2018

Math Self-efficacy Effects on Prisoners' Academic Achievement

Randall Peder Bergman
Bethel University

Math Self-Efficacy Effects on Prisoners' Academic Achievement

Randall P. Bergman

A dissertation submitted to the faculty of Bethel University
In partial fulfillment of the requirements for the degree of
Doctorate of Education.

Saint Paul, MN
2018

Approved by:

Advisor: Dr. Michael Lindstrom

Reader: Dr. Erica Hering

Reader: Dr. Lloyd Komatsu

Acknowledgements

This dissertation would not have been possible without cooperation from the Wisconsin Department of Corrections that approved for this study of their prisoner population. The 181 incarcerated male prisoners who volunteered their time and participated in this study were crucial to its completion. The correctional staff who are dedicated to the supervision and care of prisoners were also essential contributors. I am forever thankful for their sacrifices and contributions to this study. I hope this study met or exceeded their expectations.

I specifically thank Dr. Joseph Tatar for accepting my request and helping me find a pathway to study Wisconsin prisoners enrolled in adult basic education. I am also appreciative of the support and encouragement of my dissertation advisor, Dr. Michael Lindstrom, throughout my doctorate program and my professional education journey. My wife and children provided me the unconditional love, encouragement, and prayers necessary throughout my doctorate work as well over the last twenty most wonderful years of my life. I love and thank them dearly.

Several others have sacrificed, supported, and prayed for my success to complete this program within my own community of faith at Frist Lutheran Church in Columbia Heights and Bethel University. I thank Dr. Craig Paulson and Dr. Erica Hering particularly for their supportive words and teachings both inside and outside of the classroom. I am much indebted to all the leaders in public education who helped, guided, and trained me to become a professional education administrator at Noble Academy in Brooklyn Park and at Forest Lake Public Schools.

I give my thanks and praise to The Lord of Life for the blessing of public service entrusted to me by the Minnesota Department of Corrections at MCF-Saint Cloud that inspired this study and has helped to provide for my family many blessings over the past five years.

Abstract

This study examined three hypothesized math-self efficacy (MSE) sources that inhibit adult basic education male prisoner math achievement. Previous correctional studies indicated that United States prisoners tend to have low self-efficacy and therefore lower academic achievement (Greve & Enzmann, 2003). Adult education studies also indicated lower self-efficacy in adults older than age 20 who take coursework to complete their high school diploma (Jameson & Fusco, 2014). Survey studies of MSE factors from analysis show that students who self-report lower self-confidence, negative self-beliefs, increased math anxieties, and greater devaluation of math's usefulness to their future employment have significant barriers to math achievement (Hendy, Schorschinsky, & Wade, 2014; Liew, et. al, 2014). One hundred and eighty-one males enrolled in Adult Basic Education programs incarcerated in the Wisconsin Department of Corrections volunteered for this study. A survey derived from previous research factor analysis and scale measures adapted MSE questions in a prison context to calculate prisoner MSE in order to compare to math achievement (Hendy, Schorschinky, & Wade, 2014). Academic performance indicators included math test scores and prisoners' dropout year from K-12. Correlation and regression analyses from the scaled-scored TABE® data determined calculations of MSE significance for math academic achievement. The researcher categorized 52 prisoner free-responses into three MSE constructs. Correlational analysis revealed prisoners' beliefs initially were statistically significant for math achievement. Hierarchical multiple regression analyses revealed prisoners' anxieties had a long lasting impact on low math achievement when correlated with prisoners' dropout grade levels after they exited public school to when they were incarcerated and while enrolled in correctional adult basic education programming.

Table of Contents

List of Tables

Table of Figures

List of Abbreviations

ABE	Adult Basic Education
ACE	Adverse Childhood Experiences
ACES	Academic Career Employability Skills
AHSD	Adult High School Diploma
ANOVA	Analysis of Variance
APA	American Psychological Association
ASSET	Assessment of Skills for Successful Entry and Transfer
ATT	Attendance
CCRS	College Career Readiness Standards
CI	Confidence Interval
CRS	Future Math Courses Preparedness Imparted by the Course
DOC	Department of Corrections
GE	Grade Level Equivalency
GED	High School Graduate Equivalency Diploma
HSD	High School Diploma
INSTR	Instructor-Related Factors
MARS	30 item Mathematics Anxiety Ratings Scale (Richardson & Suinn, 1972)
MBS	11-item Math Barriers Scale with two subscales that measures math anxieties
MCS	7-Item Math Confidence Scale that measures math beliefs
MVS	10-item Math Value Scale with two subscales that measures math attitudes
MPSS	Mathematics Performance Problems Scale (Dowling, 1978)
MSE	Math Self-Efficacy

MSES	Mathematics Self-Efficacy Survey (Betz & Hackett, 1989)
MSES-R	Mathematics Self-Efficacy Scale-Revised (Pajares & Kranzler, 1995)
NADE	National Association of Developmental Educators
NCES	National Center for Education Statistics
NRS	National Reporting System
NLSMA	National Longitudinal Study of Mathematics Ability Organizational Factors
PISA	Program for International Student Assessment
SCCM	Social-Cognitive Career Choice Model (Lent, Brown & Hackett, 1994)
SDQIII	Self-Description Questionnaire (Marsh, Walker & Debus, 1991)
SELMA	Self-Efficacy to Learn Mathematics Asynchronously
SES	Socioeconomic Status
SME	Science, Math and Engineering
SPSS	Statistical Package for the Social Sciences
SS	Scale Score
SSK	Study Skills
STEM	Science, Technology, Engineering and Mathematics
TABE®	Test of Adult Basic Education (scale score functioning levels grades 0-12.9)
TPC	Transition from Prison to Community [philosophy]
TPSC	Transition from Post-Secondary and Career [ABE Class]

Research MSE Construct Definitions

Math Anxieties**:** Student physical responses that effect accurate assessments of mathematics achievement (Bandura, 1977; Bandura, 1997). Solving mathematical problems increases heart rate and blood pressure, tenses-up muscles and dilates pupils requiring greater attention and brain activity. It is common for most people to experience some form of math anxiety before and during a math test. Such anxieties influence the validity and reliability of student performance measures on math tests, problem solving, and grades (Beilock & Carr, 2005; Hendy, Schorschinky, & Wade, 2014; Hess, 1965; Lavie, 2010).

Math Attitudes: Student attributes resulting from social influences, value judgments, devaluations, and/or emotional responses about the purpose and worthiness of doing mathematics (Boaler & Dweck, 2016; Hendy, Schorschinky, & Wade, 2014).

Math Beliefs**:** Student internal fixed or growth mindsets (Boaler & Dweck, 2016) about one's own abilities to do mathematics that come from prior learning experiences and one's own perceived abilities to do math (Hendy, Schorschinky, & Wade, 2014; Usher & Pajares, 2006) as well as a student's positive and/or negative internal dialogues about mathematics as an inherent trait (Núñez-Peña, Suárez-Pellicioni, & Bono, 2013).

Chapter I: Introduction

Purpose of the Study

This study's primary purpose was to measure the relationship between math and academic achievement using prisoner MSE scale scores to formulate, articulate, and define male prisoner barriers to learning mathematics. ABE goal obtainment and success in mathematics is essential for prisoners to earn a first secondary education credential by passing the GED or other high-stakes exam math tests. A secondary result of this study was to explore the extent of the relationships of the three identified MSE categories with prisoners' student math achievement and to overall achievement.

This study had five fundamental goals. First, this study adapted and produced a standardized MSE measurement for nontraditional students that is acceptable and relevant for use with male adult prisoners within a correctional setting. Second, this study collected information to support Bandura's (1997) social learning theory that self-efficacy is an accurate descriptor and predictor of academic proficiency and pro social behavior (Bandura, 1997). Third, this study attempted to verify that self-efficacy theory is applicable to studying and teaching adult male prisoners. Fourth, this study proposed and provided an evidence-base in Assessment of Skills for Successful Entry and Transfer (ASSET) that further explains why self-efficacy sources and subscales relate to math and academic performance in adult male prisoners. Such MSE scale studies may support antisocial or at least negate prosocial factors along with provide a pedagogy for math instructors to reduce negative academic behaviors in prisoners. Fifth, this study examined the extent that each of the three defined MSE sources affected overall MSE in relationship to math and academic performance.

Statement of the Problem

Self-efficacy studies on student behavior have primarily concentrated on Caucasian, (Usher, 2009), European (Raufelder, et al., 2013) and adolescent (Esperian, 2010; Hogan, Bullock, & Fritsch, 2010) students. The applicability of self-efficacy theory and its potential correlation to mathematics instruction and acquisition for incarcerated adult males enrolled in taxpayer subsidized ABE programs and its impact on recidivism has not been quantified or thoroughly investigated by any study within the United States of America known to this researcher at the time of this study.

ABE programming in State Correctional Facilities enrolls approximately 24%-36% of the prisoner population nationally taken from prisoners who do not possess a high school diploma (National Research Council, 2014). Such programming often targets prisoners who do not possess a secondary education credential (diploma/GED) in order for them to earn this credential to further their likeliness of obtaining employment (Duwe & Clark, 2013; Davies, et al., 2013; National Research Council, 2014). The most recent national study of prisoners in 2014 showed that incarcerated adults as a population were significantly lower in numeracy skills from U.S. household populations on average when comparing numeracy scores of those with less than a high school credential across all race categories (Rampey, et al., 2016). Prisoners' negative numeracy outcomes and antisocial behavioral outcomes can be statistically correlated with self-efficacy and then to MSE. MSE studies typically do not isolate the male gender prisoner population. They tend to include socio-economic demographics and asses the population as a whole (Gagnon & Barber, 2014; Lockwood, Nally, Ho, & Knutson, 2012; Taylor, 1992). A few studies have suggested a moderate or weak predictive expected value with mixed-gendered student populations (Dutton, 1954; Fennema & Sherman, 1978; Hackett & Betz, 1981). Other

MSE studies (Fan & Williams, 2009) suggested focusing more attention on how different social and physical settings effect MSE, but failed to mention or account for male prisoners in their samples. It is unclear if MSE is a predictor of performance for all or any specific type of students (Bandura, 2001; Hackett & Betz, 1981). Researchers examined how MSE related to prisoner math and academic outcomes for prisoners in Norway as it pertained to their sentences and motives for participation (Roth, Asbjørnsen & Manger, 2016). Use of prisoners' MSE scores as descriptors of their educational performance provided insight to how MSE effects math and future academic choices and achievement of low performing students. Use of MSE as a descriptor of academic difficulties is missing from the research for advancing and improving mathematics instruction and for motivation in prisoner populations at the time of this study.

Studying male prisoner MSE and relating it as a descriptor of prior low math and poor academic performance provides a new venture and fresh approach into understanding student background experiences as they relate to present students' abilities, motivations, and/or aptitudes to achieve at school and particularly in math. Prisoners' MSE scores may be promising prisoner measures teachers can monitor and potentially use to motivate and to improve student learning within correctional settings. Knowledge of poor performing student MSE and MSE latent variable effects on their learning may help teachers and administrators utilize classroom time and resources for this particular student population. Such studies that reference MSE as a descriptor of student ability to learn usually use it for determination or predictability in choosing a college STEM major or future career pathways (Gore & Leuwerke, 2006; Sax, et al., 2015). This study attempts to use MSE descriptors for describing and correlating its effect on basic adult male math and academic achievement. This study does not attempt to make any causal relationships

or conclusions since there are far too many independent variables outside of the parameters of this study as described in chapter III to substantiate any such claims.

Introduction to this Math Self-Efficacy Study

For over four decades, social scientists have studied how individual beliefs effect academic performance based on self-efficacy theory (Bandura, 1997; Schunk & DiBenedetto, 2016). Student self-efficacy beliefs historically predict individual capabilities to accomplish specific tasks (Bandura, 1986). Self-efficacy beliefs are evident in studies to predict mathematics problem-solving ability as well as mathematics anxieties and learned societal attitudes toward study of mathematics and the people who do mathematics as a career (Bong, 1999; Pajares, 2004). Contextual and social barriers can inhibit student's perceptions of their own ability and learning of mathematics along with prior math experiences as potential effects to math achievement (Bandura, 1997; Bong, 2001).

Individual's math self-efficacy (MSE) operational definition includes perceptions of individual performance capability to solving math problems, perform math tasks, and possess behaviors as evidenced by research to doing well on math tests and in math classes (Betz & Hackett, 1993; Richardson & Suinn, 1972). The research shows that a person's MSE beliefs in their own abilities to do specific math tasks are important predictors of math and educational outcomes (Pajares & Schunk, 2001). MSE correlates with psychological constructs relating to mathematics anxiety. Research confirmed that feelings of mathematics anxiety negatively correlate with MSE (Hackett, 1985; Suinn, 2003).

MSE research also continues to measure how people's judgements of their own abilities in math are influenced by their social comparisons and math anxieties (Pajares, 1996; Schunk & Hanson, 1985) MSE has been found to be a significant predictor of extremely high or extremely

poor math achievement (Usher & Pajares, 2007). In this study, prisoner MSE research will focus on the relationship of low or poor math performance and MSE on this particular underachieving academic population.

Contained within the limitations of prisoner research, a 30-item MSE survey was modified and constructed for nontraditional students as an assessment that could equally distribute and measure three categorical aspects of MSE (Hendy, Schorschinky, & Wade, 2014; Rampey, et al., 2016). Modification of academic self-efficacy items for prisoners for contextualizing questions to prisoners' experiences was required for this study and is an internationally accepted practice in prisoner studies (Roth, Asbjørnsen & Manger, 2016). The self-reported survey offered through the Wisconsin Department of Corrections Education Department to prisoners over 90 days to a cross-section male adult prisoner cluster sample who did not possess a secondary education credential (diploma/GED). The analysis of the survey results calculated a more comprehensive MSE measure with the fewest items necessary from this particular cross section population. For validity, the researcher will compare actual prior assessment data and educational outcomes related to math and academic achievement in his attempt to describe prior and present correlative relationships between prior academic achievement and current MSE.

An essential issue for MSE research is in defining which specific latent variables to measure that are worth identifying as being relevant and relational to student success or failure in math content areas and academics as a whole. This study provides further evidence of the relationships between student academic outcomes and MSE as well as MSE and math achievement. Correlations between MSE and academic outcomes in Adult Basic Education (ABE) programing are essential because of the need for students to pass a high stakes

examination (GED) or meet competency requirements to obtain their secondary education credential (diploma/GED). The high stakes nature of the GED examination is correlational to increased math anxiety and other feelings of math devaluation and self-beliefs in the sample population of ABE students (Jameson & Fusco, 2014).

This study's population sample represents exclusively adult male nontraditional student prisoners taken from the Wisconsin Department of Corrections in the spring of 2017. Currently enrolled incarcerated males in Correctional ABE programming had dropped out of high school, failed to earn their high school diploma on time, and struggled in traditional school. Prisoners are required to pass a math test to earn their GED or other equivalency high school diploma and must demonstrate their competency in math. Prisoners provided an opportunity to participate in ABE to earn a secondary education credential (diploma/GED) while incarcerated in Wisconsin were given the opportunity to participate in this study to investigate how MSE relates to their ability to succeed in school. The prisoner cross-section sample consisted solely of students who have not earned a secondary education credential (diploma/GED). Verification from a records search by the researcher was made after been given prisoner consent. Prior educational records provided the researcher with prisoner educational test scores and correlate to prisoner MSE scores and low academic performance.

There are no studies known to the researcher in the United States that have made an attempt to correlate ABE male prisoners' prior educational records and calculate their MSE in order to attain a better understanding of the extent of these relationships to their current and possible future academic abilities. The researcher adapted constructs of three specific MSE categories for this achievement study's purpose. Using an adapted MSE survey questionnaire

the three measurement tools of MSE correlated with prisoner educational achievement tests of adult basic education knowledge and self-reported school records.

The three-pronged approach condensed three distinct MSE prior survey measurement scales into math anxieties, math confidences or beliefs, and math values or attitudes. The three key categorical descriptors of attitudes, beliefs, and anxieties provided a simpler, timesaving, and more comprehensible MSE measurement for this study. This adapted measurement of student math belief's tool and its descriptors provide implications for future MSE research. Federal regulations and State laws make research on prisoners burdensome, cumbersome, and less desirable. Attention to these limitations and overcoming these barriers is provided in the Methodology section of this study (see Chapter IV). Found in this study's summary are explorations, explanations, and future recommendations for studying prisoner populations in the United States (see Chapter V). Articulated throughout are implications on ethical, motivational, and physiological barriers within male prisoner populations.

The MSE categories of beliefs, attitudes, and anxieties toward math are real barriers for nontraditional adult students to achieve the basic secondary level math competency (Jameson & Fusco, 2014). Standardized assessment results in secondary math achievement most often determined completion of math courses and attainment of a secondary education credential (diploma/GED). In a male correctional setting, prisoner low MSE is expected and perhaps more prevalent and relevant to prisoner secondary academic achievement than their social, economic, and/or environmental factors (Forrest-Bank & Jenson, 2015). Evidence does exist that MSE measures of nontraditional students correlates to actual ability to achieve on high stakes math assessments, complete math courses, and attain a diploma (Harrison & O'Connell, 2013;

Jameson & Fusco, 2014). For this study, it was necessary to clearly identify and provide specific meanings to self-efficacy terms and confidence levels in doing mathematics.

Constructing three categorical variables associated with MSE is necessary to determine the extent of the relationships MSE has to academic achievement. For adult male prisoners enrolled in ABE, this simplification model holds three constructive domains of: beliefs, attitudes, and anxieties. Holding constant all three domains, for the purpose and benefit of this study's analysis of MSE, the researcher was able to evaluate the effect of each domain on student achievement. This study's results never intended to be generalizable outside of the target prisoner population nor conclusive as much as the intent of the results to be descriptive and provide procedural methods for the study of ABE male prisoner participants and the relationship MSE has on their academic achievement.

An adult male prisoner population enrolled in ABE programing provides a unique socio-demographical mixture of negatively impacted participants for this study. Detrimental effects of prisoners' prior educational and life experiences correlate to participants' MSE and MSE subset domains in measuring this negative effect. MSE and the three defined subset domains provide from prisoner self-reported MSE survey responses measurable MSE barriers with past academic failures. Such socio-demographic academic outcome differences were correlated with MSE measures. Found in Chapter IV are correlation explanations of MSE and MSE constructs to prisoner math achievement.

The literature review sections further examine and synthesize meanings, categorizations, and values assigned to the three constructed latent efficacy variable sources. A simplified threefold scale model of the MSE domains and the assignment of three efficacious variables was applied to the adapted survey results. Explanations of these MSE construct applications are

within the methodology Chapter III. Chapter IV analyzes the MSE survey results of the prisoners' responses and to their educational records, which determined the most significant variable effect of MSE on prisoner math achievement. Chapter V summarizes the findings of the results as well as provides implications for academics and practitioners along with cautions for use of this study's data.

Background of the Study

This research examined, measured, and described the effects of MSE and its three categorical scale sources on adult male prisoners enrolled in correctional ABE programs. Previous research on prisoners indicates that males requiring correctional education is most often due to not having completed their high school diploma. These male students tended to have significantly lower self-esteem, lower self-confidence and lower self-efficacy than traditional student populations (Greve & Enzmann, 2003). Research on adult male prisoners also suggested that this subpopulation had overall lower self-confidence, lower self-efficacy, negative self-beliefs, increased anxieties, and face several other significant barriers not experienced by traditional high school and non-incarcerated adult students (Jameson & Fusco, 2014; Zettle, & Raines, 2000). Male prisoners who do not possess a secondary diploma are more at risk for math devaluation, poor math confidence, decreased interest in math related professions, and have lower math confidence and increased anxieties doing math that may influence their overall math achievement. Measurements of confidence have been strongly associated with student self-efficacy and considered synonymous (Stankov, Lee, Luo, & Hogan, 2012).

This study explored further the extent to which adult male prisoner self-efficacy in mathematics is effected, influenced, or predetermined in adult male prisoners from their prior academic and math achievements in school. The cross-section survey participants consists of

ABE eligible male prisoners who do not possess a secondary education credential (diploma/GED) (high school diploma or GED) and are expected to share common variable traits as reported in their survey results.

Over 300 hundred willing and able male prisoners within the Wisconsin State Correctional system from March 10, 2017 to June 10, 2017 invited by this researcher through WI DOC staff to participate in this study. Over half of the prisoner population offered the opportunity chose to participate in this study. Solicitation of prisoners to complete a standardized MSE survey and to write a free response on their reaction to the survey occurred by use of an invitation letter and WI DOC staff. Analysis of the adapted MSE survey was based on expectancy-value theory, self-efficacy theory, and health belief models as developed from prior factor-analysis research (Hendy, Schorschinsky, & Wade, 2014; Jameson & Fusco, 2014). The adapted survey items compartmentalized adult male prisoner responses into three primary MSE constructs that scored individually for each MSE component as well as collectively. These MSE latent confidence or self-efficacy variables become barriers for adult male prisoner abilities to do well on math assessments, achieve in school, and particularly to pass the GED examination to earn their first secondary education credential (diploma/GED).

The efficacy effects on individual math achievement do influence MSE and these three sources in particular way. Predominately, studies on these effects and correlations examined gender differences in math achievement, science program outcomes, and career choice in STEM fields and college math classes from prior research (Ayotola & Adedeji, 2009; Huang, 2013; Schnell, Ringeisen, Raufelder, & Rohrmann, 2015). MSE also was linked with several other studies to student overall academic success in completing an education program or passing a high stakes assessment (Zimmerman, Bandura, & Martinez-Pons, 1992). Student future career

choices after high school and college has provided evidence of differences in gender and race based on a student MSE or avoidance of math related careers or fields of study (Bolat & Odacı, 2016; Zeldin, Britner, & Pajares, 2008). The retention effects on post-secondary education degree completion and student motivation to strive towards future math-related careers were researched in undergraduate and graduate students. These studies (Gore, 2006; Peters, 2013; Zeldin & Parajes, 2009) have shown a moderate to strong correlation between high MSE variables and math-related careers. Such studies represented a majority of MSE studies that research the relationship between student's beliefs, attitudes and/or anxieties with high levels of math performance and leanings toward advanced student academic achievement (Cooper & Robinson, 1991). This particular study, however, examined the results of male students with low levels of MSE across three domains. This study also attempted to explain how these MSE sources or variable domains related with each another within this lower adult functioning, lower MSE, and higher anxiety incarcerated adult population.

The researcher did not ignore the demographics, access, and restrictions to math instruction on this representative prisoner population. The population demographics of the prisoner participants in this study represented the mentally, emotionally, and physically disabled or challenged as well as those with lower intelligence and/or lower functioning levels within an adult male prison population (Davies, et al., 2013; Rampey, et al., 2016). This prisoner population expressed having had negative experiences while participating in math class and having dropped-out of public school K-12 as early as third grade (Perry, 2014).

Prisoner populations are difficult to study due to the internal review board and federal restrictions governing research on prisoners. It is important to note that this correctional education researcher has chosen to use the term "prisoner" consistently for the purpose of this

study. The term prisoner is the more internationally recognized term in academic journals, government records and other scholarly research. Prisoners were referred to as inmate in the state Wisconsin at the time of this study. It was determined that the international term prisoner would be used consistently to describe this population throughout this study and future studies.

This study examined the relationship of three sources of MSE (beliefs, attitudes, and anxieties) to academic achievement in adult male incarcerated in the State of Wisconsin. The adapted prisoner survey was distributed and offered by WI DOC staff to adult male prisoners age 18 or above enrolled in ABE programming who did not have a diploma or GED. The prisoner had records indicating they had attended public school within the United States and did not possess a secondary education credential (diploma/GED) (diploma/GED). Academic performance included tests scores and course/grade level completion. Collection of these measures by this researcher calculated and correlated with MSE item responses for each prisoner. The research design, survey results, and disaggregated data collected will help guide suggestions for further MSE research, research with prisoners in the United States, and mathematics instruction.

This study revealed trends that support claims that self-efficacy is an important topic that needs to be addressed for improving math achievement and reducing overall academic failure. This study assesses the effects each particular source domain has on prisoner MSE and academic outcome failures across the range of socio-demographic differences. Socio-economics, peer relationships, and living conditions were significantly similar within this population. These effects were minimized by controlling for a male prisoner population. Living conditions, race, socioeconomic status, language, ethnic backgrounds, school characteristics, parent and teacher effects are expected to be similar as well as the student educational learning environments within

a prison (Rampey, et al., 2016). General Self-Efficacy research from 25 countries and the General Self-Efficacy scale also demonstrate equivalency across cultures, countries, and regions), which further could be deduced to include that MSE and categorical constructs transcend across race (Scholz, Dona, Sud, & Schwarzer, 2002).

This study, therefore, allowed for better generalizability of the results for further inquiry into this at-risk and costly student population for the advancement of ABE and math instruction within correctional educational programming. Studies within correctional settings with actual prisoner and school data are more relevant to administrators and teachers. It was more useful to know to what extent students' attitudes, beliefs, and math anxieties effect secondary achievement as it may relate to a student's aptitude, ability, confidence, and need for additional instructional methods to be successful within a correctional environment.

Most previous studies on this topic used overly task-specific instruments such as confidence and relevancy in solving arithmetic problems (Bandura & Schunk, 1981; Pajares, & Miller, 1994). Other studies used day-to-day applications of mathematics that were arithmetic intensive requiring typical algebra word problems in order to measure skill mastery (Betz & Hackett, 1983). These studies have merely focused on small subset skills of what students actually perceived to have learned in a math class. These items do not measure what specific learning experiences were inhibited by negative MSE effects and may have limited student obtainment of success in math class and attaining their secondary education credential (diploma/GED).

Although these studies are highly important in inferring the relationship of MSE to student performance by their emphasis on math skill specificity to increase the predictive power of self-efficacy, they lack the effect of negative barriers to student learning and self-mastery of

these skills (Bandura, 1997; Lent & Hackett, 1987; Pajares, 1997). Such studies lose their relevance when applying their results to adult learners (Zeldin, Britner, & Pajares, 2008). Such studies did not take into account for a population sample of male prisoners, which are extreme outliers with significant academic differences, socio-economic backgrounds, motivational needs, and psychological barriers to achievement (Rose & Rosa, 2014; Tregea, 2013). These MSE studies focused primarily at student perception of mastery experience in high performing and successful math experiences that the failed student perceptions and prior experiences are missing in these studies' analyses and results (Bong, 1999; Lent & Hackett, 1987).

Much evidence suggested that students who possess a secondary education credential (diploma/GED) and are more mathematically skilled acquire more career technical skills and successfully complete higher levels of achievement and more difficult mathematics courses (Hall & Ponton, 2002; Vacca, 2004). Earning a secondary education credential (diploma/GED) has shown to have a moderately significant positive effect in job placement as well as reduction in prisoner recidivism (Cleland, et al., 2002; Duwe & Clark, 2013). There was a lack of evidence for the way correctional educational researchers can choose statistical methods to employ in efficacy studies (Mertens, 2009; Nielsen & Moore, 2003). Many assumptions made in these studies were unexplained to readers such as; the appropriate use of correlation coefficients and the development and choice of appropriate regression models for the best fit to the data. This study attempts to clarify these details by employing descriptive statistical comparative analysis and regression (linear and/or logistic) to correlate past academic performance and test scores with measurements of MSE and MSE scaled variable effects.

Prisoner self-reported MSE survey results, assessment results, and educational records are corroborated and statistically correlated to determine significance. This analysis utilized

statistical t-test models, variance differences, and Pearson correlations to determine the extent of these correlative relationships on ABE male prisoner MSE with academic achievement when they entered correctional education. This researcher then used regression analysis to measure prisoner MSE relationships with their academic achievement while incarcerated receiving ABE programing. This study showed that Prisoner MSE factors do have significance as barriers to prisoners learning math and their motivations for academic achievement.

Study Rationale

This study provided evidence and some clarity to the MSE latent variables relationships within prisoner education systems by collection of source data from a volunteer clustered sample of adult males incarcerated within Wisconsin's Department of Corrections (DOC). Each prisoner participant provided consent for the researcher to access WI DOC records to corroborate that the prisoner participants received ABE programing, had not earned a diploma/GED, and to collect standardized academic data. Such educational data provides administrators and teachers alike potential insights into the sources of MSE for prisoners still lacking and wanting a secondary education credential (diploma/GED) for future college, career, and employability options. ABE program resource allocation, professional development, and ABE teachers' insights into motivational behavioral factors may advance instructional practices that bring merit to prisoners' insight into their attitudes, beliefs, and anxieties.

Studies indicate that males with adverse childhood experiences often struggle as adults to overcome these experiences that in turn, often results in criminal behaviors (Wright, Masten, & Narayan, 2013). For the purpose of this study, adult male prisoners' math and overall academic achievement are antisocial barriers that hinders this specific population from completing math courses in public education and graduating high school or earning their GED. Barriers to

promoting prosocial behaviors needs to be addressed in instructional and curriculum decisions by educators to promote positive behavior changes in prisoners. Changing antisocial to prosocial behavior in prisoner populations are significant in recidivism reduction in ASSET and other measurements of reducing criminal behavior in prisoners (Davis, et. al, 2013; Perry, 2014).

A quantitative approach was the primary methodology of this research. Working backwards from educational history to current prisoner MSE self-reports and test scores provided a different approach from former self-efficacy studies. This researcher correlated self-reported with past educational historical test data with the prisoners' current MSE barrier assessment and their recent math test results. This approach seemed a more viable one for correctional educators and researchers because it aligned better with other investigations of adult prisoners' self-efficacy and criminology assessments that predict future prosocial or negative behaviors and provided historical trend data (Davies, et al. 2013; Steurer, & Smith, 2003).

At best, former math self-efficacy studies among American middle-school students and female post-secondary students were semi-structured and utilized only self-reported interviews to assess beliefs and examine the heuristics they used to form mathematics self-efficacy studies (Fennema, & Sherman, 1978; Hacket, 1985; Usher, 2009). That approach is similar to the one used for this study, but rarely had public demographic data and access to student educational test data for verification purposes. Other investigations used primarily qualitative evidence-based literature on particular subcultures' self-efficacy beliefs and resiliency (Hetland, Iversen, Eikeland, & Manger, 2014). Qualitative research in MSE is useful to reveal the relevant behaviors and resiliency of high self-efficacy to develop positive behaviors to promote future academic achievement and career successes in average and above-average students. Prisoner studies, however, along with studies of adults in ABE programming tend to be more reflective in

order to achieve greater understanding of the person's disposition to better determine the best intervention strategies for these student to overcome their barriers to success (Gendreau, Little & Goggin, 1996; Nally, Lockwood, Ho, & Knutson, 2014).

Using a quantitative methodology from this subculture volunteer cluster sample of adult male prisoners within Wisconsin's DOC allows for statistical exploration on the complexities of data and latent variable relationships using outcome factors that in retrospect attributed to influence individual achievement and MSE. Other factors than prior school experience that contribute specifically to negative MSE scores are more limited to this diverse student participant population. An exclusively ABE eligible adult male prisoner population provides controls for age, academic ability, and gender outside the scope of K-12 and higher education as well as similar self-efficacy studies (Kim, et al. 2015).

Several studies report on how culture plays a role in the effectiveness of different psychological methods (Van de Vijver & Leung, 2013). Evidence based research literature suggested the inappropriateness of using questionnaires to gather data with prisoners (Allred, Harrison & O'Connell, 2013). Despite these challenges with reference bias and misreporting, this study sought to add to the growing body of evidence that the construct of self- efficacy can be generalizable across different cultures (Pajares & Urdan, 2006; Scholz, et al., 2002). There were also practical academic, instructional, and institutional needs for validation that self-efficacy theory applies to adult male prisoners in ABE programming since ABE programming receives state and federally funding.

Disadvantaged adult male secondary students are becoming more at-risk of not graduating high school. This at-risk population is in need of remediation that includes different motivational strategies to be successful at the post-secondary level for employment in the 21st

century (Cooper, 2016; McCabe, 2003; Hill, 2006). A key factor for male student success in secondary and post-secondary education, employability, and staying out of prison may be improving their MSE to motivate their prosocial desire, learn math, and succeed in school (Allred, Harrison, & O'Connell, 2013; Kowski, 2014). The ability to acquire mathematical knowledge quickly and earn a secondary education credential (diploma/GED) in a timely manner is an essential component to being able to prosper intellectually, educationally, as well as economically. Such educational attainments appear to be closely associated with an adult's attitudes, beliefs, and math anxieties (Jameson & Fusco, 2014; Williams & Williams, 2010). A person's ability to problem solve and critically apply thinking skills has been shown to be essential in advancing academically to have better future career options and a healthier pro social personal life than those without such skills (Betz, & Hackett, 1983; Chaffee, 1992; McConney & Perry, 2010; Morony, et.al., 2013). Teaching critical thinking skills to male prisoners in the research has been shown to be essential for their transition into the community and considered a best practice in correctional programming for improving prisoner likeliness of employability and reducing recidivism (Davies, et al., 2013; Marsh, Ciarrochi, Marshall, & Abduljabbar, 2014).

Research Questions

The overarching question for this study asked, "To what extent do sources of MSE (attitudes, beliefs, and anxieties) affect ABE adult male prisoners' mathematics achievement?" Four research questions derived for this study's purpose were:

1. To what extent do all three of the math self-efficacy sources (attitudes, beliefs, and anxieties) correlate with adult male prisoners' current mathematics achievement scores?

2. To what extent do all three of the math self-efficacy sources (attitudes, beliefs, and anxieties) correlate with adult male prisoners' prior mathematics achievement scores?
3. Which source of mathematics self-efficacy has the most significant effect on current adult male prisoners' mathematics achievement?
4 Which source of mathematics self-efficacy has the most significant effect on overall mathematics achievement for adult male prisoners enrolled in adult basic education?

Answering these four research questions required comparing evidence using TABE® mathematics pretest surveys' scores and educational history data. Validation of corroborated data was available from prisoners' educational records. Statistical correlation and regression analyses from the aggregated individual survey questions attempted to answer the research questions by calculating, comparing, and analyzing the following achievement measures:

- Math Survey achievement as measured on the test of ABE (TABE®)
- Math Complete achievement as measured on the test of ABE (TABE®)
- Academic achievement as measured with students' dropout grade from school

Evidence from prisoner records obtained through the WI DOC pertained to the aforementioned three outcome-based measures. The MSE survey results were correlated with prisoners' TABE® math survey's scores and disaggregated statistically to quantify any MSE differences for measuring prior academic achievements. Regression analysis determined current mathematics achievement using the survey data and their MSE source latent variables to correlate with prisoner mathematics achievement on the TABE® Complete posttest taken after having received at least 40 hours of ABE instruction. Question four addressed prisoners'

mathematics overall achievement after having completed at least 40 hours of ABE instruction using regression analysis to analyze the effect from pre-test to post-test scores.

This cross sectional prisoner survey study is primarily quantitative, but also allowed prisoners to respond freely to give additional qualitative substance in the final analysis. The adapted for prisoner research 30 MSE questions printed onto one side of the 11" by 8.5" standard piece of paper for distribution. The researcher modified and categorized 10 standardized questions for each MSE construct to apply to the prisoners' setting and to ensure minimal risk to prisoners for institutional internal review considerations.

On the opposite side of the adapted MSE survey, prisoner participants received a prompt to write to the researcher anything else about their math experiences in K-12 or that they would like to contribute in their participation in this study. The researcher later categorized the prisoner free responses by MSE construct using prisoner non-identifiable, but publically available using the Wisconsin Inmate Locator to verify self-reported demographic data.

Hierarchical regression analysis determined the extent of MSE thoughts, behaviors and the other subdomain sources of attitudes, beliefs, and anxieties relationships to and correlations with individual academic achievement. The regression analysis modeled quantifiable data from prisoner survey responses as related to the four specific research questions and their reported dropout or exited grade level from school. Common thematic and categorized MSE source data and student records data will correspond with prisoner survey itemized responses in order to determine if any patterns exist related to MSE sources for overall academic achievement.

Significance of the Study

Over 25% of the prisoner population in the States of Minnesota and Wisconsin, in 2014, received ABE programming in State Correctional Facilities (Davis, et al., 2013; Duwe & Clark,

2013; WI DOC, 2014). Gaining a better appreciation and understanding of how MSE related to ABE prisoner academic achievement provided insight to reduce the number of hours and instructional effort necessary for prisoners to earn a secondary diploma. Insight into how practitioners can use less time, expend less resources, reduce redundancies, and help reduce or eliminate frustrations and anxieties for prisoners to obtain the desirable outcome of a secondary education credential (diploma/GED) is noteworthy. Understanding the relationship of MSE to prisoner motivation and achievement resulted in instructional recommendations for identifying, developing, and building more positive and higher MSE in prisoners both prior and after 40 hours of math instruction and assessment to yield these noteworthy results.

Researchers do not study prisoner academic, demographic, and prosocial relationships as it correlates to mathematical self-efficacy in isolation or comprehensively even though such findings would be of interest to psychologists and educators alike (Gagnon & Barber, 2014; Lockwood, Nally, Ho, & Knutson, 2012; Taylor, 1992). Some studies have pointed toward a moderate or weak predictive expected value with other mixed-gendered student populations from MSE (Betz & Schifano, 2000; Dutton, 1954; Fennema & Sherman, 1978; Hackett & Betz, 1981). In different environmental, social, and physical settings, student MSE influenced by peer, teacher, and parent expectations along with student achievement on academic assessments in prior research (Bong, 2001; Fan & Williams, 2009). It is not clear, however, if MSE is a predictor of performance for all or any specific type of students. It is also unclear if MSE is the result of poor academic achievement or the cause of poor performance (McConney, & Perry, 2010; Morony, et al., 2013; Parker, et al., 2014). If MSE can be shown to have any level of statistical significance in an adult male prisoner population's outcomes, then MSE may be a promising prisoner attribute teachers can monitor, address, and motivate to improve student

learning within the correctional setting to better utilize classroom resources and instructional time to improve overall adult basic education for nontraditional students.

This study adds to the evidence and provides clarity to these latent variable relationships in prisoner MSE studies by providing data from a cluster sample of adult males incarcerated within Wisconsin's Department of Corrections (DOC) Adult Male Correctional Facilities receiving ABE programming who have the goal of earning their secondary education credential (diploma/GED). Educational administrators may gain insight into resource allocation and instructional material selection from this study's results. ABE teachers also may discover insights into motivational behavioral factors that could advance their math instruction. Practitioners having correlational and regression insights into male prisoners' attitudes, beliefs, and anxieties helps to identify, adapt, accommodate, and foster better math learning experiences, improve math assessment scores, and improve prisoners chances of obtaining their first secondary education credential (diploma/GED).

Many studies provided evidence on how cultural expectations play a significant role in the effectiveness of different psychological methods (Van de Vijver & Leung, 2013). There existed evidence in self-efficacy literature that suggests the inappropriateness of using questionnaires to gather prisoner data (Allred, Harrison & O'Connell, 2013). Self-reported educational surveys that solicited prisoner consent rather than imposed it, however, are not included in this research (Jameson & Fusco, 2014; Pajares & Urdan, 2006). Despite reference bias along with other concerns about prisoner surveys, this study is able to provide authentic prisoner responses and data that correlate to their academic achievement and self-efficacy, which is much wanting in correctional, educational, and MSE research for academics.

There were practical, academic, instructional, institutional, and economic desires for validation and application of self-efficacy theory to adult male prisoners, receiving state and federally funded ABE services, to promote positive educational outcomes that lead to a secondary education credential (diploma/GED). Self-efficacy studies on student behavior primarily concentrated on Caucasian, European (Raufelder, et al., 2013; Usher, 2009) and adolescent students (Esperian, 2010; Hogan, Bullock, & Fritsch, 2010). No study known or discovered by this researcher in the United States exits that has attempted to quantify and thoroughly investigate the applicability of self-efficacy theory and its potential correlation to mathematics instruction and acquisition in incarcerated adult males enrolled in federally subsidized ABE programming and its impact on diploma completion.

Disadvantaged adult male secondary students are a more at-risk student in need of remediation and different motivational strategies to be successful at the post-secondary level for employment in the 21st century (Hill, 2006; McCabe, 2003; Perry, 2014). A key factor in male student success in secondary and post-secondary education, employability, and staying out of prison may be their MSE (Allred, Harrison, & O'Connell, 2013; Kowski, 2014). Such educational and career attainments appeared to be closely associated with an adult's attitudes, beliefs, and math anxieties along with their ability to problem-solve and critically apply thinking skills. Such studies have shown positive MSE to be essential to advancing in a math and academically to have better future economic, employment, and personal life outcomes than those without (Betz, & Hackett, 1983; Chaffee, 1992; Jameson & Fusco, 2014; Williams & Williams, 2010).

Definition of Terms and Measures

Adult Basic Education (ABE): Non-compulsory federal and state funded educational programing for adults 18 years or older, not eligible for K-12 services.

ABE Eligible Student: Adults 18 years or older, not eligible for K-12 services, and who have not obtained a valid high school diploma (or equivalent) or function level below 11th grade in math, reading, or language ability.

Functional Level: A normed measure of student knowledge and comprehension of basic math, reading, and/or language ability at grade levels between ranging from Kindergarten through grade 12 equivalency (0.0-12.9). The grade level equivalency scores are defined by five tests ranging in difficulty levels from Grades K-2, 3-5, 6-8, 9-10, and 11-12 for validity.

Math Anxieties: Student physical responses that effect accurate assessments of mathematics achievement (Bandura, 1977; Bandura, 1997). Solving mathematical problems increases heart rate and blood pressure, tenses-up muscles and dilates pupils requiring greater attention and brain activity. It is common for most people to experience some form of math anxiety before and during math assessments, that affects validity and reliability of their math test performance measure (Beilock & Carr, 2005; Hess, 1965; Lavie, 2010).

Mathematics Anxiety Rating Scale (MARS): The original 98-item assessment of student anxiety towards mathematics that had a 0.97 internal reliability and 0.85 test-retest reliability (Richardson & Suinn, 1972).

Mathematics Anxiety Rating Scale Revised (MARS-R): Twelve items from the MARS assessment of student anxiety toward mathematics shown to have a 0.90 or higher internal reliability from the MARS (Hopko 2003; Pajares & Kranzler, 1995).

Math Attitudes: Student perceived external factors, social influences, value judgments of themselves, and/or physical and emotional responses of their perceptions of the purpose and worthiness of doing mathematics (Boaler & Dweck, 2016; Usher, 2009).

Math Beliefs: Student internal fixed or growth mindsets (Dweck, 2012) about their own abilities to do mathematics based on prior experiences learning and doing math (Usher & Pajares, 2006) and internal dialogues (Núñez-Peña, Suárez-Pellicioni, & Bono, 2013).

Math Literacy Self-Efficacy Scale (MLSES): A reduced 30-item assessment of student attitudes and beliefs about mathematics that combined using factor analysis the Perceived Usefulness of Mathematics Scale (Pajares & Miller, 1984) with the Mathematics Performance Problems Scale (MPPS) (Dowling, 1978) using factor analysis with a 0.98 internal reliability.

Math Literacy Self-Efficacy Survey Adapted (MLSES-A): Twenty-five item assessment of MSE based in factor analysis of MARS, MARS-R, MLSES, and Math Confidence (Marsh & O'Neill, 1984) to survey MSE in adult students entering post-secondary education (Hendy, Schorschinsky, & Wade, 2014).

MSE Constructs: The full range of MSE sources for attitudes, beliefs, and anxieties that includes all of the source findings from previous researchers' scales for each category that also includes questions specific for passing the GED examination that is a timed test (Hendy, Schorschinsky, & Wade, 2014; Marsh & O'Neill, 1984; Núñez-Peña, Suárez-Pellicioni, & Bono, 2013; Usher & Pajares, 2006).

Test of ABE (TABE®): Standardized norm-referenced educational assessment that measures student function levels in math, reading, and language ability (Kruidenier, 2002).

Assumptions and Limitations

MSE surveys relied on participant self-reports of their math beliefs, attitudes, and anxieties. Only math anxiety has shown a strong correlation from previous studies to student test performance when correlated with student confidence from previous studies (Bandura, 2006). Student math outcomes, however, may not be solely dependent student beliefs, anxieties, and attitudes as to other factors related to learning mathematics. This research study assumes that student math beliefs, anxieties, and attitudes affect student behaviors, academic achievement, and academic outcomes equally and proportionally for the purpose of this study. The cluster sample assumes to be representative of a normal male prisoner population enrolled in ABE, which is speculative at best. The limitations of this study's results were dependent on prisoner participation in the study that are voluntary, data from the cluster sample's responses which are suspect to prisoners' reference biases, reading comprehension abilities, and accesses to and quality of the prisoner participant's prior educational records. Another limitation of this study's data collection was its dependency on male prisoner honesty and retrieval of prior math and school experiences in self-reporting. Participant accuracy of correctional and educational records and consistency in math course and grade distribution throughout Wisconsin public schools was also speculative.

The quantitative approach also is limited in its methodology. Survey responses are subject to reference bias and misrepresentation. Prisoners may not be able to perceive themselves and their abilities compared to others' abilities accurately. There are limitations to the analysis of the data as well. Correlational analysis is not resistant to outliers within the population studied. The cluster sample may not be representative of a prisoner population that does not possess a high school diploma. There may be variables other than MSE within a

prisoner population that influence the response variable. A strong correlation of any MSE source or prior educational records does not imply cause and effect relationships. Extrapolation of the results to any other prisoner population is not highly recommended. A correlation study of a prisoner population, however, at least does provide a starting point for further research and understanding of this population's math and overall learning needs through this observational study.

Nature of the Study

It is pragmatic to observe prisoner attitudes, beliefs, and anxieties regarding learning and doing mathematics at the secondary level (Beilock & Carr, 2005; Levie, 2016; Zettle, & Raines, 2000). Adult male prisoners' MSE beliefs are barriers to math achievement and explain overall at-risk students' difficulties to learning math and achievement of a secondary credential (diploma/GED) in childhood and adult experiences (Hill, 2006; Lent, et al 1986). Fear, anxiety, and panic, along with specific latent perceptions of a student's ability to achieve in math, often leads students to make less than favorable academic and career choices (Lent, et. al, 2001; Lent, et. al, 1993; McPhee, 2013; Reiss, 1991). Students with low self-concepts related to their ability to achieve in math tend to struggle more both academically and in their ability to gain employment (Randhawa, Beamer, & Lundberg, 1993; Raufelder, Sahabandu,, Martínez, & Escobar, 2013).

This study was an attempt to advance the evidence-based research base in measurement of student attitudes (Gladstone, Deal, & Drevdahl, 1960), beliefs (Pajares, 1996; Schunk, 1989), and anxieties (Suinn, 1972). Descriptive correlations with prior education records, exams, and demographic data will help to analyze student math skills acquisition and overall academic outcomes (Shell, Murphy, & Bruning, 1989; Travers, Morisano, & Locke, 2015). Collecting

survey data using the lowest possible number of MSE items for each of the three categories pertaining to external MSE barriers that hinder student math skills acquisition and academic achievements is one of the several pragmatic strategies employed. The three MSE barriers carefully defined, categorized accordingly, and constructed as latent variables were for simplicity distributed equally among the three categorical self-efficacy sources.

The adapted MSE tool for this study uses valid and reliable questions derived from the Math Anxiety Rating Scale Revised (MARS-R) and previous Math Literacy Self-Efficacy Surveys (MLSES), but not copied word for word. The thirty MSE adapted survey items selected from standardized MSE surveys for this study's purpose and chosen by the researcher. This researcher chose to rewrite three particular anxiety question items in the positive for this study's context, ethical considerations, and population. The predetermined research MSE construct measurements came out of a factor analysis study that determined the most significant measures for an accurate assessment of MSE for nontraditional adult remedial college students from hundreds of other MSE surveys used in other studies (Hendy, Schorschinsky, & Wade, 2014). This researcher did slightly revise with permission other MSE question items for this study's purposes, population considerations, and educational contexts that differed from undergraduate or K-12 students. This researcher also adapted, replaced, and added GED completion in survey items because of its specificity to this population's academic achievement goals. This study hypothesized, using the adapted MSE survey scales, that all three categorical sources calculate equal measure and worth to MSE which was unprecedented, but allowed constructivist theoretical models to permeate in the results. The premise and assumption of equality in measure was a practical necessary in order to determine which one of the three sources in adult male prisoners has the greatest effect. The effect on student math and academic achievement

from this study's cross-sectional cluster sample of male prisoners calculates to show any change in distribution of the primary efficacy sources. Venn diagram models show measurement effects of MSE within this particular prisoner sample's survey data in the results.

Organization of the Remainder of the Study

This study adhered with the federal and state guidelines and DOC regulations given by the Wisconsin Department of Correction's Research Project Agreement and Bethel University's Ethical Research on Humans policies.

This study provided all known WI DOC male prisoners enrolled in ABE programming, who did not possess a secondary education credential (diploma/GED), the opportunity to consent and participate in the survey study over a ninety-day research period, beginning March 10, 2017 through June 9, 2017. Chapter II provides a review of self-efficacy literature and theory. Articulated throughout Chapter II into Chapter III is the evolutionary progression of MSE research as well as the adapted MSE survey's theoretical underpinnings for measuring MSE in an adult prisoner population. The Chapter III explains this study's methodology, research hypotheses, measurement considerations with the adapted MSE survey, and limitations of prisoner research. Chapter IV provides correlational and regression analysis results to the four derived research questions and hypotheses. Venn-Diagram figures persist throughout this dissertation and assist the reader as well as to provide better illustrations of both the inclusive and exclusive interrelationships of the three MSE sources that define MSE categorizations and interdependences for this study. The results of the adapted MSE survey's validities and reliabilities with accompanying Cronbach's alpha coefficients as also provided in the results for each research question. A full discussion of the findings follows in Chapter V as related to math instruction, educational administration, and implications in future research.

Chapter II: Literature Review

Review of Prisoner Self-Efficacy Studies in Academic Achievement

Social scientists as early as the 1960s correlated the relationships between student attitudes toward math and their performance in school (Gladstone, Deal & Drevdahl, 1960). In the early 1970s, educators and researchers developed theories and strategies for remedial interventions in math for at-risk learners, who were likely to drop out of school and/or become a burden on society that addressed the impact people's self-beliefs had on their academic performance (Roueche, 1973). Albert Bandura's seminal work in 1977 brought forth self-efficacy terminology to connect the importance of measuring student self-efficacy within social learning theory to contextualize learning constructs as being latent variables. Social learning theory helped to explain why some students achieved and others failed academically, as a result, of their teachers, parents, peers and media effects along with other social indicators and barriers to individual academic and numeracy achievement in school (Bandura, 1997; Rampey, et al., 2016).

Bandura's (1977) terminology transformed how educators and researchers thought about how students learn and how to measure student ability to learn through motivation. Bandura coined and defined self-efficacy as "a perception that refers to beliefs in an individual's capabilities to organize and execute the courses of action required to produce results" (Bandura, 1977, p.11). Students given positive and negative reinforcements are able or not able to produce learning outcomes based on what types of reinforcements they internalize. Bandura further hypothesized that this strong and powerful conviction of conscience about self-efficacy confidences within specific domains either raises or lowers students' aptitude for learning in

particular cognitive domains by being "a cause to behaviors that promote better performance, which in turn reciprocally increases an individual's self-efficacy" (Bandura, 1977; Bandura, 1997; Williams & Williams, 2010). These reciprocal relationships, social learning theorists argue, have much value. Internal beliefs and motivations are important for the study of male prisoner populations that lack a high school diploma of whom generally exhibit low self-confidence, low self-efficacy, and high anxiety traits especially as it relates to learning within a correctional environment (Gagon & Barber, 2014; Greve & Enzmann, 2003; Vacca, 2004).

Examining the extensive school histories and test score data along with adult prisoners' MSE may bring significant evidence to light on how academic achievement effects MSE in adults. The MSE model proposed by this researcher starts from the assumption that past experiences equally and efficaciously influence and effect one's anxieties, beliefs, and attitudes toward math. This study synthesized several MSE categories and survey items into three differentiations based on differential item functioning, substantial reasoning, and reporting item-level descriptive statistics from prior research (Toland & Usher, 2016). The three self-efficacy categorical terms defined in this study provided a more comprehensive and contextualized approach, yet simpler measurements for interpretation of the effects MSE effects on prisoner math achievement.

Theory of Self-Efficacy to Mathematics Achievement

Mathematics self-efficacy is the individual belief in a one's ability to learn and succeed in school mathematics courses and math tests (Pajares & Kranzler, 1995; Williams, & Williams, 2010). It is a student's conviction that adopting certain behaviors will result in greater achievement in math, however, dependent on how each student defines it. Such MSE beliefs constructs, presented in studies that attempt to predict mathematics performance using MSE

belief constructs, are shown to be better than any other mathematics-related sources (Liu, 2009; Malpass, O'Neil, & Hocevar, 1999; Pajares & Miller, 1994), to include a strong correlation with college student success in college mathematics courses (Kitsantas, Ware, & Cheema, 2010; Parker, 1990; Zeldin, Britner, & Pajares, 2008). Those with a weaker math efficacy tend to perform less favorably on math achievement tests or simply avoid taking math oriented or integrated classes (Fast, et al., 2010; Lee, 2009; Peetsma & Veen, 2013). Students with low MSE also tend to perform poorly when compared to students with normal to high MSE scores on math tests. Older, nontraditional students tend to have high math anxiety and low self-confidence in math compared to the general student population in high school and college that contributes to their poor performance in math classes and avoidance from doing challenging math problems (Jameson & Fusco, 2014). High MSE levels and low math anxiety levels have shown to be a moderate predictor of late success in secondary and post-secondary math and academic achievement (MacMichael, 1974; Malpass, O'Neil, & Hocevar, 1999; McConney, & Perry, 2010; Morony, Kleitman, Lee, & Stankov, 2013; Parker, Marsh, Ciarrochi, Marshall & Abduljabbar, 2014).

Self-efficacy theory is more than a system of beliefs that are based on and developed by past achievements, experiences, and/or successes or failures (Bandura, 1997; McConney, & Perry, 2010; Schunk, 1983). There are capable students with low and high self-efficacies as there are less capable ones with varying levels of this belief (Morony, Kleitman, Lee, & Stankov, 2013; Zimmerman, 2006). High self-efficacy effects changes in behaviors that influence future performance regardless of previous achievement. In a previous experiment, students asked to complete a series of mathematics tests performed poorly compared to students given external encouragement from the test proctor (Bandura & Schunk, 1981). After each test, students in the

experiment group were told that they were performing poorly compared to the other students. The other experiment group was told that their performance was above that of the other students being tested. These positive and negative messages provided by the examiner to the two experimental groups regardless of their actual performance on these exams. The research theory predicted that self-efficacy rises for the students who are told that their performance was better, and in turn, this influences the results of the next exams. It turned out in several studies that student performance in the classroom and at school actually improved after inducing and giving attention to student self-efficacy beliefs by promoting positive encouragement from other groups that received negative or no encouragement (Fan, & Williams, 2009; Mostofo, 2014; Peetsma, & Veen, 2013; Zimmerman & Kitsantas, 2005).

Researchers continued to find evidence that self-efficacy has significant latent variables worth researching to explain and determine student academic achievement (Betz & Hackett, 1989; Lent & And, 1993; Lent,, Brown, & Larkin, 1986). This is especially true when correlated with literacy and mathematics abilities (Schunk, 1989; Usher & Pajares, 2009). Some findings have implied a weak relationship (House, 2001; Norwich, 1987) while others demonstrate stronger relationships (Fan, et al., 2009; Pajares & Kranzler, 1995; Skaalvik & Skaalvik, 2004) between self-efficacy to student post-secondary achievements. International studies of prisoner populations reveal prisoner individual educational histories littered with prior academic failures and high anxiety towards learning (Eikeland, Manager, & Asbjornsen, 2009; Morgan & Kett, 2003) which moderately correlates to low arithmetic abilities (Morgan, Parr & Fuhrman, 2011). Anxiety, particularly math anxiety, is a barrier to student academic success along with self-efficacy beliefs and social factors (Kesici & Erdogen, 2009; Pajares & Kranzler, 1995). For the purpose of this study, however, all MSE source domains are constant and equal in the

calculations of prior academic effect to present prisoner MSE data. Regardless, all aforementioned studies continued a tradition of exploring the relationship of MSE to student academic performance. This study, however, took a descriptive and retrospective approach in exploring the extent of MSE relationships with student academic outcomes. Prisoner low MSE self-reported scores are the byproduct for prisoners, instead of a predictor. An examination of educational records prior to beginning ABE programming during incarceration was researched, analyzed, and correlated to measure the extent of prior experiences on adult male prisoner MSE.

Sources and Categorizations of Self-Efficacy

Bandura (1997) proposed four sources of self-efficacy: mastery experiences, vicarious experience or modeling, persuasion, and physiological and affective factors. Several studies have verified these four sources as essential elements of self-efficacy (Usher, 2009; Usher & Pajares, 2009). Mastery experiences or the actual experience of succeeding is the most important and induces the most lasting self-efficacy beliefs (Zimmerman, 2006) especially for men (Ross, Scott, & Bruce, 2012; Zeldin, Britner, & Pajares, 2008). Often success attributes to actually induced self-efficacy and sporadic successes. Failure events do not tend to affect long-term confidence (Morony, Kleitman, Lee, & Stankov, 2013; Zimmerman, 2006). Traditional high school students from previous studies are able to recover from negative experiences in math class or poor math test scores with little to no effect on their MSE (Ozgen & Bindaka, 2011). Adult learners, however, do tend to have lower MSE levels that result from failure experiences (Jameson & Fusco, 2014). For the purpose of this research study, it is being argued that student mastery experience is reported on a MSE survey is actually their own perception or belief of achieving mastery in math content, but is also being compared with their actual math standardized test scores for validation purposes. For the participants of this study, this researcher

assumed that prisoners did not have mastery of secondary math content and operate out of a failure construct, rather than of success because they all dropped-out of public education prior to graduation. This study and survey, therefore, do not attempt to validate any level of student mastery nor provide specificity of math content in its measurement by using particular MSE questions related to math content. Instead, this study evaluates student beliefs of a student's self-mastery of math content and correlates it with their actual math TABE® test scores. Self-mastery of math content in MSE studies is often measured by providing specific math content examples in algebra or geometry that are representative of test items students would be required to solve correctly in an exam. Such studies have shown a high correlation between student beliefs they can solve a math problem correctly and their actual ability to solve that same problem accurately (Blake, et al., 2015; Bong & Skaalvik, 2003). Student motivation or avoidance of doing math problems also contributes to their beliefs and MSE. Student perceptions of how they compare to others in mathematics ability as defined in the measurement of student attitudes toward mathematics based on prior math experiences and people relationships. The self-reported MSE sources defined student mindsets of their fundamental perceptions of their own math abilities to do math (Boaler & Dweck, 2016).

Secondary experiences or perceptions of those experiences encountered and engrained through other people form a person's attitude or disposition toward or against doing mathematics (Fast, et al., 2010). When students compare themselves to their parents or to other peers, self-efficacy may increase or decrease depending on how the other person believes their innate qualities by others are judged. If the other person learns that they are somebody who is able to do a particular task, say mathematics, but viewed as less capable, then the student would be more likely to believe that he is capable (Bandura, 1997) by genetics or by social status. Students

compare themselves to their parents and other peers whose capabilities are not too far from them. Self-efficacy is not induced if another person is viewed as superior since parents, peer groups and classmates are important sources of self-efficacy among adolescent students (Adeyemi, 2012), as even indicated across cultures (Bates, 2007; Gonzalez, 2008; Lee, 2009). A person's attitudes towards or against participation in math, for this study's purpose, is the vicarious understanding of one's math abilities or aptitudes.

Math attitude, aptitude, or value, as defined in this study, is more commonly thought of as the concept of "confidence" within the research literature and as used for MSE measures (Hendy, Schorschinsky, & Wade, 2014; Pajares, 1996a). Studies have shown that women generally allow others' persuasions or influences to affect their behaviors, confidences, and attitudes, than men towards math (Loo & Cho, 2013; Zeldin & Pajares, 2000). For male math students, math confidences or attitudes were reported as the least likely MSE source attribute, since it only induces short-term self-efficacy effects, such as the taking of a math test (Pajares, 1996b; Zimmerman, 2006). It was not enough for learners, however, to hear other people suggest that they can do something. Students must actually experience success in accomplishing the task themselves. Low functioning adult prisoners, however, often have not experienced much success in school, math, and/or other behavioral mastery experiences. The male prisoner population has also been shown to be rather sensitive to other's opinions from the general male population and media (Laferrière, & Morselli, 2015; Rose & Rose, 2014). Connections or relationships may exist between female's self-efficacy to low academic functioning incarcerated males for this reason. Correlative relationships between low functioning male students to female math students are included in MSE studies. Low academic functioning male prisoners, however,

represent extreme outliers from the general male population in math ability and could be statistically comparable to females with low MSE and math achievement (Rampey, et al., 2016).

The categorization of at-risk and low functioning adult males for this outlier population studied consisted of diverse demographic backgrounds. At-risk, low functioning, and diverse descriptors used for this sample's self-efficacy measurements were not meant for predictive analyses of academic or MSE outcomes, but merely as categorical descriptor labels. What this means is that the adult male incarcerated participants enrolled in correctional education ABE programming had likely developed poor or low self-efficacy due to their prior negative experiences in school and childhood resulting in generally low self-beliefs, negative attitudes, low academic interests, antisocial behaviors, and increased anxieties toward academics (Forrest-Bank & Jenson, 2015; Lee, Lee & Bong, 2014).

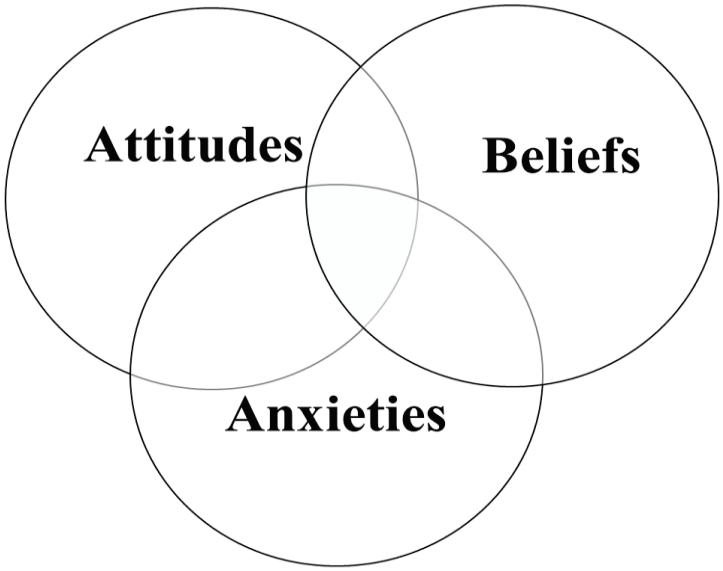
From the MSE survey's results for this study each categorical descriptor is being equally weighted using ten specific and standardized questions correlated to each domain. Ten questions related to student beliefs and directly related to individual perceptions of math ability to perform specific tasks or to general academic ability within a MSE framework (Betz & Hackett, 2006; Bong, 1999). Ten questions on student perceptions of their attitudes toward MSE related to student confidence (Hendy, Schorschinsky, & Wade, 2014). The ten anxiety questions derived and adapted for this survey consisted of the most frequent, valid, and reliable questions from MARS-R based on actual student results from low functioning adults (De, Galassi, & Galassi, 1984; Hendy, Schorschinsky, & Wade, 2014; Suinn, 2003). The adapted MSE survey's purpose consisted of measurements of this prisoner population comprised of all nontraditional male ABE students and specifically used scales for contextualize the three categories and MSE subdomains for this population (Hendy, Schorschinsky, & Wade, 2014; Roth, Asbjørnsen & Manger, 2016).

At the intersections of each domain, an individual's attitudes, beliefs, and anxieties towards math content and/or skills is the sum total of their math self-efficacy within that particular domain. The adapted survey model combines motivation constructs in replicating specific survey questions per category from prior MSE assessments shown to be most relevant in calculating MSE predictive factors (Hendy, Schorschinsky, & Wade, 2014). Math ability and MSE have been positively correlated to each other in other studies related with math anxiety to explain student poor math performance in math classes and on math tests (Knight & Wadhwa, 2014; Werner & Smith, 2001). Math anxiety has shown a strong relationship to male high school dropout rates and low math test scores (Cooper, 2016; Garber & Barber, 2014; Jameson & Fusco, 2014).

A student in adult basic education is in the midst of adversity, stress, and tends to show resiliency since they have experienced failures in their childhood and adolescent development resulted in them not graduating from high school. Attitude, belief and anxiety issues may have resulted from past failures including failure to graduate high school on time (Kortering, Braziel, & Tompkins, 2002). Such significant failures may be causes of low self-efficacy and particularly for this study's purpose, MSE (Allred, Harrison, & O'Connell, 2013). A Venn diagram or graph on the next page helps illustrate how all three self-efficacy negative constructs are illustrated to indicate that they are equally attributed to poor math self-efficacy in prisoner adult males. Little is known in correctional and educational research of the relationship between prisoner self-efficacy and poor educational achievement in adult male prisoners (Chang & Beilock, 2016; Knight & Wadhwa, 2014). To investigate which source of self-efficacy most influences students' MSE, distinctions and definitions between and within three categorical domains required contextualized explanations and simplified illustrations. The three MSE construct

source domains, however, provided a comprehensive understanding of self-efficacy and MSE's interconnectedness. The scales within Hendy's (2014) math belief's survey administered to undergraduate students addressed these categorical domains with special emphasis on the nontraditional adult student and students not necessarily pursuing math or science careers (Hendy, Schorschinsky, & Wade, 2014). The domains address the entirety of MSE for adult students having progressed beyond childhood experiences and other developmental changes that significantly effect MSE (Bandura, 1997; Matsen, 2014). At the intersection of beliefs, attitudes, and anxieties is where MSE of skill mastery exists and correlates with student achievement on math tests. The entire picture, however, of self-efficacy effects on student learning as a construct takes into account all three domains and their intersections in this researcher's application of social learning theory.

Figure 1. Math self-efficacy domains of attitudes, beliefs, & anxieties



Review of Factor Analysis and Usage in Math-Self-Efficacy Constructs

Several math belief measures ranging from 98 items (MARS) to five items (Math Confidence Scale), were developed during the twentieth century. These belief sources attempted to measure different math belief constructs that inhibit or reduce math performance in students.

These psychometrically tested measures came out of different models based in theory with the purpose of predicting math outcomes. This traditional approach to experimental self-efficacy studies positively correlated self-efficacy with favorable emotions, dispositional optimisms, self-esteem, and life satisfaction.

The results of such exploratory studies often negatively correlated self-efficacy and MSE with depression, anxiety, burnout, and health complaints (Löve, Moore, & Hensing, 2011; Suinn, 2003). Self-efficacy researchers originally constructed belief models and then derived instruments to measure that belief. Assessments offered to participants in a study and compared or correlated to previous assessments to derive additional validity and reliability in the measurement of the self-efficacy construct. The researcher then attempted to verify the results after the student participants take a math test and/or completed a class or course of study to measure the accuracy of the belief model in predicting their success or failure on the test. Math anxiety, efficacy, or belief measures are controlled and measured for effect that resulted in more test items for assessing the fullness of self-efficacy. A factor analysis approach changes, however, how researchers construct assessments and conduct studies by starting first with students test results and then discovering the most influential factors/items of measure. For MSE measurements, researchers determine which factors and test items are most significant in poor and high students. The principle-components method attempts to find the minimum number of common factors that can account for the interrelated set of scores (Bentler & de Leeuw, 2011). The purpose of factor analysis is to reduce the components to minimal constructs by empirically measuring the interrelationships of a wide variety of self-efficacy tests to find and reduce the main dimensions of self-efficacy to a new simpler test.

For example, exploratory factor analysis identified dimensions within each belief construct for sources of math beliefs, math values, math confidence, and math barriers along with analysis of the most widely used existing measures of math anxiety (MARS-R) to determine which question items in each of these prior math efficacy tests had the greatest effect. The researchers then constructed three distinct math belief measures (MVS, MCS, and MBS) to identify and compare variations in actual student math performance at the end of the course of study to construct their belief measures. Rather than using a traditional predictive model based on self-efficacy theory as used for the MARS (Richardson & Suinn, 1972), the researchers calculated factor loadings from actual student success and test data to construct their own MSE test items using three theoretically different constructs or measures (Hendy, Schorshinsky, & Wade,2014).

Factor analysis is simply a means of identifying meaningful psychological sources from correlations. Factor analysis provided the researchers the ability to control for independent variables and examined how each math belief associated with the variables as a means to identify students had the most risk for poor performance or even failure. Hendy, Schorshinsky, and Wade (2014) discovered (or hypothesized) that use of factor analysis for MSE provides a smaller, more practical assessment of student MSE that is simply threefold for student effects of confidence, values, and anxieties. Anxiety continued to demonstrate to be the most significant factor for predicting "entry level" college students' math performance as it had the greatest internal reliability, but was not the only significant factor. Math value had a moderate significance and internal reliability to math performance as did class devaluation. The researchers, using factor analysis, calculated that Math Value improved from when students began the math course to when they ended, which went on to hypothesize as an student outcome

of having taken the college math course. This hypothesis suggests that students came to value mathematics as an unintended result of completing their first college math course and that this latent variable is the easiest to improve. Math anxiety as a latent variable was measured to be more resilient, less malleable, and difficult to lessen from a one semester course (Hendy, Schorshinsky, & Wade, 2014) and potentially could be intransigent in lower functioning adult learners as result of years of aggravation (Jameson & Fusco, 2014).

Effects of Societal Attitudes toward Mathematics and Achievement

Age, race, gender, and socio-economic status (SES) factors negatively correlate to student mathematics and academic achievement (Multon & Brown, 1991). The expectations by parents, teachers, and peers contributed to children's and adults' math attitudes and expressed beliefs toward their value or worthiness of exhausting their time and energy studying mathematics regardless of race, gender, and SES. Parents', teachers', and peers' own math anxieties and expressed beliefs had significance and influence on children and adults' math anxieties (Peker, 2016). Finally, mathematics students may internalize other's external anxieties, beliefs, and attitudes that contribute to their own beliefs, confidence, and internal fixed or growth mindsets towards their ability to achieve in mathematics (Dweck, 2012).

External influences from social media and stress related to math and test scores also contribute to students developing particular attitudes towards test and mathematics by their race and gender (Change & Beilock, 2016; Fast, et al., 2010). Societal and personal stressors on students to perform poorly or positively in mathematics contribute to the construct of student perceptions of their own motivation and ability to achieve in mathematics as well as academically (Honicke & Broadbent, 2016). For prisoners, self-efficacy often relates to their perceptions of what others think they should and should not be able to achieve. Criminologists

provide evidence of this phenomenon in how male prisoners often report high influence by gang members and gang leaders to commit crimes (Laferrière & Morselli, 2015). Adult learners face several attitude barriers. These barriers often result in having lower self-confidence, feelings of inability to achieve long-term goals, ability to graduate, and other social class and age-related perceptions of their abilities to succeed in school (Hendy, Schorschinsky, Wade, 2014). Such nontraditional adult learners tend to not do higher levels of mathematics nor attempt to enroll in STEM related courses (Jameson & Fusco, 2014; Weiderkehr, et al., 2015). Social media also influences attitudes towards math. Peers and other external sources of information students see and hear every day influence students' motivations of their abilities and desirability toward doing mathematics (Boaler & Dweck, 2016).

Figure 2. Attitudes of math self-efficacy sources diagram

Effects of Student Beliefs toward Mathematics and Achievement

Student beliefs are internal fixed or growth mindsets about their own ability to do mathematics (Dweck, 2012). Students' beliefs are based on their prior school experiences, math achievement, and solving of math problems (Usher & Pajares, 2006). Students develop their

own internal dialogues that can become more negative about their academic ability when they have received negative feedback from their teachers and poor grades (Núñez-Peña, Suárez-Pellicioni, & Bono, 2013). Student beliefs often were attributed to their behaviors (Hoffman, 2010). Behaviors based on student beliefs that they can problem solve as well as be persistent in problem solving was shown to be a significant factor in student success in math (Hoffman & Schraw, 2009). Efficacy beliefs were attributed to student positive or negative self-dialogues. Negative self-talk is associated to student poor academic performance (Joseph & Konrad, 2009). Poor academic, particularly math performance is attributable to student fixed mindsets (Boaler & Dweck, 2016; Dweck, 2012). Adult male students in correctional education programming tend to have more of a fixed mindset. Their behaviors exhibited greater levels of negative self-talk and many male prisoners in treatment programs tend to have internalized that they do not have the ability to do well in school and life (Betz, et al., 2014).

Male prisoners in transitional programs who report having no value in doing homework or completing assignments is indicative of having a low MSE (Pajares & Schunk, 2001; Zimmerman & Kitsantas, 2015). Such internalized beliefs tend to result in lower confidence, lower academic worth, and reported to be common in adult basic education nontraditional adult learners (Jameson & Fusco, 2014). Students who are poor at math throughout their K-12 experience may develop, as early as first grade, inaccurate beliefs of their own math ability that have been shown to have negative effects on their present behaviors and future math performance (Ramirez, Gunderson, Levine, & Beilock, 2012). Children with inaccurate beliefs about their own innate math abilities, turn into adults who may develop social feedback influencing self-defeating and self-alienating beliefs that keep them from achieving real success in math (Dweck, 2012; Ramdass & Zimmerman, 2011). Such beliefs may be ignored or left

unchallenged in middle and high school aged students because of teachers' and school administrators' political and social concerns about holding back low performing students and not meeting high stakes test standards (Hendy, Schorschinsky, & Wade, 2014; Liew, et. al, 2014).

Figure 3. Beliefs of math self-efficacy sources diagram

The Intersection of Attitudes and Beliefs

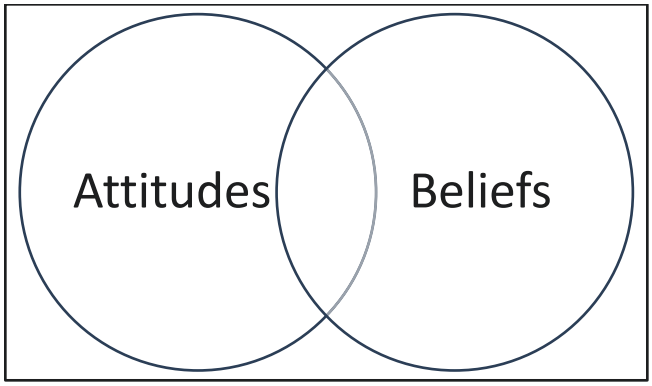
Prisoners' ability to succeed in educational programming are dependent upon their individual attitudes and beliefs. These attitudes and beliefs affect student performance in the immediate school context (Suinn, et al.,1972; Zeldin, et al., 2008). These attitudes and beliefs may also perhaps predict people's ability to be successful not only in school, but also at work and as members of society when they start negative and go unchanged without any interventions (Eysenck, 1978; Reiss, 1991; Zolli, & Healy, 2012). Prisoners have several opportunities to change their attitudes and beliefs while in prison (Greve & Enzmann, 2003). The intersection of attitudes and beliefs is where the terms academic worth and learned helplessness along with negative learning experiences produce two constructs of one measurement of student self-beliefs and attitudes towards themselves and perceptions of others towards themselves (Chesmore, Suh-

Ruu & Reynolds, 2016). These efficacy measurements often are associated with a student's academic worth.

According to Gomez (2015), learned helplessness is "a root cause of underachievement and failure for adults aging out of foster care in education and work" (p.509). Learned helplessness is a perception that has been associated with low self-esteem and high anxiety in the research literature (Gomez, 2015; Valas, 2001). These internalized beliefs often are a result of negative life experiences for at-risk children that turn into adults who struggle academically, dropout of high school, and struggle to assimilate into society (Cooper, 2015).

Prior negative learning experiences are associated with student academic worth, learned helplessness, and homelessness (Gomez, 2015; Hoffman, 2010). These factors contribute to adult perceptions of not being able to achieve academically and in mathematics as well (Hall & Ponton, 2005). These student perceptions produce an interconnected relationship between attitudes and beliefs in the research model in low achieving adult learners.

Figure 4. Intersection of math self-efficacy attitudes and beliefs



Effects of Math Related Anxieties and Student Achievement

Math anxiety is a feeling of tension, confusion, and frustration when attempting to do math problems. Besides math anxiety affecting student achievement, other measures were such developed to include more cognitive components of math value and math confidence (Pajares &

Miller. 1994) along with specific contextual and social barriers that inhibit student learning of mathematics (Bandura, 1997). Anxiety manifests itself physiologically when a person's heart rate increases, pupils' dilate, and their short-term memory is effected which causes individuals to struggle with perform mental tasks, such as arithmetic (Kahneman, Tursky, Shapiro, & Crider, 1969). Studies have shown that individuals who scored higher on the SAT math portion or other math tests showed smaller pupil dilations, reduction in heart rate, and had better working memories during the tests than those who scored poorly (Ahern & Beatty, 1979; Smith, Mcevoy, & Gevins, 1999). Negative physiological reactions attribute to math anxiety (Chang & Beilock, 2016). Math anxiety often results in the avoidance of doing math, poor math performance on tests, and difficultly in learning to solve math problems correctly. Math anxiety is common in lower functioning, at-risk, and/or disabled students (Dew, Galassi, & Galassi, 1984; Hollis-Sawyer, 2011). Students with metal health disorders and neurological disorders are representative in adult nontraditional students and adult prisoners (Jameson & Fusco, 2014; Rosen, Grodensky, & Holley, 2016). Participants in this study are likely to have had or currently have mental health disorders and/or neurological disorders correspond with math anxiety. School and math related anxieties are often present in adult nontraditional learners and adult prisoners due to the additional stresses they are coping with in their life situations (Kasworm, 2008). Additional stress on any student of mathematics results in a significant barrier to long-term learning of math concepts, long-term ability to apply mathematics in different contexts, and math test performance (Zeidner, 2007).

Math anxieties have tend to have the most significant impact on student performance other than mastery experience (Bandura, 1999; Pajares, 2003). Traditional studies of math anxiety, however, do not take into account that mastery experience and anxiety are interrelated.

A student who learns to demonstrate mastery experience in mathematics could potentially lower their anxiety levels in the same way participants in a treatment program for anxiety disorders are able to overcome or desensitize their anxieties and improve their functioning levels for better math performance and a better life (Suinn, Edie, & Spinelli, 1970). Math anxiety studies indicated that MSE's strongest relationship to poor math test performance and achievement correlated to low self-confidence, low math performance and increased test anxiety in students with learning disabilities (Ahmed, et al., 2012).

Figure 5. Anxieties of math self-efficacy sources diagram

The Intersection of Anxieties and Beliefs: Prior Experiences & Learning Environment

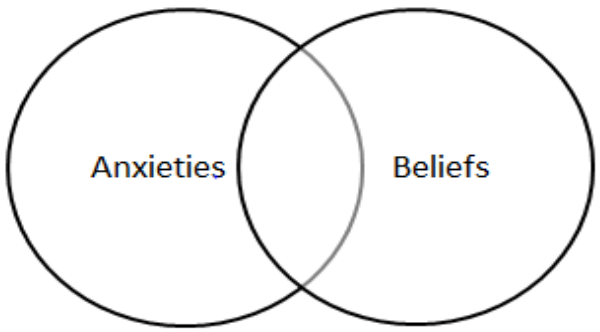
A student's self-concept affects their ability to do well in school and mathematics (Ferla, Valcke, & Cai, 2009; Pajares & Schunk, 2001; Zettle & Raines, 2000). This intersection helped explain why students with high anxiety towards math develop a belief that they are not good at it and avoid taking classes and doing well on math tests (Bong & Skaalvik, 2003; Sax, et al., 2015). Students' lower self-concepts have been associated with their placement in special education programming (Chesmore, Ou, & Reynolds, 2016). Such placements can contribute to adult student helplessness, lower self-esteem, and increased anxieties in school or math class.

Low self-esteem is another important construct and measurement that explained for a student's lack of success in school and mathematics. Juveniles and adult male prisoners often suffered with low self-esteem issues (Greve & Enzmann, 2003). Low self-esteem in prisoner populations attributed with less desire to participate in school leads to increased dropout rates (Greve, Enzmann, & Hosser, 2001).

Low self-efficacy is also associated with increased anxiety and low academic ability (Zajacova, Lynch, & Espenshade, 2005). Students who are depressed and unmotivated in math class are prone to give up on tests and on learning how to problem solve in mathematics. These students tend not to be as successful with greater levels of self-efficacy in solving math problems, learning math concepts, and on math tests (Hoffman & Schraw, 2009).

The combination of low self-beliefs, low self-esteem, and high anxiety is a barrier to successful academic and math outcomes. Academic self-concept, self-esteem, and self-efficacy are arguably synonymous constructs with self-confidence and academic value (Bong & Skaalvik, 2003; Greve & Enzmann, 2003). At the intersection of anxieties and beliefs are student's self-confidence, self-efficacy, and self-esteem as measured by the MCS questions as they relate to math and the MBS's anxiety subscale questions (Hendy, Schorschinky, & Wade, 2014). The intersection of anxieties and beliefs, as shown in Figure 6.

Figure 6. Intersection of math self-efficacy anxieties and beliefs



The Intersection of Anxieties and Attitudes: Teacher Effects & Stereotype Threats

Learning environments affect student academic outcomes on tests and in course completions. Students of similar backgrounds in different learning environments and testing situations perform differently on achievement tests (Hoffman & Schraw, 2009). Socioeconomic and racial factors often contribute to students with these low MSE attributes. Such students from poor economic backgrounds tend to blame themselves for poor academic performance and give up more easily on difficult math problems (Boaler & Dweck, 2016). These students are also prone to stereotype threats, which combine their math or school anxieties with their internal fixed mindsets or beliefs (Lamont, Swift, & Abrams, 2015)

Stereotype threats pose a significant barrier to particular students' success in the classroom, on assessments and especially in mathematics (Chang & Beilock, 2016; Larnell, Boston, & Bragelman, 2014). African-American students are well aware of the stereotype that Caucasian and Asian students do better school, and particularly in math and science. These societal stereotypes correlate with anxiety in African-American students, which makes it harder for this demographic to concentrate in all classes and particularly on math tests (Beilock, 2013). These results validate several studies that gave the same tests to different groups of students with slightly different instructions about what the test measures, especially tests of intelligence and mathematics (Wood, Newman, & Harris, 2015).

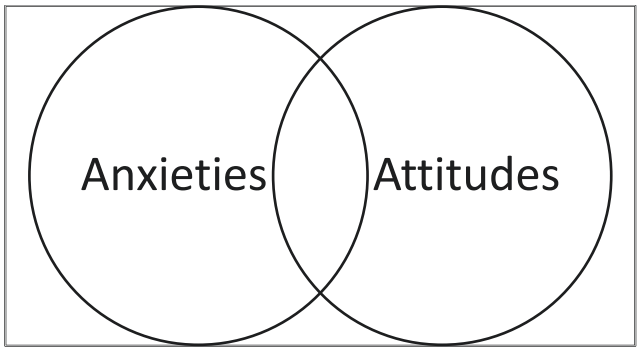
Research suggested that stereotype threat had a more significant effect on female students than on male students in math and science test performance and successful course completion (Hackett, 1985; Nyangeni & Glencross, 1997). On the other end of the spectrum, stereotype lift often helps Asian and Caucasian males do better on intelligence and math tests depending on how the test is presented and what it is measuring (Bong, 2001; Cullen, Waters, & Sackett,

2006). Male prisoner population's self-efficacy anxieties and beliefs manifest as shown in these studies of stereotype-threat and stereotype-lift. Older nontraditional adult male students who have not performed well in prior math classes, on math tests, and in school are also likely to show negative stereotype lift effects in Caucasian and Asian prisoners. These students' educational histories as underperformers in school could reveal underperforming negative effects of stereotype threat as shown in African-American males and prisoners (Cullen, Waters, & Sackett, 2006; Hollis-Sawyer, 2011; Rampey, et al., 2016). Such effects may also attribute to teachers' anxieties toward mathematics that these students may have experienced in school.

Teacher anxieties experienced vicariously by their students attributed and correlated weakly to decreased student math performance and interest. This body of research, however, mostly has demonstrated math self-efficacy effects of female students of female teachers in elementary school (Beilock, et al., 2010). Another study's results show a significant relationship between math anxiety and career inhibition and between math anxiety and perceived type of mathematics training based on the gender of the teacher or counselor. No relationships, however, correlated positively or negatively between math anxiety and gender (Widmen & Chvez, 1982). Relationships between math and science career choices, as well as college majors, correlate to student preferences by their gender. These studies (Linder, Smart & Cribbs, 2015), for the most part were conducted on elementary aged children and do not show any long term effects for adults from having teachers with higher anxieties and lessor abilities in mathematics. Mathematics anxiety, however, does lead to avoidance of mathematics, limiting opportunities for people to pursue and achieve goals, and possibilities of advancing in the STEM career fields. Societal views of life quality discriminated for intellectual and developmental disabilities when examined as a theoretical lens for examining the issue of mathematics anxiety across greater

populations. Mathematics anxiety affects self-efficacy, mathematics-teaching quality, and overall academic performance outcomes in high school, college, and overall quality of living a healthy and meaningful life (Wilson, 2015). Prisoners with anxiety disorder tend to struggle in their transition to community and release from confinement. Studies recommend that programs that help reduce prisoner anxiety may improve their overall attitude toward life, assist with reception of treatment for chemical dependency, provide for a more successful reentry into the community, and possibly reduce recidivism (Davis, et al., 2013; Forrest-Bank & Jenson, 2015).

Figure 7. Intersection of math self-efficacy anxieties and attitudes



Correlations of MSE to Math Achievement

Psychologists and educators have yet to collectively insist that self-efficacy is as an important factor or a significant predictor of academic performance as intelligence (Cervone, 2000; Schunk, 2006) and as it leads to graduation and employability. Despite the void of research and any strong "linear" relationships between student beliefs, barriers, and test anxieties, most researchers conclude that self-efficacy is an essential variable worthy of further research and consideration.

There are studies that suggest self-efficacy is an insignificant predictor of academic performance (Norwich, 1987). These studies admitted that the relationship was more complicated than previously thought and/or collinearity with another variable existed (Bandalos,

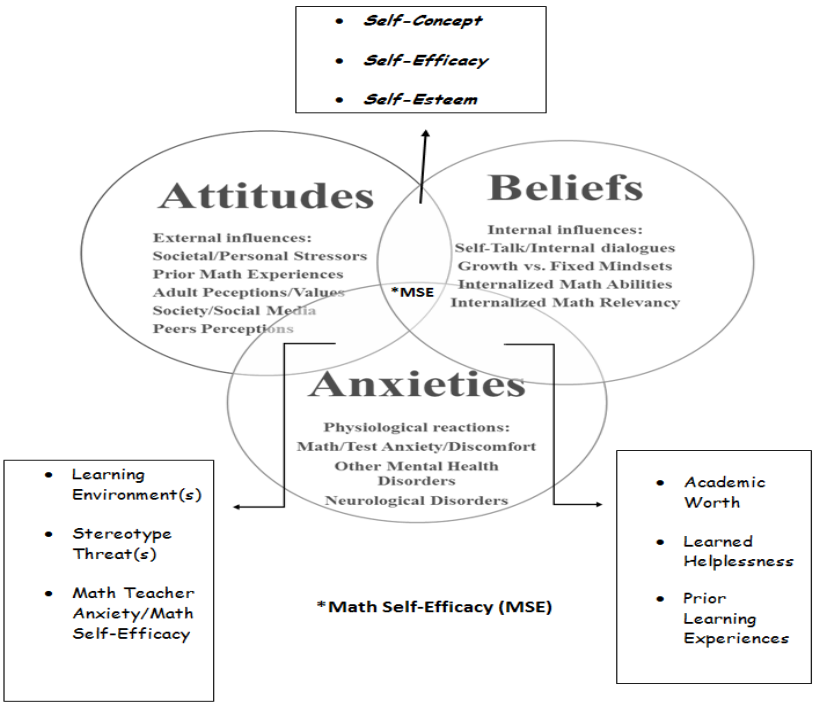
Yates, & Thorndike-Christ, 1995; Norwich, 1987). These studies also were conducted before the enactment of No Child Left Behind (NCLB) legislation and implementation by State Departments of Education which put educational testing of student academic attainment at the forefront to student graduation and credential attainment in secondary and post-secondary schools. This study suggests that MSE better correlates indirectly as well as negatively with adult male prisoner lack of academic achievement in secondary school and for ABE and outcomes rather than just merely correlated to academic performance in the specific domain of mathematics. This study also looks at math self-efficacy in terms of three distinct barriers of attitudes, beliefs, and anxieties that inhibit critical thinking, knowledge acquisition, and problem solving skills. These skills are essential for prisoner or student success in achieving ABE goals, increasing their test performance, and in attaining their high school diploma (Tuominen-Soini, Salmela-Aro, & Niemivirta, 2012).

Many self-efficacy studies have been conducted with elementary, middle school, high school, and college students on the importance of student self-efficacy in obtaining a degree, completing a course of study, and/or passing an examination (Caprara, et. al, & Barbaranelli, 2011; Hendy, Schorschinsky, & Wade, 2014 ; Kitsantas, Ware, & Cheema, 2010; Wolters, 2009). This researcher found no studies that exclusively examined male adults within a correctional setting enrolled in a correctional ABE program with the goal of attaining a first secondary education credential (diploma/GED) that correlated with their academic and math abilities.

Research relevant to this study includes such studies conducted with high school, adult basic education, and post-secondary students--especially the few correctional education studies that show that a self-efficacy construct crosses cultures and correlates with academic

achievement toward prisoner resiliency, positive behavioral change, and goal attainment (Jonesa, Mangerb, Eikeland, & Asbjørnsen, 2013; Taylor, 1992). These negative self-efficacy influences appear to be more evident for adult male prisoners than they are for juveniles in current studies (Allred, Harrison, & O'Connell, 2013). Regardless, male prisoners without a secondary education credential (diploma/GED) are more highly likely to have experienced and struggled with one or more self-efficacy sources or factors (Klevan, Weinberg & Middleton, 2016). Adult male prisoner attitudes, beliefs, and anxieties and their intersections interdependently contribute to a person's total MSE. There MSE factors produce significant barriers to student learning and math test performance. Childhood experiences, peer influences, perceptions of social-emotional wellbeing, self-esteem, and anxiety disorders all seem to affect male prisoners' MSE by the time they have reached adulthood. Illustrated in Figure 8 are the three construct domains that effect they potentially have on prisoners' actual math achievement.

Figure 8. Comprehensive contributing self-efficacy factors to overall math self-efficacy



Chapter III: Methodology

Introduction

The study attempted to apply self-efficacy theory to three hypothesized and categorized MSE sources of specific mathematical outcomes as well as general academic achievement. By using an inclusive and inductive methodology, broad and specific observations from the data analysis for this diverse population are ascertainable. The rationale for deviation from the traditionally defined four categories of self-efficacy theory that include mastery experience, modeling, social persuasion, and physiological states is based on theory, generalization, simplification, pragmatism, and unification principles (Wood & Bandura, 1989).

For over half a century, researchers have conducted correlation studies of how student dispositions regarding in their own math abilities or math self-efficacy are predictive of their achievement and motivation in math and with other academics (Huang, 2012; Multon & Brown, 1991). Such studies took samples from several different types of student populations in elementary, secondary, and post-secondary institutions (Parker, et al., 2014). This study aimed to investigate the effects of MSE sources on math achievement in adult male prisoners who do not possess a high school diploma or equivalency. In addition, achievement in math has a relationship to earning a secondary education credential (diploma/GED) and/or passing an equivalency examination such as the GED. Examination of how MSE and the three sources of MSE affect adult basic education students' overall math and academic achievement was shown using descriptive statistics and by correlating their educational histories and test scores to provide a valuable understanding a prisoner population's specific learning struggles and needs for academic achievement in order to advance to a career when released.

Philosophy and Justification

This study was essential because few research articles examine the relationships of MSE sources of anxieties, beliefs, and attitudes to mathematics and overall academic achievement on adult male prisoners while in ABE programming (Gagnon & Barber, 2014). MSE source theory throughout this study relies on other research conducted in different prisons with different prison populations. The majority of these studies are from the United States, Norway, and Australia correlated to reading achievement rather than mathematics, which this study did not.

Although many aspects of this study were similar to reading self-efficacy studies in prisoners, it was assumed that the educational and correctional settings throughout the United States along with regional factors differed significantly. Pedagogical approaches to the teaching of mathematics had significant differences across correctional educational settings due to security concerns, federal regulations, and student needs. Nevertheless, the construct of self-efficacy can be assumed to be universal based on previous evidence-based findings and applicable to all individuals with low academic achievement levels from the normal population (Armington, 2002; Bandura, 1977; Betz & Hackett, 1989; Boylan & Saxon, 2005; Marsh, Walker & Debus, 1991; Morony, Kleitman, & Stankov, 2013).

Specific mathematical-based questions not surveyed are measures of skill mastery that connects general mathematics ability to math assessment scores in prior studies (Bandura 2007; Pajeres, 2006). Instead, the self-efficacy items ranged from student beliefs in their own math ability to more general self-efficacy beliefs. Measurement of student's math confidence is often a perception of doing fast arithmetic calculations and is often highly valued and rationalized for innate ability in doing math, past successes or failures in math, and having a fixed mindset about a person's innate ability to learn and be successful at math in school.

A key assumption made for this study was that MSE construct items pertained to attitudes, beliefs, and math anxieties are equal in value. No prior knowledge of student MSE attributes by teacher and student awareness of MSE was accounted for in this study. Increased instructional sensitivity, if individually identified and assessed for each student, may have compensated for specific MSE source areas of concern. This study counterweighed cultural, psychological, and environmental factors that negatively influence and effect math achievement for incarcerated adult male prisoners by contextualizing and adapting survey questions.

Prior research demonstrated that socio-cultural, economic, and environmental factors effect mathematics performance (Bandura, 1986; Hailikari, Nevgi & Komulainen, 2007; Marat, 2005). Such research, however, does not control the socio-economic factors that influence the educational setting and quality of math instruction. The correctional setting eliminates many confounding variables that otherwise are less controlled in studies conducted in other environments that influence prisoners' academic self-worth, create barriers to achievement, and increase prisoners' anxieties as at-risk students. These barrier factors occur within a correctional setting, but are outside the parameters of this study.

Elimination of sociological and economic factors occurs within an adult male correctional setting since all prisoners have nearly identical daily living experiences and individualized math instruction in ABE rather than traditional high school. Despite parental educational attainments, presence, and occupational background differences there is a single first English language expected among all participants. Cultural, racial, ethnic, and adverse life experiences of prisoner participants differ as well. Statistical analysis of these variables was outside the parameters of this study's purpose, but from this study's qualitative prisoner responses, analysis, and results had useful implications for future research.

All ABE teachers differentiate their math lessons for adult learners and everybody has equal access and opportunity to the teacher's instruction, tutorial help, computer-based math skill development and interventions with the Wisconsin Department of Correction. Post-secondary and career technical opportunities are measured the same along with diet and health care. In effect, the correctional learning environment provided a more controlled setting to study how math self-efficacy effects achievement for adult prisoners, representative of varied backgrounds.

This study provided correlational evidence different from other survey studies that were not controlled for environmental, gender, and present day living experience conditions and other variables. This study described the relationships of individual prior academic and math achievement by dropout dates in relation with MSE and MSE subdomains. The subdomains were measured using an adapted MSE survey of male prisoners' attitudes towards mathematics, internalized beliefs, and math anxieties of doing mathematics. It was hypothesized and contextualized for this study's purpose that there are only three domain constructs essential to MSE. The three MSE sources of anxieties, beliefs, and attitudes were used to provide a comprehensive measurement of prisoner's MSE in this study.

Theoretical Framework

Self-efficacy theory and constructivist philosophy guided this correlational study. Correlational research studies, according to Porter and Carter, go beyond simply describing what exists and are concerned with systematically investigating relationships between two or more variables of interest (Porter & Carter, 2000). This study's design described and attempted to explain the nature of MSE relationships that exist in adult male prisoners' low academic performance. This study, being correlational, did not attempt to examine the causality of poor

academic performance or low MSE (Creswell, 2013), but allowed each prisoner to provide their own insights by allowing them to give their free responses afterwards to the survey.

A quantitative correlational design was the most effective method for this type of research study. This methodology offered a more non-obtrusive approach of inquiry that is better for prisoner studies that are sensitive for a protected class. The resulting identification of significant relationships between study variables provided measurements of significance relevant for further inquiry on a particular population cross-section (Creswell, 2013; Perry, 2014).

The advantage of using converging quantitative evidence is in the use of true self-reported data from the population sample. Using self-reported data directly from the population sample resulted in findings and analyses that characterized and served as basis for future studies of this protected population. Although it was difficult to extract real survey data from within a highly regulated study-protected population such as adult male prisoners, the analysis derived from gathering valuable descriptive data that was authentic and had a certain face validity for correctional researchers and professionals to use for curricular and administrative decisions.

Correlational research design provided for the researcher's inquiry into the extent to which two variables or more changed the other variables significantly (Creswell, 2009). The implementation of the correlation research design provides self-efficacy information that addresses the research questions and objectives of this study. The correlational quantitative study design is a valid method to use to explore compensation variables. Such variables included in MSE are beliefs, attitudes, and anxieties. These variable differences cross-referenced with student academic data and dropout grade levels provided further evidence of MSE's impact on prisoner achievement in mathematics, school, and potentially other life components.

Conversely, conducting a qualitative or mixed- methods research approach may have been less effective due to limitations inherent in prisoner research.

Qualitative research could also be viewed as inappropriate for the study method due to the numerical data collected (Creswell & Clark, 2009). The proposed correlational study identifies associations between MSE variables and academic achievement variables that contribute to low levels of math and overall academic performance in prisoners. The proposed study's goal was to provide a better understanding of the phenomenon of MSE in prisoners and its relationship with academic performance among adult male prisoners who lack a secondary education credential (diploma/GED) and need to further their education for future employment options. Using a non-experimental correlation design seemed most appropriate for this study's purpose to identify and explore these self-efficacy relationships to prisoner academic achievement and prosocial outcomes for this sample population.

Research Questions

The overarching question for this study asks, "To what extent do sources of MSE (attitudes, beliefs, and anxieties) affect ABE adult male prisoners' mathematics achievement?" Four research questions were derived in an attempt to answer the overarching question for this study. They were:

1. To what extent do all three math self-efficacy sources (attitudes, beliefs, and anxieties) correlate with adult male prisoners' current mathematics achievement scores?
2. To what extent do all three math self-efficacy sources (attitudes, beliefs, and anxieties) correlate with adult male prisoners' prior mathematics achievement scores?

3. Which source of mathematics self-efficacy has the most significant effect on current adult male prisoners' mathematics achievement?

4 Which source of mathematics self-efficacy has the most significant effect on overall mathematics achievement for adult male prisoners enrolled in adult basic education?

The four research questions compare evidence by using and validating corroborated student data from prisoners' educational records. Statistical correlation and regression analysis from the aggregated individual survey questions attempt to answer the primary questions by calculating, comparing, and analyzing the following achievement measures:

- Math survey achievement as measured on the test of ABE (TABE®)
- Math complete achievement as measured on the test of ABE (TABE®)
- Academic achievement as measured with prisoners' last grade exited from school

Evidence from prisoner records obtained through the WI DOC pertained to the aforementioned three outcome-based measures for research questions one, two, and three and were correlated to prisoners' survey data and disaggregated statistically to quantify any MSE differences to prior academic achievements. Regression analysis determined the extent to which these mathematics self-efficacy sources and latent variables correlated with individual academic achievement for research questions three and fourth. The fourth research question, however, specifically takes into account the overall effect of prisoners' participation in ABE programming after having taken the TABE® math pre-test, the MSE survey, and the TABE® math post-test after at least 40 hours of ABE instruction.

This cross sectional survey study is primarily quantitative; but will also allow prisoners to respond freely to give additional qualitative substance in the final analysis. Printed on one side

of the 11" by 8.5" standard piece of paper were the standardized thirty math self-efficacy items. On the opposite side of the survey, prisoner participants receive a prompt to write to the researcher anything else about their math experiences in K-12 that they would like to contribute to this study.

Hierarchical Regression analysis helped to determine the extent to which MSE attitudes, beliefs, and anxieties relate to and correlate with individual academic achievement. The analysis will provide quantifiable data from prisoner survey itemized responses related to the four specific research questions.

The analysis utilized quantifiable and qualitative data from prisoner survey responses related to the three specific research questions. Common thematic and categorized MSE source data and student records data match to prisoner survey itemized responses in order to determine if any patterns exist related to MSE sources for overall academic achievement in course completion and test scores. The sample population provided conclusions based on statistical analyses with discussion, implications, and recommendations for further studies based on academic, social, and correctional outcomes of all adult male prisoner participants.

Qualitative results and implications for further studies resulted from prisoners' responses to a free response question at the end of the survey. The results benefited the final analysis provided additional insight into MSE and self-efficacy's effect on prisoner participants in this study's sample. Evidence from prisoner record will require permission from WI DOC to access. Each prisoner's record correlated and disaggregated in the analysis quantified differences between prisoner's overall MSE response scores to varying levels of MSE subscale scores. Regression analysis aids in determining the extent these MSE subscale sources and dependent

variables of attitude, belief, and anxiety relates to and correlates with individual academic achievement.

Common thematic and categorized MSE scale data and student records data correlated with prisoner survey itemized responses will determine if any patterns exist related to MSE sources and overall academic achievement. Statistical analysis was used for further discussion and recommendations for further studies based on the positive and/or negative academic, social, and correctional outcomes of all adult male prisoner participants within the cross-section cluster sample.

Variables

Potential variables for this study includes: age, expected date of high school graduation, secondary course completion, high school grades, prior secondary math assessment scores, math ABE entry test scores (TABE®), ABE goals/goal completions as related to mathematics achievement and verification of not having earned a diploma/GED. The following variables may be significant, but were not included and outside the parameters of this study:

1. Age
2. Race
3. Socio-Economic Class (Free & Reduced Lunch)
4. Homelessness
5. Parent(s) support or lack thereof
6. Peer relationships
7. Math Teachers
8. Prison facility and/or ABE program site and ABE programming differences
9. Adverse Childhood Experiences (ACE)

Independent Variables Measured:

The independent variables for this MSE study included:

i. Prior math achievement as measured by year exited from public education
ii. Prior ABE math achievement as measured on the math TABE® survey assessment
iii. Current ABE math achievement as measured on the math TABE® post assessment

Dependent Variables Measured:

The dependent variables for this MSE study are measurable using the adapted MSE survey. They were:

i. MSE composite score as calculated on the MSE adapted survey
ii. MSE beliefs score as answered by prisoner responses to the MCS
iii. MSE attitudes score as answered by prisoner responses to the MVS
iv. MSE anxieties score as answered by prisoner responses to MBS

Hypotheses

This research tested the following research and null hypotheses to answer the corresponding four research questions (RQ =Research Question, H_A = Alternative Hypothesis, H_0=Null Hypothesis):

Relationships of Current Mathematics Achievement to Prisoner Math Self-Efficacy Scores

RQ1: To what extent do all three of the math self-efficacy sources (attitudes, beliefs, and anxieties) correlate with adult male prisoners' current mathematics achievement scores?

$H1_A$: Current mathematics achievement scores will have a correlation with math self-efficacy scores.

$H1_0$: Current mathematics achievement scores will have no correlation with math self-efficacy scores.

Relationships of Prior Mathematics Achievement to Prisoner Math Self-Efficacy Scores

RQ2: To what extent do all three of the math self-efficacy sources (attitudes, beliefs, and anxieties) correlate with adult male prisoners' prior mathematics achievement scores?

$H2_A$: Prior mathematics achievement scores will correlate with math self-efficacy scores.

$H2_0$: Prior mathematics achievement scores will show no correlation with math self-efficacy scores.

Relationships of Math Self-Efficacy Categories of Anxiety, Attitude & Belief scores to Current Mathematics Achievement

RQ3: Which source of mathematics self-efficacy has the most significant effect on adult male prisoners' current mathematics achievement?

$H3_A$: One math self-efficacy source will have a more significant effect on adult male prisoners' current mathematics achievement than the other sources.

$H3_0$: No math self-efficacy source will have a more significant effect on adult male prisoners' current mathematics achievement scores than the other sources.

Relationships of Math Self-Efficacy Categories of Anxiety, Attitude & Belief scores to Overall Mathematics Achievement

RQ4: Which source of mathematics self-efficacy has the most significant effect on overall mathematics achievement for adult male prisoners enrolled in adult basic education?

$H4_A$: One source of mathematics self-efficacy will have the most significant effect on overall mathematics achievement for adult male prisoners enrolled in adult basic education.

$H4_0$: No source of mathematics self-efficacy will have a more significant effect on overall mathematics achievement for adult male prisoners enrolled in adult basic education, than the other two.

Research Design Strategy

Insights from the prisoner MSE itemized survey data are the basis of the assumptions and models employed. Records retrieval that pertained to prisoner educational outcomes used a records search of the Wisconsin DOC inmate records database that included prisoners' demographic and educational data. Descriptive statistics provided information on age, race, mean, median, mode, variance, and standard deviation of continuous variables. Prisoner MSE questionnaire itemized results were measured for internal consistency using one sample Kolomogorov-Smirnov and Cronbach's Alpha tests. Prisoner participant educational records and assessment data was collected from WI DOC staff with permission to access the WI DOC databases and use in statistical analysis. Educational records consisted of mathematics and reading test scores as well as when prisoners reported dropping out of school. Data was collected and used for additional analysis in Chapter IV and for further implications in Chapter V.

This study assumed that lower levels of educational attainment in K-12 directly results in lower levels of math self-efficacy for adult male prisoner populations without a secondary credential. Past educational experiences influence prisoner participant beliefs, attitudes, and/or anxieties scores and have effect on current educational goal attainment in ABE programming. This study examined prisoner participant variables such as: socio-demographic profiles, prior assessment data, and educational achievements in order to measure and correlate the effects on prisoner participant MSE scores and MSE subset sources.

The methodology for this investigation was primarily quantitative. Secondary to the prisoner MSE survey study is an opportunity for prisoners to provide a free writing response for qualitative considerations for further investigations regarding prisoner research on this topic. This study combines descriptive statistical analysis of prisoner demographic data and education histories to MSE categorized questionnaire responses. Student achievement measures include; secondary grades, math course completion, and math assessment scores. Student data corroborates and correlates with prisoners' participant survey item responses of MSE source measures for correlative and regression analysis.

These three MSE measures correlated to individual prisoner socio-demographic and educational history data for comparative statistical analysis. Additional correlations from these variables are itemized and categorized to MSE survey responses. Use of hierarchical regression analysis aggregated MSE composite results for additional correlational analysis to prisoner outcomes. Disaggregation of the aggregated data using a second linear hierarchical regression analysis to calculate which of the three sources has largest effect was constructed.

This study was comprised of 181 WI DOC adult male prisoner participants. WI DOC staff provided the adapted MLSES 30-item prisoner MSE survey to volunteer participants. Collection of the prisoner surveys and consent forms will occur over a 90-day period through the Department of Research. After the surveys and consent forms were received, additional collection of test scores and prisoner data occurred over an additional 180 day period.

Prisoner participation in the study consisted of 181 prisoners selected by the WI DOC from a cross section population enrolled in correctional education programing. Only consenting prisoner participants' educational data throughout the study was used. Educational attainment and performance data of descriptive statistical data using prisoner educational K-12 assessments

and transcripts along with TABE® pre-test scores was used for this study's purpose. Verification of socio-demographic and diploma attainment data with MSE data provided assurances of test and participant validity, survey reliability, and use in multivariate regression analysis.

Composite and sub-score MSE source data was measured using regression against the total composite MSE score to determine statistical significance to prisoner educational past math and academic outcomes. Determinations of statistical significance used confidence intervals, and Pearson correlations with regression analyses of continuous assessment data comparative of TABE® survey intake and TABE® complete post-test scores. A pilot study was not possible for this study.

Regression analysis with categorical explanatory variables for dropout grade levels used modeling of three MSE source measures to answer each of the research questions related to achievement in order to quantify participant differences. To measure the extent of the MSE latent variables of attitude, belief, and math anxiety correlate to academic achievement, the Pearson Correlation Coefficients quantify the extent and significance of each potential correlational relationship (Ahmet & Kurbanoglu, 2011; Coughlin, 2005).

Participants meeting the specific sample criteria for this study and currently enrolled in adult basic education within a correctional setting must first give written consent. WI DOC education staff provided the opportunity for prisoner participation and collect consent forms for security purposes and prisoner research standards. Prisoner participants gave their signed consent forms to WI DOC staff provided the study's MSE survey to them. Prisoners completed the survey on their own, but assistance was provided if requested, to assure prisoners of their rights not to participate and to supervise prisoners while they completed the survey. Prisoners who participated in the survey returned their surveys to WI DOC staff members who returned

them to the WI DOC RRC chair's office for further security, integrity, and review purposes. The WI DOC RRC chair mailed the surveys that passed internal review to Bethel University.

The survey's response items were collected on one side of an 11" by 8.5" standard piece of paper. On the opposite side of the survey, participants have a prompt to write their comments to the researcher about their math experiences and/or anything else that they would like to contribute to this study. Dr. Erica Hering received the surveys at Bethel University mailed after June 10, 2017, and delivered through the U.S. Postal Services. This researcher received the surveys and consent forms from Dr. Hering and then recorded, tabulated, and used them in item analysis, quantitative analysis, and qualitative analysis using SPSS version 24.

Several statistical procedures methodically addressed this study's four research questions. These procedures included cross-tabulations, chi-square, and Pearson tests for analysis of categorical data. Descriptive statistics of continuous and discrete variables included linear regression analysis to determine using the data to display correlative relationships between educational discrete data and prior test scores to MSE and the three MSE subscales.

The cross-tabulation displayed both the individual and collective phenomenon MSE survey data across each of the variable categories. Cross tabulations explored the study's categorical data and discuss participant profiles. The chi-square test helped to infer whether there was an association between two or three categorical variables. The chi-square test determined whether there is a statistically significant association between the independent variables to the dependent variables. The Pearson test determined the degree of significance of each correlation from within the dependent variables (MSE sources) to the MSE composite score. The Pearson r correlation coefficient assisted in measuring the survey's validity along with the Cronbach's Alpha that measured the adapted survey's internal reliabilities.

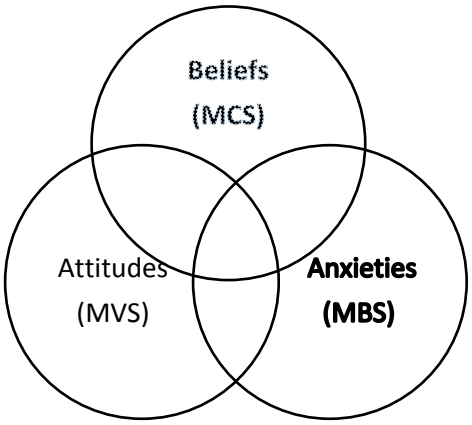
Measures and Instrumentation

The survey's scales used for this study were the math value scale (MVS), math confidence scale (MCS), and math barriers scale (MBS). The scales for this MSE survey were adapted from Hendy, Schorschinky, and Wade's (2014) Beliefs survey to include a nonresponse category to ensure participants free choice in answering questions (Hendy, Schorschnky, & Wade, 2014). The administration of the survey to a cross-sectional cluster sample of willing and consenting adult male prisoner participants occurred over a period of 90 days from March 10, 2017 to June 10, 2017.

The adapted MSE survey assessed and assigned a value to prisoner MSE of each participant. The MSE survey consisted of items derived but different from the MARS, MSES-R, and the Self-Description Questionnaire III-math subscales. The adapted MSE questions, by design, specifically addressed nontraditional adult prisoners' prior experiences and work backward from educational experience. This prisoner MSE survey tool, written, designed, and adapted from the original by the researcher for the study's purpose to measure MSE in adult prisoners, provides a better measurement of this cross section's MSE. This survey, therefore, was different from previous versions of the MARS and MARS-R as well as other MSE scales. Hendy, Schorschinky, and Wade (2014) determined and categorized three domains of the most significant factors for MSE measurement in adult learners. Using factor analysis, these three categories were termed as most significant in determining MSE of nontraditional adult student populations (James & Fusco, 2014; Suinn & Winston, 2003). The adapted MSE questions from Hendy's (2016) scales used a Likert scale to assess the three measurable subscale domains. No pilot studies were conducted to establish the means and standard deviations of the adapted MSE survey due to Federal restrictions and researcher's time restrictions that prohibited pilot survey

testing of prisoners for this study. Provided in the results, calculations and considerations of inter-item validities and reliabilities were analyzed. A copy of the instrument measurement and scoring rubric is included in Appendix C and Appendix D. For each of the three MSE measures, a mean score and standard deviation was computed across the items and within each domain. Verification that items measured within the same construct for each domain, was calculated using the Cronbach α for internal consistency. SPSS V.24 provided an internal reliability analysis for all the MSE items, MSE sources, as well as for the MSE survey itself to meet the hypothesis testing assumptions for further correlation and regression analysis. Kolomogorov-Smirnov hypothesis testing of the means and standard deviations in the results determined goodness of fit of the MSE adapted survey's results for a normal distribution at 95% confidence. This test computed the differences between cumulative observed and expected frequencies and then compared the largest value of this cumulative difference to chance expectations. The Kolomogorov-Smirnov tests replaced Chi square analysis that determined normal distribution of survey items since the MSE questions and categories by design had a natural symmetry comprising one-third of the MSE composite score (Coughlin, 2005).

Figure 9. Three measures of math self-efficacy in prisoners' comparison graphic



Calculations to determine the adapted MSE's internal reliability included comparisons with Hendy Schorschinky and Wade's (2014) internal reliabilities for the adapted MSE survey results. For this study, the three discouraging words questions were rewritten in the positive as encouraging words told to prisoners while in K-12 in order to prevent further risk and psychological harm by focusing on negative experiences with prisoners whom the research clearly indicates already likely have had and further negative reinforcement would be an unnecessary risk.

Hendy Schorschinky, and Wade's (2014) MSE survey had two subcategories for the ten items under math barriers (MBS) that included seven anxiety questions and three discouraging words questions. This study simply combined these ten items under the anxieties construct. By doing so, this study's design combined Hendy Schorschinky, and Wade's (2014) subdomains as significant math anxiety barriers as illustrated in Figure 9. Hendy Schorschinky, and Wade's (2014) MSE survey did reveal a normal distribution for meeting regression and correlation assumptions for all items and constructs except for the subcategory of No Future Value within the MVS (Hendy, Schorschinky, & Wade, 2014). MVS, however, did calculate at 95% confidence as an MSE construct having a normal distribution as was anticipated for the attitudes construct in this study. A normal distribution must be determined using Kolomogorov-Smirnov hypotheses testing of the means and standard deviations for both internal reliability comparisons and for establishing equivalency in external validity (Coughlin, 2005; Hendy, Schorschinky, & Wade, 2014).

Given a normally distributed outcome of the adapted MSE survey items, correlation and regression analyses were used to correlate to each research question. A multivariate regression item analysis used the educational background variable data from the dropout year with the MSE

composite scores and the three MSE subscale categories. Multiple regression analyses proceeded after the first analysis to determine the relationship between MSE composite scores to the other MSE scale scores. Extrapolation of the surveys' item analysis with all three measures of: math beliefs (MCS), attitudes (MVS), and anxieties (MBS) correlated with the researcher's adapted survey and with current or initial prisoners' TABE® scores. According to Hendy, Schorschinsky, and Wade's study (2014) of first year remedial math placement of college math students, age, and gender were also found to be significantly associated with math devaluation (attitudes), math confidence (beliefs), and anxieties using hierarchical multiple regression analysis. For this study, however, the primary focus was on statistically significant correlations within MSE and within MSE constructs to previous and current math scores to answer the four research questions.

The purpose of the multiple regression analysis in this study was to identify the most significant source domain that significantly described adult low functioning males, defined by their current math TABE® scores. By controlling for prisoner demographic background variables, math achievement was measured using current or initial TABE® math scores in ABE. In unison, all variables entered in SPSS were calculated to determine the correlation significance between MSE and academic achievement.

Sampling Design and Participants

A cross-section cluster sample taken from within WI DOC ABE facilities emerged from prisoner participants who voluntarily gave consent and took the MSE adapted surveys. There was a goal to provide every ABE eligible prisoner within the WI DOC the opportunity to participate in this study. That was achieved with 317 identified prisoners seeking their first secondary education credential (diploma/GED) that were given the opportunity. A sample

emerged from this study of 181 adult male prisoner participants. The researcher accessed and correlated prior educational records and demographic data from the consenting 179 adult male prisoner participants since two participants chose to consent, but not provide any information.

This researcher requested from the WI DPI to have access to WI DOC's database for the self-selected participants' records. The researcher provided a copy of the consent forms in order to access the WI DOC database system and the test scores also were self-reported by 32 of the participants to the researcher. The researcher had no control, however, of which prisoners participated in the study. This researcher ensured that this study was in full compliance with federal and state regulations on studies of prisoner populations.

Through the WI DOC's Research Review Chair (RRC), prisoners' participant MSE surveys were mailed. MSE surveys were the primary data source for determining prisoner math self-efficacy. Given adult prisoner written consent, the researcher had permission to access prisoner demographic data, educational records, and test scores through the WI DOC Adult Basic Education database system. The researcher accessed and collected participant public and educational data from the WI DPI inmate locator and database system.

Data Collection Procedures

The researcher submitted a letter of introduction (Appendix A) to the WI DOC research and Policy RRC Chair to explain the purpose of the survey to the WI DOC staff and prisoners. The WI DOC RRC Chair distributed the researcher's letter to the WI DOC ABE Department Heads and/or ABE teachers to read to eligible prisoner participants enrolled in ABE programming at their facilities. Prisoner participants at the facilities read, or had read to them if they were unable, the consent forms. Prisoners signed the consent form to participate and take the survey (Appendix B).

Those who consented to participate in the study received a prisoner MSE survey (Appendix C) from a WI DOC educational staff member. The participants returned their MSE survey to the WI DOC educational staff member who in turn returned it to the WI DOC Research and Policy Division. The WI DOC RRC Chair returned all forms to the researcher at the end of the collection period in June 2017 by US Mail.

The RRC Chair screened each consent form and survey for security and research integrity purposes under the federal and state guidelines for prisoner research. The RRC chair sent the consent forms and the surveys together in a pre-addressed envelope to this researcher's institution (Bethel University). The RRC Chair mailed complete and incomplete consent forms and participant surveys to Bethel University in care of Dr. Erica Hering to deliver to the researcher. The researcher collected and used all prisoner surveys that had a corresponding consent form for the sample. Age, race, and gender of participants were verified using the public accessible WI DOC Inmate Locator (WI DOC, August 2017). From a separate private WI DOC educational data portal test data was collected educational records and test scores as well as verification of name, gender, and race. Permissions were required and granted from the WI DOC and each individual prisoner by written consent to access and report on test assessment data as well as verify dropout grade level.

This researcher submitted an introduction letter, a participant consent form, and a MSE adapted survey to the Wisconsin Department of Corrections Research and Policy Division Chair. After full IRB approval by Bethel University (Appendix H) along with receiving a letter of understanding from the WI Department of Public Instruction on rights and permissions in order to access the WI DOC database for prisoner educational histories and test scores (Appendix G). The Wisconsin DOC Research and Policy Division distributes the researcher's letter, participant

consent forms, and math self-efficacy surveys to ABE Department Heads at all WI DOC adult correctional facilities with ABE programming for distribution to prisoners currently enrolled in ABE classes to consider. The ABE staff members will read the researcher's letter, distribute the consent forms to the targeted and interested adult prisoners, and collect consent forms. Upon receiving prisoner consent, the ABE WI DOC employees distributed the adapted MSE survey to the participant to complete independently. Participants who voluntarily returned the MSE survey to the ABE WI DOC staff member will participate in the study and given the opportunity to withdraw at any time. WI DOC education staff members returned all consent forms and surveys after the collection period to the WI DOC RRC chair's office. The WI DOC RRC screens, bundles, and returned all participant consent forms and surveys to this investigator after the closing of the sample period after June 10, 2017.

Data Analysis

Descriptive statistics provided information on the mean, median, mode, variance, and standard deviation of continuous variables such as test scores and MSE. The one-way analysis of the variance (ANOVA) application compared means of continuous variables among the samples using F-distribution if necessary. To explore mean differences among the MSE three sources, ANOVA tests determined if the difference between the means (MSE to MSE and Prior scores) by the MSE source (attitude, anxiety, belief) are statistically significant (Bluman, 2012).

Statistical Packages for Social Science (SPSS) version 21.0 analyzed the collected quantitative data. Descriptive statistics reported the distribution of prisoners' responses, the mean, error, and standard deviation. Computation in this study for statistical significance level was set at $p < .05$. Calculation of the Pearson Product correlation was used to investigate whether all three sources of math self-efficacy correlate with academic achievement. Lastly, hierarchical

linear regression analysis examined which of the three sources of math self-efficacy was the greatest indicator of academic performance in mathematics and reading achievement.

The researcher examined correlative patterns among the variables. Regression analysis was conducted based on the discovered patterns of inter-correlations. Further hierarchical regression modeling examined interactive effects of multiple descriptors. Logical sequences for each hypothesis were examined. Comprehensive regression helped determine the emergence of any significant specific MSE effects.

Reliability in correlation design refers to how reasonable the data obtained was for the given study (Hesse-Biber & Leavy, 2005). The reliabilities of this correlation study was determined by using both internal consistency and external consistency (Neuman, 2003). The internal consistency refers to how reasonable the data collected was and if there was consistency in observation obtained from the participants in the study (Hesse-Biber & Leavy, 2005). The data's external consistency was verifiable by comparing the information found for the current study with information collected from other self-efficacy studies (Hesse-Biber & Leavy, 2005; Neuman, 2003). The external consistency determined whether information collected for the purpose of this study was confirmable in other studies. These two consistency models provided internal reliability analysis with Hendy, Schorschinky, and Wade's (2014) study comparisons using Cronbach's Alpha and helped determine a degree of validity in correlational comparisons with other studies. Future prisoner studies must meet the same required permissions for prisoner research as well as provide consistent internal reliabilities and external validities in the results (Morgan & Kett, 2003; Neumann, 2003).

Limitations of Methodology

The theoretical lenses used in this study to interpret and understand MSE, its sources, and its effects are limited to variable constructs not associated with knowledge and comprehension of math content. The real value of this prisoner study is in the processes, measurements, and demographic differences of responses evidenced in the data in an educational prisoner population study in compliance with state and federal regulations.

This study is limited in its findings to 179 adult male prisoners incarcerated in the state of Wisconsin from March 10, 2017 to June 10, 2017. Participation was limited to prisoners who were ABE eligible, lacked a first secondary education credential, and chose to participate in the study. The adapted MSE survey's validity is limited because of the researcher's adaption for a "N/A" response option to ensure prisoner rights and freedom of choice for compliance to federal regulations on prisoner studies. The external validity of the adapted MSE survey was compared with Hendy's math belief's scales. The reliabilities were much more trustworthy for this population with Hendy's (2014) study from the MARS and MLSES, since that study collected information from struggling remedial math first year undergraduates, being much more similar with a prisoner population than professional, college graduate, and undergraduate student populations as other studies reported. The adapted survey does take into account reliability in its standardized scaled items from collective MSE survey scales and studies (Hendy, Schorschinky, & Wade, 2014). Generalizing this study's results for populations other than adult male prisoners lacking a secondary education credential, would be highly speculative and difficult to defend. Generalizing even with the targeted population is speculative as well since certain subpopulations unintentionally will not be present within this sample. Only 141 of the 181 prisoners surveyed completed the entire survey. Therefore, only 78.3% accuracy of the results

was available for further and total MSE correlational analysis due to the limitations of SPSS v.21 and the choice of the researcher not to impute theoretical values for actual responses.

The study did not take into account special needs of prisoners, such as ABE eligible prisoners on IEPs nor English Language Learners (ELL). This study did not discriminate by race and/or cultural background, except unintentionally by excluding ELL students. The study groups or pools all of the 141 ABE eligible and valid prisoners together within a given cluster sample by attitude, belief, and anxiety scale scores along with composite scores for regression analysis. The choice of linear verses logistic regression analysis was limited only to the discovered data provided within this study's results, and either could easily be the wrong choice for the phenomena. The choice was made to not impute values was based on research of studies with similar downtrodden populations. Imputation hinders the likeliness of a mean response for missing values that do not appear to be missing at random as is common for factor analysis, intention- to-treatment, or anxiety type studies. Imputation is problematic for the results. Therefore, in the analysis, it is more important to measure only for the participants who completed the study and then propose theories for future studies to explore on the actual missing participant count as to why participant responses were missing (Howell, 2007; Schlomer, Bauman, & Card, 2010).

This study limits its findings regionally to prisoners within the Wisconsin Department of Corrections and receiving ABE programming within this system. The participants of this study were a volunteer cluster sample population of ABE eligible prisoners without a verifiable secondary education credential enrolled in adult basic education math classes. The results of this study primarily took into account the negative aspects of MSE in adult males. The results,

therefore, may not be generalizable nor relevant to MSE studies that correlate positive MSE scores with positive academic outcomes.

The cross-section cluster sampling method also limited its findings to broader generalizations about ABE eligible prisoners since it does not account for the participants whom choose not to participate from the sample. These adapted MSE surveys are not evident in the results, except for use in the rate of return from the total number of prisoners invited to participate and for statistical confidence measures.

The participant sample was limited by the extent to which participants are able to read and understand the adapted MSE survey. Since there was not a control group, the study was also further limited by participant's individual educational experiences, adverse childhood experiences, reference biases, and their likeliness to participate in the survey.

This study examined the relationships between reading and mathematics on one common standardized assessment and prisoners' dropout grade levels. This study used no other academic indicators of successes or failures. The focus of this study was on male prisoners with low math functioning levels, varying motivation to achieve in post-secondary and/or career technical programs, and their attitudes, beliefs, and anxieties in relationship with MSE to their academic indicators in ABE programming. This focus significantly limits the results of this study to the prisoner population participants, but does supply ample evidence for further research inquiry into this population subgroup.

Ethical Considerations

The Belmont Principles state that three basic ethical principles are respect for persons, beneficence, and justice (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1978). The researcher sought and obtained Institutional

Review Board (IRB) approval from the WI DOC RRC (Appendix E). Bethel University's review committee approved this study on March 4, 2017. Both committees communicated that studies that qualify as live human subject research by definitions as provided in federal guidelines were reviewed and must be approved for prisoner research. The WI DOC RRC went even further under Wisconsin State Statute by only approving research under Executive Directive #36, WI DOC Policy, and the researcher's written compliance with the Research Project Agreement. There were no incentives for prisoners to participate in this study other than to contribute to correctional educational research and the hope for advancement in mathematics instruction. WI DOC required that descriptions of confidentiality were understandable and written to a grade level acceptable to the WI DOC. The researcher made use of the Lexile® Framework® pro-analyzer tool to help ensure readability sufficient to meet the guidelines of the WI DOC. Permission for use of the English Professional Lexile® Analyzers from Lexile.com customer support was granted on October 2, 2016. The invitation and the consent forms were converted into plain text and were analyzed at an acceptable Lexile® score for a prisoner population. WI DOC approved both research documents for distribution to DOC staff and prisoners.

In detail within the participant's consent form, limitations to prisoner confidentiality were specific per federal and state guidelines. There was an understood mediation of WI DOC Staff, the RRC Chair, and Office of the Secretary to screen prisoner responses for safety and security using the prison mail system and for the researcher to access the WI DOC database for participant data.

Informed consent and the assessment of risks and benefits is in accordance with the Belmont principles. This researcher followed the Belmont Principles (National Commission for

the Protection of Human Subjects of Biomedical and Behavioral Research, 1978) and Federal Regulation 45 CFR 46.305 as a framework and guide throughout the research process.

In an effort to further minimize risk to human subjects, the researcher completed the Collaborative Institutional Training Initiative (CITI) and with the WI DOC Research Agreement for the purposes, objectives, and implementation throughout this study. These regulations protect human subjects and particularly prisoner subjects in research studies. Prisoners are a protected class of human participants because their freedoms are limited while incarcerated. It is therefore necessary to provide additional assistance in their invitation to participate with an invitation letter from the researcher read by WI DOC staff and supervised by WI DOC staff to assure and protect each prisoner's freedom of choice.

The quantitative methods included obtaining educational records. Aggregated and disaggregated public data on prisoner outcomes required permission to access the database from the Wisconsin Department of Public Instruction in 2017 with evidence of participant consent to the Family Educational Rights Act of 1974 (FERPA). Prisoner participants, who met the criteria set for this study, were offered through a DOC staff member's invitation to participate to avoid any perception of cohesion. Those who did participate did so by their free will after being notified of the risks of participation and providing their written consent to participate in this survey as well as for the researcher to acquire additional educational data from each participant both public and in accordance with FERPA.

Prisoner subjects were made aware in writing of the identified potential risks of participation as well as the potential benefits to other adult male prisoners. They were asked to sign a participation consent form for the researcher to have access to their educational histories, employability information after release, and educational assessment data to use in this study.

All prisoner participant identities were held in a locked safe by this researcher. Prisoner identification numbers were special coded and concealed after they were used for verification purposes. This researcher shredded any indemnifying information along with prisoner consent forms and surveys at the end of the study. To further protect prisoners' identities, data was carefully selected, redacted, and statistically reported in aggregate form. Prisoner data entries and free-written responses were categorized by themes (Zolli & Healy, 2012). Prisoner responses were coded using identification numbers and replaced later by a random assignment of numerical values for each participant. Only aggregate test data from participant's information, after verification and correlation to their corresponding statistical data, was used in the quantitative results to protect prisoners' FERPA rights. A reminder was also included in the final participant notice that be no prisoner would receive any consequences for withdrawal and/or failure to answer individual survey item(s) while participating in this study.

Chapter IV: Results

Introduction of the Purpose

This quantitative study's primary purpose was to measure the relationships between math and academic achievement using prisoner MSE, (the three MSE constructs of anxieties, beliefs, and attitudes) to formulate, articulate, define, and measure male prisoner barriers to learning mathematics. The participants in this study all are prisoners enrolled in ABE within Wisconsin's Department of Corrections education system attempting to earn their first secondary education credential by passing the GED or another high-stakes timed exam that includes comprehension and ability to perform basic and high school level mathematics operations. The study's purpose is to explore the extent of the relationship of MSE in prisoners' survey results to their academic achievement.

A secondary result of this study was exploration into the extent of these interrelationships within the three identified MSE categories to prisoners' math achievement and overall achievement as MSE sources from when prisoners dropped out from the public education system. The results measured the effect of MSE, MSE constructs, and sources of MSE from when prisoners exited school, prisoner initial (intake) TABE® math test results taken prior to the MSE survey and prisoner post-test TABE® math results afterwards and having received at least 40 hours of instruction after having taken the MSE survey.

Review of Procedures

WI DOC education staff offered 317 prisoners from March 10, 2017 through June 9, 2017 the opportunity to take the adapted MSE survey. Permissions were obtained from the WI DOC, Bethel University, WI DPI, and for each prisoner's written consent to collect prisoner

education information in 2017 and administer the adapted MSE survey over a ninety-day collection period. The male prisoner population consisted of prisoners enrolled in ABE programs who met the specific criteria for participation of not having earned a secondary education credential (diploma/GED). The WI DOC determined which prisoners from the sample received the opportunity to participate in this study.

One hundred and eighty-one prisoners volunteered to participate and gave their full written consent. One additional prisoner completed a survey, but did not complete the consent form, so the researcher discarded his scores and survey results from this study's entries. Two prisoners consented to provide their education and test information for this study, but did not answer any questions on the survey. This resulted in a 57% survey response rate from the prisoner sample with 179 adapted MSE surveys. The researcher also obtained prisoner demographic, exit (dropout) year data, and TABE® scores with permission through the WI DOC database. The TABE® intake math assessment scores, administered prior to March 10, 2017, were correlated with the prisoner participants along with the TABE® post-test scores administered after June 10, 2017.

Results were tabulated from 181 prisoners who participated by voluntary consent were correlated with their survey responses. One prisoner did not fill out the survey that resulted in withdrawing his submission from the study. There were 141 complete surveys out of 179. Therefore, 141 surveys were analyzed using SPSS v.24 for MSE due to missing items. A missing values analysis for the 40 incomplete surveys was conducted and then correlated to prisoners' test scores and dropout grade levels. Public data on prisoners was collected on their demographic data. Prisoner identities were then concealed and protected using a logical coding

system for prisoner responses. None of the 181 consenting prisoners throughout this study communicated through the WI DOC any desire to withdraw from this study.

SPSS version 24 calculate Cronbach's alphas and conduct hypotheses testing for goodness of fit to analyze the indemnified, coded, and collated quantitative data. Internal consistencies for each item, the MSE constructs, and MSE were calculated. Descriptive, correlational and regression statistics subsequently were computed for this study with the level for statistical significance set at 95% confidence (α=0.05). Descriptive statistics along with means and standard deviations were useful for explaining and comparing the distribution of prisoners' responses. Pearson's product correlations investigated further internal and external correlations of MSE and the three MSE constructs to math academic achievement as measured using the TABE® math intake survey and post-test complete assessments to attempt to answer research questions one and two. To determine the greatest predictor of math achievement with prisoners' TABE® scores and the year they dropped out of public education to answer research questions three and four, hierarchical linear regression and correlational analyses assumptions were met or partially met. That allowed for further examination of all three MSE construct comparisons for the research findings.

Prisoner Demographics and MSE Survey Item Analysis

This quantitative study consisted of 181 adult male prisoners completing a five-question scale on the adapted MSE prisoner survey and provided an opportunity for them to respond to a free-response question on the backside of the survey. Table 4.1 provides descriptive statistics for all one hundred and seventy-nine of the prisoner participants in this study with their ages to cross-validate prisoner information. The WI DOC database and WI DOC public access Inmate Locator was used for this validation step. One hundred and seventy-nine prisoner participants

completed all or at least some portion of the adapted MSE and provided the grade level exited before dropping out from public education. Univariate statistics shown in Table 4.1 are for the fully completed surveys and displayed for the fully completed MSE construct scores respectively. There were insignificant differences between the means and standard deviations of the pairwise and listwise statistics as shown in Table 4.1.

Table 4.1

Adapted MSE Survey Prisoner Demographics & Univariate Statistics

Pairwise MSE Data	Min	Max	Mode	Mean	Range	St. Dev.	N
Age	18	78	24	35.23	60	12.24	181
Exited School	3	12	10	8.5	9.0	1.95	179
TABE® Math (Pretest)	288	607	480	483.3	319	72.17	179
TABE® Math (Pretest)	337	723	481	521.5	386	70.27	179
Anxieties	14	48	27	30.69	34	6.29	152
Beliefs	19	50	38	39.62	31	6.13	160
Attitudes	18	46	30	32.74	28	5.26	158

Table 4.2

Adapted MSE Survey Prisoner Demographics and Univariate Statistics and MSE Scores

Listwise MSE Data	Min	Max	Mode	Mean	Range	St. Dev.	N
Age	18	78	24	35.13	60	12.44	141
Exited School	3	12	10	8.5	9.0	1.95	141
TABE® Math (Pretest)	288	607	480	484.7	319	71.83	141
TABE® Math (Pretest)	337	723	481	521.5	386	69.35	141
Anxieties	14	48	27	30.64	34	6.26	141
Beliefs	19	50	38	39.28	31	6.24	141
Attitudes	18	46	30	32.67	28	5.20	141
MSE	65	142	105	102.60	77	13.6	141

The use of listwise statistics for MSE, however, controls for differences in missing values and keeps population variances in check by having equal sample sizes for comparative analyses assuming missing items are completely at random.

Item and missing values pattern analyses provides insight into prisoner responses or non-responses to the survey. The researcher observed and analyzed 40 missing prisoner response

items using the SPSS missing values function. In Table 4.2, the 40 missing response items, means, and standard deviations list the results for three MSE constructs of beliefs, attitudes, and anxieties. Missing item pattern analysis displayed in Figure 1 suggests that the missing items are not completely at random. Shown also in Table 4.1 is the number of prisoner participant responses, the means, standard deviations, and missing items for the three categories. The items were written using a five-point Likert scale model ranging from a score of one indicating the prisoner strongly disagrees with the statement, to a score of five that the prisoner strongly agrees (Appendix C). A neutral score of three provided and served as the expected mean for each item. The researcher categorized the survey responses by the three MSE constructs for beliefs, attitudes, and anxieties shown in Table 4.2. Table 4.2 provides the number (N) of participants who answered each question. The percent of prisoner responses from one through five illustrates the distribution of responses to each item. The standard deviations and the means provide the necessary descriptive data for determining internal reliabilities for each item as well as for the MSE sources and the survey as a whole for correlational analyses (Coughlin, 2005). Kolmogorov-Smirnov tests compares the distributions of each item by comparing the empirical distribution functions of each item instead of comparing one of the distributions to the MSE theoretical distribution (Coughlin, 2005). The purpose of having separate distributions for missing values analysis was to test for a normal distribution as well as to provide further internal validity of each item's validity for each MSE construct. Internal reliabilities were determined using Cronbach's alpha. Prior research survey items and internal reliabilities scores from Hendy, Schorschinky, and Wade (2014) were used for determination of contextualized question items and MSE source constructs for calculating external validity. Consistency and allowance of adaptation of question items to contextualization in this a prisoner study was derived from prior

research with Norway's adaptation in a similar adult literacy survey which also compared results between multiple surveys adapted for prisoner use that showed no significant differences in the results (Morgen & Kett, 2003).

Table 4.3

Prisoner MSE Survey Item Analysis Chart

<table>
<tr><th>Prisoner MSE Item Analysis</th><th>Mean</th><th>Std. Deviation</th><th>N</th></tr>
<tr><td>Beliefs Questions</td><td></td><td></td><td></td></tr>
<tr><td>Q1: Being good at math will help me have more career options.
<table>
<tr><th>Scale</th><th>Frequency</th><th>Percent</th></tr>
<tr><td>5</td><td>101</td><td>55.8%</td></tr>
<tr><td>4</td><td>42</td><td>23.2%</td></tr>
<tr><td>3</td><td>20</td><td>11%</td></tr>
<tr><td>2</td><td>4</td><td>2.2%</td></tr>
<tr><td>1</td><td>8</td><td>4.4%</td></tr>
<tr><td>Missing</td><td>6</td><td>3.3%</td></tr>
</table></td><td>4.28</td><td>1.05939</td><td>175</td></tr>
<tr><td>Q2: Getting good grades in math will help me get a good job.
<table>
<tr><th>Scale</th><th>Frequency</th><th>Percent</th></tr>
<tr><td>5</td><td>72</td><td>39.8%</td></tr>
<tr><td>4</td><td>42</td><td>23.2%</td></tr>
<tr><td>3</td><td>43</td><td>23.8%</td></tr>
<tr><td>2</td><td>10</td><td>5.5%</td></tr>
<tr><td>1</td><td>6</td><td>3.3%</td></tr>
<tr><td>Missing</td><td>8</td><td>4.4%</td></tr>
</table></td><td>3.9480</td><td>1.10109</td><td>173</td></tr>
</table>

Q7: I can get a good grade in math even if I don't do the assignments.

Scale	Frequency	Percent
5	6	3.3%
4	8	4.4%
3	21	11.6%
2	35	19.3%
1.0	103	56.9%
Missing	8	4.4%

1.7225	1.06935	173

Q9: How good my math teacher is effects how well I do in class.

Scale	Frequency	Percent
5	90	49.7%
4	45	24.9%
3	18	9.9%
2	7	3.9%
1	11	6.1%
Missing	10	5.5%

4.1462	1.16656	171

Q11: To get a good job, I must learn more math skills as an adult.

Scale	Frequency	Percent
5	63	34.8%
4	44	24.3%
3	38	21%
2	18	9.9%
1	9	5%
Missing	9	5%

3.7791	1.19845	172

Q12: Coming to math class is important; I can ask questions if I get confused.

4.4569	0.87326	174

Scale	Frequency	Percent
5	112	61.9%
4	38	21%
3	18	9.4%
2	3	1.7%
1	3	1.7%
Missing	7	3.9%

Q13: Getting good grades and passing math classes, relates to how much money I can make later in life. — 3.6667 | 1.27418 | 171

Scale	Frequency	Percent
5	58	32%
4	44	24.3%
3	38	21%
2	16	8.8%
1	15	8.3%
Missing	10	5.5%

Q14: I am confident I that I can learn math skills that are job related. — 4.1098 | 1.01418 | 173

Scale	Frequency	Percent
5	81	44.8%
4	44	24.3%
3	38	21%
2	6	3.3%
1	4	2.2%
Missing	8	4.4%

Q27: The percent correct on a test is a good measure of math ability. — 3.9077 | 1.05200 | 168

Scale	Frequency	Percent

5	60	33.2%			
4	54	29.8			
3	38	21			
2	11	6.1			
1	5	2.8%			
Missing	13	7.2%			
Q30: Getting an answer on a calculator isn't really doing math.			3.1156	1.39702	173
Scale	Frequency	Percent			
5	43	23.8%			
4	23	12.7%			
3	45	24.9%			
2	35	19.3%			
1	27	14.9%			
Missing	8	4.4%			
Attitudes Questions			**Mean**	**St. Dev.**	**N**
Q3: Math is easy for me, I am confident I'll do well in math class.			3.0575	1.14656	174
Scale	Frequency	Percent			
5	22	12.2%			
4	34	18.8%			
3	69	38.1%			
2	30	16.6%			
1	19	10.5%			
Missing	7	3.9%			
Q4: I can practice math problems by myself until I understand.			3.2714	1.31821	175
Scale	Frequency	Percent			
5	35	19.3%			

4	51	28.2%			
3	41	22.7%			
2	22	12.2%			
1	26	14.4%			
Missing	6	3.3%			

Q5: If I get a bad grade on a math test, I know I can do better the next time with more practice.			4.1771	1.04911	175
Scale	Frequency	Percent			
5	89	49.2%			
4	48	26.5%			
3	23	12.7%			
2	10	5.5%			
1	5	2.8%			
Missing	6	3.3%			

Q6: I can get a good grade in math, even if I skip class.			1.9195	1.23268	174
Scale	Frequency	Percent			
5	13	7.2%			
4	8	4.4%			
3	23	12.7%			
2	38	21%			
1	92	50.8%			
Missing	7	3.9%			

Q8: I am confident I will eventually be able to do a math problem.			4.2791	0.98706	172
Scale	Frequency	Percent			
5	96	53%			
4	41	22.7%			

3	27	14.9%			
2	3	1.7%			
1	5	2.8%			
Missing	9	5%			
Q15: I am confident I am able to pass the GED math exam.			3.7485	1.30201	171
Scale	Frequency	Percent			
5	66	36.5%			
4	42	23.2%			
3	33	18.2%			
2	14	7.7%			
1	16	8.8%			
Missing	10	5.5%			
Q25: Given permission to use a calculator, I do much better on math tests.			2.3353	1.25882	173
Scale	Frequency	Percent			
5	16	8.8%			
4	13	7.2%			
3	40	22.1%			
2	48	26.5%			
1	56	30.9%			
Missing	8	4.4%			
Q26: I can change my ability to do math by working harder.			4.2659	1.02801	173
Scale	Frequency	Percent			
5	98	54.1%			
4	40	22.1%			
3	23	12.7%			

2	7	3.9%			
1	5	2.8%			
Missing	8	4.4%			
Q28: How fast I can get an answer is a good measure of math ability.			3.6532	1.18908	173
Scale	Frequency	Percent			
5	51	28.2%			
4	50	27.6%			
3	45	24.9%			
2	15	8.3%			
1	12	6.6%			
Missing	8	4.4%			
Q29: The ability to memorize determines how well you do on a math test.			4.0588	1.10783	170
Scale	Frequency	Percent			
5	81	44.8%			
4	41	22.7%			
3	30	16.6%			
2	13	7.2%			
1	5	2.8%			
Missing	11	6.1%			
Anxieties Questions			**Mean**	**St. Dev.**	**N**
Q10: I do NOT get easily distracted while doing math.			2.6608	1.45183	171
Scale	Frequency	Percent			
5	27	14.9%			
4	36	14.4%			
3	33	18.2%			

2	32	17.7%			
1	53	29.3%			
Missing	10	5.5%			
Q16: My elementary school teachers told me I am good at math.			3.2025	1.38403	163
Scale	Frequency	Percent			
5	38	21%			
4	34	18.8%			
3	41	22.7%			
2	23	12.7%			
1	27	14.9%			
Missing	18	9.9%			
Q17: Other students told me I am good at math.			3.2711	4.23893	166
Scale	Frequency	Percent			
5	25	13.8%			
4	29	16%			
3	60	33.1%			
2	20	11%			
1	32	17.7%			
Missing	15	8.3%			
Q18: My parent(s) told me that I am good at math.			3.0184	1.31690	163
Scale	Frequency	Percent			
5	27	14.9%			
4	30	16.6%			

3	56	30.9%			
2	19	10.5%			
1	31	17.1%			
Missing	18	9.9%			
Q19: I can concentrate on math problems for long periods of time.			3.1897	1.39516	174
Scale	Frequency	Percent			
5	40	22.1%			
4	42	24.1%			
3	29	16.7%			
2	37	20.4%			
1	26	14.4%			
Missing	7	3.9%			
Q20: When I do math problems, I get frustrated and angry.			2.9128	1.40528	172
Scale	Frequency	Percent			
5	31	17.1%			
4	31	17.1%			
3	40	22.1%			
2	32	17.7%			
1	38	21%			
Missing	9	5%			
Q21: When I do math problems, I feel stupid.			2.6550	1.58048	171
Scale	Frequency	Percent			
5	36	19.9%			
4	21	11.6%			

3	26	14.4%			
2	24	13.3%			
1	64	35.5%			
Missing	10	5.5%			
Q22: When I do math problems, I feel nervous and don't do well.			3.3534	1.46740	174
Scale	Frequency	Percent			
5	56	41%			
4	32	17.7%			
3	33	18.2%			
2	24	13.3%			
1	29	16%			
Missing	7	3.9%			
Q23: When I am taking a math exam, I forget everything that I have practiced.			3.0632	1.38594	174
Scale	Frequency	Percent			
5	35	19.3%			
4	36	19.9%			
3	39	21.5%			
2	33	18.2%			
1	31	17.1%			
Missing	7	3.9%			
Q24: When I get confused about something in math, I feel tense and have trouble breathing.			3.8663	1.35060	172
Scale	Frequency	Percent			
5	85	47%			

4	26	14.4%
3	28	15.5%
2	19	10.5%
1	14	7.7%
Missing	9	5%

Kolomogorov-Smirnov hypothesis testing of the means and standard deviations determined significance for normal distributions at 95% confidence (p=0.05) for all survey items. Using SPSS v.24 for missing data analysis the Kolmogorov-Smirnov item hypotheses analyses for all items in the survey, the results yielded a significance for each item at $p < 0.001$. Each MSE source construct was then tested using Kolmogorov-Smirnov tests for three variable sources in this survey. The significance for each construct is shown in Table 4.3 at a 95% confidence level ($p<0.05$). The results suggest that beliefs and attitudes are normally distributed MSE sources with at least 95% confidence. Anxieties, however, did not produce a statistically significant result for rejecting the null hypothesis. The anxieties construct, therefore, retains the null hypothesis that anxieties does not have a normal distribution in this sample. One interpretation of this finding is that anxieties mean rating is significantly less than beliefs and attitudes. The anxieties' source had the most (110) missing items. Prisoners chose not to answer 28 anxiety related questions compared to the other two sources. This result was greater than the total combined missing responses for the other two sources in the MSE survey.

Table 4.4

Prisoner MSE Constructs Analysis Totals Chart

Math Self Efficacy (N=141)	**Mean**	**St. Dev.**	**Sig.**

		102.5922	13.59827	0.033

Scale	Total *(cumulative participant responses)*	Percent
5	1653	31%
4	1069	19%
3	1056	19%
2	608	11%
1	777	15%
Missing	285 *(39)*	5%

MSE Constructs (pairwise)	**Mean**	**St. Dev.**	**Sig.**
Anxieties Questions (N=152)	30.6546	6.29207	0.200

Scale	Total *(participant responses)*	Percent
5	400	22%
4	317	17%
3	385	21%
2	263	14.5%
1	345	19.5%
Missing	110 *(28)*	6%

	Mean	**St. Dev.**	**Sig.**

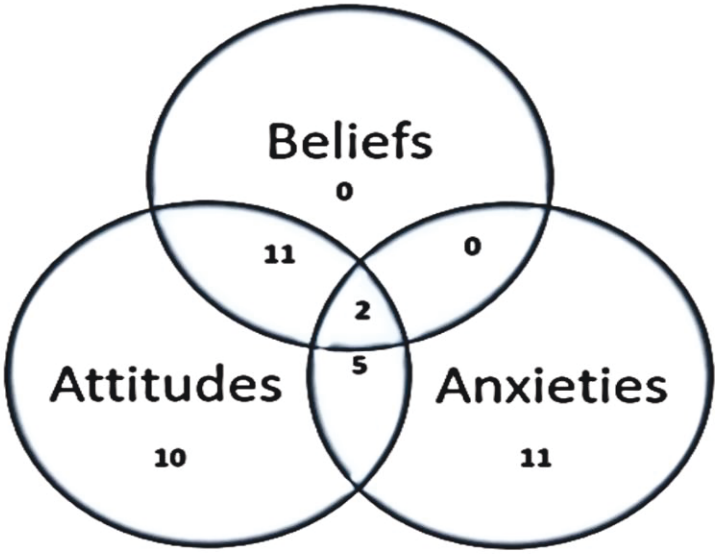
Attitudes Questions (N=157) Scale / Total *(participant responses)* / Percent 5 / 686 / 38% 4 / 384 / 21.5% 3 / 317 / 17.5% 2 / 145 / 8% 1 / 191 / 10.5% Missing / 87 *(23)* / 4.5%	32.745	5.26306	0.041
Beliefs Questions (N=160) Scale / Totals *(participants)* / Percent 5 / 686 / 38% 4 / 384 / 21% 3 / 317 / 17.5% 2 / 145 / 8% 1 / 191 / 10.5% Missing / 88 *(20)* / 5%	39.6188	6.13232	0.026

Normal distribution assumptions for MSE, beliefs, and attitudes provides further evidence that these relationships are collinear and interdependent. The anxieties construct by not attaining a normal distribution for this sample population suggests that prisoner anxieties may have confounding effects on the other variables and perhaps prisoner academic outcomes. Additional tests on the anxieties construct are necessary for determining the possible true distribution of the anxieties' construct and effect it has on one source to the other two sources. The researcher used further missing values analyses with one-way ANOVA to determine the

significance of the differences between the means to explain plausible reasons for the discrepancies within and between anxieties as well as to the other two MSE constructs.

Figure 10 compared the missing prisoner adapted MSE responses by the number of prisoner participants who did not answer each construct item. The results showed that 41 (22.6%) prisoner participants missed items on the adapted MSE survey. Two (5%) prisoner participants missed all items. Two prisoners missed items in all three MSE constructs domains. By further item analysis, these two participants missed 90% of the items on the adapted survey. Ten (25%) prisoner participants who missed items, missed items exclusively within the attitudes construct. Eleven (27.5%) missed items exclusively within the anxieties construct. Eleven (27.5%) prisoner participants chose not to answer both beliefs and attitudes construct items. Five (12.5%) prisoner participants did not answer items in both attitudes and anxieties constructs. Zero prisoner participants missed items exclusively in the beliefs' construct. Zero prisoner participants also missed items between beliefs and anxieties. The participant missing response analysis provides insight on how the constructs interrelate for prisoners who chose not to answer certain types of question items on the adapted MSE. This result provides further evidence of a bias for prisoner participants in this sample who were comfortable or more willing to answer MSE items related to beliefs, but not related or interrelated with anxieties and attitudes. The ANOVA results also indicated that there exists a significant difference between the groups on the frequency of prisoners responding to beliefs $F(9, 131) = 2.13$, $p=0.031 <0.05$ and attitudes $F(9,131) = 1.932$, $p<0.001$ construct questions from prisoners. For the anxieties construct there was not a significant effect $F(9,131) = 3.821$, $p=0.531$ between the means with the other constructs. The one-way ANOVA results indicated that the set of mean differences among beliefs, attitudes, and anxieties had significant differences.

Figure 10. Missing values math self-efficacy construct analysis by prisoners' responses



The results of the missing values analysis suggest that it was highly evident that prisoners were more likely to miss anxieties' construct related questions with significantly greater variability. Therefore, prisoners overall had a lower anxieties' construct score (M=30.64, SD=6.29) and more extreme values than the other two MSE constructs. Figure 10 illustrated the interrelationships among the missing values items between the three source constructs in this study. The beliefs' construct items did not have any significant missing values in relationship with the other two constructs indicating that prisoners were more comfortable answering questions on beliefs about math than items that may have invoked their own math anxieties.

Math Self-Efficacy Prisoner Adapted Test Reliability Analysis

The researcher used a domain sample model for reliability analysis since the researcher derived the adapted MSE adapted from the Math Beliefs Survey (Hendy, et al., 2014). The model conceptualizes reliability as a ratio of the variances of the observed scores to the true

scores. Using correlations, estimated reliabilities of the observed test scores with the true scores are derived (Allen & Yen, 1979). When prisoner participants' MSE true scores are not obtainable, estimated reliability scores become necessary. The item analysis results reveal that 40 participants' (22.2%) missing items were not completely at random, because they were interrelated with prisoners' anxieties. The results suggest that prisoners avoided answering questions related to anxieties and attitudes especially those pertaining to parents, peers, calculators, and past math experiences. Additionally, adapted MSE questions pertaining to prisoners' attitudes and beliefs on the present and future value of doing mathematics obtained higher mean scores from anxieties questions. To show the relationship effects of MSE to the MSE sources, this researcher performed univariate ANOVAs using SPSS separately for each constructed source. The results suggest there are similar and significant effects of beliefs F (26,114) =10.28 and attitudes F (27,113) =10.95 on the overall MSE scores with a significant lesser effect (50%-53%) from anxieties on the overall MSE score F (29,111) =5.211 in comparison.

Higher overall mean scores for beliefs (M=39.62, SD=6.13, N=160) and attitudes (M=32.75, SD=6.29, N=158) constructs have a better fit with the higher overall MSE score and distribution (M=102.5922, SD=13.6, N=141). The result from these pairwise relationships fit a normal distribution pattern with an upward positive progression and illustrated using the means plots for beliefs and attitudes (Figures 11 & 12). The effect of lower mean scores for anxieties (M=30.6546, SD=6.29, N=152) with the possibly non-random missing values has a more sporadic relationship with a normal distribution of MSE scores. This result is evident in the means plots that shows more variance, but still illustrate the potential for a linear relationship to exist for regression analyses (Figures 11 & 12).

Figure 11. Means plot total math self-efficacy to beliefs construct responses

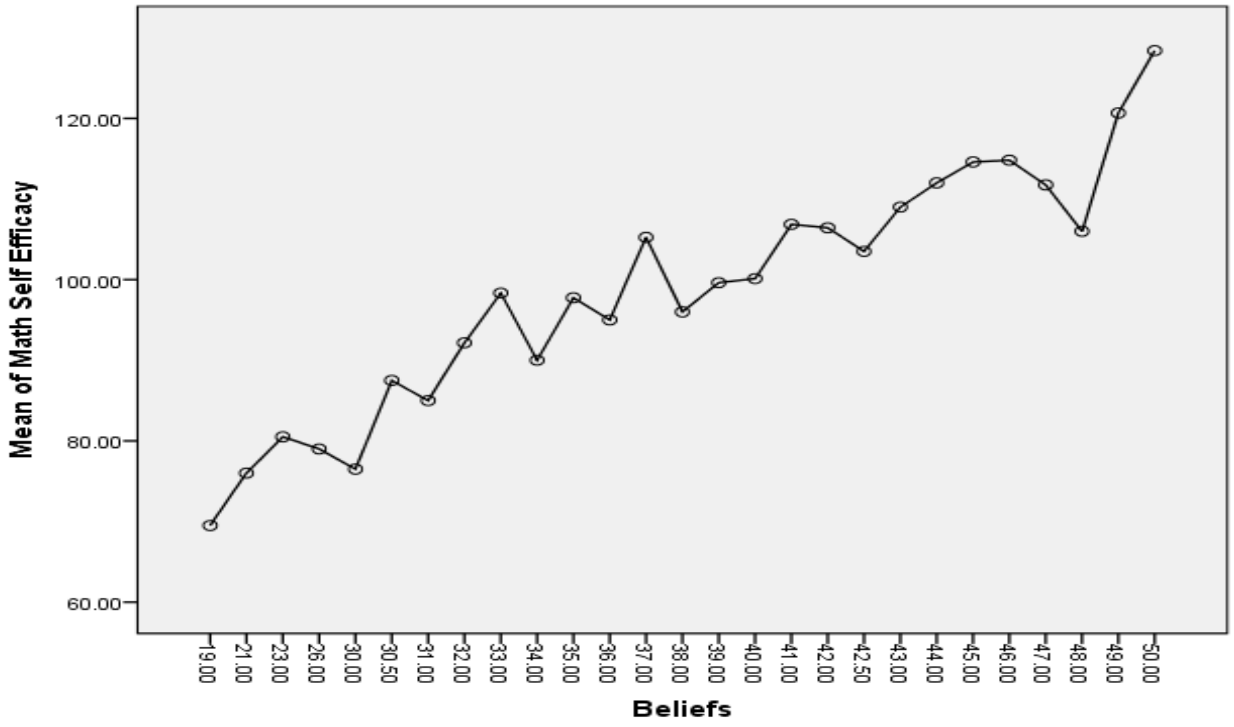


Figure 12: Means plot total math self-efficacy to attitudes construct responses

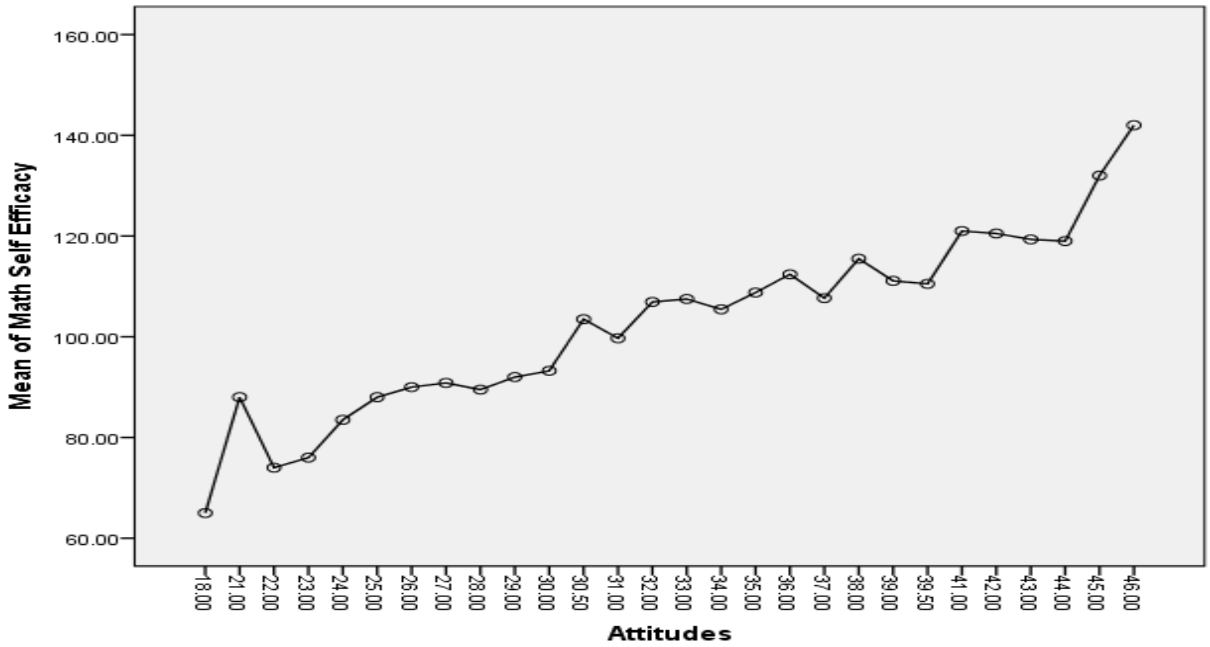
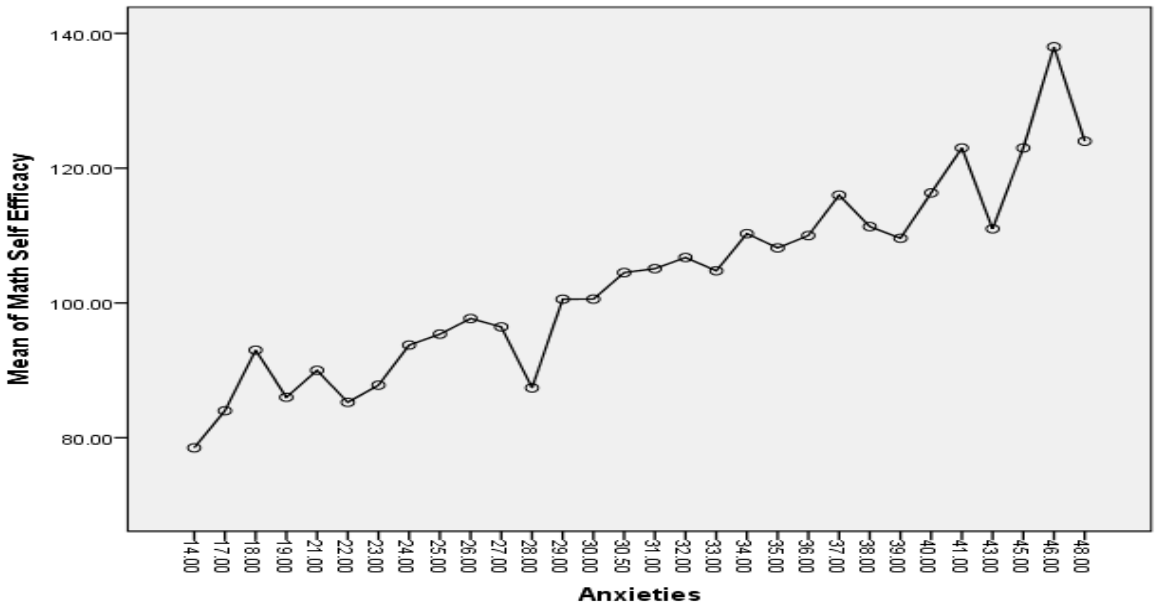


Figure 13: Means plot total math self-efficacy to anxieties construct responses



The MSE construct means plots and ANOVA results indicate a necessity to use listwise comparisons in further analysis of the adapted MSE results for the research sample to reduce bias and assume existence of a collinear relationship. Assumptions, however, that the anxieties construct actually follows a normal distribution are outside of 95% confidence (p=0.53), but seem necessary, practical, and important enough to further examine the relationships between the constructs with other academic performance indicators.

Only complete MSE surveys (listwise) comparisons met the assumptions for correlational significance testing and linear regression analyses since incomplete surveys produced inaccurate MSE composite scores to correlate with constructs and academic outcomes. The reliabilities of the adapted MSE constructs and test items provide evidence for comparisons, validity, and generalizations using a normal distribution for further analyses given the reliabilities of the MSE construct items.

Each construct of the adapted MSE tested positive for internal consistencies using Cronbach's alpha. The calculated Cronbach's alpha for anxieties, beliefs, and attitudes were

0.701, 0.751, and 0.700 respectively. All items produced strong internal reliabilities using the item's means comparisons from Cronbach's alpha to the adapted MSE survey for inter-item correlations. The standardized item Cronbach's alphas examined correlations among items given the assumptions that the variances are equal. Table 4.5 shows that the means, variances, and standard deviations were close in magnitude from the sample population to suggest the true variance and means are likely equal and normally distributed.

Table 4.5

Prisoner Math Self-Efficacy Adapted Survey Reliability Chart

*Indicates p<.05

Prisoner MSE Adapted Survey	***Item Means (VAR)***	***Scale Mean (SD)***	***Cronbach's Alpha***	***Cronbach's Alpha Standardized Items***
Anxieties	66.617 (2588.427)	133.2340 (18.5775)	0.701*	0.831*
Inter-item correlations	0.711*			
Beliefs	70.9344 (2004.433)	141.8688 (18.9351)	0.751*	0.885*
Inter-item correlations	0.794*			
Attitudes	67.633 (2444.294)	135.266 (18.057)	0.700*	0.893*
Inter-item correlations	0.807*			

Table 4.6 provides an analysis of the differences of internal reliabilities using pairwise deletions for MSE anxiety and encouraging words items that were adapted and contextualized to

read for the prisoners using positive statements instead of as discouraging words written as negative statements for this MSE survey and study (Hendy, Schorschinky, & Wade, 2014).

Table 4.6

MBS Comparison Analysis of Adapted MSE Missing Item Analysis Chart

<table>
<tr><td>Item Analysis and Reliability Measures to Hendy, Schorschinky, & Wade's (2014) Math Belief's Survey.</td><td>Mean</td><td>Standard Deviation</td><td>Cronbach's alpha</td><td>Cronbach's Alpha for MSE Beliefs Survey 2014</td></tr>
<tr><td>Anxiety/
N=161</td><td>2.9831</td><td>4.02085</td><td>0.91</td><td>.91</td></tr>
<tr><td>Encouraging Words/Discouraging Words
N= 158
Q16: My elementary school teachers told me I am good at math.
Q17: Other students told me I am good at math.
Q18: My parent(s) told me that I am good at math.
<table><tr><td>Scale</td><td>Frequency Q1+Q2+Q3</td><td>Percent</td></tr><tr><td>5</td><td>27+25+27=79</td><td>14.3%</td></tr></table></td><td>9.1646</td><td>3.59735</td><td>0.87</td><td>0.87</td></tr>
</table>

4	36+29+30=95	17.2%				
3	33+60+56=149	27%				
2	32+20+19=71	12.8%				
1	53+32+31=116	21%				
Missing	10+15+18=43	7.8%				

Table 4.6 shows that prisoners in this study had on average normal anxiety MSE scores (M=2.98, SD=4.02), but significantly lower encouraging words scores (M=9.16, SD=3.6) with three prisoners who chose not to respond to these questions. A significant percentage (68.5%) of prisoner participants disagreed or were neutral in regards to encouraging words questions on the survey. Comparison internal reliabilities of this survey with the MSE Belief's survey produced by factor analysis (Hendy, Schorschinky, & Wade, 2014) suggested no difference between anxieties internal reliabilities, even though the three Discouraging Word's questions were revised in the positive as Encouraging Word's questions. The combined anxieties' construct with discouraging words as encouraging words with anxiety meet this study's purpose with strong internal reliability and external validity with Hendy, Schorschinky, and Wade's MSE survey results in 2014. Strong internal inter-item correlations as shown in Table 4.5 along with external comparisons of internal reliabilities for all construct items provides strong validity measures for this survey given to this particular prisoner population's normal distribution of MSE latent variables in the results.

Summary

The results of the missing values and item analyses along with tests for internal consistencies for prisoner MSE on the adapted MSE survey were good enough and close enough

(between 0.711-0.807. $p<0.05$) to assume internal consistency and equivalency between and within the study's adapted MSE constructed items. Kolmogorov-Smirnov analyses provided strong evidence ($p<0.01$) that the distribution of items and overall MSE total scores are normally distributed ($p<0.05$) and have equal probabilities. The sources of beliefs and attitudes also suggested at 95% confidence on a normal distribution by the one sample Kolmogorov-Smirnov test and ANOVA results. The anxieties construct, however, had more sporadic missing item responses, a significantly lower means, and confounding interrelationships with attitudes and beliefs constructs which resulted in less than 95% confidence for a normal distribution assumption. An excellent internal consistency exists among the three MSE constructs assuming standardization of test items (0.831-0.893). For this study's purposes, such assumptions are necessary for answering the third and fourth research questions null hypotheses that state, "No difference exists among MSE source constructs" which relate to variance equivalency. The item and variance analyses provide further evidence that a significant number of missing values directly and indirectly relate to prisoner anxieties not completely randomly missed and significantly skewed in the MSE results in this study's sample population.

To include and/or impute missing responses in further correlational and regression analyses would not be practical or necessary for this study's purpose in answering the research questions. From the item analyses, means plots, and one-sample Kolmogorov-Smirnov analyses the assumptions that the true adapted MSE test scores follow a normal distribution pattern and meet the assumptions for linear regression are feasible. The non-randomization of missing values is problematic for further analyses and generalizations. Discussion of the missing values implications in the results and for further study is in Chapter V. Even though the adapted MSE survey items and the three adapted MSE constructs have statistical significance issues with

normality assumptions for one construct, the adapted MSE does appear to have similar variances, linear residuals, and meets heteroscedasticity using listwise comparisons to meet linear regression assumptions and for determining hierarchical correlations. An assumption was determined that anxieties' construct items distributed normally. This provided practical and important evidence for answering this study's four research questions. One-way ANOVA results indicated a significantly lesser effect that anxieties has on MSE along with the means plots analyses that indicate a linear progression. The variation in the normal distribution for anxieties in this prisoner sample seems likely attributable to missing values and extremes resulted from having strong internal reliability measures. Notice that extremes existed both high and low for anxieties. MSE beliefs and attitudes had only low extremes, which explains the differences in variance between anxieties to these two independent constructs.

There were significantly higher percent differences (3%-4%) of missing items for anxieties' construct questions to beliefs and attitudes. The results of the means plots analyses only indicated that one of the means did not belong to the group. Anxieties, however, seems to have spillover effects into the other constructs as shown in Figure 4.2. Only complete adapted MSE survey results were used (n=141) to avoid further complications when using linear regression and not removing the extremes (outliers) from the survey's data. For practical research purposes and determination of the extent of the relationship of MSE and all three MSE constructs, the assumption that anxieties' construct responses actually are normally distributed becomes necessary for further inquiry in answering each research question. It is also not too far of a theoretical stretch that prisoner populations do not produce a normal distribution for anxiety related responses, because anxieties may run higher in prisoner populations to a general population of low achieving students. Prisoner increased anxieties from a normal population

could be the result of living and learning within a prison institutional setting as well as from their own inherent qualities. Regardless, the results suggest of this missing data analysis suggest prisoners in this sample were more likely to not respond to anxiety related questions on the survey (M=30.65, SD=6.29) from the other two MSE construct items as shown in Table 4.6.

Table 4.7

Missing Data Construct Items Analysis Chart

Univariate Statistics							
	N	Mean	Std. Deviation	Missing		No. of Extremes[a]	
				Count	Percent	Low	High
Attitudes	158	32.7405	5.26306	23	12.7	1	0
Beliefs	160	39.6188	6.13232	21	11.6	5	0
Anxieties	152	30.6546	6.29207	29	16.0	2	3
a. Number of cases outside the range (Q1 - 1.5*IQR, Q3 + 1.5*IQR).							

Research Question 1

Research Question #1 asks, to what extent do all three of the math self-efficacy sources (attitudes, beliefs, and anxieties) correlate with adult male prisoners' current mathematics achievement scores? To what extent, therefore, did low or high mathematics academic achievement correlate to current low or high MSE composite scores was the hypothesis statement.

The null hypothesis for research question one stated that current mathematics achievement would have no correlation with MSE scores. TABE® Survey Math combined scores of achievement were tabulated along with the test of TABE® Complete Math combined scores for one-sample correlation analysis using SPSS. Mathematics achievement measurements used for the prisoners' dropout grade for cross-tabulations with prior math achievement scores.

The researcher cross-validated prisoner test data by accessing the public WI DOC database and WI DOC Educational Records database for 141 listwise means comparisons as shown in Table 4.6. The TABE® math combined assessment measures ABE goal obtainment and progress in mathematics combining the two scale score averages from 235 to 795 for the 25 questions in applied math and 25 questions in math computation. WI DOC staff administered the TABE® Survey in math to prisoners at intake prior to having received any ABE instruction. After at least 40 hours of ABE instruction occurs, prisoners are then administered the TABE® Complete Battery math post-test to measure growth. TABE® Complete Battery Combined Math scores used for this study came after prisoner participants submitted the MSE adapted survey. The MSE measures correlate with MSE and all three MSE construct sources using bivariate analysis. The prisoner participant's initial and post-test TABE® results determine the extent of relationships to MSE to prisoner academic outcomes in the 141 complete prisoner MSE surveys without imputing missing items. One-way bivariate analysis using SPSS V.24 for the dependent variables of MSE were calculated and produced a means plot shown in Figure 4.5.

When controlling for each participant's MSE, the statistics in Table 4.6 show a significant difference using one sample T-Tests for MSE disaggregated by ABE NRS functioning level scale scores for; Levels 1 & 2 (Beginning ABE Literacy), Level 3 & 4 (Low and High Intermediate ABE), and Levels 5 & 6 (Low and High Adult Secondary Education) in mathematics. The means comparisons and plots for MSE with the Math survey test provided further evidence that a relationship exists between these two factors. Statistical analyses of the means examined the extent of this relationship between MSE scores with the TABE® intake survey results to attempt to answer the first research question. Using different distribution levels rather than the NRS levels may have produced different results. The NRS levels, however, were

used to be consistent with the practice of ABE programming and federal reporting. NRS functioning levels provided comparison results with student TABE® scores to grade levels.

Analysis Summary: Research Question 1

The results suggest there are weak, but significant differences between TABE® Math intake survey results and prisoners' MSE scores t (1, 39) = 1.145, p<0.001. On average prisoners who scored better on the TABE® Math survey exam had higher MSE scores. The means plot analysis shows that slight upward linear progression in Figure 4.5. The effect sizes of the differences, as measured by Hedge's *g,* suggest that the most significant effect of MSE on prisoners' TABE® Math intake survey scores were at the Adult Secondary Education levels (ASE) and got less significant for the lower ABE prisoner NRS levels of Beginning and Intermediate. Table 4.6, however, also suggests there is not a reliable difference between MSE and prisoner NRS ABE levels because the 95% confidence levels overlap.

Figure 14. Means comparison between math self-efficacy and math intake pre-test scores

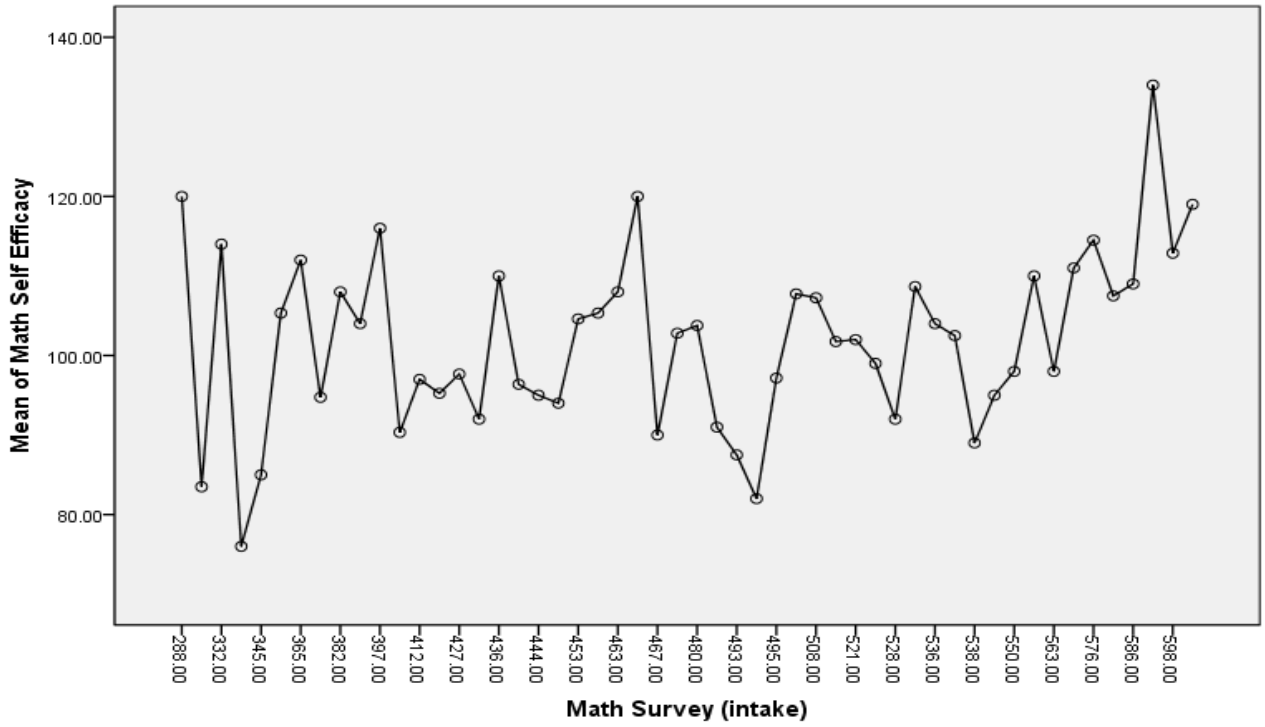


Table 4.8

Research Question 1 Differences between Prisoners MSE and TABE® Intake TABE® Math Survey Combined Scores

Math TABE® Survey (scale score NRS ranges)	MSE *M (SD)*	*95% CI*	*Std. E*	*t*	*N*	*Hedge's G*
Overall (295-795)	102.59 *(13.6)*	(100, 105)	5.895	1.145***	141	
ASE (566-795)	112.24 *(15.0)*	(105, 119)	3.280	34.22***	21	0.70
Intermediate (442-565)	101.86 *(12.1)*	(99, 104)	1.315	77.46***	85	0.56
Beginning (295-441)	98.57 *(13.8)*	(94 .103)	2.330	42.32***	35	0.29

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

To answer the first research question, low math achievement had a weak but statistically significant effect with prisoners at the beginning levels in ABE having a lower MSE (g=0.26). The relationship's effect gets stronger with prisoners' math achievement from a moderate effect for intermediate leveled prisoners (g=0.56) to a larger effect on prisoners at the ASE levels (g=0.7). It is unnecessary, however, to categorize prisoners by NRS levels for further analyses of this overall weak relationship between MSE and prisoners' achievement since the NRS levels are arbitrary and statistically insignificant constructs since the 95% confidence intervals overlap. Overall, however, a positive correlation existed between high MSE and high math achievement on the TABE® Math survey exam for the 141 prisoners who completed the MSE survey F (9, 131) = 3.821, p<.001 by ANOVA. Further ANOVA results suggest that attitudes within MSE groups actually had the most significant main effect of MSE on TABE® Math survey scores F (9, 131) = 3.835, p<.001. Second and third were beliefs F (9, 131) = 2.130, p=0.31<0.05 and anxieties F (9, 131) = 3.821, p=.053 with less and not significant results at the same confidence

levels respectively to attitudes. Prisoners' intake TABE® Math survey results from this sample population more likely were indicative of MSE attitudes towards math (M=32.74, SD=5.26), having the least variability on a normal distribution regardless of NRS levels in listwise comparisons. These results for question one indicates to reject the null hypothesis since prisoner MSE composite scores correlates with low math achievement.

Research Question 2

Research Question #2 asks, to what extent do all three of the math self-efficacy sources (attitudes, beliefs, and anxieties) correlate with adult male prisoners' prior mathematics achievement scores? To what extent did low prior math achievement correlate to low MSE composite scaled construct scores as well as high prior math scores to high MSE scores? The null hypothesis for research question #2 stated that prior mathematics achievement has no correlation with math self-efficacy scores.

Correlation tests examined associations between the dependent variables of exit grade level, MSE, and the three MSE constructs to the TABE® pre-test scores at intake.

Table 4.9

Research Question 2: Correlations between Prisoners' MSE and TABE Pre & Post Test Scores using Listwise Data

N=141	*Mean*	*Std. Dev.*	*R1*	*Sig.*	*R2*	*Sig.*
MSE	102.59	13.60	0.230**	.006	0.148	.08
Anxieties	30.64	6.26	0.197*	.019	.191*	.023
Attitudes	32.28	5.20	0.130	.125	.037	.666
Beliefs	39.28	6.24	0.196*	.020	.100	.236
Exited	8.55	1.98	0.586**	.000	1.00	---

R1 =TABE® Survey Pearson Correlation R2=Exited School Pearson Correlation * $p < .05$, ** $p < .01$, *** $p < .001$ (2-Tailed)

Math TABE® Survey scores were categorized with reported exit scores from public education on the adapted MSE survey. The MSE categories of anxieties, attitudes & beliefs scores relationship to Math Achievement was measured using the TABE® Survey at intake scores with exit levels calculated using SPSS V. 24. Pearson Correlations were calculated using listwise comparisons for the entire sample population's responses for each MSE construct even though listwise comparisons added some bias for prisoner respondents who missed construct items. The results of the analysis suggest the correlation between exiting school and intake math achievement is positive and moderate ($r=.586$, $N=141$, $p<001$).

T-tests results suggest there are significant differences between attitudes', beliefs', and anxieties' constructs and MSE. Beliefs and MSE had significant differences with $t(1,140) = 27.5$, $p<0.01$ along with attitudes $t(1,140) = 19.1$, $p<.05$, but anxieties $t(1, 410) = 11.3$, $p = 0.53$ respectively had no significant difference. On average, higher or lower beliefs ($M=39.62$, $SD = 6.13$) construct scores, resulted in significantly higher or lower MSE and TABE® scores than attitudes ($M=32.74$, $SD=5.26$) and anxieties ($M=30.65$, $SD=6.29$).

ANOVA tests of the differences between grade level means of math achievement on the TABE® survey by prisoners' last grade exited from school were calculated. A moderate correlation existed and determined the extent of the strength of the associations between these variables to include a standard error coefficient to account for other possible correlations. The results in Table 4.10 indicated that dropout grade level was not as significant of variable or delineation by up to grade 11 since the confidence intervals by grade level overlapped, except for grade 12. A different result could have occurred using less grade level categorizations. Nevertheless, the results suggested that prisoners who exited school in Grade 12 more likely performed better on the TABE® survey intake exam. The eight prisoners who exited school in

grades three and five also had significant performance results compared to prisoners who exited in later grades. This outlier is attributable to the few number and much older ages of prisoners whom exited school at the elementary levels compared with the majority of prisoners who exited school at the middle and high school grades. The results further suggested there is a significant main effect of MSE on TABE® survey exam scores F (1,139) = 7.593, p<.01. The results of Pearson Correlation analyses suggests a positive and moderate relationship exists between exiting school and TABE® survey exam scores (r=.586, n=141, p<0.001), but weak correlations exist between TABE® survey exam scores and MSE (r=.148, n=141, p=0.040). The strongest Pearson correlation occurred between intake TABE® pre-test exam scores with beliefs (r=.205, n=141, p<.01), then anxieties (r=.165, p<.05) and attitudes (r=.150, p<0.1) followed as being weaker correlations.

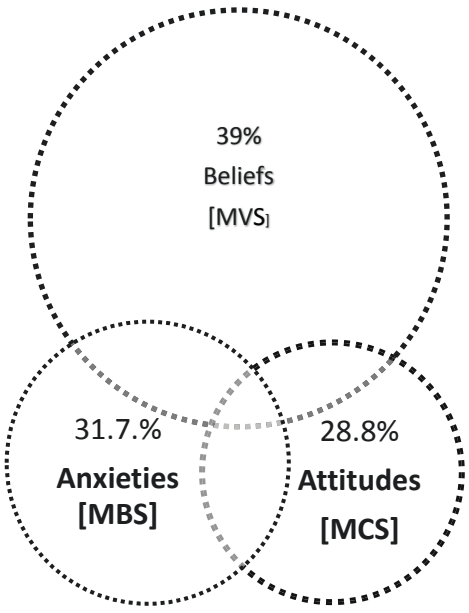
Table 4.10

Research Question 2: TABE® Survey Pre-Test Results by Exited School Years

Math TABE® Survey (Exited School)	TABE® Survey *M (SD)*	*95% CI*	*Std. E*	*N*
3rd grade	416.5 *(27.577)*	(200, 664)	19.5	2
4th grade	108			1
5th grade	389.1 *(60.284)*	(339, 440)	21.3	8
6th grade	429 *(56.37)*	(89, 107)	13.67	17
7th grade	433.55 *(70.635)*	(88, 111)	23.54	9
8th grade	458.79 *(51.696)*	(94, 109)	10.55	24
9th grade	484.08 *(48.752)*	(91, 105)	9.56	26
10th grade	531.94 *(40.402)*	(99, 111)	6.83	35
11th grade	535.84 *(78.061)*	(91, 111)	21.65	13
12th grade	591 *(17.717)*	(113, 142)	7.233	6
TOTALS	*484.7 (71.83)*	*(473, 497)*	*6.049*	*141*

A prisoner's intake TABE® Math survey results from this sample population more likely correlated to MSE beliefs towards math (M=32.74, SD=5.26), having the least variability from the results regardless of NRS levels in listwise comparisons. The results of both the t-test and ANOVA analyses suggest statistically significant weak correlations between prisoner MSE constructs and intake TABE® survey scores. Attitudes (r=0.150, n=141, p=0.038), anxieties (r=0.165, n=141, p=0.025), and beliefs (r=0.205, n=141, p=0.007) also had weak positive correlations with prisoner math achievement, with the belief's construct as the strongest indicator out of the three MSE constructs of math achievement. Figure 4.6 shows the percent of the MSE constructs to the effect on the TABE Pretest results. The results indicate that the null hypothesis can be rejected that stated, no one MSE construct had more significance than another construct on prisoner MSE, since beliefs had a significant effect on TABE® survey intake scores by several percentage points at a 95% confidence level from the other two MSE constructs.

Figure 15. Quantitative math self-efficacy comparison analysis diagram for TABE® pre-tests



Research Question 3

Research question 3 asks, which source of mathematics self-efficacy has the most significant effect on adult male prisoners' mathematics achievement? The research hypothesis for question three suggested that one source of MSE will have a significantly higher effect on adult male prisoners' mathematics achievement than the other sources. The null hypothesis states that no math self-efficacy source will have a more significant effect on current adult male prisoners' mathematics achievement scores than the other two. The results for question 3, however, suggested otherwise.

This researcher first conducted regression analysis for MSE as shown in Table 4.11 with means plots analyses using SPSS v.24 to determine normal distribution assumptions and identification if any patterns for each MSE construct existed as shown in Figures 12, 13, and 14. The overall for the first model predicting prisoners' MSE was statistically significant, $F(1,140) = 81.709$, $P<0.01$ and the model explains 5.2% of the variance in the Math TABE® intake survey scores with a positive upward slope.

Table 4.11

Research Question 3: Regression Pairwise Pre-Test Score Correlations to Math Self-Efficacy

Pairwise Correlations for MSE					MSE
Predictor	B	SE	β	Sig.	95% Confidence interval for B
(Constant)	81.709	.7.661		0.000	
TABE® Survey	.043	.016	.228	0.007	(.012, .074)
R^2					5.2%

**Dependent variable: Math Self-Efficacy*

The means plot analysis for MSE sources controlled for the grade level prisoners reported exiting school. Prisoners' beliefs (Figure 11), attitudes (Figure 12), beliefs, and anxieties (Figure

13) had mean MSE sub-scores calculated using SPSS v.24. The results of the means analysis confirmed that there exists a normal distribution for MSE source scores with the most extremes evident in the anxieties' construct compared to the other MSE constructs. Means plot comparisons are most consistent and relevant for grade 12 for all MSE constructs consistent with the grade level 95% confidence levels overlapping in the other grade levels 3-11. Prisoners exiting school in the twelfth grade were the only significant finding in the results with a positive correlation to MSE. Positive collections existed with prisoners whom dropped out of school in grade twelve with MSE construct sub-scores with anxieties, beliefs, and attitudes as well that did not overlap confidence intervals.

Figure 16. Means plot of anxieties' source to exited school

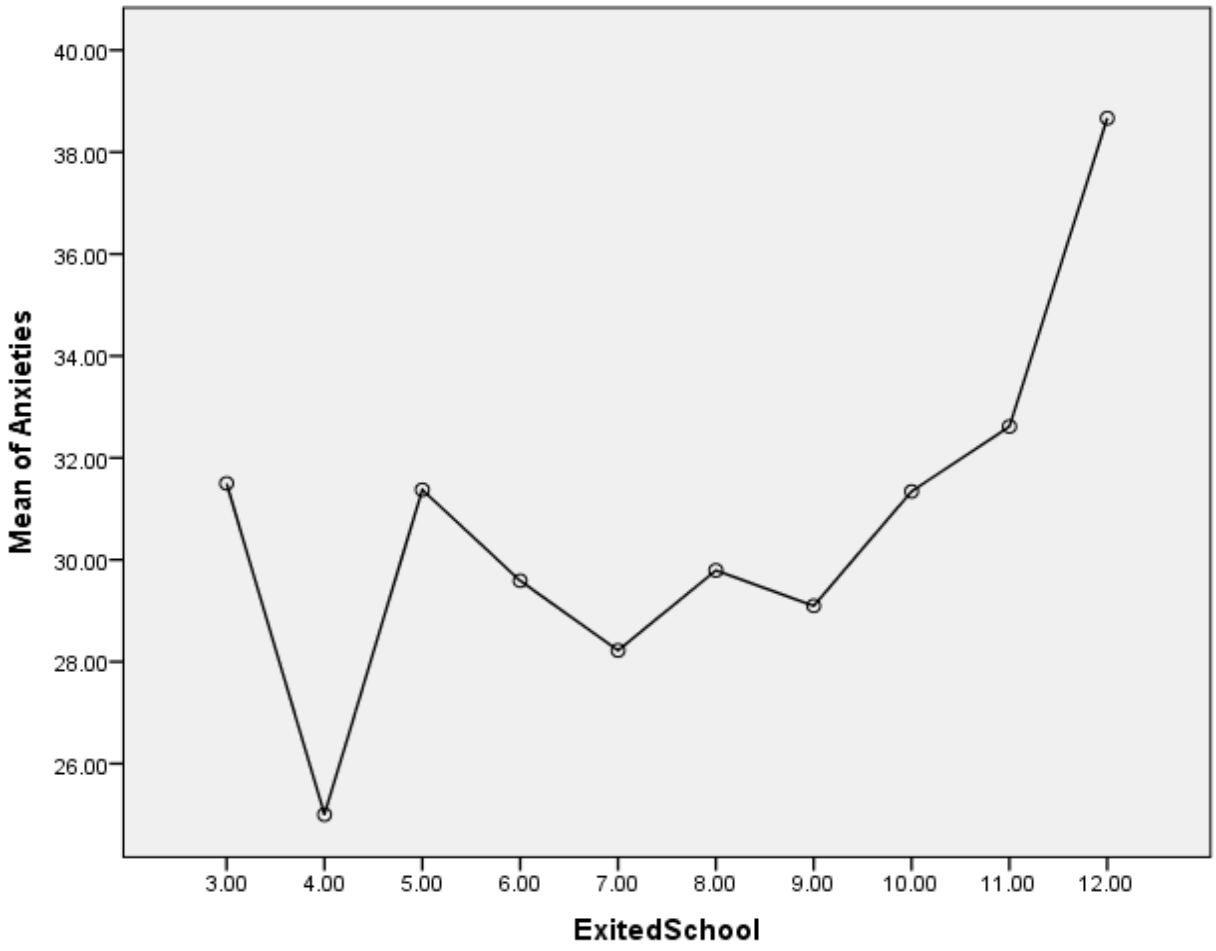


Figure 17. Means plot attitudes' source to exited school

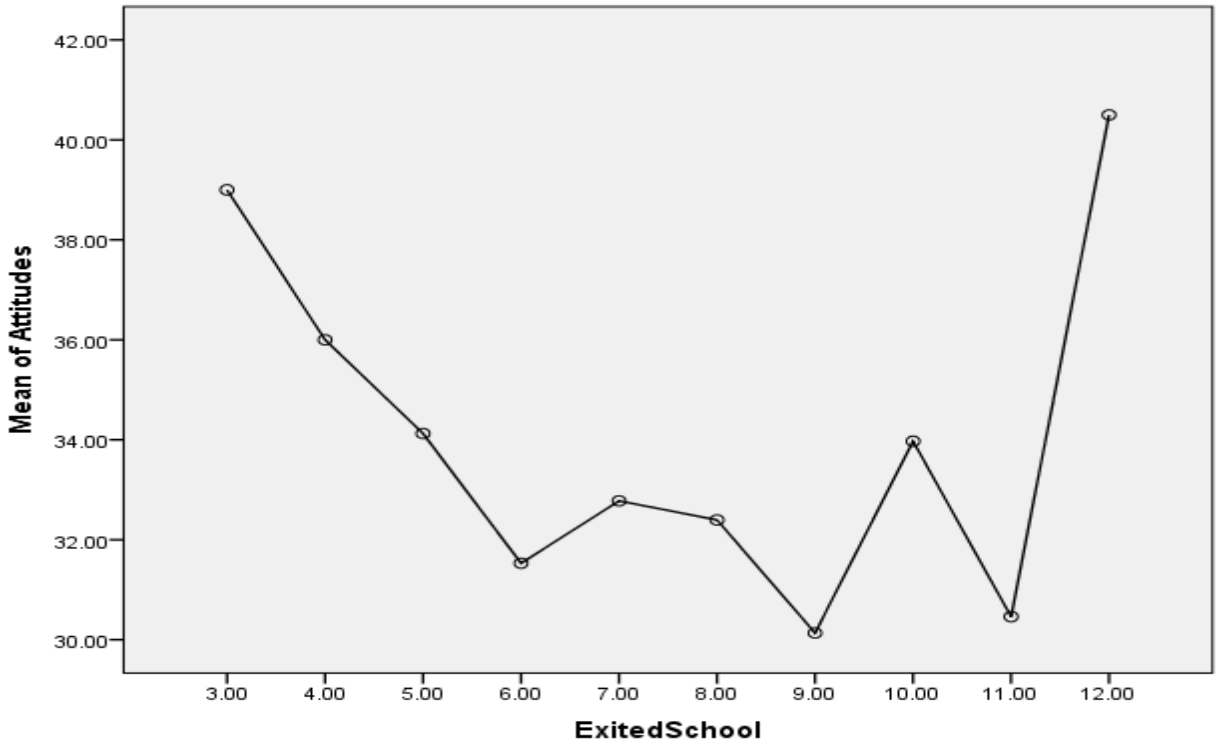
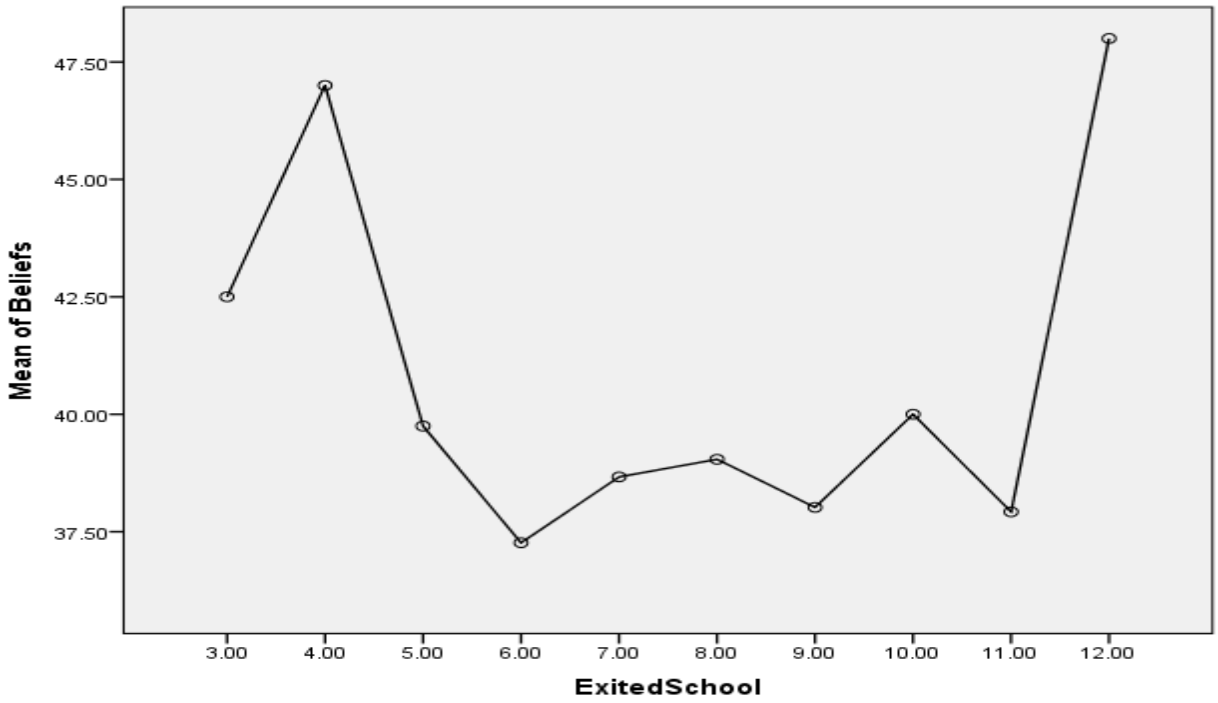


Figure 18. Means plot beliefs' source to exited school



To attempt to answer question 3, pairwise statistics were used to reduce biases favoring attitudes and anxieties as evident in the grade level means plots and prior missing values analyses for regression analyses. SPSS v.24 for linear regression analysis allowed for specification of multiple models for a single regression command given regression's assumptions. Regression analysis provided evidence to understand which among the independent MSE construct variables related best with each of the dependent variables, and explored the extent of these relationships in order to answer the research question using hypothesis testing. Tables 4.11, 4.12, 4.13, and 4.14 provided the regression results for each MSE construct at 95% confidence intervals for determination of rejecting or retaining the null hypotheses depending on whether or not a zero slope of the regression line is likely. A zero slope of the regression line would indicate that no relationship exists between the variables. The regression line having positive or negative slope indicates a direct or indirect relationship between MSE and academic math achievement in relationship to the dependent variable.

Table 4.12

Research Question 3: Regression Model Pairwise Analyses for Attitudes (n = 158)

						Attitudes
				t		95% Confidence Interval for B
Predictor	B	SE	β		Sig.	
(Constant)	26.889	3.184		8.445	.000	(20.599, 33,178)
TABE® Survey	0.022	.011	.294	1.889	.061	(-.001, .044)
TABE® Post-Test	-0.004	.012	-.049	-.315	.753	(-.027, .020)
Exited School	-0.321	.282	-.120	-1.137	.257	(-.878, .237)
R^2						4.1%

**Dependent Variable: Attitudes*

Table 4.13

Research Question 3: Regression Model Pairwise Analyses for Anxieties

Regression Model Predicting Math Outcomes by Anxieties (n = 152)						Anxieties
				t		95% Confidence Interval for B
Predictor	B	SE	β		Sig.	
(Constant)	24.561	3.93		6.249	.000	(16.794, 32,328)
TABE® Survey	0.017	.014	.192	1.184	.238	(-.11, .046)
TABE® Post-Test	-0.013	.015	-.145	-.891	.374	(-.043, .016)
Exited School	0.560	.351	.174	1.596	.113	(-.133, 1.253)
R^2						5.1%

**Dependent Variable: Anxieties*

Table 4.14

Research Question 3: Regression Model Pairwise Analyses for Beliefs

Regression Model Predicting Math Outcomes by Beliefs (n = 160)						Beliefs
				t		95% Confidence Interval for B
Predictor	B	SE	β		Sig.	
(Constant)	34.845	3.699		9.419	.000	(27.538, 42,153)
TABE® Survey	0.035	.013	.403	2.606	.010	(.008, .061)
TABE® Post-Test	-0.020	.014	-.231	-1.480	.141	(-.048, .007)
Exited School	-0.182	.331	-.058	-0.549	.584	(-.835, .472)
R^2						4.7%

**Dependent Variable: Beliefs*

Tables 4.12, 4.13, and 4.14 revealed that the TABE® survey pretest scores were the only statistically significant predictor for MSE. Using regression analyses, Table 4.14 showed that

the beliefs' construct items were the only statistically significant regression result of all three MSE constructs using pairwise deletions. Even though the coefficient of determination is 0.047 indicating that only 4.7% of the variation in TABE® survey pretest results attributed best with beliefs, since there exists enough evidence to conclude that the slope of the regression line for beliefs is positive. Pairwise deletions included missing data for each construct to maximize data and treat each MSE construct as a separate test. Pairwise deletions helped to reduce bias among all three MSE variable constructs that occurred in listwise deletions when combining adapted MSE scores as attempted to answer research questions one and two. For answering research question three, items assumed to be missing are completely at random for linear regression analyses, but from the regression analyses problems persisted with collinearity suspected from the previous missing items analysis and in the statistics for anxieties and attitudes in the confidence intervals.

To answer research question three, therefore, required controlling for each MSE construct as a separate survey to attempt to produce a regression line for the predictors of the TABE® pre-test, TABE® post-test, and dropout school grade levels to determine overall effect. Pearson's Correlation Coefficient calculations for two-tailed analyses using pairwise deletions in SPSS v.24, indicated the TABE® survey resulted in statistically significant and equivocal pairwise comparisons with beliefs (r=.196, n=160, p=.020) and anxieties (r=.197, n=152, p=.019) as predictors for prisoners compared to attitudes (r=.158, n=, p=.125). The Pearson correlational analysis reported a weak, but statistically significant correlation between prisoner anxieties as reported in exiting school grade level (r=.201, p=0.014) that did not exist for the beliefs' (r=.051, p=0.520) nor attitudes' constructs (r=0.035, p=.662). Prisoners with higher anxieties' scores more likely dropout of school at earlier grade levels as validated in the means plot analysis

(figure 4.10). Anxieties' construct scores had the greatest proportion of variance of the three constructs in the model ($R^2 = 5.1\%$), but did not produce a positive regression line with 95% confidence (Table 4.9).

This result, therefore, does not necessarily suggest lower math and/or academic performance in lower anxiety prisoners or visa-versa. The correlation between anxieties and exited school grade levels indicates that prisoners with higher anxieties' scores were more likely to exit school (dropout) sooner, even though the results indicate that they performed no better nor worse on the TABE® tests while in prison from prisoners whom dropped out of school up to the eleventh grade. A moderate Pearson correlation existed between dropout grade levels and math intake survey scores ($r=0.638$, $p<.001$, $n=150$), which was influenced heavily by the prisoners who dropped out of school in twelfth grade whom performed significantly better. The two correlations together, therefore, may suggest that the prisoners with low anxieties' scores were likely to exit or dropout of school later and score better on math tests while in prison. The possibility exists, however, with less than 95% confidence that no correlation exists between anxieties and TABE® survey and post-test math test performance having both negative lower and positive upper bounds.

The attitudes and anxieties constructs also have possible correlational statistical biases because their missing items do not appear to be completely at random. Those prisoners who exited school later with lower anxieties' scores were also more likely to score higher on the TABE® intake survey, but not the TABE® complete. Unfortunately, most missing items on the adapted MSE were in the anxieties' construct. The difference between anxieties and beliefs missing values was ten respondents (6%). From the ten missed respondents for anxieties, missing values discrepancies already were observed as likely to be interdependent with attitudes'

construct items. This likeliness, therefore, extends into problems with independent observations, multicollinearity between constructs, and biases favoring anxieties and attitudes having missing values that result in more favorable, positive correlations from within the population sample in the results.

The regression pairwise results help reduce, but do not eliminate these biases favoring attitudes and anxieties having shared missing items. The confidence intervals displayed in Table 4.12 and Table 4.13 indicate attitudes and anxieties do not have at 95% confidence a positive or negative relationship, because they have lower negative bound and upper positive bound values for all three predictors. Anxieties' construct scores, for instance, had the greatest proportion of variance for the three predictors ($R^2 = 5.1\%$), but did not produce a positive regression line with 95% confidence (Table 4.13). The beliefs construct was statistically significant and the least biased indicator of TABE® Pre-Test survey scores with positive lower and upper bound intervals and 95% confidence that the slope of the regression line is correlated positive and ascends upward. The beliefs' construct tested survey items also had the least number of missing values. These missing values did not appear to inter-correlate or intersect with the other two MSE constructs' missing values in prisoners who responded.

Overall, therefore, beliefs emerged as the one MSE construct that had both a statistically significant positive regression line $R^2 = .047$, $F(3,156) = 2.574$, $p = .01$, and did not violate the assumption on independence of observations or collinearity for missing values. A significant correlation exists between the higher beliefs construct scores and higher TABE® Pre-Test survey scores with a 95% confidence interval for a positive slope and weak correlation from the prisoner sample data. The regression and correlational analyses together suggest beliefs as a better indicator of prisoner current math abilities measured on the TABE® Pre-Test survey exam, even

though beliefs did not have the largest effect or least variation (4.7%) on adult male prisoners' current math achievement in comparison to the other two MSE sources in this prisoner sample. Structural research biases favored attitudes and anxieties as interdependent MSE sources. Anxieties also had a statistically significant Pearson correlation with exited grade level (r=.191, n=152, p=0.023) which did not however prove statistically significant as a predictor of math outcomes. Beliefs had the strongest Pearson correlation to the adapted MSE (r=.794, n=141, p<0.001) when compared to anxieties (r=.711, n=141, p<001), but was slightly weaker than attitudes (r=.807, n=141, p<.001). This listwise result continued to emphasize the belief's construct has the strongest correlation as statistically significant and least biased predictor of MSE, dropout grade level, and academic outcomes on the TABE® survey exam. The results indicate again to reject the null hypothesis and accept the research hypothesis that the belief's construct has a statistically significant effect on prisoners' math achievement.

Research Question 4

Research question 4 asks, which source of mathematics self-efficacy has the most significant effect on overall mathematics achievement for adult male prisoners enrolled in adult basic education? The alternative hypothesis stated that Adult male prisoners' overall mathematics achievement scores would have a significantly stronger correlation to one source of MSE than the other sources. The null hypothesis stated that adult male prisoners' overall mathematics achievement scores while enrolled in adult basic education will not have a significantly stronger effect on math self-efficacy than the other sources. This question took into account the effect of enrollment in ABE on prisoner achievement.

The confidence intervals for the TABE® Complete posttest overlapped at most grades, except for grade 12. The results suggest that there is a significant difference for prisoners who

dropout at twelfth grade in their TABE® Post-Test scores from prisoners who dropped out at the other grade levels. No statistical difference, however, existed for prisoners who dropped out from school to MSE and/or to MSE constructs as is shown in Table 4.15. Whichever source has the most impact on overall academic achievement, therefore, prisoners who dropped out in grade twelve had some significant positive effect on their math achievement results.

Table 4.15

Research Question 4: Results for TABE® Combined Post-Test by Exited Grade

Math TABE® Combined Post-Test (Exited School)	TABE® Post-Test *M (SD)*	*95% CI*	*Std. E*	*N*
3rd grade	416.5 *(27.577)*	(200, 664)	19.5	2
4th grade	108			1
5th grade	389.1 *(60.284)*	(339, 440)	21.3	8
6th grade	428.9 *(56.367)*	(89, 107)	13.67	17
7th grade	433.55 *(70.635)*	(88, 111)	23.54	9
8th grade	458.79 *(51.696)*	(94, 109)	10.55	24
9th grade	484.08 *(48.752)*	(91, 105)	9.56	26
10th grade	531.94 *(40.402)*	(99. 111)	6.83	35
11th grade	535.84 *(78.061)*	(91, 111)	21.65	13
12th grade	591 *(17.717)*	(113, 142)	7.233	6
TOTAL	*484.7 (71.83)*	*(473, 497)*	*6.049*	*141*

The anxieties construct shown in Table 4.16 and Table 4.17 did not attain 95% significance. This may be attributable to the fact that prisoners who dropped out of school

earlier did not respond to more survey items. The missing item results may not have produced enough data since the results suggested that prisoners scored higher in anxieties compared with a normal distribution.

Table 4.16

Hierarchical Linear Regression of Predicting MSE on Academic Achievement

Regression Model Predicting Self-Reported Development in Math Achievement (n = 141)	Math Self-Efficacy			
Predictor	B	SE	β	Sig.
(Constant)	11.893	3.85		
Math TABE® Intake Survey	.043	.016	.228	**
Exited Grade level	-.004	.331	-.008	
Math TABE® Post-Test	-.114	-.096	.459	
Anxieties	1.045	.074	.790	
Attitudes	1.646	.089	.630	*
Beliefs	2.066	.131	.015	*
R^2				5.2%

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

Table 4.17

Regression Correlations of MSE Sources and Academic Achievements

(n = 141)	Academic Outcomes						
Variable	1	2	3	4	5	6	7
1. Math Self Efficacy	1						
2. Attitudes	.807***	1					
3. Beliefs	.794***	.572***	1				
4. Anxieties	.711***	.351***	.253**	1			
5. Exited Grade	.148*	.037	.100	.191*	1		
6. Math TABE® Pre-Test	.228**	.150*	.205**	.165*	.661***	1	
7. Math TABE® Post-Test	.124	.076	.083	.123	.861***	.625**	1

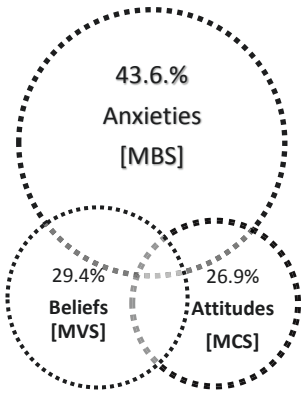
Note. * $p < .05$, ** $p < .01$, *** $p < .001$ *(2-tailed)*

Analysis Summary: Research Question 4

The quantitative results to the fourth research question, "Which source of mathematics self-efficacy has the most significant effect with respect to overall academic achievement for adult male prisoners enrolled in ABE?" compare prisoner MSE to math achievement on the TABE® post-test results using linear regression correlations. Each model does not indicate statistical significance at 95% confidence levels as shown in Table 4.15. This result indicated that MSE and MSE constructs have significant effects on prisoner Math TABE® intake scores, but this effect reduced by a 45.6% total decrease for MSE, 49.3% for attitudes, 59.5% for beliefs, and 25.5% for anxieties after prisoners received at least 40 hours of ABE instruction.

Figure 19 provides a comparative analysis of the percentage of effect each MSE construct had on Math TABE® post-test results regardless of statistical significance using values from Table 4.15 times a factor of three for scale measurement. Math Barriers or Beliefs, unlike the results of the Pre-Test regression analysis shown in Figure 15 had a greater effect on prisoners' math achievement entering into prisoner education programing. Anxieties, however, had the greatest effect on prisoners' achievement results on the TABE® math post-test shown in Table 4.12 compared to the other two MSE source constructs in this study.

Figure 19. Quantitative MSE Comparison Analysis Diagram for TABE® Post-Tests



Overall Regression Analysis Summary

The overall regression of the first model showed prisoners' academic outcomes on the post-test TABE® were not statistically significant, $F(1,139) = 7.593$, $p = 0.086 > 0.05$. The model, however, explains only 5.2% of the variance of MSE's total impact on prisoners' post-test scores ($r=0.124$, $p=0.072$). The first model suggested that prisoners with higher MSE combined scores had the highest post-test TABE® math survey scores after taking the MSE ($\beta = 0.124$). MSE beliefs scores had the highest post-test TABE® math complete scores ($\beta = 0.342$) with attitudes second ($\beta=0.121$) and anxieties third ($\beta=0.097$).

The second, third, and fourth regression models controlled for dropout (exited) grade levels for anxieties, beliefs, and attitudes constructs. The overall regression correlations of the first model predicted prisoners' academic outcomes on the post-test TABE® complete math results using all three MSE constructs as the dependent variables. The results of the second, third, and fourth regression models also found no statistical significance between prisoners and TABE® complete math post-test scores compared to their adapted MSE results, which had insignificant Pearson correlations as well as overlapping 95% confidence intervals.

Prisoner Free Item Responses

The survey provided 180 prisoner participants the opportunity for a free response at the conclusion of the quantitative MSE survey. Fifty-two prisoners (29%) provided written responses that were usable for further consideration and analysis in this study and for future studies correlated with prisoners' race and age data. The researcher categorized the survey responses by the three operating definitions of beliefs, attitudes, and anxieties or not applicable (N/A) according to prisoner primary statements. This researcher cross-validated descriptive public data, provided by prisoner respondents, of age and race using the WI DOC Inmate

Locator website. Prisoner ages and races are provided in the qualitative results to give more substance and meaning to their responses, especially since their names are concealed. To quantify the results for this study's purpose, the researcher assigned a letter corresponding to each descriptor and a number to each prisoner response under each MSE source construct.

Beliefs

White prisoner, age 44 (B1): I noticed that using the computer is helping me learn more than work in a book.

Native American prisoner, age 43 (B2): I was poor at math because as a child it did not come easy for me. I consciously quit trying to learn it around third grade, not until I was in my 30s did I become convinced that if I practiced, studied and took advantage of instruction, I could actually perform math at a satisfactory level. After taking math courses and applying myself, I [want to] tutor the GED/HSED math here in this institution. Inspiring an inmate to want to learn math is the real challenge. Possibly, allowing inmates to participate in stock market simulations and business math-to show inmates how crucial math is for real world money making. Many of these inmates are highly motivated to make money.

White prisoner, age 21 (B3): I think [what is] tough [about] doing bad at math [is] not knowing the math problem. Always asking for help. Thinking the teacher is tired of me asking for help. And it's hard work by yourself.

White prisoner, age 26 (B4): I have a love hate relationship with math. Math has never been my best subject but [I] feel that it could be with better time, commitment, and the will power to learn.

White prisoner, age 30 (B4): Math is in my [daily] life. So knowing math is good for me. From decimals, fractions, to algebra or geometry.

Black prisoner, age 44 (B5): The math class is very important for me and the future of my life, because I want to find a better job when I get out so I can help my kids with their homework.

White prisoner, age 28 (B6): I believe math is an important part of your life. Not only if you continue to pursue education, but in life in general. I wish I would have taken a better advantage of this when I was in high school!

White prisoner, age 58 (B7): In my opinion, every time they change the books for math and test, make me go back to start. It became more difficult, and [confused] me. Before was real math, now they want you to square root to solve problems that put too much problem on your mind. Also, some of those books don't express the way you should do the problem so you can practice on your own. People like me can do good in doing the problems but get [nervous] and depress when I am taken the math test the computer make it more difficult and hard to understand the math test. There should be a better way to teach math like in the old ways was explained.

White prisoner, age 27 (B8): I'm really good at math and catch on fast. I also have disability and hearing loss so my reading and language is poor. Speaking with the men about how hard math is for certain people is understandable [because] I feel they take math too far. But the same time [they are] not. To me, the more math you do the better job you will receive it depends on what you going for a career. Some good jobs don't need all the extra stuff just the basic. But if you try to get all high tech in the electronic, computer, and technology then you might need more but I've experienced plenty of employment in metal window factory or in construction or building homes, carpentry you really only NEED the basic in my opinion. but the technology going on the way it is, I'm thinking we will [probably need to know] more.

White prisoner, age 32 (B9): Practice makes perfect. The more anyone practices the more and better anyone is likely to become!

White prisoner, age 47 (B10): I can add and subtract and multiply, everything else is hard. I can't read a ruler other than just an inch or smaller or [find] angels. I have tried several times to reach my GED and the only tests I have failed more than a couple times was math. In my everyday life I haven't found that math other than the three [operations] I can do has ever stopped me from getting and doing a good job. I feel that I can learn math just enough to pass the GED/HSED with work and learning it all over. I am determined not to give up because it is important to me. Thank you.

White prisoner, age 37 (B11): At work, math has [not] been useful [other] than [math] classes I've taken at school. Working as an Auto body tech, welder, painter, and other jobs. Math has not been used daily throughout my career.

White prisoner, age 46 (B12): I have eighteen years of experience in the railroad industry. I truly believe math is very important tool to have in performing everyday tasks. But, most jobs [mainly] require people skills, and taking orders from supervision. When a person is working for someone else, those qualities are very essential.

Black prisoner, age 58 (B13): I would get upset with myself when I can't get the answer to a math problem, but it just made me work much harder to find the right answer. I was always in special classes back in grade school and high school, but as I got older, I found out that hard work will bring better results.

Attitudes

Black prisoner, age 20 (A1): I strongly believe if you have a good attitude about math it'll take you a long way and better experience.

Black prisoner, age 54 (A2): To whom this may concern, it's been 35 years since I was in math class. In the last 6 months I've learned so much. I truly never understood the importance of school for myself. I've always expressed to my kids how important an education is. I'll admit, it took a lot for me to make this decision to go back to school, I was very nervous about it. The one thing I can put my hands on that made me relax was having an excellent math teacher who understood my struggles, and allowed me to learn at a healthy pace and [during] my difficult times she was very patient. At some point I wanted to give up but my math teacher was so good at what she do, she knew when to push me and when to fall back and let me make the necessary mistakes to learn. Yeah, I do the work but my math teacher made it possible. Today, I see the importance of math.

Black prisoner, age 24 (A3): Math can be hard sometime, but when I keep trying I can get better.

Black prisoner, age 62 (A4): I think the math test should go back to the old math test, 'cause it's more easy to understand.

Black prisoner, age 30 (A5): I think the old math test was better because the new test is very hard. I think you all should go back to the old test.

White prisoner, age 24 (A6): I've always excelled in math and find math fun and enjoyable. I get bored doing math problems that I've already learned and am stuck relearning. I love learning new things in math and in some cases old things I have forgotten due to lack of needing to use them.

Black prisoner, age 38 (A7): I think the "math" test should go back to the way it was, and the reason why is because the new "math" test is much harder for me. Thank you much.

Black prisoner, age 26 (A8): My experiences have been okay as I can say until I got to a higher grade. I love math. It's one of my best classes to have. I used to get mad at problems I had. Then I stop doing that and take my time on it. I get better at math or anything else I'm getting attitudes about.

Black prisoner, age 30 (A9): I feel that needing to get a high score on the math test is not helping the students who are struggling. The more students struggle in school the more inmates getting held back waiting to get in school. Now this is just a suggestion to whoever is in control of what I'm about to say. They need to lower the test scores or not put as many questions on the test. Do you know how many inmates who have done all the test but still don't graduate because they can't finish the math test? But who am I…this just my opinion on what should happen with the situation we are in.

White prisoner, age 37 (A10): I think it's better to have just one way it work on the problem not ten, just get all mixed up.

Black prisoner, age 35 (A11): I am happy that learning math without a calculator is making my math skills stronger.

Native American prisoner, age 37 (A12): Trying my hardest but never can hold what I learned in fractions but "+" and "-"come easy, so I hope that's good enough.

White prisoner, age 35 (A13): I'm good at mostly everything up to algebra, but still do have trouble with it. My addition, subtraction, multiplication, and division are all good, pretty sharp. Haven't really touched geometry.

Black prisoner, age 31 (A14): My teacher shows me step by step until I learned how to do it. Now I am a lot better at math and almost ready to take the GED test.

Black prisoner, age 31 (A15): Help and a good teacher can get you a long way in school.

Anxieties

Black prisoner (X1), age 29: Math it's part of life but hard as hell, especially when there is a person who has attention deficit disorder or some type of problem with focusing on one thing. Me…I hate math but as I said its part of life.

Black prisoner (X2), age 31: I'm doing the best I can to pass this class it's hard but my teacher help me a lot. He is the best.

White prisoner (X3), age 24: When I have a question with math. I personally understand better one-on-one with the tutor/teacher.

Black prisoner, age 19 (X4): I would like to say [about math] is when you really need the help over math you get attitudes out in your beliefs. Because you knew the math real good. But you forget most of the math when you haven't been in class for a long time or enrolled in school so what will you do when you don't have the same brain you had before you left that math at class or school? Please help & thanks.

White prisoner, age 23 (X5): Depending on the math problem I can become frustrated, such as with multi equations. There are some steps I skip, ending up with a wrong answer. When I keep at it I notice I do better but if I stop practicing problems I tend to forget steps. Also, there are some teachers that teach differently, I've noticed some teach short cuts and some teach the whole proper steps to any problem. Preferably, I rather have a teacher who teaches the easier ways to any problem for an easier understanding to figure out math problems.

White prisoner, age 23 (X6): Doing math builds up my anxieties and I start feeling nervous and really confused. Working with numbers gives me a really bad headache. I could only concentrate for 5 min then I am lost and distracted.

White prisoner, age 31 (X7): What I take from math is a skill that will help me throughout my life, so I do not have anxieties learning or taking tests because learning and failing does not hurt. I feel that people feeling like that is due to feeling pressured either by peers doing well or family members pushing them to work harder. Some people aren't relaxed enough and have more subjects to study then just math, so the person's focus is scattered. Some people [have] beliefs that the only math they need to know is adding and subtracting, which in many cases are true, but if you're seeking a job in science, or inventing things you'll need more then adding and subtracting. In all honesty, your

survey was pointless, but I believe the necessary data you'll want is what people write in this section here. Wish you luck!!

Black prisoner, age 33 (X8): Hello, I'm writing because I feel I'm never [going to] get this math correct. I'm in desperate need of help and I'm not getting the real help like I'm supposed to. Yes. I want my G.E.D. but how is that gonna happen when no one really care if you learn math or not? I feel like a big failure to my children and to myself. I was so determined to get my G.E.D. before I'm released but I've never attended a school were you have to figure everything out on your own and expect yourself to pass math with the small amount of knowledge you have about math. I'm 33 yrs. old and still can't get a hang of this math thing and to be honest I don't think no one here care if you receive your G.E.D. or not to be honest. All I ever wanted was my education so I can further myself to college and make something of myself and find a nice job to take care of my family, and stay away from crime. But how [does] the system think [they are going to] stop crime if they can't provide real help to offer us adult offenders a basic education? All of this is backwards and all we want is a G.E.D. or H.S.E.D. to survive out in the real world to make something of our self. I don't know if it's much you can due or ever respond to my letter or even if they make sure you get my letter but we need help. Thanks.

Black prisoner, age 34 (X9): I feel my experiences in math have been terrible. I have been in…class feeling lost looking for help to better myself and the more and more I push myself to not give up, I find myself coming to class just to feel short. And it makes me want to give up. I have been in R.G.C.I. math for 3 years and the things I have learned where things I work on with other students outside of class. My attitude has not been the greatest do to the way I feel when I come to my math class I feel lost. And at times out of place. I would like to take my schooling as well as my math to a higher level but without the right teachers behind me I will not be able to get myself to the level of math I know I am capable of being. I do enjoy school and will never give up. It's just I have not had the best experiences. I am still hoping to get my math grades higher so that I can take the G.E.D. test.

White prisoner, age 27 (X10): Hello. I believe when you are learnin' about a math subject it's a lot about who teaches you and my teacher…is the best teacher. If you don't know a

problem it's very important that the person teachin' you has enough patience to sit down and explain. Thank you. Have a nice day.

White prisoner, age 34 (X11): I was born w/a part of my brain not functioning proper due to fetal alcohol syndrome. My birth mom used drugs/or alcohol during pregnancy, so that's a big reason why I'm so impulsive in decisions, in life, and that's what's led my (4x) prison incarcerations! I am good with numbers, names, faces, etc, but I make impulsive decisions on the street when I am smart w/certain subjects/topics, but don't do good w/math in school. I am 34, I was homeschooled in my home @ a young age, but failed 6th gr. 2x, and my mom was my teacher the whole time. My issues at home led me to get adoption vacated in 1996, (@14) and now, I'm in prison again, for the 4th x due to poor decisions in jail. I want my math scores to be upped, when I do finally get my GED, I know I tried my best. Thank you for the opportunity to help-my release date is on 7/18/2017 and I hope I got my GED this time out!

Black prisoner, age 30 (X12): I feel I am bad at math and other subjects. I have A.D.D. which I am in the process of addressing with the psychiatrist here at the prison.

White prisoner, age 43 (X13): I am not good at math and I have a problem remembering what I have learned.

Black prisoner, age 37 (X14): It been a struggle with math a very long time for me. I can do the work on a calculator very well. Some of us don't got a good brain. Some struggle with using a calculator. When I take a test, I can't complete within the time. The [test should not] be [a] time tested. My goal is to get my G.E.D. Thank you.

Black prisoner, age 47 (X15): I believe the test I take shouldn't be timed. I do bad when I'm timed.

White prisoner, age 41 (X16): I just would like to have an easier math test to pass the class. Because for me math is a little difficult for me and I tried to do well in math, but for me it's difficult.

White prisoner, age 33 (X17): I am 33 years old. Math is the reason I dropped out of school. My brain just can not pass the division part of math. It's like there is a wall in my brain and it will just not let me threw. My name is […]. I would love to hear an update on this research afterward. Thanks for your help.

Black prisoner, age 55 (X18): I had a hard time focusing in class when I growing up, because of my learning disability. I am from Minnesota may be you can find some school records.

Black prisoner, age 27 (X19): I like doing math a lot and it make me getting better and smarter. I thank my teacher. He is very good at maths. He is the best teacher.

White prisoner, age 29 (X20): I believe that to better understand math it [is] easier to get help around the clock if needed. We have teachers that will constantly help us then maybe we can get it and keep it in our minds.

Black prisoner, age 41 (X21): If the test wasn't timed I believe I could pass it without any problems. Anxieties kick in and that becomes a real problem for me. I understand math is not easy or simply its hard as you move along.

Not Applicable (N/A)

Black prisoner, age 35 (N/A): Keep doing this don't stop now. I really like this. Now some of the people can feel like someone is trying to understand us now. Keep doing this and on the streets too. Thank you for your time.

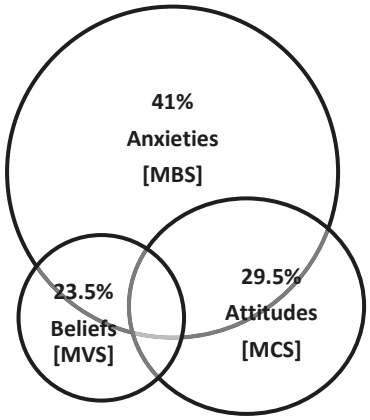
White prisoner, age 41 (N/A): Since [high school] I was always asking for 3 or 4 dimensional problems. So I would like to work on 3 or 4 dimensional problems or projects? Like the research just wish they did it for each class every 6 months.

Free Response Analysis

Fifty-two prisoners out of 180 provided free-responses to the MSE survey. Over half (51%) of the prisoner responses correlate to math barriers (MBS) or math anxieties in specifically referencing attention deficit or other disabilities. Categorizing the qualitative responses into the three MSE subcategories, twenty-one (41%) of the free responses pertained to prisoner anxieties with math and people anxiety related effects on their math class, math ability, and/or math test performance. Fifteen (29.5%) prisoner respondents expressed their beliefs in writing about the importance of hard work, math to career opportunities, practice, and/or using a calculator. Twelve (23.5%) prisoner responses correlated with self-internalized beliefs of math ability or math values (MVS). Two responses were determined as not being applicable or

relevant to any of the three MSE sources or categorizations. The results of the qualitative free-response codification by MSE constructs are similar to the results in the quantitative correlation analysis for MSE to TABE® post-test scores as shown in Figure 15, with over 40% of the responses emphasizing the influence of math anxieties on math achievement. This exploratory result suggests a correlation exists between prisoners' free responses with their MSE scores and further evidence that anxiety effects achievement the most after prisoners in this sample received ABE instruction on the TABE® math post-test.

Figure 20. Qualitative Venn-Diagram of prisoners' free-responses to MSE survey



Summary of Prisoner Free Response Results

One fourth of the prisoner sample provided a free-response on the backside of the adapted MSE survey. The prisoners' free responses indicate a genuine interest in research and communication of their math and school experiences to this researcher. The majority of responses explained why this prisoner sample struggled in math class and performing on math tests. All three MSE constructs were present in the prisoner sample's free responses. Math anxieties, which includes challenges pertaining to attention deficient disorder in being successful

in mathematics, were the most common barriers to math achievement as explained by the majority of respondents. The common rationales pertaining to the quality of math instruction, difficulties on math tests, and the qualities of math teachers expressed by respondents for their successes or failures as well as liking or disliking math was also consistent with the quantitative results and literature review. One risk of conducting an ethical prisoner study is that the population does not have to participate. The 51 prisoner responses dispelled that concern.

Chapter Conclusion

Chapter IV analyzed 181 male prisoner TABE® math pre-test and post-test scores reduced to 141 self-reported dropout grade levels in relationship to adapted MSE survey data results. Item analysis with missing values analyses verified test assumptions for missing values effects, correlational analyses, linear regression, and implications for interpretations in answering the four interdependent research questions.

Item-analyses was conducted using Cronbach's alpha results to analyze responses along with means plots in order to determine inter-reliabilities and effect sizes for MSE construct items. All items had a normal distribution for meeting this study's practical purposes, regression assumptions, and for statistical significance testing. There were 40 surveys with missed MSE responses. The MSE missed responses had significant effects on the validity for the results, especially for assuming normal distribution of anxiety related responses. The missing analysis suggested enough significance between listwise verses pairwise analyses with 21.67% mismatches of indicator variables for determining academic outcomes as measured and compared with prisoner performance on the post-test. The missing values and item analyses limited generalizations of correlational analyses and interpretations beyond this study's results

for this targeted population sample since 40 prisoners (21%) did not completely answer the adapted MSE survey.

The significant percentage of missed anxieties MSE construct items had effect on the means comparisons, distribution results, and hypotheses testing outcomes measured by Kolmogorov-Smirnov tests. The result of the missing responses demonstrated that statistical significance could not be assumed on a normal distribution for the anxieties construct ($M=30.64$, $SD=6.29$, $p = 0.200 > 0.05$) compared with beliefs ($M=39.28$, $SD=6.13$) and attitudes ($M=32.67$, $SD=5.26$) which were statistically significant at 95% confidence ($p<0.001$ for both). For practicality and statistical purposes, the researcher chose to assume a normal distribution of the anxieties construct since the other two constructs of beliefs and attitudes respectively were statistically significant for assuming a normal distribution ($M=39.62$, $SD=6.132$, $p=0.026<0.05$ & $M=32.74$, $SD=5.263$, $p=0.041<0.05$). All adapted items also tested to have statistical significance for normal distribution ($p<.001$). Many of the missed anxiety responses to subsequent items did not appear at random. These results suggested that the majority of responses missed were participants seemingly uncomfortable with answering anxiety and attitude related questions. Prisoners, therefore, chose not to continue to respond to subsequent and interrelated revised MSE items. It was decided for practical purposes and statistical reasons to not include missing scores in the overall analysis and to reduce the sample size ($n=141$) in order to control for this phenomenon using listwise pairings by assuming the anxieties construct has a normal distribution. This researcher acknowledges that by using listwise pairing a bias against the anxiety construct items existed rather than favoring anxieties construct items in order to calculate its significance or effect to prisoners' academic achievement.

Correlational and regression analyses of MSE's relationship to academic outcomes attempted to answer all four research questions related to the overarching research question that asked, "To what extent do sources of MSE (attitudes, beliefs, and anxieties) affect ABE adult male prisoner academic achievement?" Eliminating the missing scores provided for constant variances with high reliability estimates in which the errors in MSE scores were less likely to be uncorrelated with each other that met homoscedasticity requirements for regression analysis to further answer the overarching research question for descriptive and predictive analyses.

The quantitative results to the first research question asked, "To what extent do all three of the math self-efficacy sources (attitudes, beliefs, and anxieties) correlate with adult male prisoners' current mathematics achievement scores?" Answering this question resulted in comparing prisoner MSE scores to their intake survey assessment scores. The results of the first question's analysis suggested the correlation between prisoner MSE and intake TABE® survey scores to be weak, positive, and statistically significant ($r=0.228$, $n=141$, $p=0.007<0.05$) at 95% confidence. When disaggregating data by the four NRS ABE function levels, the results for the first question revealed that the lower the prisoners' TABE® intake pre-test scores, the more likely the prisoner was to have a lower adapted MSE score and visa-versa for prisoners with higher MSE and higher TABE® intake pre-test scores.

The second research question asked, "To what extent do all three of the math self-efficacy sources (attitudes, beliefs, and anxieties) correlate with adult male prisoners' prior mathematics' achievement scores?" This question's results compared prisoner MSE source constructs of attitudes, anxieties, and beliefs to their intake TABE® survey assessment scores. The results of the analysis suggest statistically significant weak correlations between prisoner MSE constructs and intake TABE® survey scores for Attitudes ($r=0.150$, $n=141$, $p=0.038$),

Anxieties (r=0.165, n=141, p<0.025), and Beliefs (r=0.205, n=141, p<0.007) with beliefs as the strongest predictor of the three MSE constructs.

The third research question asked, "Which source of mathematics self-efficacy has the most significant effect on current adult male prisoners' mathematics achievement?" This question's results used all three MSE constructs (anxieties, attitudes, and beliefs) to correlate with math achievement on the TABE® intake survey. Linear regression analysis in the first model and then stepwise for dropout (exited) reported grade levels in the second model were used. The overall regression of the first model described prisoners' academic outcomes on the pre-test TABE® math survey combined results, with MSE as the dependent variable, to be statistically significant, $F(1,139) = 7.593$, $p = 0.007 < 0.05$. The model, however, only explains 5.2% of the variance of MSE's total impact on prisoners' pre-test scores with 61% for attitudes effect, 20% for anxieties effect and 14% for beliefs effect on total MSE. The first model suggests that prisoners with lower MSE combined scores have significantly lower pre-test TABE® math survey scores at intake in prison ($\beta = 0.228$). MSE belief scores had lower impact on the pre-test TABE® math survey combined scores ($\beta = 0.205$) with anxieties second ($\beta = 0.165$) and attitudes third ($\beta = 0.150$).

The second regression model predictor of prisoners' academic outcomes on the pre-test TABE® math survey results used MSE as the dependent variable and controlled for exit grade levels. The second model found lower MSE scores, controlling for prisoner exit levels, to be statistically significant ($\beta = 0.119$). The result suggests the earlier prisoners exited school the more likely they are to have lower MSE scores ($\beta = 0.661$). The extent of the relationship between exiting school and MSE had a stronger correlation with predicting or describing pre-test TABE® survey scores (r=0.148, p<0.05) then on MSE scores (r=0.661, p<0.05). This result

might be attributable to the fact that prisoners took the TABE® survey pre-test prior to completing the adapted MSE survey for this study.

The fourth research question asked, "Which source of mathematics self-efficacy has the most significant effect on overall mathematics achievement for adult male prisoners enrolled in adult basic education?" Answering this question required comparing prisoner MSE to math achievement on the TABE® post-test results using linear regression for each model. The results did not show statistical significance at 95% confidence intervals requiring the retaining the null hypothesis that no source of mathematics self-efficacy had a more significant effect on overall mathematics achievement for adult male prisoners enrolled in adult basic education, than the other two.

The qualitative free-response results representing over one-fourth (28%) of the participants presented all MSE construct-related issues in math achievement. The majority (51%) of free responses from the prisoner participants concerned anxiety construct related issues and correlated with math barriers in the Math Beliefs Model which provide further implications for researchers and teachers of mathematics as presented in Chapter V (Hendy, et al., 2017).

Hierarchical linear regression stepwise analysis answered the primary research question for this study, "To what extent do sources of MSE (attitudes, beliefs, and anxieties) affect ABE adult male prisoner academic achievement?", investigating which of the three self-efficacy constructs was the greatest predictor of mathematics achievement, as measured by achievement from the intake pre-test to post-test results. This researcher harvested the TABE® math survey scores when compared with the post-test combined TABE® math complete scores after participants submitted the adapted MSE survey results along with prisoner participant self-reported (dropout) exited grade levels. The results of this analysis showed that a strong

significant relationship between prisoner overall math academic achievement on the TABE® post-test to prisoner intake TABE® survey scores ($r=0.861$, $p<0.001$). A moderately significant predictor of prisoners' math performance existed from prisoners' reported dropout grade levels from public education that correlated with post-test academic achievement ($r=0.670$, $p<0.001$). Another statistically significant, but weak predictor of academic and math achievement in ABE for prisoners in this study was prisoners' MSE combined score ($r=0.148$, $p=0.040<0.05$) with an overall 5.2% effect. There was no statistical significance between any of the three MSE constructs and prisoners' math academic achievement after they had taken the MSE adapted survey (Anxieties, $p=0.123$; Attitudes, $p=0.076$; Beliefs, $p=0.083$). The results indicated that whatever weak statistically significant relationships existed from MSE and MSE constructs diminished in this same prisoner sample population after they took the TABE® math complete battery post-test after having took the survey. The extent of the relationships between prisoner MSE and math academic achievement was determined for this study to be limited by prisoner responses (or lack thereof) to anxiety questions. Qualitatively, prisoner's previous academic experiences and test scores revealed a stronger relationship to their math achievement than MSE.

This study's results suggest that there is no statistically significant correlation of MSE sources to a prisoners' future math achievement. About 5% percent of the effect on prisoners' intake pre-test math scores was attributable to the MSE survey and TABE® pre-test scores at a 95% confidence interval level. MSE's overall effect from TABE® pretest to TABE® post-test math scores was reduced from 5.2% to 2.2% having a 57.7% decrease. The beliefs construct had the largest effect and correlation between prisoner MSE and prisoner pre-test intake math results that was also statistically significant. The anxieties' construct correlated closest with prisoner post-test math results, but was not statistically significant. The grade level a prisoner dropped-

out of school had a moderate and significant effect on their math-test scores (r=.661, N=141, P<.001), but varied in significance depending on how the grade levels were distributed. Prisoners who dropped out of school before twelfth grade had lower MSE levels, lower math scores, and reported higher anxieties in both the quantitative and qualitative results. Prisoner free responses suggested a correlation between anxieties and having to take timed, high stakes, and increased difficulty tests. The prisoner free responses overwhelmingly expressed concerns with how their high anxieties, attention deficit disorders, and/or other disabilities have kept them from being successful in math and school. Anxieties' quantitative overall effect from the statistical analyses in their post-test TABE® results correlates positively with the qualitative responses. These positive correlations occurred after the prisoners acclimated to prison life at their intake, had taken this study's survey, and had received at least 40 hours of ABE instruction from a correctional educator within an ABE program afterwards.

Chapter V: Discussion, Findings, Implications and Recommendations

Overview of the Study

This chapter contains a discussion of the findings presented in Chapter IV, implications for improving math instruction and administration as well as recommendations for future research with an overarching conclusion of this study's purpose, findings, and significance. This study's method was primarily quantitative, but included a free response survey question at the end. The question provided antidotal qualitative insights for answering each of the four research questions.

This study's primary purpose was to measure relationships between mathematics academic achievement using prisoner MSE sources constructed for this study and TABE® scale scores to formulate, articulate, and define male prisoner barriers to learning mathematics. This study addressed the following four research questions.

1. To what extent do all three of the math self-efficacy sources (attitudes, beliefs, and anxieties) correlate with adult male prisoners' current mathematics achievement scores?
2. To what extent do all three of the math self-efficacy sources (attitudes, beliefs, and anxieties) correlate with adult male prisoners' prior mathematics achievement scores?
3. Which source of mathematics self-efficacy has the most significant effect on current adult male prisoners' mathematics achievement?

4. Which source of mathematics self-efficacy has the most significant effect on overall mathematics achievement for adult male prisoners enrolled in adult basic education?

These four research questions compared prisoner survey responses taken from a Math Self-Efficacy (MSE) survey adapted and contextualized for use with prisoners to the 28 questions in the Math Beliefs survey compiled by Hendy, Schorschinky, and Wade in 2014 for use with college students. The Belief's model survey used factor analysis from previous MSE research to define three measures of MSE that correlated best with math outcomes. This study correlated student data from prisoners' prior educational records and test scores to their 30-item MSE survey responses. Statistical correlation and regression analysis from the aggregated individual survey questions answered the research questions by calculating, comparing, and analyzing the following achievement measures:

- Math Survey achievement as measured on the test of ABE (TABE®)
- Math Complete achievement as measured on the test of ABE (TABE®)
- Academic achievement as measured with prisoners' last grade exited from school

This study explored the extent of the relationships of three MSE source categories (anxieties, attitudes, and beliefs), with prisoners' math achievement. Unlike college students, adult basic educational programs embed NRS levels in basic, intermediate, and secondary education as progress indicators toward diploma completion and program effectiveness. Timed standardized tests quantified both student and program achievement for prior and current achievement analyses. Mathematics is essential for prisoners to earn a first secondary education credential or to pass the GED. Additional survey questions and language adaptations addressed differences between college students' math course completion to prisoners in adult basic

education required to pass specific criteria on the GED mathematics examination to earn a first secondary credential.

Highlights of the Study

This study achieved five fundamental goals as presented in its introduction. First, this study adapted and produced a MSE survey tool for nontraditional students that was acceptable and relevant for use with male adult prisoners within a correctional setting. The survey instrument produced, from the sample population, an equivalent in reliabilities to Hendy, Schorschinky, and Wade's (2014) scaled measures and produced valid results.

Second, the accumulated results further supported Bandura's social learning theory that self-efficacy is an accurate descriptor and predictor of academic proficiency and pro-social behavior by demonstrating a positive statistical relationship between MSE and current math achievement as was indicated in a strong, positive correlation between pre and post-test results ($r=.861$, $N=179$,, $p<.001$).

Third, this study verified self-efficacy theory as applicable to studying and teaching math to adult male prisoners. The quantitative and qualitative data produced results relevant to understanding this male prisoner population, consisting of prisoners who had not earned a secondary education credential (High School Diploma/GED).

Fourth, this study proposed and provided an evidence-base in Assessment of Skills for Successful Entry and Transfer (ASSET) to provide further evidence that explained how self-efficacy sources and construct subscales correlate criminogenic behaviors with math ability and academic achievement within adult male prisoner populations. Future MSE studies that examine prisoner anxieties, beliefs, and attitudes may continue to negate the impact of poor pedagogy that

fails to reduce negative academic behaviors in prisoners or at least promote better instructional methods to advance prisoners' academic and social growth.

Fifth, this study examined the extent that each of the three MSE sources affect overall MSE in relationship to describing math and therefore overall academic performance to which MSE sources may even predict prisoners' mathematics achievement. Since math achievement on a timed test is often necessary for prisoners to earn their GED, overall academic achievement leading to earning a secondary education credential or diploma was measured by its direct relationship to prisoners' math achievement. The results of this study therefore provide several implications and recommendations for researchers and practitioners alike to consider MSE and its three identified MSE sources for future studies and pedagogy.

Variables

The first independent variable was prisoners' prior academic achievement as determined by using the grade level exited from public education. The second independent variable was ABE math achievement using TABE® survey pre-test assessment scores at intake into a Wisconsin State Correctional facility before beginning ABE programing. Measurements of current ABE math achievement used the math TABE® complete post-test assessment scores after prisoners had taken the MSE survey and at least completed 40 hours of ABE instruction. The dependent variables consisted of prisoners' MSE survey composite scores, MSE beliefs scores, MSE attitudes scores, and MSE anxieties scores. The types of measurements for these variables included categorical, ordinal, and interval data. The exited grade level variable included 10 levels, consisting of third through twelfth grades reported on prisoner educational records as their dropout grade from public education. Additional demographic variables such as ethnicity, age, and instructional hours received were not used for quantitative correlation and regression

analyses, but are presented as qualitative data collected from prisoner free responses to add depth, understanding, and value to this study.

Data Collection

Prior to data collection, this researcher received approval to conduct this study from Wisconsin Department of Correction's Policy and Research Review Committee along with Bethel University's Institutional Review Board (IRB) in St. Paul, Minnesota. Prisoner consent forms and surveys were distributed and collected by WI DOC Education staff. For security and institutional purposes, the consent forms and surveys were screened by the Wisconsin Department of Correction's Policy and Research Review Committee Chair before being mailed to Bethel University for this researcher to analyze. Names/prisoner identification was collected with the consent forms and surveys for validation and security purposes. All prisoner data was saved in a locked safe and used only by this researcher for this study's purpose. After prisoner personal information was used for data entry and cross-validation purposes, it was redacted. All prisoner data is prepared to be permanently destroyed by shredding it by this researcher upon the one-year anniversary of this study.

A total of 181 prisoners participated voluntarily out of the 317 offered the opportunity to participate in this study. The 317 offered participation met the sample population's criteria of not having received a secondary education credential (diploma/GED) at the time the survey was offered to prisoners on March 10, 2017 through June 9, 2017. Of the total participants, 141 completed the entire survey, providing a complete composite score used to answer the four research questions. One prisoner did not complete the survey at all, whose score and information was not used. The results of this study consisted of 179 prisoners who did complete at least some portion of the survey. The prisoners' ages ranged from 18 to 78 years old. Of the prisoners

who participated in the survey, three prisoners identified as Asian, 10 identified as Native American, 87 identified as black, and 80 identified as white. Fifty-two prisoners (29%) submitted written free responses to an open-ended question on the backside of the survey. The free response data was organized, quantified, and correlated into this study's results.

Findings for Research Question 1

The relationships of current academic achievement to prisoner MSE scores were tested using T Tests for significance and ANOVA for the following research question and hypotheses:

RQ1: To what extent do all three of the math self-efficacy sources (attitudes, beliefs, and anxieties) correlate with adult male prisoners' current mathematics achievement scores?

$H1_A$: Current mathematics achievement scores will have a correlation with math self-efficacy scores.

$H1_0$: Current mathematics achievement scores will have no correlation with math self-efficacy scores.

The findings of this study revealed that there were statistically significant differences in prisoner math achievement on the TABE® survey with their MSE composite scores. As such, the null hypothesis was rejected. The results suggest a positive correlation does exist between MSE and math achievement: $t(1, 39) = 1.145$, $p<0.001$. Prisoner MSE is lower, especially with prisoners who have increased anxieties when compared with other normally distributed populations. Therefore, prisoners in this study overall had lower MSE scores that resulted in lower mathematics achievement scores throughout this study's results.

The prisoners' free responses seemed to support the quantitative statistically significant Pearson correlation results that low MSE scores seem to correlate with low math achievement

(r=.288, n=141, p<0.01). As a nineteen year-old black prisoner (X4) wrote, "you forget most of the math when you haven't been in class for a long time or enrolled in school." Another Native American prisoner, age 43 (B2) wrote, "I was poor at math because as a child it did not come easy for me. I consciously quit trying to learn it around third grade." Both prisoners dropped out of school before seventh grade. Their reflections seem to indicate a self-awareness represented among these prisoners in ABE that MSE is related to their math achievement. The fact that MSE correlated with prisoner math achievement is not surprising given the self-awareness expressed by several prisoners in their free responses beginning on page 146 that their beliefs, attitudes, and anxieties negatively influenced their motivations to learn math and stay in school.

Findings for Research Question 2

ANOVA and Pearson correlational analyses measured the relationships of math achievement to prisoner MSE scores. The following research question and hypotheses were addressed:

RQ2: To what extent do all three of the math self-efficacy sources (attitudes, beliefs, and anxieties) correlate with adult male prisoners' prior mathematics achievement scores?

$H2_A$: Prior mathematics achievement scores will correlate with math self-efficacy scores.

$H2_0$: Prior mathematics achievement scores will show no correlation with math self-efficacy scores.

The findings of this study revealed that there were statistically significant differences in prisoners' prior math achievement on the TABE® survey compared to their MSE composite belief's and anxieties' construct scores. As such, the null hypothesis was rejected. The belief's construct was the strongest indicator of low achievement on the TABE® survey assessment t

(1,140) = 27.5, $p<0.01$ compared with the anxieties' construct t (1, 410) = 11.3, $p = 0.53$ and attitudes construct t (1,140) = 19.1, $p<.05$. The anxieties' construct results, however, were not statistically significant. Prisoners who dropped-out of school before 12th grade had statistically significant differences from those who dropped-out while in 12th grade. The results indicate that math achievement correlates more strongly with low MSE scores in prisoners who drop out at elementary (3-6) or middle school (7-9) from those who drop out later in the high school grades (10-12). The results indicate that prisoner beliefs and anxieties from prior experiences do in fact significantly have a negative result on their academic achievement.

The results of the free responses, however, continue to emphasize the importance of anxieties as to why prisoners struggled to stay in school to earn their diploma and with math achievement. A 23-year-old white prisoner (X5) wrote that "There are some steps [he] skips, ending up with a wrong answer." Another 23-year-old white prisoner wrote, "Working with numbers gives me a really bad headache. I could only concentrate for 5 min then I am lost and distracted." These types of responses continue to emphasize the influence of having a learning disability or anxiety about doing math to prisoners' math and academic achievement as measured on tests or stating in school. A black prisoner X9 summarized this finding best when he wrote,

> My attitude has not been the greatest do to the way I feel when I come to my math class I feel lost and at times [I want] out of [this] place. I would like to take my schooling as well as my math to a higher level but without the right teachers behind me I will not be able to get myself to the level of math I know I am capable of being. I do enjoy school and will never give up. It's just I have not had the best experiences. I am still hoping to get my math grades higher so that I can take the G.E.D. test.

Findings for Research Question 3

The MSE categories of anxiety, attitude & belief scores, as they relate to current math achievement were tested using the following research question and hypotheses using regression analysis:

RQ3: Which source of mathematics self-efficacy has the most significant effect on adult male prisoners' current mathematics achievement?

$H3_A$: One math self-efficacy source will have a more significant effect on adult male prisoners' current mathematics achievement than the other sources.

$H3_0$: No math self-efficacy source will have a more significant effect on adult male prisoners' current mathematics achievement scores than the other sources.

The findings of this study revealed that the beliefs construct was the only statistically significant predictor for prisoner math scores using pairwise deletions in regression analysis $F(2, 159) = 2.606$, $p=0.01$ with the model explaining 4.7% of the variance in MSE. As such, the null hypothesis was rejected for RQ3.

This finding, therefore, indicates that beliefs matter most for prisoners when they begin instruction, especially for those enrolled in ABE programs seeking their GED. The beliefs construct, for this study, consisted of prisoners' internalized abilities, relevancies, mindsets, and self-talk about math and towards themselves as able to do math. Prisoners, from the free response survey articulated several reasons that their beliefs improved while participating in ABE compared to their prior experiences. White prisoner B10, age 47 summarized his conflicting math beliefs issues:

I can add and subtract and multiply, everything else is hard. I can't read a ruler other than just an inch or smaller or [find] angles. I have tried several times to reach my GED and

> the only tests I have failed more than a couple times was math. In my everyday life I haven't found that math other than the three [operations] I can do has ever stopped me from getting and doing a good job. I feel that I can learn math just enough to pass the GED/HSED with work and learning it all over. I am determined not to give up because it is important to me.

A black prisoner, age 30 (A9) also expressed his concerns about the value and need to score well on math tests when he wrote, "I feel that needing to get a high score on the math test is not helping the students who are struggling with math." A white prisoner, age 35 (A13) commented on his beliefs about algebra being his barrier to achievement, "I'm good at mostly everything up to algebra, but still do have trouble with it." A Native American prisoner, age 37 (A12), expressed his beliefs about "trying my hardest but never can hold what I learned in fractions," as being problematic for passing the GED. Other prisoners such as B11 expressed their beliefs that the math taught in school has not been very useful to their career advancement opportunities and in their work experiences in railroad and other industries. A white prisoner, age 46 (B12), summarized this belief, "Most jobs [mainly] require people skills, and taking orders from supervision." A black prisoner, age 58 (B13), nicely summed up in his free response the importance of having a growth mindset in math rather than a fixed mindset:

> I would get upset with myself when I can't get the answer to a math problem, but it just made me work much harder to find the right answer. I was always in special classes back in grade school and high school, but as I got older, I found out that hard work will bring better results.

Quantitatively, beliefs had a strong positive correlation to prisoner MSE ($r=.794$, $n=141$, $p<0.001$) just closely behind attitudes ($r=.807$, $n=141$, $p<0.001$) taken from research question

four's findings. MSE belief's strong positive correlation to MSE provided further evidence regarding how significant prisoner beliefs are with their intake math scores when prisoners begin ABE after, in many cases, years since they last attended school as a child. Prisoner beliefs about math's relevancy to employment, having meaning in their lives, and having a growth mindset towards math achievement, provided both insight and face validity to the quantitative results that beliefs mattered most to prisoners' prior academic achievement.

Findings for Research Question 4

Hierarchical linear regression was used to test for the relationships between the MSE categories of anxiety, attitude and belief scores and mathematics achievement. Linear regression both measured and provided a prediction model for MSE's relationship to mathematics achievement outcomes to answer corresponding research question four:

RQ4: Which source of mathematics self-efficacy has the most significant effect on overall mathematics achievement for adult male prisoners enrolled in adult basic education?

$H4_A$: One source of mathematics self-efficacy will have the most significant effect on overall mathematics achievement for adult male prisoners enrolled in adult basic education.

$H4_0$: No source of mathematics self-efficacy will have a more significant effect on overall mathematics achievement for adult male prisoners enrolled in adult basic education, than the other two.

The findings of this study revealed no statistical significance for any one construct. Therefore, the null hypothesis was retained. Regression correlations using hierarchical analysis revealed the beliefs' construct had the strongest positive correlation to intake scores ($r=0.205$, $n=141$,

$p<0.01$). The anxieties' construct, however, had the strongest overall correlation and effect size to math achievement when taking into account both pre-test and post-test results. This result was not shown to be statistically significant $F(1, 140) = .790$, $p = 0.53$ in listwise comparative regression analysis since the anxieties' construct did not consist of a normal distribution for this prison population sample.

The 21 prisoners, however, writing in their free responses, indicated much discouragement and difficulty with math because of anxiety related causes. For example, a Black prisoner, age 31 (X1) wrote, "Math its part of life but hard as hell, especially when there is a person who has attention deficit disorder or some type of problem with focusing on one thing. Me…I hate math." Other prisoners wrote "you forget most of the math taught" (X4), and "doing math builds up my anxieties…I feel nervous and confused" (X6). These anecdotal, yet powerful expressions, provided from this prisoner sample population emphasized that even though the results for research question four were not statistically significant (as to the negative effect high anxieties had on math achievement), the consequences for prisoners and/or any student with anxieties are most certainly important. Math anxiety as well as their negative self-beliefs or attitudes about math certainly are important factors when it comes to male prisoners' abilities to succeed on a high stakes timed math test required for earning their secondary diploma. The possibility that male prisoners as children chose to drop out of school because of their negative and uncomfortable physical and emotional responses to mathematics and/or their math teachers is widespread throughout the qualitative results and found wanting of further study.

Implications for Practitioners

The result that the anxieties construct positively correlates most strongly with prisoners' exit grade levels ($r = .201$, $N = 150$, $p < 0.05$), suggests that teachers, parents, and peers promote and

provide supportive language and encouragement at all levels of K-12 education for male students' academic success. Teachers and administrators must strive to provide personal attention and academic accommodations for students such as X8 who share similar stories of academic failure as described in his own words below:

> Black prisoner, age 33 (X8): Hello, I'm writing because I feel I'm never [going to] get this math correct. I'm in desperate need of help and I'm not getting the real help like I'm supposed to. Yes. I want my G.E.D. but how is that gonna happen when no one really cares if you learn math or not? I feel like a big failure to my children and to myself. I was so determined to get my G.E.D. before I'm released but I've never attended a school were you have to figure everything out on your own and expect yourself to pass math with the small amount of knowledge you have about math.

Math teachers should provide and promote encouraging words from other teachers, parents, and peers often in and outside the classroom and eliminate or counter any discouraging words about math. Promoting positive attributes in low achieving students can assist in developing their self-efficacy in all subjects, not just in math. More encouragement and care taken with the student-teacher relationships and student-content efficacies in low achieving students could help prevent them from dropping out of school by addressing their concerns and learning needs early.

Teachers should recognize and discuss with students their own math beliefs and attitudes about math at the start of a class, course, and/or school year. Teacher-led inquiries into attitudes and beliefs about math can help raise and bring about cessation of negative biases or self-doubts. Acknowledgment of negative beliefs and attitudes about math that leads to cognitive coaching of prisoners towards a growth mindset and positive self-efficacies can help reduce belief-based frustrations, negative attitudes, and anxieties as well as constructively support a more conducive

mathematics' learning environment. Educators should consider, address, and accommodate instruction to reduce students' anxieties for improving student overall academic achievement across disciplines, especially on any high stakes education assessment for college, military, and/or career placement.

Students should be encouraged to talk as much about math and its usefulness in life as they are expected to do math problems. Questions regarding math's relevancy to daily life and future work should be open and honest. Administrators and teachers should work together to advocate for math textbook and curriculum adoption that is more applicable and contextual to future employment. Additional considerations in curricular decisions ought to consider lower functioning students needing more individualized instruction and time solving real-life math problems. Nebulous math problems that make life seem even more useless or pointless must be avoided as well as traditional drill and skill practice without explanation for its purpose.

Administrators and teachers need to recognize math anxiety as a significant barrier to math achievement. Administrators should work to provide accommodations and alternative ways to reduce math test anxiety. Administrators can reduce math anxiety by advocating against one-size-fits-all policies and eliminating the time limits of standardized tests for students with any type of documented disability at any age, regardless of whether they qualify for special education. Failure on timed tests results in both emotional repercussions on students' motivations and negative institutional financial consequences when students' dropout. Advocacy for allowing students to choose to remove timers on tests and to retake math tests is realistic in this technological age. Any standardized math test can be easily reproduced with different questions, scored within seconds, and be provided in an untimed format that requires just a minimal number of questions to measure math content mastery.

Administrators and teachers should work together to provide students more opportunities to learn about and examine their own math barriers, beliefs, anxieties, and/or attitudes in the classroom as a component of instruction. Hawthorne effects can be encouraged by instructors and administrators to promote and advance student achievement and to reduce and potentially eliminate efficacy and frustration barriers for all students.

Reading and math achievement are often interrelated and were hypothesized and determined to be valid and reliable through national and international studies as conducted by the Institute of Educational Sciences and the National Council of Education Statistics that included a study of U.S. Prisoners in 2014 (Rampey, et al., 2016). Implications from this study's results indicate that practitioners should consider a more holistic view to teaching both reading and mathematics together rather than in isolation, especially for lower functioning students with learning disabilities.

Implications for Academics

The internal reliabilities of the adapted MSE survey were a significant finding in the results. A comparison with Hendy, Schorschinsky, and Wade's study (2014) suggested similar internal reliabilities for math anxiety and discouraging words with this study. This researcher rewrote the three discouraging words questions using positive statements that resulted in no change in the survey's internal reliability. The results showed there was little or potentially no difference between the internal reliabilities from the MBS survey items to the adapted MSE used with prisoner participants (Hendy, Schorschinky, & Wade, 2014). This result revealed that items written in the positive or negative have no statistically significant difference in internal reliability. For prisoner researchers, it seems a much better practice to write questions in the positive in order to maintain as much of a positive learning environment as possible. Keeping

the learning environment as positive as possible within a prison system is important to reduce negative reinforcement, reliving adverse childhood experiences, or any unintended negative short-term or long-term effects on prisoners' mental dispositions toward mathematics or school. Further research is needed on question item comparisons in the negative and the positive to confirm this study's results in order to inform best practice.

Experimental studies could further examine group comparisons between low achieving juvenile delinquents and adult prisoners or prison male ABE students with non-prisoner ABE students in other institutional settings. The possibility that a Hawthorne effect may have helped produce this study's results is noteworthy for researchers. A Hawthorne effect provides a probable explanation for the significant increase in academic performance for prisoners who participated in this study (Gottfredson, 1996). There is a slight possibility that the prisoners might have improved their performance or had higher MSE scores simply due to their raised awareness from participating in this study. Hawthorne effects may provide additional explanations for why over a third of the prisoners voluntarily provided an additional free response at the end of the survey. The experimental effect and presence of academic improvement may be partially due to the prisoners' high compliance with the study. Elevated MSE scores and elevated beliefs' construct means from the other MSE constructs were evident from the complete listwise data for 141 participants who completed the entire MSE survey. These elevated beliefs were also present in the free responses of the prisoners, suggesting that they wanted to convey the importance of their beliefs regarding achievement or failure. A validity study would ask prisoners to complete an MSE survey prior to taking their first TABE® Math pre-test and before entering ABE programming to account for possible Hawthorne effects. Other future studies might want to consider evaluating the extent of the Hawthorne effect on

prisoners' academic achievement as the result of a one-time math counseling session or lesson in MSE. Future studies should examine further implications of possible Hawthorne or other research bias effects or rewording questions into the positive by assigning a control group.

A larger study could also consider a stratified cluster sample to examine MSE and math achievement. Future larger studies could disaggregate for statistical significance differences for race, age, and/or other prisoner classifications that are easily verifiable because prisoners' demographic data is public information. Qualitative research that begins with interviewing prisoners who did not take a traditional path in the United States to graduate high school with their peers and instead dropped out of public school early would expose different attitudes, anxieties, and beliefs in male prisoners that may provide substantial correlations and deeper understandings for academics to consider when studying prisoner populations.

The results of this study indicated that this prisoner population had similar correlations between MSE and academic achievement as in other studies with non-traditional high school and undergraduate students (Jameson & Fusco, 2014). It would be beneficial to have additional qualitative evidence from studies that probed into understanding prisoners' mindsets, educational journeys, motivations, and math anxieties in relation with their academic achievement while incarcerated and afterwards. Longitudinal studies that tracked prisoners' before, during, and after their release from prison along with their beliefs, attitudes, and anxieties scores before and after they earned a secondary diploma could be beneficial for understanding how to change prisoner behavior. Such studies would need to account for the time it takes for prisoners to earn their secondary education credential (diploma/GED) while in prison taking into account their respective intake NRS and function levels with their MSE scores.

This study, however, simply provided insight for further understanding prisoners' mental, emotional, and structural barriers to math and possibly general academic achievement while receiving ABE instruction. From this MSE study, researchers can continue to learn from prisoners the positive and negative effects educational systems, educational tests, and courses of study have on prisoners' thoughts and behaviors. Such studies may be valuable for understanding criminogenic behaviors and reducing recidivism.

This study revealed that lower educated prisoners were more than willing to participate without incentives in a correctional education study, producing an acceptable response rate for research purposes. Future studies should consider examining correlations between other prisoners' demographics and academic data. Correlational studies that disaggregate prisoner data by race, however, should be limited to larger scale studies, which have a more significant representation from all NCES race categories. Providing a significant representation of prisoner races even in larger scale studies still can be difficult and problematic for in-depth analysis according to the 2014 US PIAAC survey that sampled over 1,500 incarcerated adults and had a 98% response rate (Rampey, et al., 2016). This study provided further evidence alongside of the 2016 PIAAC prisoner study's results that indicates U.S. prisoners ought to be considered a significant population sample and a separate culture to be researched, compared, and reported in international and national studies.

Even though prisoners ought to be a separate classification for future studies, this study did provide a few universal implications for future research. For example, research is needed to investigate the impact and validity of time limits applied to high stakes tests in mathematics. Several prisoners in their free responses commented on the additional stress the limited time imposed and felt they would do better if given sufficient time.

Further research also should continue to investigate the impact of reading on low math scores. Mathematics has become much more "language-based" in recent years with the allowance of calculators and computers and focus on conceptual understandings of math over computational skills. With the majority of this prisoner population having low reading skills, reading may need to be addressed prior to or simultaneously to mathematics instruction in order for prisoners to be successful at mathematics. This may be true of several other student populations such as students learning English as a second language, students with reading disabilities, and/or students with low reading scores entering public education.

Future studies should further examine potential correlations between anxieties in math and reading achievement in prisoners or other less credentialed adult populations that are receiving educational programing or training for entering or staying in the workforce.

Cautions for Use of This Data

This data was from prisoners within the Wisconsin Department of Corrections in 2017. The researcher introduced himself to the prisoner population only through his invitation letter, the consent forms, and by WI DOC staff for ethical and security purposes. Prisoners knew that the primary researcher was a doctoral student conducting a prisoner study, which unfortunately is a rarity in prison research and prisoner experiences. The prisoners who chose to participate may have offered their beliefs and attitudes scores as they perceived were desirable responses to give a good impression of themselves by responding to the adapted MSE survey in the way they thought would please the researcher and/or the WI DOC. The 40 prisoners who avoided answering anxiety questions, however, may have actually countered the Hawthorne effects and the assumption that items missed were completely at random. This researcher, therefore,

removed prisoner missing item responses from this study's results for countering potential biases, external validity, and internal reliability purposes.

Applications and generalizations of this data to other prisoner populations would be unwarranted. The population consisted of male prisoners ages eighteen to seventy-eight. Correlation comparisons within this study's research review and methodological design were with non-traditional undergraduate college students. Comparisons or correlations to other populations such as high school students (male and/or female), female prisoners, or traditional college students would be erroneous.

This study's sampling design may have contributed to biases as evidenced in the means differences between college students and prisoners. These differences resulted in statistically significant outcomes of MSE within the three MSE constructs. The positive correlations between exited grade levels with intake TABE® math test scores may have resulted due to prisoners' biases. Participation was voluntary with no incentives. This study was completely comprised of self-selected prisoners who did not have a GED or diploma and dropped out of public education as children. Prisoners who wanted to participate may be the same prisoners who already were motivated to improve their academic skills. These facts along with several other possible confounding or lurking variables listed in Chapter III were uncontrolled and unaccounted for by this study's sampling design. Thus, the results obtained are susceptible to further strengthening or refutation by using a randomized or stratified cluster sample design.

The findings of this study may provide beneficial information on how to ethically conduct prisoner studies within federal, state, DOC and University institutional review board policies and guidelines, especially since no published experimental studies were discovered on MSE effects with prisoner populations. This study provided a description of a study's effects

and of MSE's effects on a diverse male prisoner sample that had a good response rate with usable data. This study also provided a methodology for studying prisoner populations, solicitation for participation, and ethical use of prisoner data. This study, however, did not provide prisoner quantitative data that is compatible with other prisoner results using the same or a different MSE survey. The MSE survey items for this study were contextualized for use with prisoners in ABE educational programing who did not possess a diploma and would need to pass a timed test in mathematics to earn a secondary credential (GED/HSD). At the time of this study, the GED® math and TABE® tests were timed tests that in current practice did not allow accommodations. The male prisoners in this study also did not have an alternative way to earn their high school diploma or have access to additional resources.

The exited grade level data was a mixture of self-reported data, data verified by a school district and the data input by WI DOC staff. Exited grade level or dropout grade is not public information. The correlations between TABE® survey pre-test and complete battery post-test are questionable, since the two tests are different in length and subject to their combined normed scaled scores which could produce invalid results. This researcher cautions anyone from making any further generalizations or comparisons of the standardized TABE® survey pre-test and/or complete battery post-test results to other studies. Precautions and warnings should be stated with any type of interpretations of the prisoners' free responses that may or may not be accurate to their original intent or meaning applied to further or future use, publications, and/or research.

Concluding Comments

This study provided the groundwork for ethical research decisions regarding institutional limitations, appropriate methodologies, probable correlations, and the proper obtainment of

permissions from Bethel University, Wisconsin Department of Corrections, and low academic achieving male adult prisoners for conducting academic achievement studies.

Many negative school and/or childhood experiences seemed to affect male prisoners' academic achievement as well as their social emotional wellbeing. When a male prisoner has reached adulthood, enrolled in adult basic education programming, and tested for academic ability they have had a tremendous number of barriers that have kept them from achieving - not just in math, but life. The prisoners' free-responses at the end of the quantitative survey provided much insight into their past negative experiences and barriers to achievement in math, school, and life before their incarceration in WI DOC and should be taken at face value.

The quantitative results may have only showed an approximately 5.2% MSE effect on prisoners' math test and/or academic achievement, but the qualitative responses of 29% of the participants showed 100% of the responding prisoners had struggles and individual learning needs that were not met by traditional institutional curriculum and instructional practices. Prisoners' perceptions of their school and math experiences seem to matter. When and possibly why a male student drops out of public school while still a child, as shown in this correlation study's results, can be an indicator of their plight into adulthood that may lead to him becoming an adult prisoner working towards earning his GED. By today's testing standards, this adult prisoner must pass a timed high stakes test to show progress in ABE programing and to earn his GED. This requirement seems unfair for all adults, especially male prisoners whose childhood disabilities and experiences got in their way of earning a traditional diploma and who continue to struggle with the same anxieties, beliefs, and attitudes likely related to a disability. Minnesota (2007) and New York (2016) made policies directing that high school graduation tests in

Language Arts and Mathematics be untimed (MN Rule 3501.0250, Subp. 7A; Infante, 2016). It seems unwarranted to place a higher standard on high school graduation simply based on age.

This study examined the differences in prisoners' perceptions of their anxieties, math internal values or beliefs, and external attitudes towards math in terms of MSE. Prisoners who had higher MSE beliefs and attitudes, and dropped out in grade 12, performed significantly better on math intake TABE® survey examinations. An item analysis revealed more specifically, however, that prisoners with anxieties seemed less likely to respond or respond favorably to anxiety-related MSE construct questions. Such anxiety related questions included having received encouraging words from parents, peers, and teachers while in school or childhood. This study suggests that prisoners' negative childhood experiences, anxieties, and/or public school experiences seem to make dropping-out of school and not achieving a secondary education credential (diploma/GED) a more frequently selected option for this population during their childhood rather than staying in school and overcoming their math or academic related barriers.

Prisoners' beliefs about the purpose and value of mathematics was the most significant factor and correlated best with prior math achievement on the TABE® survey exam. MSE's total effect on TABE® intake exams calculated at 5.2%. This small effect significantly declined or no longer held statistical significance with the TABE® post-test exams to MSE and/or any of the three MSE sources after prisoners completed at least 40 hours of ABE instruction while incarcerated. This considerable reduction may be attributable to a Hawthorne effect from this study, which raised their math beliefs', attitudes', and/or anxieties' self-awareness and, in turn, their math and/or overall academic achievement. More likely, however, the reduction of MSE's effect on prisoners' achievement in this study might be the result of the WI DOC correctional educators' instructional methodologies and practices that address the specific needs of each

individual prisoner attempting to learn within a correctional educational system. To what extent do sources of MSE (attitudes, beliefs, and anxieties) affect ABE adult male prisoner academic achievement?"

The answer to this overarching question suggests that prisoner achievement correlates to understanding "the when" and "the why" a prisoner today dropped-out of school in their childhood. The results indicate that changing attitudes, beliefs, and/or anxieties in any student from negative to positive for self-efficacy purposes is important for male prisoners' academic achievement and lifelong fulfillment.

References

Ahern, S., & Beatty, J. (1979). Pupillary responses during information processing vary with Scholastic Aptitude Test scores. *Science*, *205*(4412), 1289-1292.

Ahmed, Wondimu, Alexander Minnaert, Hans Kuyper, & Greetje van der Werf. (2012). Reciprocal relationships between math self-concept and math anxiety. *Learning and Individual Differences, 22*(3), 385-389.

Ahmet, A., & Kurbanoglu, I. N. (2011). The relationships between math anxiety, math attitudes, and self-efficacy: A structural equation model. *Studia Psychologica*, *53*(3), 263.

Allen, M.J. & Yen, W.M. (1979). Introduction to measurement theory. Pacific Grove, CA: Brooks/Cole.

Bandura, A. (2010). Math anxiety in female teachers may hinder math achievement in girls. *Proceedings Of The National Academy Of Sciences Of The United States Of America*, *107*(5), 1809-1810.

Bandura, A. (2006). Adolescent development from an agentic perspective. In F. Pajares & T. Urdan (Eds.), *Self-efficacy beliefs of adolescen*ts, *5*, 1-43. Greenwich, CT: Information Age Publishing.

Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. *Educational Psychologist*, *28*, 117-148.

Bandura, A. (1997). Self-efficacy. The exercise of control. New York, NY: W.H. Freeman and Company.

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

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

Bandura, A. (1994). Self-efficacy. In V. S. Ramachaudran (Ed.), Encyclopedia of human behavior. (pp. 71 - 81). New York: Academic Press.

Bandura, A. (2004). Swimming against the mainstream: The early years from chilly tributary to transformative mainstream. *Behavior and Research Therapy, 42*, 613 - 630.

Bandura, A., & Locke, E. A. (2003). Negative self-efficacy and goal effects revisited. *Journal of Applied Psychology*, *88*(1), 87-99. doi:10.1037/0021-9010.88.1.87

Barnette, J. (2000). Effects of stem and Likert response option reversals on survey internal consistency: if you feel the need, there is a better alternative to using negatively worded stems. *Educational and Psychological Measurement, 60*(3), 361-370.

Batchelder, J., & Rachal, J. R. (2000). Efficacy of a computer-assisted instruction program in a prison setting: An experimental study. *Adult Education Quarterly*, *50*(2), 120-133.

Beilock, S. L., Gunderson, E. A., Ramirez, G., & Levine, S. C. (2010). Female teachers' math anxiety affects girls' math achievement. PNAS Proceedings of; The National Academy Of Sciences Of The United States Of America, *107*(5), 1860-1863.

Benbow, C. P., & Stanley, J. C. (1982). Consequences in high school and college of sex differences in mathematical reasoning ability: A longitudinal perspective. *American Educational Research Journal*, *19*, 598-622.

Bentler, P., & de Leeuw, J. (2011). Factor analysis via components analysis. *Psychometrika, 76*(6), 461-470.

Betz, N. E., & Hackett, G. (2006). Career self-efficacy theory: Back to the future. *Journal of Career Assessment*, *14*(1), 3-11.

Blake, M. E., Masten, W. G., Henley, T. B., & Ball, S. E. (2015). Sources and Influence of Mathematics Self-Efficacy in Jamaican College Students. *Caribbean Journal of Psychology*, *7*(1).

Bluman, A. G. (2012). *Elementary statistics: A step by step approach*. McGraw-Hill. New York, NY.

Bolat, N., & Odacı, H. (2016). High School Final Year Students' Career Decision-Making Self-Efficacy, Attachment Styles and Gender Role Orientations. *Current Psychology*, 1-8.

Boaler, J., & Dweck, C. (2016). *Mathematical mindsets: Unleashing students' potential through creative math, inspiring messages, and innovative teaching*. San Francisco, CA: Jossey-Bass.

Bong, M. (1999). Personal factors affecting the generality of academic self-efficacy judgments: Gender, ethnicity, and relative expertise. *The Journal of Experimental Education*, *67*(4), 315-331.

Bong, M. (2001). Between-and within-domain relations of academic motivation among middle and high school students: Self-efficacy, task value, and achievement goals. *Journal of Educational Psychology*, *93*(1), 23.

Bong, M. (2001). Role of self-efficacy and task-value in predicting college students' course performance and future enrollment intentions. *Contemporary Educational Psychology*, *26*(4), 553-570.

Bong, M., & Skaalvik, E. M. (2003). Academic self-concept and self-efficacy: How different are they really? *Educational Psychology Review*, *15*(1), 1-40.

Carroll A, Gordon K, Haynes M, & Houghton S. (2013, March). Goal Setting and Self-Efficacy Among Delinquent, At-Risk and Not At-Risk Adolescents. *Journal of Youth & Adolescence* [serial online]. *42*(3): 431-443.

Chang, H., & Beilock, S. L. (2016). The math anxiety-math performance link and its relation to individual and environmental factors: A review of current behavioral and psychophysiological research. *Current Opinion in Behavioral Sciences*, 10, 33-38.

Chen, J. A., & Usher, E. L. (2013). Profiles of the sources of science self-efficacy. *Learning and Individual Differences*, *24*, 11-21.

Chen, P., & Zimmerman, B. (2007). A cross-national comparison study on the accuracy of self-efficacy beliefs of middle-school mathematics students. *The Journal of Experimental Education*, *75*(3), 221-244.

Chesmore, A. A., Ou, S. R., & Reynolds, A. J. (2016). Childhood placement in special Education and adult well-being. *The Journal of Special Education*, *22*(4), 122-146.

Choi, N., Fuqua, D. R., & Griffin, B. W. (2001). Exploratory analysis of the structure of scores from the multidimensional scales of perceived self-efficacy. *Educational and Psychological Measurement*, *61*(3), 475-489.

Coughlin, M.A. (2005). Applications of Intermediate/Advanced Statistics in Institutional Research. The Association for Institutional Research. Tallahasse, FL.

Christopher, P. P., Stein, M. D., Johnson, J. E., Rich, J. D., Friedmann, P. D., Clarke, J., & Lidz, C. W. (2016). Exploitation of Prisoners in Clinical Research: Perceptions of Study Participants. *IRB: Ethics & Human Research*, *38*(1), 7-12.

Cooper, C. L. (2015). Students at risk: The impacts of self-efficacy and risk factors on at-risk students. (Doctoral dissertation, University of Texas at Arlington).

Creswell, J. W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications. Thousand Oaks, CA.

Cullen, M. J., Waters, S. D., & Sackett, P. R. (2006). Testing stereotype threat: theory predictions for math-identified and non-math-identified students by gender. *Human Performance*, *19*(4), 421-440.

Davis, L. M., Steele, J. L., Bozick, R., Williams, M. V., Turner, S., Miles, J. N., & Steinberg, P. S. (2014). *How effective is correctional education, and where do we go from here? The results of a comprehensive evaluation*. Rand Corporation. Alexandria, VA.

Dong, Z. S., Zhang, D. J., & Zhang, J. H. (2013). Research on the relationship between resilience and mental health of prisoner. *Health Medicine Research and Practice*, 1, 112-115.

Dew, K. M. H., Galassi, J. P., & Galassi, M.D. (1984). Math anxiety: Relation with situational math anxiety, performance, physiological arousal, and math avoidance behavior. *Journal of Counseling Psychology*, *31*, 590-583.

Duwe, G., & Clark, V. (2013, April). *The effects of Minnesota prison-based educational programming on recidivism and employment*. Minnesota Department of Corrections.

Duwe, G. (2013, July). *What works with Minnesota prisoners: a summary of the effects of correctional programming on recidivism, employment, and cost avoidance*. Minnesota Department of Corrections.

Dweck, C.C. (2012). Implicit Theories. *Handbook of theories of social psychology*, *2*, pp.43-61 Thousand Oaks, CA.

Ernst, J., Bowen, B. D., & Williams, T. O. (2016). Freshman engineering students at-risk of non-matriculation: Self-Efficacy for academic learning. *American Journal of Engineering Education*, *7*(1), 9-18.

Fast, L. A., Lewis, J. L., Bryant, M. J., Bocian, K. A., Cardullo, R. A., Rettig, M., & Hammond, K. A. (2010). Does MSE mediate the effect of the perceived classroom environment on standardized math test performance? *Journal of Educational Psychology*, *102*(3), 729.

Ferla, J., Valcke, M., & Cai, Y. (2009). Academic self-efficacy and academic self-concept: Reconsidering structural relationships. *Learning and Individual Differences*, *19*(4), 499-505.

Forrest-Bank, S. S., & Jenson, J. M. (2015). The relationship among childhood risk and protective factors, racial micro aggression and ethnic identity, and academic self-efficacy and antisocial behavior in young adulthood. *Children and Youth Services Review*, 5064-5074.

Greenberg, E., Dunleavy, E., Kutner, M., & National Center for Education Statistics (ED), Washington, DC. (2007). *Literacy Behind Bars: Results from the 2003 National Assessment of Adult Literacy Prison Survey. NCES 2007-473*. National Center for Education Statistics. Available from: ED Pubs. P.O. Box 1398, Jessup, MD 20794-1398. Tel: 877-433-7827; Web site: http://nces.ed.gov/help/orderinfo.asp.

Greve, W., & Enzmann, D. (2003). Self-esteem maintenance among incarcerated young males: Stabilization through accommodative processes. *International Journal of Behavioral Development*, *27*(1), 12-20.

Greve, W., Enzmann, D., & Hosser, D. (2001). The stabilization of self-esteem among incarcerated adolescents: Accomodative and immunizing processes. *International Journal Of Offender Therapy And Comparative Criminology*, *45*(6), 749-768. doi:10.1177/0306624X01456008

Gomez, R. J., Ryan, T. N., Norton, C. L., Jones, C., & Galán-Cisneros, P. (2015). Perceptions of learned helplessness among emerging adults aging out of foster care. *Child and Adolescent Social Work Journal*, *32*(6), 507-516.

Gore, P. A. (2006). Academic self-efficacy as a predictor of college outcomes: Two incremental validity studies. *Journal of Career Assessment*, 14(1), 92-115.

Gore, P. A., & Leuwerke, W. C. (2000). Predicting occupational considerations: A comparison of self-efficacy beliefs, outcome expectations, and person-environment congruence. *Journal of Career Assessment*, *8*(3), 237-250.

Gottfredson, G. D. (1996). The Hawthorne misunderstanding (and how to get the Hawthorne effect in action research). *Journal of Research, In Crime & Delinquency*, *33*(1), 28-48.

Hall, J. M., & Ponton, M. K. (2005). Mathematics self-efficacy of college freshman. *Journal of Developmental Education*, *28*(3), 26.

Hendy, H. M., Schorschinsky, N., & Wade, B. (2014). Measurement of math beliefs and their associations with math behaviors in college students. *Psychological assessment*, *26*(4), 1225-1234.

Hesse-Biber, S. N., & Leavy, P. P. (2005). *The practice of qualitative research*. Thousand Oaks, CA: Sage.

Hoffman, B. (2010). "I think I can, but I'm afraid to try": The role of self-efficacy beliefs and mathematics anxiety in mathematics problem-solving efficiency. *Learning and Individual Differences*, *20*(3), 276-283.

Hoffman, B., & Schraw, G. (2009). The influence of self-efficacy and working memory capacity on problem-solving efficiency. *Learning and Individual Differences, 19*(1), 91-100.

Hogan, K. A. (2016). Understanding the relationships among students' goal orientations, self-efficacy, anxiety, and accelerated academic success in the redesign of developmental mathematics (Doctoral dissertation, Walden University).

Hollis-Sawyer, L. (2011). A math-related decrement stereotype threat reaction among older nontraditional college learners. *Educational Gerontology*, *37*(4), 292-306.

Honicke, T., & Broadbent, J. (2016). The influence of academic self-efficacy on academic performance: A systematic review. *Educational Research Review*, *17*, 63-84.

Huang, C. (2012). Discriminant and incremental validity of self-concept and academic self-efficacy: a meta-analysis. *Educational Psychology*, *32*(6), 777-805. doi:10.1080/01443410.2012.732386

Huang, C. (2013). Gender differences in academic self-efficacy: a meta-analysis. *European Journal of Psychology of Education*, *28*(1), 1-35.

Infante, A. (2016, January). Changes for the 2016 grades 3-8 English language arts and mathematics tests [open letter]. *Office of Instructional Support*. Retrieved from http://www.p12.nysed.gov/assessment/ei/2016/changes2016grades3-8ela-math-tests.pdf

Jansen, M., Scherer, R., & Schroeders, U. (2015). Students' self-concept and self-efficacy in the sciences: Differential relations to antecedents and educational outcomes. *Contemporary Educational Psychology*, *41*, 13-24.

Jameson, M. M., & Fusco, B. R. (2014). Math anxiety, math self-concept, and MSE in adult learners compared to traditional undergraduate students. *Adult Education Quarterly*, *64*(4), 306-322.

Johnson, I. Y., & Muse, W. B. (2016). Choice of Academic Major at a Public Research University: The Role of Gender and Self-Efficacy. *Research in Higher Education*, 1-30.

Johnson, P., & O'Keeffe, L. (2016). The effect of a pre-university mathematics bridging course on adult learners' self-efficacy and retention rates in STEM subjects. *Irish Educational Studies*, 1-16.

Kahneman, D., Tursky, B., Shapiro, D., & Crider, A. (1969). Pupillary, heart rate, and skin resistance changes during a mental task. *Journal Of Experimental Psychology*, *79*(1), 164-167.

Kitsantas, A., Cheema, J., & Ware, H. W. (2011). Mathematics achievement: The role of homework and self-efficacy beliefs. *Journal of Advanced Academics*, *22*(2), 310-339.

Klevan, S., Weinberg, S., & Middleton, J. (2016). Why the boys are missing: Using social capital to explain gender differences in college enrollment for public high school students. *Research In Higher Education*, *57*(2), 223-257. doi:10.1007/s11162-015-9384-9.

Kranzler, J. H., & Pajares, F. (1997). An Exploratory factor analysis of the mathematics self-efficacy scale revised (MSES-R). *Measurement and Evaluation in Counseling and Development*, *29*(4), 215-28.

Kroner, D. G., & Loza, W. (2001). Evidence for the efficacy of self-report in predicting nonviolent and violent criminal recidivism. *Journal of Interpersonal Violence*, *16*(2), 168-177.

Kortering, L. J., Braziel, P. M., & Tompkins, J. R. (2002). The challenge of school completion among youths with behavioral disorders: Another side of the story. *Behavioral Disorders*, *27*(2), 142-154.

Laferrière, D., & Morselli, C. (2015). Criminal achievement and self-efficacy. *Journal of Research in Crime and Delinquency*, *52*(6), 856-889.

Lamont R, Swift H, & Abrams D. (2015). A review and meta-analysis of age-based stereotype threat: Negative stereotypes, not facts, do the damage. *Psychology and Aging* [serial online]. *30*(1):180-193.

Larnell, G. V., Boston, D., & Bragelman, J. (2014). The stuff of stereotypes: toward unpacking identity threats amid African-American students' learning experiences. *Journal of Education*, *194*(1), 49-57.

Larson, L. M., Pesch, K. M., Surapaneni, S., Bonitz, V. S., Wu, T. F., & Werbel, J. D. (2015). Predicting graduation; the role of mathematics/science self-efficacy. *Journal of Career Assessment*, *23*(3), 399-409.

Larwin, K. (2014, February 01). Statistics Related Self-Efficacy A Confirmatory Factor Analysis Demonstrating a Significant Link to Prior Mathematics Experiences for Graduate Level Students. *Mathematics Education Trends and Research, 2014,* 1-18.

Lee, J. (2009). Universals and specifics of math self-concept, MSE, and math anxiety across 41 PISA 2003 participating countries. *Learning and Individual Differences*, *19*(3), 355-365.

Lee, W., Lee, M. J., & Bong, M. (2014). Testing interest and self-efficacy as predictors of academic self-regulation and achievement. *Contemporary Educational Psychology*, *39*(2), 86-99.

Liew, J., Lench, H. C., Kao, G., Yeh, Y., & Kwok, O. (2014). Avoidance temperament and social-evaluative threat in college students' math performance: A mediation model of math and test anxiety. *Anxiety, Stress & Coping: An International Journal, 27*(6), 650-661.

Linder, S. M., Smart, J. B., & Cribbs, J. (2015). A Multi-Method Investigation of Mathematics Motivation for Elementary Age Students. *School Science & Mathematics*, *115*(8), 392-403.

Lopez, F. G., & Lent, R. W. (1992). Sources of mathematics self-efficacy in high school students. *Career Development Quarterly*, *41*(1), 3.

Löve, J., Moore, C., & Hensing, G. (2011). Validation of the Swedish translation of the general self-efficacy scale. *Quality of Life Research*, 1-5.

Minnesota Rules (2007), Graduation Standards, *Department of Education*, Chapter 3501.0250 Subp. 7A. Retrieved from: https://www.revisor.mn.gov/rules/?id=3501&date=2007

Multon, K., & Brown, S. (1991). Relation of self-efficacy beliefs to academic outcomes: A meta-analytic investigation. *Journal of Counseling Psychology*, *38*(1), 30-39.

Morgan, M., & Kett, M. (2003). The prison adult literacy survey. *Results and Implications*, Dublin, Ireland: Irish Prison Service.

National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research. (1978). *The Belmont report: Ethical principles and guidelines for the protection of human subjects of research*. Bethesda, MD: The Commission.

National Research Council. (2014). The Growth of Incarceration in the United States: Exploring Causes and Consequences. Committee on Causes and Consequences of High Rates of Incarceration. Committee on Law and Justice, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

Neuman, W. L. (2003*). Social research methods qualitative and quantitative approaches* (5th ed.). Boston, MA: Allyn & Bacon.

Nielsen, I. L., & Moore, K. A. (2003). Psychometric data on the mathematics self-efficacy scale. *Educational and Psychological Measuremen*t, *63*(1), 128-138.

Nunnally, J.C., & Bernstein, I.H. (1994). Psychometric theory (3rd ed.). New York, NY: McGraw-Hill.

Nyangeni, N. P., & Glencross, M. J. (1997). Sex differences in mathematics achievement and attitude toward mathematics. *Psychological Reports*, *80*, 603-8.

Ozgen, K., & Bindaka, R. (2011). Determination of self-efficacy beliefs of high school students towards math literacy. *Educational Sciences: Theory And Practice*, *11*(2), 1085-1089.

Ozyurek, R. (2010). The Reliability and Validity of the Mathematics Self-Efficacy Informative Sources Scale. *Educational Sciences: Theory and Practice*, *10*(1), 439-447.

Pajares, F. (1997). Current directions in self-efficacy research. Advances in motivation and achievement, *The Journal of Experimental Education*, *10*(149), 1-49.

Pajares, F. (2005). Gender differences in mathematics self-efficacy beliefs. Gender differences in mathematics: An integrative psychological approach. *The Journal of Experimental Education, 21*(4), 294-315.

Pajares, F., & Miller, M. D. (1997). Mathematics self-efficacy and mathematical problem solving: Implications of using different forms of assessment. *The Journal of Experimental Education*, *65*(3), 213-228.

Pajares, F., & Schunk, D. H. (2001). Self-beliefs and school success: Self-efficacy, self-concept, and school achievement. *Perception*, *11*, 239-266.

Parker, P. D., Marsh, H. W., Ciarrochi, J., Marshall, S., & Abduljabbar, A. S. (2014). Juxtaposing MSE and self-concept as predictors of long-term achievement outcomes. *Educational Psychology*, *34*(1), 29-48.

Peker, M. (2016). Mathematics teaching anxiety and self-efficacy beliefs toward mathematics teaching: A path analysis. *Educational Research and Reviews*, *11*(3), 97-104.

Perry, C. (2014). Vocational and educational programs: Impacts on recidivism. Boston, MA: Harvard University Press.

Peters, M. L. (2013). Examining the relationships among classroom climate, self-efficacy, and achievement in undergraduate mathematics: A multi-level analysis. *International Journal of Science and Mathematics Education*, *11*(2), 459-480.

Porter, S. & Carter, DE (2000). Common terms and concepts in research. In Cormack, D. (Ed.) *The Research Process in Nursing* (4th Ed.). Oxford, London: Blackwell Science. 17-28.

Rampey, B.D., Keiper, S., Mohadjer, L., Krenzke, T., Li, J., Thornton, N., & Hogan, J. (2016). Highlights from the U.S. PIAAC Survey of Incarcerated Adults: Their Skills, Work Experience, Education, and Training: Program for the International Assessment of Adult Competencies: 2014 (NCES 2016-040). U.S. Department of Education. Washington, DC: *National Center for Education Statistics*. Retrieved from http://nces.ed.gov/pubsearch.

Ramdass, D. & Zimmerman, B.J., (2011). The effects of modeling and social feedback on middle school students' math performance and accuracy judgments. *International Journal of Educational and Psychological Assessment*, *7*(1), 4-23.

Ramirez, G., Gunderson, E.A., Levine, S.C., & Beilock, S.L. (2013). Math anxiety, working memory, and math achievement in early elementary school. *Journal of Cognition and Development*, *14*, 187-202.

Rosen, D. L., Grodensky, C. A., & Holley, T. K. (2016). Federally-Assisted Healthcare Coverage among Male State Prisoners with Chronic Health Problems. *Plos ONE, 11*(8), 1-11.

Roth, B. B., Asbjørnsen, A., & Manger, T. (2016). The Relationship between Prisoners' Academic Self-Efficacy and Participation in Education, Previous Convictions, Sentence Length, and Portion of Sentence Served. *Journal Of Prison Education And Reentry*, *3*(2), 106-121.

Sax, L. J., Kanny, M. A., Riggers-Piehl, T. A., Whang, H., & Paulson, L. N. (2015). "But I'm Not Good at Math": The Changing Salience of Mathematical Self-Concept in Shaping Women's and Men's STEM Aspirations. *Research in Higher Education*, *56*(8), 813-842.

Schnell, K., Ringeisen, T., Raufelder, D., & Rohrmann, S. (2015). The impact of adolescents' self-efficacy and self-regulated goal attainment processes on school performance—Do gender and test anxiety matter? *Learning and Individual Differences*, *38*, 90-98.

Schlomer, G. L., Bauman, S., & Card, N. A. (2010). Best practices for missing data management in counseling psychology. *Journal of Counseling Psychology, 57*(1), 1-10.

Scholz, U., Dona, B.G., Sud, S., & Schwarzer, R. (2002). Is general self-efficacy a universal construct? Psychometric findings from 25 countries. *European Journal of Psychological Assessment*, *18*(3), 242-251.

Schunk, D. H., & DiBenedetto, M. K. (2016). Self-efficacy theory in education, *Handbook of Motivation at School*, 34-54.

Schunk, D. H., & Miller, S. D. (2002). Self-efficacy and adolescents' motivation. *Academic Motivation of Adolescents*, 2, 29-52.

Schunk, D. H., & Pajares, F. (2009). Self-efficacy theory. Handbook of motivation at school, 35-53.

Seitchik, A. E., & Harkins, S. G. (2015). Stereotype threat, mental arithmetic, and the mere effort account. *Journal of Experimental Social Psychology*, 6119-30. doi:10.1016/j.jesp.2015.06.006

Skaalvik, E. M., Federici, R. A., & Klassen, R. M. (2015). Mathematics achievement and self-efficacy: Relations with motivation for mathematics. *International Journal of Educational Research*, *72*, 129-136.

Smith, M. E., McEvoy, L. K., & Gevins, A. (1999). Neurophysiological indices of strategy development and skill acquisition. *Cognitive Brain Research*, *7*(3), 389-404

Smith, M. C., Sheehan-Holt, J. K., National Center for Education Statistics & Educational Resources Information Center (U.S.). (2000). *Evaluation of the 1992 NALS background survey questionnaire: An analysis of uses with recommendations for revisions*. Washington, DC: The Center.

Sumner, P. L. (2015). Developmental mathematics classrooms: Learning environment, academic self-efficacy, and gender (Doctoral dissertation, Morgan State University).

Stankov, L., Lee, J., Luo, W., & Hogan, D. J. (2012). Confidence: A better predictor of academic achievement than self-efficacy, self-concept and anxiety? Learning and Individual Differences, *22*(6), 747-758.

Suinn, R. M., Edie, C. A., & Spinelli, P. R. (1970). Accelerated massed desensitization: Innovation in short-term treatment. *Behavior Therapy*, 1, 303-311.

Suinn, R. M., Edie, C. A., Nicoletti, J., & Spinelli, P. R. (1972). The MARS, a measure of mathematics anxiety: Psychometric data. *Journal of Clinical Psychology*, 2, 498-510.

Suinn, R. M., & Richardson, F. C. (1971). Anxiety management training: Nonspecific behavior therapy control. *Behavior Therapy*, 2, 498-519. Sproull, N. D. (2004). Handbook of

research methods: A guide for practitioners in students in the social sciences (3rd Ed.). Newark, NJ: The Scarecrow Press.

Toland, M. D., & Usher, E. L. (2015). Assessing Mathematics Self-Efficacy: How Many Categories Do We Really Need? *The Journal of Early Adolescence*, 072-431.

Toland, M. D., & Usher, E. L. (2016). Assessing Mathematics Self-Efficacy. Journal of Early Adolescence, *36*(7), 932-960.

Tuominen-Soini, H., Salmela-Aro, K., & Niemivirta, M. (2012). Achievement goal orientations and academic well-being across the transition to upper secondary education. *Learning and Individual Differences*, *22*(3), 290-305.

Usher, E. L., & Pajares, F. (2008). Sources of self-efficacy in school: Critical review of the literature and future directions. Review of educational research, *78*(4), 751-796.

Usher, E. L., & Pajares, F. (2009). Sources of self-efficacy in mathematics: A validation study. *Contemporary Educational Psychology*, *34*(1), 89-101.

Valås, H. (2001). Learned helplessness and psychological adjustment: Effects of age, gender and academic achievement. Scandinavian Journal of Educational Research, *45*(1), 71-90.

Vantieghem, W., & Van Houtte, M. (2015). Are girls more resilient to gender-conformity pressure? The association between gender-conformity pressure and academic self-efficacy. *Sex Roles*, *73*(1), 1-15.

Wei, T. E. (2012). Sticks, stones, words, and broken bones: New field and lab evidence on stereotype threat. *Educational Evaluation and Policy Analysis*, *34*(4), 465-488.

Widmen, C. C., & Chavez, A. (1982). Math anxiety and elementary school. *Education*, *102*(3), 272.

Wiederkehr, V., Darnon, C., Chazal, S., Guimond, S., & Martinot, D. (2015). From social class to self-efficacy: internalization of low social status pupils' school performance. *Social Psychology of Education*, *18*(4), 769-784.

Wilson, S. A. (2015). 'Fail at maths and you fail at life': Learned barriers to equal opportunities. In J. Merrick, J. Merrick (Eds.), Public health yearbook 2014 (pp. 167-183). Hauppauge, NY: Nova Science Publisher.

Wisconsin Department of Corrections. *Offender Locator*. http://offender.doc.state.wi.us/lop/home.do.

Wood, J. L., Newman, C. B., & Harris III, F. (2015). Self-Efficacy as a Determinant of Academic Integration: An Examination of First-Year Black Males in the Community College. *Western Journal of Black Studies, 39*(1), 3.

Zajacova, A., Lynch, S. M., & Espenshade, T. J. (2005). Self-efficacy, stress, and academic success in college. *Research in higher education, 46*(6), 677-706.

Zeidner, M. (2007). Test anxiety in educational contexts: Concepts, findings, and future directions. In P. A. Schutz, R. Pekrun, P. A. Schutz, R. Pekrun (Eds.), *Emotion in education* (pp. 165-184). San Diego, CA: Elsevier Academic Press.

Zeldin, A. L., Britner, S. L., & Pajares, F. (2008). A comparative study of the self-efficacy beliefs of successful men and women in mathematics, science, and technology careers. *Journal of Research in Science Teaching, 45*(9), 1036-1058.

Zeldin, A. L., & Pajares, F. (2000). Against the Odds: Self-Efficacy Beliefs of Women in Mathematical, Scientific, and Technological Careers. *American Educational Research Journal*, *37*(1), 215-246.

Zettle, R. D., & Raines, S. J. (2000). The relationship of trait and test anxiety with mathematics anxiety. *College Student Journal*, *34*(2), 246.

Zimmerman, B. J. (2008). Investigating self-regulation and motivation: Historical background, methodological developments, and future prospects. *American Educational Research Journal*, *45*(1), 166-183.

Zimmerman, B. J. (2000). Self-efficacy: An essential motive to learn. *Contemporary Educational Psychology*, *25*(1), 82-91.

Zimmerman, B. J., & Kitsantas, A. (2005). Homework practices and academic achievement: The mediating role of self-efficacy and perceived responsibility beliefs. *Contemporary Educational Psychology*, *30*(4), 397-417.

Zimmerman, B. J. C., & Timothy J. (2006). Adolescents' Development of Personal Agency. In F. Pajares & T. C. Urdan (Eds.), Adolescence and education (Vol. Self-efficacy beliefs of adolescents, pp. xii, 367 p.). Greenwich, Conn.: IAP - Information Age Pub., Inc.

Appendix A: Invitation Letter to WI DOC Staff & Students

WISCONSIN DOC ADULT BASIC EDUCATION TEACHERS & STUDENTS

INVITATION TO PARTICIPATE IN EDUCATIONAL RESEARCH ON PRISONER MATH SELF-EFFICACY

There are very few studies in adult basic education that samples adult male prisoners. There are many good reasons for this fact. One reason is that prisoners are a *protected class* of people, which makes it more difficult to get all the permissions necessary to conduct a study. For my doctorate dissertation, however, adult male prisoners are precisely the population I hope to research. As a former Wisconsin math teacher, I want to learn more about any barriers male students experience to learning math, taking math tests, and to earning their high school diploma or GED.

In order to participate in this study, inmates must give their written consent, complete a survey, and grant their permission for me to research their prior educational histories and test scores. Consent must be granted and submitted first, before any inmate can take the survey. Participants can withdraw their consent and/or survey answers at any time during this research project up to June 1, 2017.

This study asks adult male inmates, who do not currently possess a high school diploma or GED, to complete a 30-item survey of their math self-efficacy. A math self-efficacy survey is

simply an attempt to calculate the positive or negative thoughts and any stressors that may help or hinder a person to do math.

Given inmate consent to research; former math scores, grades, and overall school achievements with their math self-efficacy surveys, as a researcher, I can learn and report about these relationships. I intend for this study to help improve future math instruction by understanding these unique relationships between adult male inmate thoughts about math, stressors related to math, and how their academic achievement may be effected by these things.

I humbly ask for your time, cooperation, and participation in this research project. I realize that without your help this study is not possible. I thank you for your interest, consideration, and any additional assistance you provide me with this research request.

SINCERELY,

RANDALL BERGMAN

BETHEL UNIVERSITY

Appendix B: Informed Consent

Informed Consent for Participation in
Doctorate Dissertation Research Study

You are invited to participate of your own free choice in a study of the effects of Math Self-Efficacy on prisoner academic achievement. Math Self-Efficacy is simply your thoughts and stressors that may keep you from learning math and/or performing on a math test as well as you could.

You were selected as a possible participant in this study because you have not earned your high school diploma/GED and are enrolled in Adult Basic Education (ABE) within the WI Department of Corrections. My research study is a partial requirement of the Doctoral in Education program at Bethel University in St. Paul, Minnesota. My intention is to learn from your math self-efficacy study and prior educational data how they might relate to one another. I will need your consent to access your educational history that includes prior test scores.

If you choose to participate by giving your written consent on this form to WI DOC staff, you will be asked to complete a thirty question survey about your attitudes, beliefs and anxieties pertaining to your experiences learning and doing mathematics. The survey will take approximately ten to thirty minutes to complete. Your consent form and survey will be sent to the Wisconsin DOC Research and Policy Department by June 1, 2017 at no cost to you.

I am asking for your name and prisoner identification number that I will scramble and use simply for corroborating your identity with other academic related information for statistical analysis. Any information obtained in connection with this study that can be identified with you will remain confidential and disclosed. If there are any reports or publications from this study, no names or numbers will be identified or decodable. Only statistical data will be presented. No names or identification numbers will be used. I will shred your survey at the end of this study.

There are four research questions for this study that I am trying to answer:

1. To what extent do all three sources (attitudes, beliefs, and anxieties) of mathematics self-efficacy correlate with adult male prisoner's mathematics achievement scores?
2. To what extent do all three sources (attitudes, beliefs, and anxieties) of mathematics self-efficacy correlate with adult male prisoner's K-12 education achievement goals?
3. Which source (attitudes, beliefs, or anxieties) of mathematics self-efficacy has the strongest influence with respect to adult male prisoner's mathematics achievement scores?
4. Which source (attitudes, beliefs, or anxieties) of mathematics self-efficacy has the strongest influence with respect to overall goal achievement for adult male prisoners enrolled in adult basic education?

Your decision whether or not to participate will not affect your relationship with the Department of Corrections, Bethel University, or myself. If you decide to participate, you are free to discontinue participation at any point in this study, without affecting such relationships. Participation does have the following risks and/or potential discomforts; an evasion of privacy in your educational history and future goal attainment(s), loss of time, risk of loss of identity, feelings of embarrassment, frustration, remorse, and/or a possible development of false beliefs.

This research project has been reviewed and approved in accordance with the Wisconsin Department of Correction's Review Board for Research with Offenders, Bethel University Institution's Review for Research Board, and approved by the Wisconsin Department of Correction's Administration. If you have any questions about this research project and/or research participants' rights or wish to report a research related issue, you may contact me, Randall Bergman at 320-240-3062 or my dissertation advisor, Dr. Michael Lindstrom at (612) 209-1739 or write to the Wisconsin Department of Corrections Office of the Secretary.

You are making a choice of your own free will whether or not to participate. Your signature indicates that you have read (or been read to) the information provided and chose to participate knowing the possible risks of participation. You may withdraw at any time without prejudice after signing this form should you discontinue participation in this study. By signing this consent form you also are releasing your consent to Principal Researcher Randall Bergman in compliance with the Family Educational Rights and Privacy Act of 1974 (FERPA) to access your educational records through the Wisconsin Department of Public Instruction records database system. You will be offered a copy of this form to keep for your own records. Thank you for your participation in this study.

_____	_____	_____
Identification Number	Participant Signature	Date

Appendix C: Adapted Math Self-Efficacy Survey

***Math Self-Efficacy Survey**

* *Adapted from for Adult Basic Education Students (Betz & Hackett, 1989; Hendy, Schorschinsky, Wade, 2014)*

Circle: 1-strongly disagrees, 2-mildly disagrees, 3-neutral, 4-mildly agrees, 5-strongly agrees, or N/A-No Answer

Question 1: Being good at math will help me have more career options.	1	2	3	4	5	N/A
Question 2 Getting good grades in math will help me get a good job.	1	2	3	4	5	N/A
Question 3 Math is easy for me, I am confident I'll do well in math class.	1	2	3	4	5	N/A
Question 4 I can practice math problems by myself until I understand.	1	2	3	4	5	N/A
Question 5 If I get a bad grade on a math test, I know I can do better the next time with more practice.	1	2	3	4	5	N/A
Question 6 I can get a good grade in math, even if I skip class.	1	2	3	4	5	N/A
Question 7 I can get a good grade in math even if I don't do the assignments.	1	2	3	4	5	N/A
Question 8 I am confident I will eventually be able to do a math problem .	1	2	3	4	5	N/A
Question 9 How good my math teacher is effects how well I do in class.	1	2	3	4	5	N/A
Question 10 I do NOT get easily distracted while doing math.	1	2	3	4	5	N/A
Question 11 To get a good job, I must learn more math skills as an adult.	1	2	3	4	5	N/A
Question 12 Coming to math class is important; I can ask questions, if confused.	1	2	3	4	5	N/A
Question 13 Getting good grades and passing math classes, relates to how much money I can make later in life.	1	2	3	4	5	N/A
Question 14 I am confident that I can learn math skills that are job related.	1	2	3	4	5	N/A
Question 15 I am confident I am able to pass the GED math exam.	1	2	3	4	5	N/A
Question 16 My elementary school teachers told me I am good at math.	1	2	3	4	5	N/A
Question 17 Other students have told me I am good at math.	1	2	3	4	5	N/A
Question 18 My parent(s) told me that I am good at math.	1	2	3	4	5	N/A
Question 19 I can concentrate on math problems for long periods of time.	1	2	3	4	5	N/A
Question 20 When I do math problems, I get frustrated and angry.	1	2	3	4	5	N/A
Question 21 When I do math problems, I feel stupid.	1	2	3	4	5	N/A
Question 22 When I do math problems, I feel nervous. And don't do well	1	2	3	4	5	N/A
Question 23 When I am taking a math exam, I forget everything that I have practiced.	1	2	3	4	5	N/A
Question 24 When I get confused about something in math, I feel tense and have trouble breathing.	1	2	3	4	5	N/A
Question 25 Given permission to use a calculator, I do much better on math tests.	1	2	3	4	5	N/A
Question 26 I can change my ability to do math by working harder.	1	2	3	4	5	N/A
Question 27 The percent correct on a test is a good measure of math ability.	1	2	3	4	5	N/A
Question 28 How fast I can get an answer is a good measure of math ability.	1	2	3	4	5	N/A
Question 29 The ability to memorize determines how well you do on a math test.	1	2	3	4	5	N/A
Question 30 Getting an answer on the calculator isn't really doing math.	1	2	3	4	5	N/A

OID: _____ Name: _____ Date Taken: _____

***Prisoner Math Self-Efficacy Survey**

** Adapted from for Adult Basic Education Students (Betz & Hackett, 1989; Hendy, Schorschinsky, Wade, 2014)*

Please feel free to write to this researcher anything else about your math experiences, attitudes, beliefs, and/or anxieties that you'd like to have recorded for this study on this page before returning the survey in the envelope provided in the prison mail system at no cost by June1, 2017:

OID: _____ Name: _____ Date Submitted: _____

Appendix D: Adapted Math Self-Efficacy Scoring Rubric

Categorical Scoring Rubric:

Math Self-Efficacy Belief Questions (*Math Value Scale*)

10 Questions: (1, 2, 7, 9, 11, 12, 13, 14, 27, 30) _____out of 50

Math Classwork Devaluation (6-items): 1, 2, 9, 12, 27, & 30

*No Future Value (4-items): 7, 11, 13, & 1*4

Math Self-Efficacy Attitude Questions (*Math Confidence Scale*)

10 Questions: (3, 4, 5, 6, 8, 15, 25, 26, 28, 29) _____out of 50

Math Self-Efficacy Anxiety (*Math Barriers Scale*)

10 Questions: (10, 16, 17, 18, 19, 20*, 21*, 22*, 23*, 24*) _____out of 50

Math Anxiety Questions (7-items): 10, 19, 20, 21*, 22*, 23*, 24**

Encouraging/Discouraging Words Questions (3-items): 16, 17*, & 18**

**Reverse the ratings for items 20-24 (1=5, 2=4, 3=3, 4=2, 5=1)*

Math Literacy Self-Efficacy Composite Score: _____ out of 150

Appendix E: WI DOC Research Review Committee Approval

Scott Walker
Governor

Jon E. Litscher
Secretary

State of Wisconsin
Department of Corrections

Mailing Address

3099 E. Washington Ave
Post Office Box 7925
Madison, WI 53707-7925
Telephone (608) 240-5000
Fax (608) 240-3300

October 6, 2016

Randall Bergman
3900 Bethel Dr
St Paul, MN 55112

Dear Mr Bergman:

The Department of Corrections Research Review Committee (RRC) has reviewed and approved your request entitled *Effects of Math Self-Efficacy on Prisoner Academic Performance*. This request is approved contingent upon the following conditions:

- Approval must be obtained by the Institutional Review Board at Bethel University and a copy of the approval letter from that institution must be submitted to the RRC before data collection may begin.
- All information collected will be maintained confidential, with no offender or staff identifying information presented in any form or manner in subsequent publications or reports.
- Updates on research progress will be submitted to the RRC every six months while the study is being conducted.
- A draft of the study results will be submitted to the RRC prior to any formal publication.

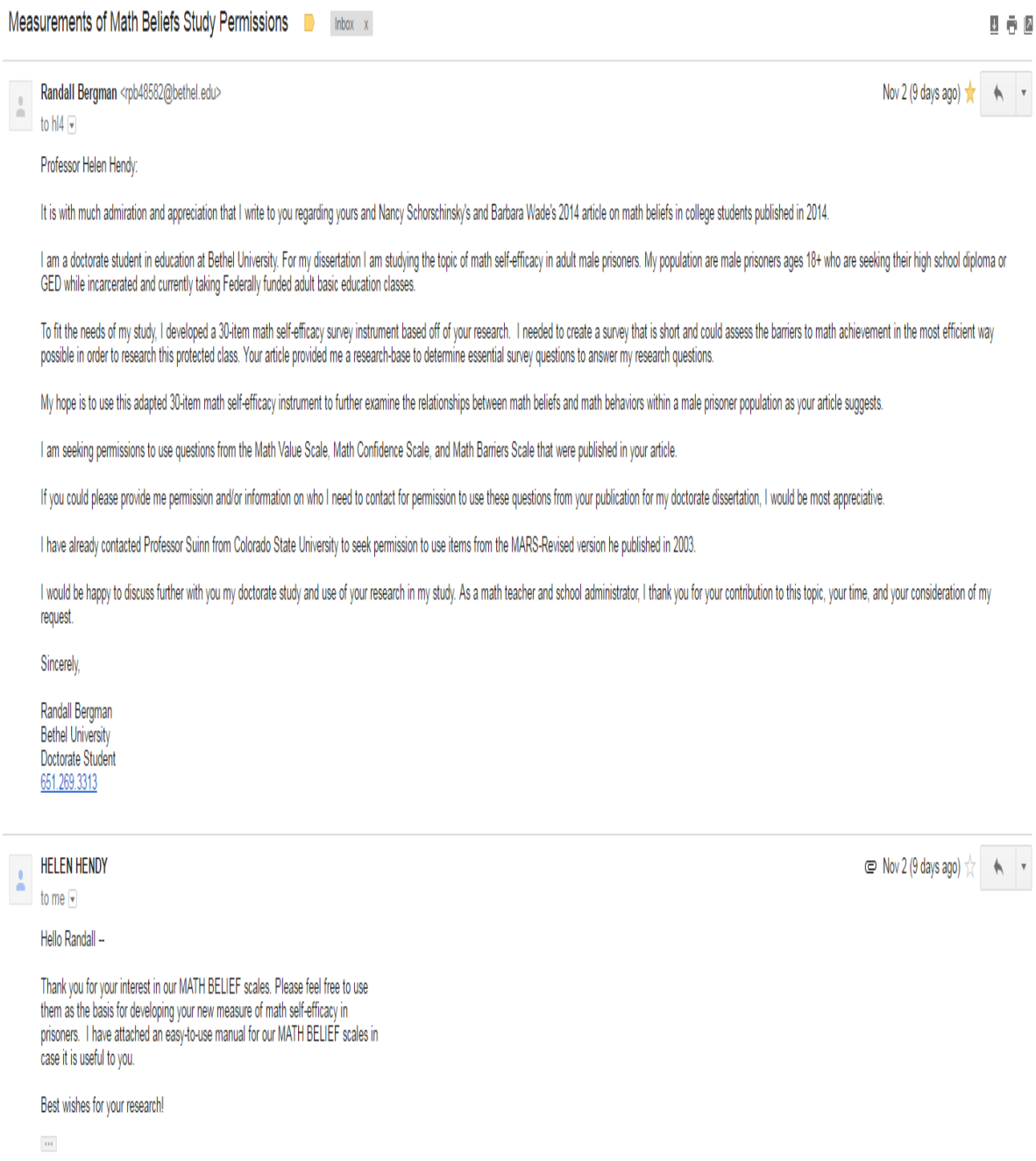
Please feel free to contact me at (608) 240-5814 or Joseph.Tatar@wisconsin.gov if you have any further questions or concerns.

Sincerely,

Joseph R. Tatar II, Ph.D
Chair- Research Review Committee

cc Marc Clements, Assistant Administrator- DAI
Autumn Lacy, Director of Program Services- DAI
Megan Jones, Director of Research- OOS
Dawn Woeshnick- RRC
Bruce Siedschlag- RRC
Kelsey Hall- RRC
Olivia Butler- RRC
Judy Foss- RRC
Maluda Fessahaye, Assistant Legal Counsel- OOS
Linda Eggert, Privacy Officer- DMS
Gloria Marquardt, HIPAA Compliance Officer- DAI

Appendix F: Permission to Use MVS, MCS, & MBS Scales



Measurements of Math Beliefs Study Permissions Inbox x

Randall Bergman <rpb48582@bethel.edu> Nov 2 (9 days ago)

to hl4

Professor Helen Hendy:

It is with much admiration and appreciation that I write to you regarding yours and Nancy Schorschinsky's and Barbara Wade's 2014 article on math beliefs in college students published in 2014.

I am a doctorate student in education at Bethel University. For my dissertation I am studying the topic of math self-efficacy in adult male prisoners. My population are male prisoners ages 18+ who are seeking their high school diploma or GED while incarcerated and currently taking Federally funded adult basic education classes.

To fit the needs of my study, I developed a 30-item math self-efficacy survey instrument based off of your research. I needed to create a survey that is short and could assess the barriers to math achievement in the most efficient way possible in order to research this protected class. Your article provided me a research-base to determine essential survey questions to answer my research questions.

My hope is to use this adapted 30-item math self-efficacy instrument to further examine the relationships between math beliefs and math behaviors within a male prisoner population as your article suggests.

I am seeking permissions to use questions from the Math Value Scale, Math Confidence Scale, and Math Barriers Scale that were published in your article.

If you could please provide me permission and/or information on who I need to contact for permission to use these questions from your publication for my doctorate dissertation, I would be most appreciative.

I have already contacted Professor Suinn from Colorado State University to seek permission to use items from the MARS-Revised version he published in 2003.

I would be happy to discuss further with you my doctorate study and use of your research in my study. As a math teacher and school administrator, I thank you for your contribution to this topic, your time, and your consideration of my request.

Sincerely,

Randall Bergman
Bethel University
Doctorate Student
651.269.3313

HELEN HENDY Nov 2 (9 days ago)

to me

Hello Randall --

Thank you for your interest in our MATH BELIEF scales. Please feel free to use them as the basis for developing your new measure of math self-efficacy in prisoners. I have attached an easy-to-use manual for our MATH BELIEF scales in case it is useful to you.

Best wishes for your research!

Appendix G: Department of Public Instruction Approval

WISCONSIN DEPARTMENT OF PUBLIC INSTRUCTION

Tony Evers, PhD, State Superintendent

March 8, 2017

Bethel University
Institutional Review Board
3900 Bethel Drive
PO2322
St. Paul, MN 55112

Re: Project SP-03-17 Math self-efficacy effects on prisoner academic performance

To Whom It May Concern:

Randall Bergman has informed the Wisconsin Department of Public Instruction that he wishes to use data from prisoner TABE scores and other educational data for his Ph.D study. It is our understanding that all data he wishes to access is actually housed at, and is the property of, the Wisconsin Department of Corrections. The DOC has granted Mr. Bergman permission to use their data. DOC is aware of its obligations under FERPA with respect to pupil data. Given that, DPI has no legal interest in the data and therefore does not need to approve Mr. Bergman's access.

If Mr. Bergman's needs change, DPI will evaluate any new requests at that time. Any questions, do not hesitate to contact me.

Sincerely,

Laura M. Varriale

Laura M. Varriale
Attorney
(608) 266-9353
Laura.Varriale@dpi.wi.gov

PO Box 7841, Madison, WI 53707-7841 ■ 125 South Webster Street, Madison, WI 53703
(608) 266-3390 ■ (800) 441-4563 toll free ■ dpi.wi.gov

Appendix H: Bethel University Review Board Approval

BETHEL
UNIVERSITY

Institutional Review Board
3900 Bethel Drive
PO2322
St. Paul, MN 55112

March 4, 2017

Randall Bergman
Bethel University
St. Paul, MN 55112

Re: Project SP-03-17 Math self-efficacy effects on prisoner academic performance

Dear Randall

On March 4, 2017, the Bethel University Institutional Review Board completed the review of your proposed study and approved the above referenced study.

Please note that this approval is limited to the project as described on the most recent Human Subjects Review Form, including email correspondence. Also, please be reminded that it is the responsibility of the investigator(s) to bring to the attention of the IRB any proposed changes in the project or activity plans, and to report to the IRB any unanticipated problems that may affect the welfare of human subjects. Last, the approval is valid until March 3, 2018.

Sincerely,

Peter Jankowski, Ph.D.
Chair, Bethel University IRB
IRB00008567
FWA00018734