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Spawning Failure - the Lived Experience of Elementary Teachers  
Who Contend with Low Mathematics Self-Efficacy: A  
Phenomenological Study

John C. Griffin

SPAWNING FAILURE – THE LIVED EXPERIENCE OF ELEMENTARY  
TEACHERS WHO CONTEND WITH LOW MATHEMATICS  
SELF-EFFICACY:  
A PHENOMENOLOGICAL STUDY

DISSERTATION

Presented in Partial Fulfillment of the Requirements for  
the Degree of Doctor of Philosophy in  
Leadership and Education in  
The Adrian Dominican School of Education of  
Barry University

By

John C. Griffin, B.S.E., M.S.Ed.

\* \* \* \* \*

Barry University

2004

Area of Specialization: Leadership

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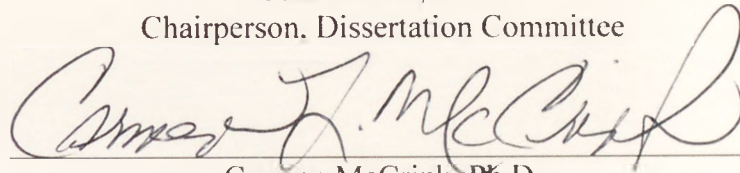
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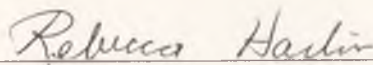
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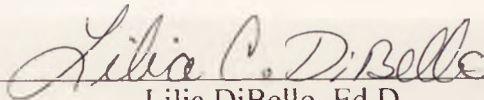
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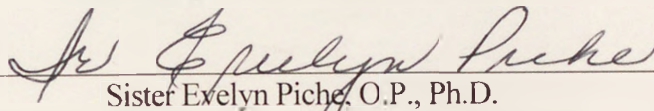
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## ACKNOWLEDGMENTS

First, I would like to thank the eight women who agreed to take part in this study. Each of them honored me with their stories, with their candor and with their tears. Without your participation this study would simply not have been possible. Our children are fortunate to have courageous teachers like you in their lives. May God bless you all.

The chair of my committee, Dr. Toni Powell, was a perpetual source of wise counsel, astute advice and professional guidance. Dr. Powell is the personification of excellence. Thank you so much for believing in me and supporting me in pursuit of a dream.

The members of my committee were extraordinary, especially Dr. Lilia DiBello, whose editorial support was simply spectacular. She devoted, no doubt, many hours to reading each page of my dissertation meticulously. This was no small feat and enabled me to transform a good dissertation into a superb one. Thank-you, Dr. DiBello; you are the quintessential professional educator.

The road to completion of my Ph.D. was six years long. Along the way I was supported by friends and family who encouraged me not only to persevere but to excel. Dr. Eric Shane, a fellow graduate student who shared the struggles of doctoral study with me for several years, provided the motivational spark when I needed it the most. Eric refused to allow me to become mired in that purgatory named "ABD." Eric, thanks for your friendship; you're the absolute best.

Sometimes life is just plain hard. For years I struggled with similar feelings of low self-efficacy as those described in this dissertation. These feelings and beliefs had woven together to form a dense forest that was difficult to escape alone. I have slowly,

but surely, walked out of this forest with the love, support, understanding and compassion of Dr. Julio Calderon. It has been said that the supposed imperfections in our lives that we lament are merely cracks through which light can shine. One's perspective ultimately controls one's beliefs and experiences. Dr. Calderon has helped me transform my experience of myself as a man. There is no greater gift that one human being can share with another. This dissertation would not have been completed without his gift.

I have been blessed by the forging of a friendship with Dr. William Johnson. Bill is the consummate scholar, gentleman and stalwart friend. He is one of those rare men who truly lives a life of integrity and compassion. Bill, thanks for your wisdom, your intellect, your good humor and, most importantly, your enduring friendship.

A friend celebrates you, encourages you, and is not afraid to wrap his arms around you in a wonderful bear hug. I have been very fortunate to have such a friend in Raul Gonzalez. Raul is a gifted educator, a loving father and husband and a source of strength for many. Thanks, Raul, for being there for me.

Finally, I would like to thank my wife, Jenny Knight. Jenny is, without question, the most amazing teacher I have ever encountered. I once told her, long before we were married, that the reason she was so good was that she was so incredibly intelligent. But my wife is more than just intelligent; she is a passionate woman whose capacity for love is seemingly infinite. She has sacrificed countless weekend evenings when we might have spent time together, cooked hundreds of meals, listened to endless stories about the oft frustrating experiences of pursuing a Ph.D. and managed to do all this with a smile on her face. Jenny, I love you with all my soul. Believe it or not, it's over.

## ABSTRACT

# SPAWNING FAILURE – THE LIVED EXPERIENCE OF ELEMENTARY TEACHERS WHO CONTEND WITH LOW MATHEMATICS SELF-EFFICACY: A PHENOMENOLOGICAL STUDY

John C. Griffin

Barry University, 2004

Dissertation Chairperson: Toni Powell, Ph.D.

This qualitative phenomenological study examines the lived experience of elementary teachers who contend with low mathematics self-efficacy. Ample evidence exists to support the claim that mathematical literacy is of fundamental importance to the future well being of our children and our nation. According to the National Council of Teachers of Mathematics, “Mathematical competency opens doors to productive futures. A lack of mathematical competence closes those doors.” According to Bandura, self-efficacy refers to the constellation of self-beliefs that regulate an individual’s ability to perform a given task competently. It follows that mathematics self-efficacy refers to one’s perceived ability to competently perform a mathematical task. The link between perceived competence, self efficacy and achievement is clear. According to Bandura, “Self-belief does not necessarily ensure success, but self-disbelief assuredly spawns failure. Low mathematics self-efficacy does not beget mathematical literacy. Given that elementary teachers are entrusted with developing mathematical literacy among their students, this researcher sought to understand more fully a potent deterrent to its formation, namely low mathematics self-efficacy.

## Purpose

The purpose of this qualitative study was to explore the experience of elementary teachers who contend with low mathematics self-efficacy and to investigate the process by which it is formed.

## Method

This researcher adopted a qualitative, phenomenological method of inquiry to investigate the experience of elementary teachers who contend with low mathematics self-efficacy and to explore the process by which it is formed. In an effort to ensure that participants had experienced the phenomenon under investigation, each prospective candidate was administered Betz and Hackett's Mathematics Self-Efficacy Rating Scale (1993). According to the instrument's evaluation criteria, the eight female participants were determined to be in the thirtieth percentile or less in terms of their mathematics self-efficacy. The participants were each subjected to semi-structured interviews and were asked, upon completion of their interview, to compose a concept map that illustrated their experience of low mathematics self-efficacy. All data was analyzed according to principles outlined by Moustakas (1994). All eight participants were graduate students enrolled in the School of Education at Barry University.

## Major Findings

1. One's perceptions of mathematics influence self-efficacy beliefs. The eight participants viewed mathematics variously as an unavoidable academic hurdle to be surmounted, as a professional obstacle to be overcome as in the form of standardized tests and licensing exams, and as irrelevant to their lives.



2. Diverse sources of low mathematics self-efficacy often converge synergistically. The sources of low mathematics self-efficacy included teachers, parents, schools, unrealistic personal expectations of performance, and grades.
3. Distressful emotions characterize the experience of low mathematics self-efficacy. These emotions included frustration, fear, anxiety, inferiority, embarrassment, and humiliation. These powerful emotions were often slow to dissipate over time.
4. Avoidance and survival are preferred methods of coping with low mathematics self-efficacy. Participants commonly avoided coursework related to mathematics, electing to remain within an emotionally safe comfort zone.
5. Elementary teachers who are afflicted with low mathematics self-efficacy are frequently able to imagine therapeutic responses to contend with it. These responses consisted of being assisted by a patient and empathetic teacher, being seen as vulnerable yet capable, involvement with hands-on learning experiences and using the potential detrimental effects of their low mathematics self-efficacy on their own children as a motivating force to persevere.

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# CHAPTER I

## THE PROBLEM

### *Introduction to the Study*

The purpose of this qualitative phenomenological study is to examine the lived experience of elementary teachers who contend with low mathematics self-efficacy. According to Albert Bandura, the eminent Stanford psychologist and originator of social cognitive theory, "Self-belief does not necessarily ensure success, but self-disbelief assuredly spawns failure" (1997, p. 77). Perceived self-efficacy refers to "...the beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (p. 3). In other words, self-efficacy beliefs constitute one's sense of competence in a particular domain or skill.

The National Council of Teachers of Mathematics (NCTM) published its *Principles and Standards for School Mathematics* in 2000. In the prelude to this document, the authors refer to the importance of developing mathematical competence.

We live in a mathematical world. Whenever we decide on a purchase, choose an insurance or health plan, or use a spreadsheet, we rely on mathematical understanding. The World Wide Web, CD-ROMs, and other media disseminate vast quantities of quantitative information. The level of mathematical thinking and problem solving needed in the workplace has increased dramatically. In such a world, those who understand and can do mathematics will have opportunities that others do not. Mathematical competence opens doors to productive futures. A lack of mathematical competence closes those doors (2000, p. 4).



### *Nature of the Problem*

Self-efficacy, the belief in "...one's capability to organize and execute the courses of action required to manage prospective situations" (Bandura, 1997, p.2), is one of the self-beliefs that people employ to exercise a measure of control over their environments. Self-efficacy beliefs are task, domain and situation specific; people access their beliefs in pursuit of some specified goal.

Extending Bandura's definition of self-efficacy, mathematics self-efficacy refers to the strength of a person's belief in his or her ability to competently perform specific mathematical tasks. Low mathematics self-efficacy, therefore, is characterized by a relatively weak level of belief in one's competence to perform mathematical tasks. Hackett and Betz (1989) define mathematics self-efficacy as "a situational or problem-specific assessment of an individual's confidence in his or her ability to successfully perform or accomplish a particular mathematical task or problem" (p. 262). Researchers have demonstrated that self-efficacy beliefs predict numerous academic outcomes, such as performance on criterion-referenced or norm-referenced tests, more effectively than variables such as academic self-concept, mathematics anxiety, previous mathematics experience, or perceived value of mathematics (Pajares, 2003; Bong, 2002; Pajares & Graham, 1999; Pajares, 1996; Lent, Lopez, & Bieschke, 1993). Pajares and Kranzler (1995) determined that the influence of low mathematics self-efficacy on mathematics achievement was as strong as general mental ability.

### *Significance of the Problem*

Senator John Glenn, in his final report to the Secretary of Education as director of the National Commission on Mathematics and Science Teaching, commented, "This

Commission is convinced that the future well being of our nation and people depends not just on how well we educate our children generally, but on how well we educate them in mathematics and science specifically” (NCMST, 2000). Upon the shoulders of our nation’s teachers rests the responsibility of producing these scientifically and mathematically literate children.

The NCTM standards reflect a comprehensive and organized effort to promote mathematics literacy amongst students and teachers alike. However, these standards will be rendered null and void in the absence of constructive action. Speaking to this theme, Bandura states, “People’s level of motivation, affective states, and actions are based more on what they believe than what is objectively true” (p. 2). One such affective state that appears to mediate constructive action is anxiety

Prospective (pre-service) elementary teachers have been shown to experience a high degree of mathematics anxiety generally, and anxiety for teaching mathematics specifically (Hembree, 1990; Levine, 1996; Trujillo, 1999). Extensive research confirms the deleterious effects of anxiety on both attitude towards mathematics as well as mathematics achievement (Hembree, 1990). Math-anxious teachers are more likely to avoid teaching the subject and are more likely to instill anxiety in anxiety-vulnerable children (Buhlman & Young, 1982). However, as apparently significant as mathematics anxiety appears to be, according to Bandura, it is not the fundamental problem.

“Perceived self-inefficacy predicts avoidance of academic activities whereas anxiety does not” (p. 445). Perceived self-efficacy operates as a cognitive regulator of anxiety. According to Bandura, it is the regulatory effects of self-efficacy that mediate the production of anxiety. Clearly the most compelling target of inquiry is mathematics

self-efficacy and not mathematics anxiety. Low mathematics self-efficacy (or inefficacy) can be seen as the illness and mathematics anxiety as one of numerous symptoms.

The stakes are high regarding the development of empowering levels of self-efficacy. Bandura speaks eloquently to the role of self-efficacy in shaping one's future. "People who regard themselves as highly efficacious act, think, and feel differently from those who perceive themselves as inefficacious. They produce their own futures rather than simply foretell them" (Pajares, 2003). Conversely, according to Bandura, the experience of low self-efficacy can result in considerable emotional pain. "The inability to exert influence over things that adversely affect one's life breeds apprehension, apathy and despair" (Bandura, 1997, p. 2). Clearly, a strong sense of self-efficacy within a domain (such as mathematics) is instrumental in determining success or failure within that domain.

Hadfield, Littleton, Steiner, & Woods (1998) determined that the strongest predictor of elementary teacher performance in the mathematics classroom is their degree of content preparedness. Hackett (1985) found that mathematics self-efficacy strongly influences the selection of mathematically related courses and careers. Coupling the findings of these studies suggests that low mathematics self-efficacy limits the ability of teachers to seek the necessary coursework that will ultimately prove decisive in their ability to perform effectively in the classroom.

#### Windmills: A Personal Narrative

I was once a little boy whose boundless curiosity led him into one adventure after another. Long before it was fashionable to think of discovering one's passions, this little boy galloped through life with an absorbent mind that saw wonder in every step. I was

eager to share this wonder with those around me and some did join me in celebration. However, those who mattered most seemed almost disinterested, as if my endless questions and unbridled enthusiasm were nuisances. Sadly, because I was unable to reconcile my joy with this puzzling indifference, I concluded at a very young age that there must be something wrong with me and so I began to withdraw. As I retreated into a life of self-consciousness, I began to lose faith in my native ability to interact fluently and naturally with people around me. My circle of friends began to shrivel as did my exuberance. Despite this gradual affective collapse, I clutched fiercely to my most prized possession, holding onto it as a drowning man might grasp a life-saving buoy; I held onto my wonder.

I lost myself for hours in books, in nature, in countless hobbies and in elaborate storytelling extravaganzas. And while my intellect grew stronger each day, my heart and spirit grew weary. Countless hours spent in solitary play were not a substitute for the friendships that had once flowed so freely and magically through my life. I had become convinced that I quite simply did not possess the basic human competence to develop friendships. This knowledge was my reality.

When you are wrapped snugly in a blanket of false perception it is nearly impossible to imagine an alternate reality. Every experience that presents itself is filtered through that blanket. I had grown into a young man before I even noticed the blanket at all. Having spent so many years alone I had never had the experience of being able to share my pain, my anger, my frustration or my near total lack of self confidence with a single human being. In my early twenties I came to the realization that this was no way to live a life.

When I began to see the blanket for what it was, I was able to slowly unravel it a thread at a time. My flawed sense of self (a fantasy born out of spiritual and emotional neglect) had wreaked considerable damage on my academic pursuits; however several fortunate encounters with extraordinary educators (who just happened to be mathematics teachers) coupled with my emerging self-empowerment, enabled me to salvage my sense of self.

Unknowingly, a little boy had traveled down the path of inefficacy, gotten lost, and then found his way home. I came to see the time I had spent alone not as a curse but as a gift. I had experienced firsthand what it was like to grapple with a disparaging apparition, namely a closely held belief of incompetence that cons you into believing a lie. A sense of inefficacy feels very real and inflicts very real suffering; however, it is a cognitive fabrication.

Don Quixote squandered his life battling imaginary foes. I might have met with the same fate had I not had the courage to see my enemy clearly and recognize it for what it was. My false perceptions had transformed innocent windmills into fearsome creatures that held me in a vice grip, immobilized by fear. When I opened my eyes and began to bravely take one step at a time towards self-mastery, those monsters eased and then released their stranglehold. Franklin D. Roosevelt was right, "We have nothing to fear but fear itself" (Rosenman, 1938).

The little boy who once feared windmills would eventually dedicate himself to an exploration of the phenomenology of low mathematics self-efficacy in the belief that by capturing the essence of another human being's experience of feeling innately

incompetent he might not only more completely illuminate the phenomenon, but in the process, come to more fully understand its impact on his own life.

### Theoretical Framework

In 1963 Bandura and Walters authored *Social Learning Theory and Personality Development*, expanding the emerging field of social learning theory that had begun in the early 1940's. Social learning theory represented a significant departure from the behaviorist notion of learning where the idea of learning simply by observing others was essentially a foreign concept. However, Bandura remained convinced that social learning theory was somehow incomplete. He reasoned that the extant learning theories of the day uniformly failed to take into account the power of individual beliefs.

In 1986 Bandura published *Social Foundations of Thought and Action: A Social Cognitive Theory* wherein he proposed that all people possess beliefs that "...enable them to exercise a measure of control over their thoughts, feelings and actions" and that "...what people think, believe and feel affects how they behave" (p. 25). Human behavior was seen as the dynamic interplay between a personal system consisting primarily of self-regulatory, self-reflective and symbolizing forces and the familiar external forces of influence emphasized by both social and behaviorist learning theories. Bandura had created a mosaic of human behavior, motivation and learning that suggested human beings were not slaves to the environment rather they were imbued with considerable power to influence and control their own destinies. Central to an understanding of social cognitive theory (SCT) is the concept of reciprocal causation.

### *Reciprocal Causation*

Social cognitive theory (SCT) proffers a model that integrates three basic influences on behavior. According to Bandura (1986), these three influences consist of personal factors, environmental factors and behavioral factors. This triadic model is referred to as reciprocal causation and is diagrammed below in Figure 1. Stajkovic and Luthans (1998) have observed that this triangular relationship is not always symmetrical. While all three factors are generally present, their relative strengths are not fixed; different factors may exert varying degrees of influence depending on the situation, the activity and the individual.

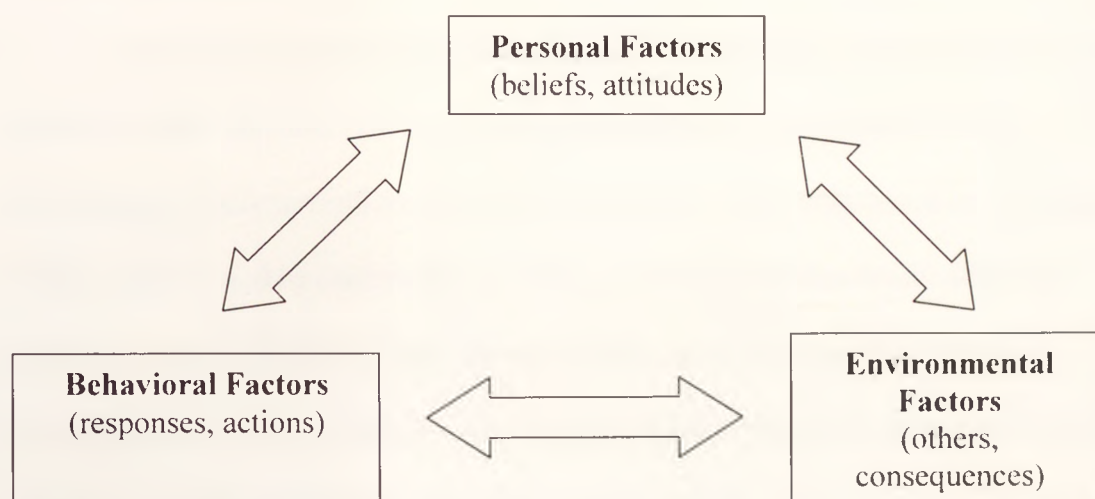


Figure 1: The Triadic Reciprocal Causation Model of Social Cognitive Theory

The interaction between personal and behavioral factors involves bi-directional interactions between one's thoughts, emotions, and biological functions and actions (Bandura, 1977). One's beliefs, expectations and self-perceptions affect and guide behavior, while behavior influences one's emotions, thoughts and experience of self-evaluation. For example, if one possesses the belief that he or she is able to withstand the

anxiety of public speaking and perform to expectations, then that individual is more likely to pursue it. Afterwards, the experience allows the person to engage in meaningful self-reflection, whereby he or she alters thoughts, beliefs and attitudes.

SCT also accounts for biological factors, such as sweaty palms, increased heart rate and the physical experience of anxiety. Using the public speaking example, if someone observes that he or she is sweating profusely prior to their performance then this behavior can be interpreted as providing supporting evidence of perceived ineptitude, thereby intensifying the biological symptoms and increasing the likelihood that the performance will fall beneath expectations. Here the bi-directional nature of reciprocal causation is evident.

There exists a bi-directional relationship between the environment and personal factors as well. Bandura (1978) postulates that both physical as well as social environments can exert influence over personal factors. Socially-based environmental factors such as models (individuals we wish to emulate) can drastically affect the appraisal of one's abilities, foster encouragement, instill fear and either erode or strengthen confidence. Inversely, the attitudes and beliefs that one brings to a social gathering can directly influence the climate of the group.

The last interactive coupling occurs between behavioral and environmental factors. If our public speaker addresses the audience with a smile on her face then she is likely to elicit positive feedback. Bandura (1989) contends that people are simultaneously producers and products of their environment. A person's behavior can limit or expand opportunities in their environment, depending on how that behavior is



received. People will often filter their selection of activities based upon perceived competencies.

The complexity of this triadic model is supported, within the SCT perspective, by five basic human capabilities. These five capabilities are symbolizing, vicarious learning, forethought, self-regulation and self-reflection. Of the five, according to Bandura (1986), the capability that is most distinctly human is self-reflection. It is from this capability that self-efficacy emerges. The explanatory power of reciprocal causation is supported by the interplay of these five basic *human capabilities*.

#### *Basic Human Capabilities*

SCT explains this bi-directional model of reciprocal causation via five basic human capabilities, as outlined by Bandura (1997, 2001) and Luthans and Stajkovic (1998). These five capabilities give rise to what Bandura refers to as human agency, "...the capacity to exercise some measure of control over one's own functioning and events that affect one's life" (p.2). Bandura states that to be an agent in one's own life is the very essence of our humanity. However, people are not regarded as being free agents, able to operate completely independently of external forces. While cognitive processes empower people to mold their destinies, they are not liberated from the influences of their environment.

*Symbolizing.* Bandura (1989) maintains that external forces affect behavior through cognitive processes. However, it is how our minds symbolize experiences cognitively that affects future behaviors. The process of symbolizing is a vibrantly visual one, resulting in the formation of enduring mental pictures and images. The formation of symbols allows experiential information to be stored easily in memory, facilitating rapid

retrieval. By cognitively processing this symbolic information, people are able to exercise foresight to imagine potential consequences of contemplated behaviors.

*Vicarious learning.* To learn vicariously is to learn not through direct experience, but through the observed experiences of others. The effects of such observation vary considerably based on the nature of the model, a topic to be addressed later. Bandura (1986) postulates that observational learning results in the formation of symbols that can eclipse the influence of symbols formed pursuant to direct experience. The value of vicarious learning can be seen in the swift formation of habit patterns in the wake of observations that can often occur at a more rapid rate than direct experiences. Precious time and energy is often preserved by augmenting direct experience with vicarious learning. The use of training videos is a clear example of vicarious learning.

Observational or vicarious learning is governed by four factors: attention span, retention, motor reproduction processes and motivation (Bandura, 1977, 1986). Attentional ability or attentiveness determines what specific information is able to be extracted from an observation. The nature of the model can influence the strength and duration of attention. Models that are regarded as complex or not relevant may diminish attentiveness. Models that are seen as closely resembling the observer are more likely to command greater attention than those that are evaluated as differing significantly.

Models can influence behavior only if the observations are retained in memory. As an observer's ability to symbolize strengthens, his or her retention and retrieval processes are improved. The process of converting stored symbolic information into action is referred to as motor reproduction. Bandura (1986) points out that the observer must be physically able to reproduce the behavior of the model. Assuming that the

observer is indeed capable of reproducing the task. doing so in front of the model can enable rapid feedback. This feedback will either confirm or revise the observer's current cognitive model of how the behavior should be performed.

Not surprisingly, the quality of the motor reproduction is influenced by a myriad of factors, including gross and fine motor skill level, sufficiency of the stored symbolic information and the motivation that the observer brings to the equation.

The observer must desire to replicate the modeled behavior. The motivation to perform can be achieved in various ways, such as anticipated positive consequences if the behavior is accomplished successfully or the avoidance of punishment. The anticipation of either significant future reward or punishment enhances attentiveness, strengthens retention, and motivates the observer to marshal maximum motor reproductive effort.

*Forethought.* Bandura (1986, 1989) argues that people not only respond to their environments after processing stored symbolism, they also self-regulate their future behaviors by way of forethought. People plan courses of action, anticipate the consequences of their intended actions and set appropriate goals for themselves.

Therefore, much human activity is seen as being purposive and deliberately regulated.

Forethought is a person's ability to motivate him or herself and to direct his or her actions in a manner guided by anticipatory feedback. Previous experiences create expectations of outcomes that will occur as a result of engaging in a behavior, prior to the behavior being performed. One can therefore conclude that the act of anticipating future events (forethought) is in and of itself a causal factor. Indeed, it is often the case that expected outcomes carry greater weight than actual outcomes when it comes to influencing behavior.

*Self-regulation.* Self-regulatory capability is of central importance in SCT.

People do not behave simply to suit the preferences or demands of others. Rather, Bandura (1989) proposes that self-regulatory systems mediate or intelligently analyze and scrutinize external influences, thereby providing a sound basis for self-directed action. This results in a greater degree of personal control over one's thoughts, feelings and actions. Self-regulation is an internal control mechanism that determines what behavior is actualized and what self-imposed consequences of that behavior will result. While self-regulatory processes may release one from the shackles of external control, the freedom is not complete. Self-regulatory mechanisms merely ensure that a gradual replacement of some of the external controls by internal ones occurs.

Self-regulation occurs via the interaction of self-produced and external sources of influence. These external sources of influence might include social and moral standards for instance. Internal motivation standards might compel one to establish goals (referred to as discrepancy production) and to strive earnestly to attain them (referred to as discrepancy reduction) Bandura (1986, 1989). Bandura has identified three factors that appear to influence one's degree of internal motivation. The first factor is a person's self-efficacy for a given task. If a person believes that he or she possesses the requisite competence to attain the goal then the result is a predictably high level of motivation. A second factor is feedback. Through feedback a person is able to consciously control and adjust his or her efforts and goals in an attempt to align them with reality. Feedback also has the effect of enhancing self-efficacy if the feedback is used to improve symbolic processing and subsequent behaviors. The third factor that influences internal motivation

is the anticipated time to goal achievement. Distant goals are less motivating than ones in the near future.

Social and moral standards also have the effect of regulating behavior. The effect is similar to the functioning of a thermostat in a home. When the temperature rises above an established level then the system intervenes to prevent unwanted heating and the temperature recedes. The average temperature, while not kept precisely at the selected level, nonetheless remains within a comfortable range. Likewise, internalized moral and social standards have the effect of alerting us to anticipated behaviors that may exceed our comfort threshold. This inhibitory effect can take the form of anticipated punitive consequences, both external and internal (a lingering sense of guilt, for instance). The standards have the effect of ensuring that our behaviors remain within a desired range of acceptability (Bandura, 1991).

*Self-reflection.* Bandura (1986, p. 21) considers self reflection to be the most uniquely human capability, for it enables people to analyze, assess and change their own thinking and behavior. Principal among these self-evaluative thoughts are perceptions of self-efficacy, the "...belief in one's ability to organize and execute the courses of action necessary to manage prospective situations" (Bandura, 1997, p.2). Within the context of SCT, self-efficacy beliefs are powerfully predictive of human functioning. Bandura has identified self-efficacy as a major determinant of self-regulation (1977). A person's self-efficacy develops largely as a result of one's history of achievement in a particular area, from the observations of others' failures and successes, from the persuasion of others and from physiological feedback (such as emotional arousal, anxiety or nervousness) while engaged in a particular behavior (Pajares, 1997).

### Statement of the Problem

The problem is that many current and prospective elementary teachers are practicing their professions while contending with a high degree of mathematics anxiety, originating from depressed levels of mathematics self-efficacy. This low sense of efficacy exacts a heavy toll both on the teacher as well as the student. While there exists considerable research that illuminates the experience of mathematics anxiety, little is available that addresses the underlying constellation of self-beliefs known as mathematics self-efficacy. How is this network of beliefs constructed and experienced? Given that mathematics self-efficacy is composed of an array of facets, the answer to this question will require questioning from a variety of perspectives. The insights that emerge from this process of questioning from various angles are referred to by Husserl as *horizons* (Moustakas, 1994). Until these questions are asked and the phenomenon of mathematics self-efficacy explored there will remain a significant gap in the professional literature.

### Purpose of the Study

The purpose of this study is to explore the process by which low mathematics self-efficacy is developed and how that process is experienced by elementary teachers

### Research Questions

What is the lived experience of elementary teachers who contend with low mathematics self-efficacy? How is low mathematics self-efficacy in elementary teachers developed?

## Definition of Key Terms

### *Self-Efficacy*

As defined by Bandura, self-efficacy refers to the "...beliefs in one's capabilities to organize and execute the courses of action necessary to organize and execute the courses of action required to produce given attainments" (1997, p. 3).

### *Mathematics Self-Efficacy*

Mathematics self-efficacy, as defined by Betz and Hackett (1983), refers to the set of beliefs regarding one's ability to perform various mathematics-related tasks and behaviors. This definition, according to Betz and Hackett, is used extensively in research settings as well as counseling interventions.

### *Low Mathematics Self-Efficacy*

For the purpose of this study low mathematics self-efficacy will be defined by the obtaining of a mean score of four or less on both sections of the MSES. The MSES asks participants to rate their level of confidence using a Likert scale where 0 represents no confidence and 9 represents high confidence. Scores of four or less correspond to less than moderate levels of mathematics self-efficacy.

### *Elementary Teacher*

An elementary teacher is defined as a teacher of students in kindergarten through fifth grade inclusive.

### *Anxiety*

Hembree (1990) refers to anxiety as the collective "...feelings of uncertainty and helplessness in the face of danger" (p. 33). He regards anxiety as an *omnibus* construct

and "...under its rubric appear a host of sub-constructs that relate to specific situations" (p. 33).

#### *Mathematics Anxiety*

Tobias (1993) defines math anxiety as a "...failure of nerve in the face of having to do a computation or an analysis of a problem involving numbers, geometries, or mathematical concepts" (p. 33). Hembree (1990) emphasizes the importance of distinguishing between mathematics anxiety and test anxiety.

#### *Prospective Elementary Teacher*

For the purpose of this study a prospective elementary teacher is a teacher who has not been employed full time in a school setting and is currently enrolled in either an undergraduate or graduate teacher preparation program.

#### Limitations

Due to the fact that the research question inherently limits the population, the sample will be limited to eight elementary teachers. These eight participants will be identified from a larger population of students enrolled in graduate level teacher preparation programs at Barry University. Results of this phenomenological inquiry should not be interpreted as being applicable to any other adult population. Also, given that the participants will all be adults, the scope of this study cannot be extended to encompass other age groups. The relatively small size of the sample may be considered a limitation to generalizability. Transferability of the findings of this study to other settings may be achieved by referencing the composite textural-structural description and determining the level of applicability.



## CHAPTER II

### REVIEW OF THE LIERATURE

#### Research Paradigm

##### *A History of Qualitative Research*

According to Denzin and Lincoln (1998), the word qualitative "...implies an emphasis on processes and meanings that are not rigorously examined or measured (if measured at all), in terms of quantity, amount, intensity, or frequency" (p. 8). Denzin and Lincoln (1998) identify five distinct phases that collectively describe the genesis of the qualitative paradigm. These five phases consist of the traditional period, the modernist phase, blurred genres, a crisis of representation and finally, the "fifth moment" or present time (pp. 11-22).

*The traditional period.* Commencing in the early 1900's and continuing through World War II, the traditional period can best be described as the era of the "lone ethnographer" (p. 15). The field-worker was "...lionized, made into a larger-than-life figure who went into and then returned from the field with stories about strange people" (p. 14). During this era qualitative researchers composed objective accounts of their field experiences, careful to maintain separation between self and subject. It is during this period that the Chicago school, "...with its emphasis on the life story and the 'slice-of-life' approach to ethnographic materials, sought to develop an interpretive methodology that maintained the centrality of the narrated life history approach" (p. 15). In an effort to more accurately represent the subject's experience, the use of common, ordinary language as might be encountered in the field was encouraged in researcher narratives.

*The modernist phase.* The modernist phase is regarded as the "...golden age of rigorous qualitative analysis" (p. 17). This phase stretched through the 1970s and began to fade as the Vietnam War came to an end. The modernist phase saw a veritable explosion of creative ferment as qualitative researchers began to take on the cause of the oppressed. It is during this era that interpretive theories such as phenomenology, critical theory and feminism emerged (p. 16). Denzin and Lincoln (1998) refer to the seminal work *Boys in White* by Becker as a "canonical text" of this period (p. 16). *Boys in White* employed typically rigorous methodological and analytical techniques vaguely reminiscent of quantitative studies. The use of "quasi-statistical" methods is reflected in Becker's observation that qualitative researchers might take a "cue" from their quantitative colleagues and attempt to discern whether sufficient evidence had been gathered to produce a convincing probability that their conclusions were justifiable (p. 17).

*Blurred genres.* Following the relatively focused era of the modernist age came the period of blurred genres during which an amalgam of "...paradigms, methods, and strategies" came into fruition. It is during this period that "...diverse ways of collecting and analyzing empirical materials..." became available, most notably computer-based methods (p. 18). Research strategies such as grounded theory and case study were developed. According to Denzin and Lincoln (1998) this era represented a shift from the "...old functional, positivist, behavioral, totalizing approaches to the human disciplines to a more pluralistic, interpretative, open-ended perspective" (p. 18). The boundaries between the social sciences and the humanities were beginning to blur. "The essay as an art form was replacing the scientific article" (p. 19). The presence or influence of the

author in his or her works was becoming the subject of scholarly scrutiny. It is during this phase of blurred genres that naturalistic, postpositivist, and constructionist paradigms became dominant.

*Crisis of representation.* The crisis in this phase refers to the philosophical rupture that occurred as researchers sought new models of truth and method (p. 19). This crisis is keenly evident in Denzin and Lincoln's recounting of the experiences of Stoller and Olkes, anthropologists who studied the Songhay of Niger. The two researchers had amassed large amounts of field-generated data and subjected it to traditional means of analysis. What became evident as conclusions began to crystallize from this analysis was that not only had they been misled by informants who had "...lied to their anthropologist" but they had completely written themselves out of the picture (p. 20). The result was the realization that their data was "worthless" and that a new methodology was urgently needed. Stoller generated a new text, "...a memoir, in which he became a central character in the story he told" (p. 20). This journey of philosophical and methodological revelation represents the essence of the crisis of representation. The experience of Stoller and Olkes highlights the merging of the act of writing with the act of fieldwork. According to Denzin and Lincoln (1998), "...the world of real lived experience can still be captured, if only in the writer's memoirs, fictional experimentations, or dramatic readings." The act of writing is viewed as a method of inquiry "...that moves through successive stages of self-reflection" (p. 21). This process originates with fieldwork and flows eventually into a completed narrative of the field experience. "There is, in the end, no difference between writing and fieldwork" (p. 21).

*The fifth moment.* The fifth moment is the present. A pronounced concern for an accurate representation of the “other” characterizes this final phase. Qualitative works are widely regarded in narrative terms as *tales of the field* (p. 22). The researcher is regarded as an integral component of the research process who can no longer distance himself or herself from his or her subjects. Qualitative research has now evolved into a tool for social reform. The era of *grand narratives* is being supplanted by “...more local, small-scale theories fitted to specific problems and specific situations” (p. 22). “Class, race, gender, and ethnicity shape the process of inquiry, making research a multicultural process” (p. 22).

#### *Contrasting Qualitative and Quantitative Research*

Denzin and Lincoln (1998) identify five points of difference when contrasting qualitative and quantitative research. These five points are uses of positivism, acceptance of postmodern sensibilities, capturing the individual’s point of view, examining the constraints of everyday life, and securing rich descriptions.

*Uses of positivism.* While both qualitative and quantitative research has been shaped by positivist and post-positivist perspectives, quantitative research is more clearly guided by the positivist tradition. The positivist tradition contends “...that there is a reality out there to be studied, captured, and understood” (Denzin & Lincoln, 1998, p. 9). According to Creswell (1998), qualitative research is a deductive process designed to focus on specific and narrowly defined topics. To this end quantitative researchers generally employ statistical techniques that measure presumed knowable realities. In contrast, post-positivism “...relies on multiple methods as a way of capturing as much of reality as possible. At the same time emphasis is placed on the discovery and verification

of theories” (Denzin & Lincoln, 1998, p. 9). While qualitative research was originally conducted within the positivist paradigm, Denzin and Lincoln (1998) report that current qualitative researchers have adopted less rigorous methods.

Although many qualitative researchers in the postpositivist tradition use statistical measures, methods, and documents as a way of locating a group of subjects within a larger population, they seldom report their findings in terms of the kinds of complex statistical measures or methods to which quantitative researchers are drawn. (p. 9)

*Acceptance of postmodern sensibilities.* According to Denzin and Lincoln (1998), many modern qualitative researchers have rejected quantitative and positivist assumptions outright, claiming that such methods allow only one version of a story to be told (p. 10). “Many members of the critical theory, constructivist, poststructural, and postmodern schools of thought reject positivist and postpositivist criteria when evaluating their own work” (p. 10). Such researchers have adopted alternative means of assessing their work, including “verisimilitude, emotionality, personal responsibility, an ethic of caring, political praxis, multi-voiced texts, and dialogues with subjects” (p. 10). In response, proponents of positivist and post-positivist traditions claim that their respective methods are free of individual bias and are good science.

*Capturing the individual’s point of view.* According to Denzin and Lincoln (1998), while both quantitative and qualitative researchers both claim to be concerned about the individual’s point of view, qualitative researchers capture this perspective more closely through the use of intensive observations and interviews. Quantitative researchers, it is argued, are not able to develop such penetrating portrayals due to their

use of impersonal, empirically-based methods. While quantitative researchers might claim that the use of interpretive methods yield unreliable results, their qualitative counterparts insist that such methods are the only reliable means of capturing the essence of an individual's point of view (p. 10).

*Examining the constraints of everyday life.* The willingness to immerse oneself in the culture being examined is, according to Denzin and Lincoln (1998) a hallmark of qualitative research methodology. This *emic* nature of qualitative research is in contrast to the *etic* nature of quantitative research where the researcher assumes an abstract or detached position relative to the subject of inquiry. This etic position is grounded in statistical methodology that values probabilistically sound methods that produce valid and reliable conclusions (p. 10).

*Securing rich descriptions.* Extending the emic nature of qualitative research, Denzin and Lincoln (1998) state "Qualitative researchers believe that rich descriptions of the social world are valuable, whereas quantitative researchers, with their etic, nomothetic commitments, are less concerned with such detail" (p. 11).

### *The Phenomenological Tradition*

Moustakas (1994) traces the roots of phenomenology to the works of Franz Brentano, a nineteenth century German philosopher. Brentano was influenced by Aristotelian thought and by the radical empiricism of Hume. The central concern of philosophy, in Brentano's view, was to understand the nature of awareness in a manner that would illuminate the distinction between the mental and the non-mental. According to Moustakas, Brentano stated without qualification, "...experience alone is my teacher" (p. 44).

Brentano (1973) distinguished between the natural sciences, which investigate physical phenomena such as sensations, and the human sciences, which investigate mental phenomena, particularly perception, memory, judgment, and, in general, mental presentations of anything whatsoever. He asserted that, "We have no right to believe that the objects of so-called external perception really exist as they appear to us" (p. 10). Only what we know from internal perception can be counted on as a basis for scientific knowledge. (Moustakas, 1994, pp. 44-45)

The German mathematician, Edmund Husserl, himself a protégé of Brentano, asserted the necessity of accumulating self-evidence as a prerequisite for the attainment of knowledge. Accordingly, Husserl supported Brentano's emphasis on the intrinsic value of inner perceptions. According to Moustakas, Husserl cautioned, "...the beginning point in establishing the truth of things must be individual perception, seeing things as a solitary self" (p. 57). "In phenomenology, perception is regarded as the primary source of knowledge, the source that cannot be doubted" (Moustakas, p. 52). Husserl believed "...scientific investigation is valid when the knowledge sought is arrived at through descriptions that make possible an understanding of the meanings and essences of experience" (p. 84). According to Moustakas, "Meaning is at the heart of transcendental phenomenology" (p. 56).

Moustakas describes Husserl as a *transcendental phenomenologist* (1994, p. 45). A transcendental phenomenologist, according to Moustakas, is one who "...emphasizes subjectivity and discovery of the essences of experience..." (p. 45). Husserl emphasized those phenomenological researchers should "...search for the essential, invariant structure (or essence) or the central underlying meaning of experience..." (Creswell,

1998, p. 52). This sentiment is echoed by Stewart and Mickunas (1990), who state, “Man desires knowledge of himself and his world, and it is philosophy’s task to achieve such understanding” (p. 5).

### *Rationale for a Phenomenological Study*

This study will focus on the lived experience of low mathematics self-efficacy in prospective elementary teachers. Because the focus is on describing the lived experiences of participants, the qualitative tradition of phenomenology will be used. According to Moustakas (1994, p. 58), “Phenomenology is committed to the description of experiences, not explanations or analyses.” Further, “The aim [of phenomenology] is to determine what an experience means for the persons who have had the experience and are able to provide a comprehensive description of it” (p. 13).

This study will be grounded in a constructivist philosophical framework and guided theoretically by social cognitive theory. Creswell observes that the role of theoretical influence within the phenomenological tradition is most prominent during the early, preparatory stages of the study (1998, p. 84). It is during this phase that an *a priori* decision is made that he or she will examine the *meaning of experiences* for individuals. Thus, an individual starts in the field with a strong orienting framework...” (p. 86). The researcher begins with the premise that “...human experience makes sense to those who live it, prior to all interpretations and theorizing. Objective understanding is mediated by subjective experience and that human experience is an inherent structural property of the experience itself, not constructed by an outside observer” (p. 86).

Given that low self-efficacy (a cognitive construct that impacts *human agency* through a transactional process involving behavior, environment and personal beliefs) is a



deeply-felt human experience and that phenomenological inquiry is designed to elucidate such experiences, the logic in choosing phenomenology to explore it is apparent. This choice is further supported by selection criteria outlined by Moustakas (1994) and Creswell (1998).

### Philosophical Paradigm

Guba and Lincoln describe their interpretation of the constructivist paradigm as a "...wide-ranging eclectic framework" (1989, p. 19). This framework posits that what is real is a construction in the mind of the individual and therefore suggests that the answer to the ontological question, "What is the form and nature of reality?" is relative. There may exist "...multiple, often conflicting, constructions, and all (at least potentially) are meaningful" (Denzin & Lincoln, 1998, p. 243). This phenomenological study promises to examine the reality of a lived experience. When this phenomenon is examined within the constructivist paradigm, one can expect that multiple and equally valid realities will be encountered.

Denzin and Lincoln (1998) state that when exploring the epistemology of constructivism the separation between the object of investigation and the investigator begins to disappear. There exists a transactional relationship between the two entities that results in findings being "...literally created as the investigation proceeds" (p. 207).

The appropriateness of placing this phenomenological study within the constructivist paradigm is apparent when one considers Guba and Lincoln's discussion of the properties of constructions. In that discussion, Guba and Lincoln (1989) state that one of these properties is that constructions "...are attempts to make sense of or to interpret experience, and most are self sustaining and self-renewing" (p. 71). This

perspective echoes the purpose of this phenomenological inquiry; to make sense of the lived experience of low mathematics self-efficacy by engaging in a reciprocal, interactive relationship with participants in an effort to build what can be described as cooperative constructions.

### *The Constructivist Paradigm*

Denzin and Lincoln (1998) describe paradigms as "...worldviews that define, for its holder, the nature of the world, the individual's place in it, and the range of possible relationships to that world and its parts..." (p. 200). *Inquiry* paradigms, in their view, "...define for inquirers what it is they are about and what falls within and outside the limits of legitimate inquiry" (p. 200). They suggest that the basic beliefs that define any given inquiry paradigm can be summarized by analyzing the answers to three fundamental or basic questions.

The first question is ontological, "What is the form and nature of reality and, therefore, what is there that can be known about it?" The second question is epistemological, "What is the nature of the relationship between the knower or the would-be knower and what can be known?" The answer to this question is constrained by the answer to the first. The third question is methodological, "How can the inquirer (would be knower) go about finding out whatever he or she believes can be known?" (p. 201).

In response to the first (ontological) question, Denzin and Lincoln state that within the constructivist paradigm "Realities are apprehendable in the form of multiple, intangible mental constructions, socially and experientially based, local and specific in nature...and dependent for their form and content on the individual persons or groups

holding the constructions” (p. 206). The idea that multiple versions of realities can be constructed introduces the *relativist* interpretation of ontology. Within the phenomenological tradition of inquiry the individual’s experience of the phenomenon in question within consciousness defines *absolute reality* for that individual (Moustakas, 1994, p. 27).

In response to the second (epistemological) question, Denzin and Lincoln observe, “The investigator and the object of investigation are assumed to be interactively linked [from the constructivist perspective] so that the findings are literally created as the investigation proceeds. The conventional distinction between ontology and epistemology disappears...” (p. 207). The social flavor of this epistemological perspective is emphasized by Denzin and Lincoln in the following excerpt:

The world of lived reality and situation-specific meanings that constitute the general object of investigation is thought to be constructed by social actors. That is, particular actors, in particular places, at particular times, fashion meaning out of events and phenomena through prolonged, complex processes of social interaction involving history, language, and action. The constructivist believes that to understand this world of meaning, one must interpret it” (p. 222).

This interactive/social quality is often celebrated within the phenomenological tradition. Referring to a phenomenological study concerning self identity enhancement, Moustakas comments, “She or he affirms interests, needs and desires; *rhythmically connects* with the mood or state of mind of the child or adolescent...” (1994, p. 39) While summarizing the applications of phenomenology to human science research, Moustakas states, “Subject

and object are integrated – what I see is interwoven with how I see it, with whom I see it, and with whom I am” (p. 59).

In response to the methodological question, Denzin and Lincoln state, “...individual constructions can be elicited and refined only through interaction *between and among* investigator and respondents” (p. 207). The final aim of a constructivist inquiry is “to distill a consensus construction that is more informed and sophisticated than any of the predecessor constructions...” (p. 207). Indeed, the succinct goal of a constructivist-guided inquiry is to achieve understanding through reconstruction (p. 210). The methodology of phenomenology, as described by Moustakas, reflects this constructivist orientation; the phenomenological researcher is encouraged to engage in lengthy direct interviews with participants for the purpose of eliciting richly detailed reconstructions of the experience. “Broad questions...may facilitate the obtaining of rich, vital and substantive descriptions of the co-researcher’s [participant’s] experience of the phenomenon” (p.1994, p. 116).

#### *The Development of Constructivism*

According to Fosnot (1996), the origins of constructivism can be traced to the eighteenth century to the works of the Italian philosopher Vico who proposed that people can only clearly understand what they themselves have constructed. From an educational perspective, Jean Piaget, John Dewey and Lev Vygotsky have been prominent contributors to contemporary constructivist thought (Fosnot, 1996; Eggen & Kauchak, 2001).

Dewey (1916) declared that knowledge and ideas emerged only from situations in which learners had to extract them from experiences that had meaning and importance to

them. Education was seen as being dependent on action conducted in a social context. Dewey's emphasis on the role of meaningful personal experience in learning is regarded by many as the central tenet of his beliefs and is reflected in the following comment. "If you have doubts about how learning happens, engage in sustained inquiry: study, ponder, consider alternative possibilities and arrive at your belief grounded in evidence" (Dewey, 1936).

Piaget's version of constructivism is based on the psychological development of children. In 1973 Piaget summarized his views in a text entitled *To Understand is to Invent* in which he stated "To understand is to discover, or reconstruct by rediscovery, and such conditions must be complied with if in the future individuals are to be formed who are capable of production and creativity and not simply repetition" (p. 20). In order to achieve an understanding of basic phenomena children must progress through stages in which they accept ideas they may later see as false. When engaged in independent, self-directed activities, children must discover relationships and ideas in classroom situations that offer intrinsic interest to them. Understanding is built, or constructed, incrementally through active involvement (Fosnot, 1996).

The third significant contributor to constructivism is the Russian sociologist Lev Vygotsky. While Dewey and Piaget are frequently referred to as *cognitive constructivists*, Vygotsky is generally considered to be a proponent of *social constructivism*. Cognitive constructivists focus on individual, internal constructions of knowledge (Cobb, 1994). Within the cognitive constructivist realm social interaction is important, but only as a catalyst for individual cognitive conflict (Fowler, 1994). Social constructivism suggests "... knowledge exists in a social context and is initially shared

with others instead of being represented solely in the mind of an individual” (Eggen & Kauchak, 2001, p. 293). According to social constructivists, the process of sharing results in learners refining their own ideas, enabling them to help shape the ideas of others (Greeno, Collins, & Resnick, 1996).

Vygotsky is perhaps best known for his development of the *zone of proximal development* theory. The zone of proximal development refers to the range of tasks that a child cannot yet do alone but can accomplish when assisted by a more skilled partner (Eggen & Kauchak, 2001). Vygotsky’s ideas were popularized for an American audience in his translated text *Mind in Society* (1978). Given that the learning of mathematics typically takes place in a social setting, it appears prudent to consider the tenets of social constructivism within the framework of this study as social factors may conceivably influence the development of low mathematics self-efficacy.

#### Role of the Researcher

The researcher will serve as questioner and recorder of information. Denzin and Lincoln (1998, p. 215) envision the constructivist researcher as a *passionate participant* who must be actively engaged in facilitating the *multivoice* reconstruction of his or her own constructions as well as those of all other participants. This perspective supports phenomenological methodology as outlined by Moustakas (1994) and Creswell (1998); the phenomenological researcher must coalesce his or her own experience of the phenomenon with those of the participants. The researcher will assume the role of passionate participant and will precede the interviewing of participants by entering a period of self-reflection or *epoche*.

### *Researcher Bias*

An essential element of phenomenological research is the inclusion of epoche. Moustakas (1994) defines epoche as the setting aside of prejudgments, biases and preconceived ideas about the phenomenon. Creswell views epoche as an idea central to phenomenology that entails the researcher "...bracketing his or her own preconceived ideas about the phenomenon to understand it through the voices of the informants" (p. 54).

I (the researcher) acknowledge a positive bias towards individuals confronted with low mathematics self-efficacy. Despite being a successful mathematics student in high school, initial college level courses were extremely difficult and failure was frequently encountered. Fortunately, through the efforts of skillful teachers and significant personal transformations, early difficulties did not dictate the course of events. In the interim, I experienced firsthand the debilitating effects of low mathematics self-efficacy. Therefore, I acknowledge that I may be highly sensitive to the perceived mathematical inadequacies in others and that such sensitivity may distort my interpretation of their experiences.

I further acknowledge that my professional role as a mathematics teacher may influence my interpretations. Teaching is a helping profession where we strive to eliminate or minimize the effects of failure. Therefore, I acknowledge that it may be difficult to listen to and absorb accounts of failure knowing that I am not able to respond.

## Literature Review

### *Introduction*

Social cognitive theory provides the necessary framework to analyze self-efficacy and the more specific notion of mathematics self efficacy. Given that the subjects in this study are adult educators, attention will then be directed to current research in the fields of adult learning and development.

### Self-Efficacy

In order to more fully understand the nature of self-efficacy, it is necessary to explore how it is acquired and how it influences both motivational and self-regulatory processes. Sources of self-efficacy beliefs include mastery experiences, vicarious experience, verbal persuasion and physiological states.

### *Sources of Self-Efficacy Beliefs: Mastery Experiences*

Pajares (1997, p. 3) states that the “case for the contextual and mediational role of self-efficacy in human behavior” can be established by exploring the four main sources from which self-efficacy emerges. The most influential source of self-efficacy beliefs are mastery experiences (Pajares, 1997; Bandura, 1986). Mastery experiences provide irrefutable and authentic evidence of whether or not someone can muster what it takes to succeed. Successes create a robust sense of efficacy while failures weaken it. The detrimental effects of failure are more pronounced if a strong sense of self-efficacy has not yet been established. However, although failures do generally erode self-efficacy, “...the impact of performance attainments on self-efficacy beliefs depends on what is made of those performances” (p. 81). In other words, it isn’t necessarily the



failure or the victory that impact self-efficacy; it is how those experiences are cognitively processed.

The degree to which an individual's sense of self-efficacy will be affected by mastery experiences is determined by a variety of factors such as the perceived difficulty of the task, the level of effort expended, the amount of external assistance, the frequency of similar successes and one's preconceived appraisal of his or her ability. The connection between mastery experiences and heightened self-efficacy has pronounced implications for educators. We are compelled to create situations for students wherein they are presented with opportunities to enhance their sense of self-worth and competence via the attainment of genuine mastery. Denying students these mastery experiences may result in degraded self-efficacy.

#### *Sources of Self-Efficacy Beliefs: Vicarious Experience*

The second source of self-efficacy is the vicarious experience of the effects produced by observing the behaviors of others. While this source of self-efficacy is not as strong as personal mastery experiences, it is often influential in situations where the individual has limited experience or has not solidified his or her sense of competency Schunk (1981, 1983 & 1987). Schunk (1983) has proposed that the effects of models are particularly relevant within the context of vicarious experience. A significant model or mentor can instill influential self-beliefs that can determine the paths that one chooses in life. The unavoidable comparisons that are made between the observer and the model during vicarious experiences can mediate the effects on self-efficacy. A model that is seen as being similar to the observer yields a greater effect than one who is seen as markedly different. Bandura states "...persons who are similar or slightly higher in

ability provide the most informative comparative information for gauging one's own capabilities" (1997, p. 96). Not surprisingly, outperforming a model whose ability is interpreted as inferior yields little benefit. Brown and Inouye (1978) have determined that when observers view a failure by a model whose ability is evaluated as superior to their own a negligible effect on self-efficacy can be anticipated.

#### *Sources of Self-Efficacy Beliefs: Verbal Persuasion*

Individuals also develop self-efficacy as a result of verbal persuasion. Zeldin and Pajares (1997) claim that while verbal persuasion is less influential than either mastery experiences or vicarious experience, it can still serve to mold one's sense of self-efficacy. The governing tenets of verbal persuasion are echoed in the work of Erikson (1959) who stated, "A weak ego is not strengthened by being persistently bolstered..." and "...children cannot be fooled by empty praise and condescending encouragement." Rather, "A strong ego, secured in its identity by a strong society, does not need, and in fact is immune to any attempt at artificial inflation" (p. 47). In short, persuaders must ensure that while earnestly attempting to cultivate confidence they are not construed as patronizing. The goals which persuaders advocate must be viewed as being attainable. While positive persuasion can strengthen self-efficacy, Bandura (1986) clearly states that negative persuasion can undermine it.

#### *Sources of Self-Efficacy Beliefs: Physiological States*

Physiological states also provide a window into the current state of self-efficacy beliefs. Due to the fact that individuals are capable of changing their own thinking, self-efficacy beliefs can wield considerable influence over physiological states that are themselves often the product of particular thought patterns. Bandura (1997) has observed

that people live within “psychic” environments that are largely of their own design. Anxiety, stress, varying mood states and arousal can all be regarded as indicators of one’s self-efficacy beliefs. People often gauge their own level of confidence or competence by way of the physiological sensations they are experiencing.

Bandura (1997, p. 108) states that it is not necessarily the “sheer intensity” of emotional and physical reactions that is important but how they are perceived and interpreted. One’s arousal can either be debilitating (in the case of low self-efficacy) or energizing (in the case of high self-efficacy). In addition, high levels of physiological arousal may serve to degrade performance while moderate levels may enhance it. Bandura (p. 109) has proposed that individuals with low self-efficacy are more sensitive to physiological sensations than those with high self-efficacy. People with differing self-efficacy may experience the same level of arousal; however, they are less likely to interpret the experience negatively. Those with high self-efficacy may interpret the butterflies that one encounters prior to a public speaking engagement, for instance, as simply a natural reaction and are more likely to benefit from the arousal than someone with low self-efficacy. In summary, it is one’s perception of arousal that is ultimately significant.

Another physiological state that can serve as a type of cognitive filter is mood state. Mood states can affect attentiveness as well as how life experiences are interpreted and later recalled from memory (p. 111). Not surprisingly, strong mood states exert greater influence over self-efficacy determinations than weak ones. Using the analogy of priming a pump for anticipated use, Bandura has concluded that negative mood states activate memories of past failures while positive mood states activate memories of past

victories, events he labels as *affective priming*. Indeed, many people have stored memories of specific successes or failures that have the potential, upon recall, of exerting greater influence than real-time, arousal-producing events. This explains the common wisdom of attempting to recall previous successes when confronting new challenges in the here and now. However, it is not uncommon for people to place greater emphasis on their affective reactions to an arousing event than on this stored (and retrievable) information. Therefore, a good mood is produced subsequent to a positive evaluation of an event and a bad mood follows from a negative evaluation. This is a critically important idea, for mood can bias how much efficacy is derived from experiences. If one is able to induce a positive mood by recalling past successes then perceived self-efficacy is improved. Successes that are created amidst a positive mood generate a stronger sense of self-efficacy than those produced amidst negative moods. Conversely, failures experienced under the spell of a negative mood are more detrimental to self-efficacy than failures encountered during a positive mood. Bandura summarizes this effect of mood on self-efficacy by stating, "The impact of mood on self-efficacy is at least partially mediated by selective recall of past successes and failures" (p. 113).

#### Integration of Self-Efficacy Information

The assembly of self-efficacy beliefs is a multi-faceted process. The process by which the various sources of self-efficacy information are integrated is not clearly explained by SCT. Bandura states, "There has been little research on how people process multidimensional efficacy beliefs; however, there is every reason to believe that efficacy judgments are governed by some common judgmental processes" (p. 114). Bandura has postulated that a variety of integrating rules may be at work. Efficacy factors may

accumulate additively, meaning that the more positive sources there are the stronger the self-efficacy. A relative weighting rule may apply in which some factors are weighed more heavily than others. A synergistic rule may be operating wherein the intersection of two different sources of self-efficacy have a multiplicative effect, greater than the effect that would be explained using the additive rule. Finally, self-efficacy development may follow a *configuration rule* whereby the effect of a particular factor is determined by whether or not a different factor is present simultaneously.

#### Effects of Self-Efficacy Beliefs

According to Pajares (1997), self-efficacy beliefs influence motivational and self-regulatory processes in a variety of ways. These beliefs may influence the choices people make in life and the behaviors they select. The majority of people elect to participate in activities in which they feel relatively confident and competent and avoid activities in which they do not. Therefore, the power of self-beliefs to influence choices in people's lives is considerable. Self-beliefs shape people's interpretation of experience and chart the courses of action they pursue, thereby determining the measure of control they have over the events in their lives. Self-efficacy beliefs determine the degree of effort someone will expend, how long they will persevere and how resilient they will prove to be in the face of adversity. Those with high levels of self-efficacy will exhibit greater effort, perseverance and resilience (p. 4). Bandura states that self-efficacy beliefs "...produce their effects through cognitive, motivational, affective and selective processes. These processes usually operate in concert rather than on their own" (1997, p. 116).

*Self-Efficacy Effects: Cognitive Processes*

Courses of action are initially determined by cognitive processes. Thought processes are responsible for enabling an individual to anticipate scenarios and to visualize future outcomes while self-efficacy beliefs will effect how situations are evaluated. Individuals with high self-efficacy will extract reasonable and attainable opportunities from their environment while those with low self-efficacy will fail to do so. Those with low or negative self-efficacy will focus on their personal limitations and perceived faults, thereby degrading their self-motivation. As Bandura points out, "It is difficult to achieve much while fighting self-doubt" (p. 117).

A major function of cognitive processing is to enable people to predict likely outcomes (p. 117). This inferential thinking affects the acquisition of skills and abilities directly. While some researchers regard the acquisition of ability as a learnable skill, others view it as an inherent aptitude. Within the framework of SCT, those with high levels of self-efficacy assume the former, skill acquisition is learnable. These individuals will seek challenges that provide opportunities for growth. When people view skill acquisition as learnable then the rate at which self-improvement takes place is accelerated (p. 117). Viewing skill acquisition as an inherited trait diminishes both interest in an activity as well as the pace of self-improvement.

The degree to which people believe they can control or influence their environment is linked to self-efficacy beliefs. People who question their abilities (low self-efficacy) are easily persuaded to acquiesce when confronted with a threatening environment while those who feel confident and competent (high self-efficacy) are apt to take the steps necessary to alter it (p. 119). Pajares (1997) comments that people with

strong self-efficacy approach difficult tasks in difficult situations as "...challenges to be mastered rather than dangers to be avoided" and exhibit greater interest in the task at hand (p. 5). These individuals establish challenging (albeit attainable) goals, commit to them and bolster their efforts in the face of failure. They recover more readily from setbacks and are far more likely than their low-self-efficacy counterparts to attribute failure to a lack of effort rather than some inborn defect or inherent inadequacy. The feelings associated with high self-efficacy create a tranquil, calm state of mind amidst the chaos of demanding tasks. Conversely, people with low self-efficacy are more prone to assessing the situation as being tougher than it truly is a belief that promotes stress, depression and anxiety (p. 5). Additionally, people with low self-efficacy are more likely to encounter a type of tunnel vision, narrowing their view of potential problem-solving tactics.

The net effect of these cognitive effects is that self-efficacy beliefs can be used effectively to predict the level of accomplishment that people will ultimately attain.

#### *Self-Efficacy Effects: Motivational Processes*

"Most human motivation is cognitively generated. The capability for self-motivation and purposive action is firmly rooted in SCT" (Bandura, 1997, p. 122). Bandura claims that the future cannot be the cause of current motivation or action; it is how the future is cognitively conceived in the present that regulates motivation or action (p. 122). There are three forms of cognitive motivators: casual attributions, outcome expectancies and cognized goals.

*Cognitive motivators: Causal attributions.* According to Weiner (1985), the retrospective evaluations people make of past performances have motivational effects.

People who attribute their successes to personal ability and their failures to insufficient effort tend to take on more difficult tasks and persist in the face of adversity. However, people who attribute their successes to fortunate situational factors and failures to inherent deficiencies in their ability will exhibit lower levels of motivation and are much more likely to quit when confronted with obstacles.

“Attributions of success to ability are accompanied by heightened beliefs of personal efficacy, which in turn, predict subsequent performance attainments” (Bandura, 1997, p. 123). However, attributions to effort are less strongly correlated to perceived self-efficacy. According to Bandura and Dweck (1988), the degree to which people alter their views of personal ability based upon perceived effort varies considerably with age. While proponents of attributional theory might identify ability as a stable characteristic, many researchers within the field of self-efficacy would construe ability as an “...acquirable skill that is developed through effort” (Bandura, 1997, p 123). Schunk and Cox (1986), for instance, have determined that high degrees of perceived effort that culminate in rising achievement can enhance self-efficacy beliefs. When ability is viewed as a stable trait it often interferes with one’s ability to develop mastery of complex activities and can result in increased vulnerability to stress, anxiety and other emotional dysfunctions.

Within the framework of SCT, ability is regarded as a changeable, albeit not consistently controllable, trait. Put simply, there are times when our perceptions of inherent ability can be difficult to modify. Likewise, effort is seen as not necessarily being stable over time. Our estimations of our effort-generating ability can fluctuate as we mature. However, our ability to control our level of effort can, for some, be quite



difficult. Evidence of this is seen when people work hard to achieve something of great importance and fail in the effort (Bandura and Cervone, 1986). Many people, upon achieving a goal after a Herculean effort convince themselves that they are unable to replicate the performance. For people who believe strongly that ability can be enhanced through personal effort, such accomplishments are positively correlated with beliefs of self-efficacy.

Interestingly, for people who believe that ability is an inborn trait, great achievements acquired through significant effort are negatively correlated with self-efficacy beliefs; these individuals interpret the intensive effort required to succeed as an indicator of defectiveness or deficiency. “Regardless of whether effort attributions correlate positively or negatively with personal efficacy, however, the stronger the efficacy beliefs, the higher the subsequent performance attainments” (Schunk & Cox, 1986; Schunk & Gunn, 1986; Schunk & Rice, 1986).

Bandura (1997, p. 125) has attempted to identify convincing examples of motivational research that outline intervention strategies based upon revising an individual’s interpretation of causal attributes; to date he has been unsuccessful. While modifying the effects of causal attributes has been shown to yield short term positive effects on motivation, these effects do not endure. The overall evidence suggests, “Causal attributions, whether in the form of ability, effort, or task difficulty, generally have weak or no independent effect on performance motivation” (p. 125). Bandura has determined that perceived self-efficacy mediates the effects of causal attributes on performance (p. 125).

*Cognitive motivators: Outcome expectancies.* Expectancy-value theory states that people "...motivate themselves and guide their actions anticipatorily by the outcomes they expect to flow from given courses of behavior" (p. 125). In general, expectancy value theory predicts that the higher one's expectancy that certain behavior will result in specific outcomes and the more highly those specific outcomes are valued, the greater the motivation to attain them. However, in studies where self-efficacy has been controlled, the predictive power of outcomes expectancies has been shown to be negligible. The predictive value of such expectancy-value theories can be enhanced by adding self-efficacy determinants (McCaul, O'Neill, & Glasgow, 1998).

The motivating potential of outcome expectancies is at least partially governed by beliefs of personal abilities. Most of us have encountered challenging activities, that if attempted and conquered, would result in a predictable rise in self-efficacy and yet we choose not to take action. Betz and Hackett (1986) have concluded that this reluctance to move forward is attributed to self-doubt regarding one's ability. The path to the attainment of meaningful, noteworthy achievements is often littered with obstacles, requiring a resilient sense of personal self-efficacy.

Outcome-expectancy theory, in Bandura's view, predicts that an evaluation of one's ability to muster sufficient effort to surmount an obstacle would predict success or failure. However, as Bandura points out, "People judge their capabilities for challenging activities in terms of the knowledge, skills and strategies they have at their command rather than solely on how hard they can exert themselves" (p. 126). In short, self-efficacy beliefs, rather than expected outcomes, determine the types of outcomes that are foreseen.

*Cognitive Motivators: Cognized goals.* Bandura claims that behavior is motivated and directed by cognized (understanding achieved subsequent to cognitive processing) goals as opposed to being influenced by imagined future successes (p. 128). Simply adopting a goal without understanding why one is pursuing it or pursuing a goal in the absence of informative feedback have been shown to produce minimal motivational effects (Bandura & Cervone, 1983; Campion & Lord, 1982). The source of motivation once a goal has been internalized resides in forethought and the self-regulatory mechanisms whereby forethought is translated into purposeful action. Bandura states, "Motivation through the pursuit of challenging standards is enhanced" (1997, p. 128). Indeed there exist abundant studies across diverse domains that support this conclusion (Locke & Latham, 1990; Mento, Steel, & Karren, 1987).

*Self-Reactive Influences as Mediators of Goal Motivation*

According to Bandura (1997, p. 128) cognitively motivated goals are mediated by three types of influences: self-evaluation of one's performances, perceived self-efficacy for goal attainment and the ongoing adjustment of personal standards. Goals are able to motivate when a self-evaluative process is woven into the experience. This evaluative process can be the proverbial "double-edged" sword, for if upon evaluating one's readiness to tackle a challenge it is determined that an insurmountable discrepancy exists between ability and the demands of the task, then motivation to proceed is neutralized. However, this analysis itself is subject to the effects of self-efficacy beliefs. Those individuals who possess high levels of personal efficacy are less likely to be intimidated by this gap than their low self-efficacy counterparts. The anticipated self-satisfaction to

be derived from achieving a goal provides substantial motivating power regardless of a person's current level of efficacy.

When confronted with unanticipated struggles along the path to goal attainment, the range of possible responses is considerable. Individuals may become instantly deflated and demoralized and abandon their goal completely. This is especially likely to happen if one is unable to adjust or realign the goal in response to a realistic appraisal of the situation. Such people are not likely to pursue an incremental path to their goal. Others may not be so completely disheartened; however they are left with insufficient motivation to maintain a quality effort. These people frequently compromise their standards in favor of mediocre performances. In Bandura's opinion, motivation is "...best maintained by a strong sense of efficacy to withstand failure, coupled with some uncertainty that is ascribed to the challenge of the task rather than to fundamental doubts about one's abilities to put forth the effort needed to fulfill personal challenges" (p. 130). The notion that strong self-efficacy beliefs improve motivation has been demonstrated, among others, by Barling and Beattie (1983) and Earley (1986).

#### *Self-Regulation, Self-Motivation and Goal Properties*

Self-regulation refers to the ability to modulate one's behavior based upon cognitive measures. Many theories of self-regulation, such as control theory, rely upon a negative feedback control system. This type of system consists primarily of a sensing mechanism, an inner comparator and error correction routine. Perceived discrepancies between performance feedback and pre-established reference standards results in a decision to actively reduce the incongruity (Bandura, 1997, p. 131).

According to Bandura (p. 131), discrepancy reduction systems play a central role in all self-regulatory systems. However, the negative feedback explanation does not seem to reflect observed human nature. The negative feedback theory predicts that once the gap between observed performance and inner reference standard has been eliminated all effort ceases. This seems to suggest that the only time that people would be compelled to action would be when they perceived some form of inadequacy. Bandura states, “Although comparative feedback is essential in the ongoing regulation of motivation, people initially raise their level of motivation by adopting goals before they receive any feedback about their beginning effort. People are proactive, aspiring organisms” (p. 131).

In Bandura’s opinion, human self-motivation relies not only on discrepancy reduction, but on discrepancy production as well. It requires proactive and reactive control. People will initially motivate themselves proactively by establishing performance standards that conflict with their current skill levels. They then marshal the necessary effort to attain those standards. Reactive control comes into play as effort is adjusted based on performance feedback, a process that continues until the desired results are achieved. At this point the entire process repeats itself; new challenges are selected, performance standards established, efforts are adjusted based on feedback and goals are reached. Therefore, self-regulation of motivation and action involves a dual-control process involving deliberate discrepancy production and discrepancy reduction.

Certain properties of goals themselves affect how strongly self-regulatory systems come into play. The three relevant properties are goal specificity, goal challenge and goal proximity (p. 133).

Goal specificity refers to how clearly the goal is delineated. The more concisely a goal is defined, the more explicit the performance standards can be. Well defined standards are more likely to provide less ambiguous feedback as the goal is pursued than vaguely stated standards. It is quite difficult to effectively regulate your behavior if your intentions have not been made manifest. Locke & Latham (1990) and Bandura & Cervone (1983) have demonstrated that clearly stated goals produce higher levels of performance than nebulous ones.

There is a large body of evidence that indicates that the more challenging the goals that people strive for, the harder they will work to achieve them (Locke and Latham, 1990). However, this is clearly a case where more is not necessarily better. When goals are set unrealistically high, powerful efforts and repeated failures are likely to erode perceived self-efficacy considerably (Bandura, 1997, p. 134). Even when goals are established that are clearly out of reach people remain surprisingly committed for an extended period of time (Erez & Zidon, 1984). When goals are set that are insufficiently challenging they fail to produce much interest and are frequently dismissed. Moderately challenging goals seem to offer the ideal opportunity for self-efficacy development by stimulating interest, encouraging persistence and providing rewarding experiences of self satisfaction upon goal achievement. Therefore, self-motivation in pursuit of extremely challenging goals is best sustained through the completion of a series of incremental sub-goals (Wood, Mento, & Locke, 1987).

The effect of goals on regulating motivation is also influenced by their temporal nature (Bandura, 1997, p. 134). Distant goals exert less influence than proximal ones. This seems to resonate with everyday experience; far-off goals are easier to put off than

goals whose timeline is much shorter. In the absence of proximal goals to focus their efforts, people generally postpone taking the necessary action until absolutely necessary. Bandura and Schunk (1981) and Stock and Cervone (1990) have determined that establishing a series of proximal sub-goals may significantly improve the development of self-efficacy. These sub-goals, if proximal and specific, may produce a steady stream of preliminary mastery experiences that serve to strengthen self-efficacy.

*Self-Efficacy Effects: Affective Processes*

According to Bandura self-efficacy also plays "...a pivotal role in the self-regulation of affective states" (1997, p. 137). There are three principal ways in which efficacy beliefs impact the nature and intensity of emotional experiences: through the exercise of personal control over thought, action, and affect.

*Affective processes: Thoughts.* The "thought modality" in the regulation of affective processes assumes two distinct forms. "Self-efficacy beliefs produce attentional biases and influence how events are construed, cognitively represented and later retrieved in ways that are either benign or perturbing" (p. 137). In other words, self-efficacy beliefs affect what we choose to pay attention to and how those things are experienced. The second form of influence concerns one's perceived cognitive ability to adequately control intrusive, disturbing patterns of thought.

*Affective processes: Action.* Self-efficacy beliefs regulate affective processes by supporting effective courses of action. People who have a high degree of coping efficacy (the belief that they are capable of enduring disquieting thoughts and uncomfortable situations) for instance are more likely to adopt courses of action that are designed to transform threatening environments into benign ones. It is through this method of

affective control that efficacy beliefs empower individuals to navigate as well as regulate stressful and anxiety producing experiences (p. 141).

When affective control is effectively implemented anxiety is typically reduced or eliminated (p. 142). This is accomplished not through the elimination of stressful events, but through the introduction of control. When an individual believes that he or she is in control of a potentially threatening experience then the onset of anxiety is typically reduced. An example of this can be seen when the novice ice skater is allowed to “hug the railing” around an ice rink until he or she is comfortable venturing out into the center of the rink. By being in personal control of the experience he or she is able to minimize the experience of anxiety (Glass, Reim, & Singer, 1971). Bandura, Cioffi, Taylor, and Brouillard demonstrated that perceived self-efficacy was strengthened by one’s ability to exert complete control over an emotionally arousing event and was significantly diminished by an inability to exercise control (1988).

*Affective processes: Affect.* The third way that self-efficacy beliefs affect the intensity of emotional experiences is via the exercise of personal control over affect. The strength of an individual’s belief in his or her ability to ameliorate prospective disturbing emotions will, in turn, determine how such events are experienced. According to Bandura, “Many human distresses are exacerbated, if not created, by failures of thought control” (Bandura, 1997, p. 145). Research indicates that it is not necessarily the frequency of disturbing emotions that explains anxiety arousal, but rather the strength of perceived personal efficacy to control or dismiss them (Kent, 1987; Kent & Gibbons, 1987). In other words, it seems that it is not merely the appearance of disturbing thoughts that is the problem; it is the perceived ability to turn them off at will that wreaks havoc.



Bandura states with some definitiveness, "The most powerful way of eliminating intrusive ideation is by gaining mastery over threats and stressors that repeatedly trigger the perturbing trains of thought" (Bandura, 1997, p. 148). The most effective way of achieving this is through the gradual introduction of mastery experiences.

Affect and behavior may each be controlled through perceived coping efficacy and thought control efficacy. Coping efficacy refers to the perceived ability to grapple with potentially unsettling experiences while thought control efficacy refers to the perceived ability to manage unpleasant thoughts and ruminations. Ozer and Bandura demonstrated these dual effects by investigating the effects of self-defense instruction on women (1990). They determined that the acquisition of self-defense mastery served to "...liberate women both psychologically as well as behaviorally" (Bandura, 1997, p. 148). Speaking about the implications of self-efficacy on affect, Bandura said, "When people have a strong sense of efficacy to control their own thinking, they are less burdened by negative thoughts and experience low levels of anxiety" (p. 149). Conversely, when people experience a sense of helplessness to control their own thinking the result can be very troubling, for it is a constant reminder of a self-regulatory weakness (p. 151).

Another means by which people may control affect is through palliative techniques such as yoga, self-relaxation, calming self-talk, meditation and diversionary recreational activities (p. 151). Rosenthal has concluded that positive diversions and beneficial lifestyle perspectives strengthen our ability to manage the stressors of everyday life (1993). Bandura summarizes the wisdom of pursuing such activities when he states, "Physical exercise, recreational activities, and enjoyable avocational pursuits help to

relieve pressures and restore restful balance to our lives. Humor tempers the sting of adversities” (1997, p. 151).

*Self-Efficacy Effects: Selection Processes*

The final effect of self-efficacy beliefs to be discussed will be their impact on selection processes. Selection processes refers to the process by which people make choices in their lives. Bandura claims that by selecting their environments people influence what they become (p. 160). The range of choices available is largely determined by the state of one’s self-efficacy beliefs. As explained by Bandura (p. 161), selection processes are different from cognitive, motivational and affective processes:

In prompt dismissal of certain courses of action on grounds of personal inefficacy, the latter regulative processes never come into play. It is only after people choose to engage in an activity that they mobilize their efforts; generate possible solutions and strategies of action; and become elated, anxious, or depressed over how they are doing.

The power of self-efficacy beliefs to impact the course of life paths through selection processes has been investigated by Betz and Hackett (1986) and Lent and Hackett (1987) in their studies of career choice and development. They concluded:

The stronger people's self-efficacy, the more career options they consider possible, the greater the interest they show in them, the better they prepare themselves educationally for different occupational careers and the greater their staying power in the chosen pursuits (Bandura. 1997, p. 161).

Choices that are made during formative periods of life carry special weight because they initiate a series of experiences that later either creates the prerequisites for

desired future outcomes or preclude them (p. 161). It is a common experience for these events to transpire without notice for they do not appear to be significant at the time. The effects of these events can be compared to the gradual changing of course of a mighty river; the adjustments are microscopic by day, virtually invisible, but glaringly obvious after several years. It is only in hindsight that the cumulative effects are noticed.

Efficacy beliefs also contribute to the course of social development. Beliefs of personal efficacy determine who we associate with and the activities we take part in. These affiliation patterns “shape the direction of self-efficacy development” (p. 161).

#### Self-Efficacy: A Developmental Analysis

Changes in self-efficacy with age do not follow rigid, lock-step stages of development that apply uniformly to everyone. Adolescence is not necessarily a time of turmoil and middle age is not always beset with crisis. There are a variety of pathways through life that are affected by age, geographical location, social status, family and education (p. 163). There are variables which are controllable and predictable and others that are uncontrollable and subject to chance. According to Bandura, “People are often brought together through a fortuitous constellation of events that can shape their lives” (p. 163).

#### *Impact of Early Mastery Experiences*

Mastery experiences as early as infancy have been shown to initiate particular developmental paths (p. 169). However, the nature of that pathway depends on the nature of the enabling experience. Experiences which foster a sense of agency (the awareness of being the source of a desired outcome) are more influential than those which do not. These early mastery experiences create an internal cognitive climate that is

more conducive to the cultivation of future cognitive skills (Ramey, McGinness, Cross, Collier, & Barrie, 1982). During this early period the exercise of influence over the physical environment appears to contribute more to this sense of personal agency than experiences of control over the social environment (Bandura, 1997, p. 164).

The initial efficacy experiences are centered in the family where the first comparative models appear. As children's social world expands their peers assume an increasingly important role. First-born children and only children are presented with different frameworks for evaluating their capabilities than children with older siblings (p. 169). When self-efficacy is rooted in inevitable episodes of sibling rivalry, individuals are more likely to become sensitive to the potentially denigrating effects of social comparisons (p. 170).

#### *Development of Self-Appraisal Skills*

The development of self-appraisal skills by children requires attention to the nature of the task, situational factors, characteristics of their own actions, as well as the results produced. As they age children generally begin to appreciate that effort can compensate for lack of ability and are able to more accurately judge their capabilities and limitations. Evaluating personal efficacy via social comparisons is a far more complex process than appraisals based on direct experience. As children age their reliance on direct experiences to gauge self-efficacy begins to diminish (p. 171).

#### *School as an Agency for Cultivating Self-Efficacy*

Bandura states, "During the crucial formative period of children's lives, the school functions as the primary setting for the cultivation and social validation of cognitive capabilities" (p. 174). As children master cognitive skills within school they

strengthen their sense of intellectual efficacy. Bandura and Schunk (1981) have shown that a strong sense of self-efficacy fosters a high level of motivation, academic accomplishments, and development of intrinsic interest in academic subjects.

According to Bandura, the primary purpose of school is to provide students with opportunities to develop self-regulatory abilities that will later enable them to educate themselves (p. 174). Zimmerman, Bandura, and Martinez-Pons (1992) examined the role of self-regulatory efficacy in students and concluded:

Self-regulation encompasses skills for planning, organizing, and managing instructional activities; enlisting resources; regulating one's own motivation; and applying metacognitive skills to evaluate the adequacy of one's knowledge and strategies. A high sense of self-regulatory efficacy contributes to mastery of academic subject matter by building a sense of cognitive efficacy and raising academic aspirations in those domains.

As Bandura points out, within the confines of school, self-regulatory efficacy is determined by more than just formal instruction; peer modeling and social comparisons are also at work.

There are a variety of school practices that tend to convert instructional experiences into negative educational efficacy (or inefficacy). These practices include ability grouping, socially competitive grading and homogenous instruction that do not take into consideration individual learning style differences. Unfortunately, once a sense of inefficacy sets in it is very difficult to modify; it tends to "feed on itself." Cooperative structures within the classroom have been shown to promote higher achievement than

competitive ones and tend to foster positive academic efficacy rather than inefficacy (p. 175).

The profound impact of children's beliefs in their cognitive self-efficacy is reflected in the following remarks from Bandura:

Children's beliefs in their cognitive efficacy have repercussions in the course of their social development as well as their intellectual growth. Those who are confident of their abilities to master academic skills and to regulate their own learning are more socially inclined and enjoy greater popularity and less rejection by their peers than do children who are too burdened with intellectual self-doubts to put much effort into academic activities (p. 176).

#### *Growth of Self-Efficacy through Adolescence*

Bandura states that contrary to popular belief, adolescence does not necessarily entail continual episodes of "storm and stress" (p. 177). However, adolescents are indeed presented with the difficult task of managing biological, educational and social changes simultaneously. This is a period of time marked by concurrent journeys through puberty, vacillating social connections, athletic performances and various academic endeavors. Reflecting on the demands of adolescence, Bandura states, "The success with which the risks and challenges of adolescence are managed depends, in no small measure, on the strength of personal efficacy built up through prior mastery experiences" (p. 178).

Adolescents' belief in their efficacy in social and academic scenarios affects their emotional well-being as well as their development (p. 178). Adolescents who possess a confident sense of social efficacy are more adept at cultivating friendships than those mired in self-doubt (Connolly, 1989). Navigating adolescence in isolation carries a

significant risk of concomitant depression. This is especially true for adolescent girls (p. 179). McFarlane, Bellissimo, and Norman (1995) demonstrated that supportive social networks (friends and family) function as effective safeguards against adolescent depression.

### *Self-Efficacy Concerns in Adulthood*

According to Bandura, "Young adulthood is a period when people have to manage many new social demands arising from lasting partnerships, parenthood, entry into vocational careers, and management of financial resources" (p. 184). For most people the path towards adulthood is less well defined than in the past. Bandura comments, "Given the increased ambiguity and diversity of society, individuals have more leeway to determine the course their lives take by cultivating their competencies and selecting, shaping, and modifying their environments" (p. 184). As was true during earlier stages of development, possessing a strong sense of self-efficacy contributes to the creation of a meaningful, rewarding life.

*Occupational roles.* The transition from school to vocation is generally more difficult than the transition from school to university. Employers prefer older, more experienced applicants than recent graduates. Students who elect not to attend college often find themselves trapped in a series of mediocre, low-paying jobs. While many industrialized countries offer formal social mechanisms for establishing non-college bound students in vocational careers, the United States does not. Such preparatory programs enable students to exercise some control over their vocational futures (p. 186).

When viewed as a period of preparation for one's vocational future, young adulthood represents a phase during which the strength of self-efficacy beliefs influence

the acquisition of the necessary social and cognitive skills that will be required in the workplace (p. 188). However, providing young adults with opportunities to develop these skills does not guarantee that they will take advantage of them. Bandura states, "Requisite competencies are not mastered without sacrifice and hard work. It requires a high level of self-regulatory efficacy to mount and sustain the effort needed to prepare oneself adequately for a give vocational pursuit" (p. 188).

The beliefs that people hold of their capabilities impact the career selection process considerably. Young adults will frequently forego vocations they see as being worthy if they lack the efficacy that would reflect an image of themselves as competent and capable people; these individuals simply decide that the demands of the job exceed their capacities. In Bandura's view, occupational efficacy beliefs are largely the product of socio-educational experiences and prevailing cultural attitudes and practices (p. 188). The negative connotations associated with low socio-economic status serve to diminish occupational self-efficacy, even when the occupation in question is held in high regard by society. In addition, gender biases have negatively impacted the occupational efficacy of women for decades, a phenomenon that is more prominent with respect to male-dominated professions (Betz & Hackett, 1981).

*Family roles.* As anyone who has experienced marriage and the subsequent birth of a child can attest, the transition from "duet" to "trio" increases the scope and diversity of coping demands significantly (Michaels & Goldberg, 1988). Parenting efficacy plays a pivotal role during this adaptation to parenthood interval. Mothers who possess a strong belief in their parenting skills will generally experience enhanced emotional well being, closer attachments to their newborns, an easier transition to parenting, and less



marital conflict (Williams, Joy, Travis, Gotowiec, Blum-Steele, Aiken, Painter, & Davidson, 1987).

According to Bandura, "Women's beliefs in their efficacy to combine occupational and familial responsibilities may shape their career choices and development" (p. 192). When women possess a low sense of efficacy to manage family-related responsibilities they are frequently discouraged from pursuing male-dominated professions. Men who doubt their efficacy to handle these dual responsibilities evade the issue by minimal involvement in the daily household chores (p. 193).

Low-income families experience considerable hardships. Reflecting on this predicament, Bandura states, "Efficacious parents carve out functional sub-communities that link their children to positive models, constructive activities, supportive social networks and the values and social norms parents hold dear" (p. 194). These actions compensate, to some degree, for limited resources.

Families who harbor an efficacious outlook seem to experience greater community satisfaction. These families are less adversely affected by their circumstances and are less likely to move. However, when confronted with extreme adversity, families with a high sense of efficacy are more apt to relocate in search of a better life (p. 195).

*Midlife changes.* By the time the middle years of life arrive, people generally settle into established lifestyles that stabilize their sense of efficacy in major areas of functioning (p. 196). However, from the perspective of social cognitive theory, life is not static; conditions in life never remain stagnant. Physical, occupational and financial changes will demand ongoing adaptations that demand reappraisals of efficacy.

With the advent of new organizational realities such as re-engineering, restructuring and downsizing, adults must come to terms with an often tentative financial landscape. To effectively manage their work lives, people must be able to constantly develop skills and efficacy beliefs that enable them to adapt to new jobs with new demands. According to Bandura, "A high sense of efficacy to master multiple jobs and careers will be essential for a secure and satisfying occupational life in the transnational economy of the future" (p. 196).

These new jobs will often require significant amounts of teamwork, necessitating the development of a high level of interpersonal and technical efficacy. While this time of rapid change offers multiple opportunities to mold one's career trajectory, it also creates uncertainty and job insecurity (p. 197). For adults in their middle years who possess low levels of self-efficacy this may result in significant stress.

The mid-life crisis resides more in the rhetoric of popular media than in the actual experiences of people in middle life. Bandura summarizes his perspective on midlife in the following:

Most people navigate through the middle years efficaciously. Some do not. Like other developmental phases, midlife is a point in a personal life trajectory, not a unique stage that spawns distinct forms of behavior. Adaptation in midlife is best predicted by the interplay of personal attributes and life circumstances rather than by one's age (p. 198).

#### Self-Efficacy and Cognitive Functioning

According to Bandura, education has now become vital for a productive life. Societies have paid dearly for the educational neglect of their youth. Failure in school

foreshadows delinquency, substance abuse, teenage pregnancy and diminished opportunities in adulthood. While children can learn a great deal from computers, they still require human teachers to help them build a sense of efficacy, to cultivate aspirations and to find meaning and direction in their pursuits (p. 213). There are three ways in which efficacy beliefs operate as important contributors to the development of cognitive competencies that govern academic achievement. Student beliefs in their efficacy to master various academic disciplines, teacher beliefs in their personal efficacy to motivate and promote learning in their students and the collective sense of efficacy of faculty members that as a community they can positively impact and direct student progress all serve to impact student cognitive development (p. 214).

#### *Students' Cognitive Self-Efficacy*

Bouffard-Bouchard, Parent, and Larivee (1991) determined that efficacy beliefs in children contribute independently to their intellectual performance and were not merely indicative of the strength of their cognitive skills. Regardless of whether children were of superior or average intellectual ability, those with a high sense of efficacy were more successful in solving conceptual problems than were children of equal ability but lower perceived efficacy. "The more self-efficacious students at each ability level managed their work time better, were more persistent, and were less likely to reject correct solutions prematurely" (Bandura, 1997, p. 215).

In 1989 Schunk published the findings of extensive studies into the factors that affect children's cognitive efficacy (especially those that present severe deficits in mathematical and language skills). Bandura summarized these conclusions with the statement, "Efficacy beliefs are influenced by acquisition of cognitive skills, but they are

not simply a reflection of them" (1997, p. 216). Perceived self-efficacy was shown to be superior to acquired skills in predicting intellectual performance. Skill development had minimal direct effects on performance and on academic efficacy. Perceived self-efficacy exerts "a more substantial impact on academic performance, both directly by affecting quality of thinking and good use of acquired cognitive skills and indirectly by heightening persistence in the search for solutions" (p. 216). These results have been replicated by numerous studies, including Pajares and Miller (1994), Pajares, Urdan, and Dixon (1995) and Hackett (1985).

Schunk and Swartz (1993) examined the benefits of combining training in various learning strategies with feedback regarding progress towards mastering those same strategies. The results revealed a cyclical process where the more perceived self-efficacy was raised, the more the strategies were used. The effects were amplified when students were asked to transfer their newly acquired strategic skills to new problem solving scenarios.

Student development of cognitive self-efficacy is influenced by the motivating power of goal setting. Short term goals provide immediate incentives and contribute to the development of cognitive self efficacy more effectively if they are self-selected rather than assigned. Schunk determined that when operating under self-set goals, children with serious mathematical deficiencies have higher initial expectations of success, develop a stronger sense of mathematical efficacy and attain higher intellectual performances than if goals are prescribed or if they pursue learning in the absence of goals (1985). Incentives provide another avenue of influence on the development of cognitive self-efficacy.

According to Bandura, incentives should be used, if necessary, “mainly to cultivate competencies, a sense of personal efficacy and enduring interest in an activity” (1997, p. 222). One of the most powerful sources of incentive-based influence on self-efficacy is people’s affective self-reactions to their own performances. When people aim for and master levels of performance that are personally meaningful the resultant sense of exhilaration builds enduring intrinsic interest in the task (Locke & Latham, 1990). These episodes of personal satisfaction serve as markers for providing convincing evidence of the growth of capability and therefore foster the development of cognitive self-efficacy (Bandura, 1997, p. 219).

An integral part of effective instruction is teaching students how to regulate their own learning. Effective intellectual functioning requires metacognitive skills for how to organize, monitor, evaluate and regulate one’s own thinking processes (p. 223). Bandura (1986) points out that failure in intellectual performance often occurs due to ineffective use of cognitive and metacognitive skills rather than lack of knowledge. “People need a sense of efficacy to apply what they know consistently, persistently, and skillfully, especially when things go wrong” (Bandura, 1997, p. 223).

Teachers’ evaluations of students’ abilities significantly influence student self-appraisals of competence. These evaluations can take the form of whom they choose to pay attention to, stated and implied expectations, grouping practices and difficulty level of assignments. When teachers credit student achievement to ability rather than hard work, perceived cognitive self-efficacy is enhanced (Schunk, 1984). This effect can be seen whether the teacher is evaluating a single student or an entire class (O’Sullivan & Harvey, 1993). When students encounter difficulty, perceived efficacy is promoted by

attributing failure to a lack of acquirable knowledge and cognitive skills and then providing a series of guided mastery experiences. These guided mastery experiences are optimized when motivated by compelling, short-term goals. Viewing cognitive ability as an acquirable skill fosters a resilient sense of efficacy (Bandura, 1997, p. 226).

According to Bandura, lifelong cognitive development is a function of self-regulated learning (p. 227). Self-regulated learning entails motivational as well as cognitive and metacognitive processes. In the world of academia, self-regulated learning takes the form of comparing what one knows against the level of understanding desired and then taking the necessary action to acquire it. Social cognitive theory integrates the cognitive, metacognitive and motivational mechanisms of self-regulation (Bandura, 1986).

The ability to regulate one's learning requires various strategic skills. These include information processing skills, cognitive skills and metacognitive skills. Information processing skills are required for identifying important information, transforming it to enhance its meaning and organizing it into generalizable forms. Cognitive skills involve structuring problems in ways that specify goals and possible routes to their attainment, selecting appropriate strategies and effectively applying them to solve problems. Metacognitive skills refer to the process of thinking about the adequacy of one's own thinking. Metacognitive thinking allows people to monitor regulative thought, to evaluate its adequacy in solving problems and to adjust it as necessary (Bandura, 1997, p. 229).

In the interest of encouraging the development of a strong sense of cognitive self efficacy in their children, Bandura suggests that parents assist them in the development of

challenging goals and endeavor to model the self-efficacy they wish to engender (p. 231). Martinez-Pons (1996) determined that such parental efforts positively affect academic performance through the enhancement of self-regulatory abilities. This conclusion is supported by Bandura who states, "A strong sense of efficacy to regulate one's motivation and instructional activities undergirds belief in one's academic efficacy and aspirations" (p. 231). According to Pintrich and Schrauben (1992), academic and self-regulatory efficacies have reciprocal effects on cognitive and metacognitive learning strategies. They discovered that compared to students low in perceived self-efficacy, those who have a high sense of academic efficacy make greater use of cognitive strategies, manage their time and learning environments better and monitor and regulate their learning more closely.

The influence of peers on the development of cognitive self-efficacy has been shown to increase as children grow older (Bandura, 1997, p. 234). It is common knowledge that students publicly label, rank and discuss how capable their classmates are. Shared social appraisals serve as persuasive modes of influence on beliefs of personal efficacy. It is often the case that students' self-appraisals of their intellectual capabilities are closely related to the appraisals by their peers. This is even more pronounced amidst classroom structures that group according to ability and offer few choices in activities to demonstrate ability (Rosenholtz & Wilson, 1980). Peer modeling of academic skills raises cognitive self-efficacy. The more similar students perceive themselves to be to the model, the more firmly they believe in their personal learning efficacy and the higher their subsequent intellectual achievements. This mode of influence is more significant when the episode of modeling entails coping successfully

with setbacks as opposed to masterful performances by highly skilled peers (Schunk & Hanson, 1985).

Peers also shape cognitive efficacy by influencing interpersonal relationships. The peers with whom one chooses to affiliate may affect what abilities or potentials are cultivated and which are discarded. Ellis and Lane (1963) analyzed the intellectual histories of students from disadvantaged backgrounds and discovered that those who elected to associate with college-bound peers were influenced by their collective interests, attitudes and achievement standards and were more likely to pursue higher education opportunities.

The world of school is replete with opportunities to encounter anxiety. From a cognitive perspective, the full impact of perceived efficacy on anxiety is best revealed by assessing belief in one's ability to fulfill academic demands, exercise control over intrusive and disturbing thoughts, and to regulate one's study activities. Students who have a low sense of efficacy to manage academic demands are especially vulnerable to achievement anxiety (Bandura, 1997, p. 235). This phenomenon has been most extensively researched within the field of mathematics. A low sense of mathematics efficacy is accompanied by high math anxiety (Betz & Hackett, 1983; Krampen, 1988). It is not the mere existence of previous failures in mathematics that produces anxiety; the anxiety is mediated entirely through the effects of the failures on perceived self-efficacy (Meece, Wigfield, & Eccles, 1990). When anxiety is correlated with academic performance, the relationship generally disappears when the influence of perceived self-efficacy is controlled (Pajares & Johnson, 1994).



### *Teachers' Perceived Efficacy*

The responsibility for creating nurturing learning environments where cognitive competencies can be cultivated rests almost exclusively with teachers. Coldarci (1992) found that teachers' sense of instructional efficacy was the single best predictor of commitment to the teaching profession. According to Bandura:

A teacher's sense of efficacy is likely to be especially influential on young children because their beliefs about their capabilities are still relatively unstable, peer structures are relatively informal, and young children make little use of social comparison information in evaluating their capabilities (1997, p. 242).

Teachers who possess a strong sense of instructional efficacy are more likely to create the necessary mastery experiences required to enhance the cognitive development of students. Those with a low sense of instructional efficacy frequently take a pessimistic view of student motivation, emphasize control of classroom behavior through strict regulations and rely on extrinsic rewards and punitive sanctions to compel students to study (Woolfolk & Hoy, 1990). A common coping strategy for teachers who experience low instructional efficacy in a given discipline is to simply avoid teaching it, thus depriving students of opportunities to develop their own sense of efficacy within the subject (Enochs & Riggs, 1990). As Bandura points out, teachers with a low sense of instructional efficacy are "...mired in classroom problems..." and "...if they had it all over to do again, would not choose the teaching profession" (1997, p. 241).

Teachers with a high sense of efficacy are more likely to regard all students as reachable and teachable, regardless of ability. They model efficacious beliefs by regarding problems as challenges surmountable by ingenuity and added effort. A

teacher's sense of instructional efficacy is not uniform across all subjects. A teacher may possess a strong sense of efficacy in the language arts and a diminished sense of efficacy in math and science for instance (p. 243).

According to Bandura (p. 249), students who are taught by teachers with a low sense of instructional efficacy suffer a loss in perceived academic efficacy and lowered expectations. This effect is even more pronounced if the student is already struggling. Fortunately, a teacher's sense of efficacy can be modified (Bandura, 1993).

### *Collective School Efficacy*

Teachers do not function in total isolation; rather they operate collectively within an interactive social system. Therefore, efficacy development within the school environment must address the social and organizational structures present.

Efficacious schools display discernible attributes according to Bandura (p. 246). These attributes include effective principals, infrequent use of tracking mechanisms, and robust family relationships. According to Coldarci (1992), principals who serve as vibrant instructional leaders can build instructional efficacy within teachers throughout the school community. Efficacious schools support and expect high standards and tend to employ mastery models of learning to ensure success. This approach is in contrast to low achieving schools that stratify according to ability and whose teachers are likely to spend less time actively teaching students regarded as uneducable (Brookover, Beady, Flood, Schweitzer, & Wisenbaker, 1979).

Another distinguishing characteristic of efficacious schools is their commitment to forming strong bonds with families. Epstein (1990) determined that parents play an instrumental role in their children's educational growth. Parents prepare their children

daily for school, serve as an advocate in a variety of forums, establish and maintain effective study habits, encourage the development of language skills, model persistence and lifelong learning and monitor progress. Dornbusch (1994) found that when students were equated for ability, the greater the degree of parental involvement in academic activities the greater the likelihood that the child would be placed in a more challenging academic track.

The ongoing decline in traditional family structures has highlighted the importance of building family connectedness to schools (Epstein & Scott-Jones, 1988). In addition, the American population is becoming increasingly diversified, encompassing cultures that are often unaccustomed to sharing in the responsibility of educating children. Schools have now inherited the responsibility of educating these diverse parents in how to serve as effective advocates for their children. Such training is ongoing and requires an ongoing system of communication between home and school (Brandt, 1989). To ensure that parents sustain a high level of participation in their children's education, schools must ensure that this steady stream of communication sends the message that involvement makes a difference.

#### Mathematics Self-Efficacy

The predecessor to mathematics self-efficacy in the literature is the globally assessed *confidence in learning mathematics* construct (Pajares & Miller, 1997). According to Pajares and Miller these early studies concluded that mathematics confidence could be used to predict mathematics performance with varying degrees of correlational strength; correlations ranged between .20 and .72. These reported correlations reveal a weak to moderate relationship. Given Bandura's cautions

concerning the use of global measures of self-efficacy, namely that they are less useful as a predictive device than specific measures, current research in mathematics self-efficacy has focused on individual judgments of ability to perform specific mathematical tasks (Hackett & Betz, 1989; Pajares & Miller, 1994).

Hackett and Betz (1989) found that students have a tendency to overestimate their mathematics abilities. They found that 54% of men and 44% of women overestimated their capabilities as opposed to 16% of the men and 18% of the women who underestimated their abilities. Pajares and Miller (1994) produced similar results.

According to Pajares and Miller (1995) self-efficacy research in academic settings has focused primarily on two areas. The first has examined the relationships between efficacy beliefs, psychological constructs and academic motivation and achievement. The second area has investigated the relationship between efficacy beliefs and choices of college major and occupation. Investigation into the latter has significant implications for counseling and vocational psychology theory given that a wide variety of careers require mathematical literacy (Lent and Hackett, 1987).

Betz and Hackett (1983) were amongst the first researchers to develop quantitative measures of mathematics self-efficacy with their creation of the Mathematics Self-Efficacy Scale (MSES). Pajares and Miller (1995) state "There are different ways of assessing self-efficacy, but the most theoretically appropriate and empirically warranted is one in which the self-efficacy measure assesses the same or similar skills required for the performance task" (p. 196). Reflecting this view, the MSES instrument incorporates a global measure of mathematical problem-solving confidence, as well as a measure of confidence to perform specific mathematics tasks and an assessment of predictions of

grades one might earn in future college-level mathematics courses. Pajares and Kranzler (1997) performed an exploratory factor analysis of this instrument and determined that it was a valid multi-dimensional measure of mathematics self-efficacy. The MSES was adapted for use with high school students by Randhawa, Beamer, and Lundberg (1993). However, contrary to Bandura's strong belief that global measures of self efficacy are "...no more informative to speak of than nonspecific social behaviors" (1986, p. 411), this modified MSES incorporates a generalized measure of mathematics self-efficacy.

Hackett (1985) proposed a causal model of mathematics self-efficacy as an explanation for the large gender difference that exists in the number of male and female students who select mathematics-oriented majors in college. She determined that a student's mathematics self-efficacy was the single most powerful predictor of occupational choice. Mathematics self-efficacy was found to be positively correlated with mathematics ability and negatively correlated with mathematics anxiety (Cooper & Robinson, 1991).

*Mathematics self-efficacy and math anxiety.* Mathematics anxiety has been investigated at length for over fifty years (Pajares & Miller, 1994). Hembree (1990) published a meta-analysis of these studies and concluded that a negative correlation exists between mathematics anxiety and performance. In addition he determined that student attitude towards mathematics and mathematics anxiety was inversely related. Hembree found that females display higher levels of mathematics anxiety than males. He examined a variety of treatments for mathematics anxiety and concluded that improved mathematics performance consistently accompanied a reduction in anxiety. This finding is significant given the prominent role within the framework of social cognitive theory of

mastery experiences and their effects on self-efficacy. An enhanced mathematics self-efficacy can be seen as an antidote to the negative effects of math anxiety.

Pajares and Miller (1994) report, "In most cases, however, math anxiety is not a powerful predictor when variables such as self-efficacy, self-concept, prior experience, and perceived usefulness are controlled" (p. 195). Meece, et al., corroborated this finding (1990). Hackett (1985) investigated the effects of mathematics self-efficacy on mathematics anxiety and found that self-efficacy had a strong, direct effect. Mathematics self-efficacy also presented a stronger effect on choice of math-related careers than did mathematics anxiety and an even stronger overall effect.

#### Adult Development

In 1890 William James, the eminent psychologist, proclaimed that by age thirty character was set "like plaster" (James, 1890; McCrae & Costa, 1990). In a similar vein, Sigmund Freud all but ignored the impact of adulthood on personality development (McCrae & Costa, 1990). This apparent minimization of the role of adulthood on personality development can be attributed to the common observation that one's physical development ceases in young adulthood and, presumably, one's emotional or psychological development should terminate as well (p. 3).

Therefore, it was a rather intrepid endeavor to venture forth with the proposition that psychological development might continue throughout life. According to McCrae and Costa (p. 4), it was Carl Jung who first made this courageous leap with his "stages of life" proposal. Jung objected to Freud's pervasive emphasis on sexuality. He proposed that sexual development was central to personality only in the young, in whom the "...function of procreation was vested" (p. 11). Jung believed that beyond the age of

forty other sources of growth must be present, sources that were uniquely important to adults. He theorized that these forces were more likely to be spiritual than sexual and instead of "...revolving around the social function of procreation..." they were chiefly concerned with an individual's relationship to self (p. 12).

Jung coined the term *individuation* to describe this continuing process of self-discovery and self-development, a process he hypothesized would occur during the second half of life. The journey of individuation would entail an ongoing struggle between psychologically opposing forces (thought vs. feeling, sensation vs. intuition), the resolution of which would require a willingness to expose these contrasting voices, thereby preventing their repression. Jung reasoned that only in advancing age could one fully integrate these forces and make manifest the epitome of psychological development (p. 12).

According to Knowles (1998) adult development theories are generally divided into three categories: those that focus on physical changes, on intellectual changes and on personality and lifespan changes. Developmental theories vary in their relative emphasis on change versus development. Knowles states, "No one theory is *best*. Rather, adult development should be viewed as consisting of multiple pathways, multidimensional" (p. 172). Adults develop along multiple dimensions simultaneously.

Levinson's *Life Task Developmental Model* is representative of a lifespan theory (1978, 1986). Theories of adult development may either include or not include a sequence of stages to describe the spectrum of changes that people typically experience throughout their lives. Levinson's model is stage based and was devised subsequent to a long term analysis of 40 middle-aged men. According to Levinson people move through

ten different stages in adult development, from *early adult transition* between the ages of 17 and 22 to *late adulthood* after age 65 (see Table 1). These ten stages are divided into three eras: early adulthood, middle adulthood and late adulthood. This model is characterized by the appearance of *life structures* that are defined as coherent relationships between one's own goals and the roles one plays in various life arenas. Life structures evolve through a sequence of distinct periods and are shaped by decisions that each individual makes at various times in adulthood (Levinson, 1986; Hayslip & Panek, 1989). According to Knowles (1998), Levinson is responsible for introducing the idea of a mid-life crisis into American culture.

Table 1

Levinson's Life Task Developmental Model

Developmental Period	Age Group	Task
Early adult transition	17-22	Explore possibilities and make tentative commitments
Entering the adult world	22-29	Create first major life structure
Age 30 transition	29-33	Reassess life structure
Settling down	33-40	Create second life structure
Midlife transition	40-45	Ask, "What have I done in my life?"
Entering middle adulthood	45-50	Create new life structure
Age 50 transition	50-55	Minor adjustments to middle life structure
Culmination of middle adulthood	55-60	Build second middle life structure
Later life transition	60-65	Prepare for retirement and old age



Table 1 (continued)

Late adulthood	65+	Create late life structure and deal with declines of old age
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Another prominent stage-based lifespan theory is Erikson's theory of identity development (1963). Building on the foundation laid by Jung, Erikson developed a more elaborate and systematic theory of development, when he postulated *stages of psychosocial development* to parallel Freud's stages of psychosocial development, and then extended them beyond adolescence and across the remaining years of life (McCrae & Costa, 1990). Erikson proposed that adults shape their identity by resolving a sequence of eight crises, each specific to a different age span (see Table 2). If an individual navigates these stages successfully then strength results. Interpreting Erikson's model, Hayslip and Panek (1989) observed that failure to adequately resolve a crisis can result in serious interference with one's ability to resolve subsequent crises. This explains why Erikson's theory is regarded as an age-graded psychosocial crisis theory.

Table 2

Erikson's Stages of Identity Development

Approximate Age	Stage	Potential Strength to be Gained
0-1 years	Basis trust vs. mistrust	Hope
1-3 years	Autonomy vs. shame/doubt	Will
4-5 years	Initiative vs. guilt	Purpose
6-12 years	Industry vs. inferiority	Competence
13-18 years	Identity vs. role confusion	Fidelity
19-25 years	Intimacy vs. isolation	Love

Table 2 (continued)

25-65 years	Generativity vs. self-absorption and stagnation	Care
65+ years	Ego integrity vs. despair	Wisdom

Loevinger (1976) developed a nine-stage model of ego development that progresses from infancy through adulthood (see Table 3). Loevinger's theory is not stage dependent and allows for individuals to become mired in one stage for indeterminate periods of time. In general terms the goal of adult development within this framework is to progress from a state of dependency to one of autonomy (Knowles, 1998).

Table 3

*Loevinger's Stages of Ego Development*

Stage	Description
Pre-social stage	Infant distinguishes himself/herself from surroundings
Symbiotic stage	Infant retains symbiotic relationship with mother
Impulsive stage	Child asserts separate identity
Self-protective stage	Child learns self-control of impulses
Self-aware stage	Self-awareness increases as does acceptance of individual differences
Conscientious stage	Person lives by individually created rules and ideals
Individualistic stage	Person focused on independence vs. dependence
Autonomous stage	Adults are fully independent and can cope with inner conflict

Another stage-based theory of adult development was developed by Gould. Gould's research included men and women and focused on the varying experiences of time as people age (Gould, 1980; Hayslip & Panek, 2002). Gould devised a version of psychoanalytic thought to explain the changes he observed in adults (McCrae & Costa, 1990). At the heart of this theory is the inherent insecurity of the child who is confronted with the uncertainties and dangers of the world. To cope with these assorted fears, the child adopts a set of beliefs that Gould called *illusions of safety*. These illusory ideas explain a child's belief that his or her parents will always be there to take care of them; that there is no real evil or death in the world; that life is simple and controllable (p. 17). While each of these illusions provides some degree of comfort to a child, each can lead an adult to form a distorted view of the world. During early adulthood individuals must come to terms with these beliefs and "...abandon them to find a more realistic view of the world" (p. 17).

Gould proposes that these illusions of safety are unconscious psychodynamic defenses. Young adults may not be cognizant of their presence and may steadfastly deny their existence; however, their behavior often reveals their residence in the unconscious. In order to attain full adulthood status one must confront and outgrow these illusory beliefs through an often emotionally painful process. These confrontations occur predictably throughout adulthood in age-defined phases, each producing significant *transformations*. Gould's theory of adult development is summarized in Table 4 (Gould, 1980, p. 66).

Table 4

Gould's Theory of Adult Development

Approximate Age	Illusory Belief
Late teens and early twenties	I will always belong to my parents; I believe in their versions of reality.
The twenties	Doing things the way my parents want with will power and perseverance will bring results, but when I am frustrated, confused, tired, or unable, they will step in and show me the way.
Late twenties, early thirties	Life is simple, not complicated. There are no significant unknown inner forces within me; there are no multiple, coexisting, contradicting realities present in my life.
Mid thirties +	There is no evil or death in the world; the demons have been expelled

A cognitive approach to personality development emphasizes the perception of one's experiences. According to Thomae (1980), from a cognitive point of view personality is one of many factors that mediate one's response to life events. This view suggests that how we evaluate what happens to us can determine how we respond. Accurate appraisals may enable us to more effectively marshal resources to contend with necessary change (Hayslip & Panek, 2002). An example of a cognitive approach to personality development is Whitbourne's concept of *identity style*.

According to Whitbourne (1987), an individual's identity style is that person's manner of representing and responding to life experiences. As people interact with others they begin to separate the *self as agent* from *self as object* (Hayslip & Panek, 2002). The nature of one's identity determines how these interactions are processed. Whitbourne identified three principal styles: *assimilative*, *accommodative* and *balanced*.

Assimilative styles result in new experiences being absorbed into the existing identity of an individual with minimal disruption. Individuals who possess accommodative styles change their identity to suit the demands of the new experience. Successful personality development results when there is a balance (the third style) between identity assimilation and identity accommodation. Whitbourne found several forms of identity assimilation and accommodation in adults and concluded that assimilative persons generally have a controlling style while accommodative persons have an acquiescent style (Whitbourne, 1987).

As adults age they must adapt to physical change and shifting roles, therefore Whitbourne proposes that people with varying identity styles will cope with the concomitant stress that these events produce differently. For example, an individual with

an emotion-focused style may elect to withdraw or become defensive when confronted with an emergency decision. An individual with a cognitive-coping style might elect to seek counsel or additional information when confronted with the same situation (Hayslip & Panek, 2002).

Another cognitive-based theory of adult personality development is Costa and McCrae's five factor approach. These five factors consist of the following traits: neuroticism, openness to new experience, extroversion, agreeableness and conscientiousness. Hall and Lindzey (1985) define such traits as "inferred mental structures" that motivate and guide one's behavior across a variety of situations or across time. Trait approaches, such as Costa and McCrae's, have been criticized for their failure to encompass the whole person, instead focusing on the traits themselves (Caspi & Bem, 1990).

Costa and McCrae postulate that adults tend to remain stable over time. Extroverts remain extroverted, people who are open to new experiences remain open, highly neurotic and anxious people remain vulnerable to these tendencies, agreeable people remain cooperative and trusting and conscientious individuals retain a sense of duty and are self-disciplined and adept problem solvers (Costa, 1991).

#### Adult Learning

Knowles (1998) discusses a variety of definitions for the term *learning* and concludes that the concept is elusive; however, he attempts to integrate these various interpretations when he defines learning as "the process of gaining knowledge or expertise" (p. 17). He later identifies two distinct *streams of inquiry* concerning the

development of discernible theories of adult learning, a *scientific stream* and an *artistic or intuitive/reflective stream*.

The scientific stream attempts to describe adult learning as the result of “rigorous (and often experimental) investigation” (p. 36) and was initiated by Edward L. Thorndike’s publication of *Adult Learning* in 1928. Knowles states that this stream of inquiry focuses not on the adult learning process per se but rather on adult learning ability.

The artistic stream “seeks to discover new knowledge through intuition and the analysis of experience” and, in Knowles’s view, is more concerned with how adults really learn (p. 37). The artistic stream of inquiry is typified by the work of Eduard C. Lindeman who published *The Meaning of Adult Education* in 1926. Lindeman’s work was strongly influenced by John Dewey, so it is not surprising that it places significant emphasis on the role of experience in learning. This emphasis is reflected in Lindeman’s comment, “Experience is the adult learner’s living textbook” (1926, p.211). Lindeman’s assumptions regarding adult learning are summarized in Table 5 (Knowles, 1998, p. 40).

Table 5

Summary of Lindeman’s Key Assumptions About Adult Learners

1. Adults are motivated to learn as they experience needs and interests that learning will satisfy.
2. Adults’ orientation to learning is life-centered.
3. Experience is the richest source for adults’ learning.
4. Adults have a deep need to be self-directing.
5. Individual differences among people increase with age.

Knowles acknowledges the contributions of clinical psychology to the field of adult learning. Specifically, he addresses the work of Sigmund Freud, Carl Jung, Erik Erikson, Abraham Maslow, and Carl Rogers. The contributions from this distinguished group of psychologists are summarized in Table 6 (p. 51). In addition, Knowles credits Havingurst (1972), a developmental psychologist, with outlining the “developmental tasks associated with different stages of growth that give rise to a person’s readiness to learn different things at different times and create *teachable moments*” (1998, p. 51).

Table 6

Major Contributions of Clinical Psychologists to Adult Learning Theory

Name	Contribution(s)
Sigmund Freud	Identified influence of subconscious mind on behavior.
Carl Jung	Introduced notion that human consciousness possesses four functions: sensation, thought, emotion, and intuition.
Erik Erikson	Provided <i>Eight Ages of Man</i> : Oral-sensory, muscular-anal, locomotion-genital, latency, puberty and adolescence, young adulthood, adulthood, and final stage.
Abraham Maslow	Emphasized role of safety.
Carl Rogers	Conceptualized a student-centered approach to education based on five <i>basic hypotheses</i> : <ol style="list-style-type: none"> <li data-bbox="557 1650 1299 1755">1. We cannot teach another person directly, we can only facilitate his learning.</li> </ol>



Table 6 (continued)

Major Contributions of Clinical Psychologists to Adult Learning Theory

2. A person learns significantly only those things which he perceives as being involved in the maintenance of, or enhancement of, the structure of self.
3. Experience which, if assimilated would involve a change in the organization of self, tends to be resisted through denial or distortion of symbolization.
4. The structure and organization of self appear to become more rigid under threat and to relax its boundaries when completely free from threat. Experience which is perceived as inconsistent with the self can only be assimilated if the current organization of self is relaxed and expanded to include it.

Knowles popularized the term *andragogy* to differentiate adult learning from youth learning or *pedagogy* (p. 58). The pedagogical model is based on six assumptions about learners. The first assumption is that "Learners only need to know that they must learn what the teacher teaches if they want to pass and get promoted; they do not need to know what they learn will apply to their lives." The second assumption is "The teacher's concept of the learner is that of a dependent personality; therefore, the learner's self-concept eventually becomes that of a dependent personality." The third assumption is that "The learner's experience is of little worth as a resource for learning; the experience that counts is that of the teacher, the textbook writer, and the audio-visual aids

producer.” Therefore, transmittal techniques (e.g. lectures, assigned readings, etc.) are the backbone of the pedagogical methodology. The fourth assumption is “Learners become ready to learn what the teacher tells them they must learn if they want to pass and get promoted.” The fifth assumption is “Learners have a subject-centered orientation to learning; they see learning as acquiring subject-matter content. Therefore, learning experiences are organized according to the logic of the subject-matter content.” The sixth assumption is “Learners are motivated to learn by external motivators (e.g. grades, the teacher’s approval or disapproval, parental pressures)” (pp. 62-63).

Andragogy is based on a different set of assumptions. The first assumption is that adults must know why they need to learn something before making the effort to learn it. Knowles refers to Paolo Freire, the celebrated Brazilian educator, who satisfied this need amongst the poor when he transformed the nature of their education from a *banking method* that emphasized passivity to an *emancipatory model* that strived to raise the consciousness of the illiterate populace. The learners had a pronounced need to break free from their oppression and therefore responded to this liberating form of education, enabling them to literally transform their world (Knowles, 1998, p. 65; Baumgartner, 2001).

The second assumption in the *andragogical* model is that adults have a “deep psychological need to be seen by others and treated by others as being capable of self-direction.” According to Garrison (1997), self-directed learning may be the most prominent and well researched topic in the field of adult education. Knowles (1975) describes self-directed learning as a “...basic human competence, the ability to learn on one’s own” (p. 17).

The third assumption is that the "...richest resources for learning reside in the adult learners themselves" (Knowles, 1998, p. 66). To children experiences are something that happen to them; to adults their experiences define who they are. As a result, if an adult's experiences are either rejected or discounted they will interpret this as a personal devaluation and learning is jeopardized.

The fourth assumption is that adults "...become ready to learn those things they need to know and be able to do in order to cope effectively with their real-life situations" (p. 67). This assumption suggests that adult educators be sensitive to the timing of learning tasks so that they coincide with the developmental readiness of the students.

The fifth assumption of andragogy is that "adults are motivated to learn to the extent that they perceive that learning will help them perform tasks or deal with problems that they confront in their life situations" (p. 67). In essence, the demands of reality, as appraised by the learner, dictate one's level of readiness to learn.

The final assumption is that the most "...potent motivators are internal pressures, such as the desire for increased job satisfaction self-esteem, and quality of life" (p. 68). This is in stark contrast to the pedagogical view which proposes that students are primarily motivated by external forces.

### *Transformational Learning*

Merriam (2001) asserts that while andragogy and self-directed learning were the subject of intense scholarly review during the 1970's and 1980's, they were eclipsed in the 1990's by transformational learning. Mezirow (1997) defines transformative learning theory as a process of effecting change in a *frame of reference* (p. 5). Frames of reference are the structures of assumption through which adults understand their

experiences. These frames of reference encompass cognitive, conative (pertaining to one's basic strivings), and emotional components, and are composed of two dimensions: *habits of mind* and *points of view*.

Habits of mind are broad, abstract, orienting and habitual ways of thinking, feeling and acting that are influenced by an arrangement of assumptions that form a set of *codes* (p. 6). These codes may be cultural, social, educational, economic, political or psychological. Habits of mind "...become articulated in a specific point of view; the constellation of belief, value judgment, attitude, and feeling that shapes a particular interpretation" (p. 6). Mezirow points to ethnocentrism as an example of habits of mind where the predisposition to regard others outside of one's own group as inferior leads to a point of view that is a complex mixture of the feelings, beliefs, judgments and attitudes one holds regarding that group. Points of view are less durable than habits of mind (p. 6). Points of view are subject to continuing change as we reflect on either the content or process by which we solve problems and identify the need to modify our assumptions. This occurs whenever we encounter results that do not meet expectations. At this point we are presented with the opportunity to try out another's point of view in order to alter our own. Mezirow states that points of view are more accessible to our awareness than are habits of mind (p. 6).

According to Mezirow we transform our frames of reference through the process of *critical reflection*. This entails reflecting critically on the assumptions upon which our interpretations, beliefs and habits of mind are based. Such self-reflection can lead to "...significant personal transformations..." (p. 7). Taylor (2000) comments that critical reflection is the defining characteristic of adult learning. Transformations in frames of

reference may occur through critical reflection as well as through transformations in habits of mind or the gradual accumulation of changes in points of view.

According to Baumgartner (2001) this process of critical reflection is followed by a period of *reflective discourse* during which people talk with others about their newly acquired perspective for the purpose of obtaining consensual validation. According to Taylor (2000) reflective or *rational* discourse is a "...necessary medium through which transformation is facilitated and developed" (p. 3). It is within the context of rational discourse that critical reflection and experience interact. Rational or reflective discourse becomes the means for enabling the final step in transformational learning, namely, putting the newly acquired perspective into action.

Meizrow (1991) outlines the ideal conditions for transformative learning to occur. These include the establishment of a safe, open and trusting learning environment, using instructional practices that support a learner-centered approach and promote student autonomy and collaboration, and the importance of offering activities that encourage exploration of alternative personal perspectives and critical reflection. Taylor (2000) conducted a review of the empirical literature concerning essential practices in promoting transformative learning in the adult classroom. He discovered six essential themes that describe classroom settings where transformational learning takes place with adults.

The essential themes or practices discussed by Taylor include fostering group ownership and individual agency, providing intense shared experiential activities, developing an awareness of personal and social contextual influences, promoting value laden course content, capitalizing on the interrelationship of critical reflection and

affective learning and recognizing the demands of time (2000, pp. 5-6). Commenting on these themes, Taylor comments:

On the surface, these findings about fostering transformative learning seem quite promising. The studies reveal that if instructors develop authentic positive relationships with their learners, use creative experiential activities, encourage group ownership and individual agency, discuss value-laden course content, are willing to engage learners on the affective level in concert with critical thinking, and have ample classroom time, change can be initiated among those predisposed to transformative learning. However, on a deeper level most of the research under-emphasizes the practical implications associated with encouraging learners. Significant concerns emerge from this review that warrant serious discussion and future research. First, is the challenge of establishing authentic and helping relationships with students in the classroom when fostering transformative learning. Previous research revealed that developing positive relationships are most significant to promoting meaningful rational discourse, which is one of the fundamental components of transformative learning (pp. 6-7).

Taylor cautions adult educators to examine the ethical dimensions of selecting transformative instructional strategies (p.7):

Just because some adult educators believe that fostering transformative learning is in the best interest of their learners, it may not reflect the wishes and desires of the learners themselves or even the institution in which they are enrolled. Do we have the right to challenge learners to change and transform? How ethical is it to

create conditions that will put learners in such emotionally challenging classroom experiences?

### Summary of the Literature

At the commencement of this review of the literature it was suggested that a parallel exists between intense psychotherapeutic treatment and the exploration of the phenomenon of mathematics self-efficacy. Indeed, it can be said that the purpose of such treatment is to attempt to understand how an individual's world is constructed and experienced by that individual. The stated purpose of this study reflects this aim, to understand how the world of someone affected by low mathematics self-efficacy is constructed and how that world is experienced. Such a voyage of understanding propels one into the world of complex emotional architecture where every nuance of detail is important. As the prudent therapist approaches a therapeutic encounter equipped with a theoretical lens through which to view and understand the client, so the wise researcher is advised to approach an intricate construct such as mathematics self-efficacy with a theoretical framework upon which a deeper understanding can be built. Bandura's social cognitive theory provides this essential framework.

Social cognitive theory has been shown to revolve around the principle of triadic reciprocal causation. This triad consists of internal, external and behavioral forces that are supported by five basic human capabilities, symbolizing, vicarious learning, forethought, self-regulation and self-reflection. Bandura has identified self-reflection as being the most intrinsically human of the five.

Arguably the most potent of the internal forces operating within an individual is self-efficacy. Self-efficacy is the belief in one's ability to organize and execute the

courses of action required to manage prospective situations. In distilled form, self-efficacy is our deeply felt belief of competence. Self-efficacy is domain and situation specific. Bandura has repeatedly stated that global measures of self-efficacy are vulnerable to misinterpretation.

Mathematics self-efficacy is a clear example of a domain-specific measure. Betz and Hackett (1983) have developed an instrument, the Mathematics Self-Efficacy Scale, to measure the relative strength of the construct in adults. This instrument was validated by Pajares and Kranzler (1997). Low mathematics self-efficacy has been shown to influence the choice of college major and occupation in males and females and is strongly correlated with mathematics anxiety and ability. Hembree (1990) conducted an exhaustive study into the sources of mathematics anxiety and concluded that it was negatively correlated with achievement. Given that high mathematics anxiety is frequently a symptom of underlying low mathematics self-efficacy, it can be concluded that mathematics self-efficacy can be used effectively to predict achievement.

Sources of self-efficacy information include, but are not limited to, interactions with teachers, peers, family members, and the collective school community. Bandura suggests that schools offer abundant opportunities for students to engage in mastery-building experiences. The accumulation, over time, of genuine mastery experiences is the most effective means of enhancing one's sense of self-efficacy. According to Bandura, "Powerful mastery experiences that provide striking testimony to one's capacity to effect personal changes can also produce a *transformational restructuring of efficacy beliefs that is manifested across diverse realms of functioning*" (1997, p, 53). This advice is reminiscent of the familiar adage, "Nothing succeeds like success."



The road to success for most adults is littered with obstacles. Erikson, Gould, Levinson, Loevinger, Costa & McCrae, and Jung have attempted to describe this path from a variety of perspectives. Perhaps the most prominent of these theorists is Erik Erikson, whose theory of identity development (1963) built upon the work done by Jung and resulted in an elaborate, lifespan-oriented description of an individual's journey through adulthood. In Erikson's model adults are compelled to resolve a sequence of predictable crises, producing a series of *learned life lessons*.

One of the most significant voices in the arena of adult learning has been that of Malcolm Knowles. Knowles was one of the earliest disciples of andragogy who highlighted important differences between children's learning and the learning of adults. One vital difference between the two is the role of experience; adults yearn to have their repertoire of life experiences valued in the classroom. Andragogy and self-directed learning commanded the attention of scholars for decades until the landscape of adult learning was transformed in the 1990's (Merriam, 2001).

Interestingly, with the advent of Meizrow's transformational learning came the revelation that self-reflection, of paramount significance to Albert Bandura, was a crucial ingredient in meaningful, life-altering adult learning. Here we witness the marriage of a pivotal element of social cognitive theory with a theory that promises to shape the nature of adult learning in classrooms across the globe. It would surely be Bandura's wish that these classrooms provide adults with plentiful mastery experiences and safe cocoons where self-efficacy might prosper.

### Studies Missing in the Literature/Contribution of Current Study

The literature is replete with studies that examine mathematics self-efficacy from a quantitative perspective. However, there does not appear to be a single study which purports to investigate the lived experience of contending with low mathematics self-efficacy. Indeed, from a qualitative point of view, the research into this phenomenon is virtually non-existent. This is surprising given the psychological foundation that supports and explains the experience. In contrast, a review of extant literature pertaining to mathematics anxiety revealed numerous qualitative studies, both in the form of published journal articles as well as unpublished dissertations.

This study promises to shine a qualitative light on the experience of living with low mathematics self-efficacy in an era where mathematical literacy is considered a passport to success. It is hoped that a greater understanding of the human impact of low mathematics self-efficacy might contribute to the development of more effective methods of instruction, methods that ignite the flames of inner strength rather than extinguish them.

## CHAPTER III

### METHODOLOGY

Education is not an affair of telling and being told, but an active and constructive process.

(Dewey, 1916, p. 43)

#### Overview of the Methodology

According to Moustakas (1994), a researcher contemplating phenomenological inquiry should “discover a topic and question rooted in autobiographical meaning and value, as well as involving social meaning and significance” (p. 103). The questions developed for this study, “What is the lived experience of low mathematics self-efficacy in prospective elementary teachers?” and “What is the process by which low mathematics self-efficacy is developed” are not only autobiographical, they are deeply rooted in social meaning.

The researcher has personally experienced low self-efficacy and has been witness to its debilitating effects. He has presented evidence previously of the societal impact of marginal mathematical literacy. The widespread development of mathematical and scientific literacy amongst the populace has been shown to be critical to the well-being of our nation. Failure to achieve such literacy may close doors of opportunity that will remain sealed pending its attainment. Low mathematics self-efficacy exacts a personal as well as societal toll.

Phenomenological studies focus on the wholeness of experience, search for meaning and essences of experience rather than measurements and explanations and seek to obtain descriptions of experience through first-person accounts in informal and formal conversations and interviews (p. 21). Given the aims of this study, to capture the

essence of the experience of low mathematics self-efficacy, it appears well-suited for the phenomenological tradition of inquiry.

### Methodology

In an effort to support this interactive, epistemological relationship, an extensive review of the literature culminated in the creation of a set of relevant questions that were then distilled into an appropriate interview protocol. This is in accordance with Moustakas' suggestion that "...a comprehensive review of the professional and research literature be conducted and that a set of guiding questions be developed" (1994, p. 103).

To ensure that each of the eight participants had experienced the phenomenon in question, the researcher administered the Mathematics Self-Efficacy Rating Scale (MSES), developed by Betz and Hackett (1983). The MSES is designed to assess one's beliefs that he or she is capable of performing math-related tasks and behaviors. The MSES contains 34 items divided into two parts: Everyday Math Tasks (18 items) and Math-Related Courses (16 items). In the first part examinees rate each item based on how much confidence they have in themselves to solve everyday math problems. The second section contains a list of 16 math-related courses that require examinees to rate the amount of confidence they have in completing the courses with a grade of A or B.

Prior to conducting the interviews the researcher engaged in a period of *epoche*, defined by Husserl as "freedom from suppositions" (Moustakas, 1994, p. 85). According to Moustakas the challenge to the researcher during *epoche* is to be transparent to oneself, "...to allow whatever is before us in consciousness to disclose itself so that we may see with new eyes in a naïve and completely open manner" (p. 86). In other words, *epoche*

consists of reflecting on and revealing any preconceived ideas concerning the phenomenon.

In addition to interviews, each participant completed a concept map that illustrated her experience with mathematics. The use of concept maps in qualitative data collection in studies involving either prospective or new teachers has been well documented (Harrahan & Tate, 2001; Trent, Pernell, Mungai, & Chizmeda, 1998; Raymond, 1997; Pankratius, 1993; Peterman, 1991).

Following the procedures derived by Stevick (1971), Colaizzi (1973) and Keen (1975) and modified by Moustakas (1994), transcripts of the researcher's epoche disclosure were first subjected to *horizontalization*, during which all statements relevant to the phenomenon were accorded equal value and were listed. All non-repetitive statements were framed as *invariant horizons* or *meaning units*; the meaning units were then clustered into *themes*. Emergent themes were synthesized into a *textural description* of the experience, which included verbatim examples.

Through a process of *imaginative variation*, the textural description was transformed into a *structural description*. According to Moustakas (1994, p. 97), imaginative variation consists of seeking "...possible meanings of the textural description through the utilization of imagination, varying frames of reference, employing polarities and reversals, and approaching the phenomenon from divergent perspectives, different positions, roles, or functions." The purpose of the structural description is to delineate the "...underlying and precipitating factors that account for what is being experienced" in other words "How did the experience of the phenomenon come to be what it is?" (p. 98).

Finally, a *textural-structural description* was prepared that illuminated the meanings and essences of the experience.

Moustakas suggests that the researcher then repeat the above procedural steps for each of the participants or *co-researchers* subsequent to lengthy personal interviews. Following the creation of the textural-structural descriptions a *composite textural-structural description* was formulated that "...integrated all the individual textural-structural descriptions into a universal description of the experience representing the group as a whole" (p. 122).

In an effort to ensure trustworthiness and transferability, the researcher enlisted outside readers to review the composite textural description. These readers attempted to reconcile their own experiences with the phenomenon with those presented in the research. Additionally, the researcher conducted member checks with the participants to ensure that their respective textural-structural descriptions truthfully reflected their experiences. A third method of contributing to trustworthiness consisted of rearranging the component themes in an effort to determine if other, equally logical patterns emerged (Creswell, 1998, p. 207).

Moustakas (1994) suggests that the researcher promote "...establishing the truth of things" by first reflecting on the meaning of the experience for himself; "...then, one must turn outward, to those being interviewed, and establish *intersubjective validity*, the testing out of one's understanding with other persons through a back-and-forth social interaction" (p. 57).

While the researcher acknowledges that it is not possible to completely eliminate bias (Strauss & Corbin, 1998) several methods were employed to mitigate its effects.

According to Johnson (1997), a key strategy in confronting researcher bias is through the use of *reflexivity*. Reflexivity refers to the continual process of critical self-reflection where the researcher revisits his or her potential biases for the purpose of becoming more self-aware. This researcher adhered to a reflexive regimen throughout the course of the study. In addition, each participant received copies of interview transcriptions so that she could review them for accuracy. Johnson also suggests the use of *peer review* to minimize the effects of bias. Peer review consisted of sharing the researcher's interpretations with a disinterested peer who "played the devil's advocate" and challenged the researcher to provide solid evidence for any interpretations or conclusions (Johnson, 1997, p. 283). Finally, the researcher made frequent use of *low inference descriptors*, such as verbatim quotes, in an attempt to filter out the effects of bias.

#### Data Generation

Eight female elementary teachers were selected for this study. This is in keeping with Creswell's recommendation that phenomenological researchers select no more than ten participants (1998). Selection of these participants was contingent upon their availability and willingness to participate in the study. Barry University School of Education faculty members who teach graduate level courses in elementary education were provided with multiple copies of a letter of consent (see Appendix A) and an accompanying explanatory cover letter (see Appendix B) for prospective participants. The cover letter elucidated the purpose of the study, its methodology and its relevance to the participants. Graduate faculty members were requested to distribute the cover and consent letters to their students.

### *Participants*

The participants consisted of a purposeful sample of eight female elementary teachers enrolled in the School of Education at Barry University who had experienced the phenomenon in question. No deliberate attempt was made to select participants based on gender. Out of a mixed gender group of approximately one hundred prospective participants, only female teachers produced scores on the selection instrument that qualified them for this study

Participants were identified by administering the Mathematics Self-Efficacy Rating Scale (MSES), developed by Betz and Hackett (1983). The MSES (see Appendix C) was designed to assess one's beliefs that he or she is capable of performing math-related tasks and behaviors. The MSES contains 34 items divided into two parts: Everyday Math Tasks (18 items) and Math-Related Courses (16 items). In the first part examinees rate each item based on how much confidence they have in themselves to solve everyday math tasks and problems. The second section contains a list of 16 math-related courses that require examinees to rate the amount of confidence they have in completing the courses with a grade of A or B. According to the scoring criteria provided with the instrument, all eight of the participants in this study scored below the thirtieth percentile, indicative of low mathematics self-efficacy.

### **Instruments**

#### *Mathematics Self-Efficacy Rating Scale*

*Reliability of the MSES.* Betz and Hackett (1983) report internal consistency reliability values of .96 for the total scale and .92, .96, .92 for the Tasks, Problems, and Courses subscales, respectively. Lent, Lopez and Bieschke (1991) reported an internal



reliability figure of .92 for the Math Tasks portion of the instrument and a two-week test-retest reliability of .94.

*Content validity of MSES.* Given that evidence for the content validity of any measure begins with delineating the domain(s) of interest, Betz and Hackett (1983) developed the MSES based on a comprehensive review of existing measures of mathematics anxiety and confidence. From that review three specific domains were identified: solving math problems, math behaviors in everyday life, and college math related courses. Each of these domains relates specifically to the construct of mathematics self-efficacy as developed by Betz and Hackett (1983) and reviewed in this study.

*Concurrent validity of the MSES.* Betz and Hackett (1983) state "...evidence for concurrent validity is based on statistically significant correlations between MSES scores and other measures of attitudes towards mathematics" (p. 335). They report total MSES scores were related as follows: math anxiety ( $r = .56$ ), confidence in doing math ( $r = .66$ ), perceived usefulness of math ( $r = .47$ ) and effectance motivation in math ( $r = .46$ ). Wettstein (1988) conducted a multi-method study of math self-efficacy and math anxiety. Self-ratings of math self-efficacy were obtained using the MSES and were predictably negatively correlated ( $r = -.39$ ). Lapan, Boggs, and Morrill (1989) also reported strong relationships between math self-efficacy and math anxiety.

*Construct validity of the MSES.* Construct validity is supported by Betz and Hackett (1983) using the *known groups* technique (Smith, 2003). The authors hypothesized that because math has traditionally been a male domain, females would report lower levels of math self-efficacy. These predicted relationships have been

demonstrated in a number of studies (Betz & Hackett, 1983; Lapan, Boggs, and Morrill, 1989). In accordance with Bandura's (1977) theory of the development of self-efficacy expectations, Matsui, Matsui, & Ornish reported that all four sources of efficacy information, that is, performance accomplishments, modeling, emotional arousal, and verbal persuasion, were related as predicted to levels of math self-efficacy (Betz & Hackett, 1983).

#### *Qualitative Interview Protocol*

The interview protocol developed for this study was generated subsequent to a comprehensive review of the extant literature on the topic (See Appendix D). Questions emerged as seminal concepts were revealed in the literature.

#### *Data Collection and Processing*

A purposeful sample was selected as described by Creswell (1998). The eight participants comprised a homogenous sample wherein each member demonstrated that she had experienced the same phenomenon. Once the participants had been identified, the phenomenological tradition dictates that in-depth interviews be conducted. Each interview lasted approximately ninety minutes and did not require additional follow-up sessions. This researcher complied with Creswell's (1998) suggestion that one spend time in self-reflection in preparation for the interviews, an activity designed to promote reflexivity and reduce bias. Following the interview each participant was asked to create a concept map that illustrated her experience with mathematics

The researcher provided copies of the MSES to interested participants, each of whom had been previously furnished with a letter of consent and accompanying cover letter. These letters contained specific information regarding the purpose of the study as

well as information regarding confidentiality of participation. Participants were informed that participation in the study was strictly voluntary. Upon completion these instruments were scored by the researcher in accordance with guidelines established by Betz and Hackett (1983) and prospective participants identified.

#### *Data Record Keeping*

The researcher will adhere to procedures outlined by Berg (2001) and Creswell (1998) where it is recommended that all data be properly secured to ensure confidentiality. Interviews were recorded digitally and later transcribed. All transcriptions were stored in word processing as well as ASCII II format to facilitate data entry into analytic software. After all transcribed data had been reviewed for accuracy the original digital recordings were destroyed. Transcribed files have been secured in a locked file in the researcher's home and will be destroyed after five years.

#### *Ethical Issues*

According to Denzin and Lincoln (1998) the issue of ethics is *intrinsic* to studies conducted within the constructivist paradigm. This is attributed to the inclusion of participant values in the inquiry (including those of the researcher). "There is an incentive, a process tilt, for revelation; hiding the inquirer's intent is destructive of the aim of uncovering and improving constructions" (p. 215). Any practice that amounts to deception on the part of the inquirer erodes the promise of confidentiality and trust that is inherent to a qualitative investigation. Therefore, this study will adhere to the ethical tenets described by Denzin and Lincoln (1998) and Creswell (1998).

In the interest of abiding by ethical principles, Moustakas (1994) strongly advises researchers to fully disclose the nature and purpose of their studies. The informed letter

of consent in this study provided this information. In addition, Moustakas suggests that researchers consider the use of *debriefing* sessions. These sessions allow participants to review the research and determine if any damaging or misleading information should either be omitted or revised, thereby leaving them with a "...sense of dignity" (p. 110). In this study the researcher attempted to simulate the intent of these debriefing sessions through the use of member checks.

According to Denzin and Lincoln (1998), "The major safeguard to place against the invasion of privacy is the assurance of confidentiality" (p. 175). In the letter of consent all participants were informed of the steps being undertaken to ensure confidentiality. Those steps included conducting the interviews in a private environment, securing all data, the use of aliases to preserve anonymity and sharing all published results with participants. Additionally, the results of the MSES evaluations were only made available to the individual participants.

Participants were informed that participation in this phenomenological study was completely voluntary and that there would be no adverse effects if they elected not to participate. Participants were also informed that there were minimal personal benefits to be realized by participating in the study aside from the gratification of contributing to our understanding of low mathematics self-efficacy.

#### Data Analysis

This study followed the *modified Stevick-Colaizzi-Keen method* of analysis as discussed by Moustakas (1994). This method requires the researcher to first engage in a period of self-reflection referred to as *epoche*. *Epoche* is followed by a process of *horizontalization* during which all relevant statements are extracted. These relevant

statements are then clustered into themes which are, in turn, synthesized into descriptions of the texture of the experience, including verbatim examples. The textural descriptions describe the essence of the experience. Through the process of *imaginative variation*, the textural descriptions are transformed into structural descriptions of the experience or *how* the phenomenon was experienced. These two levels of description, textural and structural, are merged into a *textural-structural* description of the experience.

The above process was completed for all research participants (including the researcher) and a more global, *composite textural-description of the meanings and essences of the experience* created. An interesting element of this process is the inclusion of the researcher's reflections into the development of the universal composite-textural description. According to Moustakas all participants should be referred to as *co-researchers*. This reflects Moustakas' belief that there is no separation or discernable difference between participants and researcher. This belief is constructivist in nature, as alluded to by Denzin and Lincoln (1998), "...when exploring the epistemology of constructivism the separation between the object of investigation and the investigator begins to disappear" (p. 207).

Data was analyzed using QSR N6 software. This analytical software enabled the researcher to collect and organize text and facilitated the development of textural descriptions. QSR N6 supports research while allowing the researcher to retain control over the intellectual process.

### *Ensuring Trustworthiness*

According to Denzin and Lincoln (1998), *trustworthiness* is a more appropriate term for qualitative research than terms such as internal or external validity (p. 287).

According to Krefting (1991), "In some qualitative approaches, however, the major purpose is to generate hypotheses for further investigation rather than to test them. In such situations, external validity is not relevant" (p. 214). Johnson (1997) states, "When qualitative researchers speak of research validity, they are usually referring to qualitative research that is plausible, credible, trustworthy, and therefore, defensible" (p. 282).

According to Krefting (1991) there are four categories of strategies that can be "...used throughout the research process to increase the worth of qualitative projects" (p. 217). These categories correspond to the four qualitative criteria for trustworthiness: credibility, transferability, dependability, and confirmability.

*Credibility.* Lincoln and Guba (1985) define credibility as the *truth value* of a study. They argue that if the qualitative researcher strives to represent multiple versions of reality, then he or she must portray these varying perspectives as accurately as possible. The researcher employed several of the methods discussed by Krefting (1991) in an effort to enhance credibility.

The first method was the keeping of a reflexive field journal throughout the research process that contained the researcher's "...thoughts, feelings, ideas, and hypotheses generated by contact with informants" (p. 218). It also contained "...questions, problems and frustrations concerning the overall research process" (p. 218). The purpose of maintaining this ongoing reflexive dialogue was for the researcher to become aware of potential biases and preconceived assumptions that may have influenced interpretative work.

The second method of enhancing credibility was through *triangulation*. Krefting (1991) defines triangulation as the "...convergence of multiple perspectives for mutual

confirmation of data to ensure that all aspects of a phenomenon have been investigated” (p. 218). The researcher employed *triangulation of data sources* whereby data was collected from various sources such as direct interviews, quantitative measurements, life histories and participant observation.

The third source of credibility was the use of *member checks*. Lincoln and Guba (1985) define member checking as the process of continually testing with informants the researcher’s data, analytic categories, interpretations and conclusions. This entailed sharing the research materials with the participants in an effort to ensure that the researcher had “...accurately translated the informant’s viewpoint” (Krefting, 1991, p. 219).

The fourth method of building credibility in the study was through *peer examination or review*. Peer examination consisted of sharing the researcher’s findings with colleagues who had experience with qualitative methods (p. 219). Lincoln and Guba (1985) state that peer review is a method of keeping the researcher honest and enables a deeper reflexive analysis.

*Transferability*. According to Krefting (1991) “It is not the researcher’s job to provide an index of transferability; it is his or her responsibility to provide an adequate database to allow transferability judgments to be made by others” (p. 220). The researcher is compelled to ensure that “...the content of the interviews...are typical of the lives of the informants” (p. 220). The researcher will use dense description in an effort to fully portray or capture the essence of individual experiences. Krefting (1991) suggests that frequent use of member checking may contribute to enhanced transferability of the findings by ensuring that these rich descriptions are as complete as possible.

*Dependability.* According to Krefling (1991), dependability refers to the consistency of findings in a qualitative study. She suggests that the researcher record the exact methods used during data gathering, data analysis and interpretation. The researcher, in compiling this detailed account of methodology, has attempted to contribute to transferability. Krefling (1991) also suggests that researchers consider the use of a *code-recode* procedure to enhance transferability. This entailed coding a segment of the data and returning to it two weeks later to recode it and then comparing the results. The researcher employed this code-recode procedure in this study.

*Confirmability.* According to Krefling (1991), confirmability can be strengthened by the use of an audit strategy. This strategy consists of an external auditor "...attempting to follow through the natural history or progression of events in a project to try to understand how and why decisions were made" (p. 221). This audit "...suggests that another researcher could arrive at comparable conclusions given the same data and research context" (p. 221). The auditor will have access to all records, including digital recordings, transcriptions, field notes, quantitative measurements, and analytical products.

According to Krefling (1991), the continual use of reflexive analysis throughout the study contributes significantly to the confirmability of the study. The researcher maintained a thorough reflexive field journal wherein experiences and insights were recorded in rich detail.



## CHAPTER IV

### RESULTS

#### Introduction

The purpose of this phenomenological study was to explore elementary teachers' experience of low mathematics self-efficacy and to investigate the process by which it is formed. In the phenomenological tradition participants are frequently referred to as *co-researchers*, a term that reflects the reciprocal nature of this method of inquiry (in the interest of readability, the terms participant, teacher, educator and co-researcher shall be used interchangeably). The eight co-researchers in this study were identified by their completion of the Mathematics Self-Efficacy Rating Scale, devised by Betz and Hackett (1983). Upon qualification, co-researchers were asked to complete a two-page general background questionnaire (Appendix E) prior to their interviews. The interviews were conducted in Barry University facilities and were each followed by the completion of a concept map.

Co-researchers were interviewed about their experiences with mathematics throughout their lives, focusing particularly on events that were emotionally resonant. These individuals were asked to reflect on the degree to which feelings regarding mathematics had impacted their lives and how they had responded or coped with these effects. Each co-researcher was asked to consider how her (all participants were women) sense of mathematical competence might have been enhanced earlier in her life as well as in the present.

In summary, data collection consisted of eight semi-structured, open-ended interviews conducted face-to-face, followed by the completion of concept maps that

illustrated participants' experiences with mathematics. Each interview was digitally recorded and later transcribed for analysis.

### *Summary of the Methodology*

The modified Stevick-Colaizzi-Keen method of phenomenological data interpretation, as outlined by Moustakas (1994), was employed to elicit a holistic and specific understanding of the responses to the interview protocol. The phenomenological coding strategy of horizontalization was applied to each verbatim transcript and was followed by the formation of themes that enabled the creation of a textural description of the experience for each co-researcher. These textural descriptions were compiled to create a *composite textural-structural* description of the experience. Peer review and member checking strategies were employed to assist in interpreting and verifying findings.

The process of horizontalization consisted of recording all relevant statements from each participant's interview and concept map. This process also entailed the faithful recording of gestures, pauses, sighs, tone of voice and significant emotional reactions. Upon completion of horizontalization, each participant's data was clustered around common ideas or, in the vernacular of analytical software, nodes. These nodes were assembled into themes that enabled a textural description of each participant. These eight textural descriptions were synthesized into a composite textural-structural description (achieved by constructing five over-arching themes that connected the textural descriptions of the participants), the text of which constitutes the findings of this study as described below.

This chapter presents the findings of this data collection and analysis process. The findings are presented thematically in an attempt to recreate the phenomenological interpretive process and to enhance the reader's understanding of the phenomenon. Five distinct themes emerged: perceptions of mathematics as a field of inquiry, sources of low mathematics self-efficacy, the emotional experience of low mathematics self-efficacy, coping with low mathematics self-efficacy and overcoming low mathematics self-efficacy.

### Theme #1

#### *One's perceptions of mathematics influence self-efficacy beliefs.*

Seven of the co-researchers commented on the nature of mathematics and its affect on their experience of the subject. These comments fell into three distinct coding trends or sub-themes.

#### *Math as a Hurdle*

Five of the teachers noted that mathematics was simply an obstacle to be surmounted and forgotten. Typically, mathematics was viewed by many of the participants as a filtering mechanism that prevented them from pursuing various lines of work. Often an overtone of low self-confidence was blended in with this view of "math as a hurdle". For instance, one teacher commented:

If I had to rate my confidence in math I would say maybe about sixty percent confident. I'd say I'd like it to be about seventy or seventy-five. Also, the school where I went might have played a big role in that. My undergraduate was at the University of Illinois, it was a big engineering school. And you take classes and you just get weeded out. That was the point of a lot of the classes. So I didn't

want to take a chance and....you never...you never saw your professor, he didn't know who you were. So I didn't really want to go through that...so that was the reason for not taking more math type classes.

Another participant echoed the above sentiments. Again, she addressed the "invincibility" of mathematics:

I love science but I can't do science without math, so my favorite course ever, that I've ever taken, was human physiology when I was a freshman. And I really did well in the course but I didn't understand a lot of the equations and...I was like I can't possibly go on with this. Another course I took was metals, for art, metal sculptures and things. And that involved a lot of math, too. And, again, I just didn't want to...I thought it was too hard.

One teacher commented, upon finishing her interview, that she avoids walking into mathematics classrooms because she doesn't want to see "math work" on the board. In her experience, just the sight of mathematical notation elicits a feeling of "being beyond my limits." The perception of math as a hurdle is fostered, in the experience of one co-researcher, by the attitude of some mathematics teachers, as reflected below:

Or, um, I don't know, a lot of times people try to make their personal craft seem untouchable to other people. Like this is so complicated, this is difficult. When, I think, teachers should present things in a way that everyone can learn and this is available to everybody. I don't know, math teachers are elitist a lot of times.

This same teacher recalled hearing one of her graduate teachers state, "Mathematics is a part of everybody's life and everyone deserves to know it."

*Standardized Tests and Licensing*

Without exception, every participant commented on her experiences with mathematics as it pertained either to standardized tests such as the SAT or the GRE, or to the mathematics component of professional licensing exams. Mathematics was perceived as a painful obstacle course to be negotiated en route to some desired outcome. This sentiment is expressed in the following excerpt from one teacher's comments:

Before I forget, there's one thing which is extremely important. For my masters degree I had not taken the GRE. Remember, I got into [School A] in a week and they don't require one. Here they don't require one for me because I'm a specialist student. Masters degree students are required to take either the GRE or the MAT. I am afraid, I am scared to death of having to take this and I wouldn't mind doing what you're doing in the future, which is pursuing a Ph.D., as long as the program does not require one. Because I am scared to death of taking a math class or doing that math portion because I haven't taken math in the last twenty years. And whatever it is that the GRE requires I'm sure I don't know.

This researcher found it enlightening to assume the perspective of mathematics as being little more than one formidable test. Such a perspective would appear to render mathematics as an impersonal and punitive entity. However, when the test in question is a professional licensing exam (here referred to as the CLAST), such a viewpoint becomes profound. Consider the words of the following teacher:

I guess that studying for the CLAST was pretty hard. And, you know, I could've probably studied more, but to miss it just by one point and now I have to study it all over again and take that ninety minute test, or whatever it is, maybe it's an

hour, is like, gets me down I guess. You know, like, just one more point, just one more question I could've got right, come on. Come on!

One respondent had enlisted the assistance of a friend to help her through the certification process. She had failed the exam numerous times and now her "...back was against the wall" as she prepared to take the CLAST exam one more time. Drawing upon previous experiences of failure, this teacher viewed mathematics solely as something embedded in the licensing exam for the purpose of failing her. To this single mother of two, conquering the mathematics portion of her licensing exam would spell the difference between having a job and unemployment. She commented:

You know for the state exam there's a math test that we have to take and my friend who's a math teacher, she ended up tutoring me and guess what...guess which part I haven't passed yet? I'm going to take it July 24th, I've been working on it, so hopefully, that's the only part of my certification test...I just knew when I went in there, I told her, I'm going to pass all the other parts except that part. She said, "Well, don't think that way. You know it." I took it the last time and I was short 24 points; you need 200 points or over to pass it. I think I got 176. She said, "Take it again, you know it, go ahead and take it and do it." I just, I don't know, when I go in there I put that off, I concentrate on the English part and all the other parts, reading and writing, all the parts that I know I can do well. And I passed them right off, but the math, that's the last part. And now I know I have to do it because if I haven't done it by the end of June 2005 I won't have a job. So when I take it now I'm going to do it because it has to be done.

Another co-researcher commented:

I think...one of the things that kept me back from graduating was the math section of the CLAST test that we have to take as teachers. I think I had to take that test like eight or nine times. I passed everything except that math.

Yet another teacher remarked:

And then...I renewed my Florida certificate and I had to take math again and this was years and years later. I recall that there were five parts of the math that I had to pass. And I did pass either two or three of them and that was some type of statistics because it's black and white and it's there, no problem. There are no unknowns in statistics. And there was another part that I did pass, too, but the other three parts I failed. Again!

Sometimes these teachers come frustratingly close to passing the CLAST. One teacher (who teaches kindergarten) managed to maintain a relatively positive view of mathematics despite her struggles with her certification exam. She stated:

Well, I teach kindergarten, so math is fun. We use a lot of manipulatives and... I don't mind teaching math because the concepts, one plus one, you know, not too hard. Actually, I had to study for the CLAST two years ago and I missed it by one point, the math part of the CLAST. I don't know, I got 294 and you're supposed to get 295 or something. So, I haven't retaken it yet, but I... my friend just retook it and I was studying with her because I'm probably going to take it again in September I think is the next time that they offer it.

*Mathematics as a Relevant Subject*

Mathematics was often seen as irrelevant. Evidence to support this claim varied from not being able to remember previous instruction to its apparent trivial presence in daily life experiences. One teacher stated:

I'm not the only one who feels like this. You know I can't even remember what calculus even is. You know, if you were to ask me, what's calculus, I don't know, I took it and I did really bad in it, and that's it.

At times math was viewed as relevant, but frustratingly so. This perspective is apparent in the following comments from an aspiring elementary teacher:

You know, if when I bake and it says one third of a cup of butter...If I didn't have those little marks...I can't picture it. If I didn't have those little lines on the stick of butter, you know, I couldn't do it. It's frustrating, just really frustrating. I don't even help my mother measure things around the house. God forbid she were to ask me to estimate the area of a window so we could buy fabric. I'm always afraid that she's going to get mad at me if I do it wrong and we'll end up wasting money.

Three co-researchers remarked that mathematics was not a relevant part of their lives either because they didn't have to teach it or, if they did teach it, it was to very young children. If they could not think of a compelling personal or professional reason to pursue enhanced mathematical literacy then they probably would elect not to do so. One teacher stated:



No, like I'll probably never really be excited to learn something new in math. No, probably, like I said, just because I'm teaching younger children and I know how to teach it, I won't be wanting to learn anything new. It's just not important.

Yet another teacher commented, "Other than being able to help my kids with math and being able to do my taxes, I don't think I'll have any reason to learn any more math."

One teacher was very succinct; she stated "I know you're a math teacher and all, but it really isn't a huge part of my life. It probably is more than I know."

Interestingly, for one teacher, mathematics would become a relevant topic if someone could present it to her in a manner in which she could comprehend it. She stated:

What is the real purpose of doing math, like geometry? If you could teach me why I should be doing this and how it would benefit me and you can bring it down to a level where I can understand it, then maybe I'd care.

In an unusual departure from many of the reported perceptions of mathematics, one educator commented, "...because math to me, if I can be objective, is a kind of mystery that you have to solve, to puzzle out, and I find that intriguing." This is in direct contrast to another educator who stated simply, "I like math...it's just sort of intimidating."

## Theme #2

*Diverse sources of low mathematics self-efficacy converge synergistically.*

The participants varied in the reported ages at which they recall the initial formation of negative attitudes towards mathematics. Some were quite successful at

mathematics during their elementary years and then faltered in either middle or high school.

### *Elementary School*

Six teachers reported having positive, affirming experiences with mathematics in elementary school. One teacher was very concise when she stated, "I remember [math] being very simple and easy to acquire and I was very good at it." Yet another teacher stated:

Math was fun when it was taught to me. Like even the multiplication tables, I must have been eight or nine, you know those multiplication facts from one to ten we had to know...but it was like singing. It wasn't like you were thinking, like you were learning.

Speaking in a similar vein, another educator commented:

I don't remember the process of learning math. But then again I don't remember learning how to read either. I really don't remember specific things in math. But what I remember about math was that I was really good at it when I was very young, so it must have come very naturally.

Continuing along this theme of positive recollection, a language arts teacher recalled:

I don't have very much recollection of anything in particular up until seventh grade. I had very, very good grades in elementary school. I remember I was very competitive as far as academics. I had to be number one in everything. So, I don't recall any problems with math all because I always got all A's.

One educator recalled a rather ambivalent attitude towards mathematics during

her elementary years. She stated, "It was just...it just wasn't easy, but I never had a bad experience. I mean I never had an experience that made me think, 'God, what am I doing here, I hate this!' It was just OK, I guess."

#### *Middle School and High School*

Within this community of eight elementary teachers, the seeds of low mathematics self-efficacy were planted during either middle school or high school. A single negative experience appears to have been sufficient to initiate the incubation process that engendered low mathematics self-efficacy. These memories have endured through the years, as reflected in the following comments of one participant:

My teachers were always...they were good teachers, but I had one teacher, I think it was seventh or eighth grade math, a male math teacher that I had and he was just...he was very critical and every time you asked a question, if you asked it more than two times he would get frustrated. And he would sit in the front and he would correct papers; we had tests every Friday and he would check the tests in front of everyone... just stand there and hand it back to you in front of everyone. I...to me it was intimidating so I would go in there already nervous about math, knowing I couldn't do it and then plus the fact that the teacher intimidated me just made everything worse.

Another participant, reflecting on her middle school and high school experiences with mathematics was succinct in her comments. She said, "I don't remember having what you would call an awesome experience with math, you know, through middle school and high school. It was always intimidating and frightening."

Occasionally the episodes that spawned the development of low mathematics self-efficacy bordered on humiliation. Such was the case with one participant, a proud woman of Haitian descent. She remembered:

Mr. H, yes Mr. H. He used to call me useless in the ninth grade, in my algebra class. This was a class I had to take four times to pass eventually. That was his name for me, useless. If you couldn't be successful in his class then you were useless, is...I guess, how he saw it. I guess it was just his style to motivate students.

When asked to discuss her experiences with mathematics in middle school and high school, one participant refused to elaborate beyond a tersely stated, "It was horrific." Clearly, in the lives of all eight co-researchers, middle school and high school were breeding grounds for the formation of low mathematics self-efficacy. One participant, successful in virtually all areas except mathematics recalled:

Through high school, all the way from kindergarten through twelfth grade, the only class I ever remember failing was, I think, geometry or algebra. I think it was geometry, either in my sophomore or junior year. I do remember passing it during a summer school period. So I got by it and was able to graduate, but that was pretty horrible, because I had never failed anything in my life.

One co-researcher, a young kindergarten teacher, was able to pinpoint the beginning of her negative attitude toward mathematics. She recalled, "I think the problems really started for me, with math, near the end of seventh grade when we began algebra. I think that was my downfall."

One participant recalled the extreme pressure she felt in an honors math class in which she had been improperly placed:

I remember being placed, for some reason, in an honors math class. I wish they had had in the sixties some type of remedial math that I probably would have benefited from. But they didn't have that, so we were all in a class and I remember thinking that during a test if I cheated I could probably pass. And I remember that feeling...thinking...and the teacher would walk out of the room, he was claustrophobic, I remember. And I never did cheat, but everybody else did. And I was thinking, you know it's that old kind of thing, well, you know, I could pass if I cheat. But I just couldn't do it. And I ended up not passing.

*I Should Know This: Why Aren't I Getting It?*

Three of the eight participants repeated again and again the memory of saying to themselves during a middle school or high school math class, "I should know this; why aren't I getting it" This became almost a sort of mantra for these women as they berated themselves for not being able to succeed in mathematics. One woman, an experienced special education teacher commented:

I went through school thinking...I don't know...I felt that I should know this, but I DON'T (emphasis hers) know this, but I should. I must be stupid. I don't know, there must be something that...there must be hundreds of people out there that DO (emphasis hers) know how to do this. How come I don't know how to do it?

This woman went on to say, "And you sit there struggling to try to figure it out

and then possibly get it wrong and feel silly or stupid. You just feel inferior to someone else, you think, 'Let them do it, I can't.'"

One participant, an elementary teacher who specializes in language arts and social studies, reflecting on what she should have known during middle school, commented:

I knew the multiplication tables inside and out. I...and it's so strange because I know that math should not be so difficult. Because it's either right or wrong and I should be able, you should be able to figure it out. Whereas literature is just so subjective. But I find literature so much easier to understand and it just shouldn't be that way. Math is just not for some people. And that level of thinking, "I must be so stupid because I don't understand this." And that really is what my father used to convey to me. He used to say, 'Why don't you understand this? You're supposed to be able to do this.'

Clearly, the experience of feeling that one should know something, when, in fact, one doesn't, was a difficult experience for the following woman, whose experience in a seventh grade math class can best be characterized as traumatic:

I just had horrible experiences with math. It was horrible, absolutely horrible. You could stand up in front of me all day and tell me to give you an answer and if I don't have it I'm not going to come up with it like magic. I think I've gone overboard to make sure that I don't become a teacher like that. I'll hand out a worksheet for math and I'll wait a week to get it back. I think I've become too tolerant that way. I think that the purpose of teaching is to want someone else to get something, otherwise, if they didn't want to get it they wouldn't have shown

up. But I'd rather be that way than hard, you know. Like that nun I had. I mean, to this day, I'm forty-nine years old...and it just upsets me terribly.

*Teachers, Parents and Grades*

Teachers were mentioned by all eight participants as sources of low mathematics self-efficacy. Perhaps this is not surprising given that math teachers are generally the medium through which mathematical instruction flows. One co-researcher, reflecting on her experiences with high school math teachers, said:

I've heard teachers say, 'You don't own the math.' I don't understand what that means. You don't own it. I guess that means you don't fully understand it. I've heard that expression from math teachers all the time. I think they have to understand that there are some kids who just don't get it. And there has to be a program for high school kids who are in algebra who didn't get it in middle school either.

Another participant, an aspiring first grade teacher, had this to say about her experiences with math teachers:

My tutor just made me feel very comfortable. And when you're like that, you know, you get a math problem and all of a sudden you just think about it and you could do it. But when you're in that situation when it's all pressure and you're in the room and there's someone in front of you that expects you to know within three questions or they're going to get mad at you, it's not like I can get there and sit down and give the answer the same way I did with my tutor, I can't.

Three of the eight co-researchers commented on the effects their parents had on

their mathematical self-concept. In one instance a teacher suspected that her mother enabled her low mathematics self efficacy by repeatedly allowing her to skip class. She commented:

I'm wondering why my mother was willing to go pick me up every day and not necessarily confront an issue that must have been there. Because, like I've taken enough behavior management at this point to realize that if a child all of a sudden is acting out in some kind of way, in my case it wasn't any kind of violent way, I wasn't necessarily doing anything bad, I was just calling home. Why wasn't that confronted at that point? Why was it so easy to just take me home and not deal with it or not question why? It might honestly have been an ignorance issue. She might not have known. She might have just figured that I wasn't feeling well. She never took me to a doctor. So I kind of question that. Why would a parent step in that kind of situation and not wonder, 'Isn't she missing something? She's doing this on a regular basis.' I don't remember going to class, I just remember calling home and getting away with it. And I also question administration, why weren't they questioning what it was with this kid who is good? Those are the feelings, the questions that I have now. And they're not feelings of anger; they're just questions in general. Why didn't someone do something about that because there was obviously a problem?

Another participant commented on the effects that her father, himself a math teacher at the time, had on her mathematical self-concept:

When I was in high school my father had lost a business and he went into teaching and he became a math teacher and he used to try and help me with math



in high school and he used to get so frustrated with me. He had very little patience. He would ask me questions and he would say, "Do you finally understand this?" And I would say yes just to get him out of the room, away from me. But I didn't understand it at all.

Another participant recalled numerous confrontations with an impatient parent while she was an elementary student:

Fractions...like that was really hard for me. And, I think I had a really bad experience when I was doing homework with one of my parents. My father, I was doing fractions I think, and I just didn't get it and he was getting madder and madder and madder. And finally he took something out and showed me like half of a pizza or something and finally I understood, but I just...I just didn't get it.

Yet another co-researcher reported an almost identical experience when she stated, "...but when I went to that new school I wasn't getting fractions and my dad was so angry with me; I think that really bothered me."

Four co-researchers reported that grades had a significant negative impact on their level of mathematical self-efficacy. In general, grades were seen as stress-inducing and contrary to learning. One teacher recalled being an exceptional student in middle school in all subjects except math. She recounted:

I seem to remember getting A-1-A's in almost everything, which meant that I got an A for the grade, a one for conduct...and I can't remember what the last A was for, but I got that, too. And I remember doing well, up until the time when math became just a little bit harder and then I started disliking it. No more A-1-A's. I remember all of the sudden just not getting a lot of work done and I remember

getting C's and D's and even F's. In a certain way it was traumatic. So, I guess my dislike of math began to happen at about that point.

Another participant positively correlated the grades with her attitude towards math when she commented:

It wouldn't be a problem if there weren't such things as grades, you know. I don't like to get things wrong. I don't like to get a B. So, in college I took like five different math courses and dropped every time until finally I decided to take one and I took statistics because it was the least math-like math class I could take.

For one teacher grades were the only thing she remembered about certain math classes. For example, she commented that she couldn't remember a thing about the pre-calculus class she took except she did "...really bad in it."

### Theme #3

#### *Distressful emotions characterize the experience of low mathematics self-efficacy.*

By the end of the third interview it was apparent that the emotional landscape of low mathematics self-efficacy was poignant terrain. These eight women were each adept at crafting verbal images of their experiences that spanned the emotional spectrum from frustration to trauma.

#### *Frustration*

Frustration was expressed by all eight co-researchers in various degrees of intensity. In two cases it was manifested either as anger or as rage. One teacher described her frustration in a very touching way when she remarked, "You know, there are so many people out there who are good at math...and it's frustrating to not be one of them."

Another teacher, speaking about her frustration, said, "So what I remember most about this period of my life [high school] is being frustrated, really frustrated. I've never looked at math though as something I couldn't get over. I figured that if I kept at it long enough eventually I would get it. But I never did."

In one case a teacher became self-conscious of how frequently she was using the word frustration. She commented:

Oh I think it's always been a source of...I shouldn't say frustration...I've been using that word too much. Something that I've never conquered. And I usually like to overcome things, meet things head on and try to conquer my fears and things like that. And math has always been something that I've never...I've never gone beyond it. I've never understood it and I want to.

The feeling of being frustrated by being denied the understanding that one so desperately was seeking was expressed by one co-researcher when she said, "Yeah...it's been like this black hole in my life. It is, really...a black hole. It's something that I've just never been able to overcome. I've done everything else but not that."

In one instance the frustration took the form of anger that was directed inwardly. This teacher remarked, "It's just the frustration of trying to do the math...and I get angry with myself for just not knowing how to do it."

In what was undoubtedly the single most profound moment during all eight interviews, one teacher recalled a horrific experience that unleashed a torrent of tears. The anger and confusion that this woman (a forty-nine year old Haitian special education teacher) conveyed were overwhelming. Her extreme frustration at not being able to perform on cue literally paralyzed her. This is her story:

You know, it's funny, I knew I had to meet you here today, so I woke up early this morning and I was thinking about it and tears came to my eyes because I had a horrible experience in math. English was easy enough but when it came to math I just.....couldn't get it. And she was teaching one day.....Sister D. She stood in front of me and she wanted an answer and I just could not give it to her. She yelled and she screamed and she banged on my desk and I couldn't give her an answer. I could even feel the kids around me feeling bad for me.....I don't know, we sat there for a long time, she stood over me, you know it was like...she wore the long habits that they used to wear long ago. She had her hands under her dress and she said [pounding on the desk for effect]... 'Give me an answer! GIVE ME AN ANSWER!!' (emphasis hers). And I'm looking at the book and I...just...could not see the answer. The next day, there I was again, alone and she was there again, right in front of me. And as class began guess who she called to go to the board? Yes, me. 'Go to the board!' she screamed. And it was like the movies...I sat in front of the class, but when I was walking up there...it was the longest walk. I wrote something on the board...I have no idea what I wrote and she said, 'See, I knew you weren't stupid.' So that's my experience with math. It was horrible, absolutely horrible...so that's my math story. I became a teacher so that no child of mine would have that experience...terrifying experience.

### *Fear and Anxiety*

Fear and anxiety were expressed by six of the eight participants. There was the fear of looking stupid, the fear of being wrong, the fear of failing, the fear of sharing

one's confusion with a teacher and the fear of not measuring up to one's own expectations.

One teacher commented, with a note of exasperation, "I would just like to not be scared of it. I mean...I've always been scared of math, always."

When asked to be specific about what she was afraid of, another teacher remarked, "The math itself. I am literally scared to death of this. If I were to rate the fear that I have, for example, of the math on the GRE, then on a scale of one to ten it would probably be about a forty. That's how much I'm afraid of this thing."

One teacher spoke metaphorically regarding her fear of mathematics:

You know...it's....I hate going on rides, they scare me, I don't like it. But about four years ago we went to Disney and there's that Tower of Terror where you get into that elevator and it goes down and I said to myself, "I'm going to do this." I'm just going to do it. I hate it and I'm scared of it, but I'm going to do it. And once I did it, it was great and I went back and did it again. But I feel that way about math. I just wish...I just wish I understood...just had some kind of concept about it. And it makes me insecure, you know, even when I use an adding machine.

In one case it seemed that a teacher was fearful of feeling fear itself. She commented, "I would just want my teacher to be...someone where I wouldn't go into their classroom and dread being there. Not because of them, but because of the math. I want them to know somehow that I just can't do it."

In another instance the fear appeared to be about confronting the reality of not being able to perform to expectations. This teacher remarked, "I've always been scared

that I simply couldn't DO IT! (emphasis hers) You know, I needed to pass...my grades...you know, that C or whatever."

The proverbial fear of being summoned to the board to solve a problem was mentioned by one teacher:

In the end I just gave up because I was scared. I became very scared...in the early sixties that was when you were called to the board and you had to solve a problem in front of everybody and that just terrified me. Because I knew...I knew I couldn't do it.

### *Inferiority, Embarrassment and Humiliation*

Five of the eight co-researchers reported feelings of inferiority, embarrassment or humiliation due to their perceived mathematical limitations. It was humbling to sit in the presence of professional women as they recounted such experiences. One woman stated, "...and you sit there, struggling to figure it out and then possibly get it wrong and look positively stupid. I don't know what the word is...it's just being inferior to someone else who can do it."

Another teacher remarked:

I should be able to ask 'Why is it that two plus two is four?' you know, and not feel that anyone is judging me for asking that question or feel intimidated because I asked the question, like...like I'm inferior to the people around me that know that two plus two is four without having any reservation and asking, 'Well, why is she asking?' You know?

Yet another teacher expressed a sense of inferiority while, at the same time, stating that she was capable, if she so desired, of not feeling that way. She stated, "I

know that if I wanted to be good at it, I could. If that was my forte then I could do well at it. Not, probably as well as some other people, but who knows.”

Another participant, a seasoned veteran, commented, “It makes you feel stupid. It makes you feel insecure. And there’s nothing worse than feeling...I just don’t ...everyone else is getting it, why aren’t I getting it?”

One teacher recalled, at length, an experience of inferiority while working as an accountant’s assistant prior to becoming a full-time teacher. She stated:

There were guys who worked with me at that time who were real jerks. They just sort of freaked out and literally started laughing at me for not knowing what a variance was. And I made the mistake of asking. So because of this, trust me, this was a really ugly situation, I never dared ask anything else again. I was ridiculed and it was humiliating...I felt like an idiot.

#### Theme #4

*Avoidance and survival are preferred methods of coping with low mathematics self-efficacy.*

#### *Avoidance*

Six of the eight co-researchers used avoidance strategies to contend with their math issues. At times this avoidance came at the cost of abandoning career plans that demanded mathematical coursework. For example, one teacher had plans on one day becoming a dentist. She stated:

I was at [School B], a vocational school. They would ask you what you wanted to do so I told them, ‘Well, I’d like to be a dentist.’ And they said, well these are the classes you are going to have to take, but you could take, um, dental assistant

first to lead into it, but if you took that track you didn't have to take math, so guess what I did, I took dental assistant. So I never took any math classes, you know. To me, at the time I was like, good, I don't have to take math, so I don't have to meet anybody who is going to yell and scream at me, so I spent the four years in high school studying to be a hygienist, safe from math.

One teacher steered away from any science course while enrolled in college, despite her interest in the subject, in order to avoid math. She recalled:

It was just the thought of all the equations, like the equation for blood pressure. I don't remember...even though I had taken a lot of science courses in high school I just avoided them in college. Thinking about it now, I guess I was avoiding math more than I knew.

One participant deliberately chose the field of special education with hopes that the level of mathematical rigor would be minimal. She said:

And I dropped [math] and when I decided to become a teacher I said well, I'm going to do special ed where I don't have to teach as much math you know. And the kids, alright I won't go past sixth grade where I knew...that's my limit. So that's why I decided, well, I'll become a special ed teacher and I'll stay in elementary, I won't do middle school or high school. If the superintendent called me up tomorrow and wanted me to teach math in a high school somewhere for twice the salary...I'd turn him down. I wouldn't do it.

For one teacher, the thought of having to confront math one more time at the collegiate level was just not bearable. She remarked, "I think...I know I can't do it, but there are parts of it that I just don't want to deal with, ever."



Another participant recalled very specifically her avoidance behavior while in middle school. She said:

I think I must have missed math two thirds of the time that year; I don't know how I didn't flunk it. I don't remember getting an F that year either and I don't remember getting a D so I must have ended up with a C but I missed most of the class. So I literally avoided math class and it was either in the seventh or eighth grade.

Recognizing the demands placed on the average self-contained elementary teacher, one participant shared, "I've always managed to avoid it. I couldn't even teach them arithmetic. I have a lot of respect for elementary teachers who teach it all, 'cause I couldn't do it."

#### *Survival and Remaining in the Comfort Zone*

All eight of the participants conveyed a sense of self-awareness that enabled them to successfully endure or tolerate low mathematics self-efficacy. Like a novice swimmer, they would routinely avoid deep water and opt, instead, for the comfort of shallower depths. They were intimately aware of how risky their situations were. To risk venturing into demanding mathematical venues was not a risk taken lightly. One teacher, speaking to this underlying current of survival, said:

As long as you know how to tip a waiter you're fine in life. And that's usually just a matter of multiplying whatever the total was by ten percent and ten percent is the first two numbers. So if you're dealing with twenty nine dollars it's two ninety and if they're really nice I'll multiply it by two and if they weren't I'll leave it at that and if they were medium, I'll give them another half. So that's

how I do math and I feel that as long as you can do that and as long as you can add and subtract you're basically going to get through life pretty well, mathematically speaking. You'll survive, and that's all I need.

Another teacher stated:

I had tutors outside of school and... I just remember just wanting to get by, you know, say studying for a test or doing my homework and just hoping that at the end of the day I just had what I needed to finish, to not have to do it any more.

In two cases participants were very careful to craft teaching assignments that would allow them to remain in their respective comfort zones. One teacher remarked, "I teach now, second through sixth grade, language arts, English and math, so...you don't need that much math, only math that I know I can teach them."

Another teacher reiterated this theme:

And ironically, the way my class is set up now math is actually the easiest time because no one has to do much regrouping. I only have three kids who do a little bit of that. So it's basically just working through workbook pages that they do.

In special ed you can't really teach the way that we were taught where everybody is at the same level because I really have twelve levels inside the same classroom.

So I go from kids who are adding one and one with blocks, which I can handle, to other kids who might possibly be regrouping, which is my limit.

Yet another teacher commented on her comfort zone, which for her was very clearly defined:

Not past eighth grade. I cannot go past...me...My friend says I could do it. I have a friend, like I said, she teaches at [School C] she said I can do it. I tell her,

no, I cannot. 'Well you have a teacher's manual, you have everything you need to do it,' she said. 'You have planned before, you know what to do.' I told her, I just don't want to deal with it. I don't want to. So, have me teach reading, or English, teach them how to write an essay; I can do that. But math, I won't do math, I won't do it.

Finally, a kindergarten teacher spoke openly about the threat of teaching mathematics being a "non-issue" because of the grade level she was teaching. She said: I get long division and all that stuff and that makes me confident. You know, though, it's the harder things that are tough for me. But, like I said, I enjoy teaching it. I don't mind....because it's kindergarten!

#### Theme #5

*Elementary teachers who are afflicted with low mathematics self-efficacy are able to imagine therapeutic responses to effectively contend with it.*

The therapeutic strategies envisioned by the eight participants in this study reflect Parker Palmer's advice to teachers, "When I do not know myself, I cannot know who my students are. I will see them through a glass darkly, in the shadows of my own unexamined life—and when I cannot see them clearly, I cannot teach them well" (1998, p. 2).

These eight teachers appeared to know themselves well and have clearly articulated what they would require, as adult learners and as human beings, to begin to reverse the effects of low mathematics self-efficacy.

## *Patience*

Five of the eight participants highlighted the importance of patience on the part of an instructor in helping them overcome low mathematics self-efficacy. One teacher put it very simply when she stated, "I would need someone who's patient; someone who is kind and not sarcastic."

Another teacher described at length the patience of a particularly beloved math teacher whom she encountered while enrolled in graduate school. She recounted:

Well you know, when I was at [School D], we had a very nice guy, Mr. B, in my program. He was, I mean... he would redo a problem ten times if you didn't get it. If I said, well, how'd you get that, he'd say, well let me show you. You know, if you put the x in parenthesis and you put the exponent here and you do this and this is how you get that and he would take one digit at a time, you know, and...I guess someone like Mr. B is who I would need. He took his time, he didn't rush anyone. And if the other people got it, he'd say good, you do the next ten problems because we need to work on this one. And he would take whoever didn't get it...we're adults, and he understood that. He once told us, some of you need lots of time and time I've got.

In the case of one teacher, she imagined that she would need someone extremely patient to endure what she perceived as major gaps in her learning. She stated:

I would want a teacher who was very, very patient...and caring. You know, really cares about me and without knowing whether I was good or bad in math and would just come in and give me the foundation that I needed and would have the patience to be with me.

When asked what it felt like to be treated with patience, one teacher replied: For me it's a relief. If [the teacher] is not patient I feel like I have to get this right away and if I don't get it they're going to get mad at me for asking them a question again. I guess I'm...I don't like bothering people, you know what I'm saying? And I don't like nagging. I feel like in those cases that if I ask too many questions that it was going to get to a point where he would say, 'Oh no, not you again.'

In two cases participants remembered instances of confronting teachers who did not demonstrate patience and this memory was the catalyst for nominating "a patient teacher" as a critical requirement for overcoming low mathematics self-efficacy. One woman remarked:

[My teacher] had very little patience. He would ask me questions and he would say, 'Do you get this?' And I would say yes just to satisfy him and get out of there. But I never did get it, really. . So I know I would need somebody older, somebody patient, somebody able to really understand the way it feels.

Another teacher seemed to truly enjoy fantasizing about the type of teacher who would be able to metaphorically hold her hand and help her finally succeed in mathematics. She said:

I would love to walk into a room where the person said to me, 'You know what, I'm here for you and I'm not leaving until you say, 'Ah, I've got it!'" That's the kind of teacher I'd need.

*Empathy*

Seven of the eight co-researchers reported that empathy was an important characteristic for a teacher to possess if they were to overcome low mathematics self-efficacy. One teacher, reflecting on the importance of a teacher's empathy commented:

To just...be able to relate to how I feel, maybe. I guess the typical math teacher would be very good at math and might not know how it feels to have a feeling of... a negative feeling towards it or whatever.

Another participant put it this way, "They would know that I was never really good at math." At times the problem seemed to be that math teachers lacked the capacity to "walk in another's shoes". This sentiment was expressed by one teacher who said:

A lot of math teachers are really bad at teaching math because they're so good at math. So I'd want someone who had struggled with math so they knew what it's really like.

Yet another participant commented, somewhat humorously, that her ideal teacher "...would have to be someone extremely good at math, obviously. And it would have to be someone who would be good at math without sounding too 'math like' and who could connect with me."

One teacher, recalling an experience where she was in the presence of a teacher who possessed a great deal of empathy, stated, "He walked in and said, 'Not everybody gets math and I understand that. Those of you who do must be patient with those who don't.'"

Another participant was very adamant when she said, "I don't think you have to be a great mathematician; you just have to understand me and be able to tell me how to do it. Just knowing the math doesn't mean you can pass it to me."

In an attempt to emphasize the effects of not being empathetic, one teacher stated: ...and I think the worst teacher is the one who says, 'I give up on you and you're not paying attention and why didn't you do your homework?' That's not it. The teacher has to sit down and be with the student and explain what it is that's going on.

### *Being Seen*

Four of the eight participants commented on how fundamentally important it was for them to be seen as human beings who, despite their struggles, were competent learners. The importance of being seen was frequently reported in conjunction with empathy or patience. One prospective teacher remarked:

A lot of times I would go for extra help [in college] and those rooms, they were nothing in comparison to my high school. They were huge rooms of fifty people, or sixty people, you know, where I was just a number basically. So, on top of that, on top of knowing I wasn't going to be good I didn't have that attention that I had before. I just knew they wouldn't have the kind of time for me that I needed.

One teacher commented on the importance of having a teacher who, in seeing her for who she was, would not judge her. She stated:

[My teacher] would have to seem like a real person who really understood me.

They would have to see that I am not a math person and ... it wouldn't be anyone

who would ridicule me and my knowledge of or lack of knowledge of math in any kind of way. So they'd really have to make me feel comfortable the whole time.

Three participants reported that it was frustrating to try so hard and for math teachers not to see and respond to that effort. One kindergarten teacher recalled one particular math teacher who, in fact, saw her struggles clearly. She stated:

He was very kind and I used to go to him for extra help because I couldn't fail the second time. And he said, 'I understand that...I understand you, I understand that you're trying and I'm going to make a deal with you. If you just get fifty percent right on the final exam I'll pass you with a C.' So...I imagine I got above fifty percent because I got a C. And I never had to take math again.

In one case being seen took the form of needing someone who would listen deeply and intently. This teacher commented:

[I would want] someone who's patient. Someone who is kind and not sarcastic, because you find that a lot. Somebody who would really listen to me but who is also willing to really talk to me. You know...show me the way. Someone who doesn't say 'You should know this.'

### *Hands-On Learning*

Four of the co-researchers stated that hands-on learning experiences would be an important ingredient of any attempt to overcome low mathematics self-efficacy. It occurred to me during these interviews that math teachers frequently abandon hands-on learning activities after elementary school, believing them to be too "child-like."

Speaking on the topic of hands-on learning strategies, one teacher remarked:



You know, I don't know, maybe something that would get that math to click with me. I don't know what it would be, but just something that would be creative and very hands-on, because I learn very hands-on. So maybe something that would engage me that way.

Following this line of thought, another teacher stated:

I'd want this ideal teacher to first assess me, figure out what I would need and then design something just for me... something hands-on. You may need to use the board and you might need to use visuals but I would need a lot of me actually doing the work, hands-on.

One teacher became almost silent as we started to discuss methods of overcoming her issues with mathematics. Finally, after composing herself she was able to say:

Hands-on. Hands-on. A lot of hands-on activities...teaching the concept from, you know, many different angles and how this becomes this. I don't know, just hands-on. I really...we're not talking about my favorite topic right now.

One teacher spoke energetically about the importance of incorporating real, hands-on learning experiences into any remedial program that would help her overcome her lifelong fear of mathematics. She recounted:

You would have to use real life experiences, you know. Maybe interact, I do it and then you do it, for me to get into it, to know it. I would know it because I can **do it** (emphasis hers). It has to have more than one aspect. I have to do it. I'm a practical person and I'm a doer. If I don't do it I can't learn it. I have to see it and do it. You can drive me to [School E] all you want but I won't know how to get there until I get behind the wheel and do it for myself. That's how I am. I

have to have hands-on. Even talking to somebody. If I hear you but I cannot see your face I cannot get the concept. I have to do.

*Overcoming Low Mathematics Self-Efficacy for the Children's Sake*

Six of the eight co-researchers were married with children at home. Five of these women referred to their own children as sources of motivation for overcoming low mathematics self-efficacy. One African-American woman, whose fear of mathematics bordered on the extreme, commented:

I think before I start telling [my children] what to do, start preaching, I better do it myself so I can tell them, well you better do it, because if you don't have a good education, especially if you're black, there's not much for you. If you cannot excel at something else you need to be educated.

Another teacher, who had never been able to help her children with mathematics beyond fourth grade, stated:

Of course as a mother I feel bad when I can't help my daughter who is in seventh grade. To me, the math level that she's doing today is what I did in college. And like I said before, I can't just pick up a book and know it. I have to plan, to look at it. First of all I'll have to teach it to myself, and then I'll have to find a way to make it fun for her to learn it.

This same mother went on to say, "You know, it's not easy when your kids are asking you for help and you can't. I say to them, 'Wait until Dad comes home.'"

One woman, whose only child was now a high school senior, shared the following thoughts:

Because I feel frustrated that I have a child and I've never been able to

help him with his math...ever. Maybe adding and subtracting. And maybe not even subtracting, I've always had to do it the old fashioned way. I have to cross out the number and do all that.. I know that...I'll never be able to help him again. Some people can but I can't and I wanted to, I really did.

## CHAPTER V

### RELATIONSHIP OF FINDINGS TO EXTANT LITERATURE

#### Introduction

Referring to the work of eminent Harvard psychologist Carol Gilligan, Zeldin and Pajares (2000) state that any attempt to understand [mathematical] confidence within women that is not moored in their relational experiences may not be appropriate. According to Zeldin and Pajares, "If it is true that women function from an ethic that is built on care and on social responsibility, then women may be more likely than men to permit others to play an especially critical influence on their developing [mathematical] confidence" (p. 15).

Speaking to the theme of understanding human behavior and the development of women, Gilligan comments, "...the elusive mystery of women's development lies in its recognition of the continuing importance of attachment in the human life cycle" (1982, p. 23). She elaborates on this topic further:

Among the most pressing items on the agenda for research on adult development is the need to delineate in women's own terms the experiences of their adult life. My own work in that direction indicates that the inclusion of women's experience bring to developmental understanding a new perspective on relationships that changes the basic constructs of interpretation. The concept of identity expands to include the experience of interconnection. (p. 173).

Accordingly, this researcher will anchor this review of extant literature to explain the findings in a relational context. This is appropriate given that all eight participants

were women and a pattern of human interconnection appears to be woven through the five emergent themes.

One of the purposes of this study was to investigate the lived experience of low mathematics self-efficacy, a complex phenomenon with a myriad of behavioral and emotional facets. While chapter two of this study provides an extensive review of the literature related to self-efficacy, a construct that capably explains the emergence of the behaviors and emotions revealed by the participants, a more complete understanding can be developed by considering the concepts of resilience, learned resourcefulness and gender stereotype.

### Resilience

Resilience refers to the development of competence in the face of adversity (Luthar, Cicchetti, Dante & Becker, 2000; Hamill, 2002). It is a dynamic process that does not imply invulnerability or invincibility. Resilient students generally share four characteristics: (1) Social competence (2) Strong problem solving skills and resourcefulness, (3) Autonomy and the sense of being able to exert control over one's environment, (4) A strong sense of purpose and hopefulness for the future. Conversely, students who are not resilient are deficient in one or more of these key areas (Krovetz, 1999).

The eight participants in this study are remarkable not for the presence of resilience (mathematically speaking), but for its absence. Non-resilient individuals fail to maintain a sense of competence in the face of adversity. According to Borman and Overman (2004), mathematical resilience can be seen as a developmental process that typically begins in late elementary and early middle school. This is in alignment with the

experiences of the eight co-researchers in this study, none of whom recalled significant negative experiences in their early elementary years.

### *Social Factors and Resiliency*

According to Nettles, Mucherah and Jones (2000), ready access to social resources such as caring parents who are actively involved in their child's schooling and supportive relationships with teachers have positive effects on students' academic performance. When such resources are either scarce or unavailable, academic performance and its accompanying sense of resiliency begin to diminish. Clearly, the absence of supportive relationships (from a mathematical perspective) at critical times in the lives of the participants in this study contributed significantly to the decline of their sense of competence, hence resilience.

Speaking to the theme of social skills in the domain of academic resiliency, Prilleltensky, Nelson and Peirson stated:

Compensatory mechanisms within the child and/or environment can compensate for the absence of positive factors and can serve to buffer the presence of negative factors. Attributes such as high levels of intelligence and the ability to elicit empathy are associated with resilient outcomes (p. 150, 2002).

The eight participants in this study encountered such buffering factors to varying degrees. Their respective levels of mathematical knowledge are, in all probability, not identical nor are their abilities to solicit empathy from key players in their lives, such as teachers and parents. Fluctuating abilities to elicit empathy and understanding from mathematics teachers and parents have conceivably contributed to the formation of varying degrees of resilience in the participants.

Zeldin and Pajares investigated the impact of social factors on the development of resilience and self-efficacy in mathematically or scientifically successful women. They found:

The women consistently recalled experiences that involved an influential person, often during a critical time, who helped them develop their beliefs about their capabilities while they also honed their own mathematical or scientific talents.

The various experiences, watching and learning from others, influenced them both on their ideas regarding mathematics-related areas and on their philosophies about women in these male domains. Social messages and verbal persuasions proved influential during the selection and retention of career and academic behaviors (2000, p. 242).

Discussing the findings of their qualitative inquiry into the mathematical self-efficacy beliefs of women in mathematical and scientific careers, Zeldin and Pajares go on to say:

One prominent theme to emerge from the narratives was that, just as important as it was for the women to believe in themselves, it was also important that *others* believed in *them*. The perceptions and judgments of others act as mirrors through which individuals view and define their own self beliefs (p. 242).

The critical importance of social factors (namely relationships) on the development of resilience in women is reflected in the following comments from Zeldin and Pajares:

When women struggle with obstacles, they are naturally inclined to remember episodes involving people about whom they care. These memories infuse them

with the necessary resilience to succeed. Without a belief in their own capabilities to succeed that was grounded in their relationships with significant others, the perceived obstacles they encountered might have easily deterred them from their goals (p. 243).

This researcher remembers vividly the account of one participant who recalled being emotionally tormented and intimidated by a mathematics teacher who offered not a supportive, caring relationship but an abusive one. If women rely on the ability to recall affirming memories and images from significant relationships in the service of developing resilience, then this unfortunate teacher was deprived of such an opportunity.

#### *Problem-Solving Skills and Resiliency*

It has previously been established that episodes of experiencing self-mastery are essential to the development of a cohesive sense of self-efficacy (Bandura, 1997). According to Stevens, Olivarez, Lan and Talent-Runnels "When [students] are confronted with specific tasks, [they] use a self-referent process to judge their ability to self-regulate and succeed in the activity. This process is referred to as self-efficacy and develops from prior mastery experiences, vicarious learning, verbal persuasion and evaluations of emotional states" (p. 209, 2004).

According to Sarah Hamill (2002), people employ two main coping strategies to contend with stress, a strategy based on problem-solving or an emotionally-focused strategy. Resilient and competent individuals have been shown to be similar in terms of self-efficacy, persistence as well as their more frequent use of problem-focused strategies. Problem solving strategies are active problem solving methods used to "...resolve the stressful relationship between the self and the environment" (p. 118).



In the interest of developing problem-solving skills, Dennis Fox (1994) suggests that schools offer abundant opportunities for students to actively participate in their learning. He recommends that schools provide ready access to a wide variety of manipulatives and associated materials, encourage cooperative and hands-on learning, provide multiple opportunities for involvement in decision making and goal setting activities and enable students to exert some measure of control over their own lives. He particularly advocates the use of constructivist teaching methods that emphasize student-centered strategies.

Martin Krovetz (1999) also advocates the use of classroom strategies that facilitate the experience of seeing oneself in control as well as methods that encourage resourcefulness in seeking help from others in an attempt to develop problem solving skills in students. According to Krovetz:

Fostering resiliency in children is based on deeply held beliefs that what we do every day around children makes a difference in their lives. It is about dedicating our hearts and minds to creating communities that are rich in caring, high expectations and social support, and opportunities for meaningful participation. It is the understanding that the culture and daily practices of schools need to be redesigned in ways that demonstrate a deep commitment to the potential of all students and it is the courage to work to create such communities (p. 31).

In recounting the experiences of the eight co-researchers, it appears that many of them were denied opportunities at pivotal junctures to develop effective problem solving skills. Given the relationship-orientation of this discussion, one is prompted to consider

whether the absence of supportive [mathematical] relationships at these crucial points inhibited the development of effective mathematical problem solving skills.

*Control, Autonomy and Resiliency*

It is interesting to consider that the subtitle to Bandura's landmark text on self-efficacy is *The Exercise of Control* (1997). Indeed, it has been demonstrated that an individual's perception of their relative degree of control of a situation determines their level of self-efficacy. Individuals possessing a strong sense of self-efficacy are more likely to conclude, upon inspecting their environments, that they are able to exercise some measure of control. As stated earlier, a pattern of perceiving that one has been able to exercise some measure of control in his or her life is a cornerstone of resilience.

According to Klohnen, Vandewater and Young (1996), resilient individuals are actively and meaningfully engaged in their worlds and embrace a positive and energetic approach to life that is grounded in autonomous and competent functioning. Krovetz (1999) echoes this sentiment when he states, "...a sense of one's own identity and an ability to act independently and to exert some control over one's environment are essential if we are to foster resiliency in children" (p. 29).

According to Prilleltensky (et al.), control is intricately linked to power and is defined as having the, "... opportunity to access valued material and psychological resources that satisfy basic human needs, exercise participation and self-determination, and experience competence and self-efficacy which instill a sense of stability and predictability in life" (p. 145, 2002). Prilleltensky suggests that a sense of personal control, empowerment and self-determination are each associated with positive mental

health and wellness. He contends that pathways to resilience occur when conditions to wellness are not all favorable, but some of them compensate for others.

Prilleltensky states:

Chances to express one's voice and make meaningful choices in life usually occur in micro-spheres of life such as recreational facilities, schools, jobs and primarily within an individual's interpersonal relations, especially within the family. It is within these arenas that self-determination and participation get enacted (p. 146).

Prilleltensky's emphasis on the role of relationships on the experience of control is particularly relevant to this discussion. If people are denied opportunities to exercise control due to non-supportive family and school relationships (again, from a mathematical perspective) then they are also being denied the opportunity to strengthen one of the key pillars of resiliency.

Hamill examined the importance of efficacy beliefs and coping mechanisms in resilient adolescents (2002). She states:

Efficacy beliefs regulate human functioning and emotional well being through cognitive, motivational, affective and selective processes. When facing adverse events, those who retain the belief that they will be able to exert control over their thoughts are more likely to persevere in their efforts. Those who are self-efficacious are more likely to reject negative thoughts about themselves or their abilities than those with a sense of personal inefficacy. Thus, unless people believe they can produce desired goals through their actions they will have very little incentive to persevere in the face of difficulties (p. 116, 2002).

According to Prilleltensky (et al.) holding on to a personal sense of control is of

fundamental importance to the development of resilience. He commented, "Self-efficacy and personal control serve as protective factors in the face of adversity" (p. 146, 2001)

The participants in this study almost uniformly acknowledged a lack of ability to truly control their level of mathematical competence. They routinely attributed this lack of control to an irreversible condition wherein they were rendered helpless.

#### *A Sense of Purpose and Resiliency*

According to Fox (1994), students who maintain high expectations, regardless of their academic or personal history, are more likely to develop a strong sense of resiliency. To this end he suggests schools use meaning-centered curricula that emphasize higher order thinking skills and understanding and application as opposed to retention of information.

Hamill contends that resiliency and a sense of purpose are inextricably linked to self-efficacy. She states, "Until people believe they can produce desired goals through their actions they will have very little incentive in the face of difficulties" (2002, p. 118).

According to Turner, Husman and Schallert:

Research has indicated that long term goals can provide a powerful incentive with respect to promoting academic resiliency, particularly in the threat of potential failure and shame reactions. However, such goals are not sufficient. They must be accompanied by a repertoire of skills (2002, p. 82).

Krovetz also stresses the importance of embracing a sense of purpose in the service of developing a sense of resiliency. He states that goals, educational aspirations, hopefulness and an enduring sense of a bright future all contribute to resilience (1999, p. 30).

It is enlightening to note that among the eight participants only one indicated that she contemplated a mathematically rigorous future beyond high school, a wish that was quickly abandoned during her freshman year. Indeed, it was generally the case that goals were selected that would virtually ensure that they would never experience the type of challenges and successes required to develop a sense of mathematical resilience. By keeping the goals low and easily surmountable they were denying themselves the opportunity to strengthen their sense of mathematical competence. All eight women eventually chose careers that required minimal mathematical rigor and where low mathematical resiliency would be tolerated.

#### Learned Resourcefulness

Learned resourcefulness has been defined as, "...an acquired repertoire of behavioral and cognitive skills with which the person is able to regulate internal events such as emotions and cognitions that might otherwise interfere with the smooth execution of a target behavior" (Akgun & Ciarrochi, 2003, p. 288). According to Gitner, West and Zarski, the components of learned resourcefulness include the ability to employ problem solving strategies, delay gratification, use self statements to control internal responses and perceive oneself as efficacious (2001, p. 296).

#### *Learned Resourcefulness as a Coping Mechanism*

The participants in this study reported a variety of coping mechanisms that can be more fully understood by considering the notion of learned resourcefulness. Gitner, West and Zarski report that highly resourceful students possess more problem-focused coping skills and display them longer than marginally resourceful students. In contrast,

marginally resourceful students report more distancing, avoidance, wishful thinking and keeping to oneself as preferred coping strategies (p. 297).

Akgun reports that highly resourceful students possess higher self-efficacy expectancies and employ problem-focused coping strategies more frequently than their marginally resourceful counterparts (2004). Akgun defines coping as "...a person's cognitive and behavioral efforts to manage, reduce, minimize, master or tolerate, the internal and external demands of the person-environment transaction that is appraised as taxing or exceeding the person's resources" (p. 441). Highly resourceful students are more likely to engage in positive reappraisals of their abilities and to seek social support and are less likely to select escape-avoidance strategies when confronted with adversity.

The tendency of marginally resourceful students to select escape-avoidance strategies in the face of adversity serves to illuminate our understanding of why six of the eight co-researchers used avoidance strategies to cope with low mathematics self-efficacy. [For instance, one participant recalled struggling through the one required math course for her undergraduate degree three times. She had avoided taking any mathematics courses until her senior year and, due to repeated failures, graduated late.] Indeed, according to Lewinsohn and Alexander, a positive relationship has been shown to exist between learned resourcefulness and self-efficacy (1990).

#### *Learned Resourcefulness and Self-Regulatory Mechanisms*

Akgun and Ciarrouchi report that academic stress permeates all of academic life, adversely affecting mental and physical health. People with a high degree of learned resourcefulness are able to control their negative emotions and to manage stressful tasks

more adroitly. These highly resourceful students are better able to protect or shield themselves from these adverse effects of academic stress (2003).

All eight of the participants reported that emotions such as frustration, fear and anxiety interfered with their ability to surmount mathematical challenges in their academic careers. Akgun and Ciarrouchi have determined that marginally resourceful students have a more difficult time regulating internal events such as these unsettling feelings of frustration, anxiety and fear as they attempt to complete some target behavior (2003). They also report that highly resourceful students are more likely to be able to neutralize these potential cognitive stressors than marginally resourceful students. She concluded that highly resourceful students experienced minimal effects on their academic performance due to cognitive stressors as compared to low resourceful students.

#### *Learned Resourcefulness and Social Support*

It would appear that the lack of learned resourcefulness contributed to the myriad of emotions experienced by the eight women in this study. Their inability to persevere in the presence of cognitive stressors and their choice of escape-avoidance strategies to contend with that stress seem to indicate a learned resourcefulness deficit. Additionally, these eight teachers each reported that they seldom sought the solace and support of social relationships as an avenue towards building their level of mathematical confidence. This is in keeping with Akgun's finding that generally it is the highly resourceful student who seeks such support (2004). When these eight teachers did seek social support it was for the purpose of finding someone who would commiserate with their troubles as opposed to "coaching" them towards success. According to Kim and Duda, such coping

strategies are appropriate in those instances where the individual can do little to control the outcome (2003).

### *Learned Helplessness*

If one believes that control is indeed attainable by others but not by oneself, then learned helplessness exists (Matherly, 2001). Learned helplessness may occur "...only when the inability to control is personal rather than universal" and refers to a condition "...in which individuals perform below the levels that would reasonably be expected of them" (p. 298).

Hooker has defined learned helplessness as the idea that "...one's own actions have no influence on or relationship to the outcomes of events and experiences." This belief produces a cognitive disturbance that culminates in detrimental motivational and emotional outcomes (1976, p. 194).

### Stereotype Threat

According to Cadinu, Maass, Frigerio, Impagliazzo and Latinotti, (2003) when individuals who belong to a minority group experience a performance deficit in an environment where negative stereotyping pertaining to the relevant minority group becomes salient, then a stereotype threat exists. According to this theory, individuals experiencing stereotype threat feel at risk of confirming the stereotype and this psychological pressure leads them to under perform.

### *Stereotype Threat and Assessment*

When the stereotype threat is activated in the context of evaluation individuals may experience anxiety and apprehension. They may be driven solely by the desire to avoid failure and may, as a consequence, exercise excessive caution when performing the



task (p. 268). If this stereotype threat persists then minorities may, in the long run, begin to disidentify from the relevant performance domain in order to escape the concomitant anxiety and apprehension. If this is indeed the case then one would expect decreased effort in the tasks that are relevant to the stereotype (p. 269).

According to Cadinu, et al.:

Stereotype threat may decrease performance expectancies that, in turn, may lead to lower performance. If this is the case, then minority members would suffer from a decrease both in their level of expectancy regarding their task performance and their actual performance. (p. 271)

#### *Stereotype Threat and Problem-Solving Skills*

In the opinion of Quinn and Spencer (2001), stereotype threat depresses women's math performance through interference with their ability to devise problem solving strategies. They state that stereotypes are transmitted in the culture in a variety of ways: mass media, books, parents, peers, and teachers. Stereotype threats affect children through the toys they choose to play with, the books they choose to read and the way they are treated in class. Eventually, it affects the classes they choose and the careers they pursue (p. 56).

#### *Stereotype Threat and Expectations of Performance*

One of the most fundamental means in which stereotypes about women's math abilities are promulgated is through parents' and teachers expectations. According to Frome and Eccles (1998), mothers tend to underestimate the mathematical abilities of their sixth grade daughters and overestimate the math abilities of their sixth grade sons. This is reminiscent of the accounts of participants who recalled parents who were in

denial regarding their mathematical abilities or parents and teachers who either demeaned them or exhibited little patience with their struggles.

For example, we may recall the participant whose mother enabled her avoidance behaviors by routinely picking her up from school prior to her math class. Clearly this young woman was struggling to keep her head above water, mathematically speaking, and yet her mother, apparently, was unable to confront the issue. We should recall also the participant whose middle school math teacher often referred to her as being "useless." He exhibited little or no patience with her inability to learn at some pre-determined pace.

According to Quinn and Spencer, girls generally out-perform boys in elementary schools on tests of computation and perform equally with boys on word problems. Starting approximately in junior high and continuing more strongly through high school, this pattern of achievement reverses. The gap continues to widen into college and adulthood (2001). Again, this pattern emerges among the eight participants, none of whom recalled any significant difficulties with mathematics during early elementary years. It was not until early middle school that problems began to surface, problems that intensified as they matured.

#### *Stereotype Threat and Gender Bias*

Mathematics and related areas of study are consistently stereotyped as masculine fields (Eccles, J., Jacobs, J., & Harold, 1990; Oswald & Harvey, 2001). Mathematics can be seen as a filter that keeps women out of science and technology-based careers. According to Eccles (1987), if undergraduate women in male-dominated academic areas perceive that they are currently being discriminated against because of their sex, or if they anticipate sex discrimination in their future career, they may lose confidence in their

ability to succeed in that area and may choose to pursue another field of study. Only one of the eight participants considered pursuing a career that would entail some degree of mathematical rigor (dentistry); the remaining participants steered their professional careers well away from technical pursuits.

Women are generally well aware that gender stereotypes that depict them as being bad at mathematics or science do exist. Therefore, if they perform poorly on assessments they may fear that others will attribute their weak performance to their gender (Steele, James & Barnett, 2002). Women have been found to have the conceptual or computational skills necessary to solve difficult mathematics problems, but the additional anxiety and diminished cognitive capacity associated with stereotype threat interferes with their ability to strategize, a process that requires focused concentration (Quinn & Spencer, 2001, p. 59). In general, knowledge of cultural stereotypes changes the evaluation situation for women such that their performance is depressed.

#### *Confronting Stereotype Threat*

According to Steele, confronting stereotypes is likely to be an uncomfortable and anxiety-provoking experience. "In time, women may come to distance themselves from situations and domains where they feel consistently devalued" (1997, p. 617). It is not uncommon for women in mathematics, science or engineering fields to become gradually disidentified with their chosen fields.

Major, Spencer, Schmader, Wolfe, and Crocker (1998) examined disidentification among African American students. Their findings suggested that black American students who feel threatened by negative stereotypes that imply intellectual inferiority may reduce the extent to which they derive self-esteem gratification from academic

performance and may, ultimately, disidentify from their academic area. Three of the eight participants in this study are African American.

Betz and Hackett, the authors of the instrument used in this study, found that self-ratings of mathematics self-efficacy were positively associated with self-ratings of masculinity but that self-ratings of mathematics self-efficacy were not related to femininity (1983). According to Singer and Stake, these findings "...suggest that mathematics self-efficacy contributes positively to men's beliefs that they are successfully fulfilling masculine role expectations, but that mathematics self-efficacy does not affect women's beliefs that they are successful fulfilling feminine role expectations" (p. 339, 1996).

#### Summary

The lived experience of the eight women in this phenomenological investigation who experienced low mathematics self-efficacy can be more fully understood by considering the effects of resilience, learned resourcefulness and stereotype threat. While Bandura's self-efficacy serves to illuminate their collective experiences, the resolution becomes more precise when these three additional factors are brought into focus.

Resilience has been defined as the ability to retain a sense of competence in the face of adversity. Conversely, the absence of resilience can be understood as the inability to retain such a feeling of competence. Resilient individuals are frequently supported by a social network that facilitates the formation of affirming self-beliefs, beliefs that resonates with confidence. Resilient people have been shown to be adept at actively seeking such support in the face of adversity. Given Gilligan's proposition that the lives of women can best be understood when examined through the lens of relationship, it

would appear that the participants in this study were either denied the opportunity to access such relationships or perhaps lacked the necessary skills to effectively take advantage of the relationships that were available. Trying to maintain a resilient sense of self in the face of adversity without the nurturing support of relationships is an endeavor with bleak prospects.

Learned resourcefulness presents another avenue toward the development of a strong sense of self-efficacy that was not commonly pursued by the eight participants. Learned resourcefulness represents a constellation of cognitive, emotional and behavioral skills that enable an individual to actively problem solve in the interest of overcoming adversity. Those individuals who possess minimal learned resourcefulness frequently rely on emotionally-based coping strategies such as avoidance to grapple with uncomfortable problems. The availability of mentors in a person's life can prove instrumental in the development of learned resourcefulness. Mentors can role model active problem solving strategies, and if these mentors are women, serve to convey the message that the seemingly impossible is, in fact, achievable. None of the co-researchers in this study reported the existence of such mentors. This serves to highlight the fact that highly resourceful individuals are frequently able to successfully connect with others for the purpose of enhancing their sense of confidence while their marginally resourceful counterparts are not.

The final explanatory factor that has been proposed to explain the reported lived experience of the eight participants was stereotype threat. Stereotype threat has been shown to be present when individuals who are members of an identified minority group (such as women in mathematics) experience a performance deficit when the stereotype

has been made salient. While none of the eight women in this study described experiencing stereotype threat specifically, they shared a common belief typically held by those who have experienced it, namely an aversion to mathematics and the belief that they were somehow organically unsuited to any profession requiring mathematical skill. None of the eight women reported receiving verbal support from significant people in their lives that conveyed the message that women could be competent mathematicians. The absence of verbal affirmations and the absence of powerful female role models in their lives would seem to suggest that conditions were susceptible to the destructive effects of stereotype threat.

## CHAPTER VI

### DISCUSSION OF FINDINGS

#### Introduction

*Music is the silence between the notes.*

Claude DeBussy (2004)

DeBussy's comment seems to suggest that the seemingly empty space between audible notes is as important as the notes themselves. This idea is reminiscent of what visual artists refer to as *negative space*. According to Edwards (1999), negative space is the perceptible template that defines a physical object. Again, that which is apparently invisible serves to delineate that which can be readily discerned. One cannot fully come to understand the fullness of a Beethoven symphony, the richness of a Renoir painting or the grandeur of a Michelangelo sculpture without pausing to consider that which is not there.

Carol Gilligan (1982) has reported that the presence or absence of relationship in a woman's life determines, in large measure, the course of events in that woman's life. It would seem that this idea resonates with Debussy's and Edwards' notion of negative space, namely, that one must reflect not only upon what is manifested, but upon what is absent as well.

The process of horizontalization in phenomenology compels the researcher to sit still in the manner of a patient artist and to begin to etch the boundaries of the experience in question. This *horizon-finding* procedure entails recording every statement relevant to the experience, capturing every nuance of detail. When we apply our understanding of negative space to this process, then these boundaries encompass not only what has been

experienced directly, but that which has been conspicuously absent as well. One cannot sketch a complete portrait of the experience without considering both realms. In other words, in the context of this particular study, the horizontalization process cannot be said to be complete until the manifested and the veiled are both taken into consideration. The music becomes senseless noise without the silence between the notes.

The five themes that emerged in the course of this investigation can be viewed as discrete musical notes, essential to our understanding of the nature of the lived experience of low mathematics self-efficacy, but not sufficient. The purpose of this concluding chapter is to illuminate the interstitial insights that reside in the realm of negative space and to integrate them with the palpable notes of human discourse.

#### Summary of the Findings

Five themes emerged from this phenomenological study. The five themes are summarized briefly below.

*Theme #1: One's perceptions of mathematics influence self-efficacy beliefs.*

Mathematics was perceived, variously, as a hurdle to be surmounted, a "necessary evil" to be overcome in the interest of professional certification and as irrelevant.

*Theme #2: Diverse sources of low mathematics self-efficacy converge synergistically.*

The reported sources of low mathematics self-efficacy included various stages of formal schooling (elementary, middle, upper), parents, teachers and grades, and unfulfilled personal expectations of performance.



*Theme #3: Distressful emotions characterize low mathematics self-efficacy.*

The spectrum of emotions reported by the eight co-researchers included frustration, fear, anxiety, inferiority, embarrassment and humiliation. The most frequent emotion recalled was frustration, while the most poignant was humiliation.

*Theme #4: Avoidance and survival are preferred methods of coping with low mathematics self-efficacy.*

Avoidance was the leading method of coping with low mathematics self-efficacy. The eight participants avoided taking mathematics and mathematics related courses throughout high school and college. Learning just enough mathematics to survive professionally and personally was likewise a common strategy.

*Theme #5: Elementary teachers who are afflicted with low mathematics self-efficacy are able to imagine therapeutic responses to effectively contend with it.*

The participants reported that having a patient and empathetic teacher would have had a significant impact on their mathematics self-efficacy. In addition, they stated that being seen by their teachers and taking part in hands-on learning activities would be beneficial. Several participants drew upon the effects of low mathematics self-efficacy on their own children as a source of motivation to overcome its debilitating effects.

Bandura and the Human Capacity for Reflection

*People not only gain understanding through reflection,  
they evaluate and alter their own thinking.*

Bandura (1997)

Bandura states that it is our instinctive ability to reflect, to ponder the personal significance of events and to probe inwardly into our emotional and psychological

recesses that is our most innately human trait. The experience of sitting in a barren room opposite a sobbing woman who is recalling scenes of anguish in her life that are the direct result of insensitive mathematics instruction provided me with a rare opportunity to reflect on the deeper significance of this study. As I sat in that room alone after this courageous educator had departed, the face of the poet Maya Angelou swept across my mind. I envisioned this tearful woman, metaphorically, as the caged bird to which Angelou refers in her moving work *I Know Why the Caged Bird Sing* (1969).

In tribute to this particular unnamed woman and the courage she brought into that room on a Saturday afternoon, I have inserted the following excerpt from Maya Angelou's poem as an introduction to my reflections on the findings of this study.

#### Reflections on the Findings

There are five principal notes in the following reflections, corresponding to each of the five themes. If Maya Angelou is correct, we will hear not only the notes, but that which "is longed for still."

*The caged bird sings with a fearful trill  
of things unknown but longed for still  
and his tune is heard on the distant hill  
for the caged bird sings of freedom.*

Maya Angelou

*I Know Why the Caged Bird Sings (1969)*

#### *The First Note: Perceptions*

The eight participants in this study were unanimous in their perception of mathematics as an oppressive force. It was regarded not so much as a barrier to freedom,

as alluded to by Maya Angelou, but as an obstinate hurdle to be surmounted or endured. Yet hidden from view was the sense that these women did indeed yearn for freedom, freedom from perpetual mathematical anxiety, stress and avoidance behaviors. As we have seen, non-resilient individuals frequently disassociate themselves from the source of their anxiety or stress. One such strategy for achieving this disassociation is to conveniently relegate mathematics to the realm of the irrelevant. Perhaps this is an effective technique for managing uncomfortable emotions and avoiding unsettling thoughts.

The legendary Chinese military strategist Sun Tzu advised aspiring warriors to know themselves as well as their enemies (2002). If that enemy is shrouded in menacing fog it cannot be seen clearly or accurately. This appears to have been the experience of the eight women in this study. Varying life experiences transformed the study of mathematics into an immaterial, troublesome menace. Mathematics was almost cast as the growling pit bull guarding the entrance to personal and professional liberation. Unless the ominous fog surrounding mathematics is illuminated by the light of resilience and strong self-efficacy, it will not dissipate.

But what is hidden from view here? What is concealed that might inform our understanding of what these eight women have experienced? The answer, it would appear, lies in the portrayal of mathematics as a pit bull. If one can conjure up an image of mathematics as an insurmountable and intimidating entity, then it would serve to effectively neutralize any attempt to confront it. They would be kept effectively “in check” and would never have to consider whether or not they possessed the “pit bull strength” themselves to grapple with their fears.

The sense that this "pit bull strength" did indeed live within each of them was conveyed through the expressions of extreme frustration that betrayed an underlying current of repressed anger. Recall the participant who stated, "It's just the frustration of trying to do the math...and I get angry with myself for just not knowing how to do it." It is interesting to ask why this woman felt compelled to direct her anger inwardly. Perhaps that is a safer solution than to imagine wielding the metaphorical sword of anger and swinging it in the service of mastery. Overcoming a formidable opponent (such as low mathematics self-efficacy) can be a daunting task, one that demands that one summon forth courage and sustained determination. If the battle is portrayed as a David and Goliath encounter, an image not necessarily commensurate with the true nature of the problem, then one is less likely to confront the giant, let alone grip the sword.

Further evidence that this interpretation is indeed accurate can be seen in the relative absence of mathematical allies. Marginally resilient and resourceful individuals have been shown to be less likely to enlist the support of others who might reasonably be expected to assist them in their struggles. This reluctance may be self-serving if the fear to grasp the sword exists. Gilligan reminds us that relationships may form the lens through which we must observe the behavior of women. Where were these potentially invigorating mathematical relationships? Their relative absence is informative, intriguing and predictable.

#### *The Second Note: Sources*

Robert Coles, the Pulitzer-Prize winning research psychiatrist from Harvard University, once observed that crisis can lead to growth "...when it presents an opportunity to confront impediments to further development" (Gilligan, 1982, p. 115).

Coles describes meeting a young black adolescent named John Washington, living in poverty, whose parents suffered from severe psychological disorders. Despite the existence of such oppressive conditions, John Washington managed to summon the strength of will to volunteer his services in support of the contentious desegregation effort taking place in the Atlanta public schools during the late 1950's. When asked what the source of his strength was, he responded, "That school glued me together; it made me stronger than I ever thought I could be, and so now I don't think I'll be able to forget what happened. I'll probably be different for the rest of my life" (Coles, 1964, p. 122). For this young man, his all-black school was the source of empowering and life-changing self-efficacy beliefs. However, when school is not a source of strength, but of self-doubt, the human spirit becomes vulnerable. Within the context of learning mathematics, this appears to have been the case with the women in this study.

Clearly, in the view of Carol Gilligan, the presence of supportive relationships in school would empower young women to find their voice, a voice that resonates with a strength instilled by affirming self-efficacy beliefs. However, this natural and instinctive need is often suppressed by schools in favor of a more masculine, competitive approach. Speaking to this theme, Carol Gilligan comments:

When the focus on individuation and individual achievement extends into adulthood and maturity is equated with personal autonomy, concern with relationships appears as a weakness of women rather than as a human strength (1982, p. 17).

It is interesting to note that the emergence of low mathematics self-efficacy did not occur among the women in this study until late elementary or early middle school, and, in most instances, not until high school. If one considers the transition from elementary school into middle school from a relational perspective, it is generally the case that children leave the safety and security of an intimate teacher attachment for the uncertainty of fragmented relationships.

If we examine the reported sources of low mathematics self-efficacy from the perspective of social cognitive theory (SCT), the role of achievement and relationships becomes apparent. Recall that SCT proposes that mastery experiences, vicarious experience, verbal persuasion and physiological states are potential sources of self-efficacy beliefs. According to Bandura (1997), incidents of mastery experiences impart the most profound effect.

The relative absence of recalled mastery experiences in mathematics from middle school onward and the resulting degradation of self-efficacy beliefs is one of the most significant findings in this study and serves to validate Bandura's belief. It is appropriate at this juncture to repeat Bandura's claim:

Mastery experiences provide irrefutable and authentic evidence of whether or not someone can muster what it takes to succeed. Successes create a robust sense of self-efficacy while failure weakens it. The detrimental effects of failure are more pronounced if a strong sense of self-efficacy has not yet been established (1986, p. 81).

Vicarious experiences entail observing the successful efforts of others deemed similar in ability to oneself and concluding, in essence, "If she can do it, so can I." It is significant, from the perspective of SCT, that none of the eight participants recalled having such an experience wherein they saw a similarly-skilled peer succeed in mathematics and using that observation as a motive force to propel them forward. Certainly their lives were not devoid of meaningful relationships; however, they seemingly were either unable or reluctant to draw upon those existing relationships for the purpose of elevating their mathematical self-efficacy beliefs. A possible explanation, of course, might be that these women chose friendships with individuals who shared their mathematical insecurities. However, it remains puzzling why these eight women seldom reported occurrences of drawing upon the nurturing and empowering strength of relationships in the service of forging a more powerful sense of mathematical self-efficacy. A noteworthy exception to this was the participant who recalled a supportive relationship with a math tutor during middle school and high school.

### *The Third Note: Emotions*

Of all the notes that compose this metaphorical chord, it is the note struck by emotions that resonates most deeply. When we look at the three pillars of reciprocal causation, we are reminded of the fundamental importance of the interplay between beliefs and feelings. When these eight women recalled instances of frustration for instance, these feelings were frequently ignited by self-defeating belief statements. The frustration appeared to be a symptom of an underlying self-efficacy structure that virtually ensured continued difficulty.

According to Cioffi (1991), it is not the emotions themselves that are important, it is how they are perceived and interpreted. According to Bandura (1997), individuals with a heightened sense of self-efficacy are able to more effectively regulate emotional responses to perceived stressors. When an individual believes that he or she is in control when confronted with such stressors then he or she has an easier time regulating such feelings as anxiety, fear, frustration and anger. The old maxim, ‘nothing succeeds like success’ seems to apply here. The ability to conjure up at will recollections of previous mastery experiences contributes significantly to the ability of an individual to control his or her thoughts.

The role played by mastery experiences in regulating emotional arousal is addressed by Bandura:

The most powerful way of eliminating *intrusive ideation* is by gaining mastery over threats and stressors that repeatedly trigger the perturbing trains of thought.... This is best achieved by guided mastery experiences that equip people with the knowledge, skills, and beliefs of personal efficacy to manage the things that disturb them. Through personal enablement, people gain some measure of mastery over themselves. Those who are assured of their capability to cope with threats have little reason to ruminate about them (1997, p. 148).

In the opinion of this researcher, emotions such as frustration, fear, anxiety and anger qualify as intrusive ideation. All eight women in this study experienced some degree of these disquieting emotions in the face of mathematically threatening situations.



In fact, from one perspective it may be said that their experience of mathematics is literally grounded on these emotions.

The feeling of being helpless to overcome low mathematics self-efficacy generates its own network of emotions. One participant literally recited a list of emotions she experienced as a result of feeling “mathematically helpless.” She listed confusion, frustration, exhaustion and a sense of being completely powerless to overcome her fears of mathematics as feelings that spawned from seeing herself as mathematically helpless. This is in keeping with Hooker’s finding that learned helplessness routinely gives rise to cognitive disturbances that interfere with motivational processes (1976).

*The Fourth Note: Coping*

*It is well known that "problem avoidance" is an important part of problem solving. Instead of solving the problem you go upstream and alter the system so that the problem does not occur in the first place.*

Edward de Bono (1973)

According to Gilligan, when confronted with the *onus of responsibility*, some women elect to seek the safety and refuge of drifting passively as an alternative to engaging in “...painful confrontations with choice” (1982, p. 143). She quotes a woman who, when confronted with such fears, states, “If I were drowning I couldn’t reach out a hand to save myself, so unwilling am I to set myself up against fate” (p. 143). Seeking shelter from the storm in a harbor of passivity seems to resemble the avoidance strategies used by many of the participants in this study and alludes to de Bono’s remark above.

According to Bandura (1997), teachers who possess a low level of academic self-efficacy are likely to engage in a pattern of coping characterized by "...withdrawal, emotional exhaustion, depersonalization and a growing sense of futility" (p. 242). In order to contend or cope with these unsettling emotions the women in this study avoided mathematics whenever possible. In effect, to echo de Bono's remark, they simply chose an avoidance-based problem solving strategy that entailed going "upriver" and changing the problem so that it was no longer a problem. This disengagement from mathematics removes the unpleasant obstacle, quells the cognitive disquiet and provides the comfort of a safe haven.

Recall the participant who stated, "To me, at the time I was like, good, I don't have to take math, so I don't have to meet anybody who is going to yell and scream at me, so I spent the four years in high school studying to be a hygienist, safe from math." This woman avoided math and found safety in that avoidance. Another participant put it succinctly when she said, "I think I can't do it [math] but there are certain parts of it that I just don't want to deal with." This woman, like the drowning woman referred to by Gilligan, would likely have resisted any offers of help that might have resulted in having to "deal with it."

Despite their struggles with mathematics, these eight women seemed to have been able to put those difficulties in perspective. "Math is just not that big a part of my life," one participant commented. It is easy, when immersed in research, to lose sight of the fact that one's subject of interest is not necessarily the topic of your participants' dinner table conversations. These eight educators reported, to varying degrees, that they

enjoyed a network of relationships that were non-academic in nature, relationships that provided abundant opportunities for establishing a grounded sense of well being.

These women had coped with their low sense of mathematical efficacy by “swimming upstream” and changing their environments in order to neutralize a threat. It would seem that human beings are remarkably adept at being able to maintain an internal state of equanimity amidst turbulence. As Gilligan might observe, why would a woman reach out and take hold of a helping hand if it meant placing that equanimity in peril?

*The Fifth Note: Overcoming*

According to Horner, as reported by Gilligan, “...the fear of success in competitive [academic] achievement exists because, for most women, the anticipation of success, especially against men, produces anticipation of certain negative consequences, for example, threat of social rejection and loss of femininity” (1968, p. 125). If women must access aggression in order to assert themselves academically, then according to Gilligan, women may perceive the imminent “...fracture of human connection” (1982, p. 43).

When asked to imagine the ideal teacher who might be able to help them overcome low mathematics self-efficacy, five of the eight participants described an individual who was empathetic, patient and caring. For instance, one participant, in describing her ideal teacher, stated, “[She would]...be able to relate to how I feel, maybe. I guess the typical math teacher would be very good at math and might not know how it feels to have a feeling of...a negative feeling towards it or whatever.” Another woman remarked, “...it wouldn’t be anyone who would be willing to ridicule me and my knowledge of or lack of knowledge of math in any kind of way. So they’d really have to

make me feel comfortable the whole time.” Finally, one participant said, “It would be someone who would be compassionate enough just to sit there. If I needed a thing to be told ten times, then just tell it to me ten times.”

Clearly, the quality of the emotional connection between student and teacher is of great importance to the women quoted above. If they are to confront low mathematics self-efficacy then the first step is to imagine a path through the dark forest. This dark, ominous forest harbors, as we have seen, some very real threats. For instance, stereotype threat looms as a foreboding peril. The existence of stereotype threat appears to resonate with Horner’s contention that women manifest apprehension when contemplating asserting themselves in a masculine arena. In the American culture mathematics and science are typically regarded as male-dominated disciplines. For these eight women to contemplate competing in these disciplines, the perceived risks must certainly be considerable.

“Mathematics belongs to everybody and everybody deserves to learn it.” When one participant recalled this statement from one of her graduate school professors I sensed that she was profoundly touched. Here was a math-methods professor, a woman, who had managed to convey in a single sentence her commitment to reclaiming mathematics from the realm of the masculine. It is this type of clarity of vision that will inspire women such as the participants in this study to venture into the dark forest, not alone, but guided by the caring, confident and patient presence of teachers who will light the way. Mathematics does indeed belong to us all.

## Conclusions

### *The First Research Question*

The first research question addressed the process by which low mathematics self-efficacy is formed in elementary teachers. The findings of this study suggest that low mathematics self-efficacy typically begins to appear in either late elementary or early middle school. The sources from which it emerges include: perceptions of mathematics that portray it as insurmountable and irrelevant, teachers, parents, grades, and unrealistic self-expectations of performance (“I should know this.”). These effects have a synergistic effect whereby their combined influence appears to be stronger than the sum of the individual sources.

### *The Second Research Question*

The second research question asked, “What is the lived experience of elementary teachers who contend with low mathematics self-efficacy?” The experience of contending with low mathematics self-efficacy is characterized by frustration, humiliation, fear, anxiety, feelings of inferiority and embarrassment.

Elementary teachers typically employ avoidance strategies to contend with this broad spectrum of emotions. They also make use of survival-based approaches wherein they pursue the minimum level of mathematical competency required to conduct daily professional and personal affairs.

## Implications for Practice

The fundamental power of mastery experiences and their ability to dramatically alter one’s sense of mathematical self-efficacy, when coupled with the understanding of the fundamental power of relationships to inspire women to seek such experiences,

provides us with the single most significant implication for professional practice. If mathematics educators are to free female students from the tyranny of stereotype threat, strengthen their sense of mathematical self-efficacy, and if they are to encourage the development of resiliency and learned resourcefulness, then they must forge caring, patient and empathetic relationships within their classrooms and offer abundant opportunities for students of all abilities to experience mastery. Developing a strong sense of mathematical self-efficacy in the absence of mastery experiences is a losing proposition. Bandura is adamant when he states that mastery experiences exert the greatest influence on the development of self-efficacy.

According to Bandura, self-efficacy experiences that occur as early as infancy can initiate a particular developmental course (1997, p. 169). Educators who are responsible for developing mathematics curricula for young children should consider those programs that have been designed with mastery as their focus. Teachers must be trained extensively in how to administer these programs and be comfortable with the content so that they do not unknowingly transmit negative messages to their students.

Given that the majority of the participants in this study did not begin to exhibit signs of low mathematics self-efficacy until middle school, continuing this practice of selecting mastery-centered curricula through high school is also recommended. Teacher training should incorporate workshops designed to facilitate stronger relationship skills as well. Schools might consider the establishment of mentor programs whereby new teachers are paired with seasoned veterans, an experience that should reflect the power of caring relationships.

Although cooperative learning strategies have been available for decades, many mathematics teachers are reluctant to employ them. In the interest of encouraging the development of strong relationships within the classroom, this instructional technique should be implemented on a frequent basis.

#### Implications for Theory/Recommendations for Future Research

In the back of modern, high-definition televisions resides a device whose purpose it to converge variegated beams of light into one coherent signal. In effect it is converging different aspects of an image into one, complete picture. If this device was not present, or was functioning improperly, then the resulting picture would be distorted. This converging device presents an appealing metaphor for how current instructional theory might be informed by the findings of this study.

The findings of this study indicate that the process by which low mathematics self-efficacy develops is influenced by a variety of factors. These factors include mastery experiences, instructional practices, relationships, stereotype threat, resiliency and learned resourcefulness. What appears to be absent in current instructional theory is a converging device that would serve to synthesize these insights into one coherent instructional model.

According to Zeldin and Pajares (2000) and Bandura (1997), there exists an ongoing need for qualitative investigation of the self-efficacy construct. To this end, I would offer that the findings of this study imply that grounded theory based research be conducted for the purpose of generating a *converging device* that would not only further illuminate self-efficacy, but would provide mathematics educators with a coherent

instructional theory tailored to meet the needs of female students. Existing instructional theory appears to avoid converging apparently disparate ideas.

### Limitations

Given that the eight participants in this study were female elementary teachers, the findings of this study should not be extended either to male teachers or teachers in middle schools, high schools, or universities. Also, the teachers who participated in this study represent a blend of cultural and socioeconomic backgrounds, so to extend the findings to one particular group would not be warranted. Additionally, the amount of teaching experience of the participants varied from zero to more than twenty years. Therefore, it would not be appropriate to apply the findings to teachers of one specific experience category (for instance, new teachers).

It is left to the reader to determine whether the richness of the qualitative data presented in this study warrants transference to individuals similar to the participants herein. Presumably, the preponderance of lengthy, verbatim quotes from the eight participants will support this transference. Also, this researcher acknowledges that his professional role as a mathematics educator may have resulted in unconscious bias during the analysis and interpretation of the data, despite having taken measures to prevent its infiltration.



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## Appendix A

### Letter of Consent

#### **Barry University Informed Consent Form**

Your participation in a research project is requested. The research is being conducted by John Griffin, a doctoral student in the Leadership and Education department at Barry University who is seeking information that will be useful in the field of Education. The aim of the research is to understand the experience of prospective elementary teachers who contend with low levels of mathematics self-efficacy. Self-efficacy has been described as the constellation of self-beliefs that serve either to enhance or undermine one's ability to confidently and competently perform some activity. In accordance with this objective, the following procedures will be used: administration of a mathematics self-efficacy instrument, open-ended interviews and the construction of concept maps. I anticipate the number of participants to be eight.

If you decide to participate in this research, you will first be asked to complete a mathematics self-efficacy instrument. The purpose of the instrument is to correctly identify those individuals who have experienced the phenomenon in question, namely low mathematics self-efficacy. The instrument typically requires less than fifteen minutes to complete. If the results of the instrument indicate that you have experienced low mathematics self-efficacy as defined by its authors, you will then be asked to participate in one 90 minute interview, followed by an open-ended period where you will be asked to create a concept map that illustrates your experience with mathematics. These sessions will be conducted on the premises of Barry University in a private setting. The total time commitment is estimated to be approximately two hours.

Your consent to be a research subject is strictly voluntary and should you decline to participate or should you choose to drop out at any time during the study, there will be no adverse effects.

The risks of involvement in this study are minimal and include possible unpleasant memories. If you choose to participate there will be no adverse effects on your graduate studies at Barry University. Although there are no direct benefits to you, your participation in this study may help create an understanding of how low mathematics self-efficacy evolves, how it is experienced, how it might be avoided, and how educators might appropriately respond to its presence in others with heightened sensitivity and awareness.

As a research subject, information you provide will be held in confidence to the extent permitted by law. Any published results of the research will refer to group responses only and no names will be used in the study. Data will be kept in a locked file in the researcher's home for five years and then destroyed. Your signed consent form will be kept separate from the data.

If you have any questions or concerns regarding the study or your participation in the

study, you may contact me, John Griffin, at (305) 332-8893 (cell) or (305) 969-4213 (work), my supervisor, Dr. Toni Powell, at (305) 899-3708, or the IRB point of contact, Ms. Avril Brenner, at (305) 899-3020. In addition, if you would prefer to contact me via e-mail, my address is: [jgriff44@bellsouth.net](mailto:jgriff44@bellsouth.net). If you are satisfied with the information provided and are willing to participate in this research, please signify your consent by signing this consent form.

### **Voluntary Consent**

I acknowledge that I have been informed of the nature and purposes of this study by John Griffin and that I have read and understand the information presented above, and that I have received a copy of this form for my records. I give my voluntary consent to participate in this study.

\_\_\_\_\_  
*Signature of Participant*

\_\_\_\_\_  
*Date*

\_\_\_\_\_  
*Researcher*

\_\_\_\_\_  
*Date*

## Appendix B

## Cover Letter

April 12, 2004

Dear Colleague,

As you prepare yourself for entry into a career that will inspire and challenge you in countless ways I offer you the following words of counsel from one of education's most beloved philosophers, Parker Palmer. "When I do not know myself, I cannot know who my students are. I will see them through a glass darkly, in the shadows of my own unexamined life—and when I cannot see them clearly, I cannot teach them well."

We are entrusted with the care and guidance of young minds who are constantly struggling to figure out who they are. As Parker Palmer states above, it can be difficult for us to undertake this responsibility if we have not yet spent some time in disciplined self reflection. If you choose to participate in this study you will be asked to spend time reflecting on your experiences with mathematics. **The purpose of this qualitative study is to explore the experiences of prospective elementary teachers, such as you, who contend with low mathematics self-efficacy.**

Albert Bandura, a world-renowned psychologist from Stanford University, first proposed the idea of self-efficacy. According to Bandura, self-efficacy refers to the network of self-beliefs that determine a person's level of confidence in his or her ability to undertake the necessary actions to successfully complete some specified task, such as teach mathematics to a group of lively eight year olds. Bandura goes on to say that while strong self-beliefs may not guarantee success, self *disbeliefs* most assuredly spawn failure. It is important to note that low mathematics self-efficacy is not the same thing as math anxiety. Math anxiety may, however, be a useful symptom in identifying the presence of low mathematics self-efficacy, the condition which generates it.

Your participation in this research is, of course, strictly voluntary. Your confidentiality is assured. If you choose to participate, please contact me via e-mail ([jgriff44@bellsouth.net](mailto:jgriff44@bellsouth.net)) or telephone: (305) 332-8893 (cell), (305) 969-4213 (work), no later than June 30, 2004. If you elect to participate you will be asked to complete a brief instrument that measures mathematics self-efficacy. If the results of this instrument identify you as a participant, you will be asked to complete a ninety minute interview followed by an open-ended session where you will be asked to complete a concept map that illustrates your experience with mathematics. Please understand that use of this data will be limited to this doctoral research, as authorized by Barry University, although results may ultimately (and hopefully!) be presented in formats other than the dissertation, such as journal articles or conference presentations. You have the right to express concerns to me or to my advisor, Dr. Toni Powell, (305) 899-3708.

Thank you for your interest and participation in this study. This research is impossible without the cooperation of educators like you. Good luck in your graduate school endeavors and remember that the processes of growing as a human being and as a teacher are inseparable. I leave you with this from Parker Palmer; “To become a better teacher, I must nurture a sense of self that both does *and* does not depend on the responses of others—and that is a true paradox.”

Sincerely,

John C. Griffin  
Ph.D. Candidate (Educational Leadership)  
Adrian Dominican School of Education  
Barry University



## Appendix C

## 5-Item Excerpt from the Mathematics Self-Efficacy Rating Scale

©1993 by Nancy E. Betz and Gail Hackett

Permission has been granted to include the following five items from Betz and Hackett's Mathematics Self-Efficacy Rating Scale. Respondents were asked to evaluate their degree of confidence on each item on a scale ranging from 0 (no confidence) to 9 (complete confidence).

1. How much confidence do you have that you could successfully determine how much interest you will end up paying on a \$675 loan over two years at 14.75% interest?
2. How much confidence do you have that you could successfully balance your checkbook without a mistake?
3. How much confidence do you have that you could successfully figure out the tip on your part of a dinner bill split eight ways?
4. How much confidence do you have that you could successfully complete a course in statistics with a final grade of A or B?
5. How much confidence do you have that you could successfully complete a course in computer science with a final grade of A or B?

## Appendix D

## Interview Protocol

1. Take a moment and tell me about yourself. What would you like me to know about you?
2. Now reflect on your experiences with mathematics since childhood. See this journey as a story. Tell me this child's story right up to the present moment. What feelings seem to stand out for you?
3. How do you imagine this story unfolding in the years ahead?
4. Can you remember one specific experience with mathematics that was particularly significant? What thoughts and sensations come to mind as you recall this experience?
5. Have your experiences with mathematics affected other areas of your life?
6. If you could "custom design" a personal coaching or training program that would improve your sense of competence in mathematics, what would it be like? Describe the ideal person to guide you through this process.
7. Share with me why you chose to become a teacher.

## Appendix E

## Background Questionnaire

**Participant Data  
Confidential**

1. Name: \_\_\_\_\_
2. Undergraduate institution(s) attended:
  - (1) \_\_\_\_\_
  - (2) \_\_\_\_\_
  - (3) \_\_\_\_\_
3. Undergraduate major(s): \_\_\_\_\_
4. Graduate institution(s) attended and major:
  - (1) \_\_\_\_\_ major: \_\_\_\_\_
  - (2) \_\_\_\_\_ major: \_\_\_\_\_
4. List teaching assignments in chronological order, with most recent position first. Please indicate how long you held each position.
  - (1) \_\_\_\_\_ how long? \_\_\_\_\_  
\_\_\_\_\_
  - (2) \_\_\_\_\_ how long? \_\_\_\_\_  
\_\_\_\_\_
  - (3) \_\_\_\_\_ how long? \_\_\_\_\_  
\_\_\_\_\_
  - (4) \_\_\_\_\_ how long? \_\_\_\_\_  
\_\_\_\_\_

5. List high school mathematics courses completed and grade earned.

(1) \_\_\_\_\_ grade: \_\_\_\_

(2) \_\_\_\_\_ grade: \_\_\_\_

(3) \_\_\_\_\_ grade: \_\_\_\_

(4) \_\_\_\_\_ grade: \_\_\_\_

(5) \_\_\_\_\_ grade: \_\_\_\_

6. Where did you attend high school? \_\_\_\_\_

7. How many brothers and sisters? \_\_\_\_\_ brothers \_\_\_\_\_ sisters

8. If you are not an only child, what was your birth order? \_\_\_\_\_

9. Mother's occupation while you were a student in K-12:

\_\_\_\_\_

10. Father's occupation while you were a student in K-12:

\_\_\_\_\_

11. Please list your hobbies and interests.

(1) \_\_\_\_\_

(2) \_\_\_\_\_

(3) \_\_\_\_\_

(4) \_\_\_\_\_

(5) \_\_\_\_\_

12. Teaching certifications held: (1) \_\_\_\_\_

(2) \_\_\_\_\_