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Interventions in the middle school mathematics classroom: raising standardized test scores by diminishing stereotype threat

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INTERVENTIONS IN THE MIDDLE SCHOOL MATHEMATICS CLASSROOM:
RAISING STANDARDIZED TEST SCORES BY DIMINISHING STEREOTYPE THREAT

A Thesis

Submitted to the Graduate Faculty of
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the requirements
for the degree of
Master of Natural Sciences

in

The Interdepartmental Program in Natural Sciences

by

Elizabeth Stockwell Kirkindoll
B.M.E., Centenary College of Louisiana, 1981
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Abstract

Stereotype threat is a situational concern in which persons have uneasiness or worries about confirming a negative presumption about their social group. This apprehension affects the performance of those suffering this threat in recursive cycles, causing continuing underperformance in the threatened domain. This document reviews the research on stereotype threat, its causes, characteristics and effects, and describes how stereotype threat affects learning and undermines academic performance. Attention is focused on the role that stereotype threat plays in the underachievement of females in mathematics. A report on an experiment that attempted to reduce math-related stereotype threat among middle school females is included.

Chapter 1. Introduction

1.1 Purpose of Study

This study set out to measure the effectiveness of a self-affirming, fifteen-minute writing exercise in reducing stereotype threat and thereby improving standardized test scores in mathematics of female eighth grade students in a Louisiana school. This is a very simple, cost-effective intervention that has been shown in other studies to reduce stereotype threat to lead to higher standardized test scores and grade point averages. Determining whether this effect can be detected in a local school was the goal.

Gaining knowledge about this is valuable because positive short-term reductions in stereotype threat have been documented to have long-term ramifications in math education at all levels, elementary through advanced studies, affecting not only performance markers such as GPA's, state high-stakes tests, and ACT/SAT/GRE scores, but affecting career paths and therefore the workplace as well. If low-cost, low-effort methods that have been effective elsewhere can be shown to be effective locally, this would have important implications for decision-makers.

In the remainder of this introduction, evidence will be presented that justifies concern for gender equity in the STEM fields. In the following chapter, research will be reviewed related to one specific way to address this problem. In Chapters 3, 4 and 5, a description, report and discussion of an experiment that was modeled on work of Dr. Geoffrey Cohen will be included. The results were inconclusive, but the work should have value nonetheless to others who might wish to attempt to go further.

1.2 Under-representation of Women in STEM Occupations and Majors

Women in science, technology, engineering and math (STEM) related fields are underrepresented in the American workplace according to the Economics and Statistics Administration of the U. S. Department of Commerce. Even those women who do graduate with a STEM major are less likely than their male colleagues to work in a STEM occupation (Beede, 2011). While women form 48% of the total workforce to men's 52%, they only comprise 24% in STEM-related jobs (Beede, Julian, Langdon, McKittrick, Khan, and Doms, 2011). This inadequate representation of women occurs not only in America but in other parts of the world as well (Borg, 2012). Such statistics suggest issues which have become of utmost national and international importance and are now being addressed by many organizations such as the National Academy of Engineering's Center for the Advancement of Scholarship on Engineering Education (Singletary, Ruggs, Hebl, Davies, 2009).

College-educated women are also much less likely to choose college majors in STEM-related fields (Beede, 2011). Females, even if initially interested in math, science, technology or engineering, tend not to choose these majors or not to remain in them regardless of their aptitudes in these areas. Smith, Sansone, and White state, "Although they may enroll in introductory classes or initially select to major in math-related domains, they exhibit a significantly higher dropout percentage rate than men" based on several studies (e.g., Seymour, 1999; Strenta, Elliott, Matier, Scott, & Adair, 1993; see also Brainard, Metz, & Gillmore, 2000) (Smith, Sansone, and White, 2007, p. 111). This research is substantiated by the 2006 statistic that women earned roughly one-fourth of the STEM-related doctorates awarded in this country (Miyake, Kost-Smith, Finkelstein, Pollack, Cohen, and Ito, 2010).

1.3 Gender Performance Gaps in Secondary Schools

Not only are there gender gaps within the STEM fields in the workplace and in university settings, gender performance differences have been well-researched and well-documented at all levels of education. Specifically, in mathematics, “junior high school boys outperform girls on advanced quantitative assessments (e.g., Benbow, Lubinski, Shea, & Eftekhari-Sanjani, 2000), and high school and college men perform better than women on tests of advanced mathematical ability, including standardized tests such as the Scholastic Aptitude Test (SAT) and the Graduate Record Exam (GRE)” (GRE; Brown & Josephs, 1999; Hyde, Fennema, & Lamon, 1990) (Keifer and Sekaquaptewa, 2007). Although many educators and politicians are troubled about this problem, and numerous resources have been dedicated to the eradication of this problem, it persists. In fact, the National Assessment of Educational Progress (NAEP) reports that math scores of eighth graders from the 1990’s to 2007 have basically remained constant (Vanneman, Hamilton, Baldwin, Anderson, and Rahman, 2009) (Cohen, Garcia, Purdie-Vaughns, Apfel, and Brzustoski, 2009).

1.4 New Direction of Research

Many theories have been proposed, much research has been documented, and many interventions and policies have been implemented in an effort to eliminate these various gaps between genders at the professional, university, and secondary and middle school levels. While much of the research in education has focused on changing instructional methods, curriculum reform, and professional development, a new direction of research began in 1995. Pioneered by Dr. Claude Steele, this area of inquiry focused on the “socio-psychological and cognitive processes that lead to gender differences in performance and learning” (Miyake et al., 2010). In the almost two decades since Steele commenced his work, over 300 documented research studies

have been executed in the United States and abroad. In the next chapter, some of the research which has been written, including Dr. Steele's, is reviewed.

Chapter 2. Literature Review

2.1 What Is This Phenomenon?

2.1.1 Definition of Stereotype Threat

Since 1995, when Steele and Aronson created and defined the phrase *stereotype threat* (ST), hundreds of articles on the subject have been published in scientific journals. Not only have extensive studies been done in the United States, but studies of this disruptive concern have also been conducted in Germany, France, and Italy (Keller, 2007; Croizet and Claire, 1998; Cadinu, Maass, Rosabianca, and Kiesner, 2005). Researchers realize the severity and breadth of this phenomenon as it continues to affect many population groups.

Defined by Steele and Aronson, ST is “being at risk of confirming, as self-characteristic, a negative stereotype about one’s group” (Steele and Aronson, 1995). Rivardo, Rhodes, and Klein state that “stereotype threat occurs when members of a negatively stereotyped group are put in a situation where their performance on a given task could confirm the stereotype” (2008). Adding depth to the overall concept of ST, authors Rydell, Rydell, and Boucher describe this condition further by a synthesis of writings by Steele, Spencer, Aronson, Schmader, Johns, and Forbes (2010). They comprehensively characterize ST as “the arousal, worrying thoughts, and temporary cognitive deficits evoked in situations where a group member’s performance can confirm the negative stereotype about their group’s ability in that domain”. Steele, Spencer, and Aronson liken being under the threat of stereotype to having a snake loose in the house (2002). The threat is there, even though the person may not know where it is. He cannot focus on anything else until the snake is removed.

Steele also presents three general descriptors of ST (Steele et al., 2002). First, ST is situational. The threat comes from conditions or cues within a given setting like being the only

girl in a gifted math class. Being the only female may make her vulnerable to an invisible risk of confirming that girls are not as good as boys in math. Secondly, it is a general threat, which means, at some time or another, every person can be subject to it. Examples would include being an older person in a college class, being a boy in a dance class, or being a white player on a professional basketball team. Thirdly, the nature of ST depends on the context of the threat. For example, a female student, in seemingly similar math or English classroom settings, may experience threat in the math setting but not in the English class.

Once ST was acknowledged, identified, and clearly described, social psychologists have set out to understand its effects, define the characteristics of persons who yield to its existence, and recognize the patterns of situations in which it occurs. As these discoveries develop, steps can be taken to eliminate ST.

2.1.2 Historical Markers of Stereotype Threat Research

Irwin Katz, a psychologist in the 1960's from the University of Michigan, performed the foundational research on blacks and IQ. On one part of his experiment, he told participants that the subtest they would take was one testing for hand-eye coordination. On the other part of the experiment, the participants were told that the test would be an intelligence test. He found blacks scored higher on the task when it was presented as a test of hand-eye coordination than they scored on the same task when it was presented as a test of intelligence. The interpretation of the results of Katz's study was that performance on a test could be influenced by the context in which the test was administered (Katz, Roberts, Robinson, 1963). This study began a course of thought in social psychology that has fascinated researchers. Implications of this body of research have the potential to impact educational practices.

From the 1960's to the early 1990's, research of this proposed theory of setting and context affecting one's performance lay dormant. However, during the early 1950's, a small black male child was experiencing his first encounters with segregation. The experiences of his skin color altering the conditions of his life began a lifelong quest for understanding the way people think and behave. His extensive body of work has interested researchers in the psychology, sociology, and education fields. Stereotype threat, as Dr. Claude Steele named this phenomenon, and its effects have found to impact us as individuals and as a society in considerably noteworthy ways.

Table 2.1 includes brief descriptions of some of the contributions made to the field of stereotype threat in the last two decades. This table is by no means exhaustive but is included to give the reader a quick overview of this large amount of research and its impact.

2.1.3 The Integrated Stereotype Threat Model

In 2008, Schmader, Johns, and Forbes published an article which describes the process one experiences when faced with the situational condition of stereotype threat. **Figure 2.1** is a schematic graphic of this process.

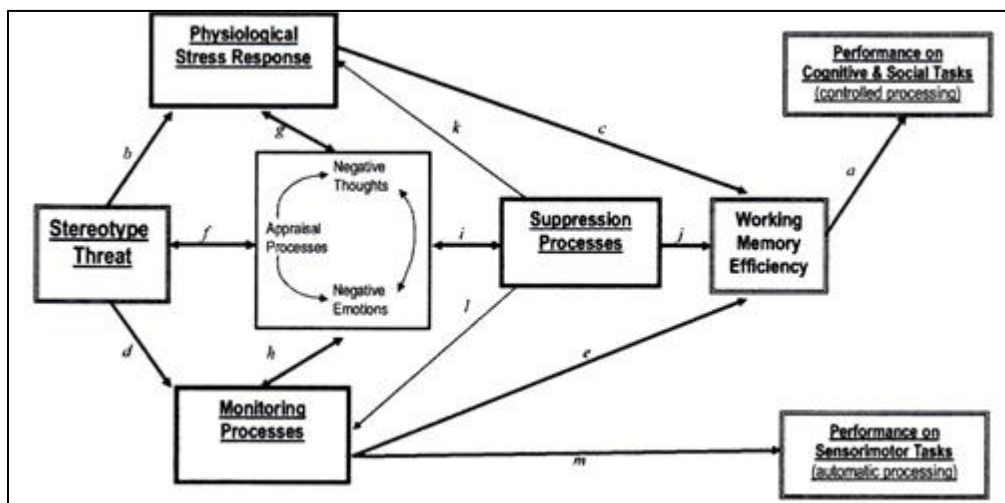


Figure 2.1 An Integrated Process Model of Stereotype Threat Effects on Performance

Table 2.1 Significant Historical Markers of Stereotype Threat Research

<u>Year</u>	<u>Research Team</u>	<u>Place</u>	<u>Topic</u>	<u>Contribution</u>
1994 Unpub	Steele & Spencer	Univ. of Michigan	Academic performance of college females in math vs. English	Stigmatization causes underperformance
	Steele & Spencer	Univ. of Michigan	Academic underperformance of college females vs. males in math	Removing the threat of stereotype confirmation dramatically improved performance
1995	Steele & Aronson	Stanford	Academic underperformance of blacks vs. whites at university level	1) Stigma pressure on intellectual functioning is a general phenomenon 2) Contingency affects academically strong and highly motivated students
1998	Croizet & Claire	Univ. of Clermont-Ferrand, France	Language ability between social classes	ST crosses social classes, cultures, and countries
1999	Aronson, Lustina, Good, Keough, Steele, & Brown	Stanford	Academic underperformance of white males vs. Asian Americans	1) Situation affects ST 2) Self-doubt is not necessary for ST to occur
1999	Shih, Pittinsky, & Ambady	Harvard	Prominence of negative (gender) or positive (ethnicity) threat	Situational differences in ST alone are fully sufficient to substantially affect intellectual performance
1999	Stone, Lynch, Sjomeling, & Darley	Princeton	Athletic underperformance of whites vs. blacks	ST occurs in new social arena further establishing its generality (sports)
2001	Blascovich, Spencer, Quinn, & Steele	Stanford	Measure of arterial blood pressure on students under stereotype threat	Physiological reactions occur in persons suffering from ST
2001	Blascovich, Mendes, Hunter, Lickel, & Kowai-Bell	Univ. of California, Santa Barbara	Measure of rise in blood pressure to see if ST causes anxiety	Physiological reactions occur even when anxiety is not consciously recognized
2002	Hess, Auman, Colcombe, & Rahhal	North Carolina State Univ.	Memory differences in younger vs. older people	ST affects the memory of aging people
2003	Schmader & Johns	Univ. of Arizona	Women interested in math counted vowels (working memory capacity)	The core impairment of a mind under ST is “the type of memory used to retain and manipulate information for immediate or near immediate use”
2004	Croizet, Gauzins, Després, Huguët, Leyens, & Méot	France	Intelligence of science majors vs. psychology majors	1) Heartbeat intervals change with cognitive load 2) Trying to defeat ST reduces mental capacity
2008	Gupta, Turban, Bhawe	A Midwestern Univ.	Men vs. women intentions of pursuing a traditional career which is gender stereotyped	ST extends to career intentions
2008	Krendl, Richeson, Kelley, & Heatherton	Dartmouth	Females, mathematics, threat, neural networks	Under ST, neural network access changes

A non-technical verbal description of this model follows: A person enters a situation which threatens his self-concept. This produces a state of imbalance which causes a disruption of performance. Both physiological and psychological responses occur because of this threatened condition. The person begins to constantly assess the situation which produces negative thoughts and emotions. This appraisal process is ongoing throughout the threatened condition. As a result, the person attempts to actively suppress his thoughts which bring them more to the front of the mind. This attempted act of suppression, along with the physiological effects and the constant reassessing of self, causes a reduction in and impairment of working memory which, in turn, affects the performance on cognitive and social tasks. It has been shown that ST also has an effect on sensorimotor tasks such as in sports or in the arts. Performance in these activities is better when automatic. It has been found that over-thinking or becoming conscious of one's behaviors and thoughts in these domains actually interfere with the performance which is often better when automatic.

2.1.4 Stereotype Threat Effects

Researchers began to study the effects of ST around 2000. The conclusions drawn so far from this immense body of documented research are remarkable. Initially, Steele proposed in the schematic representation of the stereotype threat model, these effects: distraction, self-consciousness, evaluation apprehension, test anxiety, and loss of motivation (Croizet, Désert, Dutrévis, and Leyens, 2001). Now, research has established many more. The following is a list of stereotype threat effects that have been recognized through studies:

- Reduces motivation in ST domain (Johns, Schmader, and Martens, 2005)
- Increases emotional suppression which causes worrying thoughts to remain active (Johns, Inzlicht, and Schmader, 2008)
- Triggers worries about confirming the threat (Rydell, Rydell, and Boucher, 2010)

- Reduces working memory capacity (Johns et al., 2008; Schmader, and Johns, 2003)
- Inhibits learning in the stereotyped domain (Rydell et al., 2010)
- Inhibits the execution of a learned skill (Schmader et al., 2008)
- Reduces performance by choking under pressure (Jackson, Beilock, and Nielsen, 2008; Mattarella-Micke, Mateo, Kozak, Foster, and Beilock, 2011)
- Increases arousal (Rydell et al., 2010)
- Causes stress (Steele et al., 2002; Cohen & Garcia, 2005)
- Overcompensation (Singletary et al., 2009)
- Causes anxiety even when not consciously recognized (Blascovich et al., 2001)
- Affects memory of the aging (Hess et al., 2003)
- Increases arterial blood pressure (Blascovich et al., 2001)
- Causes change in heartbeat intervals (Croizet et al., 2004)
- Causes inability to access needed neural networks (Krendl et al., 2008)
- Causes heightened testosterone levels in women under ST (Josephs, Newman, Brown, and Beer, 2001)

2.1.5 Characteristics of Persons Who May Be Vulnerable to Stereotype Threat

Steele states that there are external factors which can influence the strength of effects of ST. The degree of ST may be affected by the how much one cares about the domain of the threat and the intensity with which he cares. For example, a math-loving eighth grade girl in a gifted math class full of boys, who finds self-worth in that area and cares a great deal about the outcome of her performance, may have increased threat during a diagnostic Algebra I test. A student, who does not really care about how she performs in math, will not suffer ST to the same degree (Steele et al., 2002).

In addition to the domain of the threat and the intensity of feeling toward that domain, a person's strength of identification with the area of threat (gender, race, social class, athletic ability, memory, etc.), the type of threat (diagnostic vs. non-diagnostic), and the difficulty of the task (format complexity and increase in curriculum difficulty level) will cause more worrying

thoughts about confirming the association with the group. Other factors which possibly influence ST effects are time pressures, stigma consciousness (a person's sensitivity to the threat area), and how capable one feels about coping with the threat (Steele et al., 2002). Interestingly, Steele and Aronson (1995), state that all of these effects may occur without one's conscious awareness.

2.2 Why Does It Happen?

2.2.1 Social Identity Theory

Who am I? With whom do I belong? With what group do I fit... my family, my friends, in my school, in society? What effects and implications do the answers to these questions have on my personal preferences, on choices that affect my future? In the 1970's, two social psychologists, Henry Tajfel and John C. Turner, who were working together at Bristol University in Bristol, UK, formulated the Theory of Social Identity. This theory defines one's social identity to be the self-image or self-concept that one derives from being a member of a significant or relevant social group (McLeod, 2008).

2.2.2 Identity Contingencies

In the introduction of his seminal book, Whistling Vivaldi (Steele, 2010), the author, who is the Academic Dean of Stanford University's School of Education, talks about his first realization that he was black. Because he and the other children from his neighborhood could only swim at the local park on Wednesdays and could only roller skate on Thursdays, he learned that, by his observation, there existed a racial order, and because of his color, this racial order would impose conditions upon his life that he could not alter or control. These conditions, placed on him, not because he had *chosen* to be black, but because he was *given* this identity, are called identity contingencies. Possible examples of the causes of these circumstances with which

a person has to cope are one's gender, race, religion, age, political affiliations, sexual orientation, and mental illness. In Steele's own words "contingencies are conditions you have to deal with in a setting in order to function in it. And identity contingencies are contingencies that are special to you because you have a given social identity....They arise from the way identities in the setting are stereotyped." (Steele, 2010, p. 68). In certain situations, these conditions may be threatening.

Throughout his research, Steele has observed some emerging patterns that have convinced him of their significance. First, identity contingencies and threat do affect our individual lives in both major and minor ways. Secondly, these threats affect our societies as a whole. Thirdly, any person who is under a contingency threat suffers physiologically. And finally, there are courses of action that can be taken by the individual and by society that have been proven to eradicate these threats in controlled situations. Developing research is proving that these strategies are also producing positive changes in schools and classrooms (Steele, 2010).

2.2.3 Collective Threat

Dr. Geoffrey Cohen, a leading research psychologist in the area of identity and its effect, states that people often gain part of their self-image and worth from their associations, and when a group with which one is associated is threatened, then the individual is threatened as well. The individual suffers from what he calls "collective threat, a threat to the image of the group." (Cohen and Garcia, 2008). Because of this, even though situations may appear to be similar or exactly the same for a group of people in a particular setting, in reality, the situations may be profoundly different for the individuals who are under the contingency or threat (Cohen and Garcia, 2008).

In Whistling Vivaldi, Steele tells a vivid account of a young African American who experienced ST. Brent Staples, at that time a psychology graduate student in Chicago, recounts his experience of walking down the streets of Hyde Park:

I became an expert in the language of fear. Couples locked arms or reached for each other's hand when they saw me. Some crossed to the other side of the street.... I'd been a fool. I'd been walking the streets grinning good evening at people who were frightened to death of me. I did violence to them by just being....I tried to be innocuous but didn't know how....I began to avoid people. I turned out of my way into side streets to spare them the sense that they were being stalked....Out of nervousness I began to whistle and discovered I was good at it. My whistle was pure and sweet---and also in tune. On the street at night I whistled popular tunes from the Beatles and Vivaldi's *Four Seasons*. The tension drained from people's bodies when they heard me. A few even smiled as they passed me in the dark. (Steele, 2010, p. 6)

One of the best descriptive phrases which describes this invisible intimidation is “a threat in the air”. The one under ST has this feeling, sometimes conscious but at other times unconscious, that he is in some sort of danger or risk. This psychological peril affects his thinking, his behavior, and his performance in the situation.

2.2.4 Core Narratives and Event Interpretations

Not only can identity contingencies differ within the exact setting, but individuals can manage these threatening conditions differently according to their previously established set of beliefs. In his book, Redirect, Dr. Timothy Wilson (Wilson, 2011), Professor of Psychology at the University of Virginia, asserts that all people develop beliefs that help them make sense of what happens to them in the world. These *core narratives* originate early in childhood, initially through the relationships with their caregivers, and the beliefs continue to impact responses to people and events throughout their adult lives. Core narratives provide answers to life's essential questions of purpose and significance and become paramount when interpreting negative situations. Often, because a pattern of interpretation was set in motion during childhood, when new situations are encountered, one is not aware that instead of observing and analyzing the new

conditions within which he finds himself, unconsciously the new situation is being interpreted according to the previously ascertained belief system (Wilson, 2011).

A simple example illustrates this point of past experiences and context affecting interpretation. Look at the following picture **Figure 2.2:**

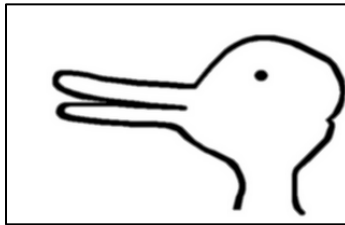


Figure 2.2 A Rabbit or a Duck?

Is this sketch interpreted as a rabbit or a duck? If retrieving from the past, the picture was likely seen as a rabbit if the interpreting person had previously owned one as a pet. The illustration was probably seen as a duck if the person was a bird hunter. In 1993, Brugger and Brugger, used a similar picture in an experiment which tested context as the foundation of interpretation. When shown this picture on Easter Sunday, 82% of the people recognized it as a bunny. On a Sunday in October, people identified the same drawing as a duck (Wilson, 2011).

Wilson states that during the process of observing, humans often unconsciously use their “personal interpreter” (Wilson, 2011, p. 8), their core belief system, and the context of the event to make sense of what is being experienced. This immediate personal search for clarification happens both with traumatic life events and in dealing with personal daily interactions with others. The answers to these personal analyses affect not only major life decisions such as career trajectories, but their evaluation, based on our personal interpreter, also makes countless, seemingly minor, often unconscious, daily decisions as well. Wilson uses the example of a student performing badly on a test. The personal assessment, arrived at through his personal interpreter, “will be a crucial determinant of what happens next” (Wilson, 2011, p. 8). Perhaps

the student recognizes that his lack of effort and inadequate study habits greatly contributed to his poor performance. In this case, the student may make the choice to change from his previous unproductive behaviors to those more effective ones which include becoming more organized, more frequent study periods, and attending all classes, therefore creating a possible positive outcome for future performance. However, what, if through his personal interpreter, the student's hopes are dashed. He feels that his fears of inadequacy are confirmed. He begins to miss class. When he does attend, he takes sparse notes. He doesn't complete class assignments. He spends little time in test preparation. His personal interpreter seems to have set up new future failures that are continuing to confirm the negative core beliefs he has about himself (Wilson, 2011).

2.3 Where Is It Revealed?

2.3.1 Recursive Cycles

In the example above, when the student saw his experience through the lens of a positive self-image, he was able to persevere, to make choices which would likely result in constructive behavioral changes. These productive selections set him on a positive trajectory for his future. However, when the student became discouraged by his failure, he elected to withdraw emotionally from the situation and from continuing his effort toward success. He, therefore, was setting himself up for more failure in the future. Both of these instances are patterns of the recursive process. Steele claims that invasive fears enter the person's mind thereby interfering with cognitive performance (Steele et al., 2002). Cohen states that "performance in these settings can be self-reinforcing. A recursive cycle, where psychological threat lowers performance, increasing threat and lowering performance further, in a repeating process, can

magnify early performance differences among students” (Cohen, Garcia, Purdie-Vaughns, Apfel, and Brzustoski, 2009).

2.3.2 Academic Underperformance: More Than Lack of Skills or Preparation?

Underachievement is a norm in society. The racial, gender, and socio-economic gaps exist in this country as in others around the world. Educators and researchers question: What are the causes of this underperformance? Are some social groups innately more intelligent than others? Are environmental and situational factors to blame? Are there intrinsic, internal, psychological processes that factor? If so, what are they? Why do these achievement gaps persist?

In their 2006 article, Cohen, Garcia, Apfel, and Master offer the results of their research as follows:

The drive for self-integrity---seeing oneself as good, virtuous, and efficacious---is a fundamental human motivation (Taylor, Brown, 1988; Steele, 1988; Sherman, Cohen, 2006). Membership in valued social groups is often a major source of individual’s sense of self-integrity (Tajfel, Turner, 1986; Cohen, Garcia, 2005). Consequently, negative characterizations of one’s group can prove threatening, especially in chronically evaluative environments.

Because people subjected to widely known negative stereotypes impugning the intelligence of their group are aware of these negative characterizations, they may worry that performing poorly could confirm the stereotype of their group (Steele, Aronson, 1995; Steele, Spencer, Aronson, 2002; Aronson, Fried, Good, 2002). This situation can create chronic stress at school and work, by burdening people with an extra psychological threat not experienced by those outside their group. If too severe, stress can undermine performance (Steele, 1995; Steele, 2002; Aronson, 2002; Zajonc, 1980; Zigler, Butterfield, 1968). Indeed, simply observing a group member who might confirm a negative stereotype about one’s group can induce threat undermining performance (Cohen, 2005).

2.3.3 Stereotype Threat Research for the Female Population

The acknowledgement of ST effect of belonging to a particular population affecting one’s academic performance began with the recognition that females at the University of Michigan were underperforming in their math classes but not in their other classes, like English. This real-

world observation piqued administrators, then psychologists, at the university to study the situation further so that a possible remedy could be found. Therefore, several research experiments were designed to provide further insight into the problem (Steele et al., 2002).

High-achieving men and women were recruited as participants in a study to test whether this real-world observation was, in fact, replicable in a laboratory. All enlisted were very good at mathematics, scoring in the top 15% of the SAT scores in the university's student population. Participants were also students who intended on developing their math skills for future use in either their personal or career goals (Steele et al., 2002).

During one experiment, both male and female students were given a difficult, then an easy math exam. The female students scored worse on the difficult math test than the men, but they had comparable scores on the easier math test. During another experiment, students were given a twenty-five minute portion from the mathematics section of the Graduate Record Exam. The specific nature of the English exam was not given. Researchers found that women scored worse on a difficult math test than the men, but on a difficult English test, the results were similar. Although these experiments did not confirm stereotype threat as a cause of this underperformance, the investigations did, however, prove that the real-life underperformance of women in math could be replicated in the psychology laboratory (Steele et al., 2002).

Researchers next needed to confirm that the removal of the ST, would, indeed, be enough to raise the performance of the females. To do this, another experiment was devised. In order to remove the threat of stereotype, instructions were given to the treatment group that on this particular math test, "women always performed equally as well as men". The results substantiated the theory that, once the threat of stereotype was removed, women's performance

in the threatened domain, mathematics, improved. In the control group, where no removal of the ST had occurred, underperformance continued (Steele et al., 2002).

In 1998, the Educational Testing Service (ETS) decided to conduct their own investigation. Researchers devised a test to see if gender and racial ST was occurring during the administration of Advanced Placement exams. They presumed that when coding gender and race before the administration of an Advanced Placement calculus test, ST would be made salient (brought to the forefront of student's mind). If saliency was, in fact, causing the underperformance experienced by these two groups, then the scores would indeed drop for the females and the racial minorities. For the control group, the students would code gender and race after the test, therefore, decreasing saliency of the any threat. Interestingly, while the female underperformance was affected enough to be called statistically significant, the racial underperformance was influenced, but not enough to reach statistical significance. Social psychologist, Christian Crandall, extrapolated from the data that "if gender and ethnicity were routinely recorded after, rather than before, this AP exam, as many as 2,837 additional young women (out of 17,000) would start college each year with calculus credit and have better admissions prospects" (Steele et al., 2002).

Inzlicht and Ben-Zeev (2000) wondered if physically placing women in the minority in proportion to men was adequate to cause ST, and if there was proportionality to the effect. In other words, when the ratio of men to women was increased, would the performance of the women decrease? They called this causal factor of situation a "threatening intellectual environment" (Inzlicht and Ben-Zeev, 2000, p. 365). It is in this environment that females in advanced STEM-related courses and places of work often find themselves. Just being placed in these environments makes them more aware of their gender and this "threat in the air" (Steele,

1997) is enough to cause underperformance. Furthermore, the researchers questioned whether minority-induced performance deficits were linked specifically to stereotypical domains, like mathematics for females. The predictions of the researchers were that as the ratios of male to females increased, there would be a decrease in performance. They also hypothesized that this underperformance would only occur in the stereotyped domain.

In order to test the hypotheses, two experiments were performed. The first study included 72 female undergraduates from Brown University and 8 male confederates (those acting as participants in the study) who were assigned to four different situations: 1) all females taking a math test 2) all females taking an English test 3) one female, two males taking a math test and 4) one female, two males taking an English test. Both tests were equally difficult as portions of the GRE were used for each. Participants, who were randomly assigned to the four groups upon arrival, were given the same instructions, same tests, and same goals for the study. They were also told that they would have to report their test results for each test to the other members of the group. After administration of the exams, they were asked to fill out demographic sheets which included reporting their personal SAT scores in both English and math. A simple accuracy scored was calculated for the analysis. The results showed that women did indeed score lower when placed in the presence of males in the math setting but not in the English. In the same sex groups, the women did not underperform (Inzlicht and Ben-Zeev, 2000).

Experiment II was conducted to test whether men would show the same type of underperformance as females in similar testing situations, and whether women in mixed sex groups where the women were in the majority (two females/ one male) would perform worse than in the same sex groups but better than in the groups where the women were in the minority as in Experiment I. Ninety-two male and female participants from Brown were assigned to the

different testing groups. The procedures were similar as participants were given a math test, then were asked to fill out their demographic surveys. The results were as expected. Males in the minority did not underperform but scored similarly to males in the same sex groups, whereas females in the minority scored significantly less than females in the same sex groups. Also, the prediction that female's performance would decrease as the number of males in the testing groups increased proved accurate (Inzlicht and Ben-Zeev, 2000).

In the previous study, gender was made salient by actually placing females in the presence of males in a testing condition. The next two research studies create the ST by mere suggestion. Cadinu, Tomasetto, and Alparone (2011) conducted research to see how parents' endorsement of gender stereotyping about math influences their children. In their article, they document that math performance of girls has been diminished by ST as early as lower elementary (Ambady, Shih, Kim, & Pittinsky, 2001). Also, "the emergence of explicit gender-stereotyping of math abilities appears around 8-9 years of age" (Muzzatti & Agnoli, 2007), and the beliefs about the differences in boys' high versus girls' low math abilities and girls high versus boys' low language and arts abilities appears around 10-12 years of age (Fredricks & Eccles, 2002; Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002).

The Cadinu and team (2011) experiment involved 156 white, female children, grades K-2 in public school, middle class, urban and suburban population. One hundred thirty-four mothers and 128 fathers participated. Children, tested individually, were read a story and were asked to draw a picture of the story immediately following the reading. In the control group, the story was fairy-tale in nature. In the treatment group, the story involved a girl with a number of stereotypical traits. The child's drawing was kept in front of the child for the remainder of the experiment. After drawing, the participants were asked to complete age-appropriate, but

difficult, math ability tests. Students were also asked to complete the explicit stereotype-awareness task outlined in the 2001 article by Ambady, Shih, Kim, and Pittinsky. Parents were asked to complete socio-demographic surveys which also contained questions concerning their stereotyping opinions.

After a very involved analysis, the results were consistent with previous findings that the performance of girls decreases when gender is made salient in a testing situation. Not surprising, the mothers' stereotyping opinions influenced the children's vulnerability to the situation of ST. Fathers' opinions do not seem to have the same affect at that age.

Another Italian study tested the effect of intrusive or worrying thoughts of females under ST on math performance. The researchers hypothesized that ST would lead to intrusive thought that would lead to negative thinking which, in turn, would lead to underperformance. During this experiment, which involved 60 female psychology students at the University of Padova, participants were told either that "recent research has shown that there are clear differences in the scores obtained by men and women in logical-mathematical tasks" (experimental group) or that "there are no differences between men and women in logical-mathematical tasks" (control group). The research design consisted of giving the females seven GRE-like problems. Before beginning the test, the participants were given a blank sheet of paper and were told to record any thoughts that came to mind during the test. These "thought-listing sentences" were then coded by evaluators into eight different categories (Cadinu et al., 2005).

The results were as expected: performance was significantly decreased in the ST condition, and participants under ST recorded a significantly greater number of negative thoughts related to mathematics. This analysis sustained the hypothesis that ST leads to intrusive thoughts which leads to a diminished performance. Researchers also found that as the worrying

thoughts continued, the performance was further affected. “Thus, intrusive thoughts at the beginning of the test may interfere with subsequent performance, which may in turn increase the likelihood of negative thinking, ultimately leading to an accelerating, self, maintaining cycle.” (Cadinu et al., 2005). As described by Jordan and Lovett (2007), “Performance in the stereotype threat condition declined as the test went on, suggesting that a vicious cycle between negative thinking and poor performance may occur under conditions of stereotype threat.” This study therefore shows that negative thoughts triggered by the ST condition have an inverse relationship with performance: as intrusive thoughts become more pronounced, performance decreases.

The most advanced technological study to date was completed by a team of researchers from both Dartmouth College and Northwestern University (Krendl, Richeson, Kelley, and Heatherton, 2008). This study involved the use of the MRI (magnetic resonance imaging) to identify what neural regions become engaged while females are experiencing ST. All recruited participants were female, right-handed, Dartmouth undergraduates who communicated via Likert scale survey that math was important to them. Instructions were initially given by a male experimenter, and during the experiment, instructions were given by a computer.

While extremely technical in nature, this experiment used a series of tests (associations, attitudes, difficult operational math problems, difficult modular arithmetic problems, etc.). During the experiment, treatment participants were given a task to complete which would “assess their ‘math attitudes’ because ‘research has shown gender differences in math ability and performance’.” Control participants were instructed that their task would involve political attitudes (Krendl et al., 2008).

The differences described in the comparisons of neural activity were “robust”. In fact, what was discovered in this study was that when women were reminded of gender stereotyping

about mathematical ability, they were not able to recruit the mathematical problem-solving part of the brain (the angular gyrus, and the left parietal and prefrontal cortex). The part of the brain accessed by these women under ST was the region of the brain that is associated with emotional and social processing (the ventral anterior cingulate cortex). Conversely, the women who had not been reminded of gender differences in math, were able to access the neural networks linked to mathematical learning (Krendl et al., 2008).

2.4 Is There a Possible Remedy?

2.4.1 Writing for a Cure: Story Editing

Around the 1930's, Kurt Lewin helped found the social psychology field. He believed that a person could be helped through quite small interventions by changing the way they viewed certain experiences. Others later augmented this approach. They came to believe that one could create positive behavioral changes by changing one's core narratives. Wilson, in Redirect (2011), calls this approach "story editing". Story editing includes not only changing ingrained, long-held self-narratives, but it also involves making changes in the way one immediately encodes and interprets new experiences. This is accomplished through several writing techniques.

James Pennebaker, a social psychologist and professor at the University of Texas at Austin, has researched writing as a healing tool for many years. His research covers a vast number of topics from helping people cope with traumatic experiences such as "9-11" to the real meaning in instant messages between couples (Pennebaker, 2004; Pennebaker, 2006). Pennebaker's writing techniques have been shown to be more effective at permanent healing of traumatic events than techniques that were previously used such as CISD (Critical Incident

Stress Debriefing) which has been the accepted form of psychological treatment of traumatic events (Wilson, 2011).

Pennebaker describes the writing paradigm which is used by children to adults as “exceptionally powerful”. He states that writing about issues “promotes physical health, subjective well-being, and selected adaptive behaviors”. In fact, students who have used this technique were found to have improved grades following the writing exercise (Pennebaker, 1997). The basic instructions for this method, taken from the 1997 article, are as follows:

For the next 3 days, I would like for you to write about your very deepest thoughts and feelings about an extremely important emotional issue that has affected you and your life. In your writing, I'd like you to really let go and explore your very deepest emotions and thoughts. You might tie your topic to your relationships with others including parents, lovers, friends, or relatives, to your past, your present, or your future, or who you have been, who you would like to be, or who you are now. You may write about the same general issues or experiences on all days of writing or on different topics each day. All of your writing will be completely confidential. Don't worry about spelling, sentence structure, or grammar. The only rule is that once you begin writing, continue to do so until your time is up. (Pennebaker, 1997)

The writing instructions given by Pennebaker are very similar to the instructions used in this research study.

2.4.2 Story Prompting

Another form of story editing is called “story prompting” (Wilson, 2011). In this approach, a person is encouraged by being given new information about a topic or is shown a possibly new type of thought process. With story prompting, the person is led in a particular direction. The goal of story prompting is to encourage positive thinking about one's self, about areas of personal success, and about topics in which the person feels some self-confidence. The hope of using this approach is to lead the person down a more optimistic and constructive path which will bring him out of the self-defeating, recursive cycle previously discussed. Story

prompting has been shown to redirect people's self-narratives which encourages positive behavioral changes and fosters success.

Why have these methods proven to be effective, both in the short-term and long-term? Wilson maintains that these approaches break the self-defeating cycles in which students find themselves. Initially after the interventions, the student is encouraged and therefore tries harder. When this effort is rewarded, the student becomes encouraged and sustains the positive behavioral changes, which boosts success even further. Thus, the negative recursive cycle is broken.

2.4.3 Values Affirmation

Values affirmation is a writing intervention in which a student affirms his self-worth. During this writing exercise, one can write about his core beliefs and values, expressing his personal narratives about his family, his relationships, his talents, his activities, and other important parts of his life. These affirmations have been shown to “buttress people’s self-integrity---their feeling of global competence and adaptiveness in the social world---so that specific threats in the academic environment are less psychologically destabilizing” (Cook, Purdie-Vaughns, Garcia, and Cohen, 2011).

Steele’s theory of affirmation is the idea that people are generally motivated to believe in themselves, in their personal value and worth. When threatened in a particular situation, ruminating on areas of self in which one is secure or feels successful, the person is strengthened and fortified, giving him the ability to persevere or to withstand criticism or negative feedback. In academic settings, students encounter daily negative feedback. If one’s self-image is low, then withstanding the criticism and maintaining a positive personal outlook may be difficult. In fact, it is clear, that when faced with constant criticism, a vulnerable student will likely succumb

to the belief that he is and will be an unsuccessful person in the classroom, and therefore concludes that he does not belong in the academic setting. For this student, the recursive cycle is now in place. A strategically-placed writing exercise has been shown to break this cycle.

2.4.4 Values Affirmation Research

Research has found that values affirmations have resulted in reducing both racial and gender achievement gaps. Dr. Geoffrey Cohen of Stanford University has led this research with experiments conducted in 2006, 2009, and 2010 which are published in Science magazine. The two studies described below are particularly important to the current study as one researches gender and the other study's population group is middle school students.

At the University of Colorado, a group of researchers (Miyake et al., 2010) tested the effect of the values affirmation writing exercise on exams scores and on a standardized physics concepts test. The research was conducted on a college-level introductory physics class of 399 participants. Because the course involved was physics, a STEM-related area, ST was predicted to be present. Also, ST is most prevalent at a critical level of a new academic domain, therefore, the entry level physics course was a perfect choice for the study. During the 15-week course, the 15-minute writing assignment was administered in Week 1 and in Week 4, shortly before the mid-term exam in Week 5. Also, an online survey was given in Week 2 in which students were asked to indicate their belief in the stereotypical statement that men perform better than women in physics. Results confirmed that the values affirmation writing exercise significantly reduced the gender achievement gap by raising female performance on the exam scores. Also, on the FMCE, the Force and Motion Conceptual Evaluation, the gender learning gap completely disappeared.

In 2006, Cohen, Garcia, Apfel, and Master conducted a study to see if the values affirmation intervention would raise the grade point averages of African American seventh graders. They immediately conducted a follow-up study that was completed in 2007. Participants were black and white seventh graders from a lower to middle class northeastern middle school. The classes in which the interventions were distributed were of the same subject, one not related to gender stereotyping since this study dealt with racial underperformance. In the first semester of the study, one exercise was completed. In the second replicated study, the intervention was given two times. Analysis was completed on both studies and showed that the grade point averages of those in the treatment group, those receiving the intervention, rose significantly. In fact, the racial achievement gap was reduced by 40%.

2.4.5 Research Questions

The purpose of this study is to use this self-affirming, fifteen minute writing exercise to improve the standardized test scores of eighth grade female math students. This study proposes the following questions: What impact does the values affirmation writing exercises have on student performance from the 2011 iLEAP test to the 2012 LEAP test? Do females who completed the values-affirmation writing exercises show more improvement in their performance from their 2011 iLEAP scores to their 2012 LEAP scores than those females who did not complete the values-affirmation over the same time period? Is the gender gap among students who completed the values-affirmation exercises smaller than the gender gap among the students who did not complete the values-affirmation exercises?

Chapter 3. Methods

3.1 Participants and Design

After obtaining university, school system, and school approval to conduct the study, participant recruitment began. Initially, a three-page document was sent to parents of all eighth grade students through distribution in the 7th hour periods. Of the 199 permission slips sent to parents, only two were returned.

A second recruitment phase was initiated. A second consent form was written and received university approval. These permission slips were copied on school letterhead and approved and signed by the school principal. They were then sent home to parents via the students, disseminated through and returned to homeroom teachers. These one-page permission slips included all pertinent information about the study. Parents were asked to accept or decline their child's participation in the study. If accepted, parents gave permission to the researcher to access their child's standardized test scores. Of the total 199 eighth grade students enrolled, fifty-nine slips, 30% of the total eighth grade students, were returned giving permission for participation. Ten slips, five percent of the total number of students, were returned denying participation.

Of the fifty-nine participating students, seven were excluded in the final data analysis. This occurred for the following reasons: three withdrew from the school during the year; four were missing the previous year's standardized test data. Therefore, the total number of students participating in the study was fifty-two. Thirty of the students were male, constituting fifty-eight percent of the total participating consented students, and twenty-two of the students were female, which accounted for forty-two percent of the total participating consented students. Because the previous study had been documented as having a positive effect, thirty-one students, or 60% of

the total sample, were given the treatment. The control group included twenty-one students or 40% of the total sample.

In order to statistically compare the tests, the mean of each group was found pre-intervention and post-intervention. These means were compared.

3.2 Tasks and Procedures

Students participated in the study for one semester. For Intervention I, students were told that they would be answering questions about their personal “ideas, beliefs, and your life.” They were also told that there was no right or wrong answers to these questions. They were then asked to read carefully over a list of eleven personal values such as music, athletic ability, and relationships with friends and family, and to think about each of them. Next, each student was asked to circle two or three values that were either MOST or LEAST important to them depending upon which group they had been randomly assigned. The students were then asked to write a few sentences describing WHY these values were either important to them OR could be seen as important to someone else (depending upon the assigned group) so, the intervention was only individually relevant to personal values in the treatment group. They were told to focus on their thoughts and feelings and to not focus on spelling or grammar as the writing would not be graded. The students were asked to give the reasons for why these values were important to them or could be seen as important to someone else (again depending upon the group assignment). Finally, the students were asked to give their opinions about the values using a Likert scale.

There were four administrations of the intervention, each approximately two weeks apart. The interventions were given by the students’ classroom teachers. At each administration of the interventions, teachers were given identical scripts to follow. Teachers were kept blind to the

purpose of the study and to the students' assignment to the condition. Teachers were instructed to distribute the materials to each student and to read the given script. After following these two instructions, teachers were asked to sit at their desks and remain there for the allotted time. After 15 minutes, teachers would then collect the envelopes, and put them in alphabetical order. Teachers were not to read any of the students' work.

Students were given large white envelopes that had been previously labeled with their names, teacher initials, hour of administration, and testing code (known only to the researcher). The envelopes were closed and were only opened by the students. Included in the envelopes were the control or treatment documents which included self-explanatory directions to be followed. Because these interventions had been previously tested when used in a research study, the instructions were clear and easily understandable for the tested age. These directions were not to be read aloud, thus maintaining the anonymity of the testing groups. Additionally, the format of the different interventions was identical. Only key words were changed, therefore, the student papers looked virtually the same. After completing the questions and the writing exercise, the students placed the completed work in the envelope, closed it, and waited for the teacher to collect it. Therefore, experimental and control group procedures were identical.

For Interventions II-IV, the only changes made were the slight altering of the listed values and their order.

Chapter 4. Results

4.1 Performance Outcomes

Performance differences were calculated at the end of the school year using the results from the state-mandated accountability tests provided by the school administration.

4.2 Statistical Analysis

Performance differences were calculated at the end of the school year using the results from the state-mandated accountability tests which were provided by the school administration. The mean for Year 1 was 346 with a standard deviation of 47, and the mean for Year 2 was 348 with a standard deviation of 25. The means in the subgroups were as follows:

Table 4.1 Mean Scores of Subgroups

	<u>N</u>	<u>Year 1 Mean Scores</u>	<u>Year 2 Mean Scores</u>	<u>Difference Between Year 1 & Year 2</u>
Control Boys	11	334.91	344.36	9.45 \approx +9
Control Girls	10	349.30	350.30	1.00 \approx +1
Experimental Boys	19	358.84	350.58	-8.26 \approx -8
Experimental Girls	12	333.25	346.00	12.75 \approx +13

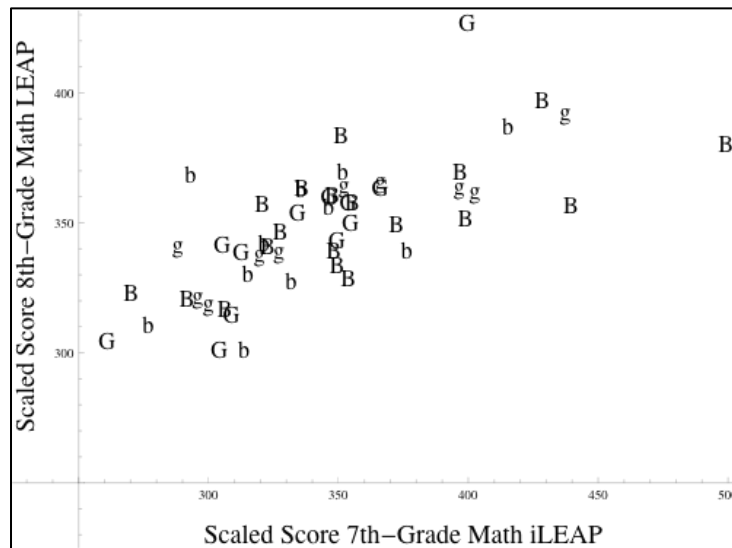


Figure 4.1 Scatter Plot of Scaled Scores

Chapter 5. Discussion

5.1 General Discussion

The current study examined the effectiveness of a values affirmation writing exercise on the standardized test scores of eight grade females. The mean of each group was found pre-intervention and post-intervention. These means were then compared.

The results from Year 1 to Year 2 for each group were as follows: Males in the control group outperformed the group's mean by 9 points (+9). Males' scores in the treatment group dropped eight points (-8). Females in the control group outperformed their group mean by 1 point (+1). Females in the treatment group had a gain of thirteen points (+13) Even though the girls' score showed a promising increase, this gain was not statistically significant.

One must be cautious to generalize this finding to the larger population. Further research is needed with a larger sample size to determine the effectiveness of the values-affirmation writing exercise on raising the standardized test scores of females.

5.2 Limitations of Study

Obtaining a large enough sample size was one of the most difficult parts of conducting this study. As previously stated, two different attempts were made to gain consent for student participation. Initially, a three-page consent form detailing the study was sent to the parents via the students through the homeroom teacher. Of 199 students, two forms were returned giving approval for involvement. A second form, shorter and less-detailed, was written and sent home. This form was copied onto school letterhead, and was endorsed by the principal's signature. Fifty-nine students returned these forms and became the sample population for the experiment.

Teachers were given very specific guidelines for the administration of the intervention: where to stand, information that should be written on the board, how to distribute the

intervention, what to do when students were completing the intervention, etc. They were also given identical scripts to read to the students during the execution of the experiment, and they were given the answers to possible questions the students might ask concerning the writing exercises. Although these measures were supposed to minimize classroom differences, classrooms differed slightly because of the administrator's personality and ability to follow the provided guidelines.

Because the instructions for the writing assignment were not read aloud but were to read silently by each student, one cannot be sure that the instructions were clearly understood.

It was the intent that students would view this assignment as normal classroom work given to them by their teacher. For this reason, distribution of the experimental materials to the individual classrooms was to be done by the school coordinator before the beginning of the school day, and materials were to be returned by the teachers to the school coordinator after students had left the school at the end of the day. The study materials were delivered to the school before each day of the interventions. It is not known if these instructions were followed exactly, which means that material delivery may have become a limitation.

The length of this study was a limitation. While four values-affirmation writing exercises were adequate in previous studies, a higher number of interventions over a period longer than one semester might be recommended. As in Cohen's research, a period of two years would be desirable to test the intervention's efficacy. This period is adequate for observing the interrupting of negative recursive cycles. The longer the observation period, the more easily it will be for the researcher to determine lasting effects on the participants.

Of concern to the researcher of stereotype threat is the timing of interventions. The likelihood of breaking a recursive cycle is greater if the intervention is well-timed in the face of

the threat. As shown in the Integrated Stereotype Threat Model by Schmader (2008), an intervention placed in the appraisal stage of the threat may have greater effect. An example of this would be administering a form of treatment right before the first major test of a semester. This buttressing of the student's self-image and self-concept might help to alleviate any worrying thoughts or fears that could enter when faced with a situation which causes the student anxiety, stress, or arousal.

The statistical method for analyzing data should be decided before the research study, and in particular an appropriate sample size should be used. Statewide in 2011, 23,291 females took the 8th-grade math LEAP. Their mean scaled score was 329.18 with a standard deviation of 40.85. At the same time, 23,549 males took the 8th-grade math LEAP. Their mean scaled score was 332.30 with a standard deviation of 40.78. (Source: "2011 LEAP/GEE State Assessment, Population Studies: Scaled Score Means for Selected Subgroups," www.doe.state.la.us/topics/leap_gee_technical_report.html.) The difference is small (3 points), but it is statistically significant, amounting to over 10 standard errors. To show that an intervention targeting performance differences due to gender is effective, we would have to be able to detect a 3-point change in the mean score of a population with standard deviation of 40. A sample size large enough to reduce the standard error to less than 1.5 points would certainly be needed. This would require more than 700 subjects.

In light of the large sample needed if the LEAP test is used as the only measure of stereotype threat, other sources of data by which to gauge it should be sought. Along with the quantitative form of assessment such as standardized test scores in this study, additional quantitative data, such as grade point averages, could be used to test the intervention's effect. Also, a qualitative portion, such as student surveys, might be added to this study.

5.3 Future Recommendations

This experiment was cost-effective and easily administered, but the sample size was small. In a chapter describing good experiment and research design, Wilson (Redirect, 2011) states that if promising results are observed with an initial small-scale study, then replications and extensions to new populations can follow. Ultimately, this can lead to the research with definitive conclusions. It is recommended, therefore, that a study with a larger sample population be initiated in order to obtain data that can support valid generalizations about the effects of the writing exercise on alleviating stereotype threat of females in math.

The literature supports several practical recommendations that teachers might wish to consider. The rest of this section will review the most important of them. Wilson and Linville (1982) conducted an experiment with college freshmen who were suffering from negative recursive cycles and were worrying about their grades. Upon entrance to the lab, participants were told that they would be completing surveys. Supposedly to help the students see what kind of questions the experimenters would be asking, the freshmen were allowed to see the results of surveys that had been previously administered to upper classmen. These results contained the information that “67 percent [of the upper-class students] said their freshmen grades were lower than they has anticipated; 62 percent of the students said their GPA had improved significantly from the first semester of their freshman year to their upper-class years” (Redirect, p. 16). Next, to make the point more firmly, the students were shown video interviews of four upperclassmen who communicated the same message as the survey results. So, in a thirty-minute session, students were “prompted” (without a writing exercise) that many people struggle initially when they enter college but that they when they persevered, their grades improved. This type of story prompting could be replicated in schools and might be of benefit to the students.

According to Jordan and Lovett (2006), there are several actions which teachers can take to help alleviate threatening situations in their classrooms. Personally, teachers can educate themselves concerning this condition. Staying informed by reading current research on this topic will certainly help. Professional development for teachers at the beginning of the school year could help set the correct tone for teachers who are interested in creating non-threatening classroom environments. It could also help promote reform at the school level.

Having students code personal information, such as gender, race, and socio-economic status after taking assessments rather than before has been shown to improve performance on tests (Steele et al., 2002). A discussion with school system officials and individual school administrators about the coding of such information might lead to policies that would reduce the effects of stereotype threat.

Before tests, psychologists, test administrators, and teachers should be careful not to evoke stereotype threat of any kind by talking about or asking any questions related to student demographic groups (such as music preferences, sporting preferences, etc.). They should also not describe tests as diagnostic or intelligence tests (Jordan and Lovett, 2006).

Once a teacher is informed, educating their students about stereotype threat will decrease its effects in the classroom. Several discussions are recommended. For example, a clear description of grading practices and criteria should be given. In this explanation, teachers should assure students that standards, although high, are attainable by each and every member of the class (Jordan and Lovett, 2006).

A discussion of the malleability of intelligence should also take place. Many students make the inaccurate assumption that intelligence is inherited or innate. Students must be educated to understand that intelligence is changeable and that effort is an essential element in

one's academic success. The students must believe that their teacher does indeed believe that all students are capable of success. Saying to the students, "In this particular class, all students perform the same. There have been no differences between boys and girls, African Americans, Caucasians, Latinos, etc." could help to reduce anxiety (Jordan and Lovett, 2006).

Students need to be taught about stereotypes, stereotyping, and stereotype threat. Giving students many different examples of types of people (different races, genders, ages, socio-economic, etc.) who have suffered from being stereotyped may give them a different paradigm with which to interpret events in their own lives. Females might feel a chilly environment in math classes, but this environment arises from uninformed social assumptions. Knowing this might help to take the threat away or at least prevent it from being felt personally and could give students a new perspective when dealing with stress in such situations (Jordan and Lovett, 2006).

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Appendix A: Consent and Assent Forms

Consent 1 Page 1.



LOUISIANA PROJECT ACHIEVE
Principal Investigator: Liz Kirkindoll, Louisiana State University

PARENTAL CONSENT FORM November 2011

Dear Parent/Guardian,

Welcome to LOUISIANA PROJECT ACHIEVE! This consent form provides information about this important project which is a study about helping your child improve in school! All eighth grade students at North Corbin and Westside Junior High Schools are invited to participate! This project includes fun and rewarding activities that have been shown to improve students' grades and test scores.

This form explains the study that your child is being asked to take part in. Initialing **each** page and signing **page 3** will indicate that you understand this study and give consent for your child to participate.

Once you provide your consent, your child will also be asked to give his or her consent. Your child cannot participate in the study unless **both** you and your child agree.

Regardless of whether you permit or deny your child's participation in this study, returning this form will ensure that your child is eligible to have the opportunity to win the \$25.00 gift card to Wal-mart.

Principal Investigator:

The research project your child is being asked to take part in is being conducted by Mrs. Liz Kirkindoll. Her email address is Elizabeth.Kirkindoll@lpsb.org should you have any further questions.

Description of Project and Its Importance:

THE LOUISIANA ACHIEVE PROJECT will take place at North Corbin and Westside Junior High Schools. It is a study about academic achievement and includes activities that have been shown to improve school grades and test scores. All 8th graders are invited to participate during the spring semester. Being in this study is entirely up to you and your child.

If you and your child agree to take part in this study, your child will first be asked to complete some questionnaires. The questionnaires ask students about their favorite topics in school, and the things that they like and dislike about school. For instance, we may ask students about how much they value membership in their different groups. Your child will then be asked to do some writing activities. The writing activities involve creative writing that has students think about important personal experiences and values, or the views of peers or role models.

The writing activities your child will complete will be decided randomly. Neither students nor teachers will be told the group in which your child is assigned. Students who do not participate in the study will do another similar activity, provided by their teacher, while those participating complete our activity.

With the help of your child's teacher, the activities will be made part of daily classroom tasks. Your child will be doing 3 to 6 questionnaires and activities. Your child's responses to the questionnaires and the writing activities will be kept completely confidential from other students, teachers, and administrators.

Approved
[Signature]

In addition, we will ask the school to give us information about your child, including his or her gender, race/ethnicity, grade level, and class information. **This will help us examine how our activities affect academic performance.** All information is kept strictly confidential. The study will only look at **group-level results, not individual results**. It is very important for us to collect this student information in order to determine the impact of the study and whether it should be made into a school-wide practice for all students.

Risks and Discomforts:

There are no foreseeable risks if your child takes part in this study. All activities have been used previously in schools without negative effect. Your child has the right to stop participating in the study at any time. You can simply email the project director for removal.

Potential Benefits:



Some of the LOUISIANA ACHIEVE PROJECT writing activities have been found to **improve grades and test scores**. We are also working with the Livingston Parish School System so that the information we learn from this project can be used to improve school planning and classroom curriculum. Finally, we have found that students enjoy participating in this project because the questionnaires and activities concern issues that they care about.

Source of Funding:

Funding for this study is being provided by the LaMSTI Project at Louisiana State University.

Prizes:

Your child will receive the opportunity to participate in a drawing for a \$25.00 Wal-mart gift card for simply returning this signed consent form by this Friday, December 2, 2011, regardless of whether participation is permitted or denied. The drawing will be held shortly after we receive the returned consent forms.

Confidentiality:

The privacy of your child's data will be completely secure. No school data (standardized test scores, race, gender) is being accessed that could not already be accessed by your child's regular teacher. We will keep your child's responses confidential by storing all data securely in a locked cabinet. Your child's teacher will not have access to the information obtained from your child. Additionally, this information will have no effect on your child's standing in school. We are happy to provide you with a summary of the findings from this study if you would wish.

There is an exception to our policy of confidentiality:

If your child's responses indicate that he or she is in serious danger, that he or she is in danger of hurting him or herself or of harming someone else, we will take action to make sure that all children are safe. Specifically, we will contact the school counselor if your child shows serious depression or threatens other children.

Invitation for Questions:

If you or your child has questions about this study, you may email Liz Kirkindoll at Elizabeth.Kirkindoll@lpsb.org. Dr. Robert Mathews is also happy to answer any questions you may have. He can be reached at (225) 578-8692 or irb@lsu.edu.

We understand that you and your child are very busy. We thank you very much for taking the time to complete and return this consent form.

PLEASE RETURN THIS FORM TO YOUR CHILD'S TEACHER BY THIS FRIDAY, DECEMBER 2, 2011, TO BE ELIGIBLE TO WIN THE \$25.00 WAL-MART GIFT CARD!!!

For the project, we are collecting school level data for participating students. Also, please remember that all of your student's data will be kept secure and confidential.

IN ORDER FOR YOUR CHILD TO TAKE PART IN THE LOUISIANA ACHIEVE PROJECT, YOU MUST CHECK THE BOX AND SIGN BELOW—THANKS!

☐

I consent to have my:

- achievement test scores (LEAP)
- race
- gender
- special education status

I have read the above information, or it was read to me, and I **agree** to have my child participate in this study. I know being in this study is voluntary and that my child has the right to decline to participate or to withdraw his or her assent at any time during the study. I have received, on the date signed, a copy of this document containing 3 pages.

Name of student (please print): _____

Name of school (please print): _____

Name of parent or guardian (please print): _____

Signature of parent/guardian _____

Date: _____

Please initial all previous pages of the consent form.

If you **DO NOT** give your consent, please sign this section

I have read the above information, or it was read to me, and I **do not agree** to have my child participate in this study.

Name of student (please print): _____

Name of school (please print): _____

Name of parent or guardian (please print): _____

Signature of parent/guardian _____

Date: _____

Consent 2.



Westside Jr. High School

12615 Burgess Ave. Walker, Louisiana 70785 Phone: 225-665-8259 Fax: 225-665-8283

Stephen Link

PRINCIPAL

Ray Alphonso

ASSISTANT PRINCIPAL

Dear Parents,

As a part of Westside Junior High's School Improvement Plan, our staff will be conducting surveys and activities that are designed to help our students. These activities will be conducted in the classroom and will NOT cause more work for your child.

A previous member of our faculty, Mrs. Liz Kirkindoll, is working towards her masters degree at LSU. As part of her thesis, she would like to access the data that we collect. The data collected will be anonymous and will be analyzed as group, not individually. This study has been approved by the LSU IRB. You may call Mrs. Kirkindoll at [redacted] or Dr. Robert Matthews from LSU at 578-8692 if you have questions about participants rights.

Since we will collect and analyze this data anyway, I would like to encourage you to permit Mrs. Kirkindoll to use this information. Please sign below indicating your desire for your child. If your child returns this form, whether or not permission is given, he/she will be entered into a drawing for a \$25 Wal-mart gift card provided by Mrs. Kirkindoll. In addition, he/she will also receive two Gator Dollars which can be used at the school for various privileges and will be given a slurpie to enjoy during recess.

Thank you for considering your child's participation in this worthwhile project.

Mr. Stephen Link, Principal

Please sign below and return to your child's **homeroom teacher** by **Friday, February 3, 2012**.

Please circle one:

I ☐ **give** ☐ **do not give** permission for Mrs. Kirkindoll to access the school's data for:

Name of student (please print): _____

Name of parent or guardian (please print): _____

Signature of parent/guardian _____

Date: _____

Assent Form.

Assent Form
LOUISIANA PROJECT ACHIEVE

This is a study about young peoples' experiences in school. We would like to ask you questions about your feelings, and your favorite subjects and activities. We would also like to ask you about the role of race and gender in your life and at your school, and about the issues, concerns, and things in young peoples' lives that are important to them.

We will keep your answers completely confidential. We will use your answers, along with information about your school performance to try to get a better idea of what school is like for you. Again, all your answers and all your school data will be kept confidential and not linked to your name.

Your parents and teachers will have no access to the answers you give, except in one case: If we learn something that would immediately put you or someone else in danger (for example, if you tell us you are going to harm yourself or others), we may discuss it with you if possible, or seek help from others (such as parents and school personnel) to protect you or the other person who is in danger. In all other circumstances, your parents and teachers will have absolutely no access to your answers at all.

This questionnaire will take about 30-40 minutes to complete. Please ask us if you don't understand anything.

There are no significant risks involved in this research project.

Please be honest as you complete this questionnaire—we need a truthful picture of the experiences of young people. **And remember, all your responses are completely confidential and will be shared with no one.** Thanks for your help!

If you agree to participate in the survey, please provide the following information and sign your name:

Personal Information:

Name: _____

School: _____

Your signature: _____

Date: _____

What are your parents'/caregivers' names: _____

Appendix B: Intervention Instructions for Teachers

Instructions for Teachers: Intervention 1.

Instructions for Teachers:

Teachers,

Please know that there are **TWO** different activities handed out to your children, therefore, please do everything possible to keep them from talking to each other during the activity or from looking on each other's desks. If they discover this, then the activity is ruined!!!

Please keep and turn in a list of problems and/or questions that arose so these can be addressed by the next activity.

Students should be seated and quiet. DURING THIS ACTIVITY, STUDENTS SHOULD REMAIN TOTALLY QUIET. If there is a question during the activity, students should raise their hand, and the teacher should go to the student's desk to answer the question.

There should be no talking ABOUT the activity DURING or AFTER the activity about its contents.

Students must remain BLIND to the fact that there are two different activities being completed in the classroom.

AFTER STUDENTS ARE SETTLED AND QUIET:

- 1) Hand out white envelopes.
- 2) Have students open them and begin. Directions are not to be read aloud.
- 3) Tell the students that the activity will **NOT BE GRADED**, however the directions should be read by the student silently and closely followed.
- 4) When the activity is complete, the student should place the papers back in the white envelope.
DO NOT SEAL THE ENVELOPE.
- 5) When everyone is complete, collect the envelopes.
- 6) **RETURN THE ENVELOPES TO THE OFFICE AT THE END OF THE DAY WHEN THE STUDENTS HAVE LEFT THE CLASSROOM.**

Instructions for Teachers:

Teachers,

Please know that there are TWO different activities handed out to your children, therefore, please do everything possible to keep them from talking to each other during the activity or from looking on each other's desks. If they discover this, then the activity is ruined!!!

Please keep and turn in a list of problems and/or questions that arose so these can be addressed by the next activity.

Students should be seated and quiet. DURING THIS ACTIVITY, STUDENTS SHOULD REMAIN TOTALLY QUIET. If there is a question during the activity, students should raise their hand, and the teacher should go to the student's desk to answer the question.

There should be no talking ABOUT the activity DURING or AFTER the activity about its contents. **Students must remain BLIND to the fact that there are two different activities being completed in the classroom.**

AFTER STUDENTS ARE SETTLED AND QUIET:

- 1) Hand out white envelopes.
- 2) Please tell the students to make sure to write their first AND last names in the blank provided.

Read the following statement to the students:

Students, two weeks ago, we completed a similar writing activity in which you choose two or three topics and wrote about one. We know which topic you wrote about. Today, please delete your previously-chosen topic and write about your second choice.

- 3) Have students open them and begin. Directions are not to be read aloud.
- 4) Tell the students that the activity will **NOT BE GRADED**, however the directions should be read by the student silently and closely followed.
- 5) When the activity is complete, the student should place the papers back in the white envelope.
DO NOT SEAL THE ENVELOPE.
- 6) When everyone is complete, collect the envelopes.
- 7) Please alphabetize the envelopes.
- 8) **RETURN THE ENVELOPES TO THE OFFICE AT THE END OF THE DAY AFTER THE STUDENTS HAVE LEFT THE CLASSROOM.**

Instructions for Teachers: Interventions 3 & 4.

Instructions for Teachers:

Teachers,

Please know that there are **TWO** different activities handed out to your children, therefore, please do everything possible to keep them from talking to each other during the activity or from looking on each other's desks. If they discover this, then the activity is ruined!!!

Please keep and turn in a list of problems and/or questions that arose so these can be addressed by the next activity.

Students should be seated and quiet. DURING THIS ACTIVITY, STUDENTS SHOULD REMAIN TOTALLY QUIET. If there is a question during the activity, students should raise their hand, and the teacher should go to the student's desk to answer the question.

There should be no talking ABOUT the activity DURING or **AFTER** the activity about its contents. **Students must remain BLIND to the fact that there are two different activities being completed in the classroom.**

AFTER STUDENTS ARE SETTLED AND QUIET:

- 1) Hand out white envelopes.
- 2) Please tell the students to make sure to write their first AND last names in the blank provided.

Read the following statement to the students:

Students, you have previously completed two similar writing activities. Today, there are some new topics included. Please feel free to write about a previously chosen topic or you may select one of the new ones.

- 3) Have students open them and begin. Directions are not to be read aloud.
- 4) Tell the students that the activity will **NOT BE GRADED**, however the directions should be read by the student silently and closely followed.
- 5) When the activity is complete, the student should place the papers back in the white envelope.
DO NOT SEAL THE ENVELOPE.
- 6) When everyone is complete, collect the envelopes.
- 7) Please alphabetize the envelopes.
- 8) **RETURN THE ENVELOPES TO THE OFFICE AT THE END OF THE DAY AFTER THE STUDENTS HAVE LEFT THE CLASSROOM.**

Appendix C: IRB Approval Notification

Application for Exemption from Institutional Oversight

Inless qualified as meeting the specific criteria for exemption from Institutional Review Board (IRB) oversight, ALL LSU research/ projects using living humans as subjects, or samples, or data obtained from humans, directly or indirectly, with or without their consent, must be approved or exempted in advance by the LSU IRB. This Form helps the PI determine if a project may be exempted, and is used to request an exemption.

- Applicant, Please fill out the application in its entirety and include the completed application as well as parts A-E, listed below, when submitting to the IRB. Once the application is completed, please submit two copies of the completed application to the IRB Office or to a member of the Human Subjects Screening Committee. Members of this committee can be found at <http://www.lsu.edu/screeningmembers.shtml>

- A Complete Application Includes All of the Following:

(A) Two copies of this completed form and two copies of part B thru E.

(B) A brief project description (adequate to evaluate risks to subjects and to explain your responses to Parts 1&2)

(C) Copies of all instruments to be used.

*If this proposal is part of a grant proposal, include a copy of the proposal and all recruitment material.

(D) The consent form that you will use in the study (see part 3 for more information.)

(E) Certificate of Completion of Human Subjects Protection Training for all personnel involved in the project, including students who are involved with testing or handling data, unless already on file with the IRB. Training link: (<http://phrp.nihtraining.com/users/login.php>)

(F) IRB Security of Data Agreement: (<http://www.lsu.edu/irb/IRB%20Security%20of%20Data.pdf>)

Principal Investigator: Elizabeth S. Kirkindoll

Rank: Graduate Student

Dept: MNS

Ph:

E-mail: Elizabeth.Kirkindoll@lsu.edu

Co Investigator(s): please include department, rank, phone and e-mail for each

None

IRB# E5774 LSU Proposal #

☒ Complete Application

☒ Human Subjects Training

Project Title:

Interventions in the Middle School Mathematics Classroom: Raising Standardized Test Scores by Diminishing Stereotype Threat

Study Exempted By:

Dr. Robert C. Mathews, Chairman
Institutional Review Board
Louisiana State University
203 B-1 David Boyd Hall
225-578-8692 | www.lsu.edu/irb

Exemption Expires: 11-20-2014

Proposal? (yes or no) No

If Yes, LSU Proposal Number

Also, if YES, either

☐ This application completely matches the scope of work in the grant

OR

☐ More IRB Applications will be filed later

Subject pool (e.g. Psychology students)

Students in two Livingston Parish middle schools

*Circle any "vulnerable populations" to be used: (children <18; the mentally impaired, pregnant women, the aged, other). Projects with incarcerated persons cannot be exempted.

PI Signature

Elizabeth S. Kirkindoll

Date

November 9, 2011

(no per signatures)

* I certify my responses are accurate and complete. If the project scope or design is later changes, I will resubmit for review. I will obtain written approval from the Authorized Representative of all non-LSU institutions in which the study is conducted. I also understand that it is my responsibility to maintain copies of all consent forms at LSU for three years after completion of the study. If I leave LSU before that time the consent forms should be preserved in the Departmental Office.

Screening Committee Action: Exempted ☒ Not Exempted ☐ Category/Paragraph 1

Reviewer

Mathews

Signature

Robert C. Mathews

Date

11/21/11

Vita

Liz Kirkindoll received her Bachelor of Music Education from Centenary College of Louisiana in 1981. After becoming certified in secondary mathematics, she spent the next twenty-five years teaching vocal music and math. In 1987, she received Teacher of the Year from Central Middle School, and in 1994, she received the Exxon Math and Science Teacher of the Year from Broadmoor High School. In 2003, the Central High School Acapella Choir, under her direction, performed at Carnegie Hall in New York City.

After retiring from teaching in 2003, Liz opened three franchises representing two companies: Curves Fitness for Women and Young Chefs Academy. While operating these businesses, Liz and her husband, Dale, won the Shining Star Award from Curves and The Young Chefs Academy Corporate Spirit Award.

Liz is wife to Dale Kirkindoll, a secondary social studies teacher, and mom to Grayson and Holt Kirkindoll. She would like to spend time in the mission field in Cuba with her husband and Cuban friends. She hopes to contribute to educational practices with this research.