apparent that the Brainology intervention was not directly aligned with either the language arts curriculum or the MAP, ERAS, and Mindset instruments.

The Brainology™ program presented information concerning intelligence, brain plasticity, and effort. These specific topics were not directly monitored or assessed during the three posttests, nor did they directly align with the 6th grade language arts curriculum. It is possible that if these concepts taught by the Brainology™ program had been more directly aligned with the 6th grade language arts curriculum then there may have been a stronger academic influence on the students in the treatment group because this information would have been a consistent message in all of their classes instead of just one isolated class session (English & Steffy, 2001). A curricular alignment among classroom instruction, the intervention, and the assessment(s) might have resulted in different results than those of the present study because the students would have been taught and then assessed on the topics of intelligence, brain plasticity, and effort.

Interventions at the student level. When students struggle in school, school leaders need to provide interventions to help the students to learn the material and to increase their achievement (Fuchs et al., 2010). These interventions are designed to help students to access the curriculum and to avoid unnecessary academic failure (Hale et al., 2006). While effective interventions can influence achievement (Kavale et al., 2008), within the present study the reliability and effectiveness of the Brainology intervention may have actually lessened its impact on the participants.

Reliability and validity of the intervention. Even though the research previously discussed (e.g., Dweck, 2007) has suggested that the Brainology intervention program was effective in increasing students' academic achievement and in encouraging students to adopt a growth mindset, the findings of the present study did not match the existing literature. One reason for these results may be due to the low levels of *reliability* and *validity* of the Mindset questionnaire. *Reliability* refers to the idea that repeated assessments of an item would be consistent or would be reproducible (Bartko, 1991), while *validity* refers to the idea that researchers can “draw meaningful and justifiable inferences” from the results (Creswell, 2005, p. 600). As seen in Table 4.4, the reliability levels of the Mindset questionnaire were calculated using Cronbach's alpha and ranged from .23 to .54. This range was particularly low relative to the reliability of the Elementary Reading Attitude Survey, which was .93. These low levels of reliability lowered the Mindset questionnaire's validity and thus the results of the study because the instrument did not accurately capture the information consistently (Murphy & Davidshofer, 2005). Since the Mindset questionnaire has a low reliability, it is reasonable

to assume that there could have been different quantitative findings if the instrument were administered again, thereby influencing the results of the present study.

Effectiveness of the intervention. Brief psychological interventions, such as the Brainology computer program, can have an impact on academic achievement (Walton & Cohen, 2011; Yeager & Walton, 2011). While the research previously discussed suggested that it is possible to influence students' self-theories (e.g., Dweck & Molden, 2007) and that influencing self-theories led to increased academic achievement (Blackwell et al., 2007), the findings of the present study did not find this to be true for any of the three posttests. The Brainology program was not effective in changing students' mindsets, their attitudes towards reading, or their reading achievement. The Brainology program had previously been shown to be effective with 7th and 8th graders (Blackwell et al., 2007), but it had not been used with at-risk 6th graders before this study. The results of the present study suggest that this intervention may not be effective with 6th grade students, possibly because of the previously discussed developmental mismatch at this age. Since the intervention was not effective in its primary purpose of influencing students' mindsets, it is perhaps not surprising that it was also not effective in its secondary goals of influencing students' attitudes towards reading or their reading achievement. Therefore, the evidence during this pilot study does not support the effect of the Brainology™ program in changing the participants' reading achievement, reading attitudes, or self-theories.

Classroom teachers. The effectiveness of the classroom teacher has a significant influence on student achievement (Darling-Hammond, 1997, 2000; Hattie, 2009), yet unfortunately students who are at-risk of school failure, such as the students in this study,

often have the least experienced and least effective teachers (Balfanz & Byrnes, 2006; Edmonds, 1979; Somers & Piliawsky, 2004). It is possible that the reason that there were no academic gains during the present study is because the students had ineffective language arts teachers. It is important to note again that the students received 15 times the amount of exposure to their language arts teachers each week as they did the intervention. Since student achievement and teacher effectiveness are associated (Darling-Hammond, 2000), if the participants' teachers were ineffective then even if the intervention had changed their mindsets the students would not have been able to increase their reading achievement due to the limited influences of their teacher. Therefore, the participants may have been ready to learn and to work harder, but they would not have received an opportunity to learn new material or to increase their achievement on the posttests because of their ineffective classroom teachers, thereby eliminating any possible academic increases on the MAP tests during this study.

Other possible explanations. In addition to the reasons just discussed, there are several other potential causes for the non-significant results that are not directly associated with the literature previously reviewed in this study. These potential causes include transference, differentiation and respectful tasks, and student engagement.

Transference of knowledge. Students' prior knowledge and cognitive strategies are associated with learning (Corno & Mandinach, 1983). One important cognitive phenomenon is *transference*, which refers to the study of "how knowledge is acquired in one situation applies (or fails to apply) in other situations (Singley & Anderson, 1989, p. 1). Transference of knowledge is essential at both the individual and organizational levels (Argote & Ingram, 2000), and the dilemma that individuals often cannot or do not

transfer their prior knowledge to new academic situations and tasks has been called “the fundamental educational question” (Singley & Anderson, 1989, p. 1). While academic interventions can influence achievement and motivation (Fuchs et al., 2010), it is important to consider that many students who have received an academic intervention often “fail to transfer their use of these strategies to other school tasks after the training” (Pintrich & Schrauben, 1992, p. 149), which may have occurred in the present study and thus influenced the three posttests.

It is possible that the intervention may have influenced students’ beliefs during the Brainology program sessions, but that the students did not transfer their new knowledge to other tasks outside the computer sessions. For example, the students may not have transferred the lesson that taught them that success and effort were associated to the actual task of the reading MAP posttest. If they did not transfer this conceptual knowledge to the task of taking the MAP posttest, then they may not have put forth their best effort and may not have scored to their full academic potential. Perhaps if the students had transferred the Brainology lessons of effort and success to the actual tasks of taking the MAP posttest, the ERAS posttest, and the Mindset questionnaire then there would have been different quantitative results in this study because the students would have worked harder on the tasks. This perceived lack of transference also supports the possibility that the Brainology intervention program was not effective.

Differentiation of instruction and respectful tasks. Differentiation of instruction (Tomlinson, 2001) refers to the philosophy of personalizing instruction for each student. Notable principles of differentiation include a high quality curriculum, flexible grouping and respectful tasks (Tomlinson, 1999). *Respectful tasks* consider an individual student’s

level of readiness and provide an opportunity for students to demonstrate academic growth (Tomlinson, 2001). Tomlinson & Strickland (2005) have posited that the learning activities that students have in school should be respectful tasks because they “allow students to engage in independent decision-making, problem solving, investigation, experimental inquiry, creative expression, and related forms of higher-order thinking processes” (McTighe & Brown, 2005, p. 238).

In examining the non-significant results, it is important to consider that the present study did not include differentiation. The study did not differentiate by process, product, or content (Tomlinson, 1999), as all participants in the treatment group ($n = 18$) received the same intervention program. Because of the diverse background of the participants, it is possible that a generalized program that was not individualized for these students may have influenced these results because students were at different developmental, academic and social levels (Adams, 2005; Elmore, 2009). It is also possible that the Brainology intervention or the instruments in this study were not respectful tasks for this population of struggling 6th grade students. Since respectful tasks provide an opportunity for students to demonstrate learning (Tomlinson, 1999), it is possible that the absence of respectful tasks may have caused the non-significant results on the ERAS, the Mindset questionnaire, and the MAP reading posttests because students did not have an opportunity to demonstrate their individualized learning. Since experimental research has long confirmed that “different minds learn differently” (Levine, 2002, p. 23), this lack of differentiation may have lessened the impact of this intervention on the diverse participants.

Engagement. The psychological construct of *engagement* has gained increasing consideration in recent years as a potential solution to the problems of declining motivation and achievement during the adolescent years (Shernoff, Csikszentmihalyi, Shneider, & Shernoff, 2003). Engagement is often used as a multifaceted term that has three primary definitions:

Behavioral engagement draws on the idea of participation; it includes involvement in academic and social or extracurricular activities and is considered crucial for achieving positive academic outcomes and preventing dropping out. *Emotional engagement* encompasses positive and negative reactions to teachers, classmates, academics, and school and is presumed to create ties to an institution and influence willingness to do the work. Finally, *cognitive engagement* draws on the idea of investment; it incorporates thoughtfulness and willingness to exert the effort necessary to comprehend complex ideas and master difficult skills. (Fredericks et al., 2004, p. 60)

Since engagement is often considered to be malleable, it has been suggested as a way to intervene with low levels of academic achievement (e.g., low test scores) as well as low levels of academic attainment (e.g., high levels of dropping out of high school) (National Research Council & Institute of Medicine, 2004).

It is possible that the participants were not engaged behaviorally, emotionally, or cognitively –or any combination of the three- either during their classes, during the intervention, or both, during this study. Since behavioral engagement and academic achievement are associated (Connell, & Wellborn, 1991; Connell, Spencer, & Aber, 1994), the lack of behavioral engagement could have influenced the non-significant results with the MAP reading test since students may not have tried their best and were not fully involved in what they were doing. In addition, since students' emotional engagement and their attitudes and preferences about school and school activities are associated (Connell, & Wellborn, 1991; Connell et al., 1994; Fredericks et al., 2004), if

students were not emotionally engaged in the intervention then this would have lessened the impact of the intervention on influencing their attitudes towards reading as seen on the Elementary Reading Attitude Survey. Finally, because psychological constructs such as goal setting (e.g., Ames & Archer, 1988) and self-theories (e.g., Dweck & Mueller, 1988) are associated with cognitive engagement, this may have influenced the results of the Mindset questionnaire. If the participants were not cognitively engaged during the study then this would have impacted the influence of the intervention in modifying their self-theories because they would not have been thinking about their own thinking.

Qualitative Findings

Qualitative data collected by the use of three focus group interviews showed that overall the treatment group ($n = 18$) had positive experiences with the Brainology computer program. Sixteen of the 18 students indicated that they liked using the program, and 16 of the 18 students stated that they would recommend the program to a friend. Potential reasons for these results will now be discussed as they relate to the previously discussed topics of adolescent development, motivation, and the academic environment of 6th grade students. Adolescents' acquisition and integration of new knowledge will also be explored as additional potential explanations for these results.

Adolescent development and social pressure. One result of the rapidly increasing importance of social relationships during adolescence (Adams, 2005) is the impact of peer influences or peer pressure on individuals' decisions. Peer influences during adolescence are associated with academic achievement (Dowrick & Crespo, 2005; Wentzel, 2003, 2007), and adolescents' peers often influence their decision-making (Ryan, 2001), such as the choice to put forth academic effort (Sacerdote & National

Bureau of Economic Research, 2000). Peer pressure's influence on adolescents' decision-making is so powerful that it has even been suggested to influence the decision for some teenage girls to become pregnant (Akerlof, Yellen, & Katz, 1996). One peer influence relevant to the present study is the issue of *social pressure*, which Festinger (1963) described as they exist in informal groups, such as the focus group interviews used in the present study.

Experimental research has long confirmed that individuals in a group are influenced by and may even change their responses based on the group's statements and choices (Asch, 1951, 1952). In this pilot study it is possible that some students may have felt a pressure to conform to other students' positive statements during the focus group interviews. Because individuals spoke openly within a group of five, six, or seven students, some participants may have felt a pressure to agree with other students who had previously shared that they liked the program or that they felt that the program had influenced their beliefs. This can be seen in the participants' responses to the questions about whether or not they enjoyed the program and whether or not they believed it influenced their self-theories. In two of the three focus group interviews the first two people who answered the question "Did you like using the [Brainology] program?" responded positively, and then all of the remaining members also answered positively. In the third group, however, the first two persons responded negatively. While still positive, the remaining members of this group were not exceptionally positive (e.g., "it was ok") relative to the other two groups. These relatively lukewarm responses compared to the other two groups may have been due to social pressures from the initial speakers. Social pressures, which are an inherent concern in focus group interviews (Festinger, 1954),

may have encouraged individual students to match the group's preferences, which would have influenced the qualitative results in this pilot study.

Motivation and engagement. Motivation describes the “why of behavior” (Covington, 1992) and it is associated with both academic achievement in general (Yeung & McInerney, 2005) and reading achievement specifically (Baker & Wigfield, 1999). One construct of motivation relevant to the present qualitative data is *engagement* (e.g., Fredricks et al., 2004), and in particular *emotional engagement*, which refers to students' affective responses and their desire or willingness to do academic tasks in school (Weiner, 1985). Emotional engagement has been linked to at-risk students' decisions to drop out of school (Balfanz, 2009; Finn, 1989) because these students feel less emotionally connected to school, enjoy school less, and exert less effort than their peers (Ekstrom, Goertz, Pollack, & Rock, 1986; Rumberger, 2001). Pintrich & de Groot (1990) have stated it is important to note students that are required to attend school but they can choose if they are cognitively or behaviorally engaged in their academic tasks. Students' emotional engagement has been suggested as a potential solution to adolescents' declining motivation and achievement (Finn & Rock, 1997) because it is presumed that if students are emotionally engaged then they are more likely to be more motivated to exert more effort on academic tasks (Balfanz et al., 2007).

In the present study the qualitative data shows that a majority of students indicated that they enjoyed using the computer program and that they liked the Brainology program; the participants shared that they liked the characters, the map, the lesson, and the computer program in general. Since components of emotional engagement include students' preferences and interests (Epstein & McPartland, 1976;

Skinner & Belmont, 1993), these data are important because it demonstrates that these students were emotionally engaged with the intervention. Emotional engagement is often considered to be a critical first step to behavioral and cognitive engagement (Fredricks et al., 2004), meaning that these qualitative results suggest that this intervention could be an effective first step to influencing adolescents' achievement and motivation because it could provide an initial emotional hook for later cognitive and behavioral engagement.

Academic environment and influencing students' beliefs. Adolescents spend a substantial amount of their lives in school (Eccles & Roeser, 2009) and adolescents' academic environment has a significant influence on their achievement and motivation (Hanushek, 2010). One previously discussed component of the adolescent academic environment that is relevant to these qualitative data is the use of interventions. Brief psychological interventions have been shown to change individuals' beliefs (Blackwell et al., 2007), behavior (Alexander & Parsons, 1973), and achievement (Walton & Cohen, 2011). The qualitative data in the present study, in which 16 of the 18 participants indicated that the Brainology intervention influenced them to change their perceptions of their intelligence, is consistent with the current literature (e.g., Yeager & Walton, 2011) that brief psychological interventions can impact individuals' beliefs. The data that 16 of the 18 students also indicated that they liked the program and that they would recommend the program to their friends is also consistent with the literature that interventions can change individuals' preferences (Walton & Cohen, 2011). It is interesting to note again that the quantitative and qualitative data for this topic are not consistent, perhaps because of the reasons suggested that influenced the intervention and assessment measures.

Other possible explanations. In addition to the reasons just discussed, there are several other potential causes for the qualitative results, including adolescents' acquisition and integration of new information. Furthermore, because the results from this pilot study suggest potential inconsistencies with both Erikson's theory of psychosocial stages of development as well as the self-theories work of Dweck, both theories will be discussed further in this section.

Adolescents' acquisition and integration of new information. Similar to Erikson, Piaget (1952; 1964; 1997; 2007) also posited that individuals go through stages of intellectual growth or cognitive development as they grow and acquire new knowledge. Piaget (2007) used the term *schema* to define both categories of knowledge (e.g., how to use a computer) and the process of acquiring new knowledge (e.g., how to use a new computer program). According to Piagetian theory, when individuals encounter new information or new experiences they can either integrate or modify the new information into their existing schema (Block, 1982). Piaget (1964) stated that *assimilation* was the "integration of any sort of reality into a structure" (p. 185) and defined *accommodation* as a modification of an existing schema. Piaget posited that both assimilation and accommodation were equally important for learning and cognitive development:

Without assimilation, there would be no sense of continuity, no appreciative mass - the very fundament of meaning. Without accommodation, there would be no sense of change, no way of escaping a perseverative solipsism. As Piaget remarks, 'if assimilation alone were involved in development...[the child] would not develop further' (Block, 1982, p. 282).

Assimilation and accommodation are equal components of what Piaget (1964) called *cognitive adaptation*, which is the process by which individuals make sense of new information. *Cognitive equilibrium* occurs when new information can be assimilated into existing schema, whereas *cognitive disequilibrium* occurs when the new information

cannot be assimilated into existing schema and the schema must be adapted to accommodate the new information (Piaget, 1997, 2007). Similar to the concept of cognitive disequilibrium is *cognitive dissonance* (Festinger, 1957), which is the uncomfortable state that occurs when individuals hold two conflicting ideas simultaneously, and thus individuals try to achieve *cognitive consonance* by resolving and avoiding the conflict (Festinger, 1954; 1957).

According to cognitive disequilibrium or cognitive dissonance theories, there may have been influences on students' statements regarding their enjoyment of the program and the program's impact on their beliefs which impacted the qualitative data. As an example, it would be reasonable to assume that cognitive consonance would be achieved by individuals in this pilot study who enjoyed the program and who then stated that the program had an impact on their beliefs. It is possible that students who indicated that they enjoyed the Brainology™ program felt an even stronger sense that the program had influenced their beliefs about intelligence and effort so as not to suffer cognitive dissonance; these students may have overstated the influence of the program due to the fact that they liked it, which would have influenced their responses in the interviews. It is also possible that if they believed that the program had influenced their beliefs that they may have overstated how much they enjoyed the program so as to achieve cognitive consonance, which also would have influenced the results by making their statements more positive.

As seen in the transcripts, 17 of the 18 students indicated that the Brainology™ computer program changed the way that they think of their intelligence and their brain. Using Piagetian theory, this means that seventeen students accommodated the new

knowledge they gained from the Brainology™ program. When they began to learn about intelligence and how their brain works, they experienced cognitive disequilibrium because these new ideas could not be assimilated into their existing schema about their intelligence and their brain, and they then accommodated this new knowledge by creating a new schema that defined intelligence as a result of hard work instead of innate ability. The other student experienced cognitive equilibrium as this new knowledge was assimilated into his existing schema concerning intelligence and the brain. Within the context of this study and using Piaget's theoretical framework, this desire for cognitive consonance would explain the students' positive statements. Sixteen of the eighteen students stated that they believed that the computer program taught them that the harder they worked the more intelligent or successful they would be. Again, using Piagetian theory, as a result of the Brainology™ program these sixteen students experienced cognitive disequilibrium and were forced to accommodate the perspective that effort was associated with intelligence and success. The other two students were able to assimilate this belief into their existing schema about the role and value of effort. In summary, the ways that these participants acquired and integrated the knowledge from the intervention could have influenced the qualitative data.

Potential inconsistencies in Erikson's theory of psychosocial development. The qualitative data in this study suggest potential inconsistencies in Erikson's theory of stages of psychosocial development. While Erikson's theory is "enormously complex and highly textured," it also has been criticized as "oversimplified" in its description of the movement between the stages of psychosocial development (Mitchell & Black, 1995, p. 148). Erikson posited that individuals negotiate learning tasks or crises (e.g., the battle

industry vs. inferiority) during their eight stages of development, and after they successfully complete these tasks they progress to the next stage. Within Erikson's theory, individuals do not necessarily revert back to tasks or struggles from previous stages, meaning that adolescents would not struggle with the crises of *trust vs. mistrust* or *initiative vs. guilt* as these tasks would have already been "solved" during the *Oral-Sensory* and *Locomotor-Genital* stages, respectively (Erikson, 1994a; Evans, 1967).

Within the present study, the qualitative data suggest that there is an inconsistency regarding Erikson's theory of psychosocial stages. According to Erikson, abstract thought is a characteristic of individuals who have transitioned from the *Latency* stage to the *Adolescent* stage, which typically occurs as individuals begin puberty. The literature reviewed (e.g., Adams, 2005) suggests that because pubertal timing varies greatly, not all of the students in this study had begun puberty, and thus according to Erikson (1994a) they would not have been developmentally ready for abstract thought. However, the students' responses to the focus group questions clearly indicate that they were capable of abstract thought as they discussed topics such as motivation, identity, failure, success, effort, intelligence, and brain plasticity. These statements, therefore, suggest that these delineations between stages as suggested by Erikson may be inconsistent, and that perhaps individuals are able to negotiate the biological and sociocultural forces outside of their current stage of development.

Potential inconsistencies in Dweck's self-theories. The qualitative data suggest that there are potential inconsistencies within Dweck's theoretical framework, specifically regarding the division of entity vs. incremental theories. The students' responses during the focus group interviews did not adhere to the "strict dichotomy"

(Kristjansson, 2008, p. 225) of preferring an incremental or entity theory as posited by Dweck (2007). Their responses to questions concerning ability, intelligence, effort, and brain plasticity were more nuanced and reflected more of a continuum than a simple division between these two constructs, which suggests that Dweck's theory is inconsistent in its explanation of individuals' actual beliefs. In addition, when one considers that Dweck has shared that the Mindset questionnaire uses the strict dichotomy of "either/or" in its statements "for the sake of simplicity" (Dweck, 2006, p. 46), it also suggests that this inconsistency may have also influenced the quantitative data in the present study, which has also been offered as a critique by previous researchers (Anderson, 1995; Kristjansson, 2008; Weiner, 1995). The potential impact on both the qualitative and quantitative data further shows this theory's inconsistent explanation of the potentially wide range of individuals' beliefs concerning these topics.

Limitations and Implications for the Research Design

There were a number of limitations and implications for the research design that resulted from this pilot study. Researchers should consider the topics of the Brainology™ computer program intervention, instrumentation, sample size, social pressure, and systems ecology when designing future studies.

Intervention. As Creswell (2005) has written, interventions in an experiment are the "ways a researcher physically intervenes with one or more conditions so that individuals experience something different in the experimental conditions than those in the control conditions" (p. 593). The intervention used in the present study was the Brainology™ computer program. Key components of this intervention that will be explored include the fidelity of implementation and timing of the intervention.

Fidelity of implementation. One important component of a successful intervention is a strict *fidelity of implementation* (FOI) to the program's suggested protocol (U.S. Department of Education, 2003). Fidelity of implementation refers to "the extent to which delivery of an intervention adheres to the protocol or program model originally developed" (Mowbray, Holter, Teague, & Bybee, 2003, p. 315). Fidelity is important because it serves as a "confirmation that the manipulation of the independent variable occurred as planned" (Moncher & Prinz, 1991, p. 247). When an intervention, such as the Brainology™ computer program, occurs in an academic or other setting, there is typically variation in the fidelity of its implementation to the program's protocol (Blakely et al., 1987; Dusenbury, Brannigan, Falco, & Hansen, 2003). While some variation in FOI is not unusual (Moncher & Prinz, 1991), too much variation can negate the reliability or fidelity of the intervention (Century, Rudnick, & Freeman, 2010).

According to Briceno (E. Briceno, personal communication, November 11, 2010; February 5, 2012), the Brainology™ program has an implementation protocol that has been developed to increase the intervention's effectiveness. Among other recommendations, the program recommends that the weekly Brainology™ computer sessions be augmented with lessons each week in the classroom. These classroom lessons last approximately one hour per week and are designed to supplement and to reinforce the messages and information that are presented in the computer program.

During the present pilot study there was a relatively low level of FOI due to restrictions on time and access to the students' language arts classroom. The treatment group ($n = 18$) did not receive any of the additional Brainology™ classroom lessons and activities; the treatment group received only the Brainology™ computer program as a

stand-alone intervention. The researcher was given permission to work with the students only once a week for approximately 30 minutes, but the researcher was not given access to working with the students outside of this time. The researcher was also not permitted to include the supplemental classroom lessons in the students' 90 minutes of daily language arts instruction. Due to these restrictions, there was a low level of FOI during this pilot study. Since a low level of FOI is a threat to an intervention's effectiveness (Dusenbury et al., 2003), it is possible that the reduced level of fidelity in this pilot study lessened the Brainology program's effectiveness and thus the results of this study because the participants received the treatment in isolation for a minimal amount of time each week.

Timing of the Intervention. As previously reported, opportunity to learn (Brophy, 1984) is significantly related to student achievement (Fuchs & Fuchs, 2006). The present pilot study was conducted over eight weeks in the late spring of 2012. During the study all students ($n = 30$) continued to receive instruction in their daily 90 minute language arts class, and all students ($n = 30$) also continued to receive their reading intervention time of 45 minutes every other day. It is, however, important to note that the timing within the academic year and as well as to the Virginia SOL exams may have influenced the dependent variable of the MAP posttest, particularly in regards to the opportunity to learn new material. Since this pilot study occurred during the spring, most of the instruction and activities that occurred for students in their language arts classes were a review designed to help them pass the state test as opposed to learning new material. Because the timing of this intervention coincided with a period of review in their language arts classes, there was not an opportunity for any of the participants ($n = 30$) to

learn new material. This means that even if the Brainology™ intervention had been effective in changing students' mindset, due to the timing of this study they would not have an opportunity to learn new material and thus demonstrate an increase in their reading achievement. Since opportunity to learn is associated with achievement (Husen, 1967), even though students had an opportunity to consolidate their prior learning, the timing of this study lessened the potential academic impact of the Brainology program because the participants did not have an opportunity to learn new material.

Instruments. Psychological *instruments* are “tools for measuring, observing, or documenting quantitative data” (Creswell, 2005, p. 592). There were three instruments used in the present study: the Mindset questionnaire, the Elementary Reading Attitude Survey (ERAS), and the Reading Measures of Academic Progress (MAP) test. The topics of sensitivity and measurement of these instruments will be discussed as potential influences on the results.

Sensitivity. Instrument *sensitivity* refers to the degree to which a given psychological instrument can “discriminate among individuals with varying levels of the desired attribute of interest” (Ferketich, 1991, p. 168). Instrument sensitivity may also describe the ability of an instrument to detect changes over time as a result of treatment effects (Eckert, Diamond, Miller, Velligan, Funderburg, & True, 1996). Instruments that are not very sensitive may not be able to detect minor changes even if they occurred during a study (Löwe, Kroenke, Herzog, Gräfe, 2004).

It is possible that the instruments chosen in this study were not sensitive enough to detect differences after an eight week intervention. The MAP tests are designed primarily to indicate differences over the course of an academic year and not specifically

over a short time period (NWEA, 2007). The ERAS is also designed to detect difference over longer periods of time, such as an academic year (McKenna & Kear, 1990). Since instruments need to be sensitive to detect differences over time (Eckert et al., 1996), it is reasonable to consider that perhaps the non-significant findings for the MAP and ERAS posttests occurred because these two instruments were not sensitive enough to identify differences that occurred over 8 weeks during this pilot study. The Mindset questionnaire, however, is designed to be sensitive to an intervention period of around three months (Blackwell et al., 2007), so it should have been sensitive enough to detect changes during this study. However, the low level of FOI that occurred in this pilot study may have negated the potential benefits of the intervention and may have made the questionnaire's sensitivity a moot point.

Measurement. Psychological *measurement* is the “process of assigning numbers (e.g., test scores) to persons in such a way that some attributes of the persons being measured are faithfully reflected by some properties of the numbers” (Murphy & Davidshofer, 2005, p. 73). Measurement allows researchers to determine whether or not a treatment impacts an outcome or dependent variable (Creswell, 2005). Two important components of measurement relative to the present study include the constructs of *reliability* and *dependent variables*.

Reliability. As previously noted, *reliability* refers to the idea that repeated assessments of an item are consistent or reproducible (Bartko, 1991). Another important concept of reliability is that the individual scores are “free from sources of measurement error and consistent” over time (Creswell, 2005, p. 597). A high degree of reliability is a requirement for a good psychological measurement (Murphy & Davidshofer, 2005).

As previously reported, separate reliability analyses were run using Cronbach's alpha for each dependent variable. As seen in Table 4.3, the reliability of the Mindset questionnaire was low with a value of .54. The ERAS instrument was higher with a value of .93, while the reported reliability of the MAP tests in general range from .92 - .96 (NWEA, 2007). Thus there is evidence that the findings for the ERAS and the MAP tests can be considered to be reliable representations of the participants' characteristics, while the Mindset questionnaire's results cannot be considered sufficiently reliable.

Because reliability and validity are associated (Creswell, 2005), the low level of reliability of the Mindset questionnaire was an internal threat to the validity of that measurement (Murphy & Davidshofer, 2005). This means that the results of the Mindset questionnaire cannot be considered to be an accurate representation of these specific attributes of the participants in this study.

Dependent variables. *Dependent variables* refer to those variables that are governed by the independent variables and are the outcomes or results that occur from the influence of the independent variables (Murphy & Davidshofer, 2005). Dependent variables are important in experimental research as they "permit researchers to determine the impact of an intervention on an outcome for participants in a study" (Creswell, 2005, p. 591). In the present study the dependent variables were the reading MAP posttest, the ERAS posttest, the Mindset questionnaire posttest, as well as the focus group interviews. While there were non-significant findings for these three dependent variables, it is possible that using different dependent variables in this study would have shown the quantitative impact of the intervention.

The dependent variable that measured reading achievement in the present study was the reading MAP test (NWEA, 2007). It is conceivable that a different dependent variable to measure reading achievement would have revealed different results. Three possible dependent variables that could have been used instead of the reading MAP test are the Virginia Reading SOL exam, the students' language arts classroom grade and effort, or a different reading assessment like the Qualitative Reading Inventory (QRI-5) (Leslie & Caldwell, 2011). The Virginia Reading SOL exam could have been used to see if there were influences on students' performance across the entire 6th grade language arts curriculum instead of just their reading achievement. It is possible that the intervention may have had an influence on other areas included on the SOL test, such as using word analysis strategies, which were not captured by the MAP test, which primarily measures reading comprehension (NWEA, 2007).

Another possible dependent variable for reading achievement in this study could have been the individuals' language arts grades. While there have long been lengthy discussions concerning the reliability and validity of classroom grades (Adams, 1932; Allen, 2005; Cizek, 1996; Cross & Fray, 1996; Thorndike, 1997), classroom grades do report student learning at specific moments in time (Pintrich & de Groot, 1990). Even though it is sometimes considered to be only an "ancillary feature of achievement" (Allen, 2005), students' level of effort is an important influence on their classroom grades (Dweck, 1986) and their academic achievement (Fredricks et al., 2004), and in particular their reading achievement (Morgan, 2008; Stanovich, 1986). According to the focus group interviews, the participants shared that the Brainology program taught them to believe that success is a result of effort. It is possible that the participants put forth more

effort in their classes as a result of the intervention and as a result that they earned higher classroom grades, but that this information was not captured as a dependent variable in the present study. Future researchers could rely on teacher observations of the participants in class by using an instrument such as the Rochester School Assessment Package (Wellborn & Connell, 1987) to determine perceived levels of effort, or they could use participants' self-reports on their academic effort (Pintrich & de Groot, 1990). This information, along with participants' classroom grades, could be used to detect the Brainology program's influence on reading achievement and academic effort.

Finally, while the reading MAP test is designed to detect reading progress in secondary students (Cizek et al., 2005), it is possible that the participants' actual reading abilities were too low for this instrument. Even though the secondary reading MAP test used in this study is designed for students in grades 6-12 (NWEA, 2007) and all the participants were in the 6th grade, they all also read below grade level and they had all experienced previous failures with reading tests, which is why they were purposefully sampled for this study. It is probable therefore that since the participants were struggling readers who read at an elementary level that there may have been an academic mismatch because the MAP test may have been too advanced for their actual independent reading level (Chall, 1983). It is possible that a different instrument that measured reading achievement and that was sensitive to their lower reading abilities could have detected the influences of the intervention. One possible reading assessment that could have worked in this situation is the Qualitative Reading Inventory (QRI-5) (Leslie & Caldwell, 2011). The QRI-5 can be used with students in grades 1 through 12, meaning that this assessment would be developmentally appropriate and academically accessible for

students who read significantly below the 6th grade level. Another benefit of the QRI-5 would be the scope of what it assesses. There is evidence (e.g., Paris, Cross, & Lipson, 1984) that it is difficult to influence students' reading comprehension, which is important to note since the MAP reading test primarily measured reading comprehension over time (NWEA, 2007). In contrast to the limited focus of the MAP reading test, however, the QRI can measure grade level reading, fluency, comprehension, vocabulary, and oral reading accuracy (Leslie & Caldwell, 2011). This type of assessment could be useful as it covers a broader area of reading achievement than just comprehension, meaning that future researchers could use the QRI-5 to probe specific areas of reading achievement for any influences from the intervention.

Sample size. *Sample size* is an exceptionally important component of a successful research design (Creswell, 2005), and a large enough sample size can reduce the risk of making Type 1 or Type II errors when researchers are testing hypotheses (Czaja & Blair, 2005). Minimizing the risk of making these errors is complex (Fleiss, 1981), yet critical for successful research studies (Cohen, 1988). One inherent concern for the present study was the small sample size ($n = 30$) of participants.

While there were 230 students in the 6th grade at Bailey Middle School during the 2011-2012 school year, only 30 students had failed their 5th grade reading SOL. Since the purpose of the study was to examine struggling students' self-theories and reading achievement, this resulted in a limited number of students who could be purposefully sampled for this study. Within this quasi-experimental research design the small sample was further divided into treatment ($n = 18$) and comparison ($n = 12$) groups.

This small sample size made it very difficult to detect significant differences, if they existed, between the groups (Cohen, 1988; Czaja & Blair, 2005; Fleiss, 1981). Based on the students' statements during the focus group interviews, the majority of the students in the treatment group believed that the program had influenced their beliefs; however the ANCOVA analysis did not detect differences between the groups. Perhaps if the sample size had been larger the ANCOVA analysis would have detected significant results that would have been consistent with the qualitative data. Future researchers should take great care to ensure that sample size is not a limitation in their studies. One way to replicate the present study with a larger sample size would be to use all of the 6th grade students at Bailey Middle School (N = 230) or all of the 6th grade students in the Copper Ridge School district (N = 959).

Social pressure. As previously discussed, the issue of social pressure (Festinger, 1963) was a concern during this pilot study. It is reasonable to assume that social pressure impacted some of the MAP posttest data based on the incident with Madeline, who finished the MAP posttest very quickly and then announced loudly that she was done, causing several other students to finish their tests rapidly. It is also reasonable that social pressure may have impacted the qualitative data, as students may have felt pressure to conform to their peers' positive statements of support of the program. Since social pressure can be a threat to reliability as well as validity (Asch, 1951, 1952; Fisher, 1993), these influences are limitations to the present study; future researchers should consider ways to minimize the impact of social pressure on both the quantitative and qualitative data. One way to minimize these influences could be to conduct personal interviews

instead of focus groups, and to have students take the ERAS, Mindset questionnaire, and MAP posttests individually instead of within a large group setting.

Systems ecology. The present study did not take into account the role that systems ecology may have played on the participants, which means that the participants ($n = 30$) in this study were exposed to multiple teachers and multiple messages each day as they moved from one class to another, any of who may have influenced the growth mindset intervention's influences. It would be interesting to explore whether or not a consistent growth mindset message across an entire school faculty and thus all of the participants' teachers would have an influence on the students' motivation and reading achievement. As an added benefit, by taking into account the role of systems ecology, future researchers could implement this intervention with a greater level of FOI than the present study.

Implications for School Leaders

The primary goals of school leaders are to ensure that all students achieve at high levels (Cotton, 2003) and that struggling students receive interventions to aid them to succeed in school (Fuchs & Fuchs, 2009). The research and results from the present study can offer suggestions for persons working with at-risk adolescent students, and are particularly important for educational leaders such as school administrators. The topics of curricular alignment and fidelity of implementation, timing of the intervention, teacher effectiveness, and motivation will now be discussed as implications for school leaders.

Curricular alignment and fidelity of implementation. School leaders should ensure that interventions that struggling students receive are not only aligned with the curricula and initial instruction but also the assessment(s) (Fuchs & Fuchs, 2009) so

students have an opportunity to learn what will be assessed (Hattie, 2009). While psychological interventions, such as a growth mindset intervention, can impact student achievement (Walton & Cohen, 2011), they must be aligned to the curricula and assessments in order to maximize their effectiveness, and Husen (1967) stated that one of the “factors which may influence scores on an achievement examination is whether or not students have had an opportunity to study a particular topic” (pp. 162-163). School administrators also need to ensure that teachers clearly understand the desired outcomes regarding student achievement, which is a critical component of effective leadership (Cambron-McCabe, Lucas, Smith, Dutton, & Senge, 2011; Reeves, 2008). Finally, school leaders should also safeguard that interventions adhere to an appropriate level of fidelity of implementation to ensure their overall effectiveness. When there is a low level of fidelity of implementation it is difficult to determine the effectiveness –or ineffectiveness- of the intervention (Blakely et al., 1987). Since school leaders are in a unique position of ensuring compliance with the implementation guidelines, they need to create the necessary opportunities for teachers, such as adequate planning time, to implement interventions appropriately to their specific academic environments.

Timing of the intervention. While some interventions should remain in place throughout the academic year, or at least until the student responds to the intervention (Fuchs & Fuchs, 2006), other interventions can occur over a shorter period of time. As an example, brief psychological or academic interventions can influence student achievement, but they need to occur early enough in the school year to have an impact. School leaders should ensure that interventions begin early enough in the school year

when students are still learning new material as opposed to in the late spring when they are reviewing for state tests.

Teacher effectiveness. The effectiveness of the teacher has a strong impact on student achievement as well as closing or widening the achievement gap (Balfanz, 2009). It is therefore better for all students, and in particular at-risk students, to have an effective teacher who presents excellent initial instruction than it is for students to have ineffective teachers and then to need remediation or intervention to compensate for the lack of quality initial instruction (Ardoyn et al., 2005; Kavale, Holdnack, & Mostert, 2005; Wodrich, Spencer, & Daley, 2006). While intervention programs are certainly necessary in general (Fuchs et al., 2003) and for reading specifically (Stanovich, 1986), school leaders should work to ensure that all of their teachers are effective so as to minimize the number of students who need interventions (Dufour & Marzano, 2011; Morgan et al., 2008) and to lessen the impact of systems ecology.

Student motivation. Considering that during adolescence students' motivation drops during the transition from 5th to 6th grade (Eccles & Wigfield, 1993; Eccles & Roeser, 2009), it is important to note that students who prefer a fixed mindset also see a decline in their achievement during middle school when compared to their peers who prefer a growth mindset (Dweck, 2007). Despite its impact on student achievement, however, there are typically few systematic efforts to increase student motivation in school (Anderman, Maehr, & Midgley, 1999; Dweck & Master, 2009).

School leaders should take opportunities to increase students' intrinsic motivation to achieve in school. There is evidence that suggests that extrinsic rewards, such as stickers or classroom parties, actually lessen students' intrinsic motivation (Deci,

Koestner, & Ryan, 1999), which can impact their responses to challenges and failures in school (Dweck, 2007). Many struggling students can become stuck in a recursive pattern of failure and low motivation, and they may adopt a “learned helplessness” response to failure (Abramson et al., 1978), meaning that at-risk adolescent students who are struggling to read may eventually give up, or they may believe that they will never be able to read as well as their peers. One way to increase these at-risk students’ motivation to improve their reading ability is to help them connect success and effort through a growth mindset intervention (e.g., Dweck, 1986). It is important to note that school leaders create, shape and maintain school’s cultures (Deal & Peterson, 1990), and it is therefore critically important that these leaders create school communities that value individual students as well as high levels of academic achievement (Deal & Peterson, 2009). A systematic school culture that would help struggling adolescent students to be more motivated in school and to connect success and effort would be a tremendous benefit in helping all students achieve at high levels (Covington, 1992, 2000).

Conclusion

Academic achievement is the result of a complicated equation that includes factors at the school, classroom and individual student level which contribute to substantial discrepancies in the educational achievement of American adolescent students (Hanushek, 2011). These discrepancies can be seen in the achievement and attainment of students based on their personal characteristics, such as race and exposure to poverty. There is compelling evidence, such as the poor relative academic performance of American adolescent students on international, national and state assessments (McKinsey & Company, 2009), for interventions to aid struggling students to increase their achievement. The existing literature demonstrates that the relationship between school

leadership and student achievement is “profound and significant” (Reeves, 2008, p. 13). School leaders, such as principals, are the instructional leaders of their schools (Fullan, 2008; Schmoker, 2006) and must intervene to aid struggling students (Reeves, 2008).

Adolescence is a period of tremendous physiological, sociological, and psychological changes (Adams, 2005; Blackwell et al., 2007; Eccles & Roeser, 2003). Students’ academic achievement during adolescence has a profound impact on their futures (Dowrick & Crespo, 2005; Eccles & Roeser, 2009; Schultz et al., 2009). For most individuals their academic identity is also forged during adolescence (Cote, 2009; Grotevant, 1987; Wigfield & Wagner, 2007); the formation of an academic identity is particularly salient because many adolescents confront the problem of school failure for the first time during middle school (Anderman & Mueller, 2010; Eccles & Wigfield, 1993; Eccles & Roeser, 2009), particularly during their 6th grade year when many factors converge simultaneously (Balfanz & Byrnes, 2006). Students’ response(s) to these academic failures is an area worthy of further discussion.

Motivation and academic achievement are closely linked (Eccles & Roeser, 2009; Roeser et al., 2009; Urdan & Turner, 2007) and their relationship can be considered to be cyclical (Zentall & Morris, 2010). For many students motivation declines during their adolescent years (Eccles & Wigfield, 1993; Eccles & Roeser, 2003; Elliot & Dweck, 2007; Hodis et al., 2011; Urdan & Turner, 2007; Wigfield & Wagner, 2007; Yeung & McInerney, 2005), yet these declines are not inevitable (Arnett, 1999). Failure(s) in school can have a significant impact on adolescent students’ motivation to put forth effort in school (Morgan et al., 2008), and some students respond to these challenges differently than their peers.

Students' beliefs about their intelligence have been suggested as providing a motivational framework for their academic motivation and achievement (Dweck & Master, 2009). A framework by Dweck (2009) describes students' belief in the usefulness and value of effort vis-à-vis achievement. Students with a growth mindset typically have learning goals, and in general they also have high levels of task persistence. Students with a learning goal or task-mastery mindset believe that "effort is the key to success and that failure, despite trying hard, does not necessarily imply incompetence but simply not having employed the right learning strategies" (Covington, 2000, p. 175). These students also have a strong locus of control as they typically attribute their success largely to their effort on the task. In contrast, students with a fixed mindset typically have performance goals, and they have been shown to have task-avoidance or other ego-protecting responses to difficult tasks. Students who subscribe to a fixed mindset do not believe that effort and success are linked, and if they fail in school they may adopt a "learned helplessness" response such as giving up (Abramson et al., 1978; Diener & Dweck, 1978; Dweck, 1975). These fixed mindset students do not have a strong locus of control, and they typically do not associate their effort as impacting their success or failures.

Students who believe in a fixed mindset can suffer from a recursive pattern of low motivation and low effort after suffering an academic failure at school. Students who experience failure need to increase their effort to be successful in school (Morgan et al., 2008), yet students who believe in a fixed mindset will eschew effort and will, most likely, continue to fail (Dweck, 2006). Stanovich (1986) has described this pattern as a negative "Matthew effect" whereby these students will suffer decreased motivation and increased "cognitive, motivational and behavioral deficits" (Morgan, 2008, p. 388). The

present study attempted to influence at-risk adolescent students to adopt a growth mindset or incremental self-theory as one way to intervene against these negative Matthew effects.

American students are encountering an increasingly complex and dynamic world (Wagner, 2006, 2008), and school leaders need to continue to intervene to ensure that struggling students catch up to their peers so America can compete internationally (McKinsey & Company, 2009). While the present study yielded non-significant results for four of the research questions, it is critical for researchers to continue to find effective interventions to help the most academically vulnerable students improve their reading achievement. Because reading is foundational for all other learning (Chall, 1983) and student motivation is a factor that causes significant variance in academic achievement (Willingham et al., 2002), school leaders would be wise to intervene with struggling readers' motivation to put forth effort in school. By increasing these students' emotional engagement with the act of reading, it is quite possible that this would prime students to be more cognitively and behaviorally engaged with reading and reading interventions (Fredericks et al., 2004), thereby leading these struggling students to respond by working harder in school and thus to increasing their reading abilities.

Some adolescent students may be caught in a recursive cycle of low achievement and low motivation (Anderman & Mueller, 2010), and schools must help these students break this negative cycle by attributing academic success not with innate ability but rather with effort and effective learning strategies (DeCharms & DeCharms, 1968; Mueller & Dweck, 1998; Weiner, 1985). It has been suggested that those students who favor a fixed mindset are at a greater risk of decreased academic achievement during

difficult challenges and transitions in school than their growth mindset peers (Rattan, Good, & Dweck, 2012). While the present study did not yield statistically significant results, prior experimental research has shown that students who preferred a growth mindset did show an increase in both their motivation and academic achievement during challenging situations in school (Blackwell et al., 2008; Cury et al., 2008; Dweck & Leggett, 1988; Dweck & Master, 2009; Hong et al., 1999; Mueller & Dweck, 1998; Nussbaum & Dweck, 2008). Since mindsets have been offered as creating a motivational framework that forms a “constellation of students’ goals, beliefs about effort, attributions, and responses to challenges” (Blackwell et al., 2007, p. 258) and because student level factors such as motivation have been shown to have a significant impact on achievement (Hanushek, 2010; Tobias, 1994; Willingham et al., 2002), it is therefore critical for school leaders to explore additional ways to help at-risk adolescent students appreciate the concepts of a growth mindset as one component of the school’s overall intervention program.

REFERENCES

- Abramson, L. Y., Seligman, M. E., & Teasdale, J. D. (1978). Learned helplessness in humans: Critique and reformulation. *Journal of Abnormal Psychology*, 87(1), 49-74.
- Adams, G. R. (2005). Adolescent development. In T. P. Gullotta, G. R. Adams & J. M. Ramos (Eds.), *Handbook of adolescent behavioral problems: Evidence-based approaches to prevention and treatment* (p. 3-16). New York: Springer.
- Adams, W. L. 1932. Why teachers say they fail pupils. *Educational Administration and Supervision*, 18: 594–600.
- Akerlof, G. A., Yellen, J. L., & Katz, M. L. (1996). An analysis of out-of-wedlock childbearing in the united states. *The Quarterly Journal of Economics*, 111(2), 277-317.
- Alan, R., & Viadero, D. (2005, July 8). Studies decry faulty graduation data, rising dropout rates. *Education Week*, p. 12.
- Alexander, J. F., & Parsons, B. V. (1973). Short-term behavioral intervention with delinquent families: Impact on family process and recidivism. *Journal of Abnormal Psychology*, 81(3), 219-225.
- Alexander, K., Entwisle, D., & Kabbani, N. (2001). The dropout process in life course perspective: Early risk factors at home and school. *The Teachers College Record*, 103(5), 760-822.
- Alexander, K. L., Entwisle, D. R., & Olson, L. S. (2007). Lasting consequences of the summer learning gap. *American Sociological Review*, 72 (2), 167-180.
- Allen, C. W., & Allen, J. (2009). *Escaping the endless adolescence: How we can help our teenagers grow up before they grow old*. New York: Random House, Inc.
- Allen, J. D. (2005). Grades as valid measures of academic achievement of classroom learning. *The Clearing House*, 78(5), 218-223.
- Alliance for Excellent Education. (2009). *Understanding high school graduation rates in Virginia*. Washington, D.C.: Author.

- Alliance for Excellent Education. (2011). *Education and the economy: Boosting the nation's economy by improving high school graduation rates*. Washington, D.C.: Author.
- Allington, R. L. (2001). *What really matters for struggling readers: Designing research-based programs*. New York: Longman.
- Allington, R. L., McGill-Franzen, A., Camilli, G., Williams, L., Graff, J., Zeig, J., . . . Nowak, R. (2010). Addressing summer reading setback among economically disadvantaged elementary students. *Reading Psychology, 31*(5), 411-427.
- Ames, C., & Archer, J. (1988). Achievement goals in the classroom: Students' learning strategies and motivation processes. *Journal of Educational Psychology, 80*(3), 260-267.
- Anderman, E. M., & Maehr, M. L. (1994). Motivation and schooling in the middle grades. *Review of Educational Research, 64*(2), 287-309.
- Anderman, E. M., Maehr, M. L., & Midgley, C. (1999). Declining motivation after the transition to middle school: Schools can make a difference. *Journal of Research and Development in Education, 32*, 131-147.
- Anderman, E. M., & Mueller, C. E. (2010). Middle school transitions and adolescent development. In J. L. Meece, & J. S. Eccles (Eds.), *Handbook of research on schools, schooling, and human development* (pp. 198-215). New York: Routledge.
- Anderson, C. (1995). Implicit theories in broad perspective. *Psychological Inquiry, 6*(4), 319-321.
- Anderson, L. W. (2002). Curricular alignment: A re-examination. *Theory into Practice, 41*(4), 255-260.
- Anderson, S., Yilmaz, O., & Washburn-Moses, L. (2004). Middle and high school students with learning disabilities: Practical academic interventions for general education teachers-A review of the literature. *American Secondary Education, 32*(2), 19-38.
- Andrews, G. R., & Debus, R. L. (1978). Persistence and the causal perception of failure: Modifying cognitive attributions. *Journal of Educational Psychology, 70*(2), 154-166.
- Andrews, R. L., & Soder, R. (1987). Principal leadership and student achievement. *Educational Leadership, 44*(6), 9-11.
- Ardoin, S. P., Witt, J. C., Connell, J. E., & Koenig, J. L. (2005). Application of a three-tiered response to intervention model for instructional planning, decision making, and the identification of children in need of services. *Journal of Psychoeducational Assessment, 23*(4), 362-380.

- Argote, L., & Ingram, P. (2000). Knowledge transfer: A basis for competitive advantage in firms. *Organizational Behavior and Human Decision Processes*, 82(1), 150-169.
- Arnett, J. J. (1999). Adolescent storm and stress, reconsidered. *American Psychologist*, 54(5), 317-326.
- Aronson, J., Fried, C. B., & Good, C. (2002). Reducing the effects of stereotype threat on african american college students by shaping theories of intelligence, *Journal of Experimental Social Psychology*, 38(2), 113-125.
- Asch, S.E. (1951). Effects of group pressure upon the modification and distortion of judgment. In H. Guetzkow (Ed.), *Groups, leadership, and men* (pp. 177-190). Pittsburgh, PA: Carnegie Press.
- Asch, S. E. (1952). *Social psychology*. New York: Prentice-Hall.
- Ashton, P. T., & Webb, R. B. (1986). *Making a difference: Teachers' sense of efficacy and student achievement*. New York: Longman.
- Atkinson, J. W. (1957). Motivational determinants of risk-taking behavior. *Psychological Review*, 64(6), 359-372.
- Aud, S., Hussar, W., Kena, G., Bianco, K., Frohlich, L., Kemp, J., & Tahan, K. (2011). *The Condition of Education 2011* (NCES 2011-033). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.
- Baker, L., & Wigfield, A. (1999). Dimensions of children's motivation for reading and their relations to reading activity and reading achievement. *Reading Research Quarterly*, 34(4), 452-477.
- Balfanz, R. (2009). *Putting middle grades students on the graduation path: A policy and practice brief*. Baltimore, MD: Everyone Graduates Center.
- Balfanz, R., & Byrnes, V. (2006). Closing the mathematics achievement gap in high-poverty middle schools: Enablers and constraints. *Journal of Education for Students Placed at Risk*, 11(2), 143-159.
- Balfanz, R., & Herzog, L. (2005). *Keeping middle grades students on track to graduation: Initial analysis and implications*. Retrieved from web.jhu.edu/CSOS/graduation-gap/edweek/Balfanz_Herzog.ppt.
- Balfanz, R., Herzog, L., & Iver, D. J. M. (2007). Preventing student disengagement and keeping students on the graduation path in urban middle-grades schools: Early identification and effective interventions. *Educational Psychologist*, 42(4), 223-235.
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, 84(2), 191-215.

- Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. *Educational Psychologist*, 28(2), 117-148.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Worth Publishers.
- Barber, B. K., & Olsen, J. A. (2004). Assessing the transitions to middle and high school. *Journal of Adolescent Research*, 19(1), 3-30.
- Barnett, D. W., Daly, E. J., III, & Jones, K. M. (2004). Response to intervention: Empirically based special service decisions from single-case designs of increasing and decreasing intensity. *The Journal of Special Education*, 38(2), 66-79.
- Bartko, J. J. (1991). Measurement and reliability: Statistical thinking considerations. *Schizophrenia Bulletin*, 17(3), 483-489.
- Baum, S., & Ma, J. (2007). *Education pays: The benefits of higher education for individuals and society*. New York: The College Board.
- Baydar, N., Brooks - Gunn, J., & Furstenberg, F. F. (1993). Early warning signs of functional illiteracy: Predictors in childhood and adolescence. *Child Development*, 64(3), 815-829.
- Bell, B. S., & Kozlowski, W. (2002). Goal orientation and ability: Interactive effects on self-efficacy, performance, and knowledge. *Journal of Applied Psychology*, 87(3), 497-505.
- Bénabou, R., & Tirole, J. (2002). Self-confidence and personal motivation. *The Quarterly Journal of Economics*, 117(3), 871-915.
- Bennett, W. J., Fair, W., Finn, C. E., Flake, F., Hirsch, E. D., Marshall, W., & Ravitch, D. (1998). *A nation still at risk*. Stanford, CA: Hoover Institute.
- Bernstein, R. (2008). *An older and more diverse nation by midcentury*. No. CB08-123. Washington, DC: U.S. Census Bureau.
- Biancarosa, G., & Snow, C. E. (2004). *Reading next: A vision for action and research in middle and high school literacy. A report to the Carnegie Corporation of New York*. Washington, DC: Alliance for Excellent Education.
- Biancarosa, G. (2012). Adolescent literacy: More than remediation. *Educational Leadership*, 69(6), 22-27.
- Binet, A. (1984). *Modern ideas about children*. (S. Heisler Trans.). Ann Arbor, MI: University of Michigan.
- Blackwell, L., Trzesniewski, K., & Dweck, C. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: A longitudinal study and an intervention. *Child Development*, 78(1), 246-263.

- Blakely, C. H., Mayer, J. P., Gottschalk, R. G., Schmitt, N., Davidson, W. S., Roitman, D. B., & Emshoff, J. G. (1987). The fidelity-adaptation debate: Implications for the implementation of public sector social programs. *American Journal of Community Psychology*, 15(3), 253-268.
- Block, J. (1982). Assimilation, accommodation, and the dynamics of personality development. *Child Development*, 53(2), 281-295.
- Bloom, B. S. (1976). *Human characteristics and school learning*. New York: McGraw-Hill.
- Bonsteel, A. (2011, 8-12). California acknowledges middle-school dropouts. *San Francisco Chronicle*, p. A8.
- Borm, G. F., Fransen, J., & Lemmens, W. A. J. G. (2007). A simple sample size formula for analysis of covariance in randomized clinical trials. *Journal of Clinical Epidemiology*, 60(12), 1234-1238.
- Borman, G. D., & D'Agostino, J. V. (1996). Title I and student achievement: A meta-analysis of federal evaluation results. *Educational Evaluation and Policy Analysis*, 18(4), 309-326.
- Borman, G. D., & Dowling, N. M. (2006). Longitudinal achievement effects of multiyear summer school: Evidence from the teach baltimore randomized field trial. *Educational Evaluation and Policy Analysis*, 28(1), 25-48.
- Bouffard, T., Vezeau, C., & Bordeleau, L. (1998). A developmental study of the relation between combined learning and performance goals and students' self-regulated learning. *British Journal of Educational Psychology*, 68(3), 309-319.
- Bowen, N. K., & Bowen, G. L. (1999). Effects of crime and violence in neighborhoods and schools on the school behavior and performance of adolescents. *Journal of Adolescent Research*, 14(3), 319-342.
- Bradshaw, C. P., O'Brennan, L. M., & McNeely, C. A. (2008). Core competencies and the prevention of school failure and early school leaving. In N. G. Guerra & C.P. Bradshaw (Eds.), *New Directions for Child & Adolescent Development*, (pp. 19-32). Wilmington, DE: Wiley.
- Brooks-Gunn, J., & Duncan, G. J. (1997). The effects of poverty on children. *The Future of Children*, 7(2), pp. 55-71.
- Brophy, J. E., & Good, T. L. (1984). *Teacher behavior and student achievement*. East Lansing, MI: Institute for Research on Teaching, Michigan State University.
- Brown v. Board of Education, 347 U.S. 483 (1954).
- Brozo, W. G. (2009). Response to intervention or responsive instruction? Challenges and possibilities of response to intervention for adolescent literacy. *Journal of Adolescent & Adult Literacy*, 53(4), 277-281.

- Byrnes, V., & Ruby, A. (2007). Comparing achievement between K-8 and middle schools: A large-scale empirical study. *American Journal of Education*, 114(1), 101-135.
- Cambron-McCabe, N., Lucas, T., Smith, B., Dutton, J., & Senge, P. M. (2011). *Schools that learn: A fifth discipline field book for educators, parents, and everyone who cares about education*. New York: Crown Business.
- Campbell, Y. C. (2006). *Effects of an integrated learning system on the reading achievement of middle school students* (Unpublished doctoral dissertation). University of Miami, Coral Gables, FL.
- Cameron, J., & Pierce, W. D. (1994). Reinforcement, reward, and intrinsic motivation: A meta-analysis. *Review of Educational Research*, 64(3), 363-423.
- Carnegie Council on Adolescent Development. (1989). *Turning points: Preparing american youth for the 21st century: The report of the task force on education of young adolescents*. Washington, DC: Carnegie Council on Adolescent Development.
- Carroll, J. (1963). A model of school learning. *The Teachers College Record*, 64(8), 723-723.
- Ceci, S. J., & Williams, R. (2007). *Why aren't more women in science*. Washington, DC: American Psychological Association.
- Century, J., Rudnick, M., & Freeman, C. (2010). A framework for measuring fidelity of implementation: A foundation for shared language and accumulation of knowledge. *American Journal of Evaluation*, 31(2), 199-218.
- Chall, J. S. (1983). *Learning to read: The great debate*. New York: McGraw-Hill.
- Chall, J. S., Jacobs, V. A., & Baldwin, L. E. (1990). *The reading crisis: Why poor children fall behind*. Cambridge, MA: Harvard University Press.
- Chapman, C., Laird, J., & Kewal-Ramani, A. (2010). *Trends in high school dropout and completion rates in the united states: 1972–2008*. Washington, DC: National Center for Education Statistics, US Department of Education.
- Christensen, C. M., Johnson, C. W., & Horn, M. B. (2008). *Disrupting class: How disruptive innovation will change the way the world learns*. New York: McGraw-Hill Professional.
- Christian, K., Morrison, F. J., & Bryant, F. B. (1998). Predicting kindergarten academic skills: Interactions among child care, maternal education, and family literacy environments. *Early Childhood Research Quarterly*, 13(3), 501-521.
- Chubb, J. E., & Moe, T. M. (1990). *Politics, markets, and america's schools*. Washington, DC: Brookings Institution.

- Cimpian, A., Arce, H., Markman, E., & Dweck, C. (2007). Subtle linguistic cues affect children's motivation. *Psychological Science, 18*(4), 314-316.
- Cizek, G. J. (1996). Grades: The final frontier in assessment reform. *NASSP Bulletin 80* (584): 103-10.
- Cizek, G. J., Gierl, M. J., & Alves, C. B. (2005). *Measures of academic progress*. Lake Oswego, OR: Northwest Evaluation Association.
- Clay, M. M. (1985). *The early detection of reading difficulties*. Portsmouth, NH: Heineman Educational Books, Inc.
- Cleary, T. J. (2009). Monitoring trends and accuracy of self-efficacy beliefs during interventions: Advantages and potential applications to school-based settings. *Psychology in the Schools, 46*(2), 154-171.
- Cohen, G. L., Garcia, J., Apfel, N., & Master, A. (2006). Reducing the racial achievement gap: A social-psychological intervention. *Science, 313*(5791), 1307-1310.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.
- Coleman, J. (1966). *Equality of educational opportunity*. Washington, DC: National Center for Educational Statistics.
- Connell, J. P., Spencer, M. B., & Aber, J. L. (1994). Educational risk and resilience in African-American youth: Context, self, action, and outcomes in school. *Child Development, 65*(2), 493-506
- Connell, J. P., & Wellborn, J. G. (1991). Competence, autonomy, and relatedness: A motivational analysis of self-system processes. In M. Gunnar & L. A. Sroufe (Eds.), *Minnesota Symposium on Child Psychology* (Vol. 23). Chicago: University of Chicago Press.
- Cooper, H., Nye, B., Charlton, K., Lindsay, J., & Greathouse, S. (1996). The effects of summer vacation on achievement test scores: A narrative and meta-analytic review. *Review of Educational Research, 66*(3), 227-268.
- Corno, L., & Mandinach, E. B. (1983). The role of cognitive engagement in classroom learning and motivation. *Educational Psychologist, 18*(2), 88-108.
- Corpus, J. H., & Lepper, M. R. (2007). The effects of person versus performance praise on children's motivation: Gender and age as moderating factors. *Educational Psychology, 27*(4), 487-508.

- Cote, J. E. (2009). Identity formation and self-development in adolescence. In R. M. Lerner, & L. D. Steinberg (Eds.), *Handbook of adolescent psychology* (3rd ed., pp. 266-304). Hoboken, NJ: John Wiley & Sons.
- Cotton, K. (1995). *Effective schooling practices: A research synthesis, 1995 update*. Portland, OR: Northwest Regional Educational Laboratory.
- Cotton, K. (2003). *Principals and student achievement: What the research says*. Alexandria, VA: Association for Supervision and Curriculum Development (ASCD).
- Covington, M. (1992). *Making the grade: A self-worth perspective on motivation and school reform*. Cambridge, UK: Cambridge University Press.
- Covington, M. V., & Omelich, C. L. (1979). Effort: The double-edged sword in school achievement. *Journal of Educational Psychology*, 71(2), 169-182.
- Covington, M. (2000). Goal theory, motivation, and school achievement: An integrative review. *Annual Review of Psychology*, 51(1), 171-200.
- Covington, M., & Dray, E. (2002). The developmental course of achievement motivation: A need-based approach. In A. Wigfield, & J. S. Eccles (Eds.), *Development of achievement motivation*. (pp. 33-56). San Diego, CA: Academic Press.
- Creswell, J. W. (2005). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (2nd ed.). Upper Saddle River, NJ: Pearson Education.
- Cross, L. H., and Frary, R.B. (April, 1996). Hodgepodge grading: Endorsed by students and teachers alike. Paper presented at the annual meeting of the National Council on Measurement in Education, New York.
- Curran-Neild, R., & Nash, F. (2009). The effect of teacher certification on middle grades achievement in an urban district. *Educational Policy*, 23(5), 732-760.
- Cury, F., Da Fonseca, D., Zahn, I., & Elliot, A. (2008). Implicit theories and IQ test performance: A sequential mediational analysis. *Journal of Experimental Social Psychology*, 44(3), 783-791.
- Czaja, R., & Blair, J. (2005). *Designing surveys: A guide to decisions and procedures* (2nd ed.). Thousand Oaks, CA: Sage Publications.
- Da Fonseca, D., Cury, F., Fakra, E., Rufo, M., Poinso, F., Bounoua, L., & Huguet, P. (2008). Implicit theories of intelligence and IQ test performance in adolescents with generalized anxiety disorder. *Behaviour Research and Therapy*, 46(4), 529-536.
- Darling-Hammond, L. (1997). *The right to learn: A blueprint for creating schools that work*. San Francisco, CA: Jossey-Bass.
- Darling-Hammond, L. (2000). Teacher quality and student achievement: A review of state policy evidence. *Education Policy Analysis Archives*, 8(1), 1-44.

- Datnow, A., Solorzano, D. G., Watford, T., & Park, V. (2010). Mapping the terrain: The state of knowledge regarding low-income youth access to postsecondary education. *Journal of Education for Students Placed at Risk*, 15(1), 1-8.
- DeCharms, R., & DeCharms, R. (1968). *Personal causation*. New York: Academic Press.
- Deal, T. E., & Peterson, K. D. (1990). *The principal's role in shaping school culture*. Washington, D.C: U.S. Dept. of Education.
- Deal, T. E., & Peterson, K. D. (2009). *Shaping school culture: Pitfalls, paradoxes, and promises*. San Francisco: Jossey-Bass.
- Deci, E., Koestner, R., & Ryan, R. (2001). Extrinsic rewards and intrinsic motivation in education: Reconsidered once again. *Review of Educational Research*, 71(1), 1-27.
- DeNavas-Walt, C., Proctor, B., & Smith, J. (2011). *Income, poverty, and health insurance coverage in the united states: 2010*. No. 236. Washington, D.C.: U.S. Census Bureau.
- Diener, C., & Dweck, C. (1978). An analysis of learned helplessness: Continuous changes in performance, strategy, and achievement cognitions following failure. *Journal of Personality and Social Psychology*, 36(5), 451-462.
- Dowrick, P., & Crespo, N. (2005). School failure. In T. P. Gullotta, G. R. Adams & J. M. Ramos (Eds.), *Handbook of adolescent behavioral problems : Evidence-based approaches to prevention and treatment* (pp. 589-610). New York: Springer.
- Drucker, P. F. (1992). *Managing for the future: The 1990s and beyond*. New York: Tuman Talley Books/Dutton.
- Dufour, R., & Marzano, R. J. (2011). *Leaders of learning. how district, school, and classroom leaders improve student achievement*. Bloomington, IN: Solution Tree Press.
- Durston, S., Hulshoff Pol, H. E., Casey, B., Giedd, J. N., Buitelaar, J. K., & Van Engeland, H. (2001). Anatomical MRI of the developing human brain: What have we learned? *Journal of the American Academy of Child & Adolescent Psychiatry*, 40(9), 1012-1020.
- Dusenbury, L., Brannigan, R., Falco, M., & Hansen, W. B. (2003). A review of research on fidelity of implementation: Implications for drug abuse prevention in school settings. *Health Education Research*, 18(2), 237-256.
- Dweck, C. (2000). *Self-theories: Their role in motivation, personality, and development*. Philadelphia, PA: Psychology Press.
- Dweck, C. (2002). Beliefs that make smart people dumb. In R. Sternberg (Ed.), *Why smart people can be so stupid*. (pp. 24-41). New Haven, CT: Yale University Press.

- Dweck, C. (2006). Is math a gift? Beliefs that put females at risk. In S. J. Ceci, & W. Williams (Eds.), *Why aren't more women in science? Top researchers debate the evidence*. (pp. 47–55). Washington, DC: American Psychological Association.
- Dweck, C. (2007). *Mindset: The new psychology of success*. New York: Random House, Inc.
- Dweck, C., Chiu, C., & Hong, Y. (1995a). Implicit theories and their role in judgments and reactions: A word from two perspectives. *Psychological Inquiry*, 6(4), 267-285.
- Dweck, C., Chiu, C., & Hong, Y. (1995b). Implicit theories: Elaboration and extension of the model. *Psychological Inquiry*, 6(4), 322-333.
- Dweck, C., & Elliott, E. S. (1983). Achievement motivation. In P.H. Mussen (Ed.), *Handbook of Child Psychology* (Vol. 4, pp. 643-691). New York: Wiley.
- Dweck, C., & Molden, D. (2007). Self-theories: Their impact on competence motivation and acquisition. In A. J. Elliot, & C. S. Dweck (Eds.), *Handbook of competence and motivation* (pp. 122-140). New York: Guilford Press.
- Dweck, C. (1975). The role of expectations and attributions in the alleviation of learned helplessness. *Journal of Personality and Social Psychology*, 31(4), 674-685.
- Dweck, C. (1986). Motivational processes affecting learning. *American Psychologist*, 41(10), 1040-1048.
- Dweck, C., & Leggett, E. L. (1988). A Social–Cognitive approach to motivation and personality. *Psychological Review*, 95(2), 256-273.
- Dweck, C., & Master, A. (2009). Self theories and motivation: Student's beliefs about intelligence. In K. R. Wentzel, & A. Wigfield (Eds.), *Handbook of motivation at school* (pp. 123-140). New York: Routledge.
- Dweck, C. S., Davidson, W., Nelson, S., & Enna, B. (1978). Sex differences in learned helplessness: the contingencies of evaluative feedback in the classroom and experimental analysis. *Developmental Psychology*, 14(3), 268-276.
- Eccles, J. S., & Roeser, R. W. (2003). Schools as developmental contexts. In G. R. Adams, & M. D. Berzonsky (Eds.), *Blackwell handbook of adolescence* (pp. 129-148). Malden, MA: Blackwell Pub.
- Eccles, J. S., & Roeser, R. W. (2009). Schools, academic motivation, and stage-environment fit. In R. M. Lerner, & L. D. Steinberg (Eds.), *Handbook of adolescent psychology* (3rd ed., pp. 404-434). Hoboken, NJ: John Wiley & Sons.
- Eccles, J. S., & Wigfield, A. (1993). Negative effects of traditional middle schools on students' motivation. *Elementary School Journal*, 93(5), 553-574.

- Eckert, S. L., Diamond, P. M., Miller, A. L., Velligan, D. I., Funderburg, L. G., & True, J. E. (1996). A comparison of instrument sensitivity to negative symptom change. *Psychiatry Research*, 63(1), 67-75.
- Eckert, T. L., Dunn, E. K., Rosenblatt, M. A., & Truckenmiller, A. J. (2008). Identifying effective school-based reading interventions: A review of the brief experimental analysis literature. *School Psychology Forum*, 2(3), 16-28.
- Edmonds, R. (1979). Effective schools for the urban poor. *Educational Leadership*, 37(1), 15-24.
- Edmonds, R. (1981). Making public schools effective. *Social Policy*, 12(2), 56-60.
- Education for all Handicapped Children Act, Public Law 94-142 (1975).
- Ekstrom, R., Goertz, M., Pollack, J., & Rock, D. (1986). Who drops out of high school and why? Findings from a national study. *The Teachers College Record*, 87(3), 356-373.
- Elliot, A., & Dweck, C. (2007). *Handbook of competence and motivation*. New York: Guilford Press.
- Elmore, R. F. (2009). Schooling adolescents. In R. M. Lerner, & L. D. Steinberg (Eds.), *Handbook of adolescent psychology* (3rd ed., pp. 193-227). Hoboken, NJ: John Wiley & Sons.
- English, F. W., & Steffy, B. E. (2001). *Deep curriculum alignment: Creating a level playing field for all children on high-stakes tests of educational accountability*. Lanham, MD: Rowman & Littlefield Education.
- Epstein, J. L., & McPartland, J. M. (1976). The concept and measurement of the quality of school life. *American Educational Research Journal*, 13(1), 15-30.
- Erdley, C. A., & Dweck, C. (1993). Children's implicit personality theories as predictors of their social judgments. *Child Development*, 64(3), 863-878.
- Erdley, C. A., Cain, K. M., Loomis, C. C., Dumas-Hines, F., & Dweck, C. (1997). Relations among children's social goals, implicit personality theories, and responses to social failure. *Developmental Psychology*, 33(2), 263-272.
- Erikson, E. H. (1994a). *Identity and the life cycle*. New York: WW Norton & Company.
- Erikson, E. H. (1994b). *Identity: Youth and crisis*. New York: WW Norton & Company.
- Evans, R. I. (1967). *Dialogue with erik erikson*. New York: Harper & Row.
- Fan, X., & Chen, M. (2001). Parental involvement and students' academic achievement: A meta-analysis. *Educational Psychology Review*, 13(1), 1-22.

- Ferketich, S. (1991). Focus on psychometrics: aspects of item analysis. *Research in Nursing & Health*, 14(2), 165-168.
- Festinger, L., Gerard, H. B., Hymovitch, B., Kelley, H. H., & Raven, B. (1952). The influence process in the presence of extreme deviates. *Human Relations*, 5(4), 327-346.
- Festinger, L. (1954). *A theory of social comparison processes*. Indianapolis, IN: Bobbs-Merrill.
- Festinger, L. (1957). *A theory of cognitive dissonance*. Stanford, CA: Stanford University Press.
- Festinger, L. (1963). *Social pressures in informal groups: A study of human factors in housing*. Stanford, CA: Stanford University Press.
- Finn, J. D. (1989). Withdrawing from school. *Review of Educational Research*, 59(2), 117-142.
- Finn, J. D., & Rock, D. A. (1997). Academic success among students at risk for school failure. *Journal of Applied Psychology*, 82(2), 221-234.
- Fisher, R. J. (1993). Social desirability bias and the validity of indirect questioning. *Journal of Consumer Research*, 20(2), 303-315.
- Fleischman, H. L., Hopstock, P. J., Pelczar, M. P., and Shelley, B. E. (2010). *Highlights from PISA 2009: Performance of U.S. 15-year old students in reading, mathematics, and science literacy in an international context (NCES 2011-004)*. U. S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.
- Fleiss, J. L. (1981). *Statistical methods for rates and proportions*. New York: Wiley.
- Foorman, B. R., Francis, D. J., Shaywitz, S. E., Shaywitz, B. A., & Fletcher, J. M. (1997). The case for early reading intervention. In B. Blachman (Ed.) *Foundations of Reading Acquisition and Dyslexia: Implications for Early Intervention* (pp. 243-264). Mahwah, New Jersey: Lawrence Erlbaum Associates, Inc.
- Fraser, B. J., Walberg, H. J., Welch, W. W., & Hattie, J. A. (1987). Syntheses of educational productivity research. *International Journal of Educational Research*, 11(2), 145-252.
- Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research*, 74(1), 59-109.
- Fryer Jr, R. G., & Levitt, S. D. (2004). Understanding the black-white test score gap in the first two years of school. *Review of Economics and Statistics*, 86(2), 447-464.

- Fuchs, D., Mock, D., Morgan, P., & Young, C. (2003). Responsiveness-to-intervention: Definitions, evidence, and implications for the learning disabilities construct. *Learning Disabilities Research & Practice, 18*(3), 157-171.
- Fuchs, D., & Fuchs, L. (2006). Introduction to response to intervention: What, why, and how valid is it? *Reading Research Quarterly, 41*(1), 92-99.
- Fuchs, D., Fuchs, L., & Stecker, P. (2010). The "blurring" of special education in a new continuum of general education placements and services. *Exceptional Children, 76*(3), 301-323.
- Fuchs, D., & Deshler, D. (2007). What we need to know about responsiveness to intervention (and shouldn't be afraid to ask). *Learning Disabilities Research & Practice, 22*(2), 129-136.
- Fuchs, L., & Fuchs, D. (2009). Creating opportunities for intensive intervention for students with learning disabilities. *Teaching Exceptional Children, 42*(2), 60-62.
- Fuchs, L., Fuchs, D., & Compton, D. (2010). Rethinking response to intervention at middle and high school. *School Psychology Review, 39*(1), 22-28.
- Fulk, B. M., Brigham, F. J., & Lohman, D. A. (1998). Motivation and self-regulation. *Remedial and Special Education, 19*(5), 300-309.
- Fullan, M. (2008). *What's worth fighting for in the principalship?* New York: Teachers College Press.
- Gardner, D. (1983). *A nation at risk: The imperative for educational reform*. Washington, DC: National Commission on Excellence in Education.
- Gersten, R., & Dimino, J. A. (2006). RTI (response to intervention): Rethinking special education for students with reading difficulties (yet again). *Reading Research Quarterly, 41*(1), 99-108.
- Giedd, J. N. (2004). Structural magnetic resonance imaging of the adolescent brain. *Annals of the New York Academy of Sciences, 1021*(1), 77-85.
- Giedd, J. N., Lalonde, F. M., Celano, M. J., White, S. L., Wallace, G. L., Lee, N. R., & Lenroot, R. K. (2009). Anatomical brain magnetic resonance imaging of typically developing children and adolescents. *Journal of the American Academy of Child and Adolescent Psychiatry, 48*(5), 465-470.
- Glickman, C. D., Gordon, S. P., & Ross-Gordon, J. M. (2001). *Supervision and instructional leadership: A developmental approach (6th ed.)*. Needham Heights, MA: Allyn & Bacon.
- Good, R., Simmons, D. C., & Smith, S. B. (1998). Effective academic interventions in the united states: Evaluating and enhancing the acquisition of early reading skills. *School Psychology Review, 27*(1), 45-56.

- Good, C., Aronson, J., & Inzlicht, M. (2003). Improving adolescents' standardized test performance: An intervention to reduce the effects of stereotype threat. *Journal of Applied Developmental Psychology, 24*(6), 645-662.
- Gordon, E. W., & Jablonsky, A. (1968). Compensatory education in the equalization of educational opportunity. *The Journal of Negro Education, 37*(3), 268-279.
- Gottfried, A. W., Gottfried, A. E., Bathurst, K., Guerin, D. W., & Parramore, M. M. (2003). Socioeconomic status in children's development and family environment: Infancy through adolescence. In M. H. Bornstein, & R. H. Bradley (Eds.), *Socioeconomic status, parenting, and child development* (pp. 189-285). Mahwah, NJ: Lawrence Erlbaum.
- Grant, H., & Dweck, C. (2003). Clarifying achievement goals and their impact. *Journal of Personality and Social Psychology, 85*(3), 541-553.
- Greene, J. P., & Winters, M. A. (2002). *Public school graduation rates in the united states*. New York: Manhattan Institute.
- Grotevant, H. D. (1987). Toward a process model of identity formation. *Journal of Adolescent Research, 2*(3), 203-222.
- Hale, J. B., Kaufman, A., Naglieri, J. A., & Kavale, K. A. (2006). Implementation of IDEA: Integrating response to intervention and cognitive assessment methods. *Psychology in the Schools, 43*(7), 753-770.
- Hall, G. S. (1904). *Adolescence: Its psychology and its relations to physiology, anthropology, sociology, sex, crime, religion, and education*. New York: D. Appleton.
- Hallinger, P., & Heck, R. H. (1996). Reassessing the principal's role in school effectiveness: A review of empirical research, 1980-1995. *Educational Administration Quarterly, 32*(1), 5-44.
- Hamre, B. K., & Pianta, R. C. (2001). Early teacher-child relationships and the trajectory of children's school outcomes through eighth grade. *Child Development, 72*(2), 625-638.
- Hamre, B. K., & Pianta, R. C. (2005). Can instructional and emotional support in the first-grade classroom make a difference for children at risk of school failure? *Child Development, 76*(5), 949-967.
- Hanushek, E. A., & Rivkin, S. G. (2006). *School quality and the black-white achievement gap*. Cambridge, MA: National Bureau of Economic Research.
- Hanushek, E. (2010). How well do we understand achievement gaps? *Focus, 27*(2), 5-12.
- Hanushek, E. (2011). The economic value of higher teacher quality. *Economics of Education Review, 30*(3), 466-479.

- Haslam, M. B., White, R. N., & Klinge, A. (2006). *Improving student literacy: READ 180 in the Austin Independent School District, 2004–05*. Washington, DC: Policy Studies Associates.
- Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. New York: Taylor & Francis.
- Haycock, K. (1998). Good teaching matters... a lot. *Thinking K-16*, 13(2), 61-14.
- Heckman, J. J., & LaFontaine, P. A. (2010). The american high school graduation rate: Trends and levels. *The Review of Economics and Statistics*, 92(2), 244-262.
- Heller, R., Calderon, S., & Medrich, E. (2003). *Academic achievement in the middle grades: What does research tell us? A review of the literature*. Atlanta: Southern Regional Education Board.
- Henderson, V., & Dweck, C. (1990). Achievement and motivation in adolescence: A new model and data. In S. Feldman, & G. Elliot (Eds.), *At the threshold: The developing adolescent* (pp. 308–329). New York: President and Fellows of Harvard College.
- Hernandez, D. J. (2011). *Double jeopardy: How third grade reading skills and poverty influence high school graduation*. New York: Hunter College and the Graduate Center, City University of New York.
- Hill, P. W., & Rowe, K. J. (1996). Multilevel modeling in school effectiveness research. *School Effectiveness and School Improvement*, 7(1), 1-34.
- Hodis, F. A., Meyer, L. H., McClure, J., Weir, K. F., & Walkey, F. H. (2011). A longitudinal investigation of motivation and secondary school achievement using growth mixture modeling. *Journal of Educational Psychology*, 103 (2), 312-323.
- Hong, Y., Chiu, C., Dweck, C., Lin, D. M. S., & Wan, W. (1999). Implicit theories, attributions, and coping: A meaning system approach. *Journal of Personality and Social Psychology*, 77(3), 588-589.
- Husen, T. (Ed.). (1967). *International study of achievement in mathematics*. (Vol. 2). New York: John Wiley & Sons.
- Individuals with Disabilities Education Act (IDEA), (1997).
- Individuals with Disabilities Education Act (IDEA), (2004).
- Irvin, J. L. (1998). *Reading and the middle school student: strategies to enhance literacy* (2nd ed.). Needham Heights, MA: Allyn & Bacon.
- Jackson, A. W., & Davis, G. A. (2000). *Turning points 2000: Educating adolescents in the 21st century*. Williston, VT: Teachers College Press.
- Jensen, E. (2009). *Teaching with poverty in mind: What being poor does to kids' brains and what schools can do about it*. Alexandria, VA.: Association for Supervision and Curriculum Development.

- Jourden, F. J., Bandura, A., & Banfield, J. T. (1991). The impact of conceptions of ability on self-regulatory factors and motor skill acquisition. *Journal of Sport and Exercise Psychology*, 13(3), 213-226.
- Jung, L. A., Gomez, C., Baird, S. M., & Keramidas, C. L. G. (2008). Designing intervention plans: Bridging the gap between individualized education programs and implementation. *Teaching Exceptional Children*, 41(1), 26-33.
- Kammrath, L. K., & Dweck, C. (2006). Voicing conflict: Preferred conflict strategies among incremental and entity theorists. *Personality and Social Psychology Bulletin*, 32(11), 1497-1508.
- Kavale, K. A., Kauffman, J. M., Bachmeier, R. J., & LeFever, G. B. (2008). Response-to-intervention: Separating the rhetoric of self-congratulation from the reality of specific learning disability identification. *Learning Disability Quarterly*, 31(3), 135-150.
- Kavale, K. A., Holdnack, J. A., & Mostert, M. P. (2005). Responsiveness to intervention and the identification of specific learning disability: A critique and alternative proposal. *Learning Disability Quarterly*, 28(1), 2-16.
- Kim, J. S., & White, T. G. (2008). Scaffolding voluntary summer reading for children in grades 3 to 5: An experimental study. *Scientific Studies of Reading*, 12(1), 1-23.
- Kim, J. S., Samson, J. F., Fitzgerald, R., & Hartry, A. (2010). A randomized experiment of a mixed-methods literacy intervention for struggling readers in grades 4–6: Effects on word reading efficiency, reading comprehension and vocabulary, and oral reading fluency. *Reading and Writing*, 23(9), 1109-1129.
- Kleim, J. A., & Jones, T. A. (2008). Principles of experience-dependent neural plasticity: Implications for rehabilitation after brain damage. *Journal of Speech, Language, and Hearing Research*, 51(1), 225-239.
- Kolata, G. (2007, January 3). A surprising secret to a long life: Stay in school. *The New York Times*.
- Kristjansson, K. (2008). Education and self-change. *Cambridge journal of education*, 38(2), 217-230.
- Kroger, J. (2003). Identity development during adolescence. In G. R. Adams, & M. D. Berzonsky (Eds.), *Blackwell handbook of adolescence* (pp. 205-226). Malden, MA: Blackwell Pub.
- Lan, W., & Lanthier, R. (2003). Changes in students' academic performance and perceptions of school and self before dropping out of schools. *Journal of Education for Students Placed at Risk*, 8(3), 309-332.
- Lau v. Nichols, 414 U.S. 563 (1974).

- Lawson, S. (2011). *The read 180 program: Analysis of program effect on the reading achievement, motivation, engagement, and self-efficacy of sixth grade middle school students* (Unpublished doctoral dissertation). College of Notre Dame of Maryland, Baltimore, MD.
- Lazarus, B. D., & Callahan, T. (2000). Attitudes toward reading expressed by elementary school students diagnosed with learning disabilities. *Reading Psychology, 21*(4), 271-282.
- Lee, A. J., Gomez, C., Baird, S. M., & Keramidas, C. L. G. (2008). Designing intervention plans. *Teaching Exceptional Children, 41*(1), 26-33.
- Leithwood, K., Harris, A., & Hopkins, D. (2008). Seven strong claims about successful school leadership. *School Leadership and Management, 28*(1), 27-42.
- Lent, R. W., Brown, S. D., & Larkin, K. C. (1984). Relation of self-efficacy expectations to academic achievement and persistence. *Journal of Counseling Psychology, 31*(3), 356-362.
- Levin, H., Belfield, C., Muennig, P., & Rouse, C. (2007). *The costs and benefits of an excellent education for all of america's children*. New York: Teachers College, Columbia University.
- Levine, M. D. (2002). *A mind at a time*. New York: Simon & Schuster.
- Levy, S. R., Stroessner, S. J., & Dweck, C. (1998). Stereotype formation and endorsement: The role of implicit theories. *Journal of Personality and Social Psychology, 74*(6), 1421-1436.
- Linnenbrink, E. A., & Pintrich, P. R. (2002). Motivation as an enabler for academic success. *School Psychology Review, 31*(3), 313-327.
- Löwe, B., Kroenke, K., Herzog, W., & Gräfe, K. (2004). Measuring depression outcome with a brief self-report instrument: Sensitivity to change of the patient health questionnaire (PHQ-9). *Journal of Affective Disorders, 81*(1), 61-66.
- Madaus, G. F., Kellaghan, T., Rakow, E. A., & King, D. J. (1979). The sensitivity of measures of school effectiveness. *Harvard Educational Review, 49*(2), 207-230.
- Maehr, M. L., & Anderman, E. M. (1993). Reinventing schools for early adolescents: Emphasizing task goals. *The Elementary School Journal, 93*(5), 593-610.
- Maehr, M. L., & Fyans Jr, L. J. (1989). School culture, motivation, and achievement. In *Advances in motivation and achievement: Motivation enhancing environments*. (6th ed., pp. 215-247). Greenwich, CT: JAI.
- Maehr, M. L., & Midgley, C. (1991). Enhancing student motivation: A schoolwide approach. *Educational Psychologist, 26*(3), 399-427.

- Maehr, M. L., & Midgley, C. (1996). *Transforming school cultures*. Boulder, CO: Westview Press.
- Maehr, M. L., & Meyer, H. A. (1997). Understanding motivation and schooling: Where we've been, where we are, and where we need to go. *Educational Psychology Review*, 9(4), 371-409.
- Mangels, J., Butterfield, B., Lamb, J., Good, C., & Dweck, C. (2006). Why do beliefs about intelligence influence learning success? A social cognitive neuroscience model. *Social Cognitive and Affective Neuroscience*, 1(2), 75-86.
- Marks, H. M., & Printy, S. M. (2003). Principal leadership and school performance: An integration of transformational and instructional leadership. *Educational Administration Quarterly*, 39(3), 370-397.
- Marzano, R. J. (2000). *A new era of school reform: Going where the research takes us*. Aurora, CO: Mid-Continent Research for Education and Learning.
- Marzano, R. J. (2003). *What works in schools : Translating research into action*. Alexandria, Va.: Association for Supervision and Curriculum Development.
- Marzano, R. J., Kendall, J. S., & Gaddy, B. B. (1999). *Essential knowledge : The debate over what american students should know*. Aurora, Colo.: McREL.
- Maslow, A. H., Frager, R., & Fadiman, J. (1970). A theory of human motivation. In *Motivation and personality*. (3rd ed.) Harper & Row New York.
- McCaslin, M. (2006). Student motivational dynamics in the era of school reform. *Elementary School Journal*, 106(5), 479-490.
- McClelland, D. C. (1965). Toward a theory of motive acquisition. *American Psychologist*, 20(5), 321-333.
- McCombs, J. S., Augustine, C. H., Schwartz, H. L., Bodilly, S. J., McInnis, B., Lichter, D. S., & Cross, A. B. (2011). *Making summer count: How summer programs can boost students' learning*. Santa Monica, CA: RAND.
- McDonnell, L. M. (1995). Opportunity to learn as a research concept and a policy instrument. *Educational Evaluation and Policy Analysis*, 17(3), 305-322.
- McKenna, M. C., & Kear, D. J. (1990). Measuring attitude toward reading: A new tool for teachers. *The Reading Teacher*, 43(9), 626-639.
- McKinsey & Company. (2009). *Detailed findings on the economic impact of the achievement gap in america's schools*. New York: McKinsey & Company.
- McTighe, J., & Brown, J. L. (2005). Differentiated instruction and educational standards: Is détente possible? *Theory into Practice*, 44(3), 234-244.

- Midgley, C., Anderman, E., & Hicks, L. (1995). Differences between elementary and middle school teachers and students: A goal theory approach. *The Journal of Early Adolescence*, 15(1), 90-113.
- Midgley, C., Feldlaufer, H., & Eccles, J. S. (1989). Change in teacher efficacy and student self-and task-related beliefs in mathematics during the transition to junior high school. *Journal of Educational Psychology*, 81(2), 247-258.
- Midgley, J. (1995). *Social development: The developmental perspective in social welfare*. Thousand Oaks, CA: Sage Publications Ltd.
- Mitchell, S. A., & Black, M. J. (1995). *Freud and beyond: A history of modern psychoanalytic thought*. New York: Basic Books.
- Mok, M. M. C., Kennedy, K. J., & Moore, P. J. (2011). Academic attribution of secondary students: Gender, year level and achievement level. *Educational Psychology*, 31(1), 87-104.
- Moncher, F. J., & Prinz, R. J. (1991). Treatment fidelity in outcome studies. *Clinical Psychology Review*, 11(3), 247-266.
- Moore, D. W., Bean, T. W., Birdyshaw, D., & Rycik, J. A. (1999). Adolescent literacy: A position statement. *Journal of Adolescent & Adult Literacy*, 43(1), 97-112.
- Morgan, P., Fuchs, D., Compton, D., Cordray, D., & Fuchs, L. (2008). Does early reading failure decrease children's reading motivation? *Journal of Learning Disabilities*, 41(5), 387-404.
- Mowbray, C. T., Holter, M. C., Teague, G. B., & Bybee, D. (2003). Fidelity criteria: Development, measurement, and validation. *American Journal of Evaluation*, 24(3), 315-340.
- Mueller, C., & Dweck, C. (1998). Praise for intelligence can undermine children's motivation and performance. *Journal of Personality and Social Psychology*, 75(1), 33-52.
- Multon, K. D., Brown, S. D., & Lent, R. W. (1991). Relation of self-efficacy beliefs to academic outcomes: A meta-analytic investigation. *Journal of Counseling Psychology*, 38(1), 30-38.
- Murphy, J. (1988). Methodological, measurement and conceptual problems in the study of instructional leadership. *Educational Evaluation and Policy Analysis*, 4(4), 290-310.
- Murphy, K. R., & Davidshofer, C. O. (2005). *Psychological testing: Principles and applications* (6th ed.). Upper Saddle River, NJ: Prentice Hall.

- National Governors Association, Council of Chief State School Officers, & Achieve, Inc. (2008). *Benchmarking for success: Ensuring US students receive a world-class education*. Washington, DC: National Governors Association.
- National Research Council & Institute of Medicine. (2004). *Engaging schools: Fostering high school students' motivation to learn*. Washington, DC: National Academy Press.
- Nave, J. (2007). *An assessment of READ 180 regarding its association with the academic achievement of at-risk students in sevier county schools* (Unpublished doctoral dissertation). East Tennessee State University, Johnson City, TN.
- Nicholls, J. G. (1978). The development of the concepts of effort and ability, perception of academic attainment, and the understanding that difficult tasks require more ability. *Child Development*, 49(3), 800-814.
- Noble, K. G., Norman, M. F., & Farah, M. J. (2005). Neurocognitive correlates of socioeconomic status in kindergarten children. *Developmental Science*, 8(1), 74-87.
- Northouse, P. G. (2012). *Leadership: Theory and practice* (4th ed.). Thousand Oaks, CA: Sage Publications, Incorporated.
- Northwest Evaluation Association. (2007). *Teacher handbook: MAP*. Portland, OR: Northwest Evaluation Association.
- Northwest Evaluation Association. (2011). *2011 normative data*. Portland, OR: Northwest Evaluation Association.
- Nussbaum, A., & Dweck, C. (2008). Defensiveness versus remediation: Self-theories and modes of self-esteem maintenance. *Personality and Social Psychology Bulletin*, 34(5), 599-612.
- Nye, B., Konstantopoulos, S., & Hedges, L. V. (2004). How large are teacher effects? *Educational Evaluation and Policy Analysis*, 26(3), 237-257.
- Odum, E. P., & Barrett, G. W. (1971). *Fundamentals of ecology*. Philadelphia, PA: Saunders.
- Ou, S. R., & Reynolds, A. J. (2006). Early childhood intervention and educational attainment: Age 22 findings from the Chicago longitudinal study. *Journal of Education for Students Placed at Risk*, 11(2), 175-198.
- Pajares, F., & Urdan, T. C. (2006). *Self-efficacy beliefs of adolescents*. New York: Information Age Pub, Inc.
- Paris, S. G., Cross, D. R., & Lipson, M. Y. (1984). Informed Strategies for Learning: A program to improve children's reading awareness and comprehension. *Journal of Educational Psychology*, 76(6), 1239-1252.

- Paus, T. (2005). Mapping brain maturation and cognitive development during adolescence. *Trends in Cognitive Sciences*, 9(2), 60-68.
- Perez-Johnson, I., & Maynard, R. (2007). The case for early, targeted interventions to prevent academic failure. *Peabody Journal of Education*, 82(4), 587-616.
- Piaget, J. (1952). *The origins of intelligence in children*. New York: W. W. Norton & Co.
- Piaget, J. (1964). Part I: Cognitive development in children: Piaget development and learning. *Journal of Research in Science Teaching*, 2(3), 176-186.
- Piaget, J. (1997). *The moral judgment of the child*. New York: Free Press.
- Piaget, J. (2007). *The child's conception of the world*. London: Rowman & Littlefield Publishers, Inc.
- Pinkus, L. (2008). *Using early-warning data to improve graduation rates: Closing cracks in the education system*. Washington, DC: Alliance for Excellent Education.
- Pintrich, P. R., & de Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology*, 82(1), 33-40.
- Pintrich, P. R., & Schrauben, B. (1992). Students' motivational beliefs and their cognitive engagement in classroom academic tasks. In D. Schunk & J. Meece (Eds.), *Student Perceptions in the Classroom* (pp. 149-183). Hillsdale, NJ: Erlbaum.
- Puma, M. J. (1993). *Prospects: The congressionally mandated study of educational growth and opportunity: The interim report*. Washington, DC: US Department of Education.
- Puma, M. J., Karweit, N., Price, C., Ricciuti, A., Thompson, W., & Vaden-Kiernan, M. (1997). *Prospects: Student outcomes -final report*. Washington, DC: US Department of Education.
- Purves, A. C., & Beach, R. (1972). *Literature and the reader: Research in response to literature, reading interests, and the teaching of literature*. Urbana, IL: National Council of Teachers of English.
- Pyle, C. (2011). *State superintendent says 2011 virginia AYP results emphasize need for new federal accountability model*.
- Rampey, B. D., Dion, G. S., & Donahue, P. L. (2009). *NAEP 2008: Trends in academic progress*. Washington, DC: National Center for Education Statistics.
- Ramsden, S., Richardson, F. M., Josse, G., Thomas, M. S. C., Ellis, C., Shakeshaft, C., Price, C. J. (2011). Verbal and non-verbal intelligence changes in the teenage brain. *Nature*, 479, 1-4.

- Rattan, A., Good, C., & Dweck, C. S. (2012). "It's ok — not everyone can be good at math": Instructors with an entity theory comfort (and demotivate) students. *Journal of Experimental Social Psychology*, 48(3), 731-737.
- Reeves, D. B. (2003). *High performance in high poverty schools: 90/90/90 and beyond*. No. 20). Englewood, CO: Center for Performance Assessment.
- Reeves, D. B. (2008). *Reframing teacher leadership to improve your school*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Richman, J. M., Rosenfeld, L. B., & Bowen, G. L. (1998). Social support for adolescents at risk of school failure. *Social Work*, 43(4), 309-323.
- Rivkin, S., Hanushek, E., & Kain, J. (2005). Teachers, schools, and academic achievement. *Econometrica*, 73(2), 417-458.
- Robins, R. W., & Pals, J. L. (2002). Implicit self-theories in the academic domain: Implications for goal orientation, attributions, affect, and self-esteem change. *Self and Identity*, 1(4), 313-336.
- Robinson, V. M., Hohepa, M., & Lloyd, C. (2007). *School leadership and student outcomes: identifying what works and why*. Sydney, AU: Australian Council for Educational Leaders.
- Rockoff, J. E., & Lockwood, B. B. (2010). Stuck in the middle: Impacts of grade configuration in public schools. *Journal of Public Economics*, 94(11-12), 1051-1061.
- Roeser, R. W., Urdan, T. C., & Stephens, J. M. (2009). School as a context of student motivation and achievement. In K. R. Wentzel, & A. Wigfield (Eds.), *Handbook of motivation at school* (pp. 381-410). New York: Routledge.
- Rosenberg, M. (1989). *Society and the adolescent self-image*. Middletown, CT: Wesleyan University Press.
- Rosenthal, R., & Jacobson, L. (1968). Pygmalion in the classroom. *The Urban Review*, 3(1), 16-20.
- Rosenthal, R. (1968). Teachers' expectancies: Determinants of pupils' IQ gains. *Psychological Reports*, 19, 115-118.
- Rosenthal, R., & Rubin, D. B. (1982). A simple, general purpose display of magnitude of experimental effect. *Journal of Educational Psychology*, 74(2), 166-169.
- Rosenthal, R. (1991). Teacher expectancy effects: A brief update 25 years after the pygmalion experiment. *Journal of Research in Education*, 1(1), 3-12.
- Rowan, B., Correnti, R., & Miller, R. (2002). What large-scale survey research tells us about teacher effects on student achievement: Insights from the prospects study of elementary schools. *The Teachers College Record*, 104(8), 1525-1567.

- Ruby, A. (2006). Improving science achievement at high - poverty urban middle schools. *Science Education*, 90(6), 1005-1027.
- Rumberger, R. W. (1995). Dropping out of middle school: A multilevel analysis of students and schools. *American Educational Research Journal*, 32(3), 583-625.
- Rumberger, R. W. (2001). *Why students drop out of school and what can be done*. Boston, MA: Civil Rights Project, Harvard University.
- Ryan, A. (2001). The peer group as a context for the development of young adolescent motivation and achievement. *Child Development*, 72(4), 1135-1150.
- Ryan, R. M., & Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology*, 25(1), 54-67.
- Sacerdote, B., & National Bureau of Economic Research. (2000). *The nature and nurture of economic outcomes*. Cambridge, MA: National Bureau of Economic Research.
- Sammons, P., Hillman, J., & Mortimore, P. (1995). *Key characteristics of effective schools : A review of school effectiveness research*. London: Office for Standards in Education.
- Sanders, W. L., & Horn, S. P. (1994). The tennessee value-added assessment system (TVAAS): Mixed-model methodology in educational assessment. *Journal of Personnel Evaluation in Education*, 8(3), 299-311.
- Sanders, W. L., Wright, S. P., & Horn, S. P. (1997). Teacher and classroom context effects on student achievement: Implications for teacher evaluation. *Journal of Personnel Evaluation in Education*, 11(1), 57-67.
- Scheerens, J., & Bosker, R. J. (1997). *The foundations of educational effectiveness*. New York: Elsevier.
- Schiefele, U., Krapp, A., & Winteler, A. (1992). Interest as a predictor of academic achievement: A meta-analysis of research. In S. H. Renninger, & A. Krapps (Eds.), *The role of interest in learning and development* (pp. 183-212). Hillsdale, NJ:
- Schmoker, M. J. (2006). *Results now: How we can achieve unprecedented improvements in teaching and learning*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Scholastic. (2011). *Read180 reading program*.
- Schultz, B. K., Evans, S. W., & Serpell, Z. N. (2009). Preventing failure among middle school students with attention deficit hyperactivity disorder: A survival analysis. *School Psychology Review*, 38(1), 14-27.
- Schunk, D. H. (1991). Self-efficacy and academic motivation. *Educational Psychologist*, 26(3), 207-231.

- Schunkk, D. H., & Meece, J. L. (2006). Self-efficacy development in adolescence. In F. Pajares, & T. Urdan (Eds.), *Self-efficacy beliefs of adolescents*. Greenwich, CT: Information Age Publishers, Inc.
- Schwerdt, G., & West, M. (2011). *The impact of alternative grade configurations on student outcomes through middle and high school*. No. 3530. CESifo Working Paper Series.
- Seethaler, P., & Fuchs, L. (2005). A drop in the bucket: Randomized controlled trials testing reading and math interventions. *Learning Disabilities Research & Practice*, 20(2), 98-102.
- Seligman, M. E. P., & Nathan, E. (1998). *Learned optimism*. New York: Pocket Books.
- Shaw, P. (2007). Intelligence and the developing human brain. *Bioessays*, 29(10), 962-973.
- Shernoff, D. J., Csikszentmihalyi, M., Shneider, B., & Shernoff, E. S. (2003). Student engagement in high school classrooms from the perspective of flow theory. *School Psychology Quarterly*, 18(2), 158-176.
- Showers, B., Joyce, B., Scanlon, M., & Schnaubelt, C. (1998). A second chance to learn to read. *Educational Leadership*, 55(6), 27-30
- Simmons, J. (2006). *Breaking through: Transforming urban school districts*. New York: Teachers College Press.
- Simmons, R., & Blyth, D. (1987). *Moving into adolescence: The impact of pubertal change and school context*. New York: Aldine de Gruyter.
- Simmons, R., Blyth, D., Van Cleave, E. F., & Bush, D. M. (1979). Entry into early adolescence: The impact of school structure, puberty, and early dating on self-esteem. *American Sociological Review*, 44(6), 948-967.
- Simmons, R., Rosenberg, F., & Rosenberg, M. (1973). Disturbance in the self-image at adolescence. *American Sociological Review*, 38(5), 553-568.
- Singley, M. K., & Anderson, J. R. (1989). *The transfer of cognitive skill*. Cambridge, MA: Harvard University Press.
- Skinner, E. A., & Belmont, M. J. (1993). Motivation in the classroom: Reciprocal effects of teacher behavior and student engagement across the school year. *Journal of Educational Psychology*, 85(4), 571-581.
- Slavin, R. E., Cheung, A., Groff, C., & Lake, C. (2008). Effective reading programs for middle and high schools: A best-evidence synthesis. *Reading Research Quarterly*, 43(3), 290-322.
- Snow, C. E., Burns, M. S., & Griffin, P. (Eds.). (1998). *Preventing reading difficulties in young children*. Washington, DC: National Academy Press.

- Somers, C. L., & Piliawsky, M. (2004). Drop-out prevention among urban, african american adolescents: Program evaluation and practical implications. *Preventing School Failure*, 48(3), 17-22.
- Spellings, M. (2008). *A nation accountable: Twenty-five years after a nation at risk*. Washington, DC: US Department of Education.
- Spencer, S. J., Steele, C. M., & Quinn, D. M. (1999). Stereotype threat and women's math performance. *Journal of Experimental Social Psychology*, 35(1), 4-28.
- 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.
- Steele, C. M., & Aronson, J. (1995). Stereotype threat and the intellectual test performance of african americans. *Journal of Personality and Social Psychology*, 69(5), 797-811.
- Stipek, D. (2006). Relationships matter. *Educational Leadership*, 64(1), 46-49.
- Stogdill, R. M. (1974). *Handbook of leadership: A survey of theory and research*. New York: Free Press.
- Strahan, D. (2008). Successful teachers develop academic momentum with reluctant students. *Middle School Journal*, 39(5), 4-12.
- Stringfield, S. (1997). Research on effective instruction for at-risk students: Implications for the st. louis public schools. *The Journal of Negro Education*, 66(3), 258-288.
- Stringfield, S., & Datnow, A. (2002). Systemic supports for schools serving students placed at risk. *Yearbook of the National Society for the Study of Education*, 101(2), 269-288.
- Stronge, J. H., Ward, T. J., & Grant, L. W. (2011). What makes good teachers good? A cross-case analysis of the connection between teacher effectiveness and student achievement. *Journal of Teacher Education*, 62(4), 339-355.
- Swain-Bradway, J. L. (2009). *An analysis of a secondary level intervention for high school students at risk of school failure: The high school behavior education program*. (Unpublished doctoral dissertation). University of Oregon, Eugene, OR.
- Swanson, C. B. (2008). *Cities in crisis: A special analytic report on high school graduation*. Bethesda, MD: Editorial Projects in Education.
- Swanson, C. B. (2011). *Diplomas count 2011: Beyond high school, before the baccalaureate*. Bethesda, MD: Editorial Projects in Education.
- Teddlie, C., & Reynolds, D. (Eds.) (2000). *The international handbook of school effectiveness research*. New York: Falmer Press.

- Teddlie, C., & Stringfield, S. (1993). *Schools make a difference: Lessons learned from a 10-year study of school effects*. New York: Teachers College Press.
- Thorndike, R. M. (1997). *Measurement and Evaluation*. (6th ed.) Upper Saddle River, NJ: Merrill/Prentice Hall.
- Title I of the Elementary and Secondary Education Act of 1965 (20 U.S.C. 6301 Et Seq.), (1965).
- Tobias, S. (1994). Interest, prior knowledge, and learning. *Review of Educational Research*, 64(1), 37-54.
- Tollefson, N., Tracy, D., Johnsen, E., Farmer, A., & Buenning, M. (1984). Goal setting and personal responsibility training for ld adolescents. *Psychology in the Schools*, 21(2), 224-233.
- Tomlinson, C. A. (1999). *The differentiated classroom: Responding to the needs of all learners*. Alexandria, VA: Association for Supervision & Curriculum Development.
- Tomlinson, C. A. (2001). *How to differentiate instruction in mixed-ability classrooms*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Tomlinson, C. A., & Strickland, C. A. (2005). *Differentiation in practice: a resource guide for differentiating curriculum, grades 9-12*. Alexandria, VA: Association for Supervision & Curriculum Development.
- Tschannen-Moran, M., Hoy, A. W., & Hoy, W. K. (1998). Teacher efficacy: Its meaning and measure. *Review of Educational Research*, 68(2), 202-248.
- United States Department of Education. (2003). *Identifying and implementing educational practices supported by rigorous evidence: A user-friendly guide*. Washington, DC: Institute of Education Sciences. Retrieved from <http://www.ed.gov/print/rschstat/research/pubs/rigorousetid/guide.html>.
- US Department of Education, Office of Elementary and Secondary Education. (2011) *Striving Readers Read180 Profile*. Retrieved from <http://www2.ed.gov/programs/strivingreaders/read180sum.pdf>.
- US Department of Education. (2004). *A guide to education and no child left behind*, Washington, D.C.: Office of the Secretary, Office of Public Affairs.
- Uline, C. L., & Johnson, J. F. (2005). This issue: Closing achievement gaps: What will it take? *Theory into Practice*, 44(1), 1-3.
- Urdu, T., & Turner, J. (2007). Competence motivation in the classroom. In A. Elliot, & C. Dweck (Eds.), *Handbook of competence and motivation* (pp. 297-317). New York: Guilford Press.

- van Garderen, D., Scheuermann, A., Jackson, C., & Hampton, D. (2009). Supporting the collaboration of special educators and general educators to teach students who struggle with mathematics: An overview of the research. *Psychology in the Schools*, 46(1), 56-78.
- Virginia Department of Education. (2011). *State-level cohort report, four year rate: Class of 2011*. Richmond, VA: Virginia Department of Education.
- Wagner, T. (2006). *Change leadership: a practical guide to transforming our schools*. San Francisco, CA: Jossey-Bass.
- Wagner, T. (2008). *The global achievement gap: why even our best schools don't teach the new survival skills our children need--and what we can do about it*. New York: Basic Books.
- Walberg, H. J., & Tsai, S. L. (1983). Matthew effects in education. *American Educational Research Journal*, 20(3), 359-373.
- Walberg, H. J., & Tsai, S. L. (1985). Correlates of reading achievement and attitude: A national assessment study. *The Journal of Educational Research*, 78(3), 159-167.
- Walton, G. M., & Cohen, G. L. (2011). A brief social-belonging intervention improves academic and health outcomes of minority students. *Science*, 331(6023), 1447-1451.
- Waters, T., Marzano, R.J. & McNulty, B. (2003). *Balanced Leadership: What 30 years of research tells us about the effect of leadership on student achievement*. Aurora, CO: Mid-continent Research for Education and Learning.
- Waters, T. J., & Marzano, R. J. (2006). School district leadership that works: The effect of superintendent leadership on student achievement. A working paper. *Mid-Continent Research for Education and Learning (McREL)*. Retrieved from <http://eric.ed.gov/PDFS/ED494270.pdf> on 5/27/2012.
- Weigert, A. J., Teitge, J. S., & Teitge, D. W. (1986). *Society and identity: Toward a sociological psychology*. New York: Cambridge Univ Press.
- Weiner, B. (1974). *Achievement motivation and attribution theory*. Morristown, NJ: General Learning Press.
- Weiner, B. (1985). An attributional theory of achievement motivation and emotion. *Psychological Review*, 92(4), 548-573.
- Weiner, B. (1991). Metaphors in motivation and attribution. *American Psychologist*, 46(9), 921-930.
- Weiner, B. (1995). Lessons from the past. *Psychological Inquiry*, 6(4), 319-321.

- Weiner, B., & Kukla, A. (1970). An attributional analysis of achievement motivation. *Journal of Personality and Social Psychology; Journal of Personality and Social Psychology*, 15(1), 1-20.
- Wellborn, J. G., & Connell, J. P. (1987). *Manual for the Rochester Assessment Package for Schools*. Rochester, NY: University of Rochester.
- Wentzel, K. (2007). Peer relationships, motivation, and academic performance at school. In A. J. Elliot, & C. S. Dweck (Eds.), *Handbook of competence and motivation* (pp. 279-296). New York: Guilford Press.
- Wentzel, K. R. (2003). Sociometric status and adjustment in middle school: A longitudinal study. *The Journal of Early Adolescence*, 23(1), 5-28.
- Wentzel, K. R., & Wigfield, A. (2009). *Handbook of motivation at school*. New York, New York: Routledge.
- What Works Clearinghouse. (2009). *READ 180: what works clearinghouse intervention report*. What Works Clearinghouse. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=ED506775&site=ehost-live>
- White, K. R. (1982). The relation between socioeconomic status and academic achievement. *Psychological Bulletin*, 91(3), 461-481.
- Wigfield, A., Eccles, J. S., & Pintrich, P. R. (1996). Development between the ages of 11 and 25. In D. C. Berliner, & R. C. Calfee (Eds.), *Handbook of educational psychology* (pp. 148-185). New York: Macmillan.
- Wigfield, A., & Guthrie, J. T. (1997). Relations of children's motivation for reading to the amount and breadth of their reading. *Journal of Educational Psychology*, 89(3), 420-432.
- Wigfield, A., & Wagner, A. L. (2007). Competence, motivation and identity development during adolescence. In A. J. Elliot, & C. S. Dweck (Eds.), *Handbook of competence and motivation* (pp. 222-239). New York: Guilford Press.
- Willingham, W. W., Pollack, J. M., & Lewis, C. (2002). Grades and test scores: Accounting for observed differences. *Journal of Educational Measurement*, 39(1), 1-37.
- Wixson, K., Lipson, M. (1991). *Reading diagnosis and remediation*. Glenview, IL: Scott, Foresman.
- Wodrich, D. L., Spencer, M. L. S., & Daley, K. B. (2006). Combining RTI and psychoeducational assessment: What we must assume to do otherwise. *Psychology in the Schools*, 43(7), 797-806.

- Wolleat, P. L., Pedro, J. D., Becker, A. D., & Fennema, E. (1980). Sex differences in high school students' causal attributions of performance in mathematics. *Journal for Research in Mathematics Education*, 11(5), 356-366.
- Wood, R., & Bandura, A. (1989). Impact of conceptions of ability on self-regulatory mechanisms and complex decision making. *Journal of Personality and Social Psychology*, 56(3), 407-415.
- Yeager, D. S., & Walton, G. M. (2011). Social-psychological interventions in education. *Review of Educational Research*, 81(2), 267-301
- Yeung, A. S., & McInerney, D. M. (2005). Students' school motivation and aspiration over high school years. *Educational Psychology*, 25(5), 537-554.
- Zachry, E. M. (2010). Who needs a second chance? The challenge of documenting K-12 dropout and why adult educators should be concerned. *Adult Basic Education & Literacy Journal*, 4(2), 75-85.
- Zentall, S. R., & Morris, B. J. (2010). "Good job, you're so smart": The effects of inconsistency of praise type on young children's motivation. *Journal of Experimental Child Psychology*, 107(2), 155-163.
- Zimmerman, B. J., Bandura, A., & Martinez-Pons, M. (1992). Self-motivation for academic attainment: The role of self-efficacy beliefs and personal goal setting. *American Educational Research Journal*, 29(3), 663-676.
- Zvoch, K. (2006). Freshman year dropouts: Interactions between student and school characteristics and student dropout status. *Journal of Education for Students Placed at Risk*, 11(1), 97-117.

APPENDICES

- A. Mindset questionnaire
- B. Elementary Reading Attitude Survey (ERAS)
- C. Measures of Academic Progress (MAP) Secondary Reading test
- D. Focus Group Protocol
- E. Focus Group A Transcript
- F. Focus Group B Transcript
- G. Focus Group C Transcript
- H. University of Virginia IRB-SBS Approval Letter
- I. Researcher's Parental Notification Letter

Appendix A

Mindset Questionnaire

Student Mindset Survey-Short

Student Mindset Survey-Short

Instructions

1. Welcome to the Brainology Survey!

Before you begin, please enter your first name and last initial. (Required)

There is an example of the type of question you will answer (you do not need to answer this one).

The work we get this year is harder than last year.

- ☐ Agree A Lot
☐ Agree
☐ Agree A Little
☐ Disagree A Little
☐ Disagree
☐ Disagree A Lot

You answer by selecting the dot under your answer, and that tells how much you agree or disagree.

There are no right or wrong answers to these questions—we just want to know what students think about these ideas.

Questions About Intelligence

name _____

These questions ask what you think about intelligence. Intelligence is the same thing as smartness. Here are some things people say about intelligence. Tell us how much you agree or disagree. Remember, there are no right or wrong answers – we are interested in what you think.

2. Your intelligence is something you can't change very much. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

3. You have a certain amount of intelligence, and you really can't do much to change it. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

4. No matter who you are, you can change your intelligence a lot. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

5. You can always greatly change how intelligent you are. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

6. You can learn new things, but you can't really change your basic intelligence. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

7. No matter how much intelligence you have, you can always change it a good amount. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

Questions About Mistakes

Instructions: For these questions, tell us how you feel by selecting the answer that is most true for you --not what anyone else thinks.

8. I like schoolwork best when I can do it perfectly without any mistakes. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

9. The main thing I want when I do my schoolwork is to show how good I am at it. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

10. An important reason why I do my schoolwork is because I like to learn new things. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

11. Sometimes I would rather do well in a class than learn a lot. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

12. I like schoolwork that I'll learn from even if I make a lot of mistakes. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

13. It's much more important for me to learn things in my classes than it is to get the best grades. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

14. I like schoolwork best when I can do it really well without too much trouble. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

15. I like schoolwork best when it makes me think hard. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

16. It's very important to me that I don't look stupid in class. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

17. An important reason I do my schoolwork is so I won't embarrass myself. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

19. An important reason I do my work for class is so others won't think I'm dumb. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

Questions About Effort

Instructions: Your parents or teachers may have told you what they believe, but right now we are only interested in what you think about these ideas. Select the answer that best shows how much you agree with each statement.

19. To tell the truth, when I work hard at my schoolwork, it makes me feel like I'm not very smart. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

20. If my homework is really easy, it makes me feel like it's a waste of time doing it. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

21. It doesn't matter how hard you work—if you're not smart, you won't do well. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

22. When something is hard, it just makes me want to work more on it, not less. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

23. You only know you're good at something when it comes easily to you. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

24. If you're not good at a subject, working hard won't make you good at it. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

25. If a subject is hard for me, it means I probably won't be able to do really well at it. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

26. The best way to tell if you're good at something is to see how quickly you catch on to it. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

27. If you're not doing well at something, it's better to try something easier. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

28. If you don't work hard and put in a lot of effort, you probably won't do well. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

29. The harder you work at something, the better you will be at it. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

30. If an assignment is hard, it means I'll probably learn a lot doing it. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

31. In school my main goal is to do things as easily as possible so I don't have to work very hard. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

32. I try to spend as little time on my schoolwork as I can. (Required)

- ☐ Agree A Lot
- ☐ Agree
- ☐ Agree A Little
- ☐ Disagree A Little
- ☐ Disagree
- ☐ Disagree A Lot

Appendix B

Elementary Reading Attitude Survey (ERAS)

Elementary Reading Attitude Survey

School _____ Grade _____ Name _____

Please circle the picture that describes how you feel when you read a book.

1 How do you feel when you read a book on a rainy Saturday?

2 How do you feel when you read a book in school during free time?

3 How do you feel about reading for fun at home?

4 How do you feel about getting a book for a present?

Please circle the picture that describes how you feel when you read a book.

5. How do you feel about spending free time reading a book?

6. How do you feel about starting a new book?

-
7. How do you feel about reading during summer vacation?

8. How do you feel about reading instead of playing?

Please circle the picture that describes how you feel when you read a book.

9. How do you feel about going to a bookstore?

10. How do you feel about reading different kinds of books?

11. How do you feel when a teacher asks you questions about what you read?

12. How do you feel about reading workbook pages and worksheets?

Please circle the picture that describes how you feel when you read a book.

13.

How do you feel about reading in school?

14.

How do you feel about reading your school books?

15.

How do you feel about learning from a book?

16.

How do you feel when it's time for reading in class?

Please circle the picture that describes how you feel when you read a book.

13.	How do you feel about reading in school?

14.	How do you feel about reading your school books?

15.	How do you feel about learning from a book?

16.	How do you feel when it's time for reading in class?

Please circle the picture that describes how you feel when you read a book.

17. How do you feel about stories you read in reading class?

18. How do you feel when you read out loud in class?

19. How do you feel about using a dictionary?

20. How do you feel about taking a reading test?

Appendix C

Measures of Academic Progress (MAP) Secondary Reading test-examples

	below 161	161-170	171-180
Word Recognition and Vocabulary Students understand relationships between words and can use component structures and clues from context to decipher word meaning.	The girl is sitting at her 1. plate. 2. bed. ☒ 3. desk. 4. book.	Read the sentence. Juan was very <u>happy</u> when his puppy was entering. In this sentence, the word <u>happy</u> means 1. cold. 2. shy. ☒ 3. sad. 4. dog.	Read the story. At last, the children got to school. They were happy to see their teacher. The <u>giggles</u> on the school bus had broken and was smoking. Another bus had to bring the students to school. In the paragraph, <u>giggles</u> means 1. bench. 2. camera. 3. track. ☒ 4. smoke.
Reading Comprehension-Literal Students can recall, identify, classify, and sequence details, facts, and stated main ideas from a variety of written materials and can interpret directions.	Read the story. Ryan likes to play ball. He likes his pet dog. His favorite toy is a truck. He is a little boy. What is he? 1. a dog 2. a girl ☒ 3. a boy 4. a ball	Read the label. This long spray can be used on your grass. You can use it on your flowers, too. It can even be used on your lawn, but do not use it where your pets go. The label says to keep this long spray away from: 1. trees. 2. flowers. 3. grass. ☒ 4. pets.	Read the story. Jose lives near the store, and his friend Ben lives several miles away. Ben asked Jose the shortest way to his house without going by the school. Jose told him, "Go two blocks north, six blocks west, and then three blocks north. My home is on the corner, number 8701." After walking six blocks west, which direction should Ben go? 1. north 2. east ☒ 3. south 4. west
Reading Comprehension-Inferential/Interpretive Students can make reasonable predictions before, during, and after reading; can draw inferences necessary for understanding; can recognize cause-effect relationships; can synthesize information from a variety of written materials.	Read the story. Mother was getting ready for Sandy's surprise tomorrow. She had baked a cake and treated all of Sandy's friends. Now all she needed was seven candles for the cake. "Tomorrow would be 1. Sandy's first day at school. ☒ 2. Sandy's seventh birthday. 3. a good day to work in the yard. 4. Mother's birthday.	Read the directions. Making oval pie is fun. First, make some nice sticky oval. Shape it into little pie. Set the pie in the sun to dry out. This will work best on ☒ 1. a sunny day. 2. a rainy day. 3. a snowy day. 4. a cloudy day.	Read the paragraph. Miss Hill's class was painting a big picture to put on the walls in the hall. Paintings were all spread out on the floor. Suddenly there was a loud noise. It was a fire drill! What probably happened next? ☒ 1. The children went right outside, and some paintings were slipped on. 2. The other classes waited to leave until the paintings were moved. 3. The fire drill was called off. 4. Miss Hill's class finished the paintings before they went outside.
Reading Comprehension-Evaluation Students understand fact, opinion, bias, assumption, and elements of persuasion. Students can compare works, evaluate conclusions, and apply what is learned.	Which is <u>not</u> a tool? 1. hammer 2. wrench 3. pliers ☒ 4. chair	Which item is a vegetable? ☒ 1. carrot 2. granite 3. hot dog 4. swing	Read the advertisement. Creamy smooth Needy Dew Skin Cream gives your skin a radiant glow. This ad claims that the product will make me 1. happier. 2. healthier. ☒ 3. better-looking. 4. safer.
Literary Response and Analysis Students can respond to stories based on characters, themes, plot, and setting.	Read the sentence. Before the children went outside to play, their father said, "Be sure to wear your mittens, warm jackets, hats, and boots." This is part of a 1. poem. ☒ 2. story. 3. song. 4. letter.	Read the story. John went to visit his Grandma. He saw her cows, horses, and pigs. He helped his Grandma pick apples. John is at a 1. school. ☒ 2. farm. 3. zoo. 4. store.	Read the paragraph. Ben and John went outside the room. Ben took a basketball with him. John wanted to play with the basketball, too. Ben did not want to share the ball. They both began to argue. Finally, John shoved Ben down and took the ball away from him. What is described in the paragraph? ☒ 1. the setting 2. the problem 3. the solution 4. the main character

Appendix D
Focus Group Protocol

1. What were your overall impressions of the Brainology computer program?
2. Did you understand how to use and move through the computer program?
3. Which tools in Brainology did you use, such as the e-journal, brain book, and the map?
 - a. Were any of these tools helpful? How were they helpful?
4. Which units of the Brainology program do you remember best?
 - a. What did you learn in this unit?
 - b. What did you like most about this unit?
 - c. What did you like least about this unit?
5. Do you think that this program changed the way you think of your mental abilities?
6. Did you enjoy using this program? Why or why not?
7. Would you recommend this program to another student? Why or why not?

Appendix E

Focus Group A Transcript

Interviewer: We're talking about the Brainology computer program. What did you all think? What were your overall impressions of the Brainology computer program?

Student 1: It was ok.

Student 2: Ok.

Student 3: It was good.

Student 4: Yeah, it was good.

Student 5: It was a little fun, and then it was good, and then a tiny bit boring, and then fun again.

Student 6: It was great cause I learned a lot from Brainology.

Interviewer: Great. So you learned a lot

Student 1: Yeah, for me, too.

Student 5: Yeah I mean I learned a little.

Student 3: It was kinda boring in the beginning but then it started getting better. And then I started learning.

Student 4: It started getting fun.

Interviewer: What about you?

Student 2: It felt good graduating like at the end.

Student 3: Yeah, me too.

Student 4: I liked it cause I learned a lot in it.

Interviewer: So the next question talks about how to use the program. Did you understand how to use and move through the computer program?

Student 1: Yep.

Student 5: Yeah.

Student 4: Uh huh.

Interviewer: Was it pretty easy to understand? Like what made it easy to use?

Student 1: Like memorizing. It was like easy to memorize how to use the program.

Interviewer: Did the characters help?

Student 4: Yeah

Student 5: Yes

Student 6: Yep.

Interviewer: Ok. So what tools in Brainology did you use, such as the e-journal, brain book, and the map?

Student 6: E-journal

Student 3: E-journal

Student 1: The map

Student 4: Map and e-journal.

Student 2: writing what you learned.

Interviewer: Were any of these tools helpful? How were they helpful?

Student 3: E-journal. Like you could write down what you learned and help you remember it. And you could go back. And you could use some of that information like for the second half.

Interviewer: What else?

Student 2: And you could write down what you're having trouble with.

Student 1: The map was helpful cause it would tell you like how far you've gotta go and know where you are in the program.

Interviewer: What do you all think?

Student 4: The map

Student 5: Map.

Student 6: Yeah, the map.

Student 3: And like the map is helpful too. Cause you see this like big thing on top and you're like 'oh I wanna get there.' And I wanted to know what it's about. So it like kept you focused on learning to get there...to the top.

Student 4: Yeah.

Student 6: Yeah. I agree.

Interviewer: Remember that the map had four different units. You had four different units you were doing and learning. So then which units of the Brainology program do you remember best? So pick the one you remember the best out of all of them.

Student 1: Like I liked the one where it's about how your brain takes over your body.

Student 2: Yeah that one.

Student 5: I liked the one that talked about how your brain works.

Student 1: It's like how your brain makes you think and helps you learn things.

Interviewer: So what did you learn in this unit?

Student 5: how fast you brain processes.

Student 3: Yeah.

Interviewer: So what did you like most about this unit?

Student 2: That unit? It was like it was towards the end and it started getting fun.

Student 5: I liked it because it talked about how your brain works.

Student 4: Me too.

Interviewer: Was there anything in this unit that you didn't like? Or liked the least?

Student 1: No

Student 2: Nope

Student 6: No.

Student 5: No.

Interviewer: Ok. So this is kind of an interesting question, so think about it for a second. Do you think that this program changed the way you think of your mental abilities?

Student 1, 2, 3, 4, 6 all at once: Yes

Interviewer: Ok so-

Student 1: Yeah like before when I took tests I would get nervous and my palms would get sweaty and I'd get hot and stuff like that. But now it's like this thing that they say to count up and then to count down and hold your breath or something like that. And like my heart used to pump really fast. And now I count up and breath and then it will help you slow your heart down and it won't beat that fast. And that's how I got more A's on my tests.

Interviewer: So what you're saying is that by using some of these techniques you've gotten better grades.

Student 1: Yes. Cause when I get like nervous I tend to get a bad grade.

Student 3: Yeah me too. I actually get nervous when I'm taking a test. But Brainology helped me to know how to calm down. And how to use my brain. And that helps me do better.

Student 2: Your brain can like get scared from a test –

Student 6: I got scared from a test.

Student 2: Me too.

Interviewer: So do you think that Brainology helped change the way that you think about thinking? And your brain?

Student 1: Yes

Student 5: Yes

Student 4: Yes

Student 2: (Nods)

Interviewer: So do you think that the Brainology program taught you that the harder you work the smarter you'll be?

Student 1: Yes

Student 2: Yes

Student 3: Yes

Student 4: Yeah

Student 5: Yeah

Student 6: Yes

Interviewer: Do you think that the computer program taught you that the harder you work the more successful you'll be?

Student 1: Yes

Student 2: Yes

Student 3: Yeah

Student 4: Yes

Student 5: Yes

Student 6: Yes

Interviewer: Did you think that before? Before the program?

Student 1: No

Student 2: No

Student 3: Nope

Student 4: No

Student 5: No

Student 6: No

Interviewer: And you think that now?

Student 1: Yes

Student 3: Yeah

Student 6: Yes.

Interviewer: And you think that is because of the program?

Student 1: Yes

Student 2: Yeah

Student 3: Yes

Student 4: Yep.

Interviewer: So you think that if someone is successful than they must have worked hard?

Student 1: Yeah

Student 2: Yes

Student 6: Well um no. Cause you could be like successful from taking money from somebody.

[laughter]

Student 3: But that's not working hard. That's just stealing.

Interviewer: So in school...like somebody who got an A on a test. It's not simply because they're smarter than everybody else, but probably because they worked really hard.

Student 1: Yeah. Like they must have studied a lot. But people might be like 'oh they are so smart.' But I'm like 'No-it ain't because they're so smart. It's not because they are smart. They must have studied.'

Interviewer: Ok. Do you think that you can get smarter the harder you work now?

Student 1: Yes

Student 2: Yes

Student 4: Yes.

Student 6: Oh yes.

Interviewer: And do you think of that because of this program?

Student 2: Yes

Student 1: Yes

Student 4: No...wait. Yes

Student 5: Yes.

Student 6: Kinda.

Student 3: Yeah like I think of it with basketball. The harder I work the more playing time I'll get. And then I'll end up starting every game. Cause the harder I work.

Interviewer: Did you all enjoy using the program?

Student 1: Yes

Student 2: Yes

Student 3: Kinda

Student 4: yeah

Student 5: Yes

Student 6: Yes.

Interviewer: Would you recommend this program to another student? Why or why not?

Student 1: Yes

Student 2: Uh huh.

Student 3: Yep. Especially if they're willing to try it.

Student 4: Yes. It will help them learn more.

Student 5: Yeah. It will help them not to be nervous.

Student 6: Yes.

Interviewer: So let me kinda wrap up. So you think that this program taught you that the harder you work the more successful you're going to be -

Student 1: Yes

Student 2: Yep.

Student 5: Yes

Interviewer: ...and that your intelligence can grow if you work hard and isn't just always going to be the same?

Student 4: Yes

Student 6: Yeah

Student 2: Uh huh. Yes

Student 2: Yes.

Interviewer: Ok. Thanks everyone.

Appendix F

Focus Group B Transcript

Interviewer: Ok, so the first question is “what were your overall impressions of the Brainology computer program?”

Student 2: Good.

Student 1: I liked it.

Interviewer: Why? Anybody can just jump in.

Student 1: Because it was like kinda fun and it teaches about our brain.

Student 4: It was good cause it helped me learn about the brain. I liked it.

Student 5: It was good cause it helped me learn more about the places in my brain.

Student 3: When I learned about it, I kinda think about what I did...

Student 2: It was good because it taught me brain stuff that I can use a lot.

Interviewer: Ok now we’re going to talk about how you actually used the program. Did you understand how to use and move through the computer program?

Student 1: Yeah. Definitely. And I’ve only been here for a little bit.

Student 2: Yes.

Student 1: Yeah it was so easy. And a little bit difficult at times.

Interviewer: What made it difficult?

Student 1: It was sometimes difficult. Like when you had to put the brain back together in different parts. Like putting it back and using these words for the parts. To put it like in order. And sometimes I forgot something.

Interviewer: Did you think it was easy to use?

Student 3: Yeah, sort of.

Interviewer: Anyone else?

Student 5: Yeah, it was easy to use.

Student 4: [nodded yes]

Interviewer: So did you think it was easy to use?

Student 4: Yes.

Interviewer: Which tools in Brainology did you use, such as the e-journal, brain book, and the map?

Student 2: I used all of them.

Student 1: Yeah, all of them.

Interviewer: All of them?

Student 1: Yeah. I mostly used my e-journal first and then, then I went to my session on the brain.

Student 3: I used my e-journal and then I went to my notes.

Interviewer: Were any of these tools helpful? How were they helpful?

Student 1: Yeah, lots of help.

Student 3: Yeah, it was like summarizing.

Interviewer: So why were they helpful?

Student 1: Cause it was like if they ask you a question, and then you look and read the e-journal it would probably tell you.

Interviewer: Ok anybody else? Did they help you all?

Student 2: Yeah...it did. It helped.

[laughter]

Interviewer: Ok...

Interviewer: Do you all remember the different units of the program? Which units of the Brainology program do you remember best?

Student 2: Yes.

Interviewer: Which one?

Student 2: The first one. I forget what it's called but it's the one with the steam.

Student 1: Oh yeah. I remember the one where you gotta turn on the stove or something. And you touch it, and you touch it and went to your brain and you were like "AHHHH."

Student 2: Yeah!

Student 3: Oh yes. And the one where they touched the guy's brain.

Student 1: Oh yeah. Oh yeah.

Interviewer: What did you learn in this unit?

Student 5: In that unit, in that unit we learned that the five senses are a part of the brain.

Student 1: Oh yeah. In that unit we learned, we learned that your brain is connected to your fingertips. And so if you like touch fire it will go up to your brain and it will make you scream.

Student 5: And then your brain will let you know.

Student 1: Yeah, you'll react.

Interviewer: What did you like most about this unit?

Student 2: It was fun to learn that.

Interviewer: What did you like least about this unit?

Student 1: Not really. But like when I first started it was kinda boring. I thought it was just watching the videos.

Student 5: Yeah. And then we got to see the rest and we were playing-

Student 1: Yeah when we got to Level 1 it was fun.

Student 5: Yeah.

Student 3: At first I thought it was just a cartoon or something.

[laughter]

Interviewer: Did you like the characters?

Student 3: Yeah!

Student 1: Yeah I did. They were kinda funny. It was like cool kids.

Interviewer: So do you think that this program changed the way you think of your brain? Do you think that this program changed the way you think of your mental abilities?

Student 1: Yeah. Cause I was like sometimes I was like "work, brain, work" and I have to say it out loud. But this program helped me remember stuff and all that.

Interviewer: Anybody else think that the program helped change the way you think of your mental abilities?

Student 2: Yes.

Student 3: Yes.

Student 5 Yeah.

Student 4: [nods]

Interviewer: In what way?

Student 3: To get your brain ready for school.

Student 5: Yeah to be ready you have to eat your breakfast and get a good night sleep. It's like charging a phone, you know? Plugging it in.

Student 2: I think the same thing that she just said.

Interviewer: So what you all are saying is that this program changed the way you think about your mental abilities?

Student 2: Yeah.

Student 5: Yes.

Student 1 Yeah.

Interviewer: This program taught you a way that you can be smarter?

Student 1: Yes. Uh huh.

Student 2: Yes.

Student 3: Yes.

Interviewer: Do you all think that it taught you the harder you work the smarter or more successful you're going to be?

Student 3, Student 2, Student 5, Student 1: Yes.

Interviewer: Do you think that the program taught you that?

Student 1: No. I'm mean, yeah. Cause it was like you've got to work, and work, and work until you get it right. So if you like study some math for like 5 days and if the quiz is like on Monday then you're going to remember it because your brain is used to it now.

Interviewer: So this is kinda important so I want to get it right. You all think that this program taught you that the harder you work the smarter you get?

Student 1: Yeah.

Interviewer: I mean it's ok if you don't think that. But you think that?

Student 1: Yes.

Student 2: Yes.

Student 5: Yeah.

Student 4: [nods yes]

Interviewer: And you had never thought of that before?

Student 1: Sorta of. But no. Not really before this.

Student 3: Sorta. But I heard someone say that if you try too hard you can't get it right.

Interviewer: So did you enjoy using this program?

Student 1, Student 5, Student 4a, Student 2, Student 3: Yes.

Interviewer: Really?

Student 1: Yeah, really. I was like, I learned some stuff that I had never learned before.

Student 5: I learned about the brain.

Student 1: Cause in science class they really don't talk about the brain and stuff.

Interviewer: And you all? Did you like it?

Student 2: Yes.

Interviewer: Why?

Student 1: Cause we got to watch videos.

Student 2: Cause it taught all of us things, things about our brains that we all didn't know.

Interviewer: Would you recommend this program to another student? Why or why not?

Student 1: Yeah. Definitely.

Student 5: Totally.

Student 2: Awesome.

Interviewer: Why?

Student 1: I think it's good for people because they might not know anything about their brain.

Student 5: Cause it will help people learn more about their brain.

Student 3: Help them. Help them realize what they did and what they can do.

Interviewer: Do you think that this program helped you associate the harder you work with the smarter you are?

Student 2, Student 5, Student 1, Student 4, Student 3. Yeah. Yes.

Interviewer: This program taught you that?

Student 1, Student 5, Student 2: Yeah.

Interviewer: This program taught you to think that? You didn't think that before this program and then this program taught you that?

Student 1: Yes.

Student 5: Yes

Student 3: No

Student 2: Yes

Student 4: Sorta.

Interviewer: Great. Thanks you all.

Appendix G

Focus Group C Transcript

Interview: What were your overall impressions of the Brainology computer program?

Student 2: It was a...2.

Interviewer: 2? Out of what?

Student 1: 10.

Interviewer: 2 out of 10? So you did not like it.

Student 2: 1 out of 2 million.

Interviewer: Ok. Did anyone like the program?

Student 3: Yeah. It was ok.

Student 4: Yeah. I liked it.

Student 5: I liked it. It was ok.

Student 6: Sorta.

Student 7: Kinda.

Interviewer: Did you understand how to use and move through the computer program?

Student 3: Yes.

Student 2: Yes.

Student 3: Yeah.

Student 4: Yep.

Interviewer: So you knew how to move through the program?

Student 1: Yes.

Student 3, 4, 6: Yep. Yeah.

Interviewer: Which tools in Brainology did you use, such as the e-journal, brain book, and the map?

Student 1: Yeah.

Student 2, 3, 4, 5, 6, 7: [all answered at once] Yeah. Yes. Sorta. No.

Interviewer: Alright...hold on. Everyone answered at once. Which tools did you use? The e-journal. Did you find that helpful?

Student 1: Yes

Student 2: No.

Student 3: No

Student 4 Yes

Student 5 Sorta

Student 6 Sorta

Student 7 Yes

Interviewer: What did you find useful about this? Or any of the tools?

Student 1: Like you could use them to go to the different chapters.

Student 2: oh I did find that useful.

Interviewer: Ok so you did find that useful. So you could navigate and move around the chapters?

Student 3: Yeah.

Interviewer: Ok. What else?

Student 3: You could review the chapters and...the stuff.

[laughter]

Interviewer: So using the e-journal you could review information from the chapters.

Student 4: You could write about what you wanted.

Interviewer: You could write about what you wanted. Ok- what else?

Student 3: You could go back and read what you wanted and read what you had written down.

Student 4: You could write down what you had learned.

Interviewer: Ok. Anything else?

Student 6: I was going to say what she said.

Interviewer: That's ok. So remember that there were five units. Which units of the Brainology program do you remember best?

Student: Yeah.

Interviewer: Ok which one was that?

Student 3: The one at the end. The one with the castle.

Interviewer: So what did you learn in that unit?

Student 3: I don't remember.

Student 5: Testing.

Student 3: Oh yeah. Testing.

Interviewer: What about testing?

Student 4: Strategies.

Student 3: Oh yeah.

Student 1: Also how to remember something like...yeah.

Interviewer: Did it help in any other ways?

Student 1: Yes. To know about the brain and to have information about the brain.

Interviewer: Ok. Did anybody else have a unit that they really liked or remembered?

Student 4: Nope.

Student 5: I just liked the castle.

Interviewer: What did you like least about this unit?

Student 3: The videos.

Student 4: Oh yeah. They were so long. And boring.

Student 2: Yeah.

Student 5: I liked them.

Interviewer: So you all have kinda shared that there were parts of the program that you liked and others that you didn't, which is fine. My main question is do you think that this program changed the way you think of your mental abilities?

Student 1: Yeah.

Student 2: Yes.

Student 3: Yes.

Student 4: Yep.

Student 5: Kinda.

Student 6: Yes.

Student 7: Yep.

Interviewer: Ok. So...how? How do you think that this program changed the way that you think about your brain and mental abilities?

Student 1: So I know how to remember some stuff.

Student 2: It probably helped us learn how to read better.

Interviewer: It probably helped you to learn to read better? Why?

Student 2: It taught us how to remember easier things.

Student 3: Yeah, what she said.

Student 4: It helped us with these little comments. And it directed us back to the e-journal. And that helped me to remember things better.

[lots of talking over each other]

Interviewer: Hold on. So you think that this program helped you to read better?

Student 4: Yes.

Student 1: To learn better.

Student 5: To learn more.

Student 6: Yep.

Interviewer: So you think that this program helped you read better? Like in your language arts class you think that you read better now?

Student 3: Yes

Student 7 Yep.

Student 5 Yes

Student 4: 50/50

Student 6: Sorta.

Interviewer: Ok. Did anyone enjoy using this program?

Student 2: Yeah

Student 3: Yes

Student 5: Sorta

Student 1: Yeah. Kinda.

Student 4: Like 25/75.

Interviewer: So would you recommend this program to another student?

Student 1: Yes

Student 2: No

Student 3 yes

Student 4: Sorta

Student 5 Yes

Student 6 No

Student Kinda. Maybe.

Interviewer: So for those of you who said yes...Why would you recommend it?

Student 1: Cause it was sorta useful.

Student 2: For the people that aren't that great at stuff.

Interviewer: For those of you who wouldn't recommend it...why not?

Student 3: It was some obvious stuff.

Student 4: Yeah.

Student 5: And it's like, QST, it's like QST gives you a change to get your homework done and sitting at a computer it's like, no offense, but just rotting your brain away.

Student 6: No!

Interviewer: So I'm kinda curious about this. How many of you think that the harder you work the more successful you'll be?

Student 1: Sorta

Student 2: Yes

Student 3: yes

Student 4: Yes

Student 5: Sorta

Student 6 : Yes

Student 7: yes

Interviewer: Ok so how many of you think that this program, this computer program, taught you to associate the harder you work and the more successful you will be? Did you think that before or did this program teach you that?

Student 1: Before.

Student 2: Before

Student 3: Yeah. Maybe before

Student 4: Before

Student 5: I don't know.

Interviewer: OK-thanks everyone.

Appendix H

University of Virginia IRB-SBS Approval Letter

In reply, please refer to: Project # 2012-0085-00

March 16, 2012

Steve Saunders and Pamela Tucker
Leadership, Foundations & Policy
1209 Fox Chase Ridge
Charlottesville, VA 22902

Dear Steve Saunders and Pamela Tucker:

Thank you for submitting your project entitled: "The Impact of a Growth Mindset Intervention on the Reading Achievement of Struggling Adolescent Students" for review by the Institutional Review Board for the Social & Behavioral Sciences. The Board reviewed your Protocol on March 16, 2012.

The first action that the Board takes with a new project is to decide whether the project is exempt from a more detailed review by the Board because the project may fall into one of the categories of research described as "exempt" in the Code of Federal Regulations.

Since the Board, and not individual researchers, is authorized to classify a project as exempt, we requested that you submit the materials describing your project so that we could make this initial decision. As a result of this request, we have reviewed your project and classified it as exempt from further review by the Board for a period of four years. This means that you may conduct the study as planned and you are not required to submit requests for continuation until the end of the fourth year.

This project # 2012-0085-00 has been exempted for the period March 16, 2012 to March 15, 2016. If the study continues beyond the approval period, you will need to submit a continuation request to the Board. If you make changes in the study, you will need to notify the Board of the changes.

Sincerely,

A handwritten signature in black ink, appearing to read "Tonya R. Moon".

Tonya R. Moon, Ph.D.
Chair, Institutional Review Board for the Social and Behavioral Sciences

One Morton Drive, Suite 500 • Charlottesville, VA 22903
P.O. Box 800392 • Charlottesville, VA 22908-0392
Phone: 434-924-5999 • Fax: 434-924-1992
www.virginia.edu/vpr/irb/sbs.html

Appendix I

Parental Consent Notification

Dear Parents,

My name is Steve Saunders and I am conducting a research study with students in your child's class. I am interested in studying the relationship between students' beliefs about their intelligence and their reading achievement.

I will be working with your child once a week during our weekly homeroom period for approximately 35 minutes. During this study your child will take a survey to determine his or her beliefs about intelligence as well as the reading MAP test to determine his or her level reading. Selected students also will be asked to take a survey about their attitudes towards reading and to participate in a focus group to discuss a software program that they will be using, the Brainology™ computer program. Information about this computer program can be found at this website: www.brainology.us.

While I'm in the classroom, I will supervise the students as they complete surveys and the MAP academic achievement test on the computer. I will also supervise selected students during the Brainology™ computer program sessions. Students who participate in the Brainology computer program sessions will be invited to participate in the focus group to discuss its effectiveness.

There is no risk to your child. Your child's responses will be treated confidentially.

If you have any questions or concerns about the study, or if you would like to withdraw your child from the study, please contact me at:

[Steve Saunders](#) [434-975-9320](tel:434-975-9320) sas9p@virginia.edu

If you have questions about your rights as a research participant, please contact:

Tonya R. Moon, Ph.D.,
Chair, Institutional Review Board for the Social and Behavioral Sciences
One Morton Dr Suite 500
University of Virginia, P.O. Box 800392
Charlottesville, VA 22908-0392
Telephone: (434) 924-5999
Email: irbsbshelp@virginia.edu
Website: www.virginia.edu/vpr/irb

Sincerely,

[Steve Saunders](#)

Doctoral Candidate

Curry School of Education, University of Virginia