THE EFFECTS OF EFFORT-BASED AND ABILITY-BASED REINFORCEMENT CUES ON STUDENT PERSEVERANCE

by

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on Student Perseverance

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ABSTRACT

Rory Allen Boone. THE EFFECTS OF EFFORT-BASED AND ABILITY-BASED REINFORCEMENT CUES ON STUDENT PERSEVERANCE. (Under the direction of Dr. Gail Collins, Ed.D) Liberty University School of Education, October, 2011.

This study examined the impact of "ability-based" and "effort-based" verbal reinforcement cues prior to task engagement in traditional sixth grade students attending Christian schools in northwest Indiana. Perseverance levels were measured during a numerically-based, problem solving task by tracking time signatures (in seconds) of the first, second, and third use of restricted "clues." The research population (n = 102) was randomly assigned into two groups (ability-cued and effort-cued). Statistical significance was found at all three measurements. Target measurement one revealed M_E = 518.7 (SD = 310.7), M_A = 402.4 (SD = 293.5), with two sample $t(100df) = 1.94$, $p = 0.027$. Target measurement two revealed M_E = 645.9 (SD = 287.1), M_A = 494.0 (SD = 296.8), with two sample $t(100df) = 2.62$, $p = 0.004$. Target measurement three revealed M_E = 738.6 (SD = 249.1), M_A = 586.6 (SD = 285.6), with two sample $t(100df) = 2.86$, $p = 0.002$. The null hypothesis stating ability-cued students would show greater levels of perseverance was rejected at all three measurement targets. Students receiving effort commendations prior to task engagement showed greater levels of perseverance than students receiving ability commendations.

Keywords: perseverance, self-concept, self-esteem, self-efficacy, ability reinforcement, effort reinforcement.

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To journey alone is a trek of melancholy solitude, but a journey with trusted companions is an adventure worth more than gold, silver, or precious gems. The dissertation adventure has brought many companions, believers, and heroes into my life.

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LIST OF ABBREVIATIONS

Analysis of Variance (ANOVA)

Cohen's Statistic (*d*)

Dependent Variable (DV)

Degrees of Freedom (*df*)

Effect Size (*r*)

F-Statistic (*F*)

Independent Variable (IV)

Indiana State Test of Educational Progress Plus (ISTEP+)

Intelligence Quotient (IQ)

Institutional Review Board (IRB)

King James Version Bible (KJV)

New International Version Bible (NIV)

Northwest Evaluation Association (NWEA)

P-Statistic (*p*)

Standard Deviation (*SD*)

Statistical Mean (*M*)

T-statistic (*t*)

Talented and Gifted Program (TAG)

CHAPTER ONE: INTRODUCTION

Introduction

Perseverance to complete tasks is an essential element in successful learning (Dweck, 2000; Multon, Brown, & Lent, 1991), but students progressing through elementary and secondary school may develop personal "perceptions" of academic ability that adversely affect student progress (Ares & Gorell, 2002; Bartholomew, 2008; Hawkins, 2009; Henderlong, 2000). Caring classroom instructors play pivotal roles in supporting students toward goal-oriented thinking and higher levels of perseverance (Boekaerts, 2006; McDevitt, Sheehan, Sinco, Cochran, Lauer, & Starr, 2008; Schunk & Zimmerman, 2003). The premise of this study contends that one facet of student academic perseverance is adult verbal cueing (e.g., praise comments) that enhances or erodes student perceptions of self-efficacy; and thereby, influences levels of academic perseverance. This study examined the relationship between "ability" and "effort" verbal reinforcement cues (e.g., "praise comments") prior to task engagement and the resulting levels of perseverance to complete an assigned numerical, problem solving task.

Charles Dickens (1997, p. 13) once stated the perplexing enigma, "It was the best of times. It was the worst of times." In the French Revolution novel "A Tale of Two Cites," Dickens chronicled the lives of war-time characters driven by brutal circumstances that shaped individual mindsets and directed destinies. Some characters were purified and refined by circumstances beyond their control. Other characters were beaten and destroyed by life's circumstances.

Mirroring the Dickens novel, students enter the classroom experiencing many circumstances beyond their personal control (Price, 2005; Sprenger, 2005). Varying

degrees of ability, perseverance, and the belief in the possibility of success challenge students to excel in the face of adversity (Elwell & Tiberio, 1994; Pintrich & DeGroot, 1990). Some students are successful in the quest to conquer negative, personal circumstances in the classroom. Other students are woefully unprepared to tackle negative circumstances. Classroom instructors stand at the crossroads of student success by creating environments of safety, support, creativity, and acceptance. As Theobald (2006) states, "One of the greatest challenges for teachers in the 21st century is to provide an environment and atmosphere that can stimulate a student's desire to learn" (p. 1). The classroom is certainly a place where student mindset determines whether the academic classroom reflects the "best of times" or the "worst of times."

Background of the Problem

Personal "mindsets" are driven by circumstances, both internal and external, which motivate human behavior (Dweck, 2008a). Equal circumstances do not create equal responses in children. Circumstances may be benevolent or destructive, but the reaction and response to the circumstances may create vastly different personal, physical, and emotional mindsets in children. Experiencing cruelty may drive one individual toward acts of violent passion or passionately drive another individual to forgiveness and a life spent improving the circumstances of others.

It is the pursuit of this dissertation to gain a better understanding of the potential influence of verbal reinforcement cues related specifically to "ability-based" and "effort-based" commendations (praise cues) on student perseverance. The goal of the research project is the discovery of improved verbal interaction strategies encouraging students to perform with greater perseverance in the face of obstacles, and higher levels of academic self-efficacy.

Review of Related Literature

Student perseverance studies are documented in the areas of athletic training and coaching (Crust, 2007; Jordan, 1999), students with special needs and remedial instruction (Borders, Earlywine, & Huey, 2004; Klassen, 2002; Konrad, Fowler, Walker, Test, & Wood, 2007), students in talented and gifted programs (Gardynik, & McDonald, 2005; Reis, Neu, & McGuire, 1997), students whose primary language is not English (Chan, 2006), college freshman and graduate students (Turnock, Rosen, & Kaminski, 1998; Young & Ley, 2002), counseling programs (Barnes, 2004; Bodenhorn & Skaggs, 2005), and work and career-related studies (Christensen, Fogarty, & Wallace, 2002; Yost, 2006).

Dweck (2000) examined the relationship between student mindsets and student performance in tradition educational classrooms, and focused on the topics of self-efficacy, achievement, and perseverance. Commonalities across age levels and classroom settings related to fixed mindset orientation and growth mindset orientation and its relationship to academic perseverance were observed (Dweck, 2008b; Dweck & Leggert, 1988). Research also noted student performance and perseverance were significantly influenced by an instructor's verbal cueing (type of praise) prior to task engagement (Dweck, 2008b). The focus of the current inquiry seeks to replicate research centered on instructor "ability cueing" (praise for the attribute of "smartness") compared to "effort cueing" (praise for the attribute of "sustained effort") prior to a structured, numerical problem-solving activity. Validation was sought to either confirm or refute Dweck's previous findings that students praised for ability or "smartness" reflected less perseverance to perform tasks as the tasks became more difficult; while students praised

for “effort” showed greater resilience as tasks became more difficult. Validation was also sought to confirm or refute the findings indicating students praised for “ability” prior to task engagement develop greater negative internal feelings as assigned tasks became more difficult; while students praised for “effort” prior to task engagement develop greater positive internal feelings as assigned tasks became more difficult.

Henderlong (2000) and Henderlong and Lepper (2002) also contributed to the study of student perseverance through detailed analysis of the potential positive or negative consequences of teacher verbal praise cues in the classroom. Henderlong notes that positive praise occurs as instructors verbally commend students for controllable features (such as effort), praise that maximized student autonomy, praise that centered on individual competency, and the setting of high, but realistic goals as groundwork for the development of student perseverance.

Gap in the Literature

Although the focus of this study was perseverance and its relationship to verbal cueing by classroom instructors, the concept of student self-efficacy was embedded in the study of student perseverance. Self-efficacy is “an individual’s judgment of their capabilities to organize and execute courses of action required to attain designated types of performances” (Bandura, 1986). Student belief systems can be shaped by the verbal cueing of an instructor, coach, peer, or parent. Verbal cueing is documented in numerous case studies within specialized student populations. Crust (2007) and Jordan (1999) noted the impact of verbal interaction and athletic perseverance. Chan (2006) studied the role of verbal cueing and increases in student perseverance in foreign language students. Students in special education classes and remedial classes were the focus of perseverance

studies by Borders, Earlywine, and Huey, (2004), Klassen, (2002), and Konrad, Fowler, Walker, Test, and Wood (2007). Verbal cueing and its relationship to performance and perseverance in student populations of "talented and gifted programs" (TAG) were described in studies by Gardynik and McDonald (2005) and Reis, Neu, and McGuire (1997). Perseverance studies involving college freshman and graduate students were performed by Turnock, Rosen, and Kaminski (1998), and Young and Ley, (2002).

Specialized populations in education have experienced significant research in the area of perseverance and the related topic of student mindset and self-efficacy. The intended goal of studying perseverance issues in specialized populations is an overall increase in student performance. Whereas much documentation was observed with perseverance studies in specialized populations, little professional research was noted related to perseverance studies in traditional junior high students in non-specialized settings. Replication of Dweck's (2008b) research in a traditional junior high setting continues the study of student perseverance in non-specialized populations.

This dissertation contributes to a broader understanding of the enhancing or inhibiting effects of verbal "ability cueing" and verbal "effort cueing" prior to task engagement by classroom instructors on student perseverance and student self-efficacy (Dweck, 2008a). The gap in the literature promoting credibility to this study was the lack of perseverance research related to traditional junior high students and verbal cueing by classroom instructors.

Statement of the Problem

As demonstrated by Dweck (2008), and Henderlong and Lepper (2002), "praise" potentially exists as both a motivating factor or a de-motivating factor based on student

interpretations of the daily verbal interactions occurring between classroom instructors and students. The investigated problem is the influence of teacher verbal cues specifically related to two forms of praise; praise that focuses on student "ability level" prior to task engagement, and praise that focuses on student "effort level" prior to task engagement. Does praise for student "ability" prior to task engagement erode academic perseverance, and does student praise for "effort" prior to task engagement enhance academic perseverance?

Purpose of the Study

Verbal interaction between teachers and students influences student mindsets and perseverance levels in positive and negative directions (Bartholomew, 2008; Coughlin, 2007; Deci & Ryan, 2004; Dewar, 2008; Tileston, 2004). Positive interaction between instructors and students spurs academic growth. Negative interaction between instructors and students erodes student confidence. Complicating the teacher to student communication paradigm is adolescent "perceptions" of reality. Covey (2009) explains the perception of reality issue as the difference between the "social mirror" and the "true mirror" (p. 152). The true mirror represents the accurate attributes of a student, while the "social mirror" represents the sum total of all perceptions held about self, as well as the views held by peers regarding self. And although classrooms may enjoy safe environments, adequate resources, and highly qualified instructors, student "perceptions" sometimes create academic mindsets that are not conducive to learning.

The goal of this study is an analysis of two groups of general education, sixth grade students exposed to instructor verbal commendations for personal, student "ability levels" prior to the initiation of a problem solving activity, and instructor verbal commendations for personal, student "effort levels" prior to the initiation of a problem

solving activity. The study extends previous research by Dweck (2000b) indicating student self-efficacy and perseverance are increased as students are verbally commended for previous effort levels prior to academic task engagement; while students commended for previous ability levels prior to academic task engagement reveal lower levels of academic self-efficacy and perseverance.

Significance of the Study

Verbal interactions between teachers and students comprise the foundation of academic instruction and student learning. Instructors present facts, formulas, processes and procedures, but also function in the classroom as mentors, facilitators, surrogate parents, mediators, social workers, psychologists, and therapists (Marzano, 2011). The influence of classroom instruction extends far beyond reading, writing, science, and math. Teachers stand in the classroom doorway and sculpt student mindsets and shape adult destinies. This study examines a small facet of the verbal interaction "picture" between instructors and students and indicates that a slight modification in verbal cueing (i.e. substituting "effort commendations" in the place of "ability commendations") positively altered student levels of academic perseverance.

Verbal commendations for "student effort" possess the potential to encourage academic perseverance, self-efficacy, and classroom success for all students because all students possess the potential to increase their effort level. This study is significant because it provides potential evidence that slight modifications in verbal cueing may positively influence academic perseverance and classroom performance.

Research Questions

The development of research questions were based on a problem solving Sudoku activity and scripted pre-task comments related to ability commendations and effort

commendations. The independent variables (IV) in the research design are the two scripts that were read to two separate, randomized groups of students prior to the problem solving activity. One script references previous student success based on student ability. The second script references previous student success based on student effort. Three independent measurements of elapsed time (from the beginning of the activity to the use of restricted clues) are noted to ascertain whether the difference in perseverance levels continued beyond the first use of a clue.

RQ1: At response target "one" (students' first reliance on an accessed clue during a problem solving activity), what is the average measureable difference (DV) in perseverance response time between students verbally commended for previous effort level prior to task engagement (IV) and students verbally commended for previous ability level prior to task engagement (IV)?

RQ2: At response target "two" (students' second reliance on an accessed clue during a problem solving activity), what is the average measureable difference (DV) in perseverance response time between students verbally commended for previous effort level prior to task engagement (IV) and students verbally commended for previous ability level prior to task engagement (IV)?

RQ3: At response target "three" (students' third reliance on an accessed clue during a problem solving activity) what is the average measureable difference (DV) in perseverance response time between students verbally commended for previous effort level prior to task engagement (IV) and students verbally commended for previous ability level prior to task engagement (IV)?

The research goal of this inquiry is the discovery of improved instructor practices that encouraged students to perform with greater levels of perseverance in the face of academic obstacles. As students are verbally commended, does praise for previous effort level cause students to develop higher levels of self-efficacy and perseverance than praise for previous ability level?

Research Design

The research design is a post-test only randomized two-group design (Howell, 2008; McCall, 1990) utilizing three independent *t*-tests at three separate measurement targets (Ary, Jacobs, & Sorensen, 2010). Students began the research project by listening to scripted ability-based or effort-based verbal commendations (praise cues). Following the scripted verbal commendations, students accessed an internet research website to begin a Sudoku problem solving activity. The web-based research site www.sudokuhints.com/research was used as the monitoring instrument for the student exercise. The independent variables in the research design are the ability-based scripted comments (IV) and the effort-based scripted comments (IV) delivered immediately preceding the problem solving activity. The two scripts are identical except for three small deviations. The ability-based script encouraged students to be successful on the problem-solving activity based on the researcher's understanding of the students' previous ability level (i.e. "smartness"). The effort-based script encourages students to be successful on the problem solving activity based on the researcher's understanding of the students' previous effort level. Students are instructed to complete the activity independently.

The research website tracked student perseverance levels by monitoring and recording time signatures of all accessed, restricted clues. In both sets of scripted comments, students were discouraged from using any type of outside assistance (including asking classmates or the researcher for help, or accessing any clues on the website). Both randomized groups (the ability-cued group and the effort-cued group) were measured for perseverance levels at three separate measurement targets (the first, second, and third accessing of restricted clues). Data was collected to determine if statistically significant, higher levels of perseverance were found in the group commended for previous effort levels. The dependent variables (DV) in the research design were the scores generated by the usage of restricted clues (measured in one second increments from the beginning of the activity until the accessing of restricted clues). Student perseverance measurements ranged from zero seconds to 900 seconds.

Independent samples *t*-tests were used to analyze statistical significance between the means of the two independent randomized groups (Ary, Jacobs, & Sorensen, 2010) at the first three usages of restricted clues. The research design utilized one-tailed *t*-tests at three separate measurement targets (use of restricted clue #1, use of restricted clue #2, and use of restricted clue #3). The one-tailed, independent samples *t*-tests were chosen (McCall, 1990) because a directional effect was suggested based on previous research by Dweck (2008b). Motuskey (1999) confirms the use of a one-tailed *t*-test as an accurate method of assessing statistical difference between groups when an effect is suspected. No pre-test was administered.

The choice to measure perseverance levels at three separate measurement targets was chosen to determine if any differing trend in perseverance levels continued

throughout the activity. Three independent *t*-test comparisons were appropriate based on the research by Howell (2002b) and Urdan (2005). *T*-tests and ANOVA are basically similar analysis tests, but when multiple groups are compared, ANOVA is the preferable test measurement to avoid Type-1 errors (rejecting the null when, in fact, it is true). In the current research study, multiple groups are not utilized. There are only two groups participating in the study, hence the choice to perform independent samples *t*-tests. Researchers use ANOVA when there are three or more groups or multiple variables, but the *t*-test is optional for two group samples even if several independent measurement targets were assessed (Urdan, 2005). Howell (2002a) endorsed the use of independent *t*-tests over several time measurement targets in a review of Evans, Bullinger, & Hygge's (1998) study of epinephrine levels in children living near a newly constructed Munich airport. Howell contends that similar statistical values would be found whether independent *t*-tests or ANOVA were performed.

The two groups were measured for perseverance levels at the first, second, and third usage of restricted clues. However, each measurement remains an independent *t*-test analysis because the goal of the study is not a comparison of restricted clue #1 to restricted clue #2, and the use of restricted clue #2 to restricted clue #3, and the use of restricted clue #1 to the use of restricted clue #3, or a comparison of multiple groups. Howell (2002a) cautions that Familywise Error Rates are possible when samples from multiple groups are compared to one another using standard *t*-tests. However, in the current study, each *t*-test stands independently and there are only two groups. The three independent measurements merely seek to quantify perseverance levels of both groups at three independent targets in the study (McCall, 1990). *T*-tests could have been utilized

for *every* use of a restricted clue, but the researcher made the choice to limit the study to the first three uses of restricted clues. It is hypothesized by the researcher that several independent measurements of perseverance levels would create clearer validation or refutation of the pre-task praise commendation effect.

The first experimental group received instructor "ability commendations" prior to task engagement and the second experimental group received instructor "effort commendations" prior to task engagement. The group commended for previous "ability" (prior to task engagement) was hypothesized to show lower levels of perseverance to complete or continue the task independently. The group commended for previous "effort" (prior to task engagement) was hypothesized to show higher levels of perseverance to complete or continue the task independently. Perseverance in the research trial is operationally defined as the amount of time a student worked on the given task (the Sudoku problem solving activity) without accessing restricted "clues." Levels of perseverance are measured in one second increments from the initiation of the exercise to the time signatures of the first three accessed restricted clues. Since the activity time was limited to fifteen minutes, student scores ranged from 0 – 900 seconds.

Statistical Analysis

"Usable Stats T-Test Package (Version 2.3)" and Microsoft Excel programs were used to compare statistical significance between the two independent samples to ascertain whether the mean values of the first population (i.e. the ability-cued group) were lower than the values of the second population (i.e. the effort-cued group) based upon the "ability-cueing" treatment and the "effort-cueing" treatment at all three measurement targets. The *t*-test for independent groups determined whether a statistically significant,

higher level of perseverance existed in the "effort-cued" group in relation to the time signatures of the first, second, and third use of restricted "clues." Group homogeneity, equality of variance, and normality were assessed prior to the directional *t*-tests using Levene's Test (1960) and Cohen's Test (1988).

Research Hypotheses and Null Form

The research hypotheses for this experiment assumes there would be a difference in perseverance levels between the group commended for previous "ability" level and the group commended for previous "effort" level. The group commended for previous effort level was suspected to show higher levels of perseverance (measured by delayed use of restricted clues located on the research website).

Student perseverance levels were measured three times during the research project. Breakdown in perseverance was assessed by observing and recording the first, second, and third usage of restricted clues (measured in one second increments from the beginning of the problem solving activity). The research hypotheses were designated as RH1, RH2, and RH3.

RH1: During a numerical problem-solving activity (Sudoku), students exposed to pre-task, instructor verbal commendations related to previous student ability level will show less perseverance to complete the numerical task compared to students exposed to instructor verbal commendations related to previous student effort level (as recorded by the number of seconds between the initiation of the problem-solving activity and the first reliance on a restricted clue).

RH2: During a numerical problem-solving activity (Sudoku), students exposed to pre-task, instructor verbal commendations related to previous student ability level will

show less perseverance to complete the numerical task compared to students exposed to instructor verbal commendations related to previous student effort level (as recorded by the number of seconds between the initiation of the problem-solving activity and the second reliance on a restricted clue).

RH3: During a numerical problem-solving activity (Sudoku), students exposed to pre-task, instructor verbal commendations related to previous student ability level will show less perseverance to complete the numerical task compared to students exposed to instructor verbal commendations related to previous student effort level (as recorded by the number of seconds between the initiation of the problem-solving activity and the third reliance on a restricted clue).

The null hypotheses for this experiment states that there would be higher levels of perseverance in the group verbally commended for previous "ability level" prior to task engagement during an academic, problem solving activity than the group verbally commended for previous "effort level" prior to task engagement during an academic, problem-solving activity in Christian school sixth grade students (H_o was $n_a > n_e$).

The two groups in the research design are sixth grade Christian school students in northwest Indiana exposed to instructor "ability commendations" prior to a numerical problem solving activity (Sudoku), and sixth grade Christian school students in northwest Indiana exposed to instructor "effort commendations" prior to a numerical problem solving activity (Sudoku). Both groups of students were instructed that the goal of the activity was the completion or continuation of the problem solving activity without using restricted clues (which were accessible during the exercise). In completing the problem-solving task, student perseverance to complete the task without assistance was measured

by an analysis of time-tracked “restricted clues” utilized during the experiment. The use of restricted clues indicated lack of perseverance to complete or continue the problem independently. The null hypotheses were designated by the terms NH1, NH2, and NH3.

NH1: During a numerical problem-solving activity (Sudoku), students exposed to pre-task, instructor verbal commendations related to previous student ability level will show more perseverance to complete the numerical task compared to students exposed to instructor verbal commendations related to previous student effort level (as recorded by the number of seconds between the initiation of the problem-solving activity and the first reliance on a restricted clue).

NH2: During a numerical problem-solving activity (Sudoku), students exposed to pre-task, instructor verbal commendations related to previous student ability level will show more perseverance to complete the numerical task compared to students exposed to instructor verbal commendations related to previous student effort level (as recorded by the number of seconds between the initiation of the problem-solving activity and the second reliance on a restricted clue).

NH3: During a numerical problem-solving activity (Sudoku), students exposed to pre-task, instructor verbal commendations related to previous student ability level will show more perseverance to complete the numerical task compared to students exposed to instructor verbal commendations related to previous student effort level (as recorded by the number of seconds between the initiation of the problem-solving activity and the third reliance on a restricted clue).

Identification of Variables

The web-based Sudoku problem-solving activity was a constant in this experiment. All students in both groups received the same Sudoku problem on the designated Sudoku

research website (Note: the ability-cued group and the effort-cued group were instructed and assessed separate from one another).

Preliminary instructions for the problem-solving activity were constants in this experiment. Prior to the scripted "ability" commendations and the "effort" commendations, all students in both groups received identical instructions.

The setting was a constant in this experiment. Students in each group participated in the same computer lab setting (located in the student's school computer lab) regardless of assigned experimental group.

The Sudoku tutorial video instructions were constants in this experiment. All students in each group viewed the same Sudoku tutorial video prior to task engagement.

The ability-based verbal cueing script was an independent variable in this experiment. Immediately preceding the first group's initiation into the Sudoku problem-solving activity, students in group "A" listened to scripted verbal commendations to be successful (praise cues) based on the researcher's perceived knowledge of the group's strong ability level in the past.

The effort-based verbal cueing script was an independent variable in this experiment. Immediately preceding the second group's initiation into the Sudoku problem-solving activity, students in group "B" listened to scripted commendations to be successful (praise cues) based on the researcher's perceived knowledge of the group's strong effort level in the past.

The dependent variables were the perseverance scores generated by the usage of restricted clues. Perseverance was defined as the ability to complete or continue the activity without the assistance of restricted clues. In this experiment, time signatures

were generated by the use of each restricted clue and measured in one second increments from the initiation of the activity to the usage of each restricted clue. Although the Sudoku problem-solving activity tracked the usage of *every* restricted clue, the focus of the experiment concentrates on the first three usages of restricted clues. Students in each independent group were exposed to scripted, verbal "ability-based commendations" or scripted, verbal "effort-based commendations" immediately preceding the Sudoku problem solving activity.

Definition of Terms

There are a number of terms within this inquiry that are unique to dissertational study. The following definitions are provided and operationally defined with the intent of establishing uniformity and consistency of understanding throughout the study.

Ability Commendations are verbal commendations issued by a classroom instructor that focus student attention on "ability" as an attribute of student success (e.g., "You will do well on this project because *you are so smart*!").

Autonomy is a student's need for independence in classroom life and academic activities (Lavoie, 2007).

Christian Schools are defined as any school declaring religious affiliation or mission. Schools in the study included two Catholic schools, two Lutheran schools, an independent Christian school with Baptist affiliation, and an independent Christian school with an interdenominational foundation.

Cooperative Classrooms are classrooms where improved personal performance is dependent upon improved performance of others (Johnson & Johnson, 1975).

Competence is the ability to do something well, measured against a standard, especially ability acquired through experience or training (Encarta World English Dictionary, 1999).

Competitive Classrooms are classrooms where improved personal performance is dependent upon the worse performance of classmates (Johnson & Johnson, 1975).

Conation is an individual's capacity to strive (Gholar & Riggs, 2004).

Effort Commendations are verbal commendations issued by a classroom instructor that focus student attention on effort as an attribute of student success (e.g., "You will do well on this project because *you always give your best effort!")*.

Fixed Mindset is the belief that basic human qualities are carved in stone, cannot be changed, and focus on fixed ability (Dweck, 2008a).

Growth-oriented Mindset is the belief that basic human qualities can be cultivated throughout life, and focus on development of effort (Dweck, 2008a).

I.S.T.E.P. is the Indiana State-Wide Testing for Educational Progress assessment. The assessment is administered once each year in Indiana public schools to determine student achievement levels. *I.S.T.E.P.* is the state-sponsored assessment.

Mindset is the view a person adopts for life which profoundly affects the way a person leads their life (Dweck, 2008a).

Motivation is the psychological feature that arouses an organism to action toward a desired goal (or) gives a reason or inspiration for a course of action (Collins, 2010).

N.W.E.A. is the Northwest Evaluation Association assessment. The assessment is administered up to three times each year (fall, winter, and spring) in numerous public and private schools in the state of Indiana to measure student academic growth.

Perseverance is a continued steady belief or effort that withstands discouragement or difficulty (Collins, 2010). In the current study, student perseverance levels were operationally defined and measured as the amount of time (in one second increments) each student worked on the problem-solving task (Sudoku) without accessing restricted "clues."

Praise is the act of expressing approval, admiration, or commendation (Collins, 2010).

Self-Concept is the cognitive, personal appraisal an individual makes about the expectations, the descriptions, and the prescriptions endorsed by self (Coopersmith & Feldman, 1974).

Self-Efficacy is an individual's judgment of their capabilities to organize and execute courses of action required to attain designated types of performances (Bandura, 1986).

Self-Esteem is the evaluative component of self-concept which is responsible for internal beliefs and feelings about personal capability, significance, successfulness, and worth (Pajares & Schunk, 2001).

Social-Cognitive Theory was developed in the 1940s, and expanding in the 1960s by Bandura. Social-Cognitive theory states that outside influences move an individual in a particular direction, but it is cognitive choice based on rewards, consequences, interests, and motivation which stir the physical body to action (Bandura, 1977).

Sudoku is a numerical puzzle in which numbers are filled into a 9x9 grid of squares so that every row, every column, and every 3x3 box contains the numbers 1 through 9 (Merriam-Webster, 1993).

CHAPTER TWO: LITERATURE REVIEW

Introduction

The catalyst for beginning this dissertational study of comparing the effects of "ability-praise" to "effort-praise" on the academic perseverance of students was the discovery of a 2008 article published by Carol S. Dweck entitled, "Caution – Praise Can be Dangerous." In work with young children, Dweck discovered that students rewarded verbally for being "smart" (i.e. ability level) were less likely to take greater academic risks, and were satisfied to "shine" by participating only in safe activities that did not call for additional effort. Students in the "praise for smartness" group were intimidated by problem-solving activities as the tasks became more difficult. When given an opportunity to discuss the problem-solving activity, the students in the "praise for smartness" group often misrepresented their actual participation level and stated that greater proportions of the tasks had been accomplished than what was actually true. Conversely, students rewarded verbally for their "tenacity" (i.e., effort level) developed greater confidence to attempt progressively difficult tasks, persevered longer in the pursuit of new tasks, and were more honest in discussions about their actual participation level in the problem-solving activity.

As illustrated earlier in the Dickens metaphor, the classroom environment could be considered a portrait of the "best of times" or the "worst of times" dependent upon student perception and mindset. A mindset focused on a perceived static view of student ability, or a mindset focused on a potentially dynamic view of student effort levels could yield significantly different results in the classroom. It is the "belief system" of the

student, not the actual academic competency of the student that guides the individual into successful or unsuccessful academic pursuits.

In the current discussion, it cannot be overlooked that classroom instructors play an essential role in the overall development of student perceptions and mindsets. Teachers function not only as academic mentors and facilitators, but as counselors and developers of student belief systems (Marzano & Marzano, 2003). Included in the development of student belief systems is the use of praise and encouragement in the classroom. Teacher praise, however, may not generate identical effects on student belief systems. Students' self-concept, self-esteem, and academic self-efficacy are developed on a daily basis in the home, school, and community. Perseverance in the face of adversity may very well be enhanced or eroded based on the type of praise disseminated by the classroom instructor and the personal mindset of the student receiving the praise message.

It is the argument of this investigation that academic perseverance is enhanced or eroded in sixth grade students through the utilization of specific "effort" and "ability" verbal reinforcements cues (praise commendations) in pre-task directives. Praise has been shown to be a motivating factor for self-efficacy, persistence, on-task behavior, and self-perceptions of ability (Cameron & Pierce, 1994; Deci & Ryan, 2004; Dewar, 2008).

Instructor praise is an integral element in classroom motivation, but the effects of praise do not always generate a positive response in recipients. Praise can be considered a de-motivating factor if the recipient does not feel the praise is sincere, the praise is unwarranted, or the praise is viewed as a judgment (Bartholomew, 2008; Dweck, 2008; Henderlong & Lepper, 2002; Kohn, 1994). The intended and unintended effects of praise

affect students in different ways conditionally dependent upon a student's personal view of self (Baumeister, Hutton, & Cairns, 1990).

The process of developing appropriate "praise" as an intrinsically motivating factor is a complicated investigation. Noted by Henderlong and Lepper (2002), four key elements of praise must be considered in determining whether praise becomes a motivating factor or a de-motivating factor, and whether praise becomes a device to build perseverance or a mechanism to erode perseverance. The four key elements affecting student interpretation of praise in the classroom are student performance attributes, task autonomy, student self-efficacy, and teacher expectations.

Teacher praise for controllable features of student performance enhances intrinsic motivation, while praise for overly simplistic tasks may cause maladaptive responses to praise. Students experiencing praise during activities with task autonomy acquire greater levels of perseverance. Praise providing positive information about individual competence raises student self-efficacy, while praise that conveys information solely through social comparison undermines student self-efficacy. Teacher expectations that set high, but realistic goals promote intrinsic motivation and perseverance. Goals that are too low or unrealistically high undermine intrinsic motivation and perseverance.

Social Cognitive Theory

Social cognitive theory is a guiding framework in the development of this inquiry. Developed by Miller and Dollard in the 1940s, and expanded by Albert Bandura in the 1960s and 1970s, social cognitive theory states that outside influences move an individual in a particular direction, but it is cognitive choice based on rewards, consequences, interests, and motivation which stir the individual to action (Bandura,

1977). An undergirding foundation of the self-efficacy and perseverance discussion is the "agentic nature" of human thinking and decision-making. Bandura explains, "Agency embodies the endowments, belief systems, self-regulatory capabilities and distributed structures and functions through which personal influence is exercised" (p. 2). In simple terms, human beings are free-will agents of their own development based on a triadic and reciprocal relationship between environmental factors, behavioral factors, and personal factors (see figure 1, p. 23). While early behavioral theories focused on operant conditioning and stimulus / response mechanisms to describe human responses to everyday situations, social cognitive theorists recognize the cognitive, "agentic nature" of human psychological development resulting in the interaction of behavioral, environmental, and personal factors (Bandura, 1986; Dweck & Leggert, 1988; Huitt, 2001).

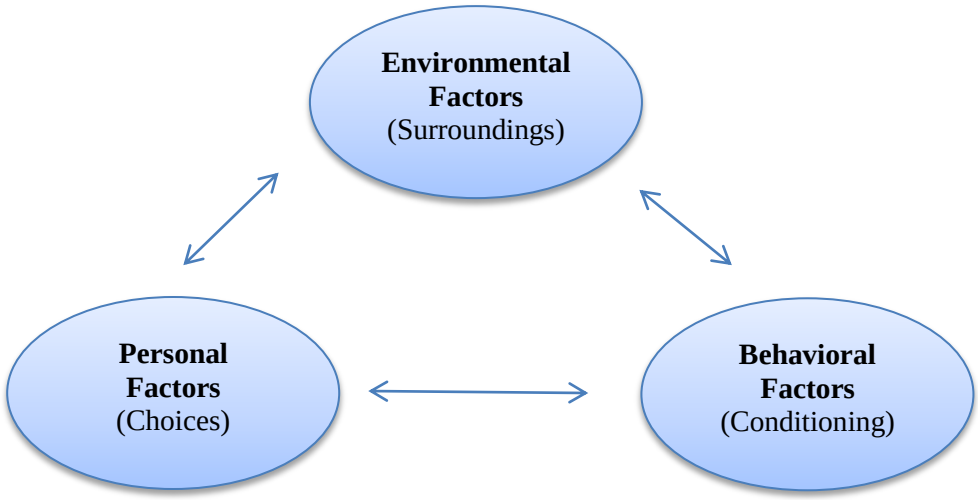


Figure 1. Bandura's "Agentic" Nature of Human Psychological Development (1986).

Lev Vygotsky's early 20th century conjecture reinforced social cognitive theory involved with student development by stating that the learning environment cannot, and must not be disconnected from the social environment. "Learning awakens a variety of internal developmental processes that are able to operate only when the child is interacting with people in his environment and in cooperation with his peers (Vygotsky, 1978, p. 90). The social environment plays a decisive role in cognitive thinking and learning (Beers, 2006; Egan & Judson, 2008; Latham, 1997). Vygotsky contended, contrary to Jean Piaget, that "learning precedes development" (1978, p. 80) and students learn and grow the most when placed in the "zone of proximal development" (p. 85). The zone of proximal development is defined as "the area just beyond the reach of the student's current ability level, but within the ability level of a peer learner or adult guide" (p. 86). Vygotsky reinforced the significance of classroom instructors as interactive partners in the establishment of learning activities and goals that stretch the current framework of student competency without placing unrealistic expectations upon the child.

Social cognitive theory recognizes that students enter the classroom with academic self-belief systems that may be healthy and productive, or skewed and destructive. As outlined by Pajares (2002), using social cognitive theory as a framework, teachers can work to improve students' emotional states and to correct their faulty self-beliefs and habits of thinking (personal factors), improve their academic skills and self-regulatory practices (behavior factors), and alter the school and classroom structures that may work to undermine student success (environment factors).

Human psychological constructs of self-efficacy and academic perseverance are the result of social-cognitive thinking processes influenced by internal and external factors (Bandura, 2001; Pajares, 2002). As children play with blocks, balls, dolls and toys, and as children interact with one another, cognitive thinking begins the process of constructing meaning. A stack of blocks becomes a towering skyscraper reaching to the heavens. A cascade of ping pong balls from a chair becomes an avalanche down the side of a mountain. A small doll becomes a best friend to share tea-parties and secrets. Toys of every size and shape become playmates, intruders, heroes, carnivores, and slap-stick comedians. Human psychological constructions, whether centered on self-efficacy and perseverance, or on child-like play, are developed through social-cognitive thinking processes which begin with basic human needs (Kohn, 1999; Morss, 1995).

The most basic physical human need is survival. Humans must breathe, eat, drink, eliminate, and feel safe in their environment. These needs must be fulfilled before the constructs of self-concept, self-esteem, and academic self-efficacy develop into a cognitive focus of inquiry. In the context of this study, focusing on the influence of "ability-cueing" and "effort-cueing" commendations, human needs will not be discussed as relating to "basic physical needs," but to student needs in an educational environment.

Following the need for survival, Sullo (2007), states that human behavior represents our best attempts to, "satisfy our basic needs or genetic instructions" (p. 8). Sullo suggests four psychological needs for emotional and educational health – "belonging," "power or competence," "freedom," and "fun." A sense of belonging, a feeling of competence, and a sense of freedom are primarily internal motivating factors.

Exerting power, being rewarded for competency and participating in enjoyable activities stimulates external motivation.

"Belonging" represents the human need to be connected to others. In the classroom, students entertain the potential for connectivity with other students as well as the classroom teacher. Strong connections in the classroom develop bonds of trust and the ability to function within the group. Weak connections in the classroom develop lack of trust in the environment which may lead to an introverted fear of participation.

"Competence" or "power" is related to the internal desire to achieve. From the earliest age, children aspire to become the next Kobe Bryant, Brad Pitt, Miley Cyrus, or Angelina Jolie. Children dream of becoming great actors and actresses, world-famous singers, and well-known celebrities. Students strive for power over their environment, and sometimes, to gain power over others in the classroom. Competence is essential to achievement and can be reinforced by success and undermined by failure.

"Freedom" is associated with the human desire to make personal choices. Highly orchestrated classrooms do not always allow students the opportunity to pursue alternate directions and possibilities. As a result, students may become frustrated and exhibit the need to exert "power" over the environment in a negative way. When choices are available, students become cognizant of personal ownership of situations that lead toward greater responsibility.

The concept of "fun" as a basic human need in the classroom is connected to the opportunity to learn new things, to participate in favorite activities, or to be successful in preferred tasks. As Glasser (1990) explains, "fun is the genetic payoff for learning"

(p. 8). When the classroom environment possesses an atmosphere of fun during the learning process, the corresponding result is participation for intrinsic reasons rather than extrinsic ones.

The psychological human needs presented by Sullo (2007), "belonging," "power," "freedom" and "fun," represent a balancing act of human needs – a stasis of human interactions. Buck (2000) recognizes "power" and "freedom" as competitive human needs while "belonging" and "fun" are viewed as cooperative needs. As long as students maintain balance between competitive and cooperative needs, the classroom environment possesses great potential for learning. An out-of-balance classroom, leaning heavily on competitive outcomes, is analogous to the physical body without homeostasis. The body must maintain a balance of water, nutrients, temperature, and pressure. Any deviation from the designed balance of the system could cause a significant health issue and the organism and its individual mechanisms begin to suffer negative consequences.

Tileston (2004) describes the internal and external factors of motivation through the lens of the "self-system" which examines the importance of stimuli and determines whether or not the entity chooses to participate in a learning situation. Once the "self-system" decides to engage the project, the "meta-cognitive system" assists in the setting of goals directed toward completion of the task. Finally, the "cognitive system" begins the process of developing strategies to accomplish the goal.

According to Lavoie (2007), the external and internal factors that influence motivation to begin tasks, sustain effort, and persevere to completion are "gregariousness, autonomy, status, inquisitiveness, aggression, power, recognition, and affiliation" (p. 98).

Lavoie defines gregariousness as the "need to belong," autonomy as the "need for independence," status as the "need to be important," inquisitiveness as the "need to know." Aggression is described as the "need to assert," power is the "need for control," recognition is the need for acknowledgement," and affiliation is the "need to associate and belong."

Sullo, Tileston, and Lavoie examine different viewpoints of the motivation portrait because the motivational dynamics of the classroom are diverse. What motivates one child may not influence another child. All three writers, however, call attention to the need for connectivity, the influence of internal and external factors, and the fragility of perceived mindsets and perceptions in relation to a student's continuing interest in activities and projects.

Junior high students (the focus of this inquiry) share a fragile adolescent mindset orientation and stand in a vortex of parental expectations, peer pressure, peer status, personal goals, and teacher expectations that create potential whirlwinds of real and unreal expectancies. Additionally, the pressure faced by students to be successful in the current era of high-stakes testing is not eased by the requirements of the school setting, community standards, or state-directed academic mandates. Students feel the same pressures that have been placed on classroom instructors, school administrators, and school districts. And despite the whirlwind of real and unreal expectancies, self-efficacy and perseverance are necessary, personal components for sustaining academic achievement (Schunk, 1996; Usher & Pajares, 2008).

Responses to these internal and external factors create varying perceptions of reality (Neihart, 2006). Some students are afraid to attempt an answer or to creatively

express a point of view for fear the answer will be wrong or outside the pre-determined framework for learning. In this environment, it is not surprising that many American classrooms spend up to six to eight weeks preparing students for state-mandated high-stakes testing concentrating on the "right" answers. Consequently, some individuals *choose* merely to exist; trapped inside a figurative "box" without windows, dreams, or passions. "Box-thinking" is an example of the fixed mindset orientation (Dweck, 2008).

As a cognitive process, Bandura (1977) contends that the classroom should be a place where modeling, imitation, and feedback are used to improve student self-efficacy and academic perseverance. Social cognitive theory embraces the development of student self-efficacy as an integral component of academic attainment. Self-efficacy, however, can sometimes be misunderstood as being synonymous with self-concept and self-esteem. Whereas self-efficacy is more closely aligned with student "effort" levels, self-concept and self-esteem are aligned more closely with student "ability" levels. Perseverance, as well, may be more closely aligned with student effort, particularly in students who have average or below average ability (Henderlong, 2000; Mueller & Dweck, 1998; Nicholls, 1978).

Self-Theory

Differentiation and definition of terms is essential when discussing self-concept, self-esteem, and self-efficacy, as the terms are sometimes used interchangeably. Self-concept and self-esteem may sometimes be used interchangeably, but not self-efficacy, as self-efficacy is based on a specific cognitive belief about the ability to complete a task successfully. Self-efficacy is closely linked with perseverance, as the belief in the

potential for academic success (self-efficacy) may greatly influence sustained effort in completing tasks.

Self-Concept

All students have a self-concept, but not all students are endowed with self-efficacy. Pajares and Schunk (2001) explain self-concept as the "totality of self-knowledge that one possesses about one's self" (p. 243). Self-concept may also be defined as "the cognitive appraisal one makes of the expectations, descriptions, and prescriptions that one holds about one's self" (Coopersmith & Feldman, 1974, p. 195). Self-concept becomes an individual's representation of structure and meaning that guide a personal understanding of existence. Describing self-concept theory, Dweck and Leggert (1988) state,

> Within a generalized entity theory, the self would be conceptualized as a collection of fixed traits that can be measured and evaluated. Within an incremental theory, the self would be seen as a system of malleable qualities that is evolving over time through the individual's efforts (p. 266).

Self-Esteem

Pajares and Schunk (2001) define self-esteem specifically as the "evaluative component of self-concept" (p. 243) that is responsible for internal beliefs about personal capability, significance, successfulness, and worth. Self-esteem can be viewed as the level of personal worth an individual "feels" based on personal judgments and social comparisons with others. Being highly dependent upon how a person feels about self, self-esteem may easily be compromised by an assessment that may or may not be true

(Kohn, 1994; Mueller & Dweck, 1998). Self-esteem can be derailed and relationships can be damaged if praise is interpreted as insincere (Dewar, 2008).

Self-Efficacy

Whereas self-concept describes a "totality of self-knowledge," and self-esteem judges feelings of personal worth, Bandura (1986) defines self-efficacy as "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances" (p. 391). According to Pajares and Schunk (2001), self-efficacy is a judgment of confidence that an individual connects with one's own abilities. Marsh, Walker, and Debus (1991) further address the difference in self-concept and self-efficacy by stating self-concept judgments are based more on social comparisons and feelings, while self-efficacy judgments focus on specific ability and are not driven by social comparisons. Improving self-efficacy enhances the "ability to initiate, persist, and succeed with classroom activities" (Fritson, 2008; Pajares & Graham, 1999).

Highlighting the complexity of self-efficacy development, Schunk (1983) states, "Self-efficacy refers to judgments of how well one can organize and implement actions in specific situations that may contain ambiguous, unpredictable, and possibly, stressful elements" (p. 848). Self-efficacy and self-concept represent different views of self. Self-efficacy seeks to question whether existent skills are sufficient to successfully complete a task, whereas self-concept and self-esteem seek to question how an individual "understands" self and "feels" about self. Self-efficacy addresses whether a person believes they "can" do something. Self-concept and self-esteem address how a person "feels" about self.

The question of whether effort or ability is more influential in developing strong academics and perseverance qualities is a challenging topic. It could be logically argued that strong academics increase a student's effort and engagement level. It could also be argued that student effort and engagement levels increase a student's ability level. Perhaps there is a reciprocal influence exerted by both forces, which leads to the discussion of student perceptions of reality, student motivation, and student perseverance.

Perception of Reality

"Perception of reality" greatly influences personal outlook on academic ability, self-efficacy, and classroom academic perseverance (Dweck, 2000; Foster & Riley, 2008; Pajares & Schunk, 2001; Zimmerman, 2000). A student with above-average ability may gravitate toward menial employment, or aspire towards entrepreneurial leadership contingent upon internal mechanisms of self-efficacy and perseverance. A below-average student may be consumed in a whirlpool of self-pity, or inspire others to worthy societal change dependent upon internal mechanisms of self-efficacy and perseverance. The development of a belief system which overcomes discouragement and disappointment begins in the mind (Zimmerman, 2008). As Marzano (2011) has stated, "Perhaps the most powerful message from the research is that relationships are a matter of student perception" (p. 82). Instructors play a vital role in helping students to develop relationships and a belief system that espouses the unfailing foundation that ***anything*** is possible.

The focus of this study is sixth grade students and the development of perseverance to complete an academic, problem-solving task (Sudoku), but as discussed by Thiers (2005), adolescent learners are a "study in contradictions." The adolescent mind longs

for the freedom to make independent decisions, but often without the sound judgment needed to make appropriate decisions. Thiers also expresses adolescence as "an era of risk-taking" where students take extraordinary risks in efforts to protect "image, individuality, emotional safety, and a sense of belonging" (p. 16). According to Price (2005), adolescent "risk-taking" is not merely the result of hormonal changes, but a complex interconnected relationship between "body chemistry, brain development, and cognitive growth" (p. 24).

Adolescent children are passionate, dramatic, erratic, intense, and risk-prone which may be more broadly linked to "pubertal maturity than hormone levels." Price also noted that adolescents (more than children and adults) often seek intense emotional situations. Even in situations where adolescents fully comprehend the risk of an unwise, dangerous, or unacceptable behavior, the intense emotional stimulus of the behavior (combined with pressure to be accepted within the group) results in uncharacteristically poor decisions.

Amen (1998) suggests that adolescent students have thoughts that are ***real***, but thoughts that are not necessarily ***accurate***. Thoughts that are negative can release brain-based chemicals which make the body feel bad. Since the body reacts to both negative and positive thoughts, whether the thoughts are real or perceived, there is an amount of control that can be exercised over the thought processes. Junior high students must understand that automatic thoughts don't always tell the truth and that many negative thoughts (which invade the mind like a colony of industrious ants) need to be stomped-out before the negative thoughts take control of the situation.

In many children of middle school age, the academic problem (or lack of problem) is associated not with the ability level each student possesses, but by the perception of the

student's potential. The mindset of the individual controls the belief system. As Sullo (2007) has observed,

> What we call reality is the world we experience, our perceived world. For all intents and purposes, perception *is* reality. Theoretically, the perceived world can match the real world. However, it usually differs somewhat because information is altered as it journeys from the real world (outside of ourselves) to the world we create in our head, the perceived world (p.10).

Additionally, Mannheim (2010), states that adolescents adopt two self-induced "myths." The first myth embraced by adolescents is the "continual stage." Adolescent students believe that every word, action, and appearance is being judged by peers in every conceivable way. This occurs because the period of puberty is often characterized by adolescent pre-occupation with self. Adolescents judge themselves too harshly and assume that peers are judging them as well (Daniels, 2005). The second adolescent myth is the "indestructible self." Adolescents understand the danger of participating in a risky activity, but often assume the consequences of the behavior will happen to someone else.

Inlay (2005) maintains that the frontal section of the brain is the last area of the brain to mature and is not fully functional until the age of twenty-five. The frontal brain is responsible for "judgment, organization, and planning that constrains emotional impulses" (p. 41). The adolescent body may have the appearance of maturity on the outside, but in fact, the frontal lobe of the adolescent learner is not yet functioning to full capacity, further complicating adolescent participation in risky, dangerous, or unhealthy behavior.

Steinberg (2011) explains the adolescent brain challenges in the following way. During the years of adolescence, the brain undergoes "pruning" and "myelination." Many more connections inside the brain are developed than are needed. During adolescence, "pruning" of unused or unnecessary connections takes place. Additionally, "myelination" (the encasing of neurons) occurs which "increases the speed of neural impulses and increases information transmission." This activity is very important in the adolescent brain in the area of the pre-frontal cortex (just behind the forehead). Cognitive advances are significant during this time. However, Steinberg points out that the adolescent brain (at this time) is much better at "cold cognition" than "hot cognition." Cold cognition is explained as brain activity unrelated to emotional involvement, such as solving an algebra problem. Hot cognition is brain activity involved with emotional involvement, such as deciding to punch another individual that insulted a girlfriend.

Although the adolescent brain is cognitively developed enough to solve complex problems, the maturity of the pre-frontal cortex, as it relates to emotional stimuli, is still immature. This explains how an adolescent can seem very mature related to academic performance, but tremendously immature when faced with peer pressure to get involved with an inappropriate activity.

Group dynamics, fear of inadequate academic ability, lack of family support or community structure, and rampant hormones twist and contort the very infrastructure of teenage existence much like another era's Lon Chaney morphing into a menacing wolf-man creature. Junior high students live in bodies not quite adult, but no longer children. As Anderman and Midgley (1999) have concluded, motivation and performance of adolescent children decline during the transition to junior high school due to the

physiological and psychological changes associated with puberty, as well as their "perceptions" of educational experiences. It is not surprising that the world they *"*believe*"* to be true facetiously supersedes the world that is actually true.

Bernabei, Cody, Cole and Sweeney (2008) acknowledge the difficult psychological path trodden by adolescents this way, "[teenage] states of mind, attitudes, moods, and beliefs" come together to create an overall mindset. On some days the mindset is more positive. On other days, the mindset is more negative. All teenagers experience good days and bad days. In fact, there are usually more good days than bad days. The successful young person, however, makes a conscious choice to disregard the negativity of the bad days and celebrates the experiences of the good days. The successful young person also recognizes the impossibility of controlling the totality of life's turbulent circumstances, but a cognitive choice is made to control personal reactions toward the challenging days.

The Fixed Mindset

Many adolescent students view academic classroom pursuits through the lens of finite ability and finite intelligence (e.g., a "fixed mindset" orientation). A fixed mindset may be described as a personal, psychological belief that ability level is a fixed, innate entity which cannot be manipulated, or not easily manipulated, toward greater achievement (Dweck, 2008b, p. 4). This mindset embraces the notion that nothing good ever happens to me and I'll never be successful at anything. In the book, "Mindset: The New Psychology of Success," Dweck states, "The view you adopt for yourself profoundly affects the way you lead your life" (p. 6). In other words, what a person believes to be true often has a way of becoming a self-fulfilling prophecy. If negativity

dominates the cognitive decision-making processes, then "fixation on failure" becomes a powerful "de-motivator." Unfortunately, many junior high students boast a remarkable talent of fixating on negative events (some that are real and many that are imaginary) and the overwhelming possibility of failure.

Nichols (2011) explains that all adolescents carry scars. Some of the scars are real and physical, while many other scars are internal and emotional. Nichols states, "Individuals can have scars and societies can have scars. Those scars determine how the individual or society approaches the future" (p. 20). It is important to get adolescents talking about the scars they have experienced academically. If perseverance is the charted goal, then unrealistic perceptions based on previous academic scars must be eliminated. In this way, students may begin to develop greater academic self-efficacy that leads to greater persistence in school, and an understanding that "ability" is never a finite capacity.

The Growth Oriented Mindset

Conversely, the growth oriented mindset challenges the concept of innate, fixed ability and espouses an incremental ability theory (ability grows as new effort is put forth). The growth oriented mindset is "a malleable view of academic growth, loves learning, thrives on challenges, values effort, and persists in the face of obstacles" (Dweck, 2000, p. 20). The growth oriented mindset spends no time labeling itself as a failure or throwing hands up in surrender (Little, 2010). Students with a growth oriented mindset confront challenges, take academic risks, stretch current limits of learning, and continue to work on projects to completion (Dweck, 2008a). Growth-oriented students view engagement and perseverance as tools for academic success.

The Effects of the Fixed Mindset and the Growth Oriented Mindset

The fixed mindset places greater value on the attribute of ability and minimizes the role of effort. Thus it is logical to conclude that the fixed mindset encounters less flexibility to deal with setbacks and, perhaps, struggles more acutely with issues of perseverance. In this context, academic perseverance only increases in situations where the proposed task is easily obtainable or does not challenge or stretch the individual's current ability level.

In the analysis of Bernabei, et al. (2008), the challenge for adolescent students is the "elimination of thought circles" (p. 53). Dweck concurs when stating that negative choices and negative patterns of thinking need elimination to avoid the trap of a "fixed mentality" (2008). "Thought circles" are described as "the mental habits that are likely to occur when people are [living] below the line" (p. 44). Bernabei, et al. continues to explain living "below the line" as "domination by negative thoughts which produce an overall negative view of life" (p. 45). Living "above the line" is cognitive awareness and the choice to allow positive thoughts and energy to guide thinking processes which produce an overall positive view of life. Negative "thought circles" may be explained as one negative thought leading to another negative thought, leading to another negative thought. Before long, the accumulated volume of negativity cascades down a mountainside like a snowball out of control. Negative thought circles easily gain strength when the thoughts concentrate on "worry, anger, or inadequacy" (Bernabei, et al, 2008, p. 54).

The growth oriented mindset avoids the pitfall of negative "thought circles" and chooses, instead, to use previous failures as "building blocks" for future success, and

places greater value on the attribute of effort while minimizing the somewhat artificial role of current ability level. The growth oriented mindset displays greater flexibility in dealing with setbacks and shows greater cognitive choice toward perseverance. Academic self-efficacy and academic perseverance are enhanced. Correspondingly, blossoming self-efficacy (gained through increased effort levels) may increase overall academic ability.

The systemic processes of fixed mindset orientation and growth mindset orientation are explained in the following flow chart (see figure 2, p. 40). The fixed mindset begins with the necessity to "look smart" and reacts negatively to challenges, resulting in reduced levels of perseverance. Effort is only expended on activities that fall within the student's current comfort zone. The fixed mindset resists input from others that are perceived to have higher levels of ability or perceived "smartness." As a result, students with a fixed mindset fail to achieve their greatest potential.

Conversely, the growth oriented mindset begins with a "desire to learn" and motivates the student to embrace challenge, resulting in ever increasing levels of perseverance. Increased levels of effort occur as natural extensions of learning. The growth oriented mindset seeks input from others that are perceived to have higher ability levels. Whereas the fixed mindset seeks to avoid situations where "smarter" students might show greater ability, the growth oriented student views the presence of higher ability students as a resource for learning, and not a potential threat to academic self-esteem. As a result, students with a growth oriented mindset continue to increase their achievement level.

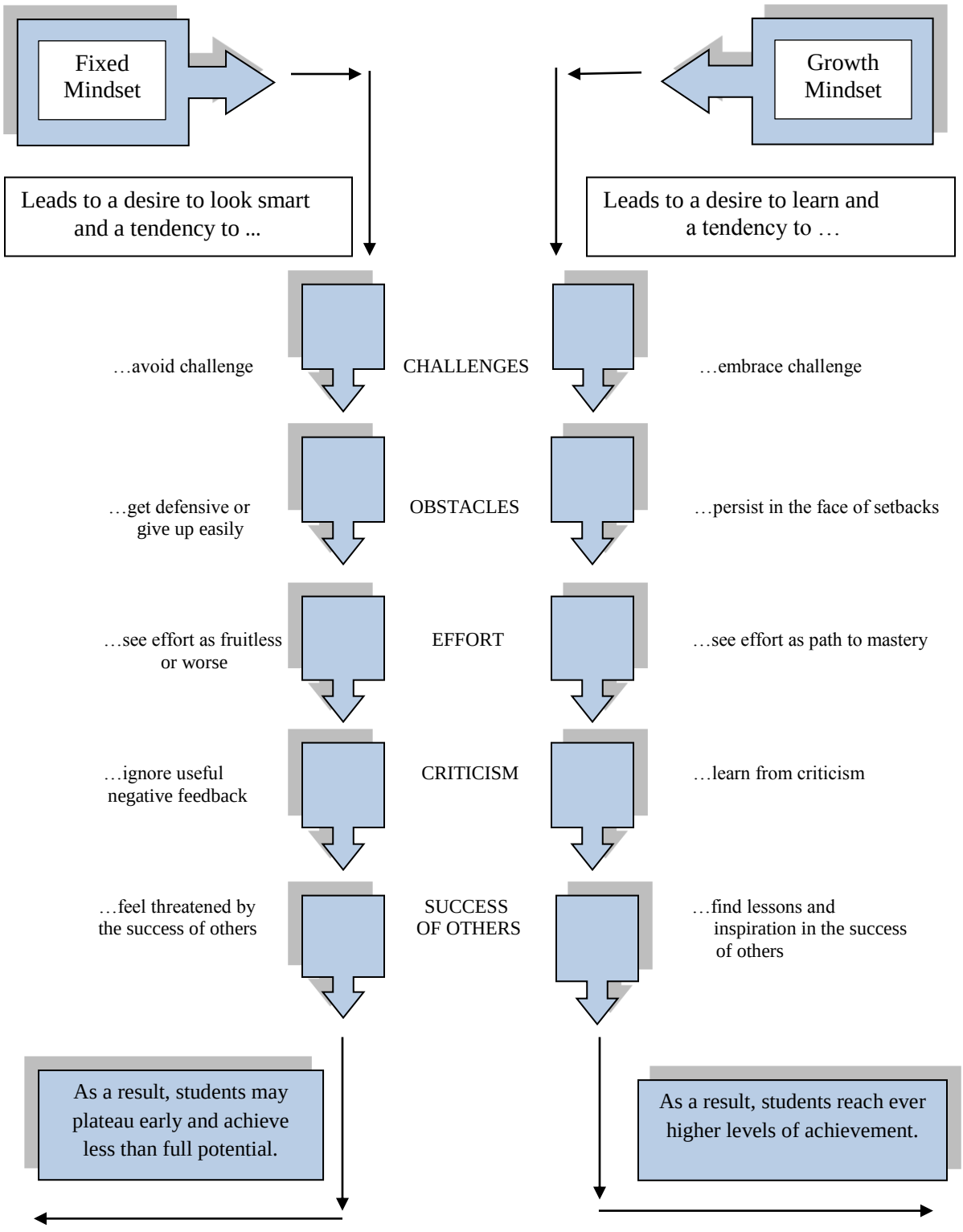


Figure 2. Adaptation of Nigel Holmes "Mindset" Diagram (Dweck, 2008b).

At the basis of each psychological construct in this study--"ability-based thinking," "effort-based thinking," "perseverance," "self-efficacy," "fixed mindset" and "growth oriented mindset" is cognitive choice influenced by environment, circumstances, and personal belief systems. Some students are affected more by their environment, while others are swayed more intensely by their circumstances. Cognitive choice then becomes the controlling mechanism interpreting the forces affecting the individual. Personal interpretation of environmental, physical, and emotional circumstances, whether accurately assessed, or recklessly misinterpreted, set the framework for the cognitive interpretation of teacher "praise" comments.

Four Key Elements of Praise

The discussion of "praise cues" is an integral component of this study. The key variable in the experimental phase of this project centers on two types of instructor praise cues prior to academic engagement--praise for ability level, and praise for effort level. A discussion of the effects of praise and the corresponding effect on student motivation follows.

Henderlong and Lepper's (2002) first key element of praise and motivation is "attributes of performance" which can be adaptive or maladaptive. As students receive praise for very simple tasks or focus is placed primarily on current ability, students may develop a maladaptive view of their performance. Dweck (1988) refers to the maladaptive student view as "learned helplessness" where students fail to put forth effort even before the level of difficulty is known. When "learned helplessness" occurs, intrinsic motivation and perseverance are undermined. Conversely, as students receive

praise for process and controllable features of their performance (such as effort levels), intrinsic motivation and perseverance are enhanced.

The second key element in the praise equation is student autonomy. When students are praised for successful task completion only because the adult leader rigidly controlled the environment, then intrinsic motivation and perseverance are reduced. In contrast, students experiencing minimal external control (or minimal "perceived" external control) develop a sense of independence that leads to greater intrinsic motivation and stronger overall perseverance. As Sullo (2007) has observed, freedom of choice and competence are increased when students believe autonomy exists in the classroom.

Once again, the "perception of reality" becomes a key consideration in the discussion of the effect of praise. With some creativity, an instructor may structure an activity promoting the appearance of complete student independence, even though the teacher monitors and controls the direction of the activity. As students "perceive" greater independence from the teacher, students experience greater potential for increased intrinsic motivation and perseverance.

Task competence is the third element in understanding the moderating effects of praise. If student competence is praised only in light of social comparison to others, intrinsic motivation and perseverance is decreased. Praise that provides positive information about individual student progress reinforces student self-efficacy, motivation, and perseverance. Lavoie (2007) challenges educators to examine the impact of the "competitive classroom" that promotes social comparison. The competitive classroom reinforces comparisons between students and spends little energy encouraging students to compare themselves to their "previous and personal best."

When classroom competition pits one student against another student, the resulting mindset can be a lesson in disappointment and futility. Performance goals in the classroom should set each student's "personal best" as the standard, and not the performance of the student across the aisle. Unequal competition in academics, sports, or international trade produces winners and losers, not "personal bests."

Multi-Facets of Praise

The use of praise in the classroom unveils multifaceted dimensions. Many school systems embrace praise as a "magical self-esteem bean" planted in the school yard in hopes of a great "beanstalk of self-affirmation" (Coughlin, 2007; Dewar, 2008; Kohn, 1994). Others contend that praise is the key to unlocking the true power of the individual. Praise, however, may have a more difficult, more problematic attachment evidenced by a reduction of academic perseverance levels and the need to promote personal appearance of ability or "smartness" as noted by Bartholomew (2008), and Dweck (2008).

When junior high classroom instructors verbally reward students, the general goal of praise is a belief that encouragement in any form will reinforce the self-esteem of the student, and thereby create a better relationship between the instructor and the student, and enhance the development of student success. The general use of praise by most teachers is genuine and altruistic, yet there are occasions when the unintended side-effects of praise may reinforce less-than-productive student mindsets that run contrary to the teacher's intention (Bronson & Merryman, 2009).

It is not the intention of this discussion to encourage classroom instructors to abandon all forms of student praise. The intent of the inquiry is to question and possibly

validate the hypothesis that praise cues do not always have the intended effect that teachers naturally assume. The purpose of the inquiry is the analysis of "ability" comments (praise commendations) compared to "effort" comments (praise commendations) in pre-task situations and the corresponding effects on student academic perseverance and self-efficacy.

Henderlong and Lepper (2002) stated that there are situations in which "praise" can "undermine, enhance, or have no effect on children's intrinsic motivation" (p. 774). If Henderlong's contention is valid, then it is possible that the use of praise may have a positive effect, a negative effect, or strangely, no effect at all. The wide range of outcomes for the use of praise stretches the understanding of the definition of praise.

Nearly all students enjoy the accolades and compliments of admirers for a job well done. Few individuals shy away from a kind expression of verbal encouragement. Classroom teachers that sense the professional and altruistic inclination that "all praise is good praise" foster the belief and the practice that daily praise is an effective motivational classroom tool. It would appear, on the surface, that "praise" (in any form) would be a natural, motivating factor in any situation for any student.

It does not seem possible from casual observation that praise for a job well done could ever be misunderstood as a negative reflection on the student, yet Bandura (1977) argues that individuals are responsible for developing their own self-perceptions of ability and capability. Self-perceptions then begin to operate within a self-induced, self-contained framework, setting only those goals that meet preconceived images of self. Consequently, students engage in choices and courses of actions that only encompass personal perceptions of possibilities, not actual reality. Consequently, personal choices

based on individual perceptions of reality (and overall mindset) interpret verbal praise and construct different interpretations of the praise statements. The interpretation may lead the student to smile and say, "thank you," or cause the student to distrust the individual that delivered the verbal compliment in the first place. Self-concepts develop overall mindsets that affect the reception or negation of verbal praise (Theobald, 2006).

It is not praise that causes problems for motivation, perseverance, and engagement, but the context, intonation, student mindset, and the past history of the student and teacher relationship that influence the interpretation of praise (Marzano & Marzano, 2003). Diverse factors interact to create myriad motivational "cause and effect" situations that influence student perseverance in the classroom.

Further complications of the praise issue include the "ability" versus "effort" discussion and the "pre-task" versus "post task" implications of praise. As previously stated, praise for ability may lead students to attempt future projects residing within "student comfort zones" and where students exhibit less motivation toward increasingly difficult tasks. On the other hand, students rewarded for effort have shown an inclination to attempt more difficult tasks in future attempts and have shown stronger motivation (Dweck, 2000).

The argument surrounding pre-task praise and post-task praise further complicates the discussion of task motivation. Schunk's research (1983) noted that "approval" is a form of social reinforcement that is best delivered post-task. Schunk minimized the importance of pre-task effort commendations in this way, "telling children they are good at subtraction may convey approval more explicitly than does telling children that they have been working hard" (p. 854). The caveat to Schunk's research is that students in

his research were verbally reinforced following *successful* problem-solving events. The link between successful completion of a task and verbal reinforcement for the completed task does not fully address the issue of student self-efficacy and perseverance based on pre-task effort.

Schunk correctly recognized the possibility that students verbally reinforced for "being good at subtraction" following an unsuccessful attempt would possibly experience a decrease in self-efficacy and overall future perseverance. In the case of an unsuccessful attempt at subtraction, verbal reinforcement for extended effort could, in fact, become more efficacious than ability reinforcement.

Pre-task and post-task verbal reinforcements have different targets. Pre-task verbal reinforcement should focus on effort. Post-task verbal reinforcement should focus on ability (after students have successfully completed a task). As Dewar (2008) has correctly stated, praise should be administered for traits students have the power to change.

In contrast to Schunk, research by Baumeister, Hutton, and Cairns (1990) noted consistent praise led to impairments in skilled performance. When consistent, verbal compliments were administered prior to task performance, students experienced various levels of academic apathy and lethargy toward extending effort to a higher level. As Henderlong and Lepper (2002) have noted, praise should be administered in such a way that high, but realistic goals are set for students. Setting unrealistic goals for students and encouraging students to work towards unattainable goals results in a reduction of academic self-efficacy and perseverance. "Over-praising" a student may create an unrealistic appraisal of ability and may interfere with student feelings of adequacy

(Dewar, 2008). Apathy, lethargy, and lower goal-setting are noted by Barker and Graham (1987), and Kamins and Dweck (1999) as potential symptoms of "over-praising" student ability.

According to Baumeister, Hutton, and Cairns (1990), "praise engenders a globally self-conscious state which impairs the automatic nature of effective skill performance" (p. 146). Henderlong and Lepper (2002), contend that praise can avoid misinterpretation when the praise is sincere, promotes autonomy, enhances competence without overreliance on social comparisons, and conveys attainable standards and expectations" (p. 774). Further complications arise as younger children can be highly influenced by praise (Dewar, 2008, Elwell & Tiberio, 1994), but praising secondary students may actually be counter-productive (Warshaw, 1975). This leaves myriad possibilities for a potentially negative impact of praise.

Bong (1996), however, attempts to reconcile the contrasting and conflicting views of Schunk's increase in self-efficacy and perseverance based on "ability comments" and Dweck's increase in self-efficacy and perseverance based on "effort comments" when stating, "no single model can capture the full dynamics of motivational behaviors" (p. 150-151). In Schunk's appraisal, motivation and self-efficacy are improved by "catching" students in successful moments following an activity. Dweck counters that the reinforcement of the "effort message" prior to task engagement is key to the development of student motivation, engagement and academic self-efficacy. Bong's approach suggests the possibility that both strategies have a rightful place in attempting to explain the development of academic motivation and student self-efficacy.

Although the focus of this inquiry is pre-task, verbal reinforcement by "ability-cueing" and "effort-cueing" commendations, the influence of adaptive attributions, autonomy, competence, realistic goals, and sincerity of commendations was noted as significant to the topical study of student self-efficacy and perseverance. The importance of strong teacher relationships with students was also noted as intricate to the role of enhanced perseverance (Marzano & Marzano, 2003).

Additionally, Sagor (2008, March) stated that "optimism" in the classroom, leading to greater perseverance, is the result of two essential building blocks. The first building block is "faith in the future." When students believe in a "personal, success-directed future," any dreams appear possible. But faith in the future must be accompanied by a nurturing, compassionate classroom instructor. Students need teachers that are trustworthy, energetic, and positive. The second building block for optimism in the classroom is "personal efficacy." Empowerment occurs as students begin to believe that current skills are only the beginning of the possible upward steps toward greater expectations. Teachers stand at the crossroads of student optimism. The verbal cues that guide the classroom experience hold great power for enhancement of student perseverance or erosion of student perseverance.

To gain a clear understanding of the complexity of the "ability-cueing" and "effort-cueing" motivational paradigm, Henderlong and Lepper's (2002) conceptual illustration (see figure 3, page 49) describing the moderating effects of praise that influences intrinsic motivation and perseverance is presented (p. 788). The principles of Henderlong and Lepper's theory influence elements of this inquiry.

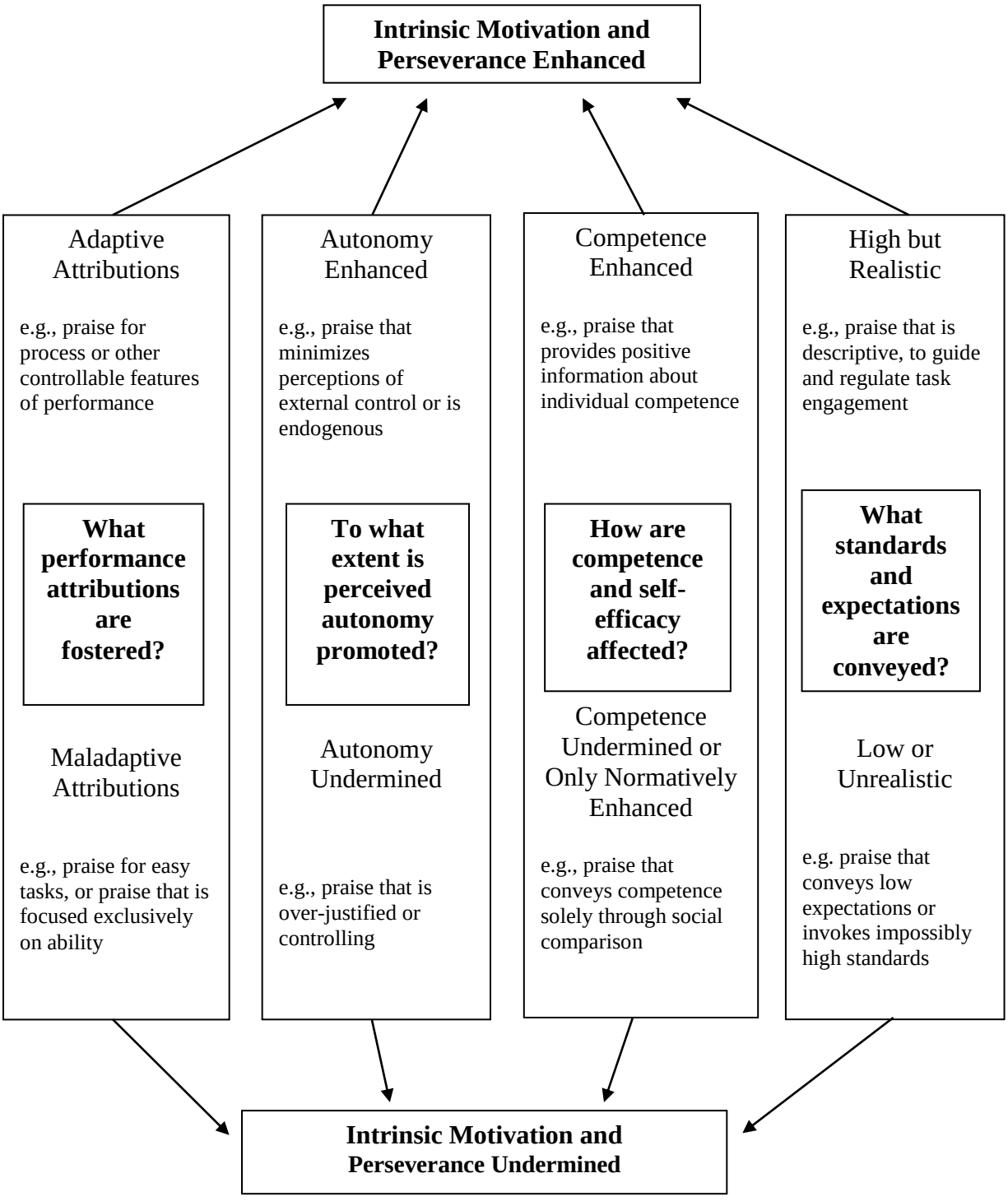


Figure 3. Variables Moderating the Effects of Praise (Henderlong & Lepper, 2002).

Motivation

Motivation has been defined as an "internal state that activates behavior and gives it direction; a desire or want that energizes and directs goal-oriented behavior; and the influence of needs and desires on the intensity and direction of behavior" (Kleinginna & Kleinginna, 1981, p. 264). Motivation is a challenging psychological theme due to the diverse nature of the precursors of motivation. Lavoie (2007) states, "Each person has a unique set of motivators that inspire and lead to action. . . . In fact, nearly an infinite number of combinations exist" (p. 97). In developing a motivational profile, Lavoie recites eight unique motivators--gregariousness, autonomy, status, inquisitiveness, aggression, power, recognition, and affiliation. Each of the motivational factors may have intrinsic or extrinsic specificity.

Intrinsically motivated behavior is driven by the task itself and engagement is motivated by pleasure or enjoyment, while extrinsically motivated behavior stems from a reward system outside an activity and engagement is motivated by external pressures or constraints (Broussard & Garrison, 2004; Eisenberger & Cameron, 1996; Henderlong & Lepper, 2002). Deci and Ryan assert that rewards for completed activities reduce intrinsic effort by reducing self-determination (1985). Positive verbal feedback has been shown to increase intrinsic motivation in both male and female students, especially in gender-appropriate tasks (Blanck, Reis, & Jackson, 1984).

Intrinsic motivation is derived from activity that emanates from self-direction and is fully endorsed by self. Self-determination theory focuses on the innate need for competence, relatedness, and autonomy (Deci, Vallerand, Pelletier, & Ryan, (1991). According to Deci et al., autonomy is the key to unlocking intrinsic motivation.

As stated by Henderlong and Lepper (2002), the importance of sincere praise cannot be underestimated. Students, including younger children, can be surprisingly perceptive to insincere gestures of praise. When praise is not genuine, it may be perceived as manipulative and condescending, and may undermine student motivation. Verbal praise shows a tendency to increase task engagement after tangible rewards for performance are presented (Eisenberger & Cameron, 1996).

The debate over tangible rewards and student performance continues to question whether the reward boosts extrinsic motivation at the expense of the development of intrinsic motivation (Ebert, Zeigler, & Cope, 2001). As Bandura (1977) has observed, different treatments have a tendency to change or strengthen perceptions of self-efficacy and perseverance. Most students seem to thrive on external rewards, but too many external incentives may lead students to believe that "learning for the sake of learning" is not worth the effort.

It is not surprising that "pro-rewards" and "anti-rewards" supporters are equally vocal in their viewpoint. "The popularization of [negative views of extrinsic motivation] can foster public attitudes against the use of tangible rewards to promote socially desirable behavior (Eisenberger & Cameron, 1996), yet extrinsic motivation is not necessarily an academically undermining quality when "administered by people within a general interpersonal ambience" (Deci, Vallerand, Pelletier, & Ryan, 1991, p. 336). If students experience external rewards in a classroom that also contains an instructor that generates autonomy, provides realistic goals, and promotes high expectations and student competence, then it is quite possible that students will experience an increase in motivation for future endeavors.

Henderlong and Lepper (2002) also stated, "Much like tangible rewards, ability feedback may produce desired outcomes in the short-run, but may undermine intrinsic motivation and subsequent perseverance" (p. 781). Concentration on student ability, and the lack of attention to student effort, may have the same motivational impact as the use of tangible rewards--strong positive response in the immediate context, but no response or a negative response when the verbal reinforcement or the tangible reward is removed.

The Challenge of the Competitive Classroom

The historical and continuing classroom model of American education is based on a competitive foundation (Goldman, 2011). The concept of cooperative learning has received growing recognition since the 1970s, yet competition in the classroom (e.g., testing scores, spelling bees, grading systems, high-stakes testing, college entry exams, school district performance grading by the state or federal government) still controls the American collective idea of academic growth (Docan, 2006). As various politicians and pundits have sometimes expounded, "Schools need to be competitive because, after all, isn't it a 'dog eat dog' world out there?"

Kohn (1992) explains the competitive school environment as a place where "mutually exclusive goal attainment" occurs. In order for one person to win, many others must lose. The competitive classroom becomes a place where the strong become stronger, and the weak are left behind. The competitive classroom mimics a form of Darwinian evolution where the weakest members of the species are left behind to struggle and eventually become extinct. As explained by Covington and Mueller (2001), the competitive classroom is comprised of a few students that operate under "success-orientation" and a great number of students that operate under "failure-avoidance."

In this atmosphere, it is not surprising that many researchers view the competitive learning environment as a place to promote success in high achievers and ensure failure in low achievers (Barker & Graham, 1987; Kamins & Dweck, 1999; Morgan, Fuchs, D., Compton, Cordray, & Fuchs, L.). The system favors the upper ability group and generates a sense of "learned helplessness" in lower ability students. Dweck and Leggett (1988) refer to the maladaptive helpless response as "characterized by an avoidance of challenge and a deterioration of performance in the face of obstacles," while mastery oriented response involves the "seeking of challenging tasks and the maintenance of effective striving under failure" (p. 256).

When analyzing the competitive classroom environment, Nicholls (1978) noted that increased motivation of high achievers appears to be dependent on the presence of low achievers; consequently, low achievers reflect lower motivation in the presence of high achievers in the competitive-based classroom. In classrooms possessing higher levels of social comparison (competitive environment), higher levels of motivation exist in the high achieving students, and lower levels of motivation occurs in the lower achieving students. This is an ominous portent in academically diverse classrooms and highlights the importance of minimizing competition between groups that are inherently unequal.

The final element of praise and motivation is standards of achievement. If the standards for an assignment or project are extremely low or extremely out of reach, praise becomes an intrinsically de-motivating factor and perseverance is highly undermined. However, praise for high goals (yet realistic goals) reinforces intrinsic motivation and task perseverance.

In the state of Indiana (the home state of this researcher), a theoretical and professional debate continues to exist over two differing models of state-wide achievement testing. The issues of "student perseverance," "student mindset" and "student motivation" are crucial considerations in the Indiana achievement testing debate. On one hand, accountability-minded legislators support the state-mandated "Indiana State-Wide Testing for Educational Progress – Plus" (*ISTEP+*). The *ISTEP+* test is a traditional "pencil and paper" assessment (and slowly evolving into a computer-based assessment). The scoring rubric for the *ISTEP+* test is a minimum competency cut-off line similar to most state-wide testing programs. Student "success" or "failure" is based on achieving a designated cut-off score.

The intrinsic motivation and student perseverance concern with the *ISTEP+* test is that every student is compared to two items--"normative data" and a "cut-off line" which guarantees a percentage of students will always be labeled as failing. The *ISTEP+* test is also administered only once per year, so student "success" or "failure" is determined by a one day, one hour event. There is no second chance during the school year to show additional growth or improvement. A student either "passes" the assessment or the student "fails" the assessment. A final problematic consideration for the *ISTEP+* test is that there are time limits imposed on the test and the test does not adapt to the current learning level of the student. All students take the exact duplicate test.

The alternative form of achievement testing in the state of Indiana is the Northwest Evaluation Association (*NWEA*) assessment. The *NWEA* assessment is a web-based, adaptive question assessment. Many districts in Indiana use the *NWEA* assessment side-by-side with *ISTEP+* (even though many districts find it difficult to fund both testing

formats) because educators believe the structure of *NWEA* is a superior model to the *ISTEP+*. The *NWEA* test is administered up to three times during the school year during the fall, winter, and spring.

The goal of the *NWEA* assessment format is "progress over time" as a student is compared to all previous test windows. The question then becomes, "Is this student making progress over time when compared to all previous assessment windows?" The purpose of the test is not a minimum competency requirement. During an *NWEA* assessment, students are not compared to another student across the aisle, the "smart kid" in the front of the class, or the sleeping kid in the back of the room. The student checks current progress against previous "personal best effort." The test does not establish time limitations and the test adapts to new levels of intricacy as students respond accurately to each question. Conversely, as students respond incorrectly, the *NWEA* test adapts subsequent questions to an easier level. In this way, every student is challenged and every student is treated with dignity and respect.

The extended conversation regarding achievement testing lies at the very core of the self-efficacy, motivation, and perseverance discussion. When students are compared to other students (which is rarely a fair comparison), it is a logical supposition that lower ability students will view participation in the testing process as unfair and debilitating. Hence, self-efficacy, motivation and perseverance are diminished for the lower ability kids in an *ISTEP+* setting. In an *NWEA* setting, the competition is not with a neighbor (or against all of the other kids in the state of Indiana), but against a previous "personal best" score. Whereas *ISTEP+* concentrates on the concept of "ability assessment" and

celebrates the "winners," *NWEA* concentrates on the concept of "effort assessment" and celebrates the "progress" of everyone.

In an *ISTEP+* setting, concentration on student "ability" builds a competitive classroom at the expense of the lower achieving students in the class. In an *NWEA* setting, concentration on "effort" builds the progress level of each and every student. Utilizing the analogy of a video game competition, students will embrace the challenge to beat a "personal best" high score, but may show little to no motivation, engagement, or perseverance to challenge a competitor who is obviously more talented. Few students have the resiliency to return to a competition-based format where victory is completely unattainable.

It is inevitable (and unfortunate) that many students embrace the practice of comparing current academic ability levels to other students in the classroom. The discouraging element of "ability comparison" is that the playing field is never equal. There are always students in the classroom with higher academic ability and others with lower academic ability. As Nicholls (1978) has discussed, a higher ability student may experience a reinforcing academic effect if that student is placed in a classroom with lower ability students. This phenomenon occurs predominantly in classrooms based on competition. If students with greater ability levels are academically reinforced in the presence of lower ability students, it is a logical proposition that lower ability students may be negatively reinforced in the presence of high achieving students. Peer competition in an academic setting may appear to "bring out the best in students," but it usually brings out the best in the higher ability children, not the lower ability children.

Encouraging "effort" (instead of "ability") prior to task engagement is a strategy that can be employed by every teacher with every student. When students are diligently encouraged to compare previous "personal bests" to current "personal bests," and are reinforced to exhibit greater effort levels over time, the end result may include higher achievement with decreased anxiety. The quest for each student then becomes a greater "personal best" instead of a comparison to a current classmate.

A cooperative approach, therefore, appears to offer a healthier and fertile soil for the development of student motivation and perseverance. Research by Zan and Hildebrandt (2005) compared cooperative classroom games and competitive classroom games and found that competitive games within themselves did not necessarily have a negative impact on student motivation and perseverance, as long as the overall classroom environment was built upon a cooperative learning foundation. There may be tremendous value in re-forming the way teachers are trained to discuss cooperative and competitive needs in the classroom. Unfortunately, the concept of the "dog-eat-dog" competitive classroom is a difficult, mythical beast to de-throne. Yet perseverance may be enhanced as the competitive classroom evolves into a cooperative learning environment.

Role of Perseverance

The discussion of academic perseverance logically coincides with the conversation of student self-efficacy. Confident individuals approach difficult tasks as challenges to be mastered rather than threats to be avoided (Bandura, 1977). The essence of developing academic skill, perseverance, and a sense of self-efficacy in the classroom is a combination of connecting the developing "skill" to a commitment of the "will" to

succeed (McCabe, 2008). Covey (1998) describes the will to succeed as a daily battle between "will-power" and "won't-power." Self-efficacy beliefs influence academic achievement and mediate the effect of possessed skills on subsequent achievement by influencing effort, persistence, and perseverance (Collins, 1982). "When a behavior is self-determined, the regulatory process is choice, but when it is controlled, the regulatory process is compliance (or in some cases defiance)" (Deci, Vallerand, Pelletier, & Ryan, 1991, p. 327).

Verbal Cueing by Teachers

Student cognitive choice, influenced by teacher verbal reinforcement, may be a reinforcing factor that positively or negatively influences academic success. If the use of verbal cues related to student "effort" has the potential to influence student belief systems in a positive way, then classroom instructors should take advantage of this potential opportunity to enhance student success.

It is recognized that an over-simplification of the "ability-cueing" and "effort-cueing" discussion may lead the reader to the conclusion that effort reinforcement is a panacea for all academic achievement. This is not the case. The pursuit of this inquiry is merely one facet to the overall discussion of student self-efficacy and the development of academic perseverance. If it is possible for classroom instructors to make minor adjustments in verbal cueing that nudges students toward a stronger, academic, growth oriented mindset, then the effort is worth the pursuit.

Targeting the Effort and Ability Question

The view of this inquiry considers the possibility that classroom instructors, who are trusted to inspire a love for learning in the minds of children, may serve as

instrumental factors in the reduction or reinforcement of self-efficacy and perseverance through consistent verbal references which target student effort and student ability (Kamins & Dweck, 1999; Schunk, 1983). The consequences of inappropriate or ineffective methods of praise in the classroom could lead to increased erosion of student self-efficacy and perseverance, and the unintentional reinforcement of student "learned helplessness" (Dweck, 2008a).

American classrooms are currently inundated with praise and positive self-promotion programs that target students with the message "you are wonderful just the way you are, so don't change a thing." Paul Coughlin suggests America has raised a generation of students who have been exposed to parents that religiously hover over their children, eagerly attempting to prevent any possibility of harm, praising and rewarding miniscule accomplishments, and thereby creating a self-indulgent form of "timid living" (2007, p. 11). In a perceived effort to increase self-esteem, every student receives a trophy, and every student earns a certificate.

The notion that no child should ever experience a setback undermines the resiliency necessary to produce strong, self-confident (and God-confident) students. As noted by Henderlong and Lepper (2002), praise administered for extraordinarily easy tasks or for tasks which focus strictly on current ability level actually contributes to maladaptive attributes, and undermines student motivation and perseverance.

A simple analogy of the human immune system of the body clearly illustrates the point. Immunizations are given to children to protect children from catastrophic and contagious diseases. Children receive inoculations that introduce a mild form of a disease strain in order that the children will be able to develop the appropriate antibodies

which later become life-saving defense mechanisms during exposure to an actual illness or disease. Children are exposed to a lesser pain (the fear of a sharp needle, a small prick of the skin, and possibly, a mild form of the illness or disease) in order to become stronger when exposed to a deadlier form of the disease. Is this done to hurt the child? No, it is meant to protect the child even though the discomfort of the moment is painful for both the child ***and*** the parent.

The same is true when considering the classroom that attempts to shield all children from any discomfort. Dweck (2008a), states the danger of the over-protective classroom environment as a place where "learned helplessness" becomes standard behavior. Students must be allowed to experience a controlled level of mild distress in order to develop the resiliency necessary to accomplish increasingly difficult tasks.

In the sports article, "Winning Requires Losing," White (2010, July 12) maintains that people have forgotten how to lose and cites a famous Nike advertisement featuring retired basketball legend Michael Jordan. The commercial states,

> I've missed more than 9000 shots in my career. I've lost almost 300 games. Twenty-six times, I've been trusted to take the game-winning shot and missed. I've failed over and over and over again in my life. And that is why I succeed.

White concludes the thought by saying that losing may be the "single greatest motivational tool in existence" because it allows a person to understand what winning ***looks like*** and it allows a person to understand what losing ***feels like*** (p. B1). If children are shielded from the experience of losing, how will they ever truly appreciate winning?

Nurturing students from preschool to adolescent, and adolescent to young adult, challenges the classroom educator to develop affirming, yet appropriate methods of praising students and their accomplishments. Students need teachers that bolster self-efficacy and perseverance without yielding to insincere and unintentionally misleading forms of praise (Kohn, 1994; Pintrich & DeGroot, 1990). Children need to be praised and encouraged, but praise must be used carefully as a tool that develops autonomy and competence. The consequences of consistent, verbal references directed toward current student "ability" and which neglect a consistent focus on student "effort," may lead children to believe that effort is uninspiring and unnecessary.

Students need instruction in the development of self-efficacy and perseverance through verbal reinforcement that "effort" is an attribute comparable to "ability" and that ability is a malleable trait (Dweck, 2008a; Multon, Brown & Lent, 1991). The development and encouragement of student effort is a challenge in an academic framework where "ability" is often touted as superior to effort. In competitive-based classrooms, it is far too easy for teachers to spend more time praising the efforts of the high-ability children completing their mathematics "mad minutes," the finalists in the classroom "spelling bee," or scoring the most points in the "accelerated reader" program. It is logical and far too easy to display the examples of the high-achieving students as the standard for the classroom and to neglect the accomplishments of the lower-achieving students.

This type of casual and unintentional verbal reinforcement of "ability" over "effort" may reinforce the stronger ability children, but any student that regularly achieves in the lower third of the class can attest to the negative impact of the ability-

based, competitive classroom. Covington and Mueller (2001) refer to the competitive classroom as the "failure oriented classroom" with the greatest number of rewards going to the best performers. The majority of students in the competitive classroom struggle to avoid failure instead of striving to gain success.

A recent topic in a roundtable discussion (2009, February) during an in-service activity of elementary school teachers at St. Paul Lutheran School in Michigan City, Indiana, queried the usefulness of intelligence quotient (IQ) tests and its subsequent impact on the topic of student perseverance and academic self-efficacy. While it may be true that student ability level can be quantified and stratified in an IQ test, the teachers agreed that the IQ test has little value in determining whether a student will persevere in school, "learn for sake of learning," successfully graduate from high school, and eventually become gainfully employed. Bronson and Merryman (2009) have stated that I.Q. tests are "astonishingly ineffective predictors of a young child's success" (p. 97). Instead, the teachers suggested that traditional elementary students should be given an age and ability appropriate activity requiring sustained effort (e.g. a picture puzzle, a "Rubik's Cube," a crossword puzzle, a "K-Nex" project, building blocks, puppets, play sets, etc.) in the quest to understand future perseverance, academic performance, and success potential.

The teachers suggested performing observations of the students at work to see which students succumbed to task difficulty and abandoned the activity, and which students showed perseverance toward completion of the task. It was surmised by the teachers that higher quality information might be gained regarding potential, student success through observance of task persistence, instead of IQ ability ranking. The

connection of success to "effort" and perseverance is obvious in the words of Gladwell (2008) when stating an Eastern proverb, "No one who can rise before dawn three hundred sixty-five days a year fails to make his family rich" (p. 224).

As children grow older, their understanding of their own ability becomes more acute (Nicholls, 1978). Nicholls noted that ability and effort are judged synonymously in students under the age of nine when differentiation of terms begins to occur. However, perception of ability as an individual entity begins to develop as students get older. Schunk (1983) demonstrated that a "heightened sense of efficacy helps to sustain task motivation, which leads to greater skill acquisition." In Schunk's research, targeted verbal reinforcement was instrumental in improving performance of lower elementary students in solving mathematical subtraction problems.

It has been noted that Schunk (1983) linked higher self-efficacy to ability feedback, whereas Miller, Brickman, and Bolen (1975) noted both ability feedback and effort feedback as efficacious to student performance and motivation. Mueller and Dweck (1998) performed research on the effects of ability praise and effort praise on fifth grade students. Students praised for ability showed a performance-goal orientation and viewed ability as the attribute for success or failure. Students praised for ability also showed less persistence, less enjoyment, and poorer performance than the students praised for effort.

> Helpless individuals appear to focus on their ability and its adequacy (or inadequacy) [while] mastery-oriented ones appear to focus on mastery through strategy and effort. Helpless individuals appear to view challenging problems as a threat to their self-esteem, while mastery-

> oriented ones appear to view them as opportunities for learning something new (Dweck & Leggett, 1988, pp. 258-259).

As noted by Schunk (1983), "Perceptions of capabilities bear an important relationship to subsequent achievement" (p. 855). Previous success easily provides fertile ground for future success. Previous failure undermines potential success in the future. Once again, "capability" is not the question. The question of success or failure gravitates to the "perception of capability."

Praise for "ability" versus praise for "effort" does not constitute an either/or dispute, as both views are clearly delineated in the research. It could easily be argued that the "pre-task effort commendation" and the "post-task ability commendation" question may be explained in the analogy of a "two-sided coin." One side of the coin represents pre-task effort commendations. The other side of the coin represents post-task ability commendations (based on successful completion of a task). Neither side of the coin is necessarily viewed as highly superior to the other side. Each factor (pre-task verbal "effort commendations" and post-task verbal "ability commendations") play a role in the development of academic self-efficacy and perseverance. Both sides of the coin are unique parts of the same "commendation to perseverance" equation.

A Christian Perspective of Mindset and Perseverance

The divine inspiration of Scripture cannot be separated from the discussion of self-efficacy and perseverance. In the Old and New Testaments, scriptural commandments and commendations abound as encouragement to complete demanding tasks. The spiritual inspiration for the transformation of the mind and the development of perseverance through all difficulties is echoed in the words of the Apostle Paul as

affirmed in Romans 12:2 (KJV), "Be not conformed to this world: but be ye transformed by the renewing of your mind, that ye may prove what is that good, and acceptable, and perfect, will of God." In the Old Testament, the prophet Jeremiah declares, "For I know the plans I have for you, declares the Lord, plans to prosper you and not to harm you, plans to give you hope and a future" (29:11, NIV).

Christian classroom instructors are charged with the task of training fledgling learners, and infusing them with the courage to dream big, grow tall, and develop a tenacious spirit of determination which refuses to accept limitations. This is an arduous task. And yet it is with confidence that the Scriptures state, "My grace is sufficient for you, for my power is made perfect in weakness. Therefore, I will boast all the more gladly about my weaknesses, so that Christ's power may rest on me" (II Corinthians 12:9, NIV).

Christian pastor, Joel Osteen (2005) addresses the self-efficacy, perseverance, and growth oriented mindset issue in this way, "God loves to use ordinary people just like you and me to do extraordinary things. You may not feel capable in your own strength, but that's okay [because] when we are weak, He is strong" (p. 62).

God provides the sustaining power and guidance that allows for increased vision in the Christian life. Reliance on the Holy Spirit strengthens Christian faith in the face of all challenges. And the supreme example of God's Son, Jesus Christ, displays the true measure of determination necessary to complete the assigned task and the divine mission.

The Psalmist proclaimed that the very existence of each human being was planned from the beginning of time and designated for purposeful activity, "For you created my inmost being; you knit me together in my mother's womb. I praise you, because I am

fearfully and wonderfully made; your works are wonderful, I know that full well (Psalm 139:13-14, NIV).

Joshua 1:9 (NIV) stands as an encouragement to persevere in the appointed course, "Have I not commanded you? Be strong and courageous. Do not be frightened, and do not be dismayed, for the Lord your God is with you wherever you go." Galatians 6:9 (KJV) commands, "Let us not grow weary of doing good, for in due season we will reap, if we do not give up" while the book of Philippians (1:6, NIV) declares, "Being confident of this, that he who began a good work in you will carry it on to completion until the day of Jesus Christ."

Christians (and Christian school teachers) have a greater foundation for the acquisition and development of self-efficacy and perseverance because the groundwork and framework for success has already been established in the divine predestined plan of God. Despite all setbacks, challenges, and conflicts, Christ affirms our standing before God *and* the entire world when declaring, "And we know that in all things God works for the good of those who love him, who have been called according to his purpose" (Romans 8:28, NIV).

Finally, an unquestionable, inspirational allusion of faith and perseverance is offered in the images of the Old Testament patriarch, Abraham. God promised an heir to Abraham twenty years before the promise was fulfilled, and yet the verbal promise was made in the past tense as if it had already come true (Osteen, 2004). Abraham possessed the appropriate Biblically-based growth oriented mindset. The growth oriented, Christian mindset challenges all Believers to think and live as though the victory has already been accomplished. With great purpose and faith in the future, all Christians can celebrate the

message of Philippians 4:13 (NIV), "I can do all things through Christ who gives me the strength."

Summary of Literature Review

The literature review presents the possibility that consistent references to student "ability" levels (verbal "ability-cueing" commendations) may actually decrease student self-efficacy and perseverance to complete assigned tasks, while references to student "effort" levels (verbal "effort-cueing" commendations) may increase student self-efficacy and perseverance to complete assigned tasks. The literature review defines the role of cognitive choice and motivation in the development of student mindsets (fixed mindsets versus growth oriented mindsets). The topic of adolescent development and the corresponding "perceptions of reality" dilemma is also discussed. The investigation continues with an examination of the "effort-cueing" and "ability-cueing" question and its relationship to self-efficacy and perseverance through a research project involving a problem solving activity (a numerically-based Sudoku problem) and instructor verbal reinforcement of an "ability encouraged group" and an "effort encouraged group."

Exploring the relationship between student self-perceptions and academic achievement remains a potentially significant area of study. It may be possible to reinforce and build student "self-perceptions" to a healthier academic viewpoint. If students can be influenced to a healthier academic mindset, then it may be possible to affect the perseverance, academic engagement, and self-efficacy outcomes of task performance based on teacher verbal commendations. Construction of a healthier growth oriented mindset may find its roots in the promotion of verbal "effort-cueing" commendations which reinforce continuing student effort.

There is an old adage which states, “Nothing ventured, nothing gained.” Sadly, the contorted perceptions of reality within the mindsets of many adolescent children twist the wisdom of “nothing ventured, nothing gained” into a crippled version of motivation and perseverance that states “nothing ventured, nothing lost.” Numerous children sulk in classrooms seeking only to survive another academic day and never realize the potential locked deep within their minds and souls. Other students reside calmly in the classroom, performing productively and seem to exhibit relatively successful patterns of learning. A few students voraciously devour new challenges and eagerly ask for more.

Gholar and Riggs (2004), however, envision that the greatest classroom experience for all students is “conation.” Gholar and Riggs refuse to accept “passive existence” or “relative productivity” for children and express the concept of conation as “the will, inner strength, determination, and volitional force that drives change” in the lives of students (p. 9). Children cannot reach conation without the inspirational leadership of mentors in the classroom. Appropriate praise in the form of verbal cueing that concentrates on increasing student relationships, focuses on student effort over student ability, and encourages students to always strive for “personal bests” should be the goal of the classroom teacher.

Methodology Preview

As proposed in the literature review, the purpose of the present inquiry was neither to disprove the importance of “ability feedback,” nor to solely endorse the importance of “effort reinforcement” as superior to “ability reinforcement.” The purpose of the study was the examination of one aspect of the “ability” discussion. In a problem-solving activity (Sudoku problem), is there a higher level of perseverance to complete the task

without assistance in groups pre-conditioned with verbal encouragement for previous effort levels than groups pre-conditioned with verbal encouragement for previous ability levels? The two groups were compared after completing a computer-interactive, web-based, problem-solving activity (Sudoku) that examined computer-tracked, restricted "clues" time signatures utilized throughout the fifteen minute activity. A greater reliance on "clues" (measured in elapsed seconds from the inception of the activity) revealed less confidence to solve the problem independently and revealed decreased levels of perseverance.

An experimental group of 102 sixth grade junior high students attending six Christian schools in northwestern Indiana were selected for this study. There were fifty-one students randomly assigned to an ability-cued group, and fifty-one students randomly assigned to an "effort-cued" group. The research design for this inquiry was a quantitative analysis of a post-test only two-group, randomized true experimental project. *T*-tests were used to calculate statistical significance between the two experimental groups at three independent measurement targets (based on the first, second, and third usage of restricted clues on the research website). Levene's Test and the Kolmogorov-Smirnov Test were implemented to assess assumptions of normality and group homogeneity. For educational research, an alpha level of .05 was set as the statistical measure of significance.

The ultimate goal of the current analysis of perseverance levels in the randomized groups of students was the reinforcement or refutation of the findings of Dweck (2008) and Henderlong (2000) reporting that pre-task effort-based verbal commendations produced higher levels of perseverance in student problem solving activities.

CHAPTER THREE: METHODOLOGY

Introduction

The introduction and literature review indicates a potential relationship between instructor verbal commendation cues prior to task engagement and corresponding levels of student perseverance to perform academic tasks. The purpose of the study is a comparison and analysis of perseverance levels in two groups of students. One group received pre-task, ability-based verbal commendations and the second group received pre-task, effort-based commendations. Levels of perseverance to complete or continue a numerical problem-solving task (see Appendix A – Sample Sudoku Problem Solving Activity) were tested, and analyzed according to the following methodology.

Design of the Study

The research design for this inquiry is a post-test only two-group, randomized true experimental project. Levene's *F*-test was implemented to check groups for equality of variance. Normal distribution of groups was evaluated using the Kolmogorov-Smirnov Test. Independent samples *t*-tests were used to analyze whether a statistically significant difference existed between the means of two randomized groups at three independent measurement targets (Urdan, 2005). *T*-tests were performed at the following independent time measurement targets: elapsed seconds from the beginning of the trial to the use of the first restricted clue, elapsed seconds from the beginning of the activity to the use of the second restricted clue, and elapsed seconds from the beginning of the activity to the use of the third restricted clue. Howell (2002a) endorses the use of independent *t*-test over several time measurement targets. In a review of Evans, Bullinger, & Hygge's

(1998) study of epinephrine levels in children living near a newly constructed Munich airport in the late 1990s, Howell contended that similar statistical values would be found whether independent *t*-tests or ANOVA were performed. According to Ary, Jacobs, and Sorensen (2010) and Motulsky (1999), the post-test only, two-group, randomized, experimental design controls for most threats to internal validity and external threats of interaction of testing and treatment.

Convenience sampling was chosen for this project because random sampling of all sixth grade students in the state of Indiana (or northwest Indiana) would constitute an impossible challenge due to time constraints and financial limitations on the researcher. McCall (1990) supports the rationale of convenience sampling as a valid methodology as long as a substantial effort has been made to randomize the groups in the study.

Validity

Internal validity of the testing environment was assessed. Internal validity of the testing procedure was enhanced because a single post-test, randomized, independent group model rules out most threat factors such as history, maturation, testing effect, regression, and mortality.

"History" (the impact of previous events) was not a concern with the experiment because the students had no prior exposure to the experimental variables before the experiment. "Maturation" was not a problem because the students were exposed to the treatment in only one setting. There was no follow-up treatment planned in the future. There were no prior tests or observations, which eliminated any "testing effect" issues. "Regression" toward the mean in subsequent tests was not a concern because there was no follow-up test.

"Selection bias" was minimized because all students were drawn from traditional sixth grade Christian school classrooms, random assignment took place based upon student rosters, and no students from any sixth grade class were precluded from the experimental study unless the parents or the students chose to opt out of the study. "Mortality" (the loss of participants) was not an issue because the experiment was a post-test only model. The only students in the study were the students in attendance on the day of the actual experiment. There were no "make-up" tests. "Subject-maturation interaction" (different maturity levels of participants) was not a major challenge to validity because all of the students in the study were taken from sixth grade classrooms, and the actual ages of participants did not deviate by more than approximately twelve months.

"Experimenter effects" were a consideration in this study. It was possible for the researcher to unintentionally bias the subjects toward a particular outcome. This issue was addressed by regular, rehearsed reading of the two scripts ("ability-cueing" and "effort cueing"). Both scripts were read with the same tone, inflection, and clarity. Both scripts were read by the same researcher in all experimental settings. Experimenter effects were minimized by the standardization of all procedures and by training the research assistant to refrain from discussing the hypotheses of the trial, the goals, or the procedures with anyone.

"Subject effects" (the development of student attitudes) could have been an issue, but were minimized during the experiment due to the relatively short time the students spent in the computer lab, as well as with the researcher. The entire activity time for each individual group lasted no longer than forty-five minutes. Subject effects were

minimized by giving equal treatment to both groups (except for the scripted comments related to "ability" and "effort") and participants did not know into which experimental group they had been placed.

"Diffusion" and "contamination" (inadvertent communication of information leading students to participate or react differently to the experiment) could have been a threat to internal validity, but the sequestering of students in another location prevented any sharing of information. Students in each group were exposed to the treatment in successive class periods. Only the sixth grade students were tested at each school site. The entire experiment at each school took no more than two class periods and the close proximity of the two testing windows ("ability-cued" participants and "effort-cued" participants) in successive class periods reduced the potential for diffusion of information and contamination of the experimental groups. The large number of participants and random assignment also contributed to internal validity as distribution norms were more likely to be experienced with a significant experimental population of 102 total participants with fifty-one students in each experimental group (Ary, Jacobs, & Sorensen, 2010).

External threats to validity were examined. "Non-representativeness" of the study group was not a significant threat to external validity. In the current inquiry, the goal specifically targeted traditional sixth grade students in Christian schools in northwestern Indiana. Considering the total number of students participating in the study, the findings of the study bear relevance to sixth grade Christian school students in Indiana, but it was readily observed that sixth grade Christian school students in Indiana may not be reflective of the entire population of sixth grade students in public schools across

America. The study of all American sixth grade students would be an impractical study. The smaller subset of Christian school sixth grade students and the subsequent findings of the experiment did not become irrelevant because of the non-representativeness issue. Future studies addressing similar "ability-cueing" versus "effort-cueing" experiments could easily be performed with sixth grade students *not* attending Christian schools in the state of Indiana.

"Artificiality" in the experimental setting was not a threat to external validity because the students participated in the computer labs of their home schools. Students were not taken to a foreign environment to participate. As expected, the sixth grade students were quite comfortable using computers, the internet, and a designated website to solve a Sudoku problem. Another consideration to external validity was "pretest interaction." As there was no pretest for participation in the experiment, the pretest interaction threat was not a concern.

Reliability

The instrument measuring student perseverance was a web-based Sudoku problem-solving. Beer, Jones, and Clark (2009) maintain web-tracking of student interaction as a reliable method of gauging student engagement and perseverance. The web-based instrument tracked student movements during the activity and recorded every accessed clue during the fifteen minute activity. Student movement in the Sudoku problem was continuously tracked in one second increments from the moment students accessed the website and placed their identification number in the appropriate box. In ascertaining the reliability of the measurement system used in this problem-solving scenario, the following trials were instituted. On four separate occasions, simulations were run with

the website, www.sudokuhints.com/research, to verify that measurements were accurately recording the data. During the four trials, a total of thirty-four volunteers (8th grade students) listened to Sudoku instructions, participated in the Sudoku activity, and at the conclusion of the trial, printed the results of the activity. The results of the four trials revealed accurate and reliable measurements of the time signatures attached to all test applications. All participants received accurate time signatures in accordance with activity on the website. No data was lost. No data was irretrievable from the website, computer terminals, or the computer lab printers.

It is also noted that the pre-trials were assessed for preliminary statistical relevance. Although the trial groups were smaller than the overall study, the preliminary analysis of the data (pre-task "ability-based" cues compared to pre-task "effort-based" cues) revealed similar results with Dweck's (2008b) studies. Participants in the trials showed higher levels of perseverance (delayed access to clues) in the effort-cued group than the ability-cued group.

Two months after the original simulations, a follow-up activity took place to re-assess and confirm the reliability of the Sudoku time signatures. Two additional simulations were run with the research website www.sudokuhints/research.com to assess reliability in the following ways. One simulation accessed a Sudoku clue every five seconds following initiation of the website activity. At the same time, another simulation began accessing a Sudoku clue every ten seconds. This timed activity continued for ten minutes before participants were asked to print the results of the activity. After the printout of the activity was reviewed, there was consistency in both the "five-second accessed clues" simulation and the "ten-second accessed clues" simulation. In neither

simulation was there found to be any deviation from the original web-design, time-tracking, or a missed time signature. Consistent five-second and ten-second intervals were noted on the appropriate printout reports. McCall (1990) explains reliability as "the measurement procedures assigning the same value to a characteristic each time it is measured under essentially the same circumstances" (p. 289). Under McCall's definition of test reliability, the Sudoku website testing instrument was confirmed as reliable.

Reliability of the perseverance definition in this experiment was also reinforced by Dweck (2008b) revealing student perseverance as a measured length of elapsed time between the initiation of an activity and the breakdown of student progress to complete or continue the activity independently. Dweck utilized qualitative observations and measurements related to student perseverance and pre-task ability cueing and pre-task effort cueing. The current research project employed quantitative analysis in the same overall pursuit of the perseverance question. Outcomes similar to Dweck further confirm the reliability of the current quantitative inquiry as it relates to student perseverance in academic problem solving activities.

Research Questions

It was the pursuit of this research inquiry to gain a better understanding of the potential positive or negative effects of verbal reinforcement related specifically to "ability-based" commendations and "effort-based" commendations in pre-task instructions. The following research questions were addressed in this study.

RQ1: At response target "one" (students' first reliance on an accessed clue during a problem solving activity), what was the average measureable difference (DV) in perseverance response time between students verbally commended for previous effort

level prior to task engagement (IV) and students verbally commended for previous ability level prior to task engagement (IV)?

RQ2: At response target "two" (students' second reliance on an accessed clue during a problem solving activity), what was the average measureable difference (DV) in perseverance response time between students verbally commended for previous effort level prior to task engagement (IV) and students verbally commended for previous ability level prior to task engagement (IV)?

RQ3: At response target "three" (students' third reliance on an accessed clue during a problem solving activity) what was the average measureable difference (DV) in perseverance response time between students verbally commended for previous effort level prior to task engagement (IV) and students verbally commended for previous ability level prior to task engagement (IV)?

Research Hypotheses

The research hypotheses for this experiment assumed there would be a statistically significant difference (as measured by the number of elapsed seconds between the beginning of the activity and the accessing of restricted problem-solving clues) between the experimental group commended for previous "ability" prior to task engagement and the experimental group commended for previous "effort" prior to task engagement. Three perseverance response times were recorded for each of the two groups during the research project resulting in the research hypotheses designated as RH1, RH2, and RH3.

RH1: During a numerical problem-solving activity (Sudoku), students exposed to pre-task, instructor verbal commendations related to previous student ability level will show less perseverance to complete the numerical task compared to students exposed to

instructor verbal commendations related to previous student effort level (as recorded by the number of seconds between the initiation of the problem-solving activity and the first reliance on a restricted clue).

RH2: During a numerical problem-solving activity (Sudoku), students exposed to pre-task, instructor verbal commendations related to previous student ability level will show less perseverance to complete the numerical task compared to students exposed to instructor verbal commendations related to previous student effort level (as recorded by the number of seconds between the initiation of the problem-solving activity and the second reliance on a restricted clue).

RH3: During a numerical problem-solving activity (Sudoku), students exposed to pre-task, instructor verbal commendations related to previous student ability level will show less perseverance to complete the numerical task compared to students exposed to instructor verbal commendations related to previous student effort level (as recorded by the number of seconds between the initiation of the problem-solving activity and the third reliance on a restricted clue).

Null Hypotheses

Based on previous research by Bronson and Merryman (2009), Dweck (2008a), and Henderlong and Lepper (2002), there was an assumption that the group commended for previous "effort level" prior to task engagement would exhibit higher levels of perseverance, and the group commended for previous "ability level" prior to task engagement would exhibit lower levels of perseverance. Independent group *t*-tests were performed to analyze statistical significance of the means. Because an effect was suspected, the null hypothesis was stated that there would be higher levels of

perseverance in the group commended for previous "ability level" prior to task engagement during an academic, problem solving activity when compared to the group commended for previous "effort level" (H_o was $n_a > n_e$).

The two groups in the research design were traditional sixth grade students attending Christian schools in northwestern Indiana exposed to "ability commendations" prior to a web-based Sudoku problem solving activity, and traditional sixth grade students attending Christian schools in northwest Indiana exposed to "effort commendations" prior to a web-based, Sudoku problem solving activity. Students were instructed that the goal of the activity was completion or continuation of the problem solving activity without using restricted clues. (Note: Clues were accessible during the exercise, but discouraged immediately prior to the beginning of the activity.) In completing the numerically-based Sudoku problem, student perseverance to complete the task without assistance was measured by an analysis of the use of time-coded "restricted clues" accessed by the students. Accessing restricted clues indicated a breakdown in perseverance to solve the problem independently. The null hypotheses were designated as NH1, NH2, and NH3.

NH1: During a numerical problem-solving activity (Sudoku), students exposed to pre-task, instructor verbal commendations related to previous student ability level will show more perseverance to complete the numerical task compared to students exposed to instructor verbal commendations related to previous student effort level (as recorded by the number of seconds between the initiation of the problem-solving activity and the first reliance on a restricted clue).

NH2: During a numerical problem-solving activity (Sudoku), students exposed to pre-task, instructor verbal commendations related to previous student ability level will show more perseverance to complete the numerical task compared to students exposed to instructor verbal commendations related to previous student effort level (as recorded by the number of seconds between the initiation of the problem-solving activity and the second reliance on a restricted clue).

NH3: During a numerical problem-solving activity (Sudoku), students exposed to pre-task, instructor verbal commendations related to previous student ability level will show more perseverance to complete the numerical task compared to students exposed to instructor verbal commendations related to previous student effort level (as recorded by the number of seconds between the initiation of the problem-solving activity and the third reliance on a restricted clue).

Identification of Variables

The ability-based verbal cueing script was an independent variable (IV) in this experiment. The effort-based verbal cueing script was an independent variable (IV) in this experiment. The scores generated from the usage of restricted clues (measured in seconds from the beginning of the activity to the accessing of clues) were dependent variables (DV) in this experiment. Three targeted measurements (DV) in both experimental groups (reliance on restricted clue #1, reliance on restricted clue #2, and reliance on restricted clue #3) were noted to ascertain the average measurable difference in perseverance response time and statistical significance between the students verbally commended for previous "ability" level and the students verbally commended for previous "effort" level.

Participants

All participants in the study were traditional sixth grade students at selected Christian schools in northwestern Indiana. The number of student participants was 102. Initial contact was made with fourteen Christian schools in northwestern Indiana. A total of six schools participated in the project. All schools were within a seventy-five mile radius of the lead researcher's residence. School populations ranged from 95 students to 310 students.

One Lutheran school and one Catholic school were located in an urban setting. One Lutheran school, one Catholic school, and both independent Christian schools were located in rural settings. One of the Lutheran schools had been in existence for 137 years. The smallest school in the study had been in existence for less than seven years. All six participating schools had female instructors as the primary contact person between the researcher and the sixth grade students. Four schools had female administrators and two schools had male administrators. Administrators at two of the schools had less than two years of administrational experience.

Christian schools in the study were defined as any school declaring religious affiliation or mission. Schools in the study included Catholic, Lutheran, and independent Christian schools. All participating school principals received an initial contact letter (see Appendix B – Initial Contact Letter), a follow-up phone call, and a full presentation of the Sudoku problem solving research project, and the procedures of the study prior to the request for student participation consent forms.

Though it was offered, no participating school required a research project presentation to the local school committee or school board. All schools provided a letter

of intent to participate in the research project as required by Liberty University's Institutional Review Board (IRB) (see Appendix C – Letter of Intent to Participate in University Research). All student participants received and returned consent forms prior to the initiation of the study (see Appendix D – Informed Consent Form).

Setting

There were six school sites designated for this study. All sites were Christian schools in northwestern Indiana possessing sixth grade students. Two schools contained kindergarten through twelfth grade students. Four schools contained kindergarten through eighth grade students. Throughout the study, schools were designated as School "A," School "B," School "C," School "D," School "E," and School "F' to protect the identities of participants.

The research experience was conducted in the computer lab of each participating school. Each school contained a functioning computer lab capable of accommodating at least one-half of the sixth grade students from the school. The randomized, experimental group setting essentially split the sixth grade class into two evenly distributed groups. Each school's computer lab utilized internet access in order for students to logon to the Sudoku tutorial website found at http://youtube.com/watch?v=OtKxtvMUahA, and the primary Sudoku research website found at www.sudokuhints.com/research.

In all of the participating schools, the students were required to walk to the school's computer lab. None of the schools had a computer lab structure built into the traditional education classroom. Additionally, class schedules at all schools were altered in order to accommodate the research testing session in the computer lab. Technology was adequate in all schools. In one of the participating schools, however, the logon

procedure was delayed because a recent change in password structure blocked all students from accessing the internet. At least twenty minutes of downtime took place as the school attempted to find a teacher possessing the new access passwords.

Instrumentation

The research website, www.sudokuhints.com/research, was developed by Sudoku programmer, David J. Nixon, and the lead researcher of this dissertation, for the expressed purpose of time-tracking the use of restricted clues during the solving of a Sudoku problem in this experimental trial. The data collected by the research website (range of 0 – 900 seconds) functioned as the dependent variable (DV). The Sudoku website tracked every keystroke attached to a problem-solving "clue" and designated a corresponding time signature based on the number of elapsed seconds from the beginning of the simulation. The printout at the conclusion of the simulation (see Appendix A – Sample Sudoku Problem) listed every type of accessed clue (e.g., hint, big hint, solve step, solve puzzle keys) and the number of seconds from the beginning of the simulation through the use of each restricted clue.

The total number of allowable seconds in the research activity was 900 seconds (fifteen minutes). Following the Sudoku tutorial video, the Sudoku research site instructions, and the specific "ability-based" commendation script or "effort-based" commendation script, the students were given fifteen minutes (900 seconds) to work on the Sudoku activity. Some students proceeded through the entire activity without accessing a restricted clue, revealing higher levels of problem solving perseverance. A few students resorted to the usage of restricted clues within ten seconds of the initiation of the activity, revealing lower levels of problem solving perseverance. The range of

measurement was 0-900 seconds. Lower levels of perseverance yielded lower numeric scores. Higher levels of perseverance yielded higher numeric scores.

The instrument used in this inquiry (a numerical, Sudoku problem-solving activity tracked on an internet research website) was developed specifically to document the moment (in one second increments) when student perseverance to complete or continue the activity independently broke down and students no longer continued the activity without accessing clues. At the very onset of the activity, students were instructed to refrain from the use of clues, even though Sudoku clues were clearly accessible from the inception of the exercise.

Beer, Jones, and Clark (2009) support the validity of computer-based website tracking of student progress and its relationship to student engagement and perseverance in a study of online Learning Management Systems (LMS), Course Management Systems (CMS), and Virtual Learning Environments (VLE) such as Blackboard and Moodle. At Central Queensland University of Australia, Beer et. al., analyzed 45,424 students to assess LMS "engagement" compared to student progress through analysis of the number of internet system "clicks" (accessing LMS modules, interacting and communicating with other students and instructors, and submissions of required content). Analysis of LMS "clicks" indicated students with outstanding progress (finishing the course with a grade of "A") "clicked" an average of 1,145.44 during the semester. Students with average progress (finishing the course with a grade of "C") "clicked" an average of 744.09 during the semester. Students with failing status (failing to pass the course) "clicked" an average of 245.66 during the semester. Although the study did not seek a causative relationship between student engagement and perseverance to the number of "clicks"

during the semester, the study did find a strong correlation between the two elements, and the validity of the LMS data as a measurement tool for tracking student progress was confirmed.

Although "engagement" or "perseverance" can describe a wide range of student behaviors (Krause, 2005), the degree to which learners are engaged with educational activities can be a measurable outcome linked to student satisfaction and perseverance (Chen, Gonyea, and Kuh, 2008). Research by Bulger, Mayer, Almeroth, and Blau (2008) also confirm that engagement or perseverance is a measurable amount of time students are completely focused on, and participating with a learning task.

The instrument used in the Sudoku research project mirrors the focus of the Queensland engagement assessment (Beer, Jones, & Clark, 2009). Tracking the engagement of student interactions with the problem solving activity was measurable by time tracking the use of restricted clues on the research website. Since the Sudoku instrument measured the moment perseverance broke down and students began accessing restricted clues, the instrument (Sudoku website problem solving / tracking) provided validity.

Procedures

All participants were treated with respect and in an ethical manner and had the opportunity to opt out of the study at any time without malice or repercussion. No student was forced to participate in the study.

The writer operated as the lead researcher in this study and one assistant was hired to facilitate supervision of students during the school-site research phase of the project. The lead researcher was responsible for instructions and narrations preceding the problem

solving activity, and the supervision of students during the problem solving activity. The lead researcher was also responsible for the collection, storage, and analysis of data following the activity. The main responsibility of the research assistant was additional supervision of the students during the problem solving activity to ensure independent work. The assistant received two hours of training prior to participating in the experimental research. As part of the training, the research assistant participated in testing simulations prior to interaction with students. The research assistant was instructed to supervise students during the Sudoku activity in the computer lab, and was also responsible for escorting students to and from their regular classrooms and the computer lab. To maintain the integrity of the experimental procedure, the research assistant was instructed to refrain from any other type of student interaction, including the answering of any questions during the experiment. Any questions during the experimental activity were directed to the lead researcher. The only allowable questions during the problem-solving activity were related to the initial instructions of the activity.

The target population was 102 traditional sixth grade students in six Christian schools in northwestern Indiana. The designation of "Christian schools" was defined as schools declaring religious affiliation or mission. Schools in the study included Catholic, Lutheran, and independent Christian schools.

Initial consent was sought from participating principals to perform the research. Presentations regarding the study took place with each school's administrational representative prior to any conversations with school personnel, parents, or students. Letters of "intent to participate" were solicited from participating school representatives. Following the submission of the "intent to participate" forms, and approval by Liberty

University's Institutional Review Board, participating schools were contacted to arrange a short, informational meeting with potential participating sixth grade students and their classroom instructors. The lead researcher provided generalized information regarding the procedures for the experiment including a problem solving activity to be performed on an internet website. General questions related to the topic of student motivation and problem solving were answered, but the specifics of the scripted comments related to verbal "ability-cueing" and verbal "effort-cueing" were not discussed with the students. Revealing the totality of the project would endanger the validity of the results of the experiment.

The choice to restrict total access to the exact purpose of the study (comparing "ability-cueing" to "effort-cueing") relied on research deception (the omission of an important aspect of the study). No persons in the study were harmed in any way by the omission of the key element of the research question (comparing "ability cueing" and "effort-cueing" prior to task engagement). The omission of the key element was necessary to protect the validity of the project.

Following the question-and-answer session with classroom teachers and sixth grade students in the initial classroom meeting, students were introduced to the "consent form" that was necessary for participation in the project. Consent forms were distributed to all sixth grade students. Students were instructed to take the consent form home for parental or guardian review. The form requested a parent or guardian signature, and a student signature, as confirmation to participate in the research study. It was also requested that the consent form be returned to the school within five days. The sixth grade teachers became the primary collection persons for the returned "consent forms."

The researcher then scheduled a research date with each sixth grade teacher, the school office, and each school principal. The research date took place two weeks after the initial meetings at each participating school.

The lead researcher contacted each school following the five-day "return period" to check on the progress of the consent forms. Five of the schools had nearly all of the consent forms returned to the classroom teacher. One school had a very poor return rate, but the sixth grade teacher informed the researcher that she would make contact with each of the parents to get confirmation of whether their child would participate in the project. Families and students were not coerced into the study, but were contacted if the form had not been returned. Only a few families declined participation in the study and those students were exempted from the research project. Forms included the necessary assurances that participants would not be harmed physically or emotionally by participation in the experimental trial.

On the day of the active research at each school site, consent forms were collected and student rosters were acquired. Alphabetically student rosters of all sixth grade participants were used to assign random number designations to all participating students (see Appendix E – Random Number List). Student names randomly assigned to "odd" numbers were placed into the first trial group ("A"). Student names randomly assigned to "even" numbers were placed into the second group ("B"). Students in the first group were designated as the verbal "ability-cueing" group." Students in the second group were designated as the verbal "effort-cueing" group." As the study progressed from school to school, the researcher alternated the "ability-cueing" group and "effort-cueing" group as the first group to participate in the study.

All participating schools had fewer than twenty-five sixth grade students. Therefore, the entire randomized number chart (Appendix F) was not entirely utilized at one site. At subsequent school sites, the researcher continued to distribute randomized numbers from the chart based on the last number distributed at the previous school. In this way, relatively even numbers of students were placed into both experimental study groups.

Each student was assigned a research identification number prior to the experiment in the computer lab. The randomized identification number was assigned based on the school's sixth grade class rosters. The students were given a small card that included the assigned research number. The students were then separated into the even numbered group and the odd numbered group. The only other personal information gathered for the study was male or female status. Students were asked to check the appropriate male or female "box" when they entered the research website. The male or female status was not a central tenet to the current study, but could be used in a later study related to male or female responses to the ability commendation and effort commendation question.

Students in the first trial group were escorted to the school's computer lab. The second group was sequestered in another classroom where the students were encouraged to read a book, or work on a class assignment while waiting for the next opportunity to participate in the computer lab. A designated staff member of the school (usually the sixth grade homeroom teacher) was assigned to monitor the students in the sequestered classroom (as requested by the researcher and each school principal).

As stated, students participated in the problem-solving activity in their school's computer lab. Students were not allowed to work in groups or solicit aid from

classmates, the lead researcher, or the assistant researcher. Dividers were put in place between computer terminals to ensure individual work on the problem-solving activity. Students were spaced at every other computer to reduce the possibility of diffusion of information. The lead researcher and research assistant circulated throughout the computer lab during the experiment to ensure the individuality and integrity of each set of test data.

Once the participants in group "A" entered the computer classroom, the students were asked to take a seat at a computer terminal and were instructed to type the assigned identification number into the website's designated box when requested. The students were also instructed to check the appropriate box on the website designating male or female status when requested.

The lead researcher discussed the problem solving activity and presented a short video tutorial containing the rules and methodology of Sudoku problem solving. The video tutorial was entitled "How to Solve a Sudoku Game" and was located as a webpage at http://youtube.com/watch?v=OtKxtvMUahA (see Appendix F – Sudoku Instructions). The video was also downloaded on the researcher's computer in the event the "How to Solve a Sudoku Game" website was blocked by the computer lab's website security filter. The researcher provided the necessary projector, screen, and laptop computer to project video instructions for all students. The length of the video tutorial was two minutes and fifty-seven seconds. Students also received short instructions regarding the Sudoku research website, www.sudokuhints.com/research, as well as directions to type their student identification number, and their male or female status.

The lead researcher then proceeded with the reading of either the "ability-cueing" script or the "effort-cueing" script. The instructions encouraged the students to complete the Sudoku number problem, but to refrain from using restricted "clues" in order to advance progress on the activity. The scripts for each group (see Appendix G – Ability Script and Appendix H – Effort Script) were identical except for three references to "student potential for success." The first group in the school's computer lab (group "A") received pre-task "ability-based" verbal cues while the "effort-based" students were sequestered in another room. After completion of the activity with the "ability-based" group, the second group (group "B") was brought to the computer lab to receive pre-task "effort-based" verbal cues before beginning the activity.

All instructions and scripts were read with the same meter, intonation, and inflection. The scripts were identical except for three small references to either "success by ability" or "success by effort." The lead researcher was the only person responsible for reading the two scripts. Utilizing one lead reader avoided the possibility that subtle, unintended informational cues were transmitted to the student participants prior to the experimental activity. The two scripts (found in Appendix G and Appendix H) were presented in full page format to maintain the integrity of each script and for the ease of the researcher in maintaining similarity and singularity of presentation.

At the conclusion of the fifteen minute activity, the students in the first group were asked to print the results of the Sudoku activity. The researcher collected the printed copies of the Sudoku data that included time signatures of every keystroke ("clues") performed by each student during the problem-solving activity. When printer capabilities

were a problem, the assistant researcher manually transcribed the data directly from the computer screen to a hard copy.

Following the completion of the activity by the students in group "A", the lead researcher spent a few minutes discussing the Sudoku strategies that were utilized by the students during their time in the computer lab, but no information was given that would reveal the true nature of the experiment (i.e. the targeted information regarding ability-cueing and effort-cueing).

The first group (group "A") was then led to another sequestered room (Note: Students from group "A" were not brought to the same classroom containing students from group "B"). The second group of students (group "B") was brought to the computer lab. Once the students in group "B" were secure in the computer lab (and the doors were closed), the first group of students (group "A") were dismissed from their sequestered classroom location to return to their regularly scheduled classes.

The second group (group "B") was then asked to take a seat at a computer terminal and was instructed to be prepared to type their assigned identification number into the website designated box, as well as their male or female status. The lead researcher then proceeded with the Sudoku video tutorial, the website instructions, and finally, the reading of either the "ability-cueing" script or the "effort-cueing" script.

After both groups of students completed the problem-solving activity, the researcher reconvened the entire group of sixth grade students to discuss the activity. Students were debriefed regarding the "ability" and "effort" commendations. Students, sixth grade teachers, and principals (when present) were allowed an opportunity to discuss the activity, and to ask questions of the researcher.

As the research data was gathered from each school, all materials and data related to the experimental procedure were kept in a locked and secure location (a file cabinet in the researcher's home office) to prevent contamination of the data and to protect the anonymity of all schools and participants in the study.

The data related to the study was collected and analyzed over a period of weeks. When all of the data was tabulated and processed, the participants were once again, debriefed regarding the final results of the study (including the ability-cued script and the effort-cued script). The final results were submitted to participating schools in a comprehensive written report, and all participating schools were given the opportunity to invite the researcher back to the local schools to discuss any portion of the research project.

The use of restricted clues and their accompanying time signatures (from 0-900 seconds) provided the perseverance measurement tool necessary to complete the research analysis. At the completion of the activity, the students printed the results of the problem solving activity. The print-out data contained time-tracking of every "hint," "big hint, "solve step" or "solve key" that was used during the activity. To establish clear understanding of the restricted clues, the following descriptions are provided.

The "clue buttons" provided the following assistance to students during the activity (i.e. if students chose to access the "clues"). As already noted, students were instructed at the inception of the activity ***not*** to use the hints, as this was an independent activity. When the "hint" key was depressed, the student were presented with one of the nine larger 3x3 boxes highlighted in grey in the Sudoku problem. The highlighted area indicating enough information in the column, row, or 3x3 square to solve a smaller box in

that particular square on the grid. As the "big hint" key was pressed, a written clue was revealed explaining that a particular number had only one possible solution location in the larger shaded section. The "solve step" key revealed a random, individual square on the grid and placed a correct number in the square. Pressing the "solve" key immediately placed all the correct numbers instantly into all eighty-one boxes.

Each use of "hint," "big hint," "solve step" or "solve" clues received an automatic time stamp from 0 to 900 seconds. The researcher gathered the data from the time signatures of the first three accessed clues to compare the difference between the population means of the "ability-cued" group and the "effort-cued" group. The Sudoku problem was not graded for correct number placement in every "cell," as that was not the designated purpose of the study. The amount of progress on the problem at the end of the fifteen minute time frame was assessed, as that was not the purpose of the study. The targeted focus in this experiment was the time stamp of each "clue" accessed during the activity. The researcher compared each experimental group to the use of restricted clue #1, restricted clue #2, and restricted clue #3. The time-stamp attached to each of the clues quantified the moment when personal perseverance eroded and each student felt the need to access a clue to advance further progress in the activity. From the time-stamped data, the researcher was able to determine if the "effort-cued" group of students exhibited a higher level of perseverance than the "ability-cued" group.

The use of "hints" or "clues" during the activity was the key component of observation for this inquiry. The "hints" or "clues" were placed on the webpage with the designated purpose of challenging the perseverance levels of the participants. Since the students were encouraged to complete the task independently without the aid of the

"hints," "clues," or help from classmates or instructors, resorting to the use of "hints" or "clues" reflected a measurable moment of perseverance erosion.

Data Analysis

The "Usable Stats *T*-Test Package (Version 2.3)" and "Microsoft Excel" programs were used to compare statistical difference between the two samples (at each of the first three time signatures attached to accessed clues) to ascertain whether the mean perseverance values of the first population (the effort-cued group) were higher than the mean perseverance values of the second population (the ability-cued group) based on the "effort-cueing" treatment and the "ability-cueing" treatment. Note: The null hypothesis for the experimental trial stated that there would be a statistically significant, higher level of perseverance in the group commended for "ability."

The *t*-test for independent group samples determined whether a statistically significant, higher level of perseverance existed in the effort-cued group in relation to the web-tracked use of restricted clues at three separate measurement targets (i.e. use of restricted clue #1, use of restricted clue #2, and use of restricted clue #3). Time signatures ranged from 0-900 seconds. *A*nalysis at three separate measurement targets was chosen to determine if the breakdown in perseverance was significant only to the first use of a restricted clue or whether the breakdown in perseverance continued to increase. Levene's *F*-test was used to ascertain homogeneity of groups and the Kolmogorov-Smirnov Test was performed to confirm normality of groups.

For educational research, the alpha level (α) was set at 0.05. According to Howell (2008, p. 335), when using an entire population (as is the case in the current Sudoku problem-solving project), "the Central Limit Theorem almost guarantees near normality of the sampling distribution of differences between the means when large samples (n_1 and n_2 are greater

than 30) are employed." The *t*-test does not require large numbers of participants to yield statistical relevancy. In fact, statistical relevance may be established with as few as twenty-five participants in each group (Ary, Jacobs, & Sorensen, 2010). The researcher chose to include more than fifty students in each group ($n_1 = 51$, $n_2 = 51$) because "as the number of subjects increases, the likelihood that randomization will produce equivalent groups increases" (Ary et al., 2010, p. 305).

Directional one-tailed *t*-tests were utilized in the study because an effect was suspected based on previous verbal "effort-cueing" and "ability-cueing" research (Bronson & Merryman, 2009; Dweck, 2008b). The randomized, independent samples, directional *t*-test was chosen to measure the means of the effort-cued group and the ability-cued group to assess statistical significance (Ary, Jacobs, & Sorensen, 2010; Howell, 2008; McCall, 1990).

Summary of Methodology

The methodology section explained the process by which data was collected, analyzed, and reported. Directional *t*-tests were used to provide an analysis of the statistical significance of perseverance levels in two groups of students. "Usable Stats T-Test Package (Version 2.3)" and "Microsoft Excel" programs were utilized as primary statistical analysis tools. Two website-based programs were used to conduct the study. The first website contained a video Sudoku tutorial. The second website was a Sudoku problem solving activity that tracked the use of restricted clues during the experiment and measured student perseverance levels (ranging from 0-900 seconds).

CHAPTER FOUR: FINDINGS AND RESULTS

Introduction

Did pre-task verbal commendations affect student perseverance levels during a problem solving Sudoku activity? The current inquiry sought to investigate and address the pre-task commendation issue and resulted in the following research questions.

RQ1: At response target "one" (students' first reliance on an accessed clue during a problem solving activity), what was the average measureable difference (DV) in perseverance response time between students verbally commended for previous effort level prior to task engagement (IV) and students verbally commended for previous ability level prior to task engagement (IV)?

RQ2: At response target "two" (students' second reliance on an accessed clue during a problem solving activity), what was the average measureable difference (DV) in perseverance response time between students verbally commended for previous effort level prior to task engagement (IV) and students verbally commended for previous ability level prior to task engagement (IV)?

RQ3: At response target "three" (students' third reliance on an accessed clue during a problem solving activity) what was the average measureable difference (DV) in perseverance response time between students verbally commended for previous effort level prior to task engagement (IV) and students verbally commended for previous ability level prior to task engagement (IV)?

The initial research questions led to the development of a problem solving activity measuring student levels of perseverance. Perseverance was operationally defined as the

amount of time (in one second increments) a student worked on a problem-solving task (Sudoku) without accessing restricted "clues." Measurement targets of student perseverance were taken at the first, second, and third use of restricted clues. Time signatures (0-900 seconds) were recorded as the students progressed through the web-based activity. Research hypotheses and null hypotheses where developed to address the research questions.

Population and Demographics of the Study

Fourteen Christian schools in northwest Indiana were contacted as potential sites for the research project. Initially, seven schools gave verbal consent to participate in the study. Seven other Christian schools stated various reasons for lack of participation in the study including scheduling conflicts, *I.S.T.E.P.* testing (Indiana's state-wide test of academic progress), and lack of interest in the project.

As stated, seven schools initially gave consent to participate in the study; however, one of the school administrators later declined participation in the study after conferring with the local school committee. For undisclosed reasons, the school committee declined participation in the project. The school that chose not to participate in the study was a Catholic school with twenty-six sixth grade students. The final research sites included six Christian schools. Two sites were Catholic schools. Two sites were Lutheran schools. One of the sites was an independent Christian school with Baptist affiliation. The last school site was an independent Christian school with an interdenominational background. The denominational cross section of Christian schools was not a prescribed goal during the recruitment process, but nonetheless, created an interesting mix of Christian school sixth grade students.

Participants at all schools were primarily Caucasian. African American and Latino students comprised less than 15% of the total student population. Students of Asian/Pacific Islander heritage and multi-racial heritage represented less than five percent of all students in the study. The number of potential sixth grade participants in the six schools totaled 111 students. A total of 102 sixth grade students actually participated in the study. There were only nine total students within the six participating schools that did not choose to participate in the study.

There were fifty-one students randomly assigned to the "ability-cued" group and fifty-one students randomly assigned to the "effort-cued" group. A total of forty-six female students and fifty-six male students participated in the study. Four of the schools had 100% participation by their sixth grade students. The group population represented 92% of the sixth grade students in the targeted schools. Demographic information of each Christian school is presented in the following discussion.

School "A" was an independent Christian school located in a rural setting. The school contained 310 pre-kindergarten through twelfth grade students. White students comprised 88.2% of the student population while Latino students represented 8.4% of students, and 3.4% of students were Black. The school had no students receiving free or reduced meals. The school did not take the Indiana State-wide Test of Educational Progress *(I.S.T.E.P.).* School "A" had thirteen sixth grade participants. Six participants were male and seven participants were female. All of the sixth grade students at school "A" participated in the study.

School "B" was a Catholic school located in a rural setting. The school had 196 students in kindergarten through eighth grade. The school was predominantly White

(94.4%). The Black population was 2.8% with Asian/Pacific Islander population representing 2.8%. The school did not utilize the free and reduced meals program. *I.S.T.E.P.* scores revealed a combined passing rate of 85.1% for the math, reading, and language arts components. Twenty-two students participated in the research project. Thirteen students were male and nine students were female. All of the sixth grade students at school "B" participated in the study.

School "C" was the smallest school in the dissertation study with only ninety-five students in kindergarten through eighth grade. The Lutheran school was located in a rural setting just outside a major metropolitan area. Eighty-four percent of the students were White, while 10.8% of the students were Black, 2.6% of the students were Latino, and 2.6% of the students were multi-racial. The school did not participate in the state's free and reduced meals program, and the school did not administer the *I.S.T.E.P.* test. Fourteen sixth grade students participated in the research study with ten male students and four female students. All of the sixth grade students in school "C" participated in the study.

School "D" was a Catholic school located in an urban setting. The school contained 179 students in kindergarten through eighth grade. This school was the most ethnically diverse school in the study with 61.3% White students, 21.7% Black students, 11.8% Multi-racial students, and 5.2% Latino students. Students receiving free or reduced meals comprised 43.1% of the school population. The overall *I.S.T.E.P.* passing percentage for the school was 68.0% in combined math, reading, and language arts. There were twenty-one students in the study. Eleven of the students were female and ten

of the students were male. Three of the sixth grade students at school "D" chose not to participate in the study.

School "E" was an independent Christian school with Baptist affiliation located in a rural setting. The school had 254 students in pre-kindergarten through twelfth grade. The school's ethnic breakdown was composed of 91.3% White students, 2.9% Black students, 2.9% Latino students, and 2.9% Asian/Pacific Islander students. This school did not participate in the free and reduced meals program and also did not participate in the *I.S.T.E.P.* program. Eleven sixth grade students participated in the study. Six of the students were female and five of the students were male. Six of the sixth grade students at school "E" chose not to participate in the study. School "E" had the lowest participation rate of all schools.

School "F" was a Lutheran school located in an urban setting. The school contained kindergarten through eighth grade students with a total school population of 207. The school had 81.2% White students, 12.2% Black students, 2.2% Latino students, 2.2% Asian/Pacific Islander students, and 2.2% Multi-racial students. Twenty-five percent of the students participated in the free and reduced meals program. The school had an 89.7% passing rate on the *I.S.T.E.P.* test. There were twenty-one participants in the study. Eleven of the students were female and ten of the students were male. All of the sixth grade students at school "F" participated in the study.

Tests of Hypotheses

During the Sudoku problem solving activity, time signature measurements were taken from the first, second, and third usage of Sudoku "clues" in both the "ability-cued" group and the "effort-cued" group. From the onset of the activity, students were

instructed to refrain from accessing restricted clues, but it was assumed by the researcher that all students would eventually experience a breakdown in perseverance and begin accessing restricted clues. Breakdown in student perseverance to complete or continue the problem solving task independently was operationally defined and measured from the initiation of the problem solving activity to the time signatures of the first three uses of restricted clues.

Table 1

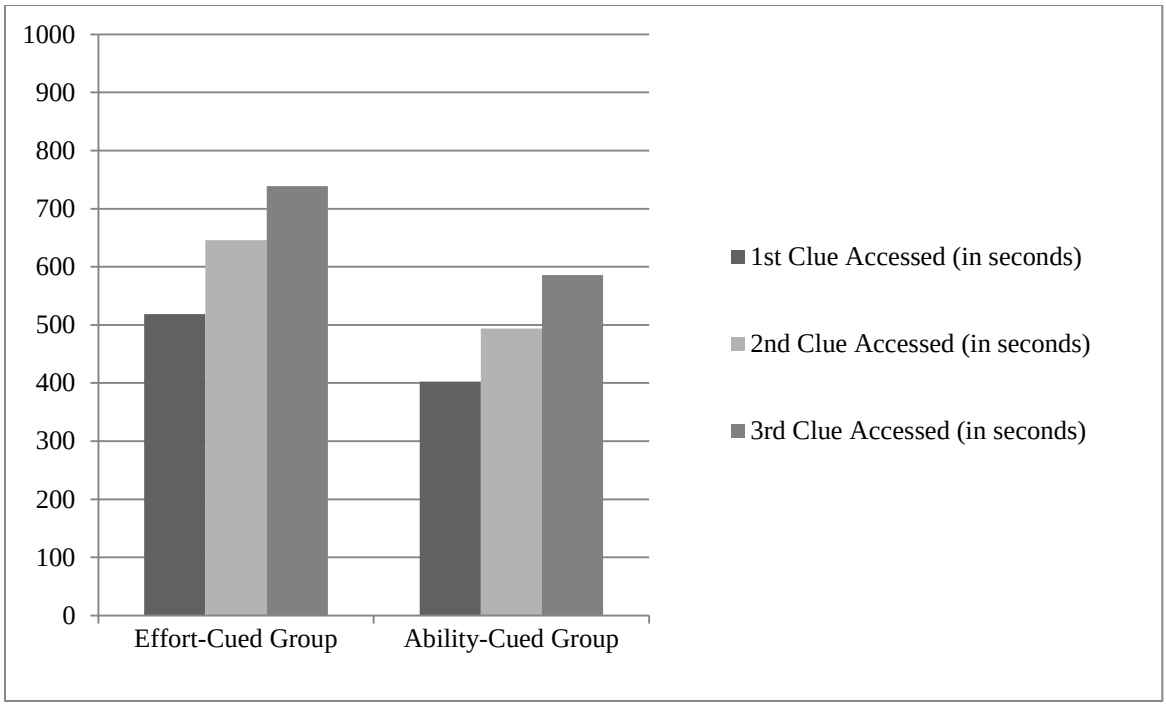
Comparison of Group Means and Standard Deviation of Effort-Cued Group and Ability-Cued Group

	Effort-Cued Group			Ability-Cued Group		
	Clue #1	Clue #2	Clue #3	Clue #1	Clue #2	Clue #3
Group Means (seconds)	518.667	645.941	738.549	402.353	494.039	586.608
Standard Deviation	310.661	287.121	249.086	293.537	296.780	285.608

Directional *t*-tests of independent group means were used to determine whether a statistically significant, higher level of perseverance was found in the time signatures of the effort-cued group compared to the time signatures of the ability-cued group at the measurement targets of the first, second, and third usage of restricted clues. The following graph illustrates the mean comparison of perseverance values for each of the first three measurement targets during the Sudoku problem solving activity.

Table 2

Mean Comparison of Accessed Clues (measured in one second increments from initiation of problem solving activity)



Inferential Findings Related to Hypothesis 1

RH1: During a numerical problem-solving activity (Sudoku), students exposed to pre-task, instructor verbal commendations related to previous student ability level will show less perseverance to complete the numerical task compared to students exposed to instructor verbal commendations related to previous student effort level (as recorded by the number of seconds between the initiation of the problem-solving activity and the first reliance on a restricted clue).

NH1: During a numerical problem-solving activity (Sudoku), students exposed to pre-task, instructor verbal commendations related to previous student ability level will show more perseverance to complete the numerical task compared to students exposed to instructor verbal commendations related to previous student effort level (as recorded by

the number of seconds between the initiation of the problem-solving activity and the first reliance on a restricted clue).

The assumptions of homogeneity of variances and group normality were tested at an alpha level of .05 and found tenable using Levene's Test, $F_{crit} = 1.60$, $F(2,100) = 1.12$, and the Kolmogorov-Smirnov Test, $p = .16$. An alpha level of .05 was used for all statistical tests. An independent samples *t*-test was then conducted to compare the dependent variable (e.g., elapsed time in one second increments from the initiation of the problem solving activity [Sudoku] to the use of the first restricted clue) in the effort-cued group and the ability-cued group. The effort-cued group ($M = 518.7$, $SD = 310.7$, $n = 51$, $P = .01$) accessed the first restricted clue (on average) 116.3 seconds later than the ability-cued group ($M = 402.4$, $SD = 293.5$, $n = 51$, $P = .19$). The results of the independent *t*-test were statistically significant, $t(2,100) = 1.94$, $p = .027$. Effect size, based on Cohen's Test (1988), $d = .39$, was small. Statistical power was .62. The 95% confidence interval for the difference between the means was -235.05 to 2.45. The researcher rejected the null hypothesis at target measurement #1.

There was a statistically significant difference between the effort-cued group and the ability-cued group at the first target measurement of time elapsed from the initiation of the problem solving activity to the use of the first restricted clue. The results suggest that the effort-cued group produced a statistically significant higher level of perseverance than the ability-cued group at the first usage of a restricted clue.

Inferential Findings Related to Hypothesis 2.

RH2: During a numerical problem-solving activity (Sudoku), students exposed to pre-task, instructor verbal commendations related to previous student ability level will

show less perseverance to complete the numerical task compared to students exposed to instructor verbal commendations related to previous student effort level (as recorded by the number of seconds between the initiation of the problem-solving activity and the second reliance on a restricted clue).

NH2: During a numerical problem-solving activity (Sudoku), students exposed to pre-task, instructor verbal commendations related to previous student ability level will show more perseverance to complete the numerical task compared to students exposed to instructor verbal commendations related to previous student effort level (as recorded by the number of seconds between the initiation of the problem-solving activity and the second reliance on a restricted clue).

The assumptions of homogeneity of variances and normality were tested at an alpha level of .05 and found tenable using Levene's Test, $F_{crit} = 1.60$, $F(2,100) = 1.07$, and Kolmogorov-Smirnov Test, $p = .019$. An alpha level of .05 was used on all statistical tests. An independent samples *t*-test was then conducted to compare the dependent variable (e.g., elapsed time in one second increments from the initiation of the problem solving activity [Sudoku] to the use of the second restricted clue) in the effort-cued group and the ability-cued group. The effort-cued group ($M = 645.9$, $SD = 287.1$, $n = 51$, $P = .01$) accessed the second restricted clue (on average) 152 seconds later than the ability-cued group ($M = 494.0$, $SD = 296.8$, $n = 51$, $P = .16$). The results of the independent *t*-test were statistically significant, $t(2,100) = 2.63$, $p = .0049$. Effect size, based on Cohen's Test (1988), $d = .52$, was small to moderate. Statistical power was .84. The 95% confidence interval for the difference between the means was -266.6 to -37.2. The researcher rejected the null hypothesis at target measurement #2.

There was a statistically significant difference between the effort-cued group and the ability-cued group at the second target measurement of time elapsed from the initiation of the problem solving activity to the use of the second restricted clue. The results suggest that the effort-cued group continued to produce statistically significant, higher levels of perseverance than the ability-cued group at the second usage of a restricted clue.

Inferential Findings Related to Hypothesis 3.

RH3: During a numerical problem-solving activity (Sudoku), students exposed to pre-task, instructor verbal commendations related to previous student ability level will show less perseverance to complete the numerical task compared to students exposed to instructor verbal commendations related to previous student effort level (as recorded by the number of seconds between the initiation of the problem-solving activity and the third reliance on a restricted clue).

NH3: During a numerical problem-solving activity (Sudoku), students exposed to pre-task, instructor verbal commendations related to previous student ability level will show more perseverance to complete the numerical task compared to students exposed to instructor verbal commendations related to previous student effort level (as recorded by the number of seconds between the initiation of the problem-solving activity and the third reliance on a restricted clue).

The assumptions of homogeneity of variances and normality were tested at an alpha level of .05 and found tenable using Levene's Test, $F_{crit} = 1.60$, $F(2,100) = 1.31$, and Kolmogorov-Smirnov Test, $p = .002$. An alpha level of .05 was used on all statistical tests. An independent samples *t*-test was then conducted to compare the dependent

variable (e.g., elapsed time in one second increments from the initiation of the problem solving activity [Sudoku] to the use of the third restricted clue) in the effort-cued group and the ability-cued group. The effort-cued group (M = 738.6, SD = 249.1, n = 51, P = .002) accessed the third restricted clue (on average) 152 seconds later than the ability-cued group (M = 586.6, SD = 285.6, n = 51, P = .04). The results of the independent t-test was statistically significant, $t(2,100) = 2.86$, $p = .0025$. Effect size, based on Cohen's Test (1988), $d = .57$, was small to moderate. Statistical power was .89. The 95% confidence interval for the difference between the means was -257.3 to -46.7. The researcher rejected the null hypothesis at target measurement #3.

There was a statistically significant difference between the effort-cued group and the ability-cued group at the third target measurement of time elapsed from the initiation of the problem solving activity to the use of the third restricted clue. The results suggest that the effort-cued group continued to produce statistically significant, higher levels of perseverance than the ability-cued group at the third usage of a restricted clue.

It was noted that the number of perseverance seconds separating the effort-cued group and the ability-cued group during the first target measurement (i.e. accessing restricted clue #1) was 116.3 seconds, while the perseverance difference between the effort-cued group and the ability-cued group in the second test (151.9 seconds) and the third test (152.0 seconds) were nearly identical. The effort-cued group continued to show higher levels of perseverance throughout the problem solving activity, but the similarity of perseverance results in the second and third trials is likely attributed to the time restraints placed on the problem solving activity. Following the initial instructions, the Sudoku tutorial, and the effort-cued or ability-cued scripts, the students were given

fifteen minutes (900 seconds) to work on the Sudoku problem solving activity. Therefore, the maximum number of seconds allowable for any participant in the activity was 900 seconds (15 minutes). Twenty-four students in the effort-cued group continued through the entire fifteen minute activity without accessing the third restricted clue. Fourteen students in the ability-cued group continued through the entire fifteen minute activity without accessing the third restricted clue. This was unexpected by the researcher. It is possible, but not substantiated (or statistically significant), that the difference in perseverance levels between the two groups would have continued to widen if the activity had been allowed to continue beyond the fifteen minute time window.

Although the general focus of the inquiry was specifically limited to the statistical significance of the first three uses of restricted clues, it was also noted that the average number of clues accessed by students in the ability-cued group was 8.3 restricted clues per student per test window. Students in the effort-cued group used an average of 4.4 clues per student per test window. Students in the ability-cued group accessed 423 total clues during the experimental trial. Students in the effort-based group accessed 224 total clues during the experimental trial. Students in the ability-cued group resorted to the use of restricted clues nearly twice as often as the students in the effort-cued group.

Summary of Findings

A total of 102 sixth grade students were randomly assigned into an ability-cued group (fifty-one students) and an effort-cued group (fifty-one students) to participate in a Sudoku problem solving activity. Previous research by Bronson and Merryman (2009), Dweck (2008a), Dweck (2008b), and Henderlong and Lepper (2002) suggested that

certain types of praise (e.g., praise for ability) can illicit an "inverse effect" on student motivation and perseverance.

During the problem solving activity, students were conditioned prior to the problem solving activity with effort commendations or ability commendations. Student perseverance levels (e.g., the ability to complete or continue the problem solving activity without accessing restricted clues) were measured at three separate targets. The three targets were the first use of a restricted clue, the second use of a restricted clue, and the third use of a restricted clue.

T-tests were performed at three testing targets to ascertain whether statistical significance could be attached to the variance in perseverance levels of the participating students. At all three measurement targets, statistical significance was found. Students commended for ability level prior to task engagement showed lower levels of perseverance. Students commended for effort level prior to task engagement showed higher levels of perseverance. Students commended for previous ability level (prior to task engagement) utilized 199 more restricted clues than the students commended for previous effort level (prior to task engagement) even though the number of students in each trial group was equal (fifty-one students in each group).

As previously stated by Dweck (2008b), students praised for their ability can develop a form of "learned helplessness" that reduces academic self-efficacy and perseverance. As noted by Bronson and Merryman (2009), students in an ability-cued group can experience an inverse reaction to praise. Students in the "praise for ability" group revealed less perseverance to continue the activity independently, and students in the "praise for ability" group requested help more frequently.

CHAPTER FIVE: DISCUSSION, SUMMARY, AND RECOMMENDATIONS

Introduction

Chapter five briefly summarizes the research inquiry presented in the previous chapters and is divided into the following sections: (a.) purpose of the inquiry, (b.) restatement of the problem, (c.) methodology review, (d.) discussion of the results, (e.) implications of relevant literature, (f.) inquiry limitations, (g.) recommendations for future practice, (h.) recommendations for future research, and (i) conclusion.

Purpose

The purpose of this study was an analysis of two groups of traditional, general education sixth grade students exposed to instructor verbal commendations for previous, personal "ability levels" and verbal commendations for previous, personal "effort levels" prior to the initiation of a Sudoku problem solving activity. The study extended previous research by Dweck (2000b) indicating perseverance was increased as students were verbally commended for previous effort levels prior to academic task engagement; while students commended for previous ability levels prior to academic task engagement revealed lower levels of perseverance.

The inquiry was investigated through the implementation of a web-based problem solving activity (Sudoku) that tracked student use of restricted clues. The use of restricted clues defined the moment when student perseverance eroded and students could no longer progress on their own without assistance. The following research questions were adopted to guide the development of the inquiry:

RQ1: At response target "one" (students' first reliance on an accessed clue during a problem solving activity), what was the average measureable difference (DV) in

perseverance response time between students verbally commended for previous effort level prior to task engagement (IV) and students verbally commended for previous ability level prior to task engagement (IV)?

RQ2: At response target "two" (students' second reliance on an accessed clue during a problem solving activity), what was the average measureable difference (DV) in perseverance response time between students verbally commended for previous effort level prior to task engagement (IV) and students verbally commended for previous ability level prior to task engagement (IV)?

RQ3: At response target "three" (students' third reliance on an accessed clue during a problem solving activity) what was the average measureable difference (DV) in perseverance response time between students verbally commended for previous effort level prior to task engagement (IV) and students verbally commended for previous ability level prior to task engagement (IV)?

The inquiry was a quantitative analysis of a post-test only two-group, randomized experimental project. Independent group directional *t*-tests were used to analyze whether a statistically significant difference existed between the means of two randomized groups. Levene's *F*-test was used to ascertain homogeneity of groups and the Kolmogorov-Smirnov Test was performed to confirm normality of groups. Based on the literature review, the following research hypotheses and null hypotheses were developed related to the research questions:

RH1: During a numerical problem-solving activity (Sudoku), students exposed to pre-task, instructor verbal commendations related to previous student ability level will show less perseverance to complete the numerical task compared to students exposed to

instructor verbal commendations related to previous student effort level (as recorded by the number of seconds between the initiation of the problem-solving activity and the first reliance on a restricted clue).

RH2: During a numerical problem-solving activity (Sudoku), students exposed to pre-task, instructor verbal commendations related to previous student ability level will show less perseverance to complete the numerical task compared to students exposed to instructor verbal commendations related to previous student effort level (as recorded by the number of seconds between the initiation of the problem-solving activity and the second reliance on a restricted clue).

RH3: During a numerical problem-solving activity (Sudoku), students exposed to pre-task, instructor verbal commendations related to previous student ability level will show less perseverance to complete the numerical task compared to students exposed to instructor verbal commendations related to previous student effort level (as recorded by the number of seconds between the initiation of the problem-solving activity and the third reliance on a restricted clue).

Consequently, the following null hypotheses were constructed to test the level of perseverance variance between the groups, and to gather evidence of potential statistical significance.

NH1: During a numerical, problem-solving activity (Sudoku), students exposed to pre-task, instructor verbal commendations related to previous student ability level will show more perseverance to complete the numerical task compared to students exposed to verbal commendations related to previous student effort level (as recorded by the number

of seconds between the initiation of the problem-solving activity and the first reliance on a restricted clue).

NH2: During a numerical, problem-solving activity (Sudoku), students exposed to pre-task, instructor verbal commendations related to previous student ability level will show more perseverance to complete the numerical task compared to students exposed to verbal commendations related to previous student effort level (as recorded by the number of seconds between the initiation of the activity and the second reliance on a restricted clue).

NH3: During a numerical, problem-solving activity (Sudoku), students exposed to pre-task, instructor verbal commendations related to previous student ability level will show more perseverance to complete the numerical task compared to students exposed to verbal commendations related to previous student effort level (as recorded by the number of seconds between the initiation of the activity and the third reliance on a restricted clue).

Restatement of the Problem

As previously expressed by Bronson and Merryman (2009), Dweck (2008a), Dweck (2008b), Elwell and Tiberio (1994), Henderlong (2000), Henderlong and Lepper (2002), and Marzano (2011), "praise" potentially exists as both a motivating factor or a de-motivating factor based on student interpretations of verbal interactions between classroom instructors and students. The problem to be investigated was the influence of teacher verbal cues specifically related to two forms of praise; praise focusing on student "ability level" prior to task engagement, and praise focusing on student "effort level" prior to task engagement. Did praise for student "ability" level prior to task engagement

erode academic perseverance, and did praise for student "effort" level prior to task engagement enhance academic perseverance?

Methodology Review

Chapter Three described the quantitative analysis of a post-test only two-group, randomized experimental project. A total of 102 sixth grade students were randomly assigned to either of two groups (an effort-cued group and an ability-cued group). Students were exposed to ability commendations or effort commendations immediately prior to a web-based problem solving activity (Sudoku). A web-based program tracked student perseverance levels by noting the time signatures of restricted clue access (e.g., breakdown in perseverance to complete or continue the activity independently). Levene's *F*-test and the Kolmogorov-Smirnov test were used to compute normality and equality of variance between the groups. Levels of significance between the two groups were determined using directional *t*-tests around the means of each group at three independent time measurement targets.

Discussion of Results

The impetus for this study was the suggestion that certain types of praise (e.g., praise for "smartness" or ability) could cause an inverse motivational effect. Intuitively speaking, human logic endorses the notion that praising students for their ability would be an inherently "good" thing. It seems logical that praising "ability" would create good feelings and higher self-esteem. In turn, higher self-esteem should logically move students to higher achievement levels. But Bronson and Merryman (2009), Dweck (2008a, 2008b), Henderlong (2000), and Henderlong and Lepper (2002) have come to the conclusion that what seems logical may not have a valid and reliable foundation.

New research challenges the classroom educator to consider the possibility that praise for "smartness" or praise for "ability" may actually have a debilitating effect on students as they clamor to protect the outward appearances and inward perceptions of "smartness" (Dweck, 2000; Pajares & Schunk, 2001). Drawing from Mannheim (2010), adolescent students believe that their life is a perpetual stage, and that peer judgments are constantly occurring. It is not surprising that the adolescent perception of daily "microscopic judgment" causes students to protect outward appearances of ability or "smartness." Within this complex context, the dissertation researcher initially questioned the premise that a slight shift in verbal commendations could produce a significant shift in student self-efficacy and perseverance (Kamins & Dweck, 1999). The research activity sought to reinforce or refute the current research of Bronson and Merryman (2009), Dweck (2008b), Henderlong (2000), related to the "inverse power of praise."

At the onset of the research activity, it became readily apparent that the sixth grade students were very interested in participating in the research project. However, some students immediately showed trepidation as they discovered that a Sudoku problem would be the focus of inquiry. Some students had never worked with a Sudoku problem. Some students immediately expressed that their mathematics ability was not good enough to work on the problem. The researcher encouraged the students to do their best despite their apprehensions. Both groups possessed students that ***loved*** Sudoku problems, ***hated*** Sudoku problems, were ***indifferent*** to Sudoku problems, or had never even heard of a Sudoku problem. Even before the research activity began, it was evident that student perceptions of ability (or inability) negatively influenced both groups (Bernabei, Cody, Cole, & Sweeney, 2008, Collins, 1982).

It was initially feared that the wide range of "feelings" toward Sudoku problems might lead to inaccurate variance in the project. Levene's test was helpful in discovering that the randomized groups held similar variance (Gastwirth, Gel, & Miao, 2009). This provided confidence that the various student perceptions toward the Sudoku problem did not adversely alter the findings.

As soon as the first trial was performed at the first school, it became apparent that the students pre-conditioned with effort commendations generally worked a bit longer on the Sudoku problem activity without using the restricted clues than students pre-conditioned with ability commendations (Dweck & Leggert, 1988). However, each group always seemed to have a number of students that completely reversed the trend. There were students in both groups that worked the entire fifteen minutes (900 seconds) without resorting to the use of restricted clues, and there were students in both groups that accessed clues within the first two minutes of the activity.

Throughout the week of testing, visual scanning reinforced the research hypothesis that the effort-cued group would show higher levels of perseverance. Though not statistically significant, it was also noted that the students in the "praise for ability" group tended to have "wandering eyes" during the activity (i.e., the tendency to look around the room). Students in the "praise for ability" group appeared to be looking for additional help from classmates, the research assistant, or the dissertation researcher. After the final testing window was closed at the sixth school, the data was analyzed and the following results were noted:

1.) The null hypothesis for the first measurement stating that the ability-cued group would show higher levels of perseverance was rejected (based on the first use of a

restricted clue measured in one second increments from the initiation of the activity). The ability-cued group (M = 402.4, SD = 293.5, n = 51) accessed the first restricted clue (on average) 116.3 seconds sooner than the effort-cued group (M = 518.7, SD = 310.7, n = 51). The results of the independent t-test were statistically significant, $t(2,100) = 1.94$, $p = .027$.

2.) The null hypothesis for the second measurement stating that the ability-cued group would show higher levels of perseverance was rejected (based on the second use of a restricted clue measured in one second increments from the initiation of the activity). The ability-cued group (M = 494.0, SD = 296.8, n = 51) accessed the second restricted clue (on average) 152 seconds sooner than the effort-cued group (M = 645.9, SD = 287.1, n = 51). The results of the independent t-test were statistically significant, $t(2,100) = 2.63$, $p = .0049$.

3.) The null hypothesis for the third measurement stating that the ability-cued group would show higher levels of perseverance was rejected (based on the third use of a restricted clue measured in one second increments from the initiation of the activity). The ability-cued group (M = 586.6, SD = 285.6, n = 51) accessed the third restricted clue (on average) 152 seconds sooner than the effort-cued group (M = 738.6, SD = 249.1, n = 51). The results of the independent t-test were statistically significant, $t(2,100) = 2.86$, $p = .0025$.

For educational research, the alpha level was set at .05. At the conclusion of the research analysis, it was discovered that the results of the second and third measurement targets were not only statistically significant at an alpha < .05 level, but revealed high statistical significance at an alpha < .01 level.

Though anecdotal, the following observations were noted as significant to the study. In two separate schools, two female students in each school had never worked with Sudoku problems in the past. The four female students (two in each school) expressed tremendous fear of participating in the problem solving activity. The feelings of the students were unknown to the researcher prior to the initiation of the testing window. Ironically, the following scenarios were nearly identical in both schools.

During the trial at the first school, a female student raised her hand and the dissertation researcher responded to the student. The female student said she still didn't understand how to work with the problem. The female student next to her immediately raised her hand and chimed she didn't understand what to do either. By methodology rules, all the researcher could do was reinforce the original Sudoku instructions. Strangely, a nearly identical situation took place at the fifth participating school later in the research week. Another female student raised her hand, and stated the same concerns as the female student from the previous school earlier in the week. The female student said she still didn't understand how to work the problem. Immediately, the female student next to her raised her hand and stated that she, as well, still did not understand how to work the problem. The researcher responded by reinforcing the original Sudoku problem solving rules.

It was not surprising that some of the students were unfamiliar with Sudoku problems or had fears about attempting to solve Sudoku problems. The surprising phenomenon was that the first set of female students (at the first school) had been randomly assigned to the ability-cued group and the other set of female students (at the

fifth school later in the week) had been randomly assigned to the effort-cued group, yet the verbal responses of the girls were nearly identical.

The significance of the anecdote is that the female students in the effort-cued group worked on the Sudoku problem solving activity for nearly ***four minutes*** on their own before asking for assistance from the researcher. The girls looked at the Sudoku problem as a "challenge to be mastered" rather than a threat to be avoided (Bandura, 1977). The female students in the effort-cued group did not access any clues during the four minutes, but kept trying to understand the methodology of Sudoku problem solving on their own.

The two female students from the subsequent school that had been randomly placed into the ability-cued group had worked independently on the Sudoku problem for less than ***ten seconds*** before their perseverance level was exhausted and they decided it was impossible to continue. Dweck (2008a) would describe the behavior of the "ability-cued" set of girls as a form of "learned helplessness." Though this situation was not quantifiably measurable, nor statistically significant, it did draw considerable attention to the possibility that ability commendations prior to task engagement had reduced the level of perseverance in one group of girls, and effort commendations prior to task engagement increased the level of perseverance in the other set of girls (Dweck, 2008b). It also reinforced the concept that "effort" is a malleable trait leading to greater ability level (Multon, Brown, & Lent, 1991).

The results of this study reinforced research performed by Bronson and Merryman (2009), Dweck (2008a), Dweck (2008b), Henderlong (2000), and Henderlong and Lepper (2002). All three independent, targeted measurements revealed statistical significance. All three targeted measurements revealed data supporting the inverse power of ability-

cueing on student perseverance levels. Notably, the two groups of female students in the previous scenario also highlighted the impact of ability-cueing on academic self-efficacy and perseverance. Almost immediately, the female students randomly assigned to the ability-cued group experienced a break-down in perseverance, and a complete collapse in academic self-efficacy to attempt the problem solving activity independently. Negative self-perceptions immediately reduced academic performance (Bernabei, Cody, Cole, & Sweeney, 2008).

As Covey (1998) has stated, the development of self-efficacy and perseverance is a constant battle between "will-power" and "won't-power" and is regularly reinforced by positive student interactions with classroom instructors (Marzano, 2011). The female students in the ability-cued group gave up on the problem solving project even before they attempted to work on the Sudoku problem. Conversely, the two female students assigned to the effort-cued group showed academic self-efficacy and higher levels of perseverance even though they had little background knowledge to solve or continue the problem on their own. A heightened sense of self-efficacy helped to sustain task motivation leading to greater perseverance in the face of adversity (Schunk, 1983).

Implications of Relevant Literature

Throughout the current investigation of verbal praise cues, three research sources influenced the development of thesis, research questions, and experimentation. Bronson and Merryman (2009) chronicled the potential "inverse power of praise" and reported that children rewarded for their "smartness" often under-perform, struggle with new skills, and spend significant portions of their energy attempting to reinforce the appearance of "smartness" in front of classmates, teachers, and parents. Henderlong

(2000) noted, "Ability feedback may be a cheap commodity that may produce the desired outcome in the short-run, but may set the stage for disaster when the child is later confronted with inevitable minor failures" (p. 16).

Dweck (2008b) provided a solid framework for the current inquiry when suggesting that students rewarded specifically for previous "ability" tended to value protection of their "ability status" above the process of learning and achieving. Students rewarded for their previous "effort level" valued challenge and the potential to learn (Bandura, 1977). All three major contributors suggested that the practice of rewarding students for ability level leads students to adopt a maladaptive view of success leading to learned helplessness, lack of perseverance, and fear of new challenges (Henderlong & Lepper, 2002). Conversely, students rewarded for previous effort level generally moved toward greater independence, greater levels of persistence, and a view that achievement is a skill to be developed (McCabe, 2008).

The results of the current study further reinforce the findings of Bronson and Merryman (2009), Dweck, (2008b), and Henderlong and Lepper (2002). The current inquiry supported previous research indicating greater levels of perseverance and self-efficacy are experienced when students are exposed to effort commendations prior to task engagement. Additionally, students exposed to ability commendations prior to task engagement experience lower levels of perseverance and self-efficacy.

Though the findings of this study do not indicate any "magical key" to unlock student perseverance, self-efficacy, classroom success or a panacea for all conditions related to academic achievement, the subtle shift in verbal commendation cues does appear to possess potential to re-direct student mindsets toward a more successful

outcome. The statistical significance of higher levels of perseverance in students exposed to pre-task effort commendations encourages classroom educators to re-think the methodology of the "praise component" in the classroom. Based on the research findings, it is clear that "praise for effort" created higher levels of perseverance and "praise for ability" produced lower levels of perseverance.

Limitations

An originally acknowledged limitation of the study remained true throughout the inquiry. Although statistical significance was shown that bolstered previous research suggesting effort commendations were superior to ability commendations in developing higher levels of student perseverance, it was recognized that the current study was performed with sixth grade students attending Christian schools in northwestern Indiana. This study bears relevance to the current study group, but correlations to other groups (e.g., public schools, various socio-economic groups, and other grade levels) may or may not yield similar results. Further research is necessary. It is interesting to note, however, that the results of the current study were consistent with previous research by Dweck (2008b) illuminating similar results in other group settings.

Another limitation of the study was the number of students and schools in the study. Six schools and 102 sixth grade students participated in the research project. This was by no means a small study, but the researcher would have enjoyed an extension of the activity into a greater number of schools and a larger pool of students. Although statistical significance was attached to each of the independent *t*-tests of the current study, it would have been interesting to follow the results through a much larger group of students to further confirm the continued strength of "effort commendations" as superior

to "ability commendations" in developing higher levels of academic perseverance. However, the expense and time constraints of a larger study made it unfeasible for the researcher to expand the limits of the study beyond its current scope. From a qualitative viewpoint, it would have been interesting to perform a follow-up interview or questionnaire with the students to gather a better understanding of student "self-perceptions" ***following*** the completed activity.

Validity limitations were addressed in the following ways. "Experimenter effects" were minimized by rehearsed reading of all scripts with the same voice inflection throughout the presentation. Limiting student questions during the activity also reduced the potential of unintentionally biasing the students toward a particular outcome. "Diffusion," "contamination," and "subject effects" were minimized by sequestering and supervising the students in the two randomized groups. Participants in the "effort-cued" group never interacted with the students in the "ability-cued" group until after the experimental trial was completed at the host school. No group experienced the possibility of influencing the other group.

Technology in some schools was also challenging. Even though the researcher contacted the schools prior to the research phase of the project to confirm that the technology needs of the project could be accommodated at the host schools, several of the schools encountered printer issues that kept the researcher from printing the results of each testing session directly to hard copy. In these cases, the research assistant was required to manually record the data directly from the computer screen following each session. No data was lost due to printer problems because the "printer contingency plan" was already put in place prior to the initiation of the experimental research phase.

Manual data retrieval forms were prepared before the research visits to the schools. The manual data retrieval forms were used at three of the school research sites. Had the contingency protocol not been put in place prior to the research phase of the project, the data could easily have been lost by the students logging off the computers before the critical data was retrieved. Fortunately, all schools in the study were flexible in regard to time constraints, and the manual retrieval of data was not a time issue.

In retrospect, the entire experimental research phase of the project might best be suited to a university research site or a lab school. This would have given the researcher greater control over the accessed data as it was produced. Technology could have been a severe limitation to the study. However, it is also noted that moving all student participants to a separate research facility might be financially and logistically restrictive, and could also produce threats to validity.

It was also an interesting, and possibly limiting factor, that private parochial schools were only used in the study. As the research project progressed, the researcher began to question whether the students in a private, parochial setting might initially tend to have greater perseverance and overall higher academic self-efficacy levels than the average public school sixth grade class. Generally speaking, parents of private, parochial school students might have higher expectations for their children than the average public school classroom. Though the question is a moot point at this time in the inquiry, it does bear scrutiny. However, since the results of the inquiry have been specifically stated as bearing statistical relevance only to Christian school, sixth grade students in northwestern Indiana, the concerns of private parochial school versus public school findings are minimized.

Sudoku knowledge prior to the experiment could also be viewed as a limitation to the study. The researcher attempted to minimize the prior knowledge factor by presenting a Sudoku video tutorial prior to the activity. The size of the randomized test group (102 total sixth grade students) also helped with the previous knowledge limitation. Due to the large group of students, and the relative homogeneity of the two randomized groups, it was assumed that the two groups presented an even distribution of students with no Sudoku knowledge, some Sudoku knowledge, and advanced experience with Sudoku problems.

It was noted earlier in this dissertation that the expressed purpose of the Sudoku problem solving activity was an examination of the impact of ability-based commendations and effort-based commendations on student perseverance levels, and that accuracy of number placement in the Sudoku problem was not a focus of inquiry. Upon completion of the project, it was acknowledged that the lack of focus on the accuracy issue could be viewed as a limitation to the study. Although perseverance levels were the focus of the problem solving activity, the importance of accurate placement of answers in the Sudoku problem should not be minimized.

Another limitation to the study was the lack of "within groups" analysis. The independent groups, t-test measurement provided statistically significant analyses of the "between groups" difference, but did not address any "within groups" variances. Attention to "within groups" analysis may have provided additional insight into the overall discussion of student perseverance levels in the groups contained within this study.

Perhaps the greatest unforeseen limitation experienced by the researcher was the length of time required for the experimental activity. Following the instructions, Sudoku video tutorial, and the scripted "ability-based commendations" and "effort-based commendations," the students were given fifteen minutes (900 seconds) to work on the Sudoku, problem solving activity. The dissertation researcher was surprised to find that a number of students in both the effort-cued group ***and*** the ability-cued group progressed through the entire fifteen minute activity without accessing any clues. It was originally hypothesized by the researcher that the difficulty level of the Sudoku problem and the lack of previous experience with Sudoku would cause ***ALL*** students to access restricted clues within the fifteen minute time frame. This was not the case. Twenty-four students in the effort-cued group (nearly half of the students in the effort-cued group) progressed to the conclusion of the fifteen minute time frame without accessing any clues. Fourteen students in the ability-cued group (approximately one-fourth of the ability-cued group) progressed to the conclusion of the fifteen minute activity without accessing any clues.

Although the effort-cued group had nearly twice the number of students that progressed through the activity without accessing any restricted clues, it would have been interesting to see what the results would have been if the activity had been expanded to twenty or thirty minutes. Would the effort-cued group have continued to show greater perseverance if an extended activity time had been utilized? Would there have been students in both groups that would have refrained from using restricted clues regardless of the time frame of the activity? These are impossible questions to answer, but further experimentation for a thirty minute problem solving activity would be of interest to the researcher.

Recommendations for Future Practice

Throughout the literature review the complicated nature of "praise" was encountered (Bronson & Merryman, 2009). Praise that focuses on student ability has been shown to reduce student resiliency, increase student dependency, and decrease student perseverance (Kamins & Dweck, 1999). It is a relatively small concession on the part of classroom instructor to reduce verbal references focusing specifically on student ability. Reducing "ability-reinforcement" and increasing "effort-reinforcement" has shown to enhance student motivation, perseverance, and self-efficacy levels (Dweck & Leggert, 1988). In an educational world where every academic gain is meaningful, the strategy of using effort cueing instead of ability cueing holds promise for student academic progress in the classroom. As students view current "ability" as the only finite measurement instrument of academic achievement, the process of cultivating academic perseverance becomes problematic, personally challenging, and static (Collins, 1982; Daniels, 2005). When students view current "effort" as a malleable, enlightening tool for academic growth, academic cultivation becomes a continual work in progress where no goal is ever out of reach (Bandura, 1977; Multon, Brown, & Lent, 1991).

Recommendations for Future Research

Dweck (2008) performed significant research in the field of student mindsets, the development of appropriate use of praise in the classroom, and the development of academic perseverance. Bronson and Merryman (2009) continued the study with different ways of thinking about children and motivation, including the concept of the "inverse power of praise." The current research project reinforced the findings of both researchers and authors. However, it is common to encounter parents and teachers using

the type of praise cues that continue to contribute to student dependency and maladaptive behaviors (Henderlong & Lepper, 2002). Ability-praise does not contribute to student resiliency (Henderlong, 2000).

Additional research projects need to be performed to further validate the importance of focusing on verbal effort-cueing. Suggested studies for further research would include public school classrooms at all grade levels. Additional effort-cueing studies will further validate and draw additional attention to the effort-cueing versus ability-cueing question.

As stated in the literature review, numerous studies have been performed correlating perseverance levels and verbal cueing as they relate to special academic and athletic settings. These areas include students with disabilities (Borders, Earlywine, & Huey, 2004), English as a second language students (Chan, 2006), sports teams (Crust, 2007; Jordan, 1999), graduate students (Turnock, Rosen, & Kaminski, 1998; Young & Ley, 2002), students in remedial programs (Klassen, 2002; Konrad, Fowler, Walker, Test, & Wood, 2007), and students in "Talented and Gifted" (T.A.G.) programs (Gardynik & McDonald, 2005; Reis, Neu, & McGuire, 1997). Additional research needs to take place in the general education classroom targeting effort-commendations. Of particular interest to the researcher would be an effort-cueing study with eighth grade students prior to entrance into high school, ninth grade students entering high school, and effort-cueing studies with students in extremely low socio-economic settings.

As stated in the limitations section, accuracy in the Sudoku problem solving activity was not examined. Further research is warranted to examine the relationship

between ability-based and effort-based verbal commendations, problem solving accuracy and student perseverance levels.

Additional research is also suggested for "within groups" studies. Whereas the current study focused specifically on the "between groups" effect of ability-based and effort-based verbal commendations and perseverance levels, additional insight could be gained by studying the way each group responded to the problem-solving activity. Of particular interest would be an additional study of the dynamics and variances within each group and a follow-up problem solving activity to examine consistency of perseverance responses within each group.

Finally, ancillary data in the current inquiry may later examine the difference in perseverance levels (if any) in the way female students and male students responded to the problem solving activity after being exposed to effort-commendations and ability-commendations. Although the focus of the current project did not entertain the male versus female response to the question, the collected data did include male and female designations.

Conclusion

The classroom educational process is a complicated venture when so many factors influence a student's daily progress. Bandura (1977) captured the complex nature of student academic development when describing the triadic interaction between environmental, personal, and behavioral factors. These factors interact to produce widely varying viewpoints of life and the classroom. These viewpoints may be positive or negative. Vygotsky (1978) further illuminated the complexity of student development when addressing the social nature of learning. Human beings need social and academic

interaction between peers, mentors, teachers, and other caring adults to fully develop the potential of the individual. It is within the zone of proximal development that students learn to emulate the actions of others. Learning is a process of self-discovery and self-development into a totally unique and emotionally healthy human being.

Within this context, perceptions of reality can be keenly accurate or wildly skewed (Amen, 1998; Bernabei, Cody, Cole, & Sweeney, 2008; Daniels, 2005). The process of interpreting the learning environment and communicating with other individuals shapes academic destiny (Marzano & Marzano, 2003). And yet, signals often become confused. Kind gestures are sometimes misinterpreted. A nurturing teacher may be viewed as domineering or condescending by a student possessing a weak self-concept and poor self-esteem (Marzano, 2011).

The current study examined perseverance and its relationship to verbal commendations with sixth grade students during a problem solving activity. Sixth grade students were chosen for the study because of their unique developmental stage of life. Adolescents are a study in contradictions (Theirs, 2005). Their bodies experience dramatic hormonal and physiological changes. They are no longer children. They are not yet adults. They seek freedom and independence at the same time they seek protection and insulation (Buck, 2000). Immature brain development in the pre-frontal cortex entices the student to adopt feelings of invincibility (Inlay, 2005). Feelings of anger, frustration, love, and compassion are more intense. It is easy for the adolescent student to make bad choices (Price, 2005; Steinberg, 2011). It is common for the adolescent student to feel that every movement, every action, and every word from their mouth is being hyper-scrutinized by peers and adults (Daniels, 2005; Mannheim, 2010). In this context

it is no surprise that adolescent students often misinterpret verbal interactions with adult role models. Self-concept is often out of balance with reality and lack of self-esteem leads many adolescents to "feel" that the whole world is against them.

The average teacher in a middle school or junior high classroom walks into the room each day with aspirations of communicating messages of affirmation and encouragement. Unfortunately, the mindsets of many adolescent students are not prepared to accept the affirming comments of the classroom teacher. And yet, it is vital that the classroom teacher provides the appropriate encouragement necessary to facilitate positive academic development in the adolescent student (Marzano, 2011).

And this is where the literature review meets the research inquiry. Adolescent students are keenly aware when teachers offer praise that is insincere (Dewar, 2008; Kohn, 1994). Adolescents are not usually affirmed by public praise, as it often becomes an impetus for negative peer interaction (Bronson & Merryman, 2009). Adolescents do not want praise for a task that is too easily performed (Henderlong, 2000). Adolescent students need praise for tasks that show autonomy (Deci, Vallerand, Pelletier, & Ryan, 1991). "Over-praising" children results in diminished returns as students develop higher levels of apathy, lethargy, and lower goal-setting (Graham, 1987; Kamins & Dweck, 1999). It is a complicated milieu for the instructor of adolescent students, yet the results of the current study indicate a positive relationship between praise based on verbal commendations relating to previous student effort levels and the development of higher levels of perseverance.

Student self-efficacy and perseverance can be increased by appropriate verbal commendations. This study highlighted a statistically significant increase in academic

perseverance levels in sixth grade students exposed to pre-task verbal commendations related to previous effort levels. "Effort" is a malleable quality. It can be nurtured and shaped. "Effort is trait that students have the ability to change (Dewar, 2008). Students should be encouraged to develop those traits that are within their power to control.

Sullo (2007) has stated that adolescent students have a psychological mindset that naively endorses "personal perception" *as* "total reality." Classroom teachers stand at the gateway of student achievement and possess the unique opportunity to shift student perceptions of reality (Neihart, 2006; Pajares & Schunk, 2001) to a healthier and, perhaps, more accurate view of self. Sincere and realistic effort commendations prior to academic engagement provide another avenue for teachers to guide students to a healthier and more productive "perception" of academic perseverance.

REFERENCES

Amen, D. G. (1998). *Change your brain, change your life: The breakthrough program for conquering anxiety, depression, obsessiveness, anger, and impulsiveness*. New York, NY: Three Rivers Press.

Anderman, L. H., & Midgley, C. (1997). Motivation and middle school students. In J. L. Irvin (Ed.), *What current research says to the middle level practitioner* (pp. 41-48). Columbus, OH: National Middle School Association.

Ares, N., & Gorrell, J. (2002). Middle school students understanding of meaningful learning and engaging classroom activities. *Journal of Research in Childhood Education, 16*(2), 263.

Ary, D., Jacobs, L. C., & Sorensen, C. (2010). *Introduction to research in education* (8th ed.). Belmont, CA: Wadsworth, Cengage Learning.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191-215.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.

Bandura, A. (2001). Social cognitive theory: An agentic perspective. *Annual Review of Psychology*, *52*, 1-26.

Barker, G. P. & Graham, S. (1987). Developmental study of praise and blame as attributional cues. *Journal of Educational Psychology, 79*(2), 62-66.

Barnes, K. L. (2004). Applying self-efficacy theory to counselor training and supervision: A comparison of two approaches. *Counselor Education and*

Supervision, 44(1), 56-69.

Bartholomew, B. (2008). Why we can't always get what we want. In F. Schultz (Ed.), *Education annual editions 08-09* (pp. 61-65). New York, NY: McGraw-Hill Contemporary Learning Series.

Baumeister, R. F., Hutton, D. G., & Cairns, K. J. (1990). Negative effects of praise on skilled performance. *Basic and Applied Social Psychology, 11*(2), 131-148.

Beer, C., Jones, D., & Clark, K. (2009). *The indicators project identifying effective learning: adoption, activity, grades and external factors*. Paper presented at ASCILITE 2009, Auckland, New Zealand. Retrieved from http://indicatorsproject.wordpress.com/2009/10/09/the-indicators-project-identifying-effective-learning-adoption-activity-grades-and-external-factors/.

Beers, B. (2006). *Learning driven schools*. Alexandria, VA: Association for Supervision and Curriculum Development.

Bernabei, P., Cody, T., Cole, Ma., Cole, Mi., & Sweeney, W. (2008). *Top twenty teens*. (2nd ed.). St. Paul, MN: Top 20 Press.

Blanck, P. D., Reis, H. T., & Jackson, L. (1984). The effects of verbal reinforcement of intrinsic motivation for sex-linked tasks. *Sex Roles, 10*(6), 369-386.

Bodenhorn, N., & Skaggs, G. (2005). Development of the school counselor self-efficacy scale. *Measurement and Evaluation in Counseling and Development, 38*(1), 14-29.

Boekaerts, M. (2006). Self-regulation and effort investment. In W. Damon & R. M. Lerner (Eds. in Chief), K. A. Renninger & I. E. Sigel (Vol. Eds.), *Handbook of*

Child Psychology. Vol. 4: Child Psychology in Practice (pp. 345-377). New York: Wiley.

Bong, M. (1996). Problems in academic motivation research and advantages and disadvantages of their solutions. *Contemporary Educational Psychology, 21*, 149-165.

Borders, A., Earleywine, M., & Huey, S. J. (2004). Predicting problem behaviors with multiple expectancies: Expanding expectancy-value theory. *Adolescence, 39*, 539-551.

Bronson, P. & Merryman, A. (2009). *NurtureShock: New thinking about children*. New York, NY: Twelve – Hachette Book Group.

Broussard, S. C. & Garrison, M. E. B. (2004, December). The relationship between classroom motivation and academic achievement in elementary school-aged children. *Family and Consumer Research Journal., 33*(2), 106-120. doi: 10.1177/1077727X04269573

Buck, N. (2000). *Peaceful parenting*. San Diego, CA: Black Forest Press.

Bulger, M. E., Mayer, R. E., Almeroth, K. C., & Blau, S. D. (2008). Measuring learner engagement in computer-equipped college classrooms. *Journal of Educational Multimedia and Hypermedia, 17*(2), 129-143.

Cameron, J., & Pierce, W. D. (1994, Fall). Reinforcement, reward, and intrinsic motivation: A meta-analysis. *Review of Educational Research, 64*(3), 363-423. doi: 10.3102/00346543064003363.

Chan, D. W. (2006). Adjustment problems, self-efficacy and psychological distress among Chinese gifted students in Hong Kong. *Roeper Review, 28*(4), 203-209.

Chen, P. S. D., Gonyea, R., & Kuh, G. (2008, February/March). Learning at a distance: Engaged or not? *Innovate: Journal of Online Education, 4*(3). Retrieved from http://innovateonline.info/index.php?view=article&id=438&action=login.

Christensen, T. B., Fogarty, T. J., & Wallace, W. A. (2002). The association between the directional accuracy of self-efficacy and accounting course performance. *Issues in Accounting Education, 17*(1), 509-530.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.

Collins, J. L. (1982, March). Self-efficacy and ability in achievement behavior. Paper presented at the meeting of the American Educational Research Association, New York.

Collins English dictionary (30th ed.). (2010). United Kingdom: HarperCollins.

Coopersmith, S., & Feldman, R. (1974). Fostering a positive self-concept and high self-esteem in the classroom. In R. H. Coop & K White (Eds.), *Psychological concepts in the classroom* (pp. 192-225). New York, NY: Harper and Row.

Coughlin, P. (2007). *No more jellyfish, chickens, or wimps: raising secure, assertive kids in a tough world.* Grand Rapids, MI: Bethany House Publishers.

Covey, S. (1998). *The seven habits of highly effective teens: The ultimate teenage success guide*. New York, N.Y: Simon & Schuster.

Covey, S. (2009). *The most important six decisions you'll ever make: Personal workbook*. New York, NY: Fireside.

Covington, M. V., & Mueller, K. J. (2001). Intrinsic versus extrinsic motivation: An approach/avoidance reformulation. *Educational Psychological Review, 13*(2), 157-

176.

Crust, L. (2007). Mental toughness in sport: A review. *International Journal of Sport and Exercise Psychology, 5*(3), 270-290.

Daniels, E. (2005, April). On the minds of middle schoolers. *Educational Leadership, 62*(7), 52-54

Deci, E., & Ryan, R. (1985). *Intrinsic motivation and self-determination in human behavior*. New York, NY: Plenum Press.

Deci, E., Vallerand, R.J., Pelletier, L. G., & Ryan, R. M. (1991). Motivation and education: The self-determination perspective. *Educational Psychologist*, *26*(3), 325-346.

Deci, E. & Ryan, R. (2004, July 21). Increasing student success through instruction for self-determination. *Online American Psychological Association.* Retrieved from http://www.psychologymatters.org/selfdetermin.html.

Dewar, G. (2008). The effects of praise: What scientific studies reveal about the right way to praise kids. *Parenting Science*. Online version retrieved from http://www.parentingscience.com/effects-of-praise.html.

Dickens, C. (1997). *A tale of two cities*. New York, NY: Signet Classic.

Docan, T. N. (2006). Positive and negative incentives in the classroom: An analysis of grading systems and student motivation. *Journal of Scholarship of Teaching and Learning, 6*(2), 21-40.

Dweck, C. S. (2000). *Self-theories: Their role in motivation, personality, and development.* New York, NY: Psychology Press.

Dweck, C. S. (2008a). *Mindset: The new psychology of success.* New York: Ballantine

Books.

Dweck, C. S. (2008b). Caution – Praise can be dangerous. In K. M. Cauley and G. Pannozzo (Eds.), *Educational Psychology Annual Editions 07-08* (pp. 147-151). Dubuque, IA: McGraw-Hill Contemporary Learning Series.

Dweck, C. S., & Leggett, E. L. (1988). The social-cognitive approach to motivation and personality. *Psychological Review, 95*(2), 256-273.

Ebert, O., Ziegler, M., & Cope, G. (2001). *Learning and earning: The role of incentives in educational achievement.* Retrieved from the University of Tennessee, Center for Literacy Studies website: http://www.edst.educ.ca/aerc/2001/2001ebert.htm.

Egan, K. & Judson, G. (2008, Summer). Of whales and wonder. *Best of Educational Leadership, 2007-2008, 65*, 20-25.

Eisenberger, R., & Cameron, J. (1996). Detrimental effects of reward: Reality or myth. *American Psychologist, 51*(11), 1153-1166.

Elwell, W. C., & Tiberio, J. (1994). Teacher praise: What students want. *Journal of Instructional Psychology, 21*(4), 322-329.

Encarta world English dictionary (1st ed.). (1999). New York, NY: St. Martin's Press.

Evans, G.W., Bullinger, M., & Hygge, S. (1998). Chronic noise exposure and physiological response: A prospective study of children living under environmental stress. *Psychological Science, 9,* 75-77.

Foster, J. D. & Riley, R. F. (2008, April 24). On being eager and uninhibited: Narcissism and approach avoidance motivation. *Personality and Social Psychology Bulletin, 34*(7), 1004-1017. doi: 10.1177/0146167208316688

Fritson, K. K. (2008). Impact of journaling on students' self-efficacy and locus of control.

Insight: A Journal of Scholarly Teaching, 3, 75-83.

Gardynik, U. M., & McDonald, L. (2005). Implications of risk and resilience in the life of the individual who is gifted/learning disabled. *Roeper Review, 27*(4), 206.

Gastwirth, J. L., Gel, Y. R., & Miao, W. (2010, October 2). The impact of Levene's test of equality of variances on statistical theory and practice. *Statistical Science, 24*(3), 343-360.

Gholar, C. R., & Riggs, E. (2004). *Connecting with students' will to succeed: The power of conation.* Thousand Oaks, CA: Corwin Press.

Gladwell, M. (2008). *Outliers: The story of success*. New York, NY: Little, Brown, and Company.

Glasser, W. (1990). *The quality school: Managing students without coercion*. New York, NY: Perennial Library.

Goldman, A. (2011). *Four square and the politics of sixth grade lunch*. Westerville, OH: National Middle School Association.

Hawkins, V. J. (2009). Barriers to implementing differentiation: Lack of confidence, efficacy and perseverance. *New England Reading Association Journal, 44*(2), 11-16.

Henderlong, J. (2000). *Beneficial and detrimental effects of praise on children's motivation: Performance versus person feedback*. (Doctoral dissertation, Stanford University). Retrieved from Dissertations & Theses: Full Text. (No. AAT 9986107).

Henderlong, J. & Lepper, M. R. (2002). The effects of praise on children's intrinsic motivation: A review and synthesis. *Psychological Bulletin. 128*(5), 774-795.

How to solve a Sudoku game. (n.d.). Retrieved from http://www.youtube.com/watch?v=OtKxtvMUahA.

Howell, D. C. (2002a). *Multiple comparisons with repeated measures.* Retrieved from http://www.uvm.edu/~dhowell/StatPages/More_Stuff/RepMeasMultComp/RepMeasMultComp.html

Howell, D. C. (2002b). *Statistical methods for psychology*, (5th ed.). Belmont, CA: Duxbury Press.

Howell, D. C. (2008). *Fundamental statistics for the behavioral sciences* (6th ed.). Belmont, CA: Thomson Wadsworth.

Huitt, W. (2001). Motivation to learn: An overview. Retrieved from *Educational Psychology Interactive* at: http://www.edpsycinteractive.org/topics/motivation/motivate.html.

Inlay, L. (2005, April). Safe schools for the roller coaster years. *Educational Leadership*, *62*(7), 41-43.

Johnson, D. W., & Johnson, R. T. (1975). *Learning together and alone: Cooperation, competition, and individualization*. Englewood Cliffs, NJ: Prentice-Hall.

Jordan, W. J. (1999, Winter). Black high school students participation in school-sponsored sports activities: Effects on school engagement and achievement. *The Journal of Negro Education, 68*(1), 54-71.

Kamins, M. L. & Dweck, C. S. (1999). Person versus process praise and criticism: Implications for contingent self-worth and coping. *Developmental Psychology*, *35*(3), 835-847.

Klassen, R. (2002). A question of calibration: A review of the self-efficacy beliefs of

students with learning disabilities. *Learning Disability Quarterly*, *25*(2), 88-102.

Kleinginna, P., Jr., & Kleinginna, A. (1981). A categorized list of motivation definitions, with suggestions for a consensual definition. *Motivation and Emotion*, *5*(4), 263-291.

Kohn, A. (1992). *No contest: The case against competition*. Boston, MA: Houghton Mifflin Co.

Kohn, A. (1994, December). The truth about self-esteem. *Phi Kappa Delta*, *76*(4), 272-283.

Kohn, A. (1999). A look at Maslow's basic propositions. In H. J Freiberg, (Ed.) *Perceiving, Behaving, Becoming: Lessons Learned.* Alexandria, VA: Association for Supervision and Curriculum Development.

Konrad, M., Fowler, C. H., Walker, A. R., Test, D. W., & Wood, W. M. (2007). Effects of self-determination interventions on the academic skills of students with learning disabilities. *Learning Disability Quarterly*, *30*(2), 89-113.

Krause, K. L. (2005, September). *Understanding and promoting student engagement in university learning communities.* Paper presented at the Sharing Scholarship in Learning and Teaching: Engaging Students, James Cook University, Townsville, Australia.

Latham, A. S. (1997, May). Learning through feedback. *Educational Leadership*, *54*(8), 86–87.

Lavoie, R. (2007*). The motivation breakthrough: 6 secrets to turning on the tuned-out child*. New York, NY: Touchstone.

Levene, H. (1960). Robust tests for equality of variances. In I. Olkin (Ed.), *Contributions*

to Probability and Statistics. Palo Alto, CA: Stanford Univ. Press.

Little, T. (2010). *There's always a way*. Hoboken, NJ: John Wiley and Sons, Inc.

Mannheim, J. K. (2010). *Adolescent Development*. Online version retrieved from the University of Maryland Medical Center website: http://www.umm.edu/ency/article/002003.htm.

Marsh, H. W., Walker, R., & Debus, R. (1991). Subject-specific components of academic self-concept and self-efficacy. *Contemporary Educational Psychology, 16*, 331-345.

Marzano, R. (2011, March). Relating to students: It's what you do that counts. *Educational Leadership, 68*(6), 82-83.

Marzano, R. & Marzano, J. (2003). The key to classroom management. *Educational Leadership, 61*(1), 6-13.

McCabe, P. P. (2008). Convincing students they can learn to read: Creating self-efficacy prompts. In K. M. Cauley and G. Pannozzo (Eds.), *Educational Psychology Annual Editions 07-08* (pp. 136-142). Dubuque, IA: McGraw-Hill Contemporary Learning Series.

McCall, R. B. (1990). *Fundamental statistics for behavioral sciences*. (8th ed.). Fort Worth, TX: Harcourt, Brace, Jovanovich, Inc.

McDevitt, T. M., Sheehan, E. P., Sinco, S. R., Cochran, L. S., Lauer, D., & Starr, N. L. (2008, Fall). These are my goals: Academic self-regulation in reading by middle-school students. *Reading Improvement*, *45*(3), 115-138.

Merriam-Webster's collegiate dictionary (10th ed.). (1993). Springfield, MA: Merriam-Webster.

Miller, R. L., Brickman, P., & Bolen, D. (1982). Attribution versus persuasion as a means for modifying behavior. *Journal of Personality and Social Psychology*, *31*, 430-441.

Morgan, P. L., Fuchs, D., Compton, D. L., Cordray, D. S. & Fuchs, L. S. (2008). Does early reading failure decrease children's reading motivation? *Journal of Learning Disabilities*, *41*(5), 387-404. doi: 10.1177/0022219408321112

Morss, J. R. (1995). *Growing critical: Alternatives to developmental psychology*. New York, NY: Routledge.

Motulsky, H. J. (1999). *Analyzing data with graph-pad prism*. San Diego, CA: GraphPad Software, Inc.

Mueller, C. M. & Dweck, C. S. (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.

Neihart, M. (2006, Summer). Dimensions of underachievement, difficult contexts, and perceptions of self: Achievement/affiliation conflicts in gifted adolescents. *Roeper Review*, *28*(4), 196-202.

Nichols, J. (2011, April). Engagement, adolescents, and scar stories. *Middle Ground*, *14*(4), 20-21.

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*, 800-814.

Osteen, J. (2004). *Your best life now: 7 steps to living at your full potential*. New York, NY: FaithWords.

Osteen, J. (2005). *Daily readings from your best life now*. New York, NY: Warner Faith.

Pajares, F., & Graham, L. (1999). Self-efficacy, motivation constructs, and mathematics performance of entering middle school students. *Contemporary Educational Psychology, 24*, 124-139.

Pajares, F., & Schunk, D. H. (2001). Self-beliefs and school success: Self-efficacy, self-concept, and school achievement. In R. Riding & S. Rayner (Eds.) *Perception* (pp. 239-266). London: Ablex Publishing.

Pajares, F. (2002). *Overview of social cognitive theory and of self-efficacy*. Online version retrieved from http://des.emory.edu/EDUCATION/mfp/eff.html.

Pintrich, P. R., & DeGroot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performances. *Journal of Educational Psychology*, *82*(1), 33-40.

Price, L. F. (2005, April). The biology of risk-taking. *Educational Leadership*, *62*(7), 22-26.

Reis, S. M., Neu, T. W., & McGuire, J. M. (1997). Case studies of high-ability students with learning disabilities who have achieved. *Exceptional Children, 63*, 463-479.

Sagor, R. (2008, March). Cultivating optimism in the classroom. *Educational Leadership*, *65*(6), 26-31.

Schunk, D. H. (1983). Ability versus effort attributional feedback: Differential effects on self-efficacy and achievement. *Journal of Educational Psychology, 75*(6), 848-856.

Schunk, D. H. (1996). *Self-efficacy for learning and performance*. Paper presented at the Annual Conference of the American Educational Research Association, New York, NY, April 8-12, 1996.

Schunk, D. H., & Zimmerman, B. J. (2003). Self-regulation and learning. In W. M. Reynolds & G. E. Miller (Vol. Eds.), I. B. Weiner (Editor-in-Chief), *Handbook of Psychology, Vol. 7: Educational Psychology* (pp. 59-78). Hoboken, NJ: Wiley.

Sprenger, M. (2005, April). Inside Amy's brain. *Educational Leadership. 62*(7), 28-32.

Steinberg, L. (2011, April). Demystifying the adolescent brain. *Educational Leadership*. *68*(7), 42-46.

Sullo, B. (2007). *Activating the desire to learn*. Alexandria, VA: Association for Supervision and Curriculum Development.

Thiers, Naomi. (2005, April). The adolescent learner. *Educational Leadership*, *62*(7) 84-85.

Theobald, M. A. (2006). *Increasing student motivation: Strategies for middle and high school teachers.* Thousand Oaks, CA: Corwin Press.

Tileston, D. W. (2004). *What every teacher should know about student motivation*. Thousand Oaks, CA: Corwin Press.

Turnock, P., Rosen, L. A., & Kaminski, P. L. (1998). Differences in academic coping strategies of college students who self-report high and low symptoms of attention deficit hyperactivity disorder. *Journal of College Student Development, 39*(5), 484-493.

Urdan, T. C. (2005). *Statistics in plain English* (3rd ed.). New York, NY: Routledge.

Usher, E. L. & Pajares, F. (2008, November). Self-efficacy for self-regulated learning: A

validation study. *Educational and Psychological Measurement*, *68*(3), 443-463. doi: 10.1177/0013164407308475

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. M. Cole, V. John-Steiner, S. Scribner, & E. Souberman (Eds.). Cambridge, MA: Harvard University Press.

Warshaw, M. (1975). Behavior modification in secondary schools. *Educational Technology, 15*(8), 21-25.

White, D. (2010, July 12). Winning requires losing. *The News-Dispatch*, p. B1.

Yost, D. S. (2006, Fall). Reflection and self-efficacy: Enhancing the retention of qualified teachers from a teacher education perspective. *Teacher Education Quarterly, 33*(4), 59-76.

Young, D. B., & Ley, K. (2002, Fall). Brief report: Self-efficacy of developmental college students. *Journal of College Reading and Learning, 33*(1), 21-31.

Zan, B. & Hildebrandt, C. (2005, Fall). Cooperative and competitive games in constructivist classrooms. *The Constructivist, 16*(1), 65-79.

Zimmerman, B. J. (2000). Self-efficacy: An essential motive to learn. *Contemporary Educational Psychology*, *25*, 82-91.

Zimmerman, B. J. (2008, March). Investigating self-regulation and motivation: Historical background, methodological developments, and future prospects. *American Education Research Journal, 45*, 166-183.

APPENDIX

Appendix A – Sample Sudoku Problem Solving Activity

Friday, 19th November 2010

Difficulty: Easy

8	4	9		5			7	
3	7	6	8	2	4	1	9	5
2	1	5		9				8
	9						5	
6	2	7		4		9		3
	8				9			
9	3	4		8			1	
1	5	2	9		3			7
7	6	8	4	1		5	3	9

www.sudoku-research.com

Survey ID number: 017
0038: **Big Hint:** Put a 5 in box 3
0052: **Step:** Put a 9 in box 3 at r2c8 (Cell Rule - boxes)
0112: **Big Hint:** Put a 9 in box 5
0141: **Big Hint:** Put a 5 in box 7
0173: **Step:** Put a 5 in box 7 at r8c2 (Cell Rule - rows)
0189: **Step:** Put a 3 in box 9 at r9c8 (Cell Rule - rows)
0196: **Big Hint:** Put a 3 in box 7
0205: **Step:** Put a 3 in box 7 at r7c2 (Cell Rule - columns)
0249: **Step:** Put a 4 in box 2 at r2c6 (Cell Rule - rows)
0264: **Step:** Put a 6 in box 1 at r2c3 (Cell Rule - rows)
0304: **Hint:** Look at box 1
0319: **Step:** Put a 2 in box 1 at r3c1 (Cell Rule - boxes)
0335: **Print**
total Hints: 1
total Big Hints: 4
total Solve Steps: 9
total Solves: 0

Appendix B – Initial Contact Letter (Letter of Introduction)

February 11, 2011

To (Current School Administrator)

School Address

Invitation to Participate in Dissertation Research

Greetings,

My name is R. Allen Boone. I am the administrator of St. Paul Lutheran School in Michigan City, Indiana. I am also a student at Liberty University pursuing my doctorate in Educational Leadership focusing on student motivation and perseverance.

I am currently looking for 5 – 8 Christian schools in Indiana willing to participate in a study focusing on student motivation and problem-solving. There is absolutely no expense to participate in this study, minimal time commitment on your part, and the benefit of expressing to your school board that your school has been invited to participate in university research.

My research project involves sixth grade students and a problem-solving activity. I would enjoy meeting with you and your school board to discuss this project. Other than meeting with you and your school committee, my entire time in your school classrooms would be no longer than two class periods on one school day.

I will be calling you in a few days to discuss further details of the project and allow you an opportunity to ask questions about the research. I am an administrator just like you and I know the value of your time to your students and your building. I promise to take no more than ten minutes of your time when I call.

All research is being conducted under intense university review board policies which should provide reassurance about the procedures of this study.

I look forward to speaking with you,

R. Allen Boone

Administrator – St. Paul Lutheran School

818 Franklin Street

Michigan City, IN 46360

(219) 874-7409 aboone@stpaulmichigancity.com

Appendix C - Letter of Intent to Participate in University Research

(Note: Letter of Intent to Participate in University Research must be placed on school letterhead.)

(Note: Please date your response.)

Letter of Intent to Participate in University Research

Our school has received information regarding the university research project ***("Student Motivation and Problem-Solving")*** being conducted by Mr. R. Allen Boone.

This letter serves as our school's "intent to participate" in the research project.

Sincerely,

(Note: School administration signature is required.)

Appendix D – Informed Consent Form

CONSENT FORM
"Problem-Solving Strategies in Sixth Grade Students"

Mathematics Problem Solving Project

Rory Allen Boone

Liberty University

School of Education

You are invited to participate in a research study targeting student problem solving and student motivation. You were selected as a possible participant because the focus of the study is sixth grade students in Christian schools. We ask that you read this form and ask any questions you may have before agreeing to participate in the study.

This study is being conducted by Rory Allen Boone, a doctoral student in the School of Education at Liberty University in Lynchburg, Virginia.

Background Information
The purpose of this study is to learn more about the ways that students are motivated to solve simple and complex math problems, and how students prepare themselves to be successful.

Procedures:

If you agree to be in this study, we would ask you to do a few simple things:

1.) Watch a short 3 minute video on Sudoku problem solving.
2.) Listen carefully to the instructions of the lead researcher.
3.) Spend 20 minutes on a problem solving activity in your computer lab.
4.) Work independently on the problem solving activity.

Risks and Benefits of being in the Study
The risks in this study are small and no more than what you would normally encounter in everyday classroom life. You will not be asked for any personal information and each student will be assigned a number. Your name or identity will never be used in this research. The activity will take place in a familiar place – your school's computer lab. The problem solving activity will be very similar to a problem solving activity you would normally experience in your math class.

A benefit of participation in this study may include a better understanding of what motivates students to be more successful in school. At the conclusion of the project, the results of the study will be shared with all schools that participated in the study.

Confidentiality:

The records of this study will be kept private. In any sort of report we might publish, we will not include any information that will make it possible to identify a subject or a school. Research records will be stored securely in locked file cabinets and only researchers will have access to the records. No names will be attached to any of the data that is gathered from your school. The name of your school will not be used in any of research. All schools will receive a designation of "School A," "School B," and so on. After all of the schools have supplied data to the study, and the results have been analyzed, all of the data from the schools will be shredded and destroyed. The results of the study will only be used for academic study.

Voluntary Nature of the Study:

Participation in this study is voluntary. Your decision to participate or not participate will be respected by the researchers and the host school. If you decide to participate, you are free to withdraw from the study at any time without repercussion.

Contacts and Questions:

The researcher conducting this study is Rory Allen Boone. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact him at St. Paul Lutheran School, (219) 874-7409 or aboone@stpaulmichigancity.com. The supervising professor for this study is Dr. Gail Collins at Liberty University, (423) 667-4855 or glcollins2@liberty.edu.

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, **you are encouraged** to contact the Institutional Review Board, 1971 University Blvd, Suite 2400, Lynchburg, VA 24502 or email at irb@liberty.edu.

You will be given a copy of this information to keep for your records.

Statement of Consent:

I have read the above information. I have asked questions and have received answers. I consent to participate in the study.

Student Signature: _____ Date: _____

Parent / Guardian: _____ Date: _____

Signature of Investigator: _____ Date: _____

Appendix E – Random Number List

A computer-generated, randomized integer list was produced by the statistical website http://www.random.org designed by the School of Computer Science and Statistics at Trinity College. The number list will be read from left to right and from top to bottom.

042 098 002 065 003 014 029 009 070 087 088 085
095 039 053 066 025 050 048 079 086 092 076 024
008 073 078 017 072 081 001 068 094 043 012 036
090 028 034 069 018 091 082 026 015 019 041 074
020 038 083 030 096 045 061 100 071 084 080 011
097 044 040 005 022 004 013 033 099 075 027 067
059 023 057 047 058 006 007 049 051 035 077 093
032 089 016 060 054 064 031 055 010 056 063 021
046 062 037 052

The table of 100 random numbers was produced according to the following specifications: "Numbers were randomly selected from within the range of 001 to 100. Duplicate numbers were not allowed."

Appendix F – Sudoku Instructions

The following video instructions and strategies for solving a Sudoku problem can be found at the following web address: http://www.youtube.com/watch?v=OtKxtvMUahA.

Sudoku is a one-rule puzzle game that can be either satisfyingly simple or deceptively difficult.

To complete this How-To you will need:

Sudoku puzzle
Pencil
Eraser

Step 1: Understand the pattern of a Sudoku puzzle. Cells where an individual number goes are called squares; squares are then sectioned off in groups of nine to create boxes. A Sudoku puzzle has a total of 81 squares, and nine boxes. They create a three-box-by-three-box grid.

Tip: Many Sudoku puzzles have dark lines separating the nine three-square-by-three-square boxes for easy identification.

Step 2: To solve a Sudoku puzzle, each row of nine squares must contain the numbers 1 through 9. Each column must also contain the numbers 1 through 9, and each box must contain the numbers 1 through 9. No row, column, or box may repeat any number.

Step 3: Start with an easy puzzle, and work your way up to successively more difficult puzzles. Many squares will already be filled in, no matter the puzzle level. Based on those filled in squares, using logic and the process of elimination, begin deducing which numbers fit in the empty squares.

Tip: Any puzzle that has one single solution will have at least 17 squares already filled in.

Step 4: Use cross-hatching, the process of figuring out where a number fits by eliminating possibilities based on numbers in the other squares in the same row, column, and box. For example, if the top-middle box contains no number 8, and the other boxes along the top row of the Sudoku board contain 8s in the first and second rows, process of elimination dictates the 8 in the upper-middle box must be in the third row.

Step 5: Once you've solved one square by cross-hatching, use the technique to fill in as many squares in that single box as you can.

Step 6: Once you have exhausted one box, either by filling it in completely or running out of discoverable solutions, continue to the next box, then the next box, until you've gone through all nine boxes.

Step 7: Typically, by doing simple cross-hatching you will fill in several squares. Once you've gone through all the boxes, return to the box you started with and repeat the process, as it's likely there are now more available solutions.

Step 8: After cross-hatching, try the counting method. Look at a single square, and count 1 through 9 through all possibilities, marking off ones that are immediately disqualified because it already appears either in the same box, the same column, or in the same row as the empty square.

Step 9: For most easy puzzles, these simple techniques should be sufficient to help you complete the puzzle. As you practice, you'll be able to develop your own strategies and think ahead, which will help you progress on to more difficult puzzles.

Appendix G – Ability Script

“Today, we will be attempting to solve a Sudoku number problem on a designated website. Your teacher informs me that this is a very smart group of students.

Do your best to solve the Sudoku problem without any “helps,” but if you get stuck, there are “hint” keys, “big hint” keys, “solve-step” keys and “solve” keys. Be careful – the “solve” key will give ***all*** the answers to the Sudoku problem. If you press the “solve” key, your opportunity to solve the problem on your own will end.

Since I am confident in your ability, I’m sure you will do a great job. Remember, you are to solve this puzzle on your own without any help.

At the conclusion of our activity, we will discuss your strategies for solving Sudoku problems. You will have fifteen minutes to work on your activity.

Remember, this is a smart class, so do your best!

Please log-on to the website www.sudokuhints.com/research and begin the activity. Remember to type your ***ID number*** and ***Male or Female*** in the designated boxes on the webpage.

Appendix H – Effort Script

"Today, we will be attempting to solve a Sudoku number problem on a designated website. Your teacher informs me that this group of students always gives their best effort.

Do your best to solve the Sudoku problem without any "helps," but if you get stuck, there are "hint" keys, "big hint" keys, "solve-step" keys and "solve" keys. Be careful – the "solve" key will give ***all*** the answers to the Sudoku problem. If you press the "solve" key, your opportunity to solve the problem on your own will end.

Since I am confident in your effort, I'm sure you will do a great job. Remember, you are to solve this puzzle on your own without any help.

At the conclusion of our activity, we will discuss your strategies for solving Sudoku problems. You will have fifteen minutes to work on your activity.

Remember, this is a class that always gives its best effort, so do your best!"

Please log-on to the website www.sudokuhints.com/research and begin the activity. Remember to type your ***ID number*** and ***Male or Female*** in the designated boxes on the webpage.

Appendix I - T-Test Level of Significance

(If calculated t is greater than value shown, reject the null hypothesis.)

SIGNIFICANCE LEVEL FOR A DIRECTIONAL (One-Tailed) TEST						
df	.10	.05	.025	.01	.005	.0005
1	3.078	6.314	12.706	31.821	63.657	636.619
2	1.886	2.920	4.303	6.965	9.925	31.598
3	1.638	2.353	3.182	4.541	5.841	12.941
4	1.533	2.132	2.776	3.747	4.604	8.610
5	1.476	2.015	2.571	3.365	4.032	6.859
6	1.440	1.943	2.447	3.143	3.707	5.959
7	1.415	1.895	2.365	2.998	3.499	5.405
8	1.397	1.860	2.306	2.896	3.355	5.041
9	1.383	1.833	2.262	2.821	3.250	4.781
10	1.372	1.812	2.228	2.764	3.169	4.587
11	1.363	1.796	2.201	2.718	3.106	4.437
12	1.356	1.782	2.179	2.681	3.055	4.318
13	1.350	1.771	2.160	2.650	3.012	4.221
14	1.345	1.761	2.145	2.624	2.977	4.140
15	1.341	1.753	2.131	2.602	2.947	4.073
16	1.337	1.746	2.120	2.583	2.921	4.015
17	1.333	1.740	2.110	2.567	2.898	3.965
18	1.330	1.734	2.101	2.552	2.878	3.922
19	1.328	1.729	2.093	2.539	2.861	3.883
20	1.325	1.725	2.086	2.528	2.845	3.850
21	1.323	1.721	2.080	2.518	2.831	3.819
22	1.321	1.717	2.074	2.508	2.819	3.792
23	1.319	1.714	2.069	2.500	2.807	3.767
24	1.318	1.711	2.064	2.492	2.797	3.745
25	1.316	1.708	2.060	2.485	2.787	3.725
26	1.315	1.706	2.056	2.479	2.779	3.707
27	1.314	1.703	2.052	2.473	2.771	3.690
28	1.313	1.701	2.048	2.467	2.763	3.674
29	1.311	1.699	2.045	2.462	2.756	3.659
30	1.310	1.697	2.042	2.457	2.750	3.646
40	1.303	1.684	2.021	2.423	2.704	3.551
60	1.296	1.671	2.000	2.390	2.660	3.460
120	1.289	1.658	1.980	2.358	2.617	3.373
X	1.282	1.645	1.960	2.326	2.576	3.291

Appendix J – Time Table for Dissertation Research

February, 2011 – Defense of Dissertation Proposal

February, 2011 – Submission of Application to Liberty University Institutional Review Board

February, 2011 – Approval of Liberty University Institutional Review Board

March, 2011 – Initial Contact Letter (Letter of Introduction) mailed to Selected Schools

March, 2011 – Follow-up Phone Conversations with School Administrators to Answer Questions and Secure Participation

April, 2011 – Begin Meetings with School Boards of Participating Schools

April, 2011 – Visit Participating Schools to Explain the Research Project and Distribution of Informed Consent Forms

April/May, 2011 – Field Research at Participating Schools

May, 2011 – Analysis of Research Data

May, 2011 – Write-Up of Results and Findings (Ch. 4) and Discussion (Ch. 5)

June, 2011 – Pre-defense Conference with Committee Members

June/July, 2011 – Research Consultant Approval of Dissertation

July/August 2011 – Professional Editing of Dissertation

October, 2011 – Dissertation Defense