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## Home and Classroom Learning Environment Correlates of Academic Self -Efficacy in Middle School Mathematics.

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**HOME AND CLASSROOM  
LEARNING ENVIRONMENT CORRELATES  
OF ACADEMIC SELF-EFFICACY IN MIDDLE SCHOOL MATHEMATICS**

A Dissertation  
Submitted to the Graduate Faculty of the  
Louisiana State University and  
Agricultural and Mechanical College  
in partial fulfillment of the  
requirements for the degree of  
Doctor of Philosophy

in

The Department of Educational Leadership, Research, and Counseling

by

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May 2001



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## ABSTRACT

This study investigated the relationship between home and classroom learning environment characteristics and middle school students' self-efficacy beliefs about mathematics. Specifically, the study examined linkages between sources of efficacy in the home and classroom learning environments and the strength of students' self-efficacy beliefs in mathematics.

Social cognitive theory includes self-efficacy beliefs as a major source of human agency and functioning (Bandura, 1997). Enactive mastery experiences, vicarious learning (modeling), verbal persuasion, and physiological/affective states (emotional arousal) are four sources of human efficacy. While numerous studies have been completed linking self-efficacy to learning and achievement (Pajares, 1996b), *no studies within schools* were found that examined linkages between environmental/experiential sources of efficacy beliefs described as important within current self-efficacy theory (Bandura, 1997). Further, how these sources contributed, either singularly or in combination, or within and across home and school environments, to self-efficacy, was not known.

Eighth grade mathematics students (n=663) in 44 mathematics classes in 6 randomly selected schools from two large, urban, southeastern school districts participated in the study. Original measures were developed to operationalize the independent variables (perceptions of home and classroom learning environment factors contributing to the development and strengthening of self-efficacy beliefs) and the dependent variables (eighth grade students academic self-efficacy beliefs about

mathematics, self-efficacy effort and persistence, and self-efficacy outcome expectations). Likewise, a new response format which represents a more clear and direct operational definition of the self-efficacy belief construct was developed.

Results of the study show empirical linkages between students' perceptions of classroom and home learning environment events and characteristics, and the events and characteristics which strengthen students self-efficacy beliefs in eighth grade mathematics. The results supported Bandura's (1997) discussions of how important environmental events and experiential factors influence the development and strengthening of self-efficacy beliefs. Other results of the study suggested that eighth grade mathematics students as a group, have self-efficacy beliefs that are relatively specific to different mathematics domains (arithmetic, fractions, and equations). The study has implications for educational measurement, social cognitive theory, and educational practice through the arranging of functioning environments that contribute to the development of students' academic self-efficacy beliefs, in a critical curricula area, mathematics.

## CHAPTER 1: INTRODUCTION

### Overview

Historically, educational policy makers in the United States have developed and implemented policies which reflect concern for student and teacher-centered reforms to improve education and to hold education systems accountable for school outcomes, notably, learning and achievement. Cuban (1990) has noted that educational reform policies, much like harmonic waves, ebb and flow over time with little demonstrable influence or sustained effects on school outcomes. Policy-based educational reforms such as site-based management, teacher licensing and credentialing, school vouchers and charter schools, reductions in class size, etc., have been documented in the research literature as *distal variables* (those removed from the daily learning experiences of students) that have little demonstrable effect on student learning, achievement, or school improvement (Wang, Haertel, & Walberg, 1993). Thus, the extant literature suggests that meaningful change in schools (Fullan, 1993a, 1993b), and enhanced learning and achievement for students, is not likely to occur as a result of policy-based initiatives alone.

Large-scale syntheses and meta-analyses of the literature related to school learning have shown that *proximal variables* (psychological, instructional, home environment, etc.) have a more profound effect on student learning than the distal variables previously mentioned (Wang, et al., 1993). Important proximal variables that have been identified as having an affect on school and learning by Wang, et al. are “student abilities, preferences, and prior achievement; teacher characteristics and

classroom behaviors; instructional materials and practices; amount of time devoted to learning; curriculum content; and classroom climate” (p.253).

The proximal variables cited above largely encompass two important classes of variables related to student learning: a) student characteristics and b) learning environments. This study was designed to address each of these factors from the general theoretical perspectives found in social cognitive theories of learning as they pertain to self-efficacy as a primary agent in human functioning (Bandura, 1997). More specifically, this study examined the role of home and classroom learning environments and their contributions to the development of middle school students’ academic self-efficacy beliefs in mathematics. Within the context of school change, improvement and effectiveness, and social cognitive theories of learning, the study examined theoretical sources of efficacy beliefs embedded in home and classroom learning environments and how these are linked to the strength of students’ academic self-efficacy beliefs in mathematics.

Bronfenbrenner and Ceci (1994) in their bio-ecological model proposed that explaining variations in developmental outcomes necessitates an understanding of the relationships existing among distal environmental factors, characteristics of the individual, the proximal learning settings, and measures of the outcomes. Learning, being a process, is a synthesis of information acquired in various forms; i.e. visual, auditory, and tactile. Bowden, Ramsden, and Martin (1989) explained that learning is about searching for meaning, developing understanding, and relating that understanding to the environment. Given that learning is both social and individual, it allows for the



modification of behavioral tendencies through exposure and conditioning to the environment surrounding the individual. As a consequence, the environment is seen differently by different individuals and as the individual interfaces with the environment personal conceptions undergo change (Bowden, Ramsden, & Martin, 1989). Therefore, understanding more about the reciprocal relationships between individuals and learning environments provides meaningful information for learning environment research and self-efficacy theory (Lorsbach & Jinks, 1999).

### Understanding Human Behavior and Learning

Learning environments exist everywhere and entail practically everything, i.e. the home, school, and classroom. Included in these environments are affective, cognitive, and behavioral components which are difficult to separate. In the early 1900s, educational researchers, theorists, and practitioners began studying learning environments utilizing the concept of individual differences among learners to examine a person's abilities and traits (Ellett, 1986). Enormous effort was expended in measurement studies with less attention paid to the study of learning environment characteristics and even less to the relationships and interactions between different types of environments and the characteristics of individual learners.

Given the amount of effort expended in early measurement studies, by the 1930s, a defined body of knowledge which provided an understanding of individual differences among learners and a better idea of human learning was established. In education, much of the established knowledge was developed by social psychologists who were interested in student, teacher, and student-teacher interactions, but broader

conceptions of the relationships between these individuals and their environments were emerging. For instance, one of the simplest and more conceptually clear formulations in the psychology of human behavior was explicated by Lewin (1936). Lewin conceptualized that all humans operate in a *dynamic field* or *life space* and that all behavior (B) is a function of two independent variables, namely, person (P) and environment (E). This conceptualization led to his simple equation that  $B = f(P, E)$ .

Lewin's simple equation tried to quantify the fact that an individual's behavior is a function of his/her personal characteristics and the environmental effects of the surroundings the individual is exposed to or allowed to experience. This equation can be deemed a summary of Lewin's view on the nature vs. nurture controversy and explains the relative contributions of and interactions between the variables which formulate behavior (Ellett, 1986). Lewin's theoretical concept of behavior served as a catalyst for additional studies in education and psychology which have generated much broader perspectives of human learning and behavior.

#### Methodologies and Conceptualizations

The measurement of learning environment characteristics has a relatively long and rich history. Conceptual work by Moos (1974a, 1974b) and the earlier development and application of classroom learning environment measures to curriculum evaluation and research projects (e.g. the Learning Environment Inventory, Anderson & Walberg, 1968; 1974) initiated the subsequent development and use of a variety of classroom learning environment measures. The initial focus of these measures was on students' perceptions of psycho social characteristics of the classroom learning environment from

a whole class perspective. More recently, learning environment measures have been developed from a more constructivist, personal learning environment perspective (Fraser, Fisher, & McRobbie, 1996). Another recent trend in the development of classroom learning environment measures has been the use of actual and preferred forms to contrast how students actually see classroom characteristics to how they prefer these characteristics to be (Fraser, 1993, Olivier, Bobbett, Ellett, Cavanagh, & Dellar, 1998).

Learning environments research has included examining relationships between learning environment perceptions and a variety of school-related outcomes, including student achievement. These studies have utilized a variety of methodologies and constructs which span a wide range of issues, subject matter areas, grade levels, and classroom groups (Ellett, 1986). Moving from the early years, when conceptualizations of the study of learning environments were being developed to the present, the field has experienced a proliferation of methodologies, dependent and independent variables, and measurement instruments which are too numerous to list. Reviews of a number of the measurement instruments, the variables they were designed to measure, and other supporting documentation can be found in several sources such as Anderson (1982), Chavez (1984), and Fraser (1986b; 1991).

Concomitant with this vast body of knowledge and the many variables which have been studied, home and school learning environments have been noted as explaining much of the variance in educational outcomes. Walberg (1980) developed a nine-factor model of educational productivity which emphasized out-of-school

influences and social-psychological variables as contributors to this expanding theoretical framework. The psychological environment of the classroom and influence of the home are among the nine factors Walberg (1980) identified. While contemporary studies of the home and school as learning environments have recognized the complex and interactive nature of both, they have been presented as complex social systems concerned with both institutional and individual dimensions (Fraser & Walberg, 1991; Getzels & Guba, 1957; Hoy & Miskel, 1996). Likewise, these environments have received attention in school restructuring and reform movements (Cuban, 1990; Wang, Haertel, & Walberg, 1993).

Numerous studies have been concerned with school restructuring and professionalization to increase educational outcomes (Darling-Hammond & Goodwin, 1993; Fullan, 1993a, 1993b; Rungeling & Glover, 1991). Likewise, a number of studies have been concerned with identifying and measuring home and school environment correlates of student learning (Fraser & Walberg, 1991; Loup, 1994; Wang, et al., 1993). Referring to the results of prior studies, a number of unresolved issues were identified and used to guide this study: *What contributes most to academic learning and achievement? How will an individual's academic beliefs affect academic behaviors? What are the best measures of the variables underpinning academic learning and achievement? What influence does the home and classroom have on human academic self-efficacy?* Thus, this study was conducted to better understand learning environments from conceptions found in self-efficacy theory reflected in the work of Bandura (1977a, 1986, 1997). The need to develop learning environment measurements

that capture elements of self-efficacy theory was recently noted by Lorsch & Jinks (1999). Other than the measures developed in this study, there are no other known measures of classroom or home learning environments that have been specifically developed within the context of self-efficacy theory.

### The Theoretical Frame Guiding The Research Studies

Conceptualizations of Human Self-Efficacy. Self-efficacy refers to *beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments* (Bandura, 1997, p. 3). These beliefs can influence an individual to become committed to successfully execute the behaviors that are necessary to produce desired outcomes. Bandura (1997) argues an individual can exercise influence over what is done, i.e. the individual may believe a particular behavior or response will produce an outcome, but if the individual has serious doubts concerning performance the behavior will not be executed and the outcome will not be achieved. Likewise, if an individual believes a task can be accomplished, the individual will persevere longer even when faced with repeated failures.

The belief system and the interactions of the entities which formulate behaviors that were proposed by Bandura (1997) are more dynamic than those previously established by the Lewin equation. Bandura's (1997) model of triadic reciprocal causation, which will be discussed in more detail in Chapter 2, is more interactive than the previously developed notion. Similarly, original arguments (Bandura, 1977a) concerning the specificity of the self-efficacy concept have changed over the past two decades.

Generality vs Specificity of Self-Efficacy Beliefs. Early studies of self-efficacy held the construct to be task and situation specific. The personal perceptions an individual had in a particular area of specialization, study, or interest were believed to be reflected in the individual's behavior. Thus, particular self-efficacy levels were considered specific to the task and response situation.

Pajares (1996b) concurred with Bandura (1977a, 1982, 1986) on the specificity of an individual's self-efficacy beliefs. He has argued that problems are compounded when researchers inaccurately define and assess self-efficacy and other expectancy beliefs. Pajares also maintains that self-efficacy can be used to predict academic beliefs and attainments when theoretical guidelines and procedures on the specificity of the self-efficacy construct are followed. Similarly, early theorists have also argued that the belief structure of an individual will influence subsequent behaviors and actions (Abelson, 1979; Dewey, 1933; James, 1885/1975; Mead, 1982; Rokeach, 1960, 1968).

More recently, the literature explains efficacy beliefs as structured experiences and reflective thought, i.e. more generalized beliefs rather than highly specific self beliefs (Bandura, 1997; Bandura, Adams, & Beyer, 1977; Cervone, 1989; Ewart, Stewart, Gillilan, & Kelemen, 1986; Zimmerman, 1989). Bandura (1997) further speculates that "in given domains of functioning, efficacy beliefs vary in level, strength, and generality" (p. 22). Therefore, in a given domain of functioning there will be no single relationship between efficacy beliefs, outcome expectations, and behavior. Individuals will use their efficacy beliefs in deciding to pursue a particular course of action and deciding on the amount of time which will be dedicated to this pursuit.

The literature shows that a sense of self-efficacy does not begin from an infantile state each time an individual undertakes a new activity or seeks to improve upon past performances. Bandura (1997) avowed a transfer of self-efficacy beliefs across activities and settings indicating a form of discriminant generalization which can be utilized to enhance perceived self-efficacy. According to Bandura (1997) five processes are offered to explain how mastery experiences are used to produce some degree of generality in self-efficacy:

1. perception of similarity - different activities are governed by similar cognitive or task demands.
2. codevelopment - skills in different domains are acquired concurrently.
3. cognitively structuring commonalities - commonalities between tasks or activities are used to stimulate success.
4. transformational restructuring - using mastery experiences to succeed in different undertakings.
5. coping - individuals realize the impact of successful experiences in one area or undertaking and apply what has been learned in other diverse areas.

Considering the specificity of the self-efficacy construct expressed by early theorists and initially by Bandura, and the more recent acknowledgments of some degree of generalization associated with self-efficacy beliefs, the major point at issue was not whether self-efficacy beliefs are content specific or whether they can be generalized. The major issues this study explored were the individual and collective

links between the classroom and home learning environment and middle school students' academic self-efficacy beliefs, i.e. the links between learning environments and academic self-efficacy beliefs.

Sources of Self-Efficacy. Bandura (1997) identified four sources of information that foster self-efficacy: a) *enactive mastery experiences*, b) *vicarious experiences*, c) *verbal persuasion*, and d) *physiological and affective states*; each will be discussed in more detail later in the study. Each of these sources can be influenced by the classes of independent variables chosen for study, namely the home and classroom learning environments. A key question guiding this study was *Which factors in the home and classroom learning environments make the greatest contributions to middle school students' academic self-efficacy beliefs about mathematics?*

#### Linking Learning Environments to Academic Self-Efficacy and Achievement

The psycho social characteristics of the classroom learning environment and student personal variables including student abilities, prior knowledge, motivation and persistence, and outcome expectancy have been shown to influence learning. As such, these variables can be used as predictors of student academic achievement (Haertel, Walberg & Haertel, 1981; Walberg & Anderson, 1972).

Likewise, the home as a learning environment has been documented as “the most salient out-of-school context for student learning, amplifying or diminishing the school’s effect on learning” (Wang, et al., 1993, p. 278). The SES of the home, the amount of time parents spend assisting students with homework, the amount of support provided through books and other media, parents recognizing and stressing the value of



academic achievements, and assuring regular student attendance at school all impact learning. As such, it can be concluded the home as a learning environment encompasses more proximal variables associated with students' daily educational experiences (Walberg, 1979, Wang, et al., 1993) than the distal variables previously mentioned. Therefore, the home as a learning environment contributes to students' learning and, ultimately, the knowledge which is acquired and measured through students' academic achievements.

Because learning and achievement are outcomes which are normally measured through performance on tests or the like, and both can be influenced by the home and classroom learning environments, it seems only logical that both can derive from common cognitive mechanisms. Bandura (1977a) suggests that motivation, which is concerned with the activation of behavior, and persistence, which is concerned with sticking to a particular behavior, are both cognitive mechanisms affecting learning. In general, a person having a high sense of self-efficacy will put forth a greater amount of effort, persist for a longer period of time, and formulate personal perceptions that positively influence the outcomes of a pending situation. In this study, the outcomes were identified as the learning process and, ultimately, academic achievement. Self-efficacy beliefs were studied to better understand their influence on behavior. In addition to the individual and collective predictors of academic self-efficacy from the classroom and home learning environments, the generalizability of the self-efficacy construct was explored because early discussions of self-efficacy held the construct to be completely situation and task specific. These early discussions provided little or no

information concerning beliefs crossing from one domain to another or beliefs occurring at some general level (Bandura, 1977a). More recent research recognizes situations where self-efficacy beliefs can be generalized (Pajares, 1996b) and mastery experiences in one area can cross into subsequent areas (Bandura, 1997).

The following sections include brief overviews of the literature as it relates to each component of the conceptual framework (i.e., learning environments, self-efficacy, and middle school mathematics). Conceptual models are presented to describe the nesting and interactions of each of the conceptual components. A statement of the research problem which was addressed is provided, as well as the purpose and significance of the study. Conceptual and operational definitions of the study variables are followed by primary and supplemental research questions which were used to guide the study, the development of instruments for data collection, and data analyses.

## Study Context

### Learning Environments

The number of research studies on learning environments is extensive (Anderson (1982), Chavez (1984), Ellett (1986), and Fraser (1986b)). An environment can be characterized as the surrounding conditions and influences that affect a person's development. It is composed of the social, physical, and psychological attributes that interact with characteristics of the individual. In particular, for purposes of this study, a learning environment was defined as the shared perceptions of students, teachers, and other significant individuals in a particular setting (Dale, 1972; Fraser, 1986b); viz., the

home and classroom. These perceptions characterize the environment through the eyes of each participant as well as the members of the setting collectively.

Researchers have found learning environments influence students' academic growth and achievement (Fraser & Walberg, 1991). Current learning theories indicate meaningful learning is reflective, constructive, and self-regulated. However, the real benefits of defining, measuring, and analyzing learning environments are derived when we can successfully predict the outcomes of various kinds of learning environments, as well as explain how these environments bring about the outcomes with which they are credited (Walberg, 1974).

Following the premises of adaptive instruction, it can be argued that students learn in different ways, at different rates, and for learning to be most affective, individual differences among students must be accommodated (Wang & Walberg, 1986). In other words, it can be said there are as many learning environments in a classroom as there are students. Adhering to constructivist views of 30 students with 30 different learning environments in a class and the need to maximize the potential of each individual student, the dynamic interactions of behavior, people, and their learning environments were explored, rather than the more traditional unidirectional views linking personal characteristics, environment, and behavior (e.g., Lewin, 1936).

It was concluded from the review of literature that learning environments are not determined by material surroundings. Judgments about an environment are based on perceptions of how well the particular environment meets the expectations of those involved in it and how each individual is affected or influenced. Parents and others

within the community are partners responsible for establishing learning climates and supporting the educational endeavors of the entire school system. Teachers interface with students from varied backgrounds and educational abilities daily and make assessments about students' abilities and the support students are provided. Students are poised to make informed judgments about classroom learning environments because of their exposures to them.

The measurement instruments which were used to formally assess classroom learning environments in schools are based on the late 1960s work associated with Havard Project Physics and the use of the Learning Environment Inventory (LEI) (Anderson & Walberg, 1968; Anderson & Walberg, 1974; Fraser, Anderson & Walberg, 1982; Walberg, 1968; Walberg & Anderson 1968a, 1968b; Welch & Walberg, 1972), as well as Moos's social climate scales (1974b). Some of the more popular measurement instruments which have been used at the secondary education level are referenced in Chapter 2.

While the vast majority of past learning environment studies has been completed at the classroom level, these studies have typically included students' collective perspectives of the psycho-social characteristics of the classroom and school learning environments (Fraser, 1986b; Fraser & Walberg, 1991). More recently, learning environment researchers have developed personal (rather than class) measures of student learning environment perceptions to accommodate learning theories grounded in social constructivism (Fraser, Fisher, & McRobbie, 1996). In addition, classroom and school environment researchers have developed measures of actual and preferred

perceptions of learning environments (Fraser, 1993; Olivier, Bobbett, Ellett, Cavanagh, & Dellar, 1998) to provide information for school evaluation and improvement efforts. The results of learning environments research have added considerably to a growing body of knowledge about effective schools and schooling (Wang, Haertel, & Walberg, 1993).

Every learner must develop the motivation to learn and couple this motivation with the methods and materials which are provided in an area of interest. In other words, a learner must learn how to process information, ideas, and the subject matter presented. When this processing occurs the home and the classroom become more than just shelters for students, parents/guardians, and teachers. These environments become tools which can be manipulated to pique student interest and curiosity. Modern learning theories maintain the student should want something, perceive something, do something, and obtain satisfaction from the learning experience. Dale (1972) explains, "The instructional [learning] environment, then, is an interacting situation in which the continuity of experience and the relating of experience are critically important" (p.16). The questions which were formulated to guide the study remain: *What contributes most to academic learning and achievement? How will an individual's academic beliefs affect their academic behaviors? What are the best measures of the variables underpinning academic learning and achievement? What influence does the home and classroom have on human academic self-efficacy?* The section that follows provides an overview of self-efficacy theory and its relationship to other self concepts and classroom and home learning environments.

### Differentiating Self-Efficacy from Other Self Concepts

In the private and social sector, in business and industry, and throughout the country, issues of self-esteem and self-worth have been popular components of study for sociologists and psychologists. For instance, in the state of California, one of the testing grounds for educational and social constructs, a *Commission on Self-Esteem* was established to devise and implement policies to increase feelings of self-worth among its citizens (Blascovich & Tomaka, 1991). Other self-esteem councils were established around the country following the published reports of the California task force beginning in 1990. The purpose of the California task force and other self-esteem councils was to gather data on self-esteem to support the claims being made. This was necessary to be assured that claims were made on hard facts and not wishful thinking. Results of data collected have shown that issues concerning self-esteem are quite controversial with those in favor, mostly educators, believing a student's perceptions of his/her own worth are important. Those in opposition believe the attempts educators make in trying to improve student's perceptions of their own worth are ineffective and nonsensical distractions (Kohn, 1994). With some 200+ instruments aimed at measuring self-esteem and some 10,000+ studies completed, the results that emerged are not encouraging and the consequences which are expected from increased or decreased feelings of self are mixed, insignificant, or absent (Jackson, 1984; Kohn, 1994).

In the education literature, the self-esteem and self-worth constructs are typically used interchangeably and often confused with self-efficacy. The self-esteem and self-

worth constructs are general in nature, whereas, self-efficacy is content and situation specific (Bandura, 1977a, 1982, 1993, 1997; Crocker & Major, 1989). Some researchers have regarded self-esteem as a more general form of self-efficacy. According to attitude theories expressed by Ajzen & Fishbein (1980) and Rosenberg & Abelson (1966), self-esteem is an attitude toward self which is based on an elaborate set of beliefs about oneself. Bandura (1997) is quite clear in explaining self-efficacy as beliefs in an individual's capabilities to *organize* and *execute courses of action* which lead to attainments.

The literature supports a family of variables which are linked to attribution theory. These variables establish a commonality among a number of constructs that are associated with locus of control. The term locus of control refers to a construct that originated from Rotter's social learning theory (Rotter, Chance, & Phares, 1972) defining the extent to which one believes personal behavior is caused by internal or external factors. Lefcourt (1991) identified some of the locus of control constructs and the researchers making contributions in the various areas of study as Causal Attributions (Weiner, Heckhausen, Meyer, & Cook, 1972), Helplessness (Seligman, 1975), Personal Causation (DeCharms, 1976), Efficacy (Bandura, 1977a), Perceptions of Control (Langer, 1983), and Personal Competence (Harter & Connell, 1984). Although the locus of control constructs are somewhat related, their methodologies are diverse enough to allow researchers to draw upon their unique differences to disentangle and explore them individually.

Examining self-referent thought in terms of the self-concept and the constructs associated with locus of control one begins to understand how people's attitudes affect

their overall outlook on life. According to Bandura (1982), individuals continually make decisions about the courses of action they are going to pursue, the amount of energy they are willing to expend in these pursuits, and the amount of time they are going to invest once an action has been decided upon. Courses of action initially take shape in a person's thoughts (Bandura, 1993). If the person has a high sense of self-efficacy, the scenarios which are played out are those of success. These scenarios can then be used as guides or support to achieve anticipated goals or end results. If the person's self-efficacy is low or weak, what is visualized is a failure or a negative course of action. What is played out is self-doubt and a lack of confidence to reach desired goals or end results. Why is a distinction needed between the self concepts, self-efficacy, and the other constructs associated with locus of control?

A review of the literature revealed there was no single or all-purpose test which can be used to measure self-efficacy, the focus of the study. It has been acknowledged that two individuals can have the same level of self-esteem, yet the structure of their self-efficacy beliefs may be entirely different (Rosenberg , 1982). Because self-efficacy is generally perceived to be content and situation specific (Bandura, 1977a, 1982, 1986, 1997), an individual may have high self-efficacy for one endeavor and low self-efficacy for another. An example would be a student who is very efficacious about mathematics and is willing to expend great effort to solve difficult math problems. This same student may have low self-efficacy toward history and will display little confidence in composing history essays or remembering dates and events. The same student may be very efficacious in a particular mathematics class, with a particular teacher and experience very low efficacious tendencies in a different mathematics class or with a



different mathematics teacher. Bandura (1997) discussed in detail how beliefs in personal efficacy can have diverse effects on an individual's course of action.

The course of action an individual will pursue can also be affected by the individual's beliefs about internal and external factors of control (Lefcourt, 1982).

Individuals with strong internal locus of control will believe they are in control of their destinies, whereas individuals with strong external locus of control believe someone or something is in control of their destinies. This view of control causes an individual to predict events and shape outcomes to their likings or succumb (Bandura, 1997).

Because outcomes are impacted by actions, what one believes and how one reacts will largely determine the outcomes one experiences (Bandura, 1997). The interactions of the person, the environment, and the behaviors or outcomes which result are reciprocally determined and reflected in what has been termed in the literature as social cognitive theory. Self-efficacy as was defined by Bandura (1977a, 1982, 1986, 1997) is subsumed under the concept of social cognitive theory.

Following Bandura's concept of the nature of human agency as it pertains to social cognitive theory, people interface and manage their environment by exerting and reflecting on their personal skills. In these transactions, people analyze the situations they are confronted with, assess their abilities, consider a course of action and possible outcomes, act on their judgements, and reflect on the results based on the actions taken (Bandura, 1997).

Bandura (1997) presented the four sources of information, previously mentioned, as factors that develop self-efficacy beliefs. According to Bandura (1997) self-efficacy belief systems are constructed from these four primary sources:

- **enactive mastery experiences** that serve as indicators of capability. An individual uses personal experiences to stimulate outcomes. Based on past successes or failures, an individual develops the drive and determination to accomplish a specific task or function. This source is considered the most influential source by Bandura (1997) because it provides the most authentic assessment of one's abilities.

- **vicarious experiences** that alter efficacy beliefs through the transmission of competencies and comparison with the attainments of others. Individuals not only depend on their capabilities through enactive experiences, but they use the experiences of others as models of behavior to impact an outcome.

- **verbal persuasion** and allied types of social influences that one possesses certain capabilities. When realistic suggestions or feedback are provided by others, especially authority figures or those viewed by the individual as possessing the capabilities sought, the individual is provided an incentive to perform the task or function.

- **physiological and affective states** from which people partly judge their capableness, strength, and vulnerability to dysfunction. A psychological/affective state is developed by an individual to enhance the physical state. An individual uses varying levels of emotions to accomplish a task or function. By heightening emotional levels an individual is able to overcome negative emotions and reduce stress, thereby improving performance.

Each of these sources of self-efficacy is embedded in environmental experiences. The manner and extent to which such experiences result in cognitive and behavioral

consequences for individuals (or groups) serve to develop the strength and generality of self-efficacy beliefs. For example, successful academic accomplishments of students (enactive mastery experiences) accompanied by verbal persuasion from parents or teachers serve to strengthen students' academic self-efficacy beliefs. Alternatively, failure at academic tasks and verbal admonishments serve to weaken students' self-efficacy beliefs. Thus, understanding the extent to which these various sources of efficacy were embedded in classroom and home learning environments for students, and how they singularly or in combination contributed to the strength and generality of students' efficacy beliefs was an important research concern in this study. This also seemed to be a concern for other researchers since the literature well documents positive linkages between the strength of students' academic self-efficacy beliefs and subsequent academic learning and achievement in school (Bandura, 1989a; Pajares, 1996b; Schunk, 1981), persistence to maintain high academic achievement (Lent, Brown, & Larkin, 1984, 1986; Pintrich and DeGroot, 1990), and effort in mathematics problem solving (Betz & Hackett, 1983; Pajares, 1996a; Pajares & Miller, 1994, 1995).

#### The Importance of Classroom and Home Learning Environment Experiences

The importance of studying the contributions of classroom and home learning environments is well indicated by their influence on student learning at school (Wang, et al., 1993). Many studies over the past three decades have documented linkages between a large number of classroom variables and academic achievement (e.g. the quality of teaching, students' perceptions of psycho-social elements of the learning environment, on-task behavior and cognitive engagement rates, emphasis given to the development of higher order thinking skills, cooperative learning in academic tasks,

teacher expectations for students) (Brophy & Good, 1986; Walberg, 1986).

Additionally, the educational quality of the home environment has been recognized as a major factor contributing to students' learning and achievement in school (Marjoribanks, 1986; Walberg & Marjoribanks, 1976), and the home environment is viewed as an important element of models of educational productivity (Walberg, 1980).

### The Classroom Learning Environment

Research documents that classroom environments have a potent influence on how well students achieve desired educational outcomes (Fraser, 1986b). Studies among middle school students have shown supportive relationships with teachers, peers, and an emphasis on student participation in well organized classrooms promote student interest in the subject matter and a sense of academic self-efficacy (Moos, 1987). While these studies indicate that positive relationships exist between the structure of the classroom, supportive educational environments, and academic self-efficacy, studies by Walberg and Marjoribanks (1976) concluded correlational or causal relationships established for one group at one time may not hold for other times, social classes, ethnic groups, or countries.

A number of variables have been identified as having an affect on school and learning. Among those variables identified by Wang et al. (1993) were "student abilities, preferences, and prior achievement; teacher characteristics and classroom behaviors; instructional materials and practices; amount of time devoted to learning; curriculum content; and classroom climate" (p.253). It has also been shown that too much focus in any one of the areas previously mentioned could have problematic consequences. In addition, too much attention to academic tasks and extrinsic rewards

such as grades can diminish student interest in academic subjects and cause a lack of intrinsic motivation to learn and achieve (Moos, 1987).

### The Home Learning Environment

Earlier research studies showed parental interest played a significant role in children's academic achievements (Douglas, 1964; Miller, 1971). Parental interest was found to be closely tied to social class with middle-class parents providing more supervision in their children's school work than parents with lower incomes. It was also explained that students were often streamlined into classes with the expectations of those associated with the upper social classes being greater than those of students associated with the lower classes.

Piaget (1947) offered a similar perspective when he suggested a child's development is environmentally dependent. Children are immersed from birth into a social environment which creates and affects their physical environment. Schema, he suggested, are developed by the absence or presence of certain stimuli. These stimuli are many times social and can change the structure of the individual because they have the ability to modify thought. These stimuli, also, help create a system of values which, when imposed upon the individual, causes a series of responses. It then becomes understandable how those associated with the upper social classes have more exposure and opportunities for success than those in the lower social classes. It can be argued that in various SES classes, whether Black, White, Hispanic, or etc., what is culturally valued can well determine what is modeled and socially praised. More so, environmental variables such as poverty, population density, large family size, poor

health, and inadequate general knowledge have been associated with low social classes (Miller, 1971).

Wang, et al. (1993) identified four categories describing out-of-school influences on learning, among which home environment was included. Family involvement has been documented as improving student performance as well as enhancing attendance, decreasing delinquency, and reducing dropouts and pregnancy rates (Epstein, 1988; Grace, Weinstein, & Walberg, 1983; Moles, 1982; Peterson, 1989).

#### Combining The Home and Classroom Learning Environment Experiences

Marjoribanks (1979, 1986) examined connections between the family [home] learning environment, school characteristics, and student outcomes. He found family social status and teacher attitudes exerted independent influences on student achievement. When psychological continuity can be maintained between the home and the classroom the impact can be very positive and powerful enhancing students' enthusiasm and commitment to learning (Moos, 1987; Marjoribanks, 1979, 1982, 1986). Conversely, when discontinuity exists between the home and the classroom, students underachieve and become at-risk (Laosa, 1984, Lightfoot, 1978). More recently, Marjoribanks (1999), referencing the works of Coleman (1988, 1993) and Darling & Steinberg (1993), suggested that parental human capital, which was defined using distal influences such as social status, and social capital, which was defined using more proximal influences such as the relationship existing between child and parents, contribute to the proximal learning settings of children, and subsequently to measured academic outcomes.

Educators generally agree that “family environment influences the development of children’s cognitive abilities” (Walberg, & Marjoribanks, 1976, p.527). These findings are supported by Bandura (1993) who suggested most human motivation is cognitively generated. From their motivational processes, people form beliefs about what they can do and use forethought to guide their actions or reactions to situations they encounter. Thus, motivation was conceptualized here as partly governed by self-beliefs in capabilities to complete an action or to produce a desired outcome.

#### Human Motivation, Perceptions of Learning, and The Study of Mathematics

Motivation has been long identified as one of the most difficult and obscure theoretical and practical issues for educators and parents (Wall, Schonell, & Olsen, 1962). It can be concluded from the review of literature that the mental habits of children and the mental blocks they develop for certain subjects, especially mathematics and the sciences, can be attributed to encouragements or lack of encouragements they receive in school and home and family situations. In addition to encouragements (or lack thereof) children receive, their beliefs about their perceived abilities can cause dysfunctions when they are grossly miscalculated (Bandura, 1989b). Bandura (1989b) suggested that an individual develops a resilient sense of efficacy when cognitive beliefs and actual performance in specific areas are correctly assessed and reinforced positively. Likewise, it is difficult to bring about positive results when individuals err in their judgments about their abilities and are discouraged or reinforced negatively (Bandura (1989b). *But why develop the study focusing on mathematics?*

Mathematics was chosen for this study because of the national and international concern about low academic achievement in this critical curricular area, especially for

disadvantaged students. Motivational processes associated with mathematics computations have been shown to have a significant influence on student academic achievement (Dweck & Licht, 1980). Research findings have shown that math anxiety and math achievement are inversely and moderately correlated (Betz, 1978). Vocational and educational psychologists have become sensitized to the role mathematics interests and achievements play in shaping students' career futures (Betz, 1992; Meece, Wigfield, & Eccles, 1990). Likewise, few researchers have investigated the relationship between math self-efficacy and learning environments, and none from the perspective of social cognitive theory. Therefore, this study yields information having importance for a) advancing social cognitive theory, b) arranging more optimally functioning learning environments for students, and c) developing new home and classroom learning environment measures.

In a recent article, Lorschach & Jinks (1999) suggested that understanding human efficacy has many implications for conceptualizing and measuring classroom learning environments. However, they proposed no specific measure, nor did they say much about how, and in what ways, classroom learning environments may be more optimally arranged to enhance the development of students' efficacy beliefs. This study, in part, addresses these important conceptual and methodological concerns.

Measures of home environment characteristics which influence children's aspirations have also been developed (Marjoribanks, 1976; 1979). These measures, however, have not focused as strongly on student learning factors as those developed for use in schools. As was previously discussed, no home and classroom learning



environment measures prior to those developed for this study have been developed from the perspective of social cognitive theory as it pertains to the development of academic self-efficacy beliefs. More specifically, no home and classroom learning environment instruments measuring environmental factors, events and conditions reflecting Bandura's (1997) four sources of self-efficacy (identified above) had been previously developed.

An additional issue of theoretical and practical importance which was investigated in this study was the extent to which self-efficacy beliefs are generalized across academic domains or are specific to particular content and performance tasks. Items for the self-efficacy beliefs measures in this study included tasks varying in levels of difficulty and representing more than one mathematics domain (e.g., arithmetic, fractions, and solving equations). The conceptual models established, hereafter, were used to guide the study by establishing the individual and collective variables which had the greatest predictive validity for student academic self-efficacy in mathematics. The models stemmed from the simple equation, previously, presented by Lewin (1936), i.e.  $B = f(P, E)$ , but were more inclusive to reflect Bandura's (1997) conception of triadic reciprocal causation.

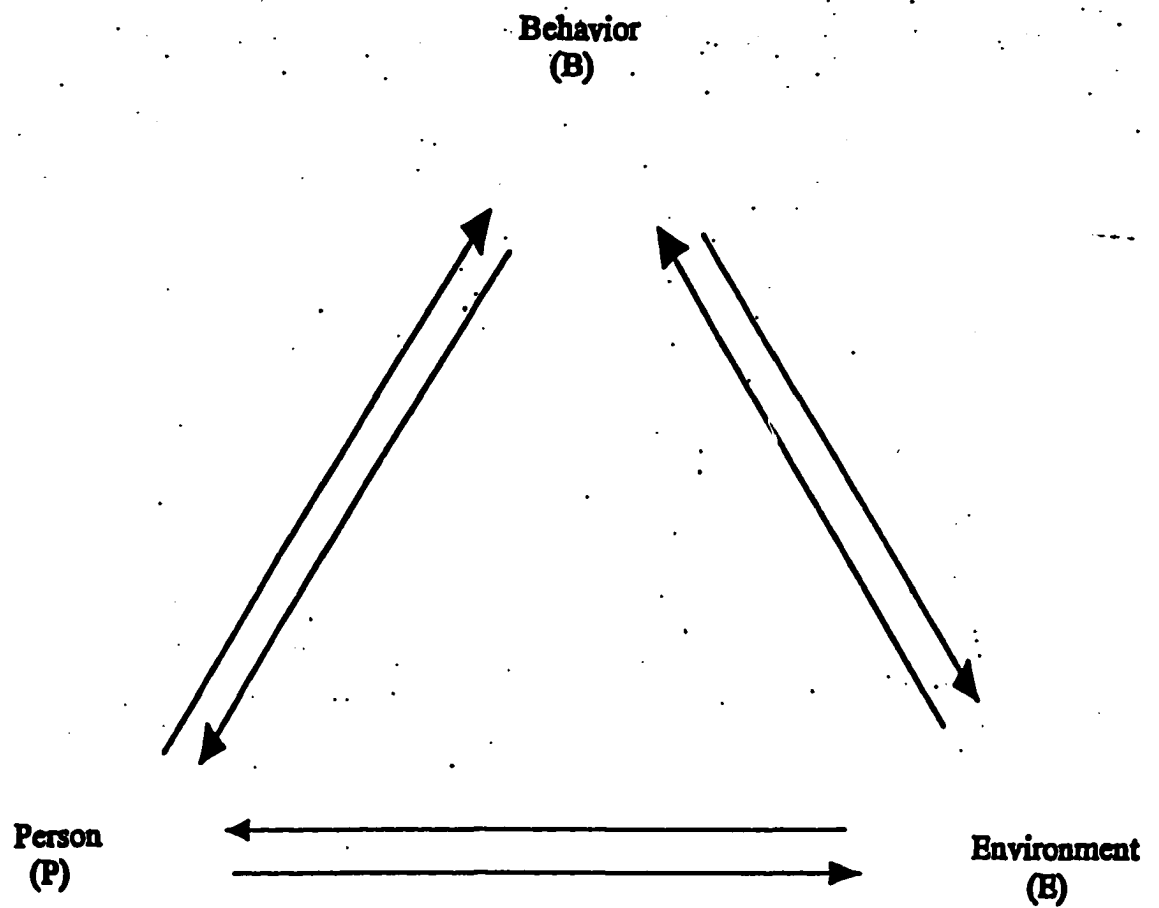
### Traditional Model of Academic Achievement

Academic achievement in schools is a continuing concern in the current era of school reform, improvement and accountability. The predominant accountability perspective seeks to link characteristics of schools and school improvement efforts directly to standardized test scores. While elements of classroom and home learning

environments and student and teacher variables have been linked to student academic achievement (Wang, Haertel, & Walberg, 1993), there has been little focus on *learning as a process*, and less still on personal characteristics of teachers and students that are linked to active learning prior to this study.

Conceptual models linking learning environments, personal characteristics and subsequent behavior have been highly influential in psychology for the past 70-80 years. For example, the Lewin equation explains behavior as a function of the person and the environment the person experiences. A more recent and more dynamic representation of the Lewin equation is expressed in Bandura's triadic reciprocal causation model. The model of triadic reciprocal causation assumes a continuous, non-linear, dynamic interaction between three major classes of variables: a) behavior, b) personal factors (cognitive, affective, and biological events), and c) the external environment.

Figure 1 depicts Bandura's (1997) model of triadic reciprocal causation. In this model causation is taken in context to describe the functional dependence or interaction of three variables; i.e. *P* the internal personal factors which occur in the form of cognitive, affective, and biological events; *E* the external environment; and *B* the expected outcomes which are represented by behavior. Each variable of the model operates bidirectionally to influence the other variables, thus developing a notion of circularity or reciprocity as was defined by Bandura (1997). Bandura further explains that reciprocity does not mean that the three sets of interacting determinants [variables] are of equal strength (Bandura, 1997, p. 6). Each variable can work independently to influence another variable or two variables may work in combination. The relative



**Figure 1: Bandura's (1997) Triadic Reciprocal Causation Model**

influence of each variable will vary for different activities, at different times, and under prevailing circumstances. The model of triadic reciprocal causation serves as a foundation for the models which were developed for the study.

The traditional model linking learning environments to academic achievement (i.e. as measured by standardized test scores) is presented as a schematic diagram in Figure 2. This model suggests that there are direct linkages between elements of home and classroom learning environments and student academic achievement. The model assumes that the linkages between academic achievement and learning environments are mediated by student learning. This model does not account for a large number of potential student characteristics that serve to further mediate linkages between learning environment characteristics and the process of learning, and subsequent academic achievement. Such models fail to include or account for an extensive body of research that supports the importance of student personal variables (e.g., self-efficacy beliefs) as predictors of subsequent behavior (i.e., learning).

The literature on learning environments is relatively quiet as to why certain home and classroom learning environment variables or classes of variables are linked to student learning and achievement. Alternatively, proponents of self-efficacy theory believe much is to be gained from the study of the reciprocal relationships between learning environments and students' academic self-efficacy beliefs (Bandura, 1997; Fraser & Fisher, 1994; Jinks & Morgan, 1996; Lorschach & Jinks, 1999; Schunk, 1981, 1982). Thus, an expanded model of academic learning and achievement that accommodates learning environment research and student academic self-efficacy

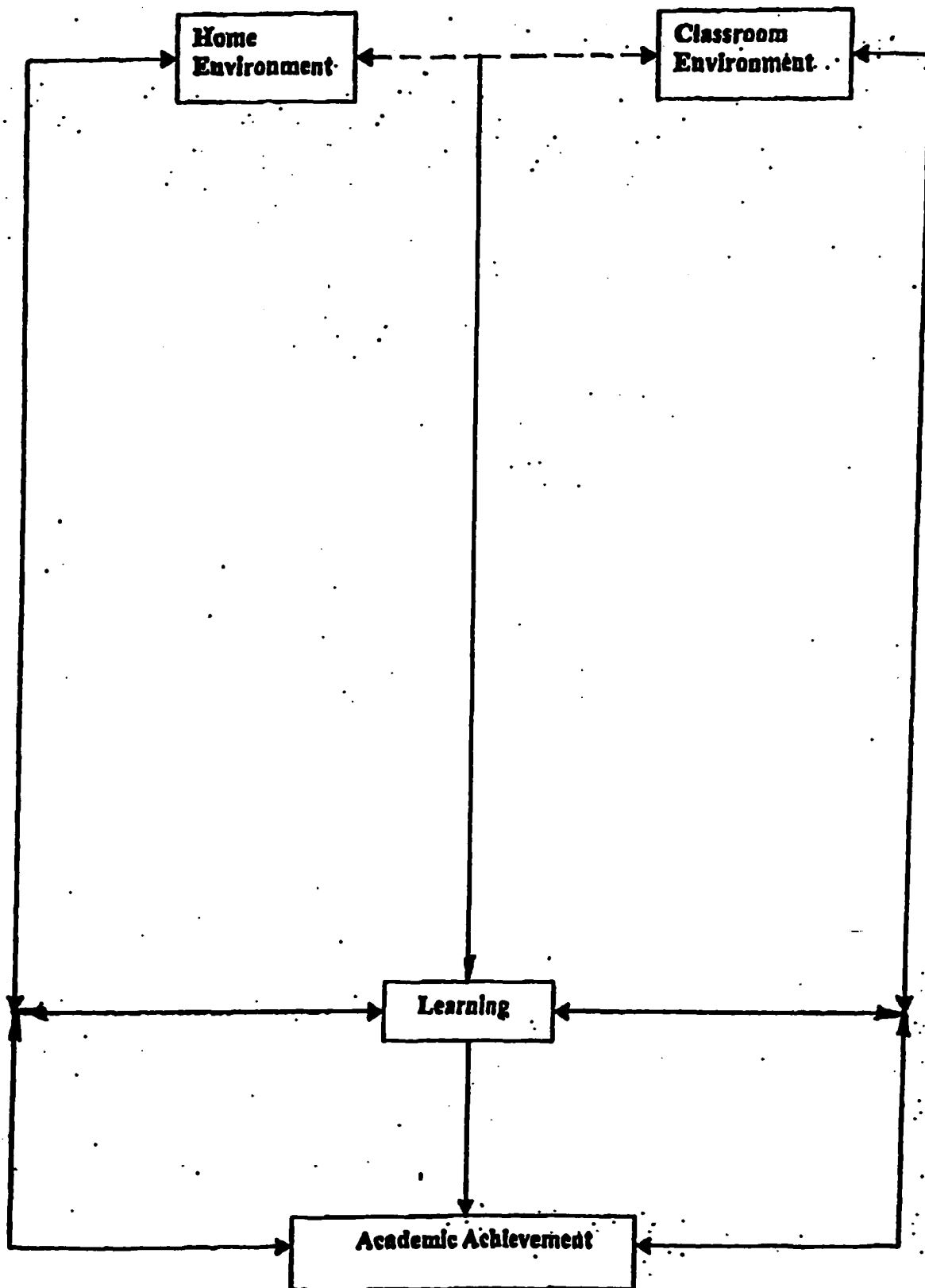


Figure 2: Traditional Model of Academic Achievement

beliefs was proposed as a framework guiding the study. The section that follows describes elements of this model and explains how these elements are linked together in a manner that reflects Bandura's (1997) conception and description of triadic reciprocal causation.

### Expanded Model of Academic Achievement

The expanded model of academic achievement presented in Figure 3 shows relationships that are assumed to exist among home and classroom learning environments, academic self-efficacy beliefs, outcome expectations, motivation and persistence, learning (cognitive/affective/behavioral processes), learning outcomes, and academic achievement. The model suggests reciprocal relationships between these elements.

The home and classroom learning environment elements of interest were the four sources of development of self-efficacy beliefs according to Bandura (1997) (enactive mastery experiences, vicarious learning, verbal persuasion, physiological/emotional arousal). Each of these antecedents of self-efficacy beliefs was considered nested in both the home and the classroom learning environment, and each was explored in the study. Thus, the figure shows that the combined elements of these two environments can be considered a new predictor of the development of self-efficacy beliefs, which in turn are linked to learning processes (cognitive, affective, and behavioral).

Consistent with Bandura's (1997) explanations of other important elements of social/cognitive theory, outcome expectancy is also shown in Figure 3 as an important

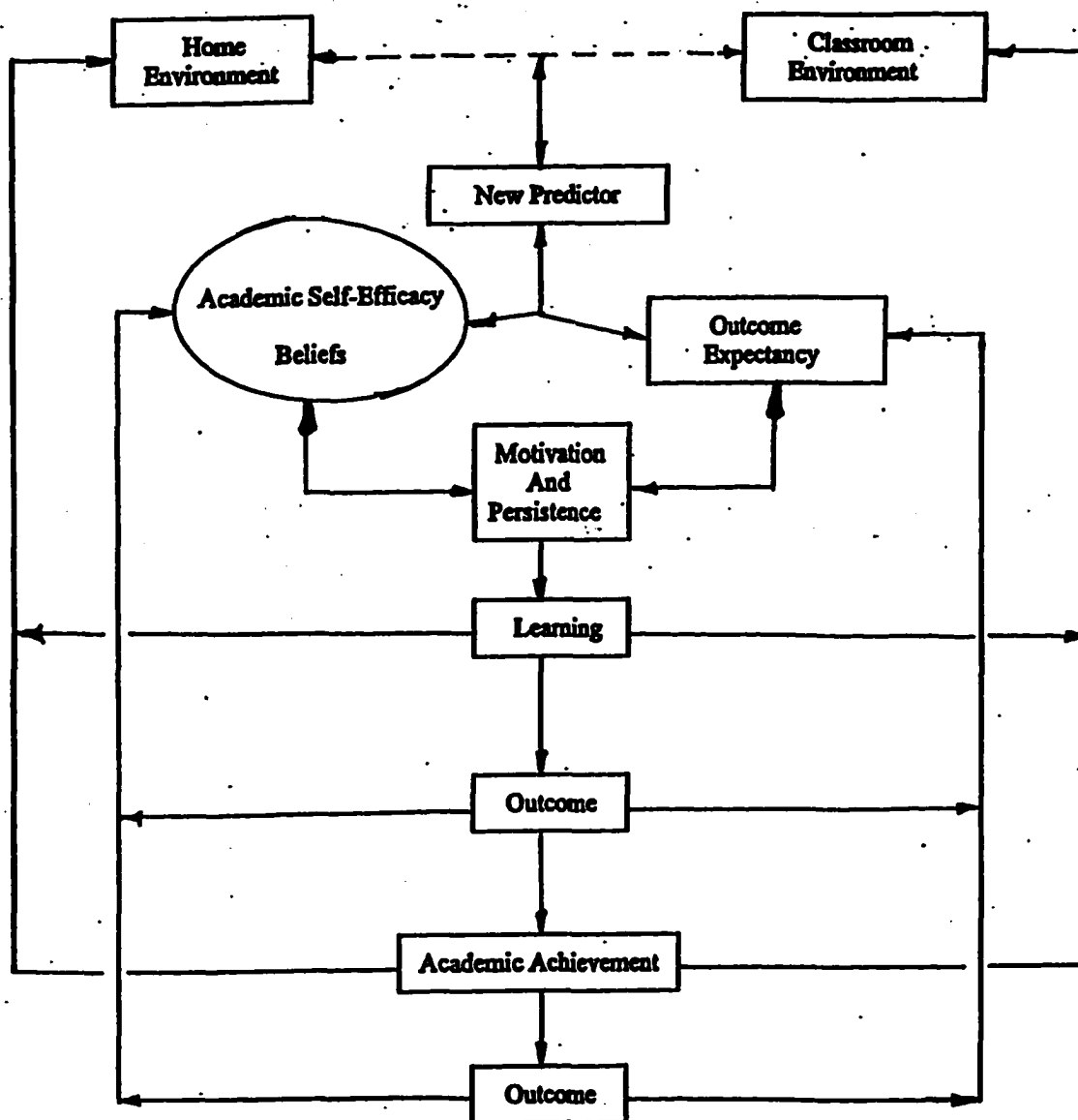


Figure 3: Expanded Model of Academic Achievement

influence on students' levels of motivation and persistence as they attempt academic tasks. Outcomes refer to social, physical and self evaluative consequences of performance attainments. Outcome expectancies are personal perceptions of predicted performance outcomes. Self-efficacy beliefs and outcome expectancies make independent contributions to motivation and persistence in attempting to accomplish academic tasks. Thus, one might have strong beliefs about the capability to perform an academic task, but the actual level of motivation and persistence at the task can be lessened by low outcome expectations. Similarly, moderate strength in the capability to do a task can be greatly enhanced by heightened outcome expectancies. In addition, strengthening either, or both, the home and classroom learning environments in terms of the four sources of efficacy beliefs, and their interactions, should enhance the strength of students' academic self-efficacy levels and their outcome expectancies as well.

The model shown in Figure 3 also suggests that the outcomes of learning processes influence both self-efficacy beliefs as well as outcome expectancies, and subsequent motivation and persistence at academic tasks. Ultimately, academic achievement (as measured by test scores) is influenced by all other elements in the model (home and classroom learning environment factors that develop academic self-efficacy beliefs, the strength of academic self-efficacy beliefs, the strength of outcome expectations, subsequent motivation and persistence at academic tasks, and performance outcomes). The two-headed arrows linking these elements in the model suggest a dynamic, ongoing system of triadic reciprocal causality between the environment, self-efficacy beliefs, academic performance and performance outcomes, in keeping with



Bandura's (1997) conception of human behavior, environment, and the self-efficacy belief system.

### Statement of the Problem

Wang et al. (1993) reported that the 1980s brought a number of educational reforms focused on improving teaching and learning as well as research tools to assess school effectiveness. Some of the programs and practices associated with these reforms have exhibited more promise than others; refer to Comer's School Development Program (Comer, Haynes, & Hamilton-Lee, 1988), Levin's Accelerated Schools Project (Levin, 1988), RJR Nabisco's Next Century Schools (U.S. Congress, 1989), the Saturn School of Tomorrow (Norris & Reigeluth, 1991), Sizer's Coalition of Essential Schools (Sizer, 1992), and Wang's Adaptive Learning Environment Model (Wang & Zollers, 1990). Successful studies have been conducted showing the psychosocial characteristics of the home learning environment have validity in predicting student achievement. Similar studies have been conducted for the classroom learning environment. Research on self-efficacy (Bandura, 1977a, 1982, 1993, 1997; Pajares, 1996b) has shown interactions between individuals and their environment can influence behaviors and personal perceptions that can be used to positively influence academic achievement. No comprehensive research studies prior to this study herewith presented were found to address singularly or in combination the contribution of the classroom and home learning environments to the development of middle school students' academic self-efficacy beliefs. More particularly, not only was this type of information found to be lacking but, no prior studies of this kind were known to have been completed in mathematics.

A review of the literature revealed the motivational processes associated with mathematics computations have significant relevance in student academic achievement (Dweck & Licht, 1980). Other research findings have shown math anxiety and math achievement are inverse and moderately correlated (Betz, 1978). With the present national attention being placed in mathematics and science (refer to the Curriculum and Evaluation Standards for School Mathematics published by the National Council of Teachers of Mathematics (NCTM) in 1989, the Third International Mathematics and Science Study (TIMSS) conducted in 1996, and the Core-Plus Mathematics Project (CPMP) which is currently being tested and is supported by the National Science Foundation), few comprehensive studies were found addressing mathematics from the perspective of self-efficacy theory and learning environment theory. In addition, no prior learning environment measures were found to be specifically developed in mathematics from the perspective of self-efficacy theory.

The research problem to be addressed in this study was multi-dimensional. First, at the empirical level, we didn't know which factors in the home or classroom learning environment contributed, most significantly, to academic self-efficacy. Second, studies had been conducted relating home learning environment and classroom learning environment to academic learning and achievement, but a void in the knowledge base existed understanding the home and school learning environment dimensions and how the dimensions either singularly or in combination, enhanced students academic self-efficacy beliefs. Third, no measures of learning environments had been developed from the perspective of self-efficacy theory. Therefore, the research

in this study was conducted to seek a better understanding of the classroom and home learning environment variables which give rise to middle school students' academic self-efficacy beliefs.

*A lingering problem* identified in the review of literature, one that was explored in the study, is the extent to which self-efficacy beliefs in mathematics are generalized or are content and situationally specific.

#### Purpose of the Study

This study was exploratory and had a five-fold purpose. First, original learning environment measures were developed to tap Bandura's (1997) four sources of students' academic self-efficacy beliefs in the home and classroom learning environments. Second, relationships between home learning environment and classroom learning environment variables and students' academic self-efficacy beliefs in mathematics were investigated. Third, the degree to which various learning environment sources of self-efficacy in the home and classroom are linked were examined. Fourth, empirical evidence was collected to explore the conceptual model used to frame the study. Fifth, the extent to which the self-efficacy concept was generalized or situationally and curricular specific was investigated, concentrating on mathematics as a content area.

#### Significance of the Study

This study had significance from a number of empirical, theoretical, and practical perspectives. It was established from the review of literature that learning contributes to academic achievement. Likewise, it was concluded that learning is influenced by our belief system and self-efficacy is a part of that system. Bandura

(1977a, 1997) identified four sources of self-efficacy which have been previously described: enactive mastery experiences, vicarious experiences, verbal persuasion, and physiological and affective states. Intuitively, it seemed logical that academic achievement was influenced by our academic self-efficacy beliefs and this belief was supported by the reported findings of: a) Bouffard-Bouchard, Parent, and Larivee (1991) who found that students with high self-efficacy engaged in more effective self-regulatory strategies at each level of ability, b) Zimmerman, Bandura, and Martinez-Pons (1992) who demonstrated academic self-efficacy mediated the influence of self-regulated learning on academic achievement, and c) a number of other researchers (e.g. Feather, 1988; Pintrich & Schrauben, 1992; Schunk, 1985) who found self-efficacy is related to self-regulated learning. However, it was not known how the sources of self-efficacy contribute either singularly or in combination to the development of academic self-efficacy beliefs. This study provided insights into this question. As well, academic achievement had been shown to be enhanced by strengthened self-efficacy beliefs (Pajares, 1996b; Bandura, 1997). Therefore, this study provided empirical data to further support linkages between factors contributing to the development of self-efficacy beliefs, which in turn are known to be related to academic achievement, and further expand self-efficacy theory from a multiple learning environment perspective.

Academic achievement has been established as an outcome variable in educational and effective schools research. The Equality of Educational Opportunity Study (EEOS) concluded that independent of a student's background and general social context little or no variance in between-school achievement could be explained by

school effects (Coleman et al., 1966). Later studies have shown that schools do make a difference in academic achievement (Brookover, Bready, Flood, Schweitzer, & Wisenbaker, 1978; Kennedy, Teddlie, & Stringfield, 1991). Research has shown the more effective schools have high student expectations (Brookover, et al., 1978). It has also been shown that teachers in effective schools have higher expectations of their students than teachers in less effective schools (Teddlie, Kirby, & Stringfield, 1989). In the Louisiana School Effectiveness Study II (LSES-II), it was reported that 13% of the variance in student achievement could be predicted from school effects and 11% from teacher effects therefore, a substantial portion of student achievement could be predicted from a combination of the two variables (Teddlie & Stringfield, 1993). Fraser, Butler Kahle, Scantleburg, & Meece (1999) report a large amount of research focuses on the effects of the school/class learning environment on students' academic achievement and references the works of Fraser, 1986a, 1986b, 1994, 1998, and Fraser & Walberg, 1991, but acknowledge only a few studies attempt to determine the joint influences of the class and home.

The cited study was unique in the literature because it investigated the combined influences of home and classroom learning environments on student academic self-efficacy. No such prior studies are known to exist. In addition, the study generated new learning environment measures grounded in social-cognitive and self-efficacy theory that can be used in a variety of future studies. Analyses of the difficulty and domain generality or specificity of various items on the Student Mathematics Self-Efficacy Inventory (SMSEI) measure were also believed to provide support (or lack of support)

for the specificity or generality of academic self-efficacy beliefs across curriculum domains and academic tasks.

The study also had practical implications. Using factors that characterize the home learning environment and the classroom learning environment, the study empirically explored the relationships that can be established among these learning environments to contribute to and/or underpin student academic self-efficacy. The results are translated into practical suggestions for parents, administrators, and teachers in Chapter 5. The reported results will help in arranging more optimally functioning home and classroom learning environments for students to enhance the influence of the four primary sources of efficacy on strengthening students' academic self-efficacy beliefs.

## Study Variables

### Conceptual and Operational Definitions of Study Variables

The following section presents the conceptual and operational definitions of the dependent and independent variables in this study. The conceptual definition will be presented first, followed by the operational definition.

#### Student Academic Self-Efficacy (Dependent Variable)

**Conceptual Definition:** Student academic self-efficacy was conceptually defined as individuals' [students'] beliefs in their capabilities to organize and execute courses of action to produce given attainments [in mathematics](Bandura, 1997). As used here, student academic self-efficacy is a student's beliefs in his/her personal capabilities to learn and master mathematics. This entails students' willingness, persistence,

motivation, and ability in learning tasks in the face of obstacles, hardships, and the lack of positive reinforcements. These beliefs influence how a student feels, thinks, motivates him/herself, and behaves based on selection, interpretation, and integration of information. Likewise, perceived self-efficacy is no longer considered to be *only* task and situationally specific as was previously discussed. The theory and research base has been expanded to include generalized notions over certain capabilities and performance domains.

Operational Definition: Student academic self-efficacy was operationalized by student scores on the subscales of the Student Mathematics Self-Efficacy Inventory (SMSEI) which was specifically developed for use in this study (see Appendix A).

#### Educational Quality of the Home Learning Environment (Independent Variable)

Conceptual Definition: The educational quality of the home learning environment was conceptually defined as the total set of human and technical resources associated with the primary residence of the student that serve to support interactions between the student and others that subsequently influence the development of the student's sense of academic competence and motivation to persist at academic tasks. These resources, which can be identified as a type of *educational capital*, are considered important reflections of Bandura's (1997) theoretical assumptions about primary factors that influence the development of self-efficacy beliefs i.e., enactive mastery experiences, modeling/vicarious learning, verbal/social persuasion, physiological/emotional arousal).

Operational Definition: Characteristics of the home learning environment were operationalized by students' scores on subscales of the Mathematics Self-Efficacy

Learning Environment Inventory - Home Form, MSELEI - HF, specifically developed for use in this study, see Appendix A.

#### Educational Quality of the Classroom Learning Environment (Independent Variable)

Conceptual Definition: The educational quality of the classroom learning environment was conceptually defined as the total set of human and technical resources associated with the school classroom setting that serve to support interactions between the student and others that subsequently influence the student's sense of academic competence and motivation to persist at academic tasks. These resources reflect tenets of Bandura's most recent explication of self-efficacy theory (1997) and represent additional educational capital for each student beyond that present in the home learning environment.

Operational Definition: The classroom environment was operationalized in this study by students' scores on subscales of the Mathematics Self-Efficacy Learning Environment Inventory - Class Form, MSELEI - CF, specifically developed for use in this study, see Appendix A.

#### Research Questions and Rationales

Since this study was an exploratory study, focused on identifying factors characterizing the home and classroom learning environments which contribute most significantly to students' academic self-efficacy beliefs, a series of primary research questions was used to guide the data analyses. These primary research questions were generated to examine relationships among the study variables shown in the conceptual models (Figure 2 and Figure 3). Additionally, a set of supplemental research questions



were used to provide further insights about relationships among the independent and dependent variables and the generalizability and specificity of the self-efficacy construct. The sections which follow include the primary and supplemental research questions which are followed by brief conceptual rationales.

### Primary Research Questions

#### Primary Research Question 1

From the perspective of self-efficacy theory, which home learning environment characteristics are the strongest correlates of students' academic self-efficacy beliefs in mathematics?

From a review of literature, the home was identified as a major contributor to student learning and achievement. The educational quality of the home environment was also identified in large-scale syntheses of the literature as a proximal variable strongly related to student academic achievement (Wang, et al., 1993). In view of the important role the home learning environment plays in the educational life of middle school adolescents and the number of young people who are considered vulnerable or at risk of high-risk behavior and school failure by dropping out, the home is identified as encompassing many proximal variables which are associated with students' daily educational experiences (Walberg, 1979; Wang et al., 1993). These proximal influences have been further operationalized around Bandura's (1997) four primary sources of self-efficacy. Using the data provided in Chapter 4 and Bandura's (1997) self-efficacy theory and model of reciprocal causation, results are presented in Chapter 5 to show that students' perceptions of elements of the home learning environment that contribute to

the development of academic self-efficacy beliefs are empirically linked to the strength of students' academic self-efficacy beliefs.

### Primary Research Question 2

From the perspective of self-efficacy theory, which classroom learning environment characteristics are the strongest correlates of students' academic self-efficacy beliefs in mathematics?

Schools have been identified as complex open systems having great disparities in the quality and effectiveness of education being offered to children in various communities. Whereas, schools are considered more global in the education offered, the classroom environment has been credited with more effectively addressing change in students learning patterns and perceptions of the environment most conducive to individual student learning. The literature clearly shows linkages between the classroom learning environment, learning, and subsequent academic achievement (Fraser, 1986a; Fraser, Walberg, Welch, & Hattie, 1987; Ellett, Hill, Liu, Loup, & Lakshmanan, 1997). Bandura's (1997) explication of self-efficacy theory is grounded in the importance of environmental interactions with others and personal experiences that reflect the primary sources of efficacy. Therefore, as these kinds of experiences occur in classrooms, students' academic self-efficacy beliefs are shown to be strengthened (refer to Chapter 5 for the results).

### Primary Research Question 3

How much of the variation in the strength of students' self-efficacy belief in mathematics can be explained by the combination of home and classroom learning environment sources reflecting self-efficacy theory?

Since the review of literature revealed the home and the school play important roles in students academic learning and achievements, it seemed reasonable that a combination of home and classroom learning environment experiences should make stronger contributions to the strength of students' academic self-efficacy beliefs than either considered separately (refer to Chapter 5 for the results).

#### Primary Research Question 4

How much of the variation in mathematics motivation (effort and persistence) is accounted for by outcome expectancy levels beyond that accounted for by academic self-efficacy beliefs?

According to Bandura (1997), outcome expectations for task performance serve to enhance and/or diminish task persistence and motivation because they represent beliefs about the consequences of task performance. Outcomes are thus differentiated from task performance. There was considerable evidence (Bandura, 1997) that self-efficacy beliefs predict task motivation and persistence. This question was designed to examine the additional contributions the strength of outcome expectations make to levels of motivation and persistence in mathematics. Data are presented in Chapter 4 and conclusions drawn in Chapter 5 to document these contributions and provide a better understanding of the elements in the model framing the study shown previously as Figure 3.

#### Supplemental Research Questions

In addition to the primary research questions, there are a variety of supplemental questions that were explored with the data as a consequence of the primary research

questions. Examples of these follow (results and conclusions are presented in Chapter 5):

- Are there significant differences between the strength of students' academic self efficacy beliefs in mathematics when they are compared by socioeconomic status (SES)?
- What is the contribution of home and classroom learning environment sources of self-efficacy beliefs and SES when considered collectively, to the strength of students' academic self-efficacy beliefs in mathematics?

Research on school climate, school culture, school parental involvement, and learning environments shows that a rather strong, positive relationship exists between SES and academic achievement (Anderson, 1982; Douglas, 1964; Miller, 1971; Morris, 1986; Walberg, 1979; Wang et al., 1993). However, the literature does not include or reflect learning environment measures specifically developed to reflect elements of self-efficacy theory. This study developed these measures and answered the following questions:

- Are there significant differences between male and female students' strengths of academic self-efficacy beliefs in mathematics?
- Are there significant differences between male and female students' perceptions of home and classroom learning environment variables that contribute to the strength of their self-efficacy beliefs in mathematics?

Early studies dealing with the relationship between gender and mathematics skills showed no differences in student performance in the elementary school years. Starting with middle school, males out perform females with much of the difference

being accounted for in confidence (Pintrich & De Groot, 1990). Literature on the relationship between gender and mathematics performance is quite abundant. Fennema & Sherman (1978) reported there was little difference in math performance between males and females in the elementary years but starting with middle school a disparity exists. Likewise, Pajares (1996b) reported that when differences exist, this difference is in a large part mediated by self-efficacy perceptions. Therefore, the above questions were designed to further explore and/or corroborate prior findings using gender and self-efficacy beliefs. Of particular interest were potential interactions between the four sources of efficacy beliefs and student gender (refer to Chapter 5 for the results).

- What are the relationships between elements of the classroom learning environment and the home learning environment that are specified within current self-efficacy theory as primary sources that contribute to the development and strengthening of self-efficacy beliefs?

According to current self-efficacy theory (Bandura, 1997), self-efficacy beliefs are strong elements of human agency that determine behavior through dynamic interactions with functioning environments. Bandura's model of triadic reciprocal causation views the self system as a dynamic mediator of behavior both affecting and effected by environments in which individuals function. There is considerable evidence that both the classroom and home learning environments influence student behavior, learning and subsequent achievement, and such influences may indeed be multiplicative (Wang, Haertel, & Walberg, 1993). There is also considerable evidence that students academic self-efficacy beliefs influence subsequent learning and achievement (Pajares,

1996b). Therefore, it was of interest in this study to examine relationships between elements of the home learning and classroom environments that according to current self-efficacy theory (Bandura, 1997), are the primary sources of the development and strengthening of self-efficacy beliefs.

#### Assumptions and Limitations

There were some major assumptions and limitations in which the study was grounded. The major assumptions were as follows:

- Student perceptions of the learning environment are accurate indicators of actual environmental characteristics and experiences.
- Students will sufficiently complete the study measures to assure reasonable sample sizes and measurement reliability.
- Students will be honest in their responses to the study measures.

Each of these assumptions is addressed in Chapter 5.

Major limitations of the study included the following:

- Data for the study was collected in Jefferson and Orleans parish schools, which will limit the generalizability of the findings to similar schools in large urban districts.
- The time of data collection (late fall 2000 and early spring 2001) may have interfered with the principals and teachers wanting to cooperate in the study, i.e Christmas and New Years holidays, end of period examinations with the students, etc.

Each of these limitations is addressed in Chapter 5.

## Summary

Chapter 1 provided a brief overview of the study. It identified the conceptual framework surrounding the independent and dependent variables and the models which were used to link home learning environment, classroom learning environment, and middle school students' academic self-efficacy beliefs. The research questions were stated and a number of supplemental research questions were posed as well. The information presented in this chapter was used to focus and guide data collection and analyses.

Chapter 2 presents a review of the literature pertinent to the dependent variable, academic self-efficacy, and the independent variables, home and classroom learning environments, that were presented in the conceptual models developed in Chapter 1.

## CHAPTER 2: REVIEW OF RELATED LITERATURE

### Introduction

Chapter 2 is a review of the literature pertinent to academic self-efficacy and learning environments that framed the conceptual model of the study presented in Chapter 1. The study was grounded in the following research based literature: 1) social cognitive theory; 2) academic self-efficacy; 3) the classroom learning environment; 4) the home learning environment; and 5) the middle school. Included in this chapter are (1) a discussion of social cognitive theory and the interactions of individuals, their environments, and their resulting behaviors, (2) a review of self-efficacy theory and research, (3) a review of learning environment theory and research, and (4) an overview of middle school education with special emphases on mathematics using the general theoretical perspectives found in social cognitive theory.

### Social Cognitive Theory, Self-Concept and Self-Efficacy

The Lewin equation, presented in Chapter 1, was based upon phenomenological theory which is a study of the development of human consciousness and self-awareness from the individual's or actor's own frame of reference. The response of the individual to the environment is observed and the resulting data are used to characterize the interaction. The Lewin equation, which can be considered unidirectional, posits behavior as a function of the interaction of the person and the environment the person experiences.

The models which were presented in Chapter 1 and serve as the basis for the study utilize much broader conceptualizations of the Lewin equation. These models entail more dynamic representations of the Lewin equation which are expressed in



Bandura's triadic reciprocal causation model. Triadic reciprocal causation is useful in explaining behavior as a function of both the person and the environment (Bandura, 1977a, 1997). Unlike the unidirectional notion of behavior (b) being a function of the person (p) and the environment (e), addressed by the Lewin equation, this conceptualization involves a bidirectional interaction of the three entities expressed in what Bandura (1997) has termed the triadic reciprocal causation model (triadic model).

The triadic model can be used to illustrate and explain the bidirectionality and reciprocity existing between the three interacting entities previously mentioned. The influence of each entity will vary with different circumstances and conditions. According to Bandura (1977b, 1978, 1986), human functioning comprises a series of reciprocal interactions between behavioral, environmental, and personal variables, i.e. cognitions and affective states. Bandura's conceptualization, which has been termed self-efficacy theory, is a subset of social cognitive theory. As such, self-efficacy is identified as a personal variable which influences learning and task performance.

Social cognitive theory (Bandura, 1977a, 1977b, 1986), which highlights the human capacity for self-regulation, focuses on the process which undergirds the personal and contextual variables which affect behavior. In social cognitive theory a person is identified as an agent (the performer of an action), as well as an object (that which is acted upon) (Bandura, 1997). Therefore, social cognitive theory can be used to describe the ongoing interactions of an individual, the environment, and the behaviors that are referred to in the triadic reciprocal causation model (Bandura, 1997).

Social cognitive theory can be used to explain those self regulatory functions which are associated with human behavior. Self-efficacy, one of the most visible aspects

of social cognitive theory, was used to explain how personal beliefs develop (Bandura (1977a, 1982, 1986, 1997). Bandura (1977a, 1997) concluded that one's sense of self efficacy will determine how long one will proceed on a chosen path until an alternative is considered. He explained how people avoid activities which are believed to exceed their coping capabilities and become involved in activities they judge themselves capable of handling. Because not all facets of self-conceptions are related to one's personal efficacy some confusion exists in the literature (Bandura, 1997). It is this line of reasoning and confusion which causes an overlap of self-efficacy and the other self constructs such as causal attribution, helplessness, self-esteem, self-worth, etc.

Lefcourt (1991) discussed locus of control and explained how it alters the internal states of certain individuals causing them to proceed along prescribed paths when faced with obstacles while others succumb to external stimuli. In other words, locus of control refers to an internal state that explains why people act or fail to act in a given situation. Rotter (1966) discussed how different people will perceive rewards associated with a success differently based on their beliefs of who is in control. He explained how people tend to internalize success and externalize failure. Their behavior then becomes a function of the causal relationships they establish.

Self-esteem and self-worth are popular and important constructs in the social sciences. Many times these constructs are used interchangeably in the literature and reflect an attitude toward self based on an elaborate set of beliefs about oneself, i.e. the extent to which one prizes, values, or approves of oneself (Blascovich & Tomaka, 1991). Each belief, associates or disassociates self with desirable or undesirable attributes and at any given moment the degree of importance will vary.

In his latest book, Bandura (1997) makes a clear distinction between the self-concepts, locus of control, and self-efficacy. Referring to Bandura's (1997) four basic sources of self-efficacy (previously defined): enactive mastery experiences, vicarious experiences, verbal persuasion, and physiological and affective states; how these four basic sources of self-efficacy are impacted by the home and classroom learning environments can contribute more explanatory power to how and why children learn. These four sources of self-efficacy will be used in the models previously described in Chapter 1 and further elaborated upon below.

Bandura (1982, 1993, 1997) uses the theory of self-efficacy to convey a complex process of self-persuasion which establishes the interrelationship existing between knowledge acquisition and the execution of an individual's response patterns to environmental stimuli, i.e. one's personal beliefs. These beliefs are the product of the four sources of efficacy (enactive mastery experiences, vicarious experiences, verbal persuasion, physiological/affective states). Bandura explains how high self-percepts of efficacy may affect the effort which is expended to realize a desired potential. When a person is confident in certain actions, has experienced previous successes with the prescribed actions, and feels certain the path chosen will continue to lead to success, the sense of efficacy for the action is increased. Difficulties and/or some self-doubt will cause a person with strong efficacious percepts to expend additional effort to achieve a desired goal (Bandura, 1982, 1993, 1997; Bandura & Schunk, 1981; Schunk, 1981). Thus, high precepts of self-efficacy can lead to successful actions and successful actions can reinforce the precepts of self-efficacy toward that action. Conversely, individuals

will avoid activities they feel will exceed their coping capabilities. Self-efficacy, then, can contribute significantly to the level and quality of human behavior and when perceived efficacy is factored out, the self-concept loses most of its predictiveness (Bandura, 1997). Hence the choice of self-efficacy as one of the variables for the study.

Adhering to the interactions specified in the triadic model, individuals must assess and reflect on their abilities, interface with their environment, and modify their behaviors and courses of action based on their perceptions of performance outcomes. Bandura's (1997) triadic reciprocal causation model served as a foundation for the models presented in Chapter 1. These same models were used to guide this study which sought to explore the most significant home and classroom learning environment characteristics contributing to the academic self-efficacy beliefs of an individual learners.

#### Student Academic Self-Efficacy

Evidence of discontent with theories of motivation based upon primary drives has existed in the literature in areas as diverse as animal psychology and psychoanalytic ego psychology (White, 1959) for decades. This discontent has lead to studies which have shown that primary drives in animal psychology are inadequate in explaining human behavior. Likewise, it has been reported that basic instincts have serious shortcomings in accountings of effective egos (White, 1959). These inadequacies and shortcomings have been the impetus for new conceptualizations which better define the interactions of animals or individuals and their environments. These conceptualizations can be traced to the early psychological works of Heider (1958) and White (1959), but the theoretical framework for academic self-efficacy as proposed in this study was based on the research

of Albert Bandura. “This theory states that psychological procedures, whatever their form, alter the level and strength of self-efficacy” (Bandura, 1977a, p.191). Accordingly, Bandura (1982) reports, “Self-percepts of efficacy are not simple inert estimates of future action. Self-appraisals of operative capabilities function as one set of proximal determinants of how people behave, their thought patterns, and the emotional reactions they experience in taxing situations” (pp. 122-123).

Self-efficacy as discussed by Bandura (1982) is concerned with how well one can follow through on a chosen path facing impending obstacles. There is a growing convergence of theory and research on the influential role of self-referent thought in psychological functioning (DeCharms, 1968; Garber & Seligman, 1980; Lefcourt, 1982; Perlmutter & Monty, 1979; Rotter, Chance, & Phares, 1972; White, 1959). From the research it can be concluded one’s sense of self efficacy will determine how long one will proceed on a chosen path until an alternative is considered. Bandura (1977a) explained how people avoid activities believed to exceed their coping capabilities and become involved in activities they judge themselves capable of handling. Bandura (1982) explained how high self-percepts of efficacy may affect the effort expended to realize a desired potential and noted how some self-doubt will cause a person with strong efficacious percepts to expend additional effort to attain a desired goal.

Within the larger context of social cognitive theory, Bandura (1997) discussed the important role that human self-efficacy plays in determining human behavior in a wide variety of settings and situations. According to Bandura (1997),

perceived self-efficacy refers to beliefs in one’s capabilities to organize and execute courses of action to produce given attainments...*[and self-efficacy*

***beliefs***...influence the courses of action people choose to pursue, how much effort they put forth in given endeavors, how long they will persist in the face of obstacles and failure, their resilience to adversity, whether their thought patterns are self-hindering or self-aiding, how much stress and depression they experience in coping with taxing environmental demands, and the level of accomplishments they realize (p. 3).

Thus, self-efficacy beliefs within social cognitive theory can be considered a primary factor in determining a wide variety of human perceptions, cognitions, and attendant behaviors.

The review of literature revealed a large number of personal constructs that mediate motivation, persistence, outcome expectations, and subsequently behaviors. These linkages also support the notion that academic achievement is a direct function of learning and learning is impacted by our beliefs (Fraser, 1986b). The research base to support the important role that self-efficacy plays in predicting and explaining human behavior, and in social cognitive theory, has been well documented by Bandura (1977a, 1982, 1997) and is summarized in the triadic reciprocal causation model (Bandura, 1997) discussed in the prior section. Additionally, Pajares (1996b) has summarized extensive literature documenting the importance of students' academic self-efficacy to subsequent learning and achievement in school. By way of summary, Pajares (1996b) makes the following points about academic self-efficacy beliefs, student learning and the extant literature:

- knowledge, skill and prior attainments are often poor predictors of subsequent attainments because of beliefs that individuals hold about their abilities and the outcomes of their efforts powerfully influence the ways in which they behave.

- mathematics self-efficacy of college undergraduates is more predictive of their interest and choice of math-related courses and majors than either their prior math achievement or math outcome expectations.
- self-efficacy beliefs are correlated with other self-efficacy beliefs, motivation constructs, and academic choices, changes, and achievement.
- regardless of ability, children with high self-efficacy complete more problems correctly and rework more of the ones they missed than children with low self-efficacy.
- modeling treatments increase persistence and accuracy on division problems by raising children's self-efficacy which has a direct effect on skill attainment.
- self-efficacy is a powerful motivation construct that works well to predict academic self beliefs and performances at varying levels.
- general measures of self-efficacy insensitive to context are weak predictors of academic performances.

Previously, cognitive learning theory supported the notion that knowledge is constructed by the learner. Research shows there is great variety in learning styles, attention spans, and development paces in the classroom which might lead us to believe that teaching is indeed an art and not a science (Gage, 1978; James, 1958). Biggs (1989) and Marton & Saljo (1984) used the term *deep approach* to characterized students seeking meaning and understanding from their studies. This constructivist based approach emphasizes learners who actively construct knowledge for themselves by

elaborating and transforming the information they are presented. Dart (1997) used the term *surface approach* to characterize another type of student who uses memorization and routine procedures to learn, a more passive approach toward learning. Each of these approaches describe characteristics of the student, but each can be a direct result of the type of instruction which is provided.

The clarity of instruction and the use of cues, feedback, and correctives (Wang, Haertal, & Walberg, 1993) are important instructional variables which can be used to influence learning. Therefore, the dual role that suggests learners must be receivers of information, and then responders in the learning process, is rejected by the dualistic view of self developed in social cognitive theory. As currently conceptualized, self-efficacy beliefs serve to mediate linkages between environmental events and behavior, and as such, are influenced by environmental events and behavior in a dynamic process (Bandura, 1997).

#### Self-Efficacy and the Home Learning Environment

Several investigations have shown the child's home learning environment significantly affects cognitive performance (Walberg and Marjoribanks, 1973). Garasky (1995) reported the educational attainment of children is viewed as a function of household production and parental involvement (Becker, 1975, 1981; Bryant, 1990; Parish & Willis, 1993). This attainment will vary by the type of family structure experienced and the age of the child when the experience occurred.

Song (as cited in Song and Hattie, 1984) divided the home environment into three major components: family structure, social status, and family psychological



characteristics. Family structure involved the number of children present in a home and their birth order. Family social status included the amount of education the parents achieved, their occupations, and their ability to afford additional education. Family psychological characteristics encompassed the encouragements and expectations that were expressed in the home. Family psychological characteristics, also, included educational activities and interests within the home and associated rewards and punishments.

In order to develop a sense of personal efficacy an individual must recognize that s/he is the agent of the action (Bandura, 1997). Starting with infancy, individuals begin to realize they can make things happen. From a baby's first cries, to play activities which fill an infant's day, through reflective thought and mastery experiences that build personal efficacy, initial opportunities and experiences for the refinement of basic actions can occur within the home environment. Thus, the home environment is considered a major influence on the development of self-efficacy beliefs and the self evaluation of personal capabilities.

#### Self-Efficacy and the Classroom Learning Environment

Good, Sikes, & Brophy (1973) noted that high achieving students received more favorable contact with teachers than do low achieving students. Similar results were obtained in studies by Brophy & Good, 1970; Good, 1970; and Horn, 1974. Student differences accounted for most of the variance found in teacher contact patterns with different levels of students.

Perceptions of the classroom learning environment are directly related to self concepts of efficacy. Galluzzi, Kirby, & Zucker, (1980) found that more children with

low self concepts, perceived their environments differently from their teacher's perceptions of the same classroom and from children with high self concepts. These findings supported Moos' (1974a) speculations described in the same article, that individuals under *high need* tend to respond to environmental measures in ways congruent with their specific needs structures.

#### Summary of Student Academic Self-Efficacy Theory

The function of any theory is to explain, to guide research, to generate new knowledge, and to guide practice (Hoy & Miskel, 1996). Self-efficacy theory plays this most important role as a subset of social cognitive theory as it provides a body of knowledge associated with individuals' belief systems. While social cognitive theory was previously described as the ongoing interactions of an individual, the environment, and the behaviors associated with an individual, Bandura (1986) supports the view that people's beliefs can influence their actions, yet their actions become dependent upon repeated successes and failures.

The personal belief system an individual develops allows for some measure of control over thoughts, actions, and feelings. This belief system is socially constructed as the individual interacts with the environment. Knowledge, skill, and prior attainments become predictors of future or subsequent attainments because the beliefs an individual holds or develops will influence their behavior and actions. Self-referent thought, then, mediates knowledge and actions, and through self-reflection an individual evaluates personal experiences and thought processes to define a suitable course of action they are willing to pursue (Bandura, 1977a, 1986, 1997, Pajares, 1996b).

## Learning Environments

Anderson & Walberg (1974) reported that the study of environments was an area of strong interest in social science research. Bloom (1964) had previously recommended the development of environmental measures to define variables that could be used to predict and manipulate learning. Fraser, Butler Kahle, Scantlebury & Meece (1999) utilizing data collected for a study, *Bridging the Gap: Equity in Systemic Reform*, in science and mathematics in Ohio, investigated the importance of the classroom, home, and peer learning environments on student outcomes. The instrument which was used to gather the data was described in Scantlebury, Boone, Damnjanovic, & Butler Kahle (1995). The results of the study showed the three learning environments (classroom, home, and peer) accounted for statistically significant amounts of variance in student attitude scores.

Since the early 1960s, a series of studies have demonstrated the use of reliable measures to predict student perceptions of their classroom learning environments. Some of the more popular instruments used and the results reported are referenced below. Likewise, the home as a learning environment is viewed as an important element of models of educational productivity (Walberg, 1980). While parental interest has been shown to be tied to social class, middle-class parents have been demonstrated to provide more supervision in their children's school work than lower working-class parents (Marjoribanks, 1986; Walberg & Marjoribanks, 1976).

Each of these learning environments will be discussed in the following sections. Their impact on student enthusiasm and commitment to learning has been demonstrated

as both positive and powerful when psychological continuity can be maintained (Moos, 1987; Marjoribanks, 1979, 1982, 1986). The classroom learning environment will be addressed first because of the potent influence the nature of the classroom has on student achievement and educational outcomes.

### The Classroom Learning Environment

The classroom learning environment, which is identified as one of the independent variables of the study, is subsumed under the larger theory of the school environment. While traditional school evaluations have been based on the larger theory, Fraser (1986b) reported that various writers have found it useful to distinguish classroom or classroom-level environment that involve more proximal measures of teacher-student and student-student interactions from school or school-level environment that involve psycho social aspects of the whole school (Anderson, 1982; Fraser & Rentoul, 1982; Genn, 1984).

Early classroom studies involved the systematic observation and coding of nonverbal clues (Dunkin & Biddle, 1974; Peterson & Walberg, 1979) or techniques involving naturalistic inquiry and case studies (Stake & Easley, 1978). Later studies, some of which resulted from the findings and instruments created for Harvard Project Physics, have focused on student and teacher perceptions of the classroom environment and, hence, form the basis for this study. This approach has an advantage over the early studies utilizing trained observers, because it characterizes the learning environment through the eyes of the actual participants, thereby capturing data a trained observer might miss (Fraser, 1986a, 1986b).

Anderson and Walberg (1968) adapted a conceptual framework developed by Getzels & Thelen to analyze and study student perceptions of the character and climate of classrooms and to develop a new high school physics course. The evaluation of the project, Harvard Project Physics, showed the importance of assessing and understanding learning environment characteristics (Walberg & Anderson. 1968a, 1968b, Welch & Walberg, 1972). The research findings associated with Harvard Project Physics are supported by other research findings on learning environments which show the psycho social characteristics of classroom learning environments demonstrate incremental validity in predicting student achievement (Fraser, 1986a; Fraser, Walberg, Welch, & Hattie, 1987 as cited in Ellett, Hill, Liu, Loup, and Lakshmanan, 1997).

Although a plethora of studies has been conducted at the classroom and school learning environment levels in the USA and in foreign countries as well (McRobbie & Ellett, 1997), these studies typically link student and teacher perceptions measured with school related variables such as achievement. A growing body of knowledge is concerned with theory development, measurement, and unit of analysis aimed at demonstrating how students and teachers mediate linkages between learning environments, personal perceptions, personal intentions, and subsequent behavior (Bandura, 1982, 1997; Ellett, Hill, Liu, Loup, & Lakshmanan, 1997; Lakshmanan, Ellett, Hill, Loup, & Liu, 1997; Resnick, 1981; Schunk, 1981, 1982, 1984).

A large number of personal constructs have been noted to mediate perceptions, intentions and subsequent behavior (Causal Attributions (Weiner, Heckhausen, Meyer, & Cook, 1972), Helplessness (Seligman, 1975), Personal Causation (DeCharms, 1976),

Perceptions of Control (Langer, 1983), Personal Competence (Harter & Connell, 1984), and Self-Esteem and Self-Worth, Crocker & Majors, 1989). Among the most recent conceptualizations is that of self-efficacy previously mentioned (Bandura 1977a, 1982, 1993, 1997). Also associated with these personal constructs are a number of factors which influence behavior. Fraser (1982) identified five classroom learning environmental factors which have been assessed with having made significant contributions to student learning and academic achievement. A short description of each factor is provided:

- personalization, involves relationships. It can be used to measure the impact of student interactions with the teacher [or parent], and the teachers' [parents'] concern for the student's personal welfare and social growth. Strong relationships in this area can create an environment conducive to learning;
- participation, involves relationships. It can be used to measure the impact of the extent to which students are encouraged to participate rather than be passive listeners. Active participation can result in enhanced learning;
- investigation, concerns personal development. It can be used to measure the emphasis on skills and processes of inquiry and their impact on problem solving and investigation;
- differentiation, focuses on system maintenance. It can be used to measure the impact of selective treatment of students on the basis of ability, learning style, interest, and rate of working;
- personal development, concerns independence. It can be used to measure the impact of students being allowed to make decisions and have control over their

own learning and behavior. Successfully motivating students in this area can lead to student persistence in the pursuit of their goals.

While these factors represent the works of one researcher, Fraser (1982), each identifies a type of environmental experience which can result in cognitive and behavioral consequences for individuals (or groups). Using Bandura's four sources of self-efficacy to evaluate the students' perspectives of the classroom learning environment, with some consideration being given to the previous findings associated with the five factors presented above and academic achievement, an instrument was developed to examine the strength and generality of students' academic self-efficacy beliefs about mathematics.

A variety of measures have been developed and used in prior research studies to assess student perceptions of the classroom environment. Among these are the Learning Environment Inventory (LEI) (Anderson & Walberg, 1968; Anderson & Walberg, 1974; Fraser, Anderson, & Walberg, 1982), the Classroom Environment Scale (CES) (Moos & Trickett, 1974; Moos & Trickett, 1987; Trickett & Moos, 1973), the Individualized Classroom Environment Questionnaire (ICEQ) (Fraser, 1990; Rentoul & Fraser, 1979), the My Class Inventory (MCI) (Fisher & Fraser, 1981; Fraser, et al., 1982; Fraser & O'Brian, 1985), the Constructivist Learning Environment Survey (CLES) (Taylor & Fraser, 1991), the College and University Classroom Environment Inventory (CUCEI) (Fraser & Treagust, 1986; Fraser, Treagust, Williamson, & Tobin, 1987), the Instructional Learning Environment Questionnaire (ILEQ) (Knight & Waxman, 1989; 1990), and the Classroom Learning Environment Survey (CLES) (Taylor, Dawson, & Fraser, 1995).

These measure are typically group administered to students in intact classrooms and traditionally have been used to measure student perceptions of the psycho-social characteristics of the learning environment from a group perspective (e.g., Students find the work in this class difficult to do). Recent trends in the development of classroom learning environment measures include the development of personal (constructivist-based) forms (i.e., I find the work in this class difficult to do) and both actual and preferred learning environment scales (Taylor & Fraser, 1991; Taylor, Dawson, & Fraser, 1995). There has also recently been a call for the development of classroom learning environment measures from a self-efficacy theory perspective (Lorsbach & Jinks, 1999). However, prior to the work associated with this study, no such measures had been developed.

Research on the classroom as a learning environment typically involves the use of student and teacher perceptual measures similar to the ones aforementioned, direct observations, or techniques involving more naturalistic forms of inquiry such as ethnography and case studies to collect, characterize, and assess data. The data provide some indications of relationships between students and students and students and teachers, the organizational properties of the class, class activities, and the physical environment (Bhushan, 1986). Bloom (1976) concluded that most students are similar in learning abilities, rate of learning, and motivation for further learning when they are engaged in favorable learning environments. Conversely, when students are involved in an unfavorable environment, these traits become dissimilar.

Bhushan (1986) asserts the teacher is a key figure in the types of relationships which prevail in a classroom. The relationships which are established and the attitudes



which exist are a direct function of the teachers' life experiences. The classroom learning environment becomes dependent upon the teacher's ability to transform or change deeply established patterns of interaction that become limited by explicit rules and regulations which are set to govern the collective life of the school as an organization.

Bhushan (1986) reported the findings of a three year study conducted from 1979 to 1981. The LEI mentioned above was administered to 4,431 students in their respective classes. The instrument contained 15 scales. At the same time the LEI was being administered to the students, 153 teachers of the students were administered The Minnesota Teacher Attitude Inventory (MTAI) developed by Cook, Leeds, and Callis (1951). The MTAI was composed of 150 items and provided an indication of teachers' attitudes toward their students. Four factors, *Rigidity and Severity in Applying School Rules, Conflict between Teachers' and Pupils' Interest, Pupils' Independence in Learning Activities, and Students' Irresponsible Tendencies and Lack of Self-Discipline*, on the MTAI were found to explain 21.4% of the total variance in MTAI scores. These four factors were used as the independent variables in a multivariate multiple regression analysis with the scale means of the 15 LEI scales. The study established some statistically significant and educationally interesting associations between teachers' attitudes and the nature of the learning environments of the teachers' classrooms. Some of the reported findings were:

1. More formally structured classes can increase learning in certain subject areas if the teacher believes in strict classroom rules.

2. Learning in certain subject areas may be slowed when the teacher has a disrespect for students' natural behavior and thinking, a desire to subordinate pupil interest, and authoritarian teacher expectations. Students in this type of environment feel the teacher is moving at a fast pace, is disorganized, and lacks direction.
3. Learning is increased in classes where teachers' belief in greater pupil freedom and self-direction is facilitated by teacher involvement. This type of environment decreases friction and apathy in the class.

According to Fraser (1986b),

*classroom climate might involve relationships between the teacher and his/her students or among students, school climate might involve relationships between teachers and their teaching colleagues, head of department, and school principal. Similarly, while classroom environment is usually measured in terms of either student or teacher perceptions, school environment is usually (but not exclusively) assessed in terms of teacher perceptions (p. 3).*

Therefore, research which is conducted on one environment may not have applicability for understanding the other environment.

Ellett (1986) provided the following summary statements to reflect some of the more evident findings of classroom learning environment studies over the three preceding decades:

1. Measures of learning environment characteristics account for significant amounts of learning variance beyond that accounted for by pretest achievement, ability indices, and social class.

2. Learning environment perceptions have been found to differentiate between a variety of subject matter areas, grade levels, and classroom groups.
3. Learning environment measures have been found to interact with variables such as task structure, grouping practices, feedback and evaluation procedures, focus of responsibility for learning, and attitude changes toward various curricula.
4. Learning environment measures have been useful in developing various classroom typologies.
5. Learning environment measures have differentiated classrooms reflective of various occupational choices.
6. Learning environment measures have demonstrated the ability to differentiate between school-level climate characteristics.
7. Learning environment measures have been used successfully as **mediating** criteria in studies of relationships between educational inputs and outputs (e.g., student achievement).
8. Characteristics of classroom climate and educational learning environments can be measured with a relatively high degree of validity and reliability.
9. Learning environment measures have demonstrated the ability to differentiate class characteristics (particularly in science classes) when cognitive measures show little sensitivity. (p. 36)

Thus, studies of learning environment characteristics have been widely cited in the extant literature and have been used rather extensively to describe classroom characteristics, compare classrooms and students from a variety of theoretical perspectives, and in curriculum and program evaluation research that links students' learning environment perceptions to subsequent learning and achievement.

### The Home Learning Environment

An increasing number of parents realize their children are not learning in school. Many have blamed the school and teachers. Others have accepted the fact that what a student learns in school is not totally dependent upon the school or teachers and that they bear some of the responsibility associated with student performance. The early years in a child's life have always been considered by those concerned with human development to be a critical time for intellectual development and for establishing a foundation for school learning and achievement. These are the years when change is more easily accomplished. Hence, educators find themselves working against overwhelming odds given that much of a student's potential for development has occurred before the student attends school. Therefore, the home, the institution which began to shape the student's life and define the processes of socialization and acculturation, is viewed as critically important (Lightfoot, 1978).

Previous studies have focused on the effects the home and family environment have on learning and achievement. Other studies have concentrated on learning environments and how they are affected by parental involvement, birth order, SES and the like. Additionally, studies have been conducted on self-efficacy and the belief

structures which are associated with individuals establishing their quality of life, using self-efficacy as an independent variable. These studies have identified positive associations between adolescent behavior and the family/home environment. Moos & Moos (1986) suggested adolescent development is promoted in families that encourage independence and provide modeling to build social skills and it is hampered in families that emphasize achievement in the context of conflict and restrictive rules. In later studies, Moos (1991) concluded children of well educated parents are more likely to learn in the home and have classroom behaviors reinforced through modeling, praise and parent-child interactions. These types of interactions follow the self-efficacy premises established by Bandura (1977a, 1997).

The National Center For Education Statistics, commissioned a study which was named The Coleman Report (Coleman, et al., 1966). This report is frequently cited in school effects literature. The results revealed the home learning environment contributes more to a student's academic achievement than other school characteristics or school findings. Studies which address the home environment and family lives of students reveal SES is a predictor of students' academic achievement. Likewise, other studies which were conducted in the 1980s show student achievement is affected by the attitudes and characteristics the students bring into the classroom, but no single factor provides the ultimate explanation of how children learn.

Numerous studies were found relating the various facets of home environment to achievement: low correlations have been reported between family structure and achievement (Marjoribanks, 1976, 1978); higher correlations ( $r = .20$  to  $.40$ ) were

reported between social status and achievement (Knief & Stroud, 1959; White, 1982); with much higher relations reported between family psychological characteristics and achievement (Bloom, 1964). The literature review revealed SES and psychological characteristics have larger correlations with academic achievement than other facets of home environment such as family structure, which entail birth order, number of children in the family, spacing of siblings, etc. These findings were supported by Song and Hattie (1984) who reported the amount of variance in achievement which is explained between social status and psychological characteristics as approximately 50 percent.

Marjoribanks (1979, 1986), also, studied the connections between families and schools and reported family status and teacher attitudes exerted independent influences on achievement. These findings were supported by Laosa (1982) whose studies revealed children who encounter and master teaching and learning processes in the home which are similar to those experienced in the classroom are more adaptive in the classroom and have an educational advantage over children with dissimilar experiences. It was explained that when a discontinuity exists between the home and the classroom, the student and teacher will spend a great proportion of their time trying to figure out each others' behaviors. Disharmony in what is being taught in the home and classroom can lead to failure or diminished achievements, even dropping out (Laosa, 1984; Lightfoot, 1978). This condition was expressed more prevalently in low SES families.

In using case study methodology, Tripp (1986) suggested that poor home-school relations exist and teachers are not familiar with the students' home lives in general. More specifically, teachers typically live outside the area in which they teach and do not

possess sufficient knowledge about students' lives outside of school. Midwinter's (1975) warned, "No matter how much you do inside the school, you can make virtually no impact at all without the informed support of the home" (p. 61). This warning supports the idea presented in this study that variables from the home and classroom environment should work collectively to establish student's academic self-efficacy beliefs and subsequent motivation, learning and achievement in school.

The development of or modification of behavior is not something that can be achieved in a vacuum. Some researchers have indicated behavioral attainments which emanate from the home environment will vary with family size, the ordinal position of the child within the family and SES. Marjoribanks and Walberg (1975) conducted a study that provided "an increased understanding of the relations between social status, sibling constellation variables, family environment and cognitive performance" (p. 15). Using eight family environmental variables: achievement, activeness, intellectuality, independence, English language, second language, mother dominance, and father dominance it was shown that detailed parent-sibling interactions and stimulations explained more variance than global or more distal variables such as parental income, education, and occupation. These findings are confirmed by more recent comprehensive reviews of the home environment and student achievement literature completed by Wang et al., (1993) and by a number of other relevant theoretical and empirical studies (Bing, 1963; Bloom, 1964; Coleman et al., 1966; Dave, 1963; Plowden, 1967; Rosen, 1959; Vernon, 1969; Walberg and Marjoribanks, 1973; Weiss, 1969; Wolf, 1964). Collectively, these studies support the importance of proximal variables in the classroom

and home learning environment that contribute to student learning (e.g., quality of teaching, supervision of home work, learning environment perceptions), rather than more distal variables (e.g., policy, funding, SES).

Each of the home environment variables or forces, sometimes referred to in the literature as elements of environmental press, are defined by a set of environmental characteristics assumed to be the behavioral manifestations of that environmental variable. The term *press* was coined by Murray (cited in Marjoribanks & Walberg, 1975) and refers to environmental variables influencing the individual. An example is “press for intellectuality [that] refers to the challenging nature of the family environment provided for siblings. This challenge may be provided in the form of thought provoking experiences presented through toys, games, hobbies, and discussions” (Marjoribanks and Walberg, 1975, p.17). The environmental factors cited above reveal that the home environment and interactions of the parents and siblings are very complex. It was also concluded that the degree and extent either of these factors exists will directly impact the self concept of the child and ultimately cognitive abilities.

Marjoribanks and Walberg (1975) isolated eight factors which identify parent-sibling interactions in the home which can be related to cognitive performance. A list and a brief discussion of each of these home learning environment variables and their contributions to learning and achievement that are considered significant are presented below:

- press for achievement, the impact parental expectations for the education of the child has on achievement;



- press for activeness, the impact the child's activities has on achievement. It can also include the use of television and other media;
- press for intellectuality, the effect of the number of thought provoking activities the child is engaged in. Books, periodicals, and other literature can be used;
- press for independence, the effect of freedom and encouragement to explore the environment as a means of achieving independence has on achievement;
- press for English, the effect the use of the English language and its reinforcement has on achievement;
- press for second language, the impact opportunities provided for the use and reinforcement of second languages has on achievement;
- father dominance, the impact the father's role in the life of the child and making family decisions has on achievement;
- and mother dominance, the impact the mother's role in the life of the child and making family decisions has on achievement.

While these factors represent the works of Marjoribanks and Walberg (1975), each identifies a type of home environmental experience which can result in cognitive and behavioral consequences for an individual student.

Findings show the total environment surrounding an individual is composed of sub environments which make contributions and develop particular characteristics or traits associated with the individual. The home environment which can be characterized by the environmental press variables: achievement, activeness, intellectuality, independence, English language, second language, mother dominance, and father

dominance have been shown to have some relevance in shaping behaviors which impact learning and achievement.

Some argue the influence of the home on learning and achievement is greater than that of the school. Walberg (1979) cited Richard Wolf in Achievement in the United States saying "...Home background and instructional time prove to be the strongest, most consistent correlates of achievement, but a number of other factors, such as measures of the learning environment and teacher preparation, are found to be educationally significant" (p. 8). This study addressed these latter issues, but focuses on the home learning environment as an important variable in promoting academic self-efficacy in middle school mathematics.

#### Middle School Education and Associated Problems

Since the mid-1980's various commissions as well as individuals supported by philanthropic and government funds have focused on problems of education in the United States, i.e., the government and businesses spending billions of dollars on remedial education, functionally illiterate adults entering the work force, remedial math in college, students with limited higher-order thinking skills, etc. These reports indicate the U. S. is having problems with its school systems and the education of the adolescents these systems serve.

A Nation At Risk (National Commission on Excellence in Education, 1983), the best known and most influential of the national reports, was sponsored by the U.S. Department of Education. The authors of this report argued the United States is *at risk* in the sense it once held a position of excellence in commerce, industry, service, and

technology. This superior position has gradually eroded to the point many other nations are threatening the position that was indisputably held by the U.S. (Ornstein & Levine, 1993). Likewise, it has been argued, the major causes of this erosion are problems that have developed in school systems, especially middle schools.

Bill Honig, California's Superintendent of Public Instruction in 1987, characterized the middle school and its students in Caught in the Middle (Superintendent's Middle Grade Task Force Report, 1987). He asserted that middle grade students are unique. No other grade span encompasses such a range of intellectual, physical, psychological, and social development. It is because of this wide range in student needs that educators must be sensitive to the entire spectrum of each student's capabilities and the special attention they require.

The middle school years and early adolescence, are traumatic times for many children (Csikszentmihalyi & Schmidt, 1998). When the physical and psychological changes associated with early adolescence are coupled with a transition to a new educational environment, the impact on the student can be devastating (Swanson, Spenser, & Petersen, 1998). It was found that the elementary school environment was viewed as rather protecting, but middle school is less personal and more intimidating to adolescents (Newman, 1998). In addition, studies indicate that the child leaves an environment where s/he has a larger physical structure than their peers and enters an environment where in many cases they are less physically developed than their peers. It was revealed that each of these conditions has an effect on the beliefs and attitudes of the young adolescent (Brown & Theobald, 1998).

A review of literature clearly shows that middle school years are crucial in the development of adolescents. It is during these years that many students develop their beliefs about school, their teachers, and the processes associated with learning. Most of these students take a positive view toward school and life in general and continue with hopes of academic, social, and cultural success.

For other students, the middle school years are more critical as they become frustrated, disenfranchised with school and education, and some, eventually, drop out. In the early 80's the term *at risk* was developed to provide a means of characterizing those students who seemingly did not fit in school or an educational setting and had the potential for dropping out. These students have always existed but the term served as a new label to identify them (Russell, Grandgenett, & Lickteig, 1994).

Bandura (1982) cited Beck, 1976; Lazarus & Launier, 1978; Meichenbaum, 1977; and Sarason, 1975 when he acknowledged that those who judge themselves as inefficacious in coping with environmental demands dwell on their personal deficiencies and imagine potential difficulties as more formidable than they really are. This defeatist attitude becomes overwhelming and ultimately leads to failure. Thus, it can be explained that those with low precepts of self-efficacy will not stick to a task long enough to receive reinforcement and as a consequence give up and except failure. In the case of adolescents in our schools, failure can be easily identified with dropping out.

For many students, the middle school years represent a last chance to develop a sense of academic purpose and personal commitment to educational goals. Those who fail at the middle grade level often drop out of school and may never again have the

opportunity to develop to their fullest potential (Superintendent's Middle Grade Task Force, 1987). If the destiny of our adolescents remains in these institutions, careful thought must be given to the manner in which teachers teach and children learn.

Oppositions to the above reported findings and lines of thinking are supplied by Berliner and Biddle (1995). They provide evidence which suggests the crises in the U. S. educational system are manufactured and the educational system is not in as deplorable a condition as has been reported. Data which were being used to establish the notions and myths about American education were reported to be misunderstood, misleading, suppressed, and often times distorted by different people in varying positions of authority to weaken the public school system and suppress the underprivileged (Berliner & Biddle, 1995).

Following the tenets of either of the above arguments, dissatisfaction with the present system of education remains a daily news item and a topic of discussion among educators and parents. While there are numerous debates which can be held on the problems of education, one important concern was that the problems are school related; i.e., teachers, administrators, and the curriculum offered fail to prepare students for the challenges they face in the global world. Other arguments maintain that problems exist with students and their lack of preparation for school or their interest in the curriculum. Still other considerations may be given to the amount of support parents provide schools and students in achieving educational goals. Based on the aforementioned topics of debate, neither group or argument seems totally correct, i.e. parents, educators and policymakers, and reform initiatives will vary and become common place because of a lack of rationality in proposing and implementing change in these pre-existing systems.

Cuban (1990) addressed the rationality of school reform initiatives using the pendulum and cycle metaphors. He argued school reform initiatives recur because educational policymakers and decision makers do not analyze the problem, rather they succumb to the politics of the problem. He explained that like a pendulum, there is movement, but the swing returns to some state of equilibrium without any change being made. Likewise, he expressed how reform initiatives are like a cycle, which can go through some evolutionary trend, or vary upwardly/downwardly in spirals, or fluctuate similar to waves in amplitude and frequency, but predictably follow some pattern without meaningful change occurring. Cuban (1990) cites Elmore, 1987; Kerchner & Boyd, 1987; Raywid, 1985 when he discusses how some researchers and analysts have tried to disentangle the values, arguments, and issues that mark the solution of choice to the perceived problem of inadequate public schooling. Realizing that choice does not necessarily follow change and vice versa, the linkages between choice and its impact on school-site decision making, staff morale, the remaking of curriculum, and the delivery of instruction are not quite clear. Though a myriad of approaches and explanations to problems associated with education are offered by educational philosophers, researchers, policy makers, and others, the perennial question about American education remained, *What are the most appropriate means and ends?*

Answers may be found in psychological literature which has traditionally explained relationships between personal beliefs and learning. Likewise, researchers acknowledge that teaching is complex, demanding, uniquely human and has much to do with the beliefs of the teacher (Agne, Greenwood & Miller, 1994; Clark & Peterson,

1986; Combs, 1982; Fenstermacher, 1979). While many schools hold to fairly traditional methods of instruction and encourage parental involvement, nontraditional approaches may be required to create classroom learning environments which are conducive to building and increasing student academic self-efficacy. As well, classroom and home learning environments may need to be better integrated in a manner that enhances students' academic self-efficacy beliefs, especially in the crucial middle school years and a critical curricula area such as mathematics.

### Middle School Mathematics

Mathematics was chosen for this study because of the national and international concern about low academic achievement in this critical curriculum area, especially for disadvantaged students. It was found that students who are inadequately prepared in mathematics during their secondary school years lose many career choices (Sells, 1973), 60% of college mathematics enrollments are in subjects which are taught in high school (National Research Council, 1989), and 75% of Americans stop studying mathematics before they complete career and job prerequisites causing the business sector to spend more on remedial math for employees than is spent for mathematics in schools, colleges, and universities combined (National Research Council, 1989).

While the United States ranks above many nations in mathematics achievement, and these rankings vary somewhat by grade level, research conducted in middle schools (eighth grade) in the early 1980s indicated that among 15 industrialized nations the US ranked 13<sup>th</sup>. Our students lagged behind those of other countries, notably Japan (Carnegie Task Force, 1986). Following concerns being raised about curriculum and

evaluation, teaching and teacher education, and student assessments, the National Assessment of Educational Progress (NAEP) tested national samples of students ages nine, thirteen, and seventeen. NAEP (1992) reported that little change in student scores for the period of the early 1970s to the late 1980s. The tests were given in mathematics, science, reading, writing, geography, and computer skills.

Midgley, Eccles, & Feldlaufer (1991) reported that children become more negative about the value of mathematics and their computational skills in the fifth to tenth grade with the most noticeable decline occurring around the seventh grade. It seems quite logical that school administrators, principals, mathematics department heads, teachers, and parents would be interested in what could be done to build students' academic self-efficacy beliefs in mathematics. A goal of this study was to develop an instrument which can be used to assess students' perceptions of the classroom environment so adjustments can be made to make the classroom learning environment more effective. Data collected with this measure and the results which are reported can be found in Chapter 4 and 5.

The study conducted by Midgley, Eccles, & Feldlaufer (1991) found a decline in children's mathematical skills occurring the first year of junior high, seventh grade. In many cases, elementary school covers grades K-5, middle school/junior high covers grades 6-8, and high school covers grades 9-12. Rather than focusing the study on the time of the transition, research has shown that the nature of the transition has been deemed more important.

Studies document that as students move from elementary school to middle school they encounter a change in their mathematical educational environment. In middle



school mathematics, students are given fewer opportunities to make decision about what they will learn. The research literature shows this occurs at a time when students are entering puberty and demanding more control over their lives (Lee, 1979). In addition, because students are provided less autonomy and decision making ability concerning what they are to study, their motivation toward learning and achievement is affected (DeCharms, 1980; Richter & Tjosvold, 1980).

Motivational processes associated with mathematics computations have been shown to have a significant influence on student academic achievement (Dweck & Licht, 1980). Bandura (1977a) suggested that motivation, which is concerned with the activation of behavior, and persistence, which is concerned with sticking to a particular behavior, are both cognitive mechanisms which can effect learning, this can be specifically related to the learning of mathematics. Meyer & Koehler (1990) found that students will persist on a task such as solving a mathematics problem when they feel they will be successful in solving the problem and value the final results. Mathematics anxiety occurs when students have a fear of failure.

Research findings have shown that math anxiety and math achievement are inversely and moderately correlated (Betz, 1978). Following Seligman's (1975) theory of *learned helplessness* which is consistent with social learning theory and Bandura's (1977a) theory of self-efficacy which acknowledges the fact that people avoid situations they feel are threatening or toward which they feel a sense of failure, repeated frustrations associated with learning mathematics can result in low performance and ultimately, withdrawal or dropping out of mathematics classes (Parente & Chisholm, 1980; Weiner, 1972).

The Curriculum and Evaluation Standards for School Mathematics published by the National Council of Teachers of Mathematics (NCTM) in 1989 provided educational reform recommendations dealing with how mathematics should be taught, what should be taught in mathematics classes, and how mathematics classes should be structured. The *standards* which were based on the findings of researchers studying traditional methods of teaching mathematics where rote memorization and teacher lectures were utilized verses constructivist based approaches where abstraction and reflection are fundamental. Abstraction is a mental mechanism which is used to generate new mathematical knowledge. In this process, the mind selects, coordinates, combines, and registers into memory the mental entities which are used to reason *mathematical realities* (Crick, 1994). Reflection is the mental replaying of experiences, actions, or mental processes used in achieving expectations or results.

While rote learning has been shown to result for most students in traditional mathematics curricula in the US, a move toward increasing students' abilities to deal with real world problems and to see the relevance of their studies is being purported. These efforts are aimed at increasing students' enthusiasm for advanced studies in mathematics and the sciences. One project, the Core-Plus Mathematics Project (CPMP) was designed to address weaknesses identified in the Third International Mathematics and Science Study (TIMSS) findings. This project which is currently being tested and is supported by the National Science Foundation is designed to make mathematics useful and accessible to all students whether college-bound or employment bound. The overall objective of projects of this nature are to improve the standings of our country in international comparisons and to create future scientists.

Published reports over the past century have evidenced the lack of success in mathematical attainments of American students when they are compared to their international counterparts. This statement is supported by the results of the First International Study of Achievements in Mathematics which were published in 1967. The findings showed American 13-year-old students finished next to last in math and science achievement among 10 major industrialized nations.

The Second International Mathematics Study was conducted during the 1981-1982 school year (SIMS). These results showed American eight-graders ranked 10<sup>th</sup> among 20 national groups in arithmetic, 12<sup>th</sup> in algebra, 16<sup>th</sup> in geometry, and 18<sup>th</sup> in measurement.

The results of the Third International Mathematics and Science Study (TIMSS) conducted in 1995 were similar to those reported by the Carnegie Task Force (1986) in that eight-grade students scored about average with students from Germany and northern Europe but considerably lower than students from Korea, Singapore, and Japan. While these results could lead to in-depth discussions about international competitiveness, it was concluded that there is no clear link between success on the tests and goals for improvement or meeting specific criteria of importance within the participating countries (Atkin & Black, 1997).

Coincident with the TIMSS research, thirteen of the countries that participated in TIMSS, participated in a study conducted by the Organization for Economic Cooperation and Development (OECD). The OECD study focused on the changes the countries were attempting to make in their existing programs of study because each country was

dissatisfied with its science and mathematics educational programs. While each country had educational reform efforts which were driven by different goals and expectations, some common efforts the countries seemed to embrace were increases in educational productivity, preparing students for jobs, concerns about health and environmental deterioration, protecting natural resources, and students being able to exhibit critical thinking skills.

Vocational and educational psychologists have become sensitized to the role mathematics interests and achievements play in shaping students' career futures (Betz, 1992; Meece, Wigfield, & Eccles, 1990). Throughout this century a *back-to-basics* approach of learning mathematics has been promoted, but critics argue that we have never strayed from *a basic approach*, we've been there all along (Bishop, 1999; O'Brien, 1999; Cossey, 1999). Based on the TIMSS findings and the reports of other researchers mentioned above, our approaches to studying and teaching mathematics have apparently resulted in our students lagging behind other industrialized nations. These findings and other similarly reported findings have caused a resurgent interest in mathematics education at all levels of American schooling (Stigler & Hiebert, 1997; Reys, Robinson, Sconiers, & Mark, 1999). In order to change or improve teaching and learning in the classroom, considerations should be given to the study of the classroom learning process (Stigler & Hiebert, 1997; Ma & Willms, 1999). While efforts have been aimed at setting national standards in mathematics and holding teachers accountable for what is taught, concentrated efforts may need to be aimed at improving students' learning (Battista, 1999; National Research Council, 1989; National Council of Teachers of Mathematics, 1989).

## Summary

Chapter 2 presented a review of the literature pertinent to the dependent variable, academic self-efficacy, and the independent variables, home and classroom learning environments, that frame the conceptual model of the study presented in Chapter 1. The study has been grounded in the following literature: 1) social cognitive theory; 2) academic self-efficacy; 3) the classroom learning environment; 4) the home learning environment; and 5) the middle school. The chapter also provided:

1. an overview of middle school education as it pertains to the education of adolescents,
2. a discussion on social cognitive theory and the interactions of individuals, their environments, and their resulting behaviors,
3. a review of self-efficacy theory and research,
4. a review of learning environment theory and research with emphases on the home and classroom learning environments, and
5. a review of literature pertaining to middle school mathematics.

Chapter 3 describes the research methodology and other facets of the research design which were employed in this study.

## CHAPTER 3: RESEARCH METHODOLOGY AND PROCEDURES

Chapter 3 includes a description of the research design, instruments and measures, and the data collection and analyses procedures used to address the research questions associated with the study.

### Research Design

This study explored relationships among middle school students' *perceptions* of home and classroom learning environment characteristics and self-reported academic self-efficacy beliefs about their abilities to do eighth grade mathematics. Specifically, the study was designed to explore linkages between sources of student self-efficacy in the home and classroom learning environments and the strength of students' academic self-efficacy beliefs about eighth grade mathematics. It should be recognized that the measures used in the study were measures of perceptions of learning environment characteristics, not more direct and perhaps more objective measures such as direct, systematic observations. An ex-post-facto design in which the variables were assigned and not manipulated was used (Campbell & Stanley, 1981).

Federal regulations require that all research with human subjects be reviewed and approved by an authorized university-level committee prior to the initiation of the study. This requirement is considered most important when the subjects are students under the age of 18. At Louisiana State University (LSU), the Institutional Review Board (IRB) is the authorized committee. An approval application with the associated information packet was submitted and approved by the LSU committee before proceeding with the study. Following is a discussion of the study variables and the targeted population for the study.

### Dependent Variable

As discussed in Chapter 1, self-efficacy beliefs can influence an individual to become committed to a task until a successful outcome is achieved. The dependent variable, student academic self-efficacy, was operationalized by student scores on the subscales of the Student Mathematics Self-Efficacy Inventory (SMSEI) which was developed for use in the study. This measure was designed to examine the belief structure of eighth grade mathematics students so the correlates of these beliefs could be explored within and between the independent variables.

### Independent Variables

Independent variables of the study were operationalized using two original measures of a) students' perceptions of the home learning environment (Mathematics Self-Efficacy Learning Environment Inventory - Home Form) (MSELEI-HF), and b) students' perceptions of the classroom learning environment (Mathematics Self-Efficacy Learning Environment Inventory - Class Form) (MSELEI-CF).

### Target Population for the Study

The target population for the study was all eighth grade mathematics students from two neighboring parishes in Louisiana, Jefferson and Orleans. These parishes provided a diverse student population with the major ethnic and socioeconomic groups represented. In addition, both parishes comprised a geographical area which consisted of urban and suburban schools indicative of other southeastern school districts in the United States.

Initially, middle schools were targeted for the study population. These schools generally had a grade configuration of grades 6 through 8 but it was determined that the

schools could not be chosen by name only because some schools labeled as junior high schools qualified. Likewise, some eighth grade classes were found in the elementary and senior high schools. Mathematics classes were of interest in the study because of the national (and international) concern for low math achievement among middle school students (i.e., results of the Third International Mathematics Study and the National Assessment of Educational Progress).

Jefferson and Orleans Parishes served an eighth grade student population of approximately 9,114 students. These students attended approximately 49 schools in the two parishes. Fourteen schools were initially targeted for participation in the study, seven schools in each parish (~30% of the schools serving eighth grade students). Both parishes mandated that individual school participation in the study was to be voluntary. Following is a description, and a discussion of the development and testing of the measures used for data collection.

#### Development of the Study Measures

The self report measures used in the study were original measures specifically developed to explore answers to the research questions. Each measure was content validated using expert panels and pilot tested with small groups of students before data were collected for the larger study.

An initial draft of each measure was developed using information obtained from the literature reviews on self-efficacy and learning environments. Initial item pools were developed and discussed with a small number of university measurement faculty and middle school mathematics teachers. A review of the items and the response format



was completed to determine content validity of the items relative to self-efficacy and learning environment theories. Revisions were made to the items and response format until superfluous wording and items were removed. A final review of the measurement items and response formats was completed with selected university faculty and pilot test measures were printed.

### Pre-Pilot Testing

The measures used in this study were original measures that were specifically developed for the study. Therefore, it was necessary to pre-pilot the measures to obtain verification that the items comprising the measures were reasonable representations of the constructs to be measured. Since the measures were to be administered to students, student input relative to the draft items was solicited. Involvement of students was preceded by obtaining parental consent. A copy of the parental consent form is provided in Appendix A. Each measure was pre-pilot tested and discussed with a sample of three eighth grade students. Two eighth-grade math teachers, a fellow graduate student, and four parents were also used as members of a review panel to provide input about the appropriateness of the draft items for each of the study measures. Input from the pre-pilot phase of the study was used to make minor revisions in the study measures before more extended pilot activities occurred with a larger number of students.

### Student Responses to the Initial Draft of Measures

In the pre-pilot activities, students were asked to read the questionnaires for unfamiliar language and/or misunderstandings (i.e., *Were there any unfamiliar words or*

*expressions used which an eighth-grade student would not understand?* or *Were any of the questions confusing?*) Students were provided high lighters and asked to identify any unclear words, expressions, or questions/statements. An example of a change which resulted from student comments follows:

One statement on the MSELEI-CF was worded, *When I have to take a math test in this class...I am anxious and/or nervous*. One student responded, “This statement is confusing. I don’t understand what is being asked? The statement should be broken up into two separate statements, one for anxious and one for nervous.” After some discussion, it was agreed that the statement would be made into two separate statements as advised and the new statements read:

1. When I have to take a math test in this class...I am anxious.
2. When I have to take a math test in this class...I am nervous.

Following the discussion on readability and understanding, students were asked to rank the sixteen math problems from the easiest to solve to the most difficult. After the students ranked the problems, each student was asked to solve as many of the problems as they could. When the students finished solving their problems, solutions were discussed and/or worked with each student to confirm one or two possible approaches and solutions to each problem. The exercise provided the researcher an indication of the difficulties associated with each problem, which problems students could solve and which problems were too difficult for an eighth-grade mathematics student to solve. Problems were designed to vary from simple to extremely difficult to solve. After discussions with students it was agreed that the problems provided considerable variation in difficulty.

Each student was provided five alternative stems for the self-efficacy measure (SMSEI). Five problems were provided for each stem and students were asked to respond to each problem. The five alternatives were:

1. How strongly do you believe you can....solve the following problem?
2. How strong is your personal belief that you can...solve the following problem?
3. How confident are you that you can...solve the following problem?
4. How sure are you that you can...solve the following problem?
5. How sure are you that you have the ability to...solve the following problem?

This exercise was designed to provide an indication of the variability in responses to the questions/statements based on the stems used. After discussions with students on the expert panel, it was agreed that two stems caused more concentration and in depth self analyses about students' abilities to work the mathematics problems. The two stems which the researcher decided to explore and use in the subsequent pilot test were:

1. How strongly do you believe you can...solve the following problem?
2. How confident are you that you can... solve the following problem?

Each stem was designed into a pilot instrument and randomly distributed in the subsequent pilot-test class to identify the stem which provided the most response variability among the pilot-test student.

Each student was provided a copy of the demographic information form and asked to answer each question to the best of their abilities. No student experienced any major difficulties answering the demographic questions. Concerns which were expressed by the students on the expert panel follows:

1. "I am not sure what the highest number of years of school my father completed."
2. "I am not sure what the highest number of years of school my mother completed."
3. "I am not sure if we own or rent our home."

The concerns were acknowledged as valid but it was decided that the questions would remain as a part of the survey instrument.

The students were provided a copy of the consent form which was to be sent home with each student asking for parental consent for the students to participate. The consent form was mandated by the IRB at LSU. Each student was asked to read the consent form and highlight any areas which were not clear or understandable. No students expressed any major difficulties responding to the consent form nor did they feel their parent would have difficulties reading and responding.

#### Parent, Graduate Student, and Teacher Responses to Initial Draft of Measures

The panel of four parents, the graduate student, and two teachers were asked to read each of the items in the complete survey packet and to provide comments on their readability, comprehensiveness, and clarity. Parents expressed no major concerns with the content or understandability of any of the items. The graduate student and teachers expressed some concerns. Areas which were generally identified by the graduate student and teachers as problematic included the following:

1. "Many students will probably not be able to identify the number of years their parents attended school."

2. "Students will not want to respond to the free/reduced priced lunch question for fear of their fellow students overseeing their response."
3. "The question concerning the parents alive and living with each other is a bit intrusive."

The comments received by these individuals were further discussed and clarified, and after additional discussion, the decision was made to retain these items on the demographic instrument.

The graduate student and teachers were also asked to rate the degree of difficulty associated with the math problems comprising the draft mathematics self-efficacy beliefs measure. All agreed that the mathematics problems on this measure did indeed vary from extremely simple to extremely difficult. One teacher made the following observation/comment:

"The questions which reads,...How strongly do you believe you can...solve the following quadratic equation by factoring?...should be changed to... How strongly do you believe you can...solve the following systems of linear equations?... because these are the statements we normally make in our classes. The children may not know what a quadratic equation is at this grade level."

Similarly, the graduate student expressed the following concern:

"This is not a huge deal but I am still worried that the students may not have been exposed to a system of linear equations and may interpret based on their ability to solve the indefinite equation...perceptions of ability upon relative interpretation of work (skill needed)."

After some discussion, the wording of this question was considered by the panel as age and grade appropriate. This particular mathematics problem was restructured and the question was changed to reflect concerns and input from the review panel (graduate student and teachers).

### Pilot Testing

Prior to administering the measures to the targeted population for data collection, and following the pre-test of the measures with a small sample of students and discussions with the expert panel, a pilot-test was conducted with eighth grade mathematics students in one class in an Orleans Parish school. The teacher was asked to administer the pilot measures and the two forms of the self-efficacy measure, SMSEI (each with a different response stem). Parental consent was received for each participating student. Scan-tron forms for each instrument were secured through the Louisiana State University Measurement Center. The two stems for the self-efficacy measure which were pilot-tested were:

1. **How strongly do you believe you can....solve the following problem?** This stem was used on the form designated as Form A.
2. **How confident are you that you can....solve the following problem?** This stem was used on the form designated as Form B.

Tables 3.0 and 3.1 provide profiles of the pilot-test mathematics students (n=29) participating in the Orleans Parish school by age, gender, race, and SES. The 17 items comprising the SMSEI were used to determine the final format, Form A or Form B, to be used for data collection. All items on Form A and Form B were the same except for the wording of the 17 item stems.

Using descriptive statistics such as the item means, medians, variances, and standard deviations for comparisons, Forms A and B proved to be similar. Form A had an Alpha reliability of .84 compared to .71 for Form B. Likewise, questions 1, 13, and

Table 3.0

Form APilot Test - Profile of Pilot Test Sample by Personal Characteristics of the Respondents  
(n=14)

Characteristic	Frequency	Percent of Total
<u>Age</u>		
13	12	85.7
14	2	14.3
<u>Gender</u>		
Male	2	14.3
Female	12	85.7
<u>Race</u>		
Black	10	71.4
Asian	—	---
White	3	21.4
Hispanic	—	—
Other	1	7.2
<u>Socioeconomic Status</u>		
Free/Reduced Lunch	4	28.6
No Free/Reduced Lunch	8	57.1
Missing	2	14.3

Table 3.1

Form BPilot Test - Profile of Pilot Test Sample by Personal Characteristics of the Respondents  
(n=15)

Characteristic	Frequency	Percent of Total
<u>Age</u>		
13	15	100.0
14	---	---
<u>Gender</u>		
Male	8	53.3
Female	7	46.7
<u>Race</u>		
Black	11	73.3
Asian	3	20.0
White	1	6.7
Hispanic	—	—
Other	---	---
<u>Socioeconomic Status</u>		
Free/Reduced Lunch	9	60.0
No Free/Reduced Lunch	6	40.0
Missing	—	---



14 on Form A had zero variance, whereas, questions 1, 2, 4, 13, and 14 on Form B had zero variance. Using this information, Form A and the stem, **How strongly do you believe you can.....solve the following problem?**, was used as the response stem for the self-efficacy measure. Refer to Table 3.2 for a summary of the criteria used to select the final form of the measure used for data collection in the larger study. A description of this measure is provided in the following section.

### Description of Study Measures

Initial validity and reliability issues were addressed in the pilot activities described above. A replica of the measure used for data collection is included in Appendix A. The actual data collection measure was produced as a scan-tron form. Each of the measures used in the larger study to explore the research questions is further discussed below.

#### Student Academic Self-Efficacy

The Student Mathematics Academic Self-Efficacy Inventory (SMSEI) developed for use in the study was a new measure of students' self reports of the strength of their beliefs in their capabilities to successfully complete various tasks in mathematics that varied in degree of difficulty across the eighth grade math curriculum. This new measure also included a small set of items that reflect on-task motivation and persistence in the face of barriers to success in mathematics consistent with the prior work of Loup & Ellett (1993) and Johnson (1999). The first part of the SMSEI consisted of 17 items. The first set of items (n=17) were math problems, graded in difficulty from least difficult to most difficult. Students responded to each math

Table 3.2

**Pilot Test - Criteria for Data Collection Form Selection**

Criteria	Form A (n=14)	Form B (n=15)
<b><u>17 Items associated with SMSEI</u></b>		
Mean	8.22	8.22
Variance	.36	.39
Items with Zero Variance	SMSEI1 -- -- SMSEI13 SMSEI14	SMSEI1 SMSEI2 SMSEI4 SMSEI13 SMSEI14
Std Deviation	.60	.63
Alpha	.84	.71
<b><u>Student Response to Pilot Questionnaires (Item Mean)</u></b>		
Directions were clear for each task	3.71	3.60
Words easy to read and understand	3.57	3.87
Each question read thoroughly and the response thought about	3.29	3.60
The questionnaire was too long	2.64	2.93

problem using a ten point rating scale and a response format that reflected the *strengths of their beliefs in their capabilities to successfully complete each problem* (0=Very Weak Belief to 9=Very Strong Belief). The ten point scale and items graded in difficulty procedures have been described as a preferred way to measure the strength of self-efficacy beliefs (Bandura, 1997). Likewise, Bandura (1977a, 1982, 1986, 1997) in his theory of self-efficacy, views the construct to be content and situationally specific. Thus, assessment of students' academic self-efficacy beliefs in one subject, mathematics, across a series of mathematics problems varying in difficulty seemed necessary to provide a comprehensive view of the construct as it relates to eighth grade students' beliefs.

The items comparing the mathematical self-efficacy measure are shown in Appendix A as Part I of the overall data collection instrument. The final response format for each item on the SMSEI was decided upon after the pre-pilot testing, pilot-testing, and discussions with the expert panel synthesized above.

The second part of the SMSEI, an Academic Efficacy Motivation and Persistence Index (AEMPI), consisted of five items designed to assess efficacy motivation and persistence levels in a) solving math problems, b) overcoming barriers/obstacles to solving math problems, and c) repeating efforts to solve math problems after failing to do so. The items developed for the AEMPI follow Bandura's (1982) premises that individuals continually make decisions about the courses of action they are going to pursue and the amount of energy they are willing to expend in these pursuits. When an individual has strong self-efficacy beliefs toward a task, the

individual will persist at the task longer than s/he will if their self-efficacy beliefs are weak. The AEMPI items are shown in Appendix A as Part II of the overall set of measures used in the study.

In addition to the SMSEI and AEMPI, an Outcome Expectancy Index (OEI) was developed to measure students' expectancies associated with identified performance outcomes. The OEI portion of the measure consisted of six items and can be found in Part V of the instrument provided in Appendix A.

### Home Learning Environment

The Mathematics Self-Efficacy Learning Environment Inventory (Home Form), MSELEI-HF, which was developed for use in this study was a new measure of students' self reports of factors, events and conditions in the home environment that reflect the four primary sources of self-efficacy beliefs discussed by Bandura (1997) within social cognitive theory. These four primary sources are a) *enactive mastery experiences*, b) *vicarious experiences*, c) *verbal persuasion*, and d) *physiological and affective states (emotional arousal)*. This new measure was designed to assess students' perceptions of factors, events and conditions in the home environment that positively or negatively influence the development of self-efficacy beliefs in mathematics. Four to five items were developed for each of the four primary sources of self-efficacy. Students responded to each item using a four-point frequency of occurrence scale (1=Almost Never, 2= Sometimes, 3=Often, 4=Almost Always). The final response format for the MSELEI-HF was determined through the pilot research activities with students as was previously discussed. An example of a typical item is ***I am successful...in doing my***

***math homework at home.*** The items which operationalized each of the four primary sources of self-efficacy described by Bandura (1997) are included in Appendix A. The final form of the MSELEI-HF consisted of 18 items and is shown in Part III of the survey measures provided in Appendix A.

### Classroom Learning Environment

The Mathematics Self-Efficacy Learning Environment Inventory (Class Form) (MSELEI-CF) developed for use in this study was a new measure of students' self reports of factors, events and conditions in the classroom that reflect the four primary sources of self-efficacy beliefs discussed by Bandura (1997) within social-cognitive theory. These four primary sources are a) *enactive mastery experiences*, b) *vicarious experiences*, c) *verbal persuasion*, and d) *physiological and affective states (emotional arousal)*. This new measure was designed to assess students' perceptions of factors, events and conditions in the classroom environment that positively or negatively influence the development of self-efficacy beliefs in mathematics. Four to five items were developed for each of the four primary sources of self-efficacy. Students responded to each item using the same response format described above for the MSELEI-HF measure. The final response format for the MSELEI-CF was determined through pilot research activities. An example of a typical item is ***I am successful...in doing my math problems in this class.*** The items operationalizing each of the four primary sources of self-efficacy described by Bandura (1997) are included in Appendix A. The final form of the MSELEI-CF consisted of 20 items and is shown in Part IV of the survey measure provided in Appendix A.

## **Data Collection Procedures**

Data for the study were collected in the fall semester, 2000 and the beginning of the spring semester, 2001. Data collection packets included a checklist which could be used by the classroom teacher to administer the questionnaires, a consent form which required a parent's signature, a demographic information sheet which was to be completed by each student, the Student Questionnaire, and the five study measures which were to be completed by each student, i.e., a four page questionnaire, Student Questionnaire - Form A. A replica of each document is provide in Appendix A. The actual instruments were produced on 8 ½ X 11 inch scan-tron forms that were secured through the Louisiana State University Measurement Center. Data were collected within intact classrooms by this researcher and the regular classroom teachers using the scan-tron forms.

### **School Board Approval**

Both parishes mandated that school participation was to be voluntary. First, a letter was written to the Superintendent of Jefferson Parish and Orleans Parish Public School Systems requesting permission to seek the participation of selected schools within their school district. A sample of the approval letter is provided in Appendix A. A response was received from both parishes granting approval to seek individual school participation.

### **Individual School Approval**

A letter was sent to the randomly chosen schools seeking the principal's permission to grant his teachers and students approval to participate in the study. A sample of the approval letter is provided in Appendix A.

### Teacher and Student Participation

When the principals of selected schools agreed to participate, individual mathematics teachers were contacted via faxes, letters, and phone calls. In addition to the letter seeking teachers' and their classes' participation in the study, a narrative discussion of the study was given to each teacher to increase their awareness of what was trying to be accomplished. Once the identified teachers agreed to participate, parental consent forms were delivered to the teacher for each student to take home. The parental consent forms required a parental signature before the surveys could be distributed to the students for data collection.

Each teacher was provided a packet containing the two questionnaires, the four page data collection questionnaire, Student Questionnaire - Form A, and the demographic information sheet, the Student Questionnaire. Each teacher developed or was provided a class number, school number, and teacher number which was used by the individual students for identification purposes. Each student was assigned a student number which was also used for identification purposes.

General instructions and directions were read to the students and the data collection process began with each student bubbling the numbers they were assigned or provided on the scan-tron sheets. When the identification portion of the data collection and demographic information sheets were completed, the students were given additional instructions and allowed to complete the data collection process. The entire process required approximately thirty minutes for completion.

Once the data collection forms were completed, each student was asked to check their individual sheets for errors and stray marks. The forms were collected, returned to

packets they were delivered to the teachers and the researcher was contacted so the data could be picked up. The researcher picked up the data collection forms and returned them to the Louisiana State University Measurement Center for scanning. When the scanning was completed, raw data was supplied to the researcher on a computer diskette and ready for cleanup and data analyses.

### **Data Analyses**

A variety of statistical analyses were completed in the study. These analyses included:

- descriptive statistical summaries of demographic information for the sample and for the five measures used.
- factor analyses for each of the five measures developed for the study.
- Chronbach Alpha (internal consistency) reliabilities for the factored dimensions of the five measures.
- bivariate correlations among and between the SMSEI, AEMPI, OEI, MSELEI-HF, and MSELEI-CF.
- multiple regression analyses regressing the SMSEI, AEMPI, and OEI measures on factored dimensions of the MSELEI-HF and the MSELEI-CF (both separately and combined).
- a series of ANOVA's to explore differences in the strength of students' self-efficacy beliefs and home and classroom learning environment perceptions when classified by demographic variables (i.e., gender, SES).

A more in depth discussion of the data analyses is provided in Chapter 4.



## **Summary**

**The information contained in Chapter 3 explains the research design, study measures, data collection procedures, and data analyses used to address the primary and supplemental research questions framing the study.**

## CHAPTER 4: RESULTS

Chapter 4 presents the results of the study. The descriptive statistics for the sample and the data analyses conducted to address the primary and supplemental research questions provided in Chapter 3 are tabulated and discussed. The results are presented as follows: a) descriptive statistics for the survey sample; b) descriptive statistics for the measurement instruments; c) factor analyses of the study measures; d) analyses of internal consistency for the study measures; e) summaries of the intercorrelations among the measures and subscales; and f) analyses pertinent to the primary and secondary research questions.

### Descriptive Statistics for the Sample

The sample for the study was drawn from eighth grade mathematics classes in Jefferson and Orleans Parishes. The schools represented varied grade configurations as shown in Table 4.0. Three schools were listed as middle schools with grades 6-8. One school was a junior high with grades 7-9. One school was labeled an elementary school with grades K-8. One school was a senior high school with grades 7-12.

Approximately 1263 eighth grade mathematics students were initially contacted for the study and 663 mathematics students participated. Included in this total was 648 eighth grade mathematics students (97.7%). The other 15 students (2.3%) were comprised of 8 seventh grade students (1.2%), 2 ninth grade students (0.3%) enrolled in eighth grade mathematics, and 5 students (0.8%) not bubbling in a response, Table 4.1. The observed participation rate and the number of valid cases ( $n=663$ ) for the mathematics students who participated represented a 52.5% participation rate for the total number of students that were contacted.

Table 4.0

**Profile of Participating Jefferson and Orleans Parish Schools  
by Designation, Grade Configuration, Student Enrollment, % Minority, and SES**

Characteristic	School 1	School 2	School 3
<b><u>Jefferson Parish</u></b>			
Designation	Middle	Junior High	Middle
Grade Configuration	6-8	7-9	6-8
Student Enrollment (1999-2000)	765	971	1074
% Minority	61.1	74.4	45.5
% Free/Reduced Lunch	68.1	85.2	50.2
<b><u>Orleans Parish</u></b>			
Designation	Elementary	Middle	High
Grade Configuration	K-8	6-8	7-12
Student Enrollment (1999-2000)	1048	987	1219
% Minority	57.4	98.9	91.6
% Free/Reduced Lunch	33.4	79.0	48.2

Table 4.1  
Summary of Demographic Information (n=663)

Characteristic	Frequency	Percentage of Total
<b>Grade:</b>		
7th	8	1.2
8th	648	97.7
9th	2	0.3
Missing <sup>a</sup>	5	0.8
<b>Student's Age:</b>		
12	11	1.7
13	389	58.7
14	189	28.5
15 and Over	56	8.4
Missing	18	2.7
<b>Ethnicity:</b>		
African-American (Black)	326	49.2
Asian	27	4.1
Caucasian (White)	184	27.8
Hispanic	82	12.4
Other	29	4.4
Missing	15	2.3
<b>Gender:</b>		
Male	284	42.8
Female	376	56.7
Missing	3	0.5
<b>Father's Educational Level: (Highest Grade Completed)</b>		
I Don't Know	235	35.4
Elementary (Grades 1- 6 )	10	1.5
Middle/Jr. High (Grades 7 - 9)	11	1.7
Some High School	35	5.3
High school graduate	137	20.7
Some college	102	15.4
Bachelor's degree	44	6.6
Master's degree	34	5.1
PhD or Professional degree	39	5.9
Missing	16	2.4

(Table continued)

Characteristic	Frequency	Percentage of Total
<b>Mother's Educational Level:</b>		
<b>(Highest Grade Completed)</b>		
I Don't Know	161	24.3
Elementary (Grades 1- 6 )	6	0.9
Middle/Jr. High (Grades 7 - 9)	24	3.6
Some High School	45	6.8
High school graduate	150	22.6
Some college	126	19.0
Bachelor's degree	65	9.8
Master's degree	49	7.4
PhD or Professional degree	23	3.5
Missing	14	2.1
<b>Parents' Mortality/Marital Status:</b>		
Live with Natural Parents	590	89.0
Do not live with Natural Parents	64	9.7
Missing	9	1.4
Mother unknown	28	4.2
Mother known	600	90.5
Missing	35	5.3
Father unknown	76	1.5
Father known	554	83.6
Missing	33	5.0
Mother alive	624	94.1
Mother not alive	13	2.0
Do not know if mother is alive	5	0.8
Missing	21	3.2
Father alive	576	86.9
Father not alive	38	5.7
Do not know if father is alive	27	4.1
Missing	22	3.3
<b>Mother and Father:</b>		
Live with each other	263	39.7
Do not live with each other	373	56.3
Do not know	3	0.5
Missing	24	3.6

(Table continued)

Characteristic	Frequency	Percentage of Total
Parents:		
Own the family home/condo	331	49.9
Rent the family home/condo/etc.	253	38.2
Other	13	2.9
Don't know	49	7.4
Missing	17	2.6
SES:		
Free Lunch	357	53.8
No Free Lunch	278	41.9
Missing	28	4.2
Children Other than the student living in the home or apartment:		
0	106	16.0
1	219	33.0
2	166	25.0
3	88	13.3
4 or more	79	11.9
Missing	5	0.7
Expected Grade in this mathematics class:		
A	110	16.6
B	176	26.5
C	235	35.4
D	74	11.2
F	46	6.9
Missing	22	3.3

<sup>a</sup> Number of missing cases

The age of the students varied from 12 to 17 with the majority of the students being 13 (58.7%). Thirteen is the average age of eighth grade students because most students begin school at the age of six. The thirteen year old age group was followed by students who were 14 (28.5%). Fifteen, sixteen, and seventeen year old students totaled 8.4% of the sample.

African-Americans (49.2%) comprised the largest racial sub-group within the student sample, Table 4.1. The percent African-American at each school varied from a low of 45.5% to a high of 98.9%, Table 4.0. The other racial sub-groups represented within the student sample were Whites (27.8%), Hispanics (12.4%), and Asians (4.1%), Table 4.1. Students who responded to *Other* (4.4%) in the racial profile on the demographic instrument were found to be descendants of Native American Indians, Central and South America, the U.S. Virgin Islands, and the Republic of Haiti. The data indicate a diverse racial make-up of families represented in the study.

More female (56.7%) students than males (42.8%) participated in the study. To ascertain the socioeconomic status of the students' families, students were asked their participation in free or reduced price lunch programs. The economic mix was fairly proportionate with 53.8% of the respondents indicating that they received free or reduced priced lunches and 41.9% indicating they did not receive free or reduced priced lunches, Table 4.1.

It should be noted that the percentages for the sample population in all cases do not reflect 100% because of missing or unreported frequencies. A summary of the above reported descriptive statistics and additional descriptive statistics completed for

some of the other pertinent demographic variables is presented in Table 4.1. A discussion of the students and participating schools in each parish follows.

#### Jefferson Parish Students

Jefferson Parish served a student population of approximately 51,371 students in 84 schools in the 1999-2000 school year. This population contained approximately 3,779 eighth grade students attending 21 schools. Of the 21 schools, 4 schools were eliminated because they served a special student population, i.e., charter school, schools labeled as special schools, or schools with an eighth grade student population of less than 100 students. One school was eliminated because of its remoteness. Therefore, the targeted sample of students for Jefferson Parish was chosen from 16 schools. Because of the geographical nature of Jefferson Parish, a widespread parish divided by a navigable waterway, the Mississippi River, the schools were remotely located. Nine of the schools were located on the west bank of the Mississippi River and seven of the schools were located on the east bank of the river. A random sample was taken from the schools on each bank and three school were contacted on each bank for participation in the study. One of the contacted schools on each bank refused to participate and was replaced with another randomly chosen school. This process of replacement continued until three schools agreed to participate one on the west bank and two on the east bank. The three school represented 14% of the schools in the parish serving eighth grade students.

Table 4.2 provides a profile of the students participating in the study from the Jefferson Parish school population by age, gender, race, and SES.



Table 4.2  
Profile of Participating 8<sup>th</sup> Grade Jefferson Parish School Population  
by School, Age, Gender, Race, and SES (n=329)

Characteristic	School 1 Frequency	School 2 Frequency	School 3 Frequency
Students Participating	81	41	207
<u>Age</u>			
12	—	—	---
13	28	10	3
14	40	12	104
Other	12	17	16
Missing	1	2	5
<u>Gender</u>			
Male	38	15	109
Female	43	26	97
Missing	—	—	---
<u>Race</u>			
Black	19	24	46
Asian	7	1	11
White	26	8	89
Hispanic	27	5	46
Other	2	1	10
Missing	—	2	5
<u>SES</u>			
Free/Reduced Lunch	51	32	94
No Free/Reduced Lunch	30	9	101
Missing	—	—	12

The three Jefferson Parish schools served an eighth grade population of approximately 629 mathematics students. The school on the west bank served approximately 198 eighth grade mathematics students and 41 of the students participated in the study. This represented a 20.7% participation rate. The two schools on the east bank served approximately 431 eighth grade mathematics students and 288 of the students participated in the study. This represented a 66.8% participation rate. From a population of 629 eighth grade mathematics students, a sample of 329 eighth grade, Jefferson Parish mathematics students participated in the study. This resulted in a 52.3% participation rate within Jefferson Parish.

#### Orleans Parish Students

Orleans Parish served a student population of approximately 82,187 students in 127 schools in the 1999-2000 school year. This population contained approximately 5,335 eighth grade students attending 28 schools. Of the 28 schools, 2 schools were eliminated because they served a special student population, i.e., one charter school and one Montessori school. Likewise, 9 schools were eliminated because they served an eighth grade mathematics student population of less than 150 students. Therefore, the targeted sample of students for Orleans Parish was chosen from 17 schools. Because of the geographical nature of the parish, a defined urban area surrounded by diversified suburban communities and divided by two navigable waterways, the Mississippi River and the Industrial Canal, the school board had the parish subdivided into 7 school districts. It was decided that one school would be randomly solicited for participation from each district. The random sample was taken and the schools were contacted for

their participation in the study. As schools were contacted and refused to participate they were replaced with another randomly chosen school. This process of replacement continued until three Orleans Parish schools agreed to participate. One school was located in a suburb in eastern New Orleans, east of the Industrial Canal. Two of the schools were located in suburbs west of the City of New Orleans. The three school represented 11% of the schools in the parish. Table 4.3 provides a profile of the students participating in the study from the eighth grade, Orleans Parish mathematics school population by age, gender, race, and SES.

The three Orleans Parish schools served an eighth grade population of approximately 634 mathematics students. The school in eastern New Orleans served approximately 294 eighth grade mathematics students and 162 of the eighth grade mathematics students participated in the study which represents a 55.1% participation rate. The two urban schools served approximately 340 eighth grade mathematics students and 172 eighth grade mathematics students participated in the study which represents a 50.6% participation rate. From a population of 634 eighth grade mathematics students, a sample of 334 eighth grade, Orleans Parish mathematics students participated in the survey. This resulted in a 52.7% participation rate within Orleans Parish.

#### Summary of Descriptive Statistics for Survey Sample

In summary, 6 schools participated in the study and the useable data reflected the cooperation of 14 teachers and 42 eighth grade mathematics classes. Table 4.0 provides a profile of the schools participating in the study. Tables 4.1, 4.2, and 4.3 provided

Table 4.3

**Profile of Participating 8<sup>th</sup> Grade Orleans Parish School Population  
by School, Age, Gender, Race, and SES (n=334)**

Characteristic	School 1 Frequency	School 2 Frequency	School 3 Frequency
Students Participating	94	162	78
<u>Age</u>			
12	3	—	5
13	84	93	70
14	7	49	2
Other	—	10	---
Missing	—	10	---
<u>Gender</u>			
Male	37	59	26
Female	57	101	52
Missing	—	2	---
<u>Race</u>			
Black	30	148	59
Asian	3	—	5
White	54	—	7
Hispanic	1	1	2
Other	5	8	3
Missing	1	5	2
<u>SES</u>			
Free/Reduced Lunch	10	126	44
No Free/Reduced Lunch	78	29	31
Missing	6	7	3

profiles of the students participating in the study from both parishes. The observed participation rate and the number of valid cases (n=663) for the mathematics students who participated represented a 52.5% participation rate for the total number of students that were contacted. The data indicated a diverse racial and economic make-up of families represented in the study.

#### Summary of Descriptive Statistics for Measurement Items

The following sections provide summaries of descriptive statistics for each measure used to operationalize the dependent and independent variables in the study. Table B.1 in Appendix B gives an item location index for each measure. The item numbers can be cross referenced with the item numbers on the Student Questionnaire - Form A included in Appendix A. Means, standard deviations, and means expressed as percentages of the maximum possible scores on each item were computed for the total sample of respondents. A summary of this information is presented in Appendix C, Table C.1 for the total sample (n=663) and used in the discussions which follow.

#### Student Mathematics Self-Efficacy Inventory (SMSEI)

Descriptive statistics for each item on the 17-item SMSEI measure are shown in Appendix C, Table C.1. Item means, standard deviations, and means expressed as percentages of the maximum possible scores are reported for each item of the SMSEI. As noted in the table, the M%Max score is computed by dividing the item mean by the maximum possible score for the item (4). All items on the SMSEI were scored using a 10-point frequency scale. A score of zero meant that students believed that a particular

math problem was very difficult to solve or the problem required a lot of effort to solve, i.e. the students had very weak beliefs in their abilities to solve the particular problem. A score of 9 meant the students had very strong beliefs in their abilities to solve the problem, i.e. the math problem was not very hard or difficult to solve or the students believed they could solve the problem if they put forth enough effort. The higher the mean score on the measure, the greater the belief the students had in their abilities to solve the problem. Question 1, Part I read, *How strongly do you believe you can solve the following problem?...275-121=?* The problem was designed as a simple subtraction problem that most eighth grade mathematics students **should** be able to solve, i.e. simple arithmetic. The mean for this question was 8.72 as can be seen in Table C.1, therefore, students had strong beliefs that they could solve the problem. Conversely, the lower the mean score on the measure, the more uncertainty students had in their abilities to solve the problem. Question 7, Part I read, *How strongly do you believe you can solve the following system of linear equations?... $y = x$  and  $y = 3x-4$ ?* The problem was designed as a difficult problem most eighth grade mathematics students **would not** be able to solve. The mean for this question was 4.87 as can be seen in Table C.1. Students had weak beliefs in their abilities to solve this problem.

#### Academic Efficacy Motivation and Persistence Index (AEMPI)

Descriptive statistics for each item on the 5-item AEMPI measure are shown in Table C.1. Item means, standard deviations, and M%Max are reported for each item of the AEMPI. All items on the AEMPI were scored using a 10-point frequency scale. A score of zero meant the Math Problem/Factor/Event/Condition was not very difficult to

accomplish or it required little or no effort. A score of 9 meant the Math Problem/Factor/Event/Condition/Belief was very hard to accomplish or required a very strong effort. The higher the mean score on the measure greater the contribution to students' motivation and persistence to complete mathematics tasks.

The five items on the AEMPI had mean scores that varied from 5.47 to 6.69 as shown in Table C.1. Question 1, Part II read, *How hard do you work...to solve problems in school?* This question was designed to explore the amount of effort mathematics students *would* be willing to expend to solve problems or participate in class activities. The mean for this question was 5.47 as can be seen in Table C.1, indicating students were willing to work hard in class. Likewise, Question 4, Part II read, *How much effort do you put out in this class...when you try to solve math problems that are difficult to solve?* This question was designed to explore students' persistence and willingness to solve problems or to participate in class activities. The mean for this question was 6.69 as can be seen in Table C.1, therefore, students reported they put forth strong efforts in their math class.

#### Outcome Expectancy Index (OEI)

Descriptive statistics for each item on the 6-item OEI instrument are shown in Table C.1. Items on the OEI were scored using a 4-point frequency scale. A score of one meant the Factor/Event/Condition *Almost Never* occurs. A score of 4 meant the Factor/Event/Condition *Almost Always* occurs. The means for the five items ranged 1.42 (M%Max=.36) to 3.57 (M%Max=.89). The M%Max for five of the six items was .71 or greater. These results show that students' outcome expectancies were rather high.

### Mathematics Self-Efficacy Learning Environment Inventory - Home Form(MSELEI-HF)

Descriptive statistics for each item on the 18-item MSELEI-HF instrument are shown in Table C.1. Items on the MSELEI-HF were scored using a 4-point frequency scale. A score of one meant the Factor/Event/Condition almost never occurs. A score of 4 meant the Factor/Event/Condition almost always occurs. The higher the mean score on these measures the more contribution the home environmental variable is expected to contribute to the student's self-efficacy beliefs about mathematics. Question 11, Part III read, *Adults in my home encourage me...to do well in my math class*. The problem was designed to explore the affects of verbal persuasion on students' mathematics self-efficacy beliefs as shown in Table C.1. The mean for this question was 3.39 (M%Max=.85).

Conversely, the lower the mean score on the measure, the smaller the contribution to students' self-efficacy beliefs about mathematics. Question 7, Part III read, *Other children in my home show me...how to do my math homework*. The problem was designed to explore the affects of vicarious experiences within the home on the students' self-efficacy beliefs. The mean for this question was 1.61 (M%Max=.40)as can be seen in Table C.1, therefore, the students did not believe other children within the home made major contributions to their mathematics self-efficacy belief structure.

### Mathematics Self-Efficacy Learning Environment Inventory - Class Form (MSELEI-CF)

Descriptive statistics for each item on the 20-item MSELEI-CF instrument are shown in Table C.1. Items on the MSELEI-CF were scored using a 4-point frequency scale. A score of one meant the Factor/Event/Condition almost never occurs. A score



of 4 meant the Factor/Event/Condition almost always occurs. The higher the mean score on these measures the more contribution the classroom environmental variable is expected to contribute to students' self-efficacy beliefs about mathematics. Question 8, Part IV read, *My teacher shows me...the steps to follow in solving math problems*. This item was designed to explore the affects of class room vicarious experiences on students' mathematics self-efficacy beliefs. The mean for this question was 3.25 (M%Max=.81) is shown in Table C.1. The student response was very positive for this item which means the majority of the students believed their teacher provided support by modeling and showed them how to solve math problems in class.

Conversely, the lower the mean score on the measure, the smaller the contribution to students' self-efficacy beliefs about mathematics. Question 12, Part IV read, *Other children in my class encourage me...to do my math problems*. This item was designed to explore the affects of verbal persuasion by other students within the class on the students' self-efficacy beliefs. The mean for this question was 1.99 (M%Max=.50) as can be seen in Table C.1, therefore, the students did not believe other children within their class made major contributions to their mathematics self-efficacy belief structure.

### Factor Analyses

Series of factor analysis procedures were completed to test the nature of the underlying constructs explored on the five measures; i.e. SMSEI, AEMPI, OEI, MSELEI-HF, and MSELEI-CF. These analyses were completed because each of the measures were newly developed for this study. Data for students' academic self-efficacy beliefs about mathematics were collected using the SMSEI. Data for

motivation and persistence were collected using the AEMPI. Data for the learning environments were collected using the MSELEI-HF and MSELEI-CF. Data for outcome expectancies were collected using the OEI. Table B.2 in Appendix B gives an item location index for each factored measure and the subscales of that particular measure. The item numbers can be cross referenced with the item numbers on the Student Questionnaire - Form A included in Appendix A.

Initially, an unconstrained exploratory principal component factor analysis procedure was conducted to empirically establish or verify the dimensions associated with each instrument. An eigen values of 1.0 was used to terminate the extractions. Next, a single component was extracted for each measure. The communalities and component structure matrixes were checked to see which factors contributed the most to the principal component solution.

Finally, a series of orthogonal (Varimax) rotation techniques (SAS Institute, 1985) were used to iteratively extract additional factors. The overall objective was to identify a set of independent factors for students' academic self-efficacy beliefs about mathematics, student motivation and persistence, each measure of the learning environments that serve as correlates of students' academic self-efficacy beliefs, and the outcome expectancies associated with student beliefs.

Three general rules were established and utilized to interpret the results of the factor analyses. These rules were used to retain items on the factors of each measure and to select the solutions which represented the best conceptual and statistical interpretations of the data. The rules were: 1) an item should be retained if the

magnitude of the loading of that item is greater than or equal to  $r = .33$ , i.e. at least 10% of the variance in the item is in common with the factor on which it loaded; 2) the item loaded primarily on one factor and is retained on that factor; 3) if an item loads with an  $r = .33$  on more than one factor, the item is retained on the factor with the larger loading where the difference between the squared loadings ( $r^2$ ) is .10 or greater, i.e. 10% or more.

Means, standard deviations, and means expressed as percentages of the maximum possible scores on each factored measure were computed for the total sample of respondents. A summary of this information is presented in Appendix D, Table D.1 for the total sample ( $n=663$ ) and used in the discussions which follow.

#### SMSEI and AEMPI Combined Factor Analyses

In an attempt to explore the conceptual dimensions of students' mathematics self-efficacy beliefs, a series of principal components factor analysis procedures were conducted using orthogonal (Varimax) rotation techniques (SAS Institute, 1985). Item means were substituted for missing item data for a small number of cases (less than 6.0% of the total respondents) in order to maximize the number of usable cases included in the factor analyses.

Table 4.4 provides a summary of the results of the one-factor, principal components solution for the SMSEI combined with the AEMPI. Item loadings ranged from a low of .24 to a high of .76 with the 22 items loading on the single factor and 17 of the 22 items loading at or exceeding .50. The results of the one factor solution explained approximately 33% of the total variance in the data.

Table 4.5 provides a summary of the results of the four-factor, principal components solution for the SMSEI combined with the AEMPI. A review of the orthogonal, rotated factor pattern/structure coefficients for the two- through four-factor solutions for the SMSEI revealed the four-factor orthogonal solution represented the best conceptual and statistical fit. Twenty-one of the twenty-two items loaded on one of the factors using the initial criteria established for item retention. Item loadings ranged from .61 to .84 for Factor I, .56 to .84 for Factor II, .57 to .88 for Factor III, and .46 to .85 for Factor IV. The results of the four-factor solution explained approximately 61% of the total variance in the data.

Factor I, Fractions, consisted of six items and accounted for 33% of the variance in the solution. This factor captured the students' beliefs in their abilities to perform specific mathematical computations involving fractions, whole numbers, mixed numbers and decimal percentages. The problems were designed to provide an eighth grade student with marginal difficulties in determining mathematical solutions to the prescribed problems.

Factor II, Arithmetic, was composed of six items and accounted for 13% of the variance in the solution. This factor pertained to students' beliefs in their abilities to perform simple arithmetic computations, i.e. addition, subtraction, multiplication and division. The problems were designed to provide an eighth grade student with minimal difficulties in performing these operations.

Factor III, Motivation and Persistence, was comprised of five items and accounted for 9% of the variance in the solution. The items associated with this factor

Table 4.4

**Summary of Factor Pattern Coefficients (1-Factor Solution) for the  
Student Mathematics Self-Efficacy Inventory (SMSEI) Combined with the  
Academic Efficacy Motivation and Persistence Index (AEMPI) (n=663)**

Item <sup>a</sup>	Communality Estimates <sup>b</sup>	1- Factor <sup>c</sup>
<b>SMSEI:</b>		
1	.30	.55
2	.37	.61
3	.23	.48
4	.34	.59
5	.46	.68
6	.43	.66
7	.28	.53
8	.26	.51
9	.45	.67
10	.45	.67
11	.51	.71
12	.52	.72
13	.36	.60
14	.27	.52
15	.51	.71
16	.58	.76
17	.27	.24
<b>AEMPI:</b>		
1	.06	.24
2	.07	.27
3	.08	.30
4	.25	.50
5	.26	.51
<b>Variance Explained<sup>d</sup> = 33.13</b>		
<sup>a</sup>	SMSEI and AEMPI item number on the original instrument	
<sup>b</sup>	Sum of squared loadings for this one-factor solution	
<sup>c</sup>	Principal components solution	
<sup>d</sup>	Expressed as a percentage of explained variance in the data by the solution	

Table 4.5

Summary of Rotated Factor Component Coefficients for the Four-Factor Orthogonal Solution of the Student Mathematics Self-Efficacy Inventory (SMSEI) Combined with the Academic Efficacy Motivation and Persistence Index (AEMPI) (n=663)

	Item <sup>a</sup>	Communality Estimates <sup>b</sup>	Factor Coefficients			
			I	II	III	IV
SMSEI:	1	.71	.07	<b>.84</b>	.08	.05
	2	.62	.19	<b>.76</b>	.06	.12
	3	.33	.30	.15	.02	<b>.46</b>
	4	.63	.10	<b>.76</b>	.09	.17
	5*	.52	.35	.44	.05	.45
	6	.51	.42	<b>.56</b>	.06	.12
	7	.77	.18	.05	.10	<b>.85</b>
	8	.76	.13	.08	.09	<b>.85</b>
	9	.50	<b>.61</b>	.27	.11	.19
	10	.62	<b>.76</b>	.14	.08	.16
	11	.75	<b>.84</b>	.15	.07	.13
	12	.71	<b>.80</b>	.20	.01	.17
	13	.54	.25	<b>.69</b>	.13	.06
	14	.50	.19	<b>.66</b>	.15	-.04
	15	.63	<b>.71</b>	.18	.06	.29
	16	.70	<b>.76</b>	.24	.09	.22
	17	.49	.37	.04	.02	<b>.59</b>
AEMPI:	1	.72	-.06	.05	<b>.84</b>	.03
	2	.77	.01	.03	<b>.88</b>	.00
	3	.73	.03	.12	<b>.84</b>	-.07
	4	.53	.20	.20	<b>.65</b>	.16
	5	.47	.24	.16	<b>.57</b>	.26
Variance Explained <sup>c</sup>			33.13	12.58	9.43	6.18
Variance Explained <sup>d</sup> = 61.32						
(Four-factor solution)						

**Bold type** indicates item/factor location

\* Item loading does not meet original criteria established for item retention

<sup>a</sup> SMSEI and AEMPI item number on the original instrument

<sup>b</sup> Sum of squared loadings for this four-factor solution

<sup>c</sup> Expressed as a percentage of explained variance in the data by each factor in the four-factor solution

<sup>d</sup> Expressed as a percentage of explained variance in the data by the four-factor orthogonal solution

were designed to assess students' motivation and persistence to perform mathematical operations and develop solutions to eighth grade math problems. The items did not consist of math problems like the other 17 items but were composed of questions which explored the qualities of effort and persistence to complete the mathematical tasks. The items five items factored separately from the other 17.

Factor IV, Equations, was comprised of four items and accounted for 6% of the variance in the solution. With this factor, a measure of the students' beliefs in their abilities to perform complicated mathematical operations and solutions to problems requiring higher order thinking skills was established. The problems were designed to provide an eighth grade student with maximum difficulties in determining a solution.

The combination of the SMSEI and AEMPI items was an attempt to determine if there were statistical fits within the items which were designed conceptually and theoretically. The four-factor solution showed the items fit together along the same boundaries they had been designed, therefore, the solution which will be used in additional analyses will utilize the SMSEI and AEMPI as two separate entities.

#### SMSEI Factor Analyses

In an attempt to explore the conceptual dimensions of students' mathematics self-efficacy beliefs, a series of principal components factor analysis procedures was completed using orthogonal (Varimax) rotation techniques (SAS Institute, 1985). Item means were substituted for missing item data for a small number of cases (less than 3.0%) in order to maximize the number of usable cases included in the factor analyses.

Table 4.6 provides a summary of the results of the one-factor, principal components solution for the SMSEI. Item loadings ranged from .50 to .78 with the 17

Items loading on the single factor and all items loading at or exceeding .50. The results of the one factor solution explained approximately 40% of the total variance in the data.

Table 4.7 provides a summary of the results of the three-factor, principal components solution for the SMSEI. A review of the orthogonal, rotated factor structure coefficients for the two- and three-factor solutions for the SMSEI revealed the three-factor orthogonal solution represented the best conceptual and statistical fit. Sixteen of the seventeen items loaded on one of the three factors using the initial criteria established for item retention. Item loadings ranged from .46 to .87. The results of the three-factor solution explained approximately 61% of the total variance in the data.

Factor I, Fractions, consisted of six items and accounted for 40% of the variance in the solution. This factor captured students' beliefs in their abilities to perform specific mathematical computations involving fractions, whole numbers, mixed numbers and decimal percentages. The problems were designed to provide an eighth grade student with marginal difficulties in determining mathematical solutions to the prescribed problems.

Factor II, Arithmetic, was composed of six items and accounted for 13% of the variance in the solution. This factor pertained to students' beliefs in their abilities to perform simple arithmetic computations, i.e. addition, subtraction, multiplication and division. The problems were designed to provide an eighth grade student with minimal difficulties in performing these operations.

Factor III, Equations, was comprised of four items and accounted for 8% of the variance in the solution. With this factor, a measure of the students' beliefs in their abilities to perform complicated mathematical operations and solutions to problems



Table 4.6

**Summary of Factor Pattern Coefficients (1-Factor Solution) for the Student Mathematics Self-Efficacy Inventory (SMSEI) (n=663)**

SMSEI Item <sup>a</sup>	Communality Estimates <sup>b</sup>	1- Factor <sup>c</sup>
1	.30	.54
2	.38	.61
3	.25	.50
4	.34	.59
5	.47	.69
6	.44	.66
7	.28	.53
8	.26	.51
9	.46	.68
10	.47	.69
11	.54	.74
12	.56	.75
13	.36	.60
14	.26	.51
15	.54	.73
16	.60	.78
17	.29	.54

Variance Explained<sup>d</sup> = 39.91

- 
- <sup>a</sup> SMSEI item number on the original instrument  
<sup>b</sup> Sum of squared loadings for this one-factor solution  
<sup>c</sup> Principal components solution  
<sup>d</sup> Expressed as a percentage of explained variance in the data by the solution

Table 4.7

**Summary of Rotated Factor Component Coefficients for the  
Three Factor Orthogonal Solution of the  
Student Mathematics Self-Efficacy Inventory (SMSEI) (n=663)**

SMSEI Item <sup>a</sup>	Communality Estimates <sup>b</sup>	Factor Coefficients		
		I	II	III
1	.70	.00	<b>.83</b>	.00
2	.61	.20	<b>.75</b>	.11
3	.32	.31	.14	<b>.46</b>
4	.63	.11	<b>.76</b>	.18
5*	.51	.35	.43	.44
6	.51	.42	<b>.56</b>	.12
7	.78	.17	.00	<b>.87</b>
8	.77	.12	.00	<b>.87</b>
9	.49	<b>.61</b>	.28	.21
10	.62	<b>.75</b>	.15	.17
11	.75	<b>.84</b>	.15	.14
12	.71	<b>.80</b>	.20	.19
13	.55	.23	<b>.70</b>	.00
14	.51	.18	<b>.69</b>	.00
15	.63	<b>.71</b>	.19	.30
16	.70	<b>.76</b>	.25	.24
17	.49	.37	.00	<b>.59</b>
Variance Explained <sup>c</sup>		39.91	12.55	8.05

Variance Explained<sup>d</sup> = 60.51  
(Three-factor solution)

**Bold type** indicates item/factor location

\* Item loading does not meet original criteria established for item retention

<sup>a</sup> SMSEI item number on the original instrument

<sup>b</sup> Sum of squared loadings for this three-factor solution

<sup>c</sup> Expressed as a percentage of explained variance in the data by each factor in the three-factor solution

<sup>d</sup> Expressed as a percentage of explained variance in the data by the three-factor orthogonal solution

requiring higher order thinking skills was established. The problems were designed to provide an eighth grade student with maximum difficulties in determining a solution.

Table D.1 in Appendix D provides a summary of the M, SD, and M%Max. The results of the items on the SMSEI indicate:

- a. The less difficult and easy mathematics problems were viewed by the students as easy to solve. Data in Table D.1 shows the students had very strong beliefs that they would be able to solve the less difficult problems (arithmetic,  $M=51.25$ ,  $M\% \text{ Max}=.95$ ).
- b. As the problems increased in difficulty (fractions,  $M=40.54$ ,  $M\% \text{ Max}=.75$  and equations,  $M=21.20$ ,  $M\% \text{ Max}=.59$ ) the data in Table D.1 revealed the students' beliefs in their abilities to solve the problem diminished.

#### AEMPI Factor Analyses

To explore the conceptual dimensions of students' academic motivation and persistence, a series of principal components factor analysis procedures were conducted using orthogonal (Varimax) rotation techniques (SAS Institute, 1985). Item means were substituted for missing item data for a small number of cases (less than 6.0%) in order to maximize the number of usable cases included in the factor analyses.

Table 4.8 provides a summary of the results of the one-factor, principal components solution for the AEMPI. Item loadings ranged from a low of .65 to a high of .85 with the 5 items loading on the single factor and all items loading at or exceeding .50. The results of the one-factor solution explained approximately 61% of the total variance in the data.

When the five items on the AEMPI are interpreted as a single factor, motivation, the items received moderate student responses with a mean of 30.50, a SD of 10.36, and  $M\%Max = .68$ . Refer to Table D.1 for the single factor results.

Table 4.9 provides a summary of the results of the two-factor, principal components solution for the AEMPI. A review of the orthogonal, rotated factor pattern/structure coefficients for the one- and two-factor solutions for the AEMPI revealed the two-factor orthogonal solution represented the best conceptual and statistical fit. All 5 items loaded on one of the two factors using the initial criteria established for item retention. Item loadings for a Factor I ranged from a low of .85 to a high of .88 and from a low of .86 to a high of .90 for Factor II. The results of the two-factor solution explained approximately 81% of the total variance in the data.

Factor I, Effort, was designed to explore the amount of energy students feel they exerted to learn mathematics and solve the problems which are assigned. The factor was composed of three items which provided 61% of the total variance in the solution.

Factor II, Persistence, investigated the ability and effort associated with students hanging-in-there to accomplish a mathematical goal or end even. The factor incorporated two items which explained 20% of the total variance in the solution..

When data for self-efficacy motivation was interpreted as two factors:

- a. Factor 1, Effort, the effort to accomplish a task or the amount of effort mathematics students *would* be willing to expend to solve problems or participate in class activities. This factor was composed of questions similar to Question 1, Part II which read, **How hard do you work...to solve problems in**

Table 4.8

**Summary of Factor Pattern Coefficients (1-Factor Solution) for the Academic Efficacy Motivation and Persistence Index (AEMPI) (n=663)**

AEMPI Item <sup>a</sup>	Communality Estimates <sup>b</sup>	1 Factor <sup>c</sup>
1	.67	.82
2	.73	.85
3	.69	.83
4	.52	.72
5	.43	.65

Variance Explained<sup>d</sup> = 60.78

- 
- |              |   |
|--------------|---|
| <sup>a</sup> | AEMPI item number on the original instrument                                |
| <sup>b</sup> | Sum of squared loadings for this one-factor solution                        |
| <sup>c</sup> | Principal components solution   |
| <sup>d</sup> | Expressed as a percentage of explained variance in the data by the solution |

Table 4.9

Summary of Rotated Factor Component Coefficients for the  
Two-Factor Orthogonal Solution of the  
Academic Efficacy Motivation and Persistence Index (AEMPI) (n=663)

AEMPI Item <sup>a</sup>	Communality Estimates <sup>b</sup>	Factor Coefficients	
		I	II
1	.77	<b>.85</b>	.22
2	.83	<b>.88</b>	.24
3	.81	<b>.88</b>	.19
4	.81	.28	<b>.86</b>
5	.84	.16	<b>.90</b>
Variance Explained <sup>c</sup>		60.78	20.45
Variance Explained <sup>d</sup> = 81.23 (Two-factor solution)			

**Bold type** indicates item/factor location

\* Item loading does not meet original criteria established for item retention

<sup>a</sup> AEMPI item number on the original instrument

<sup>b</sup> Sum of squared loadings for this two-factor solution

<sup>c</sup> Expressed as a percentage of explained variance in the data by each factor in the two-factor solution

<sup>d</sup> Expressed as a percentage of explained variance in the data by the two-factor orthogonal solution

**school?** The items received moderate student responses with a mean of 17.34 and  $M\%Max = .64$ .

b. Factor 2, Persistence, the persistence and willingness of students to hang-in-there to solve problems or participate in class activities. This factor consisted of questions similar to Question 4, Part II which read, **How much effort do you put out in this class...when you try to solve math problems that are difficult to solve?** The students still reported moderate responses with a means of 13.06 and  $M\%Max = .73$ .

A summary of the results of the responses to the questions on the AEMPI are presented in Table D.1. This table shows the M, SD, and  $M\%Max$  of each factored subscale. The summary results indicate the following:

- a. When the five items are interpreted as a single factor, motivation, student responses to the data are moderate ( $M=30.5$ ,  $M\%Max=.68$ ). This can be construed as the students reporting they expend strong effort to accomplish their mathematical tasks.
- b. Using the two-factor interpretation, effort and persistence factor, the persistence factor ( $M=13.06$ ,  $M\%Max = .73$ ), the perceptions of the students to **hang-in-there** to accomplish the mathematical task provided a stronger response than the effort factor ( $M=17.34$ ,  $M\%Max=.64$ ), the energy which is expended to accomplish the mathematical task.

#### OEI Factor Analyses

In an attempt to explore the conceptual dimensions of students' expectancies associated with the outcomes of their mathematics self-efficacy beliefs, a series of

principal components factor analysis procedures were conducted using orthogonal (Varimax) rotation techniques (SAS Institute, 1985). Item means were substituted for missing item data for a small number of cases (less than 6.0%) in order to maximize the number of usable cases included in the factor analyses.

Table 4.10 provides a summary of the results of the one-factor, principal components solution for the OEI. Item loadings ranged from .08 to .81 with the 6 items loading on the single factor and 5 items loading at or exceeding .50. The results of the one-factor solution explained approximately 45% of the total variance in the data.

Table 4.11 provides a summary of the results of the two-factor, principal components solution for the OEI. A review of the orthogonal, rotated factor structure coefficients for the one- and two-factor solutions for the OEI revealed the two-factor orthogonal solution represented the best conceptual and statistical fit. Five of the six items loaded on a single factor using the initial criteria established for item retention. Item loadings for Factor I ranged from .68 to .80. Factor II was composed of a single item with a loading of .97. The results of the two-factor solution explained approximately 63% of the total variance in the data. After a more detailed analysis of the I and II factor solutions, it was determined that a single factor composed of the five items associated with Factor I should be retained. Item 2 which explored the hostility encountered from friends did not conform to the theory incorporated in the other five items and was eliminated for this reason of nonconformity.

The results indicate:

- a. Item 2 did not meet the requirements for retention on a factor which was established in Chapter 3.



Table 4.10

Summary of Factor Pattern Coefficients (1-Factor Solution) for the Outcome Expectancy Index (OEI) (n=663)

OEI Item <sup>a</sup>	Communality Estimates <sup>b</sup>	1 Factor <sup>c</sup>
1	.65	.81
2	.01	.08
3	.48	.69
4	.48	.69
5	.65	.81
6	.46	.68

Variance Explained<sup>d</sup> = 45.46

- 
- <sup>a</sup> OEI item number on the original instrument  
<sup>b</sup> Sum of squared loadings for this one-factor solution  
<sup>c</sup> Principal components solution  
<sup>d</sup> Expressed as a percentage of explained variance in the data by the solution

Table 4.11

**Summary of Rotated Factor Component Coefficients for the  
Two-Factor Orthogonal Solution of the  
Outcome Expectancy Index (OEI) (n=663)**

OEI Item <sup>a</sup>	Communality Estimates <sup>b</sup>	Factor Coefficients	
		I	II
1	.65	<b>.80</b>	.09
2*	.95	.04	<b>.97</b>
3	.48	<b>.69</b>	-.02
4	.55	<b>.70</b>	-.24
5	.65	<b>.80</b>	.09
6	.47	<b>.68</b>	.10
Variance Explained <sup>c</sup>		45.46	17.07
Variance Explained <sup>d</sup> = 62.53 (Two-factor solution)			

**Bold type** indicates item/factor location

\* Item loading meet original criteria established for item retention but the item was eliminated because of nonconformity to theory

<sup>a</sup> OEI item number on the original instrument

<sup>b</sup> Sum of squared loadings for this two-factor solution

<sup>c</sup> Expressed as a percentage of explained variance in the data by each factor in the two-factor solution

<sup>d</sup> Expressed as a percentage of explained variance in the data by the two-factor orthogonal solution

- b. The mean for the other five items which factored was 15.68, Table D.1.
- c. The data revealed the students' outcome expectancies were rather high (M%Max=.78).

### MSELEI-HF Factor Analyses

In an attempt to explore the conceptual dimensions of the antecedents of mathematics students' self-efficacy beliefs as they relate to the home learning environment, a series of principal components factor analysis procedures were conducted using orthogonal (Varimax) rotation techniques (SAS Institute, 1985). Item means were substituted for missing item data for a small number of cases (less than 5.0%) in order to maximize the number of usable cases included in the factor analyses.

Table 4.12 provides a summary of the results of the one factor, principal components solution for the MSELEI-HF. Item loadings ranged from .01 to .78 with the 18 items loading on the single factor and 12 items loading at or exceeding .50. The results of the one factor solution explained approximately 28% of the total variance in the data.

Table 4.13 provides a summary of the results of the three factor, principal components solution for the MSELEI-HF. A review of the orthogonal, rotated factor structure coefficients for the two- and three-factor solutions for the MSELEI-HF revealed the three-factor orthogonal solution represented the best conceptual and statistical fit. Sixteen of the eighteen items loaded on a single factor using the initial criteria established for item retention. The factors and their associated items provide an index of the home learning environment variables (HLEI) which students believe

Table 4.12

**Summary of Factor Pattern Coefficients (1-Factor Solution) for the  
Mathematics Self-Efficacy Learning Environment - Home Form (MSELEI-HF) (n=663)**

MSELEI-HF Item <sup>a</sup>	Communality Estimates <sup>b</sup>	1- Factor <sup>c</sup>
1	.05	.23
2	.00	.01
3	.01	.12
4	.47	.68
5	.54	.74
6	.56	.75
7	.20	.45
8	.45	.67
9	.29	.54
10	.36	.60
11	.37	.61
12	.27	.52
13	.57	.78
14	.00	.25
15	.30	.55
16	.25	.50
17	.28	.53
18	.05	.22

Variance Explained<sup>d</sup> = 28.25

- 
- <sup>a</sup> MSELEI-HF item number on the original instrument  
<sup>b</sup> Sum of squared loadings for this one-factor solution  
<sup>c</sup> Principal components solution  
<sup>d</sup> Expressed as a percentage of explained variance in the data by the solution

Table 4.13

**Summary of Rotated Factor Component Coefficients for the  
Three-Factor Orthogonal Solution of the  
Mathematics Self-Efficacy Learning Environment - Home Form (MSELEI-HF) (n=663)**

MSELEI-HF Item <sup>a</sup>	Communality Estimates <sup>b</sup>	Factor Coefficients		
		I	II	III
1*	.31	.08	.36	-.42
2	.41	-.13	.26	<b>-.57</b>
3	.42	.10	-.04	<b>.64</b>
4	.54	<b>.71</b>	.19	-.04
5	.67	<b>.80</b>	.15	-.05
6	.69	<b>.82</b>	.14	.00
7	.31	<b>.51</b>	.02	.22
8	.59	<b>.76</b>	.07	.09
9	.40	<b>.63</b>	.04	.02
10*	.37	.42	.44	.06
11	.49	.39	<b>.55</b>	-.21
12	.27	<b>.41</b>	.32	.05
13	.57	<b>.63</b>	.42	.03
14	.63	.02	.28	<b>.74</b>
15	.59	.15	<b>.76</b>	-.04
16	.55	.11	<b>.73</b>	.03
17	.60	.11	<b>.75</b>	.17
18	.59	-.03	.31	<b>.71</b>
Variance Explained <sup>c</sup>		28.25	11.52	10.29
Variance Explained <sup>d</sup> = 50.06 (Three-factor solution)				

---

**Bold type** indicates item/factor location

\* Item loading does not meet original criteria established for item retention

<sup>a</sup> MSELEI-HF item number on the original instrument

<sup>b</sup> Sum of squared loadings for this three-factor solution

<sup>c</sup> Expressed as a percentage of explained variance in the data by each factor in the three-factor solution

<sup>d</sup> Expressed as a percentage of explained variance in the data by the three-factor orthogonal solution

provide support and reinforce their self-efficacy beliefs about mathematics. The sixteen items followed Bandura's (1982, 1993, 1997) theory of self-efficacy (i.e. the items were conceptually developed along the four sources of efficacy, enactive mastery experiences, vicarious experiences, verbal persuasion, and physiological/affective states). Item loadings for each factor ranged from .41 to .82 for Factor I, .55 to .76 for Factor II, and -.57 to .74 for Factor III. The results of the three-factor solution explained approximately 50% of the total variance in the solution.

Factor I, Home Support, inquired about the support students' feel they receive from within the home which aids in their pursuits of academic excellence in mathematics. This support comes from parents, grandparents, guardians, and other siblings as the student attempts and completes their home work. The factor was composed of eight items which explained 28% of the total variance in the solution.

Factor II, Home/Positive Affect, pursued students' feelings of the positive factors they believe help them accomplish their mathematical goal or tasks. This factor incorporated four items which were conceptually developed along the four sources of efficacy and explained 12% of the total variance in the solution.

Factor III, Home/Negative Affect, provided some considerations of the things students believed hindered them from accomplishing their mathematical goals or solutions to problems. The factor was constructed of four items which followed the theory of self-efficacy and explained 10% of the total variance in the solution.

A summary of the results of the responses to the questions on the AEMPI are presented in Table D.1. This table shows the M, SD, and M%Max of each factored subscale. The summary results indicate the following:

- a. The three home environmental factors make reasonable contributions to the mathematical belief structure of eighth grade mathematics students, home support ( $M=18.44$ ,  $M\%Max=.58$ ), the negative affects of the home environment ( $M=11.16$ ,  $M\%Max=.70$ ), and the positive affects of the home environment ( $M=12.15$ ,  $M\%Max=.76$ ), Table D.1.
- b. The positive and negative affects of the home environment are the greatest contributors to students' academic self-efficacy beliefs and provide equal affect ( $M\%Max=.76$  and  $.70$ , respectively), Table D.1.

#### MSELEI-CF Factor Analyses

In an attempt to explore the conceptual dimensions of the antecedents of mathematics students' self-efficacy beliefs as they relate to the classroom learning environment, a series of principal components factor analysis procedures were conducted using orthogonal (Varimax) rotation techniques (SAS Institute, 1985). Item means were substituted for missing item data for a small number of cases (less than 6.0%) in order to maximize the number of usable cases included in the factor analyses.

Table 4.14 provides a summary of the results of the one factor, principal components solution for the MSELEI-CF. Item loadings ranged from .17 to .68 with the 20 items loading on the single factor and 9 items loading at or exceeding .50. The results of the one factor solution explained approximately 26% of the total variance in the data.

Table 4.15 provides a summary of the results of the five-factor, principal components solution for the MSELEI-CF. A review of the orthogonal, rotated factor

Table 4.14

**Summary of Factor Pattern Coefficients (1-Factor Solution) for the Mathematics Self-Efficacy Learning Environment - Class Form (MSELEI-CF) (n=663)**

MSELEI-CF Item <sup>a</sup>	Communality Estimates <sup>b</sup>	1- Factor <sup>c</sup>
1	.07	.27
2	.03	.18
3	.03	.17
4	.23	.48
5	.29	.54
6	.24	.49
7	.21	.46
8	.25	.50
9	.17	.41
10	.46	.68
11	.41	.64
12	.34	.58
13	.45	.67
14	.22	.47
15	.42	.65
16	.37	.61
17	.41	.64
18	.20	.45
19	.23	.48
20	.13	.37

Variance Explained<sup>d</sup> = 25.84

- 
- <sup>a</sup> MSELEI-CF item number on the original instrument  
<sup>b</sup> Sum of squared loadings for this one-factor solution  
<sup>c</sup> Principal components solution  
<sup>d</sup> Expressed as a percentage of explained variance in the data by the solution



Table 4.15

Summary of Rotated Factor Component Coefficients for the  
Five-Factor Orthogonal Solution of the  
Mathematics Self-Efficacy Learning Environment - Class Form (MSELEI-CF) (n=663)

MSELEI-CF Item <sup>a</sup>	Communality Estimates <sup>b</sup>	Factor Coefficients				
		I	II	III	IV	V
1	.64	.22	-.23	.06	<b>.73</b>	-.00
2	.64	.07	-.17	-.02	<b>.78</b>	.03
3	.47	.00	<b>.50</b>	-.10	-.33	.32
4	.44	<b>.61</b>	-.07	.10	.23	.01
5	.61	<b>.77</b>	.02	.03	.10	-.03
6*	.56	.51	-.03	.12	.52	-.06
7	.66	.13	.11	.09	-.02	<b>.79</b>
8	.51	<b>.71</b>	.01	.02	-.00	.06
9	.62	.04	.36	.02	-.05	<b>.70</b>
10	.54	<b>.64</b>	.10	.26	.06	.23
11	.57	<b>.72</b>	.01	.11	.11	.16
12	.62	.23	.06	.23	.16	<b>.70</b>
13	.54	<b>.64</b>	.12	.21	.09	.23
14	.67	.05	<b>.77</b>	.24	-.00	.12
15	.76	.19	.16	<b>.83</b>	.10	.09
16	.75	.21	.10	<b>.83</b>	.02	.04
17	.75	.11	.22	<b>.81</b>	.09	.18
18	.73	.02	<b>.83</b>	.22	.00	.06
19**	.49	.14	.36	.18	<b>.55</b>	.11
20	.57	.07	<b>.71</b>	.08	-.17	.18
Variance Explained <sup>c</sup>		25.84	15.62	7.89	6.09	5.22
Variance Explained <sup>d</sup>	= 60.66					
(Five-factor solution)						

**Bold type** indicates item/factor location

\* Item loading does not meet original criteria established for item retention

\*\* Item loading meet original criteria established for item retention but the item was eliminated because of nonconformity to theory

<sup>a</sup> MSELEI-CF item number on the original instrument

<sup>b</sup> Sum of squared loadings for this three-factor solution

<sup>c</sup> Expressed as a percentage of explained variance in the data by each factor in the five-factor solution

<sup>d</sup> Expressed as a percentage of explained variance in the data by the five-factor orthogonal solution

structure coefficients for the two- through five-factor solutions for the MSELEI-CF revealed the five-factor orthogonal solution represented the best conceptual and statistical fit. Eighteen of the twenty items loaded on a factor using the initial criteria established for item retention. The eighteen items followed Bandura's (1982, 1993, 1997) theory of self-efficacy previously discussed. Item loadings for each factor ranged from .61 to .77 for Factor I, .50 to .83 for Factor II, .81 to .83 for Factor III, .55 to .78 for Factor IV, and .70 to .79 for Factor V. The results of the five-factor solution explained approximately 61% of the total variance in the data.

Factor I, Teacher Modeling, inquired about the support, directions, and encouragement students feel they receive in their pursuits of academic excellence in mathematics as they attempt and complete their classroom work. The factor was composed of eight items which addressed the theory of self-efficacy and explained 26% of the total variance in the solution.

Factor II, Class/Negative Affect, provided some considerations of the things students' believed hindered them from accomplishing their mathematical goals or solutions to problems. This factor was constructed of four items which explained 16% of the total variance in the solution.

Factor III, Class/Positive Affect, pursued students' feelings of the positive factors they believed help them accomplish their mathematical goals or tasks. The factor incorporated four items which explained 8% of the total variance in the solution.

Factor IV, Student Independence, was comprised of the things students believed enhanced their abilities to achieve their mathematical goal or solutions to problems.

The factor consisted of four items conceptually and theoretically defined and which explained 6% of the total variance in the solution.

Factor V, Student Models, provided some considerations of the things students believed helped them accomplish their mathematical tasks or provided solutions to their mathematical problems. The factor included four items which explained 5% of the total variance in the solution.

A summary of the results of the responses to the questions on the AEMPI are presented in Table D.1. As noted in the table, the M%Max score was calculated by dividing a subscale mean by the maximum possible score of the subscale. This table shows the M, SD, and M%Max of each factored subscale. The summary results indicate the following:

- a. The five classroom environmental factors contribute to the mathematical belief structure of eighth grade mathematics students, teacher modeling (M=17.65, M%Max= .74), the negative affects of the classroom environment (M=10.91, M%Max= .68), the positive affects of the classroom environment (M=8.82, M%Max= .74), student independence (M=5.48, M%Max= .69), and student models (M=6.46, M%Max= .54), Table D.1.
- b. Teacher modeling and the positive affects of the classroom environment are the greatest contributors and provide equal affect (M%Max=.74 and .74, respectively), Table D.1.
- c. Student independence and the negative affects of the classroom provide equal contributions (M%Max=.69 and .68, respectively), Table D.1.

## Reliability Analyses

Cronbach alpha reliability analyses were used to examine the internal consistencies of each measure, i.e., the SMSEI, AEMPI, OEI, MSELEI-HF, and MSELEI-CF. In each analysis, the individual student was used as the unit of analysis. The results are shown in Table 4.16.

Each of the factored subscales proved to have rather high Alpha coefficients ranging from .65 to .90. In order to proceed with the analyses for the primary and secondary research questions, a decision was made to explore the results of the AEMPI measure as a single factor, motivation, and as a two-factor solution, effort and persistence. There was no appreciable difference in the magnitude and direction of the coefficients when the two solutions were compared, therefore, the two solutions were retained. Both factors conformed to the overall theory of self-efficacy and had been conceptually designed along this theoretically frame. It was desired to explore the conceptual significance of the two aspects of this construct.

### Summary of Analyses for the Primary Research Questions

Four primary research questions were delineated in Chapter 1. These questions pertained to bivariate and multivariate relationships between students' self-efficacy beliefs in mathematics and their perceptions of the home and classroom learning environments. Also of interest was the extent to which efficacy outcome expectations accounted for levels of efficacy motivation (effort and persistence) over and above academic self-efficacy beliefs (Arithmetic, Fractions, Equations) analyses for the study. Results of the analyses are presented in the sections which follow.

**Table 4.16**  
**Summary of Standardized Alpha Reliability Coefficients for all**  
**Subscales of the SMSEI, AEMPI, OEI, MSELEI-HF, and MSELEI-CF for Students**  
**(n=663)**

Instrument/Subscale	Alpha Coefficient
SMSEI (16) <sup>a</sup>	
Arithmetic (6) <sup>b</sup>	.84
Fractions (6)	.90
Equations (4)	.75
AEMPI (5)	.84
AEMPI (5)	
Effort (3)	.88
Persistence (2)	.78
OEI (5)	.79
MSELEI - HF (16)	
Home Support (8)	.85
Home/Positive Affect (4)	.75
Home/Negative Affect (4)	.65
MSELEI - CF (18)	
Teacher Modeling (6)	.81
Class/Negative Affect (4)	.76
Class/Positive Affect (3)	.84
Student Independence (2)	.67
Student Models (3)	.69
<sup>a</sup> Total number of items on the instrument	
<sup>b</sup> Number of items on Instrument Subscales	

### Primary Research Question 1

From the perspective of self-efficacy theory, which home learning environment characteristics are the strongest correlates of students' academic self-efficacy beliefs in mathematics?

To address Primary Research Question 1, Pearson product moment correlations were computed between the subscales of the MSELEI-HF and SMSEI using students as the units of analysis. A summary of the intercorrelations among subscales of the MSELEI-HF and SMSEI is presented in Table 4.17. These correlations show relationships between the strength of students' mathematics self-efficacy beliefs and their perceptions of characteristics of the home environment that self-efficacy theory identifies as contributing to the development and strengthening of self-efficacy beliefs. All but one of these intercorrelations were statistically significant ( $p < .01$ ), positive in direction, and rather moderate in magnitude. The largest single correlation was between the MSELEI-HF Home/Negative Affect subscale and the SMSEI Fractions subscale ( $r = -.34$ ). This correlation shows that students' self-efficacy beliefs about their capabilities to do mathematical fractions is negatively associated with home environment factors associated with students' negative feelings about doing mathematics. Considered collectively, the self-efficacy and home environment relationships shown in Table 4.17 are in the direction posited by current self-efficacy theory (Bandura, 1997).

### Primary Research Question 2

From the perspective of self-efficacy theory, which classroom learning environment characteristics are the strongest correlates of students' academic self-efficacy beliefs in mathematics?

**Table 4.17**  
**Summary of Intercorrelations Between Scores on**  
**Subscales of the MSELEI-HF, MSELEI-CF, and SMSEI Scores for All Students**  
**(n=663)**

Instrument/Subscale	SMSEI (16) <sup>a</sup>					
	Arithmetic		Fractions		Equations	
	r	n	r	n	r	n
<b>MSELEI - HF (16)<sup>b</sup></b>						
Home Support (8) <sup>c</sup>	.05**	582	.14	569	.16	584
Home/Positive Affect (4)	.14	617	.17	599	.13	620
Home/Negative Affect (4)	-.20	601	-.34	584	-.21	602
<b>MSELEI - CF (18)</b>						
Teacher Modeling (6)	.21	580	.19	565	.21	602
Class/Positive Affect (4)	.14	604	.12	586	.07**	607
Class/Negative Affect (3)	-.12	603	-.25	585	-.14	606
Student Independence (2)	.26	626	.46	608	.38	629
Student Models (3)	-.03**	601	.01**	583	.28	604

\* Unless Noted Otherwise (UNO)  $p < .01$

\*\*  $p > .01$

<sup>a</sup> Total number of items on the SMSEI

<sup>b</sup> Total number of items on the instrument

<sup>c</sup> Number of items on Instrument Subscales

To address Primary Research Question 2, Pearson product moment correlations were computed between subscales of the MSELEI-CF and SMSEI using students as the units of analysis. Table 4.17 summarizes intercorrelations among these subscales. For the table total, 12 of 15 intercorrelations were statistically significant ( $p < .01$ ). These 12 correlations were all positive in direction consistent with current conceptions of self-efficacy beliefs and environmental factors that strengthen these beliefs (Bandura, 1997). The statistically significant correlations ranged in magnitude from .46 (Student Independence with Fractions) to -.12 (Class/Negative Affect with Arithmetic). The strongest and most consistent intercorrelations between mathematics self-efficacy beliefs and the classroom environment characteristics were for the MSELEI-CF subscale of Student Independence with Arithmetic ( $r = .26$ ), Fractions ( $r = .46$ ), and Equations ( $r = .38$ ).

### Primary Research Question 3

How much of the variation in the strength of students' self-efficacy beliefs in mathematics can be explained by the combination of home and classroom learning environment sources reflecting self-efficacy theory?

To answer this research question, three separate stepwise multiple regression analyses were computed using each of the three SMSEI subscales as dependent variables (Arithmetic, Fractions, Equations) and the three factored subscales of the MSELEI-HF and the five factored subscales of the MSELEI-CF as an independent variables set. For the first analysis (Arithmetic as the dependent variable), three environment variables were statistically significant ( $p < .001$ ) in the regression model.



These three variables in the order of importance (variance explained by each variable) were as follows: Student Independence (7.5%), Teacher Modeling (1.7%), and Home Negative Affect (0.8%). However, these three variables only accounted for a total of 10% of the variation in mathematics self-efficacy beliefs (Arithmetic) ( $R=.316$ ,  $df=3,471$ ).

A similar analysis using the Fractions subscale of the mathematics self-efficacy beliefs measure as the dependent variable generated a four variable regression model that included (in order of variance explained) the following class and home learning environment variables: Student Independence (22.6%), Home/Negative Affect (2.9%), Home Support (1.3%), and Class/Positive Affect (0.6%). Each of these variables was statistically significant ( $p<.001$ ). This four variable model accounted for a total of 27.4% of the variation in students' mathematics self-efficacy beliefs (Fractions) ( $R=.52$ ,  $df=4,460$ ,  $p<.001$ ).

A third stepwise regression analysis was completed using the Equations subscale of the SMSEI as a dependent variable. In this analysis, only one variable was statistically significant ( $p<.001$ ) (Student Independence). This single variable accounted for 14.5% of the total variance in the model ( $R=.38$ ,  $df=1,473$ ).

#### Primary Research Question 4

How much of the variation in mathematics motivation (effort and persistence) is accounted for by outcome expectancy levels beyond that accounted for by academic self-efficacy beliefs?

To address this research question, a series of three hierarchical regression analyses was first completed using the global measure of efficacy motivation (one factor

solution of the AEMPI including effort and persistence) as a dependent variable. In these hierarchical regressions, the first variable entered (forced) into the regression equation was a particular subscale of the SMSEI (Arithmetic, Fractions, or Equations). At the second step in each regression, the OEI was entered. Of particular interest in each regression analysis was the amount of efficacy motivation (effort and persistence) accounted for by the OEI over and above that accounted for by the particular SMSEI subscale. In these analyses, the OEI (efficacy outcome expectation) measure accounted for additional percentages of AEMPI variance as follows: Arithmetic, 10%; Fractions, 11%; and Equations, 12%. Each of these three hierarchical, two-variable regression models was statistically significant ( $p < .001$ ) (Arithmetic,  $R = .42$ ,  $df = 2, 572$ ; Fractions,  $R = .40$ ,  $df = 2, 555$ ; Equations,  $R = .39$ ,  $df = 2, 575$ ), and each accounted for approximately 16% of the variation among students' self-efficacy motivation (persistence plus effort).

In addition to these regressions, a second set of hierarchical regression analyses was completed with each of the two factored subscales of the AEMPI as dependent variables (Effort and Persistence separately), and the SMSEI subscales (Arithmetic, Fractions, and Equations) and the OEI as independent variables. Of interest in these analyses, was the extent to which the OEI (self-efficacy outcome expectations) measure accounted for variation in either efficacy effort or efficacy persistence (separate elements of efficacy motivation), over and above that accounted for by a particular subscale of the SMSEI (Arithmetic, Fractions, Equations).

For the regressions using the SMSEI Effort subscale (factor) as a dependent variable, the OEI accounted for the following amounts of variation in efficacy effort over and above the SMSEI subscales as follows: Arithmetic, 5%; Fractions, 6%;

Equations, 6%. Each of these three stepwise, hierarchical, two-variable regression models was statistically significant ( $p < .001$ ) (Arithmetic,  $R = .29$ ,  $df = 2, 575$ ; Fractions,  $R = .27$ ,  $df = 2, 557$ ; Equations,  $R = .27$ ,  $df = 2, 578$ ) and accounted for a total of approximately 7% of the variation in students' levels of self-efficacy motivation (effort).

For the regressions using the SMSEI Persistence subscale (factor) as a dependent variable, the OEI accounted for the following amounts of variation in efficacy motivation over and above the SMSEI subscales as follows: Arithmetic, 14%; Fractions, 13%; Equations, 14%. Each of these three stepwise, hierarchical, two-variable regression models was statistically significant ( $p < .001$ ) (Arithmetic,  $R = .51$ ,  $df = 2, 597$ ; Fractions,  $R = .50$ ,  $df = 2, 577$ ; Equations,  $R = .49$ ,  $df = 2, 599$ ). Each of these two-variable regression models accounted for a total of approximately 24% of the variation in students' levels of self-efficacy motivation (persistence).

#### Summary of Analyses for the Supplemental Research Questions

Five supplemental research questions were delineated in Chapter 1 as possibly important to explore in additional analyses of the data. Three of the questions were suggested from rather extensive literature rather strongly linking elements of school climate, school culture, school parental involvement, and learning environments to students' socioeconomic status and academic achievement (Anderson, 1982; Douglas, 1964; Miller, 1971; Morris, 1986; Walberg, 1979; Wang et al., 1993). However, this literature did not include linkages between learning environment measures specifically developed to reflect elements of self-efficacy theory and these two variables (socioeconomic status and academic achievement).

Two of the supplemental research questions were grounded in gender studies in mathematics which reveal few differences between males and females in mathematics performance in the elementary school years, but differences in performance (achievement) favoring males over females in the middle school years. Much of the differences between males and females in mathematics performance has been explained by differences in confidence to do mathematics (Pintrich & DeGroot, 1990). Pajares (1996b) reported that much of the observed difference between male and female students in mathematics performance can be explained by self-efficacy perceptions.

Results of the analyses pertaining to the five supplemental questions are presented in the sections which follow.

#### Supplemental Research Question 1

Are there significant differences between the strength of students' academic self efficacy beliefs in mathematics when they are compared by socioeconomic status (SES)?

#### Supplemental Research Question 2

Are there significant differences between male and female students' strengths of academic self-efficacy beliefs in mathematics?

To answer the first two supplemental research questions, a 2 X 2 X 3 MANOVA design was used with three dependent variables (the Arithmetic, Fractions, and Equations factored subcales of the SMSEI) and two levels of socioeconomic status (free/reduced cost lunch or no free/reduced cost lunch) and 2 levels of gender (male and female). Results of this multivariate analysis pertinent to each of the first two supplemental research question are presented in the section that follows.

The MANOVA results showed a statistically significant ( $p < .002$ ) main effect for socioeconomic status, but not for gender. The main effect for socioeconomic status was largely accounted for by differences in students' self-efficacy beliefs in their capabilities to do mathematical fractions ( $F = 14.53$ ,  $df = 1, 567$ ,  $p < .001$ ). For this analysis, the mean and the mean expressed as a percentage of the maximum possible scale score for the Fractions subscale of the SMSEI for students receiving free/reduced cost was 38.8 (72%Max.). These same scores for students who did not qualify for free/reduced cost lunch were 43.1 (80%Max.).

While there was no main effect for gender in the MANOVA completed, mean comparisons of male and female students suggested consistent and only slightly higher mean scores favoring males over females. However, these mean differences were not large enough to be of any practical or educational significance. The interaction effect between socioeconomic status and gender was not statistically significant  $p < .60$ .

### Supplemental Research Question 3

What is the contribution of home and classroom learning environment sources of self-efficacy beliefs and SES when considered collectively to the strength of students academic self-efficacy beliefs in mathematics?

To address the third research question, a series of three stepwise regression analyses was completed (one each for each SMSEI subscale) using SES (free/reduced cost lunch) and the factored subscales of the home and classroom learning environment measures (MSELEI-HF and MSELEI-CF) as independent variables. Of particular interest in each of these regression analyses was the amount of variation students' beliefs about their capabilities to accomplish mathematical tasks (Arithmetic, Fractions,

Equations) that could be accounted for by home and classroom learning environment variables relative to that accounted for by SES.

In the first stepwise regression analysis using the Arithmetic subscale of the SMSEI as a dependent variable, the statistically significant ( $p < .001$ ) classroom and home learning environment variables (independent variables) entering the model and the amount of variance accounted for by each were as follows: Student Independence (5.3%), Home/Negative Affect (2.2%), and Class/Positive Affect (0.9%). The multiple correlation for this regression for the three variable model was  $R = .29$ ,  $df = 3, 449$ ). The SES variable was not statistically significant in this model.

In the second stepwise regression analysis using the Fractions subscale of the SMSEI as a dependent variable, the statistically significant independent variables entering the model were and the percentage of variance accounted for by each were as follows: Student Independence (20.8%), Home/Negative Affect (3.6%), SES (1.7%), Class/Positive Affect (1.5%), Home Support (0.6%). The multiple correlation for this regression for the five variable model was  $R = .53$ ,  $df = 5, 437$ . In this model, SES accounted for only 1.7% of the total variations in students' self-efficacy beliefs relative their capabilities to do mathematical Fractions.

The third stepwise regression analysis was completed using the SMSEI Equations subscale as the dependent variable and the classroom and home learning environment and SES variables as an independent variable set. In this analysis, the only variable to enter the regression was the Student Independence subscale of the SMSEI ( $R = .36$ ,  $df = 1, 451$ ). The SES variable failed to account for any variance among students' self-efficacy mathematics beliefs in this analysis.

#### Supplemental Research Question 4

Are there significant differences between male and female students' perceptions of home and classroom learning environment variables that contribute to the strength of their self-efficacy beliefs in mathematics?

A series of multivariate  $F$  tests was completed to examine whether males and females differed in their perceptions of characteristics of the classroom and home learning environment that theoretically contribute to the strength of self-efficacy beliefs in mathematics. In these analyses, five of eight comparisons were statistically significant as follows: Teacher modeling ( $p < .03$ ,  $F = 4.58$ ,  $df = 1, 483$ ), Class/Negative Affect ( $p < .002$ ,  $F = 9.33$ ,  $df = 1, 483$ ), Class/Positive Affect ( $p < .001$ ,  $F = 17.94$ ,  $df = 1, 483$ ), Home/Positive Affect ( $p < .005$ ,  $F = 8.08$ ,  $df = 1, 483$ ), and Home/Negative Affect ( $p < .018$ ,  $F = 5.68$ ,  $df = 1, 483$ ). For these five statistically significant comparisons, mean scores for males were greater than for females on Class/Negative Affect (Males = 11.54, Females = 10.65) and Home/Negative Affect (Males = 11.72, Females = 11.10). Female mean scores were greater than male mean scores for Teacher Modeling (Females = 18.01, Males = 17.16), Class/Positive Affect (Females = 9.3, Males = 8.22) and Home/Positive Affect (Females = 12.54, Males = 11.7).

#### Supplemental Research Question 5

What are the relationships between elements of the classroom learning environment and the home learning environment that are specified within current self-efficacy theory as primary sources that contribute to the development and strengthening of self-efficacy beliefs?

Table 4.18

**Summary of Intercorrelations Between Scores on  
Subscales of the MSELEI-HF and MSELEI-CF Scores for All Students (n=663)**

Instrument/Subscale	MSELE - HF (16) <sup>a</sup>					
	Home Support		Home/ Positive Affect		Home/ Negative Affect	
	r	n	r	n	r	n
<b>MSELEI - CF (18)<sup>b</sup></b>						
Teacher Modeling (6) <sup>c</sup>	.35	549	.40	578	-.01**	565
Class/Positive Affect (4)	.29	570	.73	602	-.19	586
Class/Negative Affect (3)	-.21	569	-.23	604	.73	589
Student Independence (2)	.22	590	.24	626	-.38	609
Student Models (3)	.39	565	.27	600	-.27	583
* Unless Noted Otherwise (UNO) $p < .01$ ** $p > .01$ a Total number of items on the MSELEI - HF b Total number of items on the instrument c Number of items on Instrument Subscales						



Table 4.18 includes a summary of bivariate correlations between factored subscales of the MSELEI-HF and the MSELEI-CF measures. With the exception of one correlation, all of the statistical relationships shown in the table are statistically significant ( $p < .01$ ). These correlations ranged in magnitude from rather strong ( $r = .73$ , Class/Positive Affect with Home/Positive Affect and Class/Negative Affect with Home/Negative Affect) to rather moderate ( $r = -.19$ , Class/Positive Affect with Home/Negative Affect). The correlations show that students' perceptions of negative or positive affect in the home environment are consistent with similar perceptions in the classroom environment. Students who viewed their classrooms positively relative to the various sources of self-efficacy beliefs also viewed their home environments as providing positive support and affective experiences relative to their learning of mathematics.

### Summary

Chapter 4 presented the descriptive statistics for the sample and the results of the data analyses conducted to address the primary and supplemental research questions. Descriptive summaries for the participating schools and mathematics students, summaries of the factor analyses, and summaries of measurement reliabilities were also provided.

Chapter 5 presents the major findings of the study and provides the implications for future research, theory development, and practice.

## CHAPTER 5: CONCLUSIONS, DISCUSSIONS, AND IMPLICATIONS

Chapter 5 presents the major findings of the study and provides the implications for future research, theory development, and practice. Included is a brief overview of the study, a discussion of the findings, the conclusions drawn from the data analyses, and the methodological, theoretical, and practical implications, and suggestions for future research.

### Overview of the Study

This study investigated the relationship between home and classroom learning environment characteristics and middle school students' academic self-efficacy beliefs about mathematics. Specifically, the study examined linkages between sources of efficacy in the home and classroom learning environments and the strength of students' self-efficacy beliefs in the critical curriculum area of mathematics. While numerous studies have been completed linking students' academic self-efficacy beliefs to learning and achievement (Pajares, 1996b), no studies within schools were found that examined linkages between environmental/experiential sources of self-efficacy beliefs described as important within current self-efficacy theory (Bandura, 1997).

Many studies have been completed to understand relationships between students' academic self-efficacy beliefs and academic achievement (Pajares, 1996b; Schunk, 1981, 1982). Of interest in this study was expanding our understanding of how linkages between students' self-efficacy beliefs and learning and achievement are mediated through the development and strengthening of these beliefs by classroom and home environment experiences. According to Bandura (1997), self-efficacy beliefs are

developed and strengthened through four primary sources: enactive mastery experiences, vicarious experiences (modeling), verbal persuasion, and physiological/affective states (emotional arousal). This study was designed to examine relationships between home and classroom environmental factors reflecting these four sources of self-efficacy beliefs and the strength of middle school students' self-efficacy in mathematics.

In addition, the study design incorporated measures of self-efficacy outcome expectancy and efficacy motivation. No previous studies are known that have attempted to examine students' (or others') self-efficacy beliefs from this more inclusive, conceptual and measurement perspective. Thus, this study was designed to enhance our understanding of how environmental and experiential sources of self-efficacy contribute, singularly or in combination, within and across home and school learning environments, to academic self-efficacy beliefs in eighth grade mathematics. The study also examined the roles that efficacy motivation (behavioral effort and persistence) and efficacy outcome expectations play relative to the strength of students' self-efficacy beliefs in mathematics. Because of the uniqueness and comprehensiveness of the study, it was necessary to develop original measures of each of the study variables.

The conceptual framework guiding the study is shown as Figure 3 (Chapter 1, pg. 33). This framework was developed to expand how major constructs in self-efficacy theory can be integrated and linked to student learning and achievement. The variables measured in this study and the subsequent data analyses were a first attempt to explore empirical linkages among variables in the conceptual framework. The study was

completed with 663 eighth grade students in 44 classes sampled from six schools in two urban school districts in Louisiana. A system of new measures designed to assess core elements of self-efficacy theory as described by Bandura (1997) was pre-piloted with a panel of students, teachers and others and was subsequently piloted tested with 29 students in three mathematics classes. After making adjustments and revisions to the measures, a large data set (n=663) was collected to explore primary and supplemental research questions framing the study.

A series of factor analyses and reliability analyses was completed on each of the study measures to empirically identify the measurement constructs and to refine the measures. Subsequently, bivariate and multivariate statistical tests were used to examine relationships among the measurement constructs relative to the research questions posed.

The specific results of these analyses are described in detail in the previous chapter (Chapter 4: Results). The section that follows is a synthesis of the major findings and conclusions of the study derived from the results of the data analyses, theoretical elements of current self-efficacy theory (Bandura, 1997), and recent comprehensive reviews of research on students' academic self-efficacy beliefs. More specific results pertinent to each research question framing the study follow the six major findings and conclusions.

## Major Findings and Conclusions

### Major Finding Number One

The five measures specifically developed for the study were measures of students' (a) self-efficacy beliefs in mathematics, (b) self-efficacy motivation (effort and persistence), (c) self-efficacy outcome expectations, (d) perceptions of home learning environment factors contributing to the development and strengthening of self-efficacy

beliefs, and (e) perceptions of classroom learning environment factors contributing to the development and strengthening of self-efficacy beliefs. Together, these measures represented a comprehensive assessment of core elements of self-efficacy theory, rather than a singular assessment of self-efficacy beliefs that is more typically the basis of research on self-efficacy.

The results supported the construct validity of the measures and the reliability of the use of these measures with the sample of eighth grade students. The measures were derived from existing construct definitions in self-efficacy theory (Bandura, 1997), and the results supported linkages among the variables consistent with this theory of human behavior.

#### Conclusion(s)

The measures developed in this study are reasonable operational definitions of the theoretical constructs from which they were derived. These measures can be used with confidence in future theory-based research on self-efficacy beliefs among students in mathematics, and with modifications, other academic learning contexts as well. The network of relationships established among the various measures is consistent with core concepts reflected in self-efficacy theory, and this network supports predicted relationships among the variables on which self-efficacy theory is based (triadic reciprocal causation) (Bandura, 1997).

#### Major Finding Number Two

The response format developed for the self-efficacy beliefs in mathematics measure used in this study was an original response format and it had not been used in any prior study. The results strongly supported this response format as understandable

to eighth grade students, capable of yielding reliable data, and useful in research on self-efficacy beliefs.

#### Conclusion(s)

The new response format developed for the self-efficacy beliefs measure (*How strongly do you believe you can....?*) represents a more clear and direct operational definition of the self-efficacy beliefs construct than other response formats currently being used in research on self-efficacy beliefs (e.g., *How confident are you that you can.....?*, *I feel that I can.....*, etc). The new response format is a reasonable and viable alternative for the development of new measures of self-efficacy beliefs.

#### Major Finding Number Three

The classroom and home learning environment variables, with few exceptions, were consistently correlated with the strength of student's self-efficacy beliefs in a way that is predicted by self-efficacy theory.

#### Conclusion(s)

The assumptions within self-efficacy theory (Bandura, 1997) that selected classroom and home learning environment factors contribute to the development and strengthening of academic self-efficacy beliefs are empirically verifiable. Thus, there is considerable empirical support for linkages among core environmental and experiential elements of existing self-efficacy theory and the development and strengthening of academic self-efficacy beliefs. It is likely in other research contexts, for example in studies of teacher efficacy, that the four key sources of self-efficacy beliefs in current theory (enactive mastery experiences, vicarious experiences, verbal persuasion and

physiological/affective states) can be empirically linked to the development and strength of these beliefs.

#### Major Finding Number Four

Outcome expectancy accounted for statistically significant and theoretically important amounts of variance in students' levels of efficacy motivation (effort and persistence) beyond that accounted for by the strength of their self-efficacy beliefs. This was particularly the case when students were asked about levels of persistence when faced with barriers or obstacles to successfully accomplish mathematic tasks.

#### Conclusion(s)

As currently described (Bandura, 1997), self-efficacy theory gives emphasis to the importance of efficacy outcome expectations to the development and strengthening of self-efficacy beliefs. Levels of task performance and accomplishment alone are not sufficient for motivating individuals to pursue given tasks. Outcome expectations (what accrues to an individual as a result of task performance and accomplishment) are essential to continued effort and persistence (motivation) to accomplish tasks, and are important as well in strengthening self-efficacy beliefs. The findings in this study lead to the conclusion that assumptions about the role of outcome expectations sufficient for strengthening these beliefs within self-efficacy theory are empirically verifiable.

Additionally, it is concluded that outcome expectations relative to mathematics performance can enhance students' levels of motivation (effort and persistence) beyond levels attributed to self-efficacy beliefs alone. The role of self-efficacy outcome expectations within current theory (Bandura, 1997) needs further explication relative to the

two sub-elements of self-efficacy motivation (effort and persistence) measured in this study.

#### Major Finding Number Five

There are no educationally significant differences in the strength of students' self-efficacy beliefs that can be attributed to gender or socioeconomic status.

#### Conclusions(s)

According to self-efficacy theory (Bandura, 1997) and a considerable body of research on academic self-efficacy (Pajares, 1996b), academic self-efficacy beliefs are strengthened by home and classroom environment and experiential factors. From the findings of this study it is concluded that, though these factors may exist in various combinations for different students, they can result in similar strengths of self-efficacy beliefs for male and female students, and for students receiving or not qualifying for free/reduced lunch. Past research has shown differences between male and female students in mathematics achievement. However, self-efficacy beliefs among students, while an important factor related to academic motivation and achievement (Pajares, 1996b), based on the results of this study, do not sufficiently account for differences in academic achievement between male and female students, and between students of different socioeconomic status.

#### Major Finding Number Six

The results of this study showed that socioeconomic status among students did not account for a statistically significant or practically important amount of variation among students in their self-efficacy beliefs. The combination of students' perceptions of home



and classroom learning environment characteristics and experiences deemed important within self-efficacy theory (Bandura, 1997), did, however, account for variation among students in their self-efficacy beliefs.

### Conclusions(s)

Students' perceptions of characteristics of the home and classroom learning environment that theoretically contribute to the development and strengthening of self-efficacy beliefs in mathematics are relatively independent of the socioeconomic status of students. Thus, a wide range of environmental factors that can cumulatively enhance the development of academic self-efficacy beliefs exists within different socioeconomic classes of students. Recent large-scale reviews of the academic achievement literature show that the educational quality of home and classroom learning environments is relatively independent of socioeconomic status (Wang, Haertel, & Walberg, 1993). This literature seems supported by the findings of this study. Relatively rich and relatively poor home and/or school environments can facilitate, or impede, the development and strengthening of students' academic self-efficacy beliefs.

### Specific Findings Pertinent to Research Questions

This section provides a discussion of the specific findings that are pertinent to the primary and supplemental research questions framing the study. Each research question is followed by a synthesis of appropriate statistical results addressing the question.

#### Primary Research Question 1

From the perspective of self-efficacy theory, which home learning environment characteristics are the strongest correlates of students' academic self-efficacy beliefs in mathematics?

Of the three factored subscales of the home learning environment measure specifically developed for this study (MSELEI-HF) the strongest statistically significant correlates of students' academic self-efficacy beliefs (Fractions,  $r = -.34$ ,  $p < .001$ ) were with the measure of students' *negative feelings* about their home learning environment experiences (MSELEI-HF Home/Negative Affect subscale). Thus, students with weak academic self-efficacy beliefs perceive their emotional/psychological home learning environment experiences more negatively than students with relatively stronger academic self-efficacy beliefs.

### Primary Research Question 2

From the perspective of self-efficacy theory, which classroom learning environment characteristics are the strongest correlates of students' academic self-efficacy beliefs in mathematics?

Of the five factored subscales of the classroom learning environment measure specifically developed for this study (MSELEI-CF), the strongest correlates of students' academic self-efficacy beliefs (Fractions,  $r = .46$ ,  $p < .001$ ) were with the measure of students' feelings of independence to accomplish mathematical tasks in the classroom (MSELEI-CF Student Independence subscale). Thus, students with strong academic self-efficacy beliefs are able to complete mathematics tasks with greater independence than students with relatively weaker academic self-efficacy beliefs.

### Primary Research Question 3

How much of the variation in the strength of students' self-efficacy beliefs in mathematics can be explained by the combination of home and classroom learning environment sources reflecting self-efficacy theory?

The combination of the home and classroom learning environment subscales (factored subscales of the MSELEI-HF and MSELEI-CF measures) accounted for a total of 10% (Arithmetic), 27.4% (Fractions), and 14.5% (Equations) of the total variation in the strength of student' self-efficacy beliefs in mathematics. The combination of these measures accounted for significantly more variation in academic self-efficacy beliefs than either of the measures considered alone. Thus, both the home and classroom learning environments make important contributions to the development and strengthening of students' academic self-efficacy beliefs.

#### Primary Research Question 4

How much of the variation in mathematics motivation (effort and persistence) is accounted for by outcome expectancy levels beyond that accounted for by academic self-efficacy beliefs?

The one-factor measure of self-efficacy outcome expectancy accounted for significant amounts of variation (10-12%) in mathematics self-efficacy Motivation (Effort and Persistence) beyond that accounted for by the measure of students' academic self-efficacy alone. Approximately 24% of the variation in students' efficacy motivation (Persistence) and 7% of the variation in students' efficacy motivation (Effort), beyond that accounted for by the measure of students' mathematics self-efficacy beliefs, was accounted for by the measure of self-efficacy outcome expectations. Thus, self-efficacy outcome expectations play an important role, beyond the strength of students' academic self-efficacy beliefs, in motivating students' in their efforts to accomplish mathematics tasks and in their levels of persistence in mathematics when faced with barriers and obstacles to task accomplishments.

### **Supplemental Research Question 1**

Are there significant differences between the strength of students' academic self efficacy beliefs in mathematics when they are compared by socioeconomic status (SES)?

### **Supplemental Research Question 2**

Are there significant differences between male and female students' strengths of academic self-efficacy beliefs in mathematics?

The results of the data analyses showed only minor differences in the strength of students' self-efficacy beliefs to accomplish mathematics tasks for students receiving free/reduced cost lunches to those not receiving free/reduced cost lunch. The only significant difference noted was for the measure of self-efficacy beliefs and capabilities to do mathematics Fractions (somewhat stronger beliefs for students who do not qualify for free/reduced cost lunch vs students who do qualify). The results of the data analyses showed no differences in the strength of male and female students beliefs and capabilities to do mathematics.

### **Supplemental Research Question 3**

What is the contribution of home and classroom learning environment sources of self-efficacy beliefs and SES when considered collectively, to the strength of students academic self-efficacy beliefs in mathematics?

The strength of students' academic self-efficacy beliefs was largely accounted for by the home and classroom learning environment variables of Student Independence, Home/Negative Affect, and Class/Positive Affect, rather than SES. These results show that home and classroom learning environment factors that contribute to the development and strengthening of students' academic self-efficacy beliefs are more potent than any other

factors that may be associated with students who receive or do not qualify for free/reduced school lunches.

#### **Supplemental Research Question 4**

Are there significant differences between male and female students' perceptions of home and classroom learning environment variables that contribute to the strength of their self-efficacy beliefs in mathematics?

A comparison of male and female students on each of the factored subscales of the home and classroom learning environments showed that five of eight comparisons were statistically significant. Males had slightly higher scores on the measure of Class/Negative Affect and Home/Negative Affect than females. Female scores were slightly greater than male scores for Teacher Modeling, Class/Positive Affect, and Home/Positive Affect. The absolute differences between male and female students however, were not considered large enough to be of any practical or educational significance (e.g., in arranging different functioning environments at home and/or school for male and female students).

#### **Supplemental Research Question 5**

What are the relationships between elements of the classroom learning environment and the home learning environment that are specified within current self-efficacy theory as primary sources that contribute to the development and strengthening of self-efficacy beliefs?

Intercorrelations between factored subscales of the home and classroom environment measures developed specifically for this study showed rather strong to

rather moderately strong relationships between these variables. These results portray classroom and home learning environments as supportive of students' self efficacy beliefs in rather predictable ways. For example, students who viewed their home environments as providing either positive or negative affective experiences, also viewed their classroom learning environments in the same way.

The conceptual framework developed for the study, the six major findings and associated conclusions, and answers to the primary and supplemental research questions, provide a basis for the discussion that follows.

### Discussions and Implications

This study was initiated by the need to develop measures of classroom and home learning environment variables considered important sources for the development and strengthening of self-efficacy in current self-efficacy theory (Bandura, 1997). The study was also designed to assess multiple factors addressed within self-efficacy theory that provide explanatory power for the self-efficacy construct as a primary element of human agency. A conceptual model linking home and classroom learning environments to self-efficacy beliefs, self-efficacy motivation (effort and persistence, and self-efficacy outcome expectancies was explicated in an attempt to show how this complex set of constructs is related to student learning and subsequent achievement (see Figure 3 in Chapter 1). Mathematics was selected as a focus for the original self-efficacy measures developed because of the national call to address teaching and learning mathematics as a critical curriculum need in schools. The findings from the study have many implications considered important for theory, future research, and practice. A discussion of the study findings in view of these implications follows.

### Implications for Theory

Bandura (1997) conceptually defines human self-efficacy as the “belief in one’s capabilities to organize and execute courses of action required to produce given attainments.” Within a more general *theory of triadic reciprocal causation*, Bandura depicts self-efficacy as the primary agent in a dynamic conception of human behavior and the environment. Thus, self-efficacy beliefs are considered to influence the choices of action individuals pursue and the degree to which they are motivated and persist in the face of obstacles and barriers to goal attainment. Those with strong self-efficacy beliefs are resilient and persistent, and those with weak self-efficacy beliefs are not. In turn, environmental experiences continuously enhance or facilitate the development and strengthening of self-efficacy beliefs.

Rather extensive summaries of research findings support the important role that self-efficacy plays in human behavior (Bandura, 1997). Recent, comprehensive reviews have also identified the important role that self-efficacy beliefs play in influencing the behavior of teachers and students in academic contexts (Tschannen-Moran, Hoy, & Hoy, 1998; Pajares, 1996b). However, the vast majority of empirical studies on self-efficacy beliefs in education settings have attempted to link self-report measures of these beliefs to different kinds of teacher behavior (e.g., classroom management strategies) (Gibson & Dembo, 1983) or to student achievement (e.g., as measured by standardized tests) (Ashton & Webb, 1986), or to measures of efficacy motivation and persistence (Loup, 1994; Ellett, 1995; Ellett, 2000). Lorschbach & Jinks (1999) have recently noted that given the increasing support for the importance of self-efficacy

beliefs in human agency, there is a need to develop classroom learning environment measures that assess factors influencing the development of self-efficacy beliefs. This study is the first known study to develop such measures for home *and* classroom learning environments and to validate these measures using a larger, more complex set of constructs within self-efficacy theory.

The results of this study provide considerable support for Bandura's (1997) discussion of how important environmental events and experiential factors influence the development and strengthening of self-efficacy beliefs. Though this study did not use an experimental design, the correlational findings reported here show empirical linkages between students' perceptions of classroom and home learning environment events and characteristics, and between these events and characteristics and the strength of academic self-efficacy beliefs in mathematics. These linkages are in the direction predicted by current self-efficacy theory.

Current self-efficacy theory (Bandura, 1997) differentiates between efficacy expectation ("....the conviction that one can successfully execute the behavior required to produce the outcome") (p.193) and outcome expectations (what is expected to accrue to the individual as a result of behavior). Theoretically, outcome expectations serve to strengthen (or weaken) self-efficacy beliefs through an individual's personal/psychological experiences of success or failure. This theoretical conception was supported by the findings of this study that showed that the measure of efficacy outcome expectation accounted for significant amounts of variance in the strength of students' self-efficacy beliefs beyond that accounted for by students' perceptions of



their classroom and home learning environments. Thus, as self-efficacy theory posits, environmental experiences, though necessary in a dynamic system of human agency, are not the only factors that develop and strengthen self-efficacy beliefs.

Personal/psychological experiences, accompanied by affective states that accrue to the individual as a result of interactions with the environment also make important contributions to the development and strengthening of self-efficacy beliefs. The results of this study also showed, in line with self-efficacy theory, that considerable variation in levels of students' effort and persistence can also be accounted for by efficacy outcome expectations. This finding is consistent with Bandura's (1997) theoretical contention that "human behavior and affective states would be best predicted by the combined influence of efficacy beliefs and the types of performance outcomes expected within given social systems." (p. 20).

Current self-efficacy theory provides much discussion of the role that self-efficacy beliefs play in human agency and subsequent motivation for behavior. Within this discussion is the role of self-efficacy in maintaining persistent behavior in the face of barriers and obstacles to goal accomplishment and resilience in the face of failure to accomplish goals. Bandura (1997) discusses persistence and resilience as the primary operational definitions of the strength of human self-efficacy beliefs. This element of self-efficacy theory was measured in this study and found to be conceptually and empirically independent of more direct measures of students self-efficacy beliefs in mathematics. Thus, and as explained within current self-efficacy theory, self-efficacy beliefs can be empirically differentiated from self-efficacy outcome expectations.

The contributions of combinations of various functioning environments (in this case classroom and home learning environments) within self-efficacy theory can complement the development and strengthening of self-efficacy beliefs, or serve to diminish these beliefs. The findings in this study provide theoretical support for this tenet of self-efficacy theory. Students' perceptions of the home and classroom learning environments were correlated in ways that are consistent with self-efficacy theory and with the larger literature supporting school and home learning environment variables as important proximal variables accounting for student learning and achievement (Wang, Haertel, & Walberg, 1993).

One continuing controversy in self-efficacy theory is the extent to which self-efficacy is to be understood as situationally and task specific as opposed to a construct that can be generalized through behavior across various performance domains. Current views of this issue (Bandura, 1997) suggest that such beliefs can be generalized across various knowledge and performance domains with considerable successful experience, and when these domains are derived from a larger domain linking their elements. For example, one might develop generalize self-efficacy strength across an athletic domain (e.g., track and field) if one has developed considerable self-efficacy strength in a variety of different events (e.g., sprints, distance events, high jump, triple jump, discus). Limited successful experiences in one event, on the other hand, would not serve to develop a self-efficacy belief system that would generalize across multiple events and situations in this athletic domain.

The results of this study, and the measurements used, suggest that eighth grade mathematics students, as a group, have self-efficacy beliefs that are relatively specific to

different mathematics domains. The factor analysis results for the mathematics self-efficacy beliefs measure clearly identified three distinct performance domains (arithmetic, fractions, equations). In addition, descriptive statistics of these three elements of the mathematics curriculum showed clear differences among students in the strength of their self-efficacy beliefs in a direction consistent with self-efficacy theory and the progression of the mathematics curriculum and learning environment experiences for this group of eighth grade students.

Considered collectively, the findings from this study support the *ecological validity* of current self-efficacy theory (Bandura, 1997). Predictions that can be derived from the theory and the explanatory power of the theory relative to home and school learning are reasonably corroborated by the study findings. Direct measures of student learning and achievement were not measured as part of this study. However, the findings of the study support self-efficacy theory and self-efficacy beliefs as important elements in understanding and explaining how classroom and home learning environments are linked to student learning and subsequent achievement. These findings are consistent with the conceptual framework within which the study was developed and the primary and secondary research questions were derived (see Figure 3 in Chapter 1).

### Implications for Future Research

The results of this study have several implications for future research. First, the study centered on just one area of the school curriculum (mathematics) for only one grade-level (eighth). Future research can add to the findings and conclusions of this study by expanding samples to include other curricula and students at other grade levels.

The possible combinations of education contexts in which to conduct future self-efficacy studies (both home and school) are vast. As such studies emerge, support for the major findings, conclusions and interpretations of results reported here may be forthcoming. Alternatively, such studies may detect nuances in the conceptualization and measurement of key constructs within self-efficacy theory not addressed in this study. Whatever the case, the nomological net (Cronbach & Meehl, 1955) for the self-efficacy construct, and its utility in explaining and predicting student learning will be enhanced. Additionally, answers to important theoretical questions such as the generalizability of self-efficacy beliefs across tasks and situations, and the distinctions between, and roles played by self-efficacy expectations, outcome expectations, and efficacy motivation within a conception of self-efficacy in social-cognitive theory can be more thoroughly substantiated.

From the measurement perspective, this study used a relatively new, more direct measure of students' self-efficacy beliefs than those typically used in research on self-efficacy. The most typical, recommended and standard format for collecting self-efficacy data is to use self-report measures and a response stem that reflect the degree to which one *can do* something, or the *degree of confidence* one has in performing a particular task (Bandura, 1977). In this study the decision was made to use a more direct measure of self-efficacy since this construct is defined in terms of the personal belief system. Therefore, the response stem used asked students to rate the strength of their beliefs that they had the capabilities to do different math problems. This response format has been successfully used in other contexts with social workers and teachers

(Ellett, 2000; Olivier, 2001; Dellinger, 2001). In this study, this response format produced reliable data and differentiated adequately between the mathematical curriculum areas measured (arithmetic, fractions, equations). Pilot tests comparing this format to others supported it as viable and preferred among these respondents (eighth-grade students). When combined with the results of other recent studies, this format can be recommended in future studies of self-efficacy beliefs. The results reported here and in other studies show that it is a viable alternative to more traditionally used formats that can be used with confidence and in a manner that is relatively free of error.

The classroom and home learning environment measures developed specifically for the study are new measures. No others are known in the literature. These measures were developed to reflect the four environmental and experiential sources of self-efficacy beliefs (i.e., enactive mastery experiences, vicarious learning, verbal persuasion, physiological/emotional arousal) discussed in current self-efficacy theory and research (Bandura, 1997). Separate factor analyses of these two measures identified sets of sub-constructs that are reasonably consistent with self-efficacy theory. However, these measures need additional development and study if they are to be able to independently measure each of the four primary sources of academic self-efficacy beliefs among students. Items developed as indicators of the four sources were somewhat statistically related in this study. Item refinement through further conceptualization and greater item refinement in future studies may well identify item sets that measure these four sources of efficacy beliefs with greater statistical independence. The correlations between these two new learning environment measures,

however, did document relationships between students' experiences in these environments consistent with existing self-efficacy theory.

From the research design perspective, this study explored initial statistical (correlational) relationships among the study variables within the context of a larger conceptual framework. While these findings yielded considerable information supporting this framework and core elements of existing self-efficacy theory (Bandura, 1997), the scope of the study did not allow for the inclusion of qualitative methods to further elaborate the core statistical findings. However, much can be learned in using mixed methods in future research. In particular, more in depth studies using qualitative methods to further understand classroom and home learning environments for students seem needed. The vast majority of studies on these environments have used self-report perceptions measures and quantitative methods. There is a considerable gap in the general literature on the study of learning environments, and more specifically learning environments as linked to the development and strengthening of academic self-efficacy beliefs, in the use of qualitative and mixed methodologies. In this study, for example, understanding more specifically how classroom and home learning environments and students' experiences become linked to the development and strength of their self-efficacy beliefs in mathematics could have been enhanced through qualitative methods. Asking selected groups of students within classes to describe the meaning of their quantitative responses to the survey questions asked may well have led to further insights about how learning environments are linked to self-efficacy beliefs. Similarly, more in-depth probing of students (and perhaps teachers) of why the strength of self-

efficacy beliefs varied considerably among students and across curriculum areas in mathematics (arithmetic, fractions, equations), might have generated additional insights about linkages between learning environments and academic self-efficacy beliefs.

It should be recognized here that the measure of socioeconomic status (SES) of students in this study was a simple classification as to whether a student did or did not qualify for free or reduced cost lunch. A more exact measure for students was not available. This designation of socioeconomic status is quite limited in its ability to tap variation in this variable among students. This fact was seemingly corroborated in the regression analyses in which this definition of SES was included as an independent variable. The findings were generally inconsistent with much of the literature showing the predictive power of SES for various school effectiveness outcomes (e.g., student attendance, achievement on standardized tests). While the school lunch definition of SES used in this study may be valid using class or school level means as the units of analysis, this definition is not recommended for future studies examining this variable using individual students as the units of analysis. Measures of SES that are more sensitive to variation in SES levels among students, such as family income, mother's and father's occupations and education levels, etc. should be used in future studies where variation among students is a major design concern.

#### Implications for Practice

Current self-efficacy theory (Bandura 1997) and syntheses of research on students' academic self-efficacy beliefs (Pajares, 1996b) and learning (Wang, Haertel, & Walberg, 1993) show that this construct is an important concern in schools. The

findings in this study can inform teachers, administrators, parents, and education policy makers in several ways. First, and foremost, the academic self-efficacy and home and classroom learning environment measures developed in this study can be used as a basis for needs assessments (either in school or at home) to assist in arranging more optimally functioning educational environments for students. Understanding the strength of students' self-efficacy beliefs, whether in mathematics or in other curriculum areas, and understanding how students perceive their classroom and home learning environments, are important elements of designing educational environments that can better motivate students and enhance student persistence and resilience in the face of difficult academic pursuits. Clearly, this is an important concern with students from educationally impoverished home and/or school environments. Self-efficacy research and theory also suggests this is important for all students. The measures developed for use in this study can be practically administered, easily scored and interpreted, and used in such needs assessments and subsequent educational environment designs. Teacher, administrator, parent, and even student self-reflections on the meaning of self-efficacy, classroom, and home learning environment assessment data might also be used to further arrange and structure learning environments to develop and strengthen academic self-efficacy beliefs.

Secondly, findings from this study show important linkages between students' home and classroom learning environments. In some instances (e.g., with female students), positive learning environment perceptions and experiences in these two environments seemingly go hand in hand. In other instances (e.g., with male students),



negative learning environment perceptions and experiences go hand in hand. These findings support a view of mathematics learning and learning environment experiences at the middle school level that are perhaps changing for male and female students in different ways at this important developmental level. *While not definitive* by any means, the results of this study suggest that school and home learning environment experiences and expectations may well begin to change for male and female students during the early adolescent years. Thus, the specific manner in which teachers and parents communicate expectations for mathematics learning and achievement, and structure positive and negative classroom and home learning experiences differently for male and female students, may well lead to differing levels of mathematics achievement for boys and girls. To the extent that expectations for school learning and home learning vary by gender, one might well expect concomitant variation in school and home learning environment characteristics and student experiences that generate considerable differences in self-efficacy beliefs in mathematics among male and female students. If self-efficacy beliefs in mathematics (or other important curriculum areas) begin to differ significantly by gender during the early years of adolescence, and if these beliefs are key elements of students' selection of preferred academic tasks and subsequent motivation, persistence and resilience as supported by current self-efficacy theory and research, studying ways in which classroom and home learning environments might be altered to address these differences is an important concern for practitioners, parents, school administrators and policy makers as well.

American education is currently experiencing a period of heightened, politically-based educational accountability in which enhanced school productivity and

achievement is a national concern. The primary focus is on increased school performance with a primary emphasis on school achievement as measured by standardized test scores. Like Louisiana, many states have moved forward policy-based, comprehensive plans to first identify low performing schools, and then to provide assistance to improve these schools. While politically popular and having considerable face validity with the general public, this general model may fall short in the ability to make meaningful, lasting changes in school over time. Self-efficacy theory and the findings from a mounting body of empirical work suggest that the strengthening of students' self-efficacy beliefs may be a highly important factor in improving student learning and subsequent school achievement.

The model framing this study (Figure 3 in Chapter 1) suggests that self-efficacy beliefs mediate the linkage between home and classroom learning environments and school outcomes. The mediating role of self-efficacy is largely motivational. Thus, learning environments that strengthen self-efficacy beliefs also enhance motivation and persistence in academic tasks, which results in higher levels of academic learning and achievement. This interpretation of the mediating role of self-efficacy beliefs is supported by the findings in this study that show that self-efficacy beliefs and learning environment factors can enhance students' effort and persistence in mathematics learning. If future research continues to document the viability of this model (and the findings reported in this study), it may be that school change and improvement efforts, and resources that support these efforts, should be designed to assess and develop school, classroom, and home learning environments that strengthen students' academic self-efficacy beliefs, and the self-efficacy beliefs of teachers, school administrators, and

parents as well. This model of school change and improvement appears to have support from existing self-efficacy theory (Bandura, 1997), syntheses of academic self-efficacy research with students (Pajares, 1996b) and teachers (Tschannen-Moran, Hoy, & Hoy, 1998), and large-scale syntheses of research on the knowledge base of schooling (Wang, Haertel, & Walberg, 1993). Finally, enhancing the educational quality of school, classroom, and home learning environments, in a manner that develops and strengthens academic self-efficacy beliefs of students across the curriculum, may well be one of our most important strategies for future school reform and educational improvement.

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**APPENDIX A:**  
**MEASURES USED FOR DATA COLLECTION**  
**AND**  
**SAMPLE APPROVAL LETTERS**



## **Consent Form**

**You are being asked to give permission for your child to participate in a research study examining the factors which motivate a student to learn mathematics. Please, read the details of the study which are given below, and sign at the bottom of the form if you give approval for your child to participate.**

**Title of the Research Study: Home and Classroom Learning Environment Correlates Of Academic Self-Efficacy In Middle School Mathematics**

**Research Directors: Principal Investigator: Dr. Chad Ellett (225) 388-1590  
Student Investigator: Thaddeus T. Claiborne (504) 466-0069**

**Purpose of the Study: The proposed study investigates the relationship between home and classroom learning environment characteristics and middle school student's personal beliefs about their abilities to do mathematics and the factors which are the greatest contributors.**

**Procedures to be Used: Researchers will meet with each identified teacher who will actually administer the instrument to the individual students during a regular classroom period. The questionnaire takes about 20 minutes to complete.**

**Potential Risks to Subjects: There is no apparent risk to the subjects involved in this study.**

**Potential Benefits of the Study: By identifying factors which motivate students to learn mathematics, teachers, school administrators and parents/guardians can develop strategies to increase the number of students who excel in mathematics.**

**Protection of the identity and privacy of the subjects: The mathematic teachers will administer the instrument to the participants who shall be identified by the code inscribed on each questionnaire. The code shall be the only means of identifying the respondents. The participants will be instructed to only answer the questions on the instrument and not add any additional markings. Other than the survey questions, only general demographic information (race, gender, age, etc.) will be asked. Teachers will be instructed to administer the instrument by giving general instructions, handing the instrument to the participants, and collecting and placing the instruments into an envelope which will be sealed and given to the investigator. Once returned to the investigator, the instruments will be sorted by school for analyses.**

(Consent Form continued)

**Student Agreement to Participate in the Study:** The proposed study will be explained to the students and volunteers will be asked to participate. No student will have to participate if they do not want to and no student will be allowed to participate without having first returned this consent form to the teacher with parental approval. The students will not be required to work any problems. The study only asks about their beliefs and the support structure which benefits them most as students.

*I have been fully informed of the above described procedure with its possible benefits and risks and I give my permission for my child to participate in the study.*

---

***Parent's Signature***

---

***Date***

---

***Student's Signature***

---

***Date***

\* The consent form was compressed into a single page.

## Checklist to Administer the Questionnaires

### In General

The researcher will assign a class number, school number, and teacher number before data collection begins. The teacher will write these numbers on the board so each student can bubble them in once the questionnaires are passed out.

Each teacher should use their role books to assign each student an individual student number. If agreed, a copy of the role book containing the students' name and student number should be supplied to the researcher for future communications between the researcher and teacher. Before any student would be contacted the researcher would discuss the reason for making a follow-up with the teacher and principal.

### Student Questionnaire

- \_\_\_ #1. Pass the single page questionnaire to each student and have them fill out the identification portion of the questionnaire, i.e. the student number, class number, school number, and teacher number.
- \_\_\_ #2. Read the instructions aloud while each student reads silently.
- \_\_\_ #3. Ask if there are any questions.
- \_\_\_ #4. Students should be allowed 5 minutes to complete the entire questionnaire.
- \_\_\_ #5. Ask each student to check the questionnaire for errors and/or stray marks.
- \_\_\_ #6. Take each questionnaire and place it in the envelope provided.

### Student Questionnaire - Form A

- \_\_\_ #1. Pass the four page questionnaire to each student and have them fill out the identification portion of the questionnaire. Each student should check the questionnaire to make sure s/he has pages 01 - 04.
- \_\_\_ #2. Read the instructions aloud while each student reads silently.
- \_\_\_ #3. Ask if there are any questions.
- \_\_\_ #4. Students should be allowed 15-20 minutes to complete the entire questionnaire.
- \_\_\_ #5. Ask each student to check the questionnaire for errors and/or stray marks.
- \_\_\_ #6. Take each questionnaire and place it in the envelope provided.

### In Conclusion

Thanks for your support. I will provide each participating teacher and school the results of this study once the data are analyzed. You can reach me at home in Kenner at 504-466-0069, by fax at 504-464-7655 or by e-mail at [telaiborne@aol.com](mailto:telaiborne@aol.com); at my office at LSU in Baton Rouge at 225-388-2182, by fax at 225-388-6918 or by e-mail at [telaib1@lsu.edu](mailto:telaib1@lsu.edu). Again, thanks for your support.

**School** \_\_\_\_\_

**Teacher's Name** \_\_\_\_\_ **Class No.** \_\_\_\_\_ **School No.** \_\_\_\_\_ **Teacher No.** \_\_\_\_\_

## Student Questionnaire

Student Identification:      XXX                      XXX                      XXX                      XXX  
   St. No.                      Class No.                      School No.                      Teacher No.

### **PART I: DEMOGRAPHICS**

**Directions:** Please, indicate your response to the following questions. For some questions more than one response may be necessary, but only fill in one bubble per line. Please, use a #2 pencil and erase thoroughly if you make a mistake.

1. Please indicate your gender.  
☐ Male                      ☐ Female
2. Please indicate your grade.  
☐ 7th   ☐ 8th   ☐ 9th
3. Please indicate your age.  
☐ 10   ☐ 11   ☐ 12   ☐ 13   ☐ 14   ☐ Other, Please write in \_\_\_\_\_
4. Your race is:  
☐ Black                      ☐ Asian                      ☐ White                      ☐ Hispanic                      ☐ Other
5. What is the highest grade completed by your father.  
☐ I don't know    ☐ Some college  
☐ Elementary School (Grades 1 - 6)                      ☐ Bachelor's degree  
☐ Middle/Junior High School (Grades 7 - 9)                      ☐ Master's degree  
☐ Some High School    ☐ PhD or professional degree  
☐ High school Graduate (Completed 12<sup>th</sup> Grade)
6. What is the highest grade completed by your mother.  
☐ I don't know    ☐ Some college  
☐ Elementary School (Grades 1 - 6)                      ☐ Bachelor's degree  
☐ Middle/Junior High School (Grades 7 - 9)                      ☐ Master's degree  
☐ Some High School    ☐ PhD or professional degree  
☐ High school graduate (Completed 12<sup>th</sup> Grade)
7. Do you receive free or reduced priced lunch?  
☐ Yes                      ☐ No
8. Please, answer the following questions about your parents: (Mark all that apply)
  - a. Do you live with your natural parent(s)                      ☐ Yes   ☐ No
  - b. Mother is unknown to you                      ☐ Yes   ☐ No
  - c. Father is unknown to you                      ☐ Yes   ☐ No
  - d. Mother alive                      ☐ Yes   ☐ No   ☐ I Do Not Know
  - e. Father alive                      ☐ Yes   ☐ No   ☐ I Do Not Know
  - f. Mother and Father Living with each other                      ☐ Yes   ☐ No   ☐ I Do Not Know
9. Do your parents:  
☐ Own the family home/condo?                      ☐ Rent the family home/condo/apartment?  
☐ Other, Please describe: \_\_\_\_\_                      ☐ I don't know
10. How many children other than yourself live in your home or apartment/condo?  
☐ 0   ☐ 1   ☐ 2   ☐ 3   ☐ 4 or More
11. Indicate what kind of grades you receive in this mathematics class.  
☐ A   ☐ B   ☐ C   ☐ D   ☐ F

\* The student questionnaire was reproduced as a single scan-tron sheet.

## Student Questionnaire - Form A

Student Identification:      XXX              XXX              XXX              XXX  
   St. No.              Class No.              School No.              Teacher No.

### General Instructions and Directions:

This survey asks about your personal beliefs to do mathematics and solve math problems at an eighth grade level. For each item, use the scale which is provided and darken the oval of the corresponding number that best indicates **the strength of your personal beliefs about your capabilities to accomplish each task**. Please, use a #2 pencil and erase thoroughly if you make a mistake. Only fill in one bubble per line.

Please, remember to answer each question based on **your own personal beliefs and not what others say or believe**. You are not required to spend time actually solving any of the problems. All responses will remain confidential and will not affect your grade in this class in any way. An example of a response follows:

**How strongly do you believe you can...find the table of contents in your math textbook?**

0	1	2	3	4	5	6	7	8	9
Very Weak			Weak			Strong			Very Strong
Belief			Belief			Belief			Belief

I know the table of contents is found in the front of the textbook. I have a "Very Strong Belief" that I can find the table of contents. So, I darken the "9."

### ---Now, do Part I of the survey---

#### Part I:

Please, use the scale provided and darken the number that best indicates **how strongly you believe** you can work or complete each mathematics problem AT THIS TIME.

1. **How strongly do you believe you can...solve the following problem?**

$$275 - 121 = ?$$

0	1	2	3	4	5	6	7	8	9
Very Weak			Weak			Strong			Very Strong
Beliefs			Beliefs			Beliefs			Beliefs

2. **How strongly do you believe you can...solve the following problem?**

$$121 + ? = 275$$

0	1	2	3	4	5	6	7	8	9
Very Weak			Weak			Strong			Very Strong
Beliefs			Beliefs			Beliefs			Beliefs

(Student Questionnaire - Form A continued)

3. **How strongly do you believe you can...solve the following problem?**

$$\sqrt{36} = ?$$

0	1	2	3	4	5	6	7	8	9
Very Weak Beliefs			Weak Beliefs			Strong Beliefs		Very Strong Beliefs	

4. **How strongly do you believe you can...solve the following expression?**

$$6 \times ? = 36$$

0	1	2	3	4	5	6	7	8	9
Very Weak Beliefs			Weak Beliefs			Strong Beliefs		Very Strong Beliefs	

5. **How strongly do you believe you can...solve the following expression?**

$$4x + 3 = 7$$

0	1	2	3	4	5	6	7	8	9
Very Weak Beliefs			Weak Beliefs			Strong Beliefs		Very Strong Beliefs	

6. **How strongly do you believe you can...work the following problem?**

The eighth grade math teachers at your school are planning a field trip. If they are planning to use the school vans which hold 10 students each and there are 105 students in the math classes, how many vans will be needed for the trip?

0	1	2	3	4	5	6	7	8	9
Very Weak Beliefs			Weak Beliefs			Strong Beliefs		Very Strong Beliefs	

7. **How strongly do you believe you can...solve the following systems of linear equations:**

$$\begin{aligned} y &= x \\ y &= 3x - 4 \end{aligned}$$

0	1	2	3	4	5	6	7	8	9
Very Weak Beliefs			Weak Beliefs			Strong Beliefs		Very Strong Beliefs	

8. **How strongly do you believe you can...solve the following systems of linear equations:**

$$\begin{aligned} 4x + 3y &= 7 \\ 2x + 6y &= 8 \end{aligned}$$

0	1	2	3	4	5	6	7	8	9
Very Weak Beliefs			Weak Beliefs			Strong Beliefs		Very Strong Beliefs	

(Student Questionnaire - Form A continued)

9. **How strongly do you believe you can...work the following problem:**  
A store is offering a discount of 15% on fishing rods. What is the amount a customer will save on a rod regularly priced \$25?
- |                   |   |   |              |   |   |                |   |   |                     |
|-------------------|---|---|--------------|---|---|----------------|---|---|---------------------|
| 0                 | 1 | 2 | 3            | 4 | 5 | 6              | 7 | 8 | 9                   |
| Very Weak Beliefs |   |   | Weak Beliefs |   |   | Strong Beliefs |   |   | Very Strong Beliefs |
10. **How strongly do you believe you can...work the following problem:**  
How many fourths are there in  $2\frac{1}{4}$ ?
- |                   |   |   |              |   |   |                |   |   |                     |
|-------------------|---|---|--------------|---|---|----------------|---|---|---------------------|
| 0                 | 1 | 2 | 3            | 4 | 5 | 6              | 7 | 8 | 9                   |
| Very Weak Beliefs |   |   | Weak Beliefs |   |   | Strong Beliefs |   |   | Very Strong Beliefs |
11. **How strongly do you believe you can...solve the following problem?**  
 $2\frac{1}{2} \div \frac{1}{4} = ?$
- |                   |   |   |              |   |   |                |   |   |                     |
|-------------------|---|---|--------------|---|---|----------------|---|---|---------------------|
| 0                 | 1 | 2 | 3            | 4 | 5 | 6              | 7 | 8 | 9                   |
| Very Weak Beliefs |   |   | Weak Beliefs |   |   | Strong Beliefs |   |   | Very Strong Beliefs |
12. **How strongly do you believe you can...solve the following problem?**  
 $2 \times \frac{1}{4} = ?$
- |                   |   |   |              |   |   |                |   |   |                     |
|-------------------|---|---|--------------|---|---|----------------|---|---|---------------------|
| 0                 | 1 | 2 | 3            | 4 | 5 | 6              | 7 | 8 | 9                   |
| Very Weak Beliefs |   |   | Weak Beliefs |   |   | Strong Beliefs |   |   | Very Strong Beliefs |
13. **How strongly do you believe you can...solve the following problem?**  
 $14 \div 2 = ?$
- |                   |   |   |              |   |   |                |   |   |                     |
|-------------------|---|---|--------------|---|---|----------------|---|---|---------------------|
| 0                 | 1 | 2 | 3            | 4 | 5 | 6              | 7 | 8 | 9                   |
| Very Weak Beliefs |   |   | Weak Beliefs |   |   | Strong Beliefs |   |   | Very Strong Beliefs |
14. **How strongly do you believe you can...solve the following problem?**  
 $2 \times 10 = ?$
- |                   |   |   |              |   |   |                |   |   |                     |
|-------------------|---|---|--------------|---|---|----------------|---|---|---------------------|
| 0                 | 1 | 2 | 3            | 4 | 5 | 6              | 7 | 8 | 9                   |
| Very Weak Beliefs |   |   | Weak Beliefs |   |   | Strong Beliefs |   |   | Very Strong Beliefs |
15. **How strongly do you believe you can...work the following problem:**  
What is an estimate of  $\frac{15}{16} + \frac{7}{8}$ ?
- |                   |   |   |              |   |   |                |   |   |                     |
|-------------------|---|---|--------------|---|---|----------------|---|---|---------------------|
| 0                 | 1 | 2 | 3            | 4 | 5 | 6              | 7 | 8 | 9                   |
| Very Weak Beliefs |   |   | Weak Beliefs |   |   | Strong Beliefs |   |   | Very Strong Beliefs |

(Student Questionnaire - Form A continued)

16. **How strongly do you believe you can...solve the following problem?**

$$2 + 1/4 = ?$$

0	1	2	3	4	5	6	7	8	9
Very Weak			Weak			Strong			Very Strong
Beliefs			Beliefs			Beliefs			Beliefs

17. **How strongly do you believe you can...solve the following quadratic equation by factoring?**

$$6x^2 + 17x + 12 = 0$$

0	1	2	3	4	5	6	7	8	9
Very Weak			Weak			Strong			Very Strong
Beliefs			Beliefs			Beliefs			Beliefs

---Now, Go To Part II---

**Part II:**

Please, use the scale provided and select the number that best indicates how hard you believe you work to complete your mathematics problems.

1. **How hard do you work...to solve math problems in school?**

0	1	2	3	4	5	6	7	8	9
Not Very			Somewhat			Hard			Very
Hard			Hard						Hard

2. **How hard do you work...to learn and understand mathematics in this class, the science of numbers and their operations and interrelations?**

0	1	2	3	4	5	6	7	8	9
Not Very			Somewhat			Hard			Very
Hard			Hard						Hard

3. **How hard do you work...to learn and understand algebra in this class, the use of letters and symbols to represent numbers in combined arithmetic operations?**

0	1	2	3	4	5	6	7	8	9
Not Very			Somewhat			Hard			Very
Hard			Hard						Hard

4. **How much effort do you put out in this class...when you try to solve math problems that are difficult to solve?**

0	1	2	3	4	5	6	7	8	9
Little or No			Some			Strong			Very Strong
Effort			Effort			Effort			Effort



(Student Questionnaire - Form A continued)

5. If you fail a math problem...**how much effort do you apply to solve an equally difficult math problem?**

0	1	2	3	4	5	6	7	8	9
Little or No Effort		Some Effort			Strong Effort		Very Strong Effort		

---Now, Go To Part III---

**Part III:**

Please, use the scale provided and report how often each event occurs.

1. **I am successful...**in doing my math homework at home.

1	2	3	4
Almost Never	Sometimes	Often	Almost Always

2. **I can do my math homework at home without help...**from my parents.

1	2	3	4
Almost Never	Sometimes	Often	Almost Always

3. **When I do my math homework at home...**it is difficult for me.

1	2	3	4
Almost Never	Sometimes	Often	Almost Always

4. **I get the help I need at home...**to be successful in doing my math homework.

1	2	3	4
Almost Never	Sometimes	Often	Almost Always

5. When I have difficulty doing my math homework...**adults (my mother, father, grandparents, brother or sister, etc.) in my home show me how to do it.**

1	2	3	4
Almost Never	Sometimes	Often	Almost Always

6. **Adults in my home explain...**how my math problems should be done.

1	2	3	4
Almost Never	Sometimes	Often	Almost Always

7. **Other children in my home show me...**how to do my math homework.

1	2	3	4
Almost Never	Sometimes	Often	Almost Always

(Student Questionnaire - Form A continued)

8. **My mother shows...me** how to do my math homework.
- |              |           |       |               |
|--------------|-----------|-------|---------------|
| 1            | 2         | 3     | 4             |
| Almost Never | Sometimes | Often | Almost Always |
9. **My father shows...me** how to do my math homework.
- |              |           |       |               |
|--------------|-----------|-------|---------------|
| 1            | 2         | 3     | 4             |
| Almost Never | Sometimes | Often | Almost Always |
10. When I have difficulty in doing my math homework,...**adults (my mother, father, grandparents, brother or sister, etc.) in my home tell me that if I keep trying I can be successful.**
- |              |           |       |               |
|--------------|-----------|-------|---------------|
| 1            | 2         | 3     | 4             |
| Almost Never | Sometimes | Often | Almost Always |
11. **Adults in my home encourage me...**to do well in my math class.
- |              |           |       |               |
|--------------|-----------|-------|---------------|
| 1            | 2         | 3     | 4             |
| Almost Never | Sometimes | Often | Almost Always |
12. **Other children in my home encourage...**me to do well in my math class.
- |              |           |       |               |
|--------------|-----------|-------|---------------|
| 1            | 2         | 3     | 4             |
| Almost Never | Sometimes | Often | Almost Always |
13. When I encounter a difficult math problem...**I am encouraged to work the problem by adults (my mother, father, grandparents, brother or sister, etc.) in my home.**
- |              |           |       |               |
|--------------|-----------|-------|---------------|
| 1            | 2         | 3     | 4             |
| Almost Never | Sometimes | Often | Almost Always |
14. When I try hard and can't solve a math problem at home,...**I get upset.**
- |              |           |       |               |
|--------------|-----------|-------|---------------|
| 1            | 2         | 3     | 4             |
| Almost Never | Sometimes | Often | Almost Always |
15. When I work math problems at home...**I feel good about myself.**
- |              |           |       |               |
|--------------|-----------|-------|---------------|
| 1            | 2         | 3     | 4             |
| Almost Never | Sometimes | Often | Almost Always |
16. When I do well in math...**I feel proud when I tell my parents.**
- |              |           |       |               |
|--------------|-----------|-------|---------------|
| 1            | 2         | 3     | 4             |
| Almost Never | Sometimes | Often | Almost Always |
17. When I solve a difficult math problem at home...**I get excited.**
- |              |           |       |               |
|--------------|-----------|-------|---------------|
| 1            | 2         | 3     | 4             |
| Almost Never | Sometimes | Often | Almost Always |

(Student Questionnaire - Form A continued)

18. When I try hard and can't solve a math problem at home,...**I get frustrated.**

1	2	3	4
Almost Never	Sometimes	Often	Almost Always

---Now, Go To Part IV---

**Part IV:**

Please, use the scale provided and report how often each event occurs.

1. **I am successful...**in doing my math problems in this class.

1	2	3	4
Almost Never	Sometimes	Often	Almost Always

2. **I can do my math problems in this class...**without my teacher's or classmates' help.

1	2	3	4
Almost Never	Sometimes	Often	Almost Always

3. **Math I do at school...**is difficult for me.

1	2	3	4
Almost Never	Sometimes	Often	Almost Always

4. **I get the help I need in class...**to be successful in doing my class math problems.

1	2	3	4
Almost Never	Sometimes	Often	Almost Always

5. When I have difficulty working math problems in this class...**my teacher shows me how to work the problems.**

1	2	3	4
Almost Never	Sometimes	Often	Almost Always

6. **When I see my teacher work a math problem...**I can work a similar problem.

1	2	3	4
Almost Never	Sometimes	Often	Almost Always

7. **Other students in my class show me...**the steps to follow in solving math problems.

1	2	3	4
Almost Never	Sometimes	Often	Almost Always

(Student Questionnaire - Form A continued)

8. **My teacher shows me...**the steps to follow in solving math problems.
- |              |           |       |               |
|--------------|-----------|-------|---------------|
| 1            | 2         | 3     | 4             |
| Almost Never | Sometimes | Often | Almost Always |
9. **I watch other students...**to see how to do my math problems.
- |              |           |       |               |
|--------------|-----------|-------|---------------|
| 1            | 2         | 3     | 4             |
| Almost Never | Sometimes | Often | Almost Always |
10. When I have difficulty in doing my math problems in this class...**my teacher tells me that if I keep trying I can be successful.**
- |              |           |       |               |
|--------------|-----------|-------|---------------|
| 1            | 2         | 3     | 4             |
| Almost Never | Sometimes | Often | Almost Always |
11. **My teacher encourages me...**to do my math problems.
- |              |           |       |               |
|--------------|-----------|-------|---------------|
| 1            | 2         | 3     | 4             |
| Almost Never | Sometimes | Often | Almost Always |
12. **Other students in my class encourage me...**to do my math problems.
- |              |           |       |               |
|--------------|-----------|-------|---------------|
| 1            | 2         | 3     | 4             |
| Almost Never | Sometimes | Often | Almost Always |
13. When I encounter a math problem I believe is difficult to solve...**I am encouraged to work the problem by my teacher.**
- |              |           |       |               |
|--------------|-----------|-------|---------------|
| 1            | 2         | 3     | 4             |
| Almost Never | Sometimes | Often | Almost Always |
14. When I try hard and can't solve a math problem in this class...**I get upset.**
- |              |           |       |               |
|--------------|-----------|-------|---------------|
| 1            | 2         | 3     | 4             |
| Almost Never | Sometimes | Often | Almost Always |
15. When I work math problems in class...**I feel good about myself.**
- |              |           |       |               |
|--------------|-----------|-------|---------------|
| 1            | 2         | 3     | 4             |
| Almost Never | Sometimes | Often | Almost Always |
16. When I do well in my math class...**I am proud.**
- |              |           |       |               |
|--------------|-----------|-------|---------------|
| 1            | 2         | 3     | 4             |
| Almost Never | Sometimes | Often | Almost Always |
17. When I encounter a difficult problem in my math class and I solve it...**I get excited.**
- |              |           |       |               |
|--------------|-----------|-------|---------------|
| 1            | 2         | 3     | 4             |
| Almost Never | Sometimes | Often | Almost Always |

(Student Questionnaire - Form A continued)

18. When I try hard and can't solve a math problem in class...**I get frustrated.**

1	2	3	4
Almost Never	Sometimes	Often	Almost Always

19. When I have to take a math test in this class...**I am anxious.**

1	2	3	4
Almost Never	Sometimes	Often	Almost Always

20. When I have to take a math test in this class...**I am nervous.**

1	2	3	4
Almost Never	Sometimes	Often	Almost Always

---Now, Go To Part V---

**Part V:**

Please, use the scale provided and report how often each event occurs.

1. When I do well in my math class...**it makes me feel good about myself.**

1	2	3	4
Almost Never	Sometimes	Often	Almost Always

2. My friends are hostile and call me names...**when I do well in my math class.**

1	2	3	4
Almost Never	Sometimes	Often	Almost Always

3. My teacher is pleased...**when I do well in my math class.**

1	2	3	4
Almost Never	Sometimes	Often	Almost Always

4. My parents are pleased...**when I do well in my math class.**

1	2	3	4
Almost Never	Sometimes	Often	Almost Always

5. Solving a new or different math problem...**makes me feel proud of myself.**

1	2	3	4
Almost Never	Sometimes	Often	Almost Always

(Student Questionnaire - Form A continued)

6. When I attempt to work my math problems and they are difficult...**I stick with it until I am successful.**
- |              |           |       |               |
|--------------|-----------|-------|---------------|
| 1            | 2         | 3     | 4             |
| Almost Never | Sometimes | Often | Almost Always |

**---Now, Stop!!---**

*Thanks for your cooperation and time in completing this survey. Please, check your answer sheet one final time for any stray marks, items not completed and so on.*

\* The Student Questionnaire - Form A was compressed and reproduced on 4 scan-ton pages.

## **Superintendent's Approval Letter**

**September 01, 2000**

**To: Colonel Alfonse Davis  
Superintendent of Orleans Parish Schools  
3510 General DeGaulle Drive  
New Orleans, LA 70114**

**From: Thaddeus T. Claiborne, Ph.D. Student  
111M Peabody Hall  
Louisiana State University  
Baton Rouge, LA 70803**

**You are being asked to give permission for selected schools within your school district to participate in a research study examining the factors which motivate a student to learn mathematics. Please, read the details of the study which are given below, and sign at the bottom of the form if you give your approval.**

**Title of the Research Study: Home and Classroom Learning Environment  
Correlates Of Academic Self-Efficacy In Middle  
School Mathematics**

**Research Directors: Principal Investigator: Dr. Chad Ellett (225) 388-6900  
Student Investigator: Thaddeus T. Claiborne (504)466-0069**

**Purpose of the Study: The proposed study investigates the relationship between home and classroom learning environment characteristics and middle school student's personal beliefs about their abilities to do mathematics and the factors which are the greatest contributors.**

**Procedures to be Used: Researchers will meet with each identified teacher who will actually administer the instrument to the individual students during a regular classroom period. The questionnaire takes about 20 minutes to complete.**

**Potential Risks to Subjects: There is no apparent risk to the subjects involved in this study.**

**Potential Benefits of the Study: By identifying factors which motivate students to learn mathematics, teachers, school administrators and parents/guardians can develop strategies to increase the number of students who excel in mathematics.**

(Superintendent's Approval Letter continued)

**Protection of the identity and privacy of the subjects:** The mathematic teachers will administered the instrument to the participants who will inscribe a code to the top of the instrument. This will be the only means of identifying the respondents. The participants will be instructed to only answer the questions on the instrument and not add any additional markings. Other than the survey questions, only general demographic information (race, gender, age, etc.) will be asked. Teachers will be instructed to administer the instrument by giving general instructions, handing it to the participants and collecting and placing the instruments into an envelope which will be sealed and given to the investigator. Once returned to the investigator, the instrument will be sorted by school for analyses.

**Student Agreement to Participate in the Study:** The proposed study will be explained to the students and volunteers will be asked to participate. No student will have to participate if they do not want to and no student will be allowed to participate without having first returned this consent form with parental approval.

*I have been fully informed of the above described study and the associated procedures, the possible benefits, and risks and I give my permission for selected schools within my district to participate in the study if they should so desire.*

\_\_\_\_\_  
***Superintendent's Signature***

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

cc: Ollie Tyler, Chief Academic Officer Orleans Parish Schools



## Principal's Approval Letter

September 18, 2000

To: Mr./Mrs. Andi Doe , Principal  
Any School  
Any Street  
New Orleans, LA 70119

From: Thaddeus T. Claiborne, Ph.D. Student  
111M Peabody Hall  
Louisiana State University  
Baton Rouge, LA 70803

I have received permission from the Department of Educational Accountability to gather data for a research project as a part of my Ph.D. program at LSU. Enclosed is a copy of the letter granting me permission to proceed. Likewise, I have attached a narrative discussion of my dissertation which provides some information about the study I would like to conduct in your school and the potential benefits the results might contribute to the improvement of education. I would like to meet with you and the eighth grade mathematics teacher(s) and discuss the steps we need to initiate to proceed with data collection.

At this point, I have completed all of my course work in my Ph.D. program of studies in Educational Leadership, Research, and Counseling at Louisiana State University in Baton Rouge. I have successfully defended my research proposal and have been approved by the internal Institutional Review Board (IRB) at LSU. The IRB reviews studies involving children under the age of 18 that are going to be conducted in an educational setting such as your school. As previously mentioned, the details of the study have been approved by the Orleans Parish School Board, but I need to have your approval as the principal of a targeted school before I can proceed. I am hoping this approval can be received before Friday, September 22 and we can proceed with data collection the following week.

The following is a brief overview of the study:

Title of the Research Study: Home and Classroom Learning Environment  
Correlates Of Academic Self-Efficacy In Middle School  
Mathematics

(Principal's Approval Letter continued)

**Research Directors: Principal Investigator: Dr. Chad D. Ellett  
(225) 388-6900**

**Student Investigator: Thaddeus T. Claiborne  
(504) 466-0069**

**Purpose of the Study:** The proposed study investigates the relationship between home and classroom learning environment characteristics and middle school student's personal beliefs about their abilities to do mathematics and the factors which are the greatest contributors.

**Procedures to be Used:** Researchers will meet with each identified teacher who will actually administer the instrument during a regular classroom period. A consent form will be sent home to solicit parental approval. Once approval is received the students will be asked to fill out the demographics part of the questionnaire which takes about 2-3 minutes to complete. The questionnaire takes about 15 minutes to complete. Finally, students will be asked to complete a 2-3 minute opinion survey.

**Potential Risks to Subjects:** There is no apparent risk involved in this study.

**Potential Benefits of the Study:** By identifying factors which motivate students to learn mathematics, teachers, school administrators and parents/guardians can develop strategies to increase the number of students who excel in mathematics.

**Protection of the identity and privacy of the subjects:** The mathematic teachers will administer the instrument to the participants who shall be identified by the code inscribed on each questionnaire. The code shall be the only means of identifying the respondents. The participants will be instructed to only answer the questions on the instrument and they are not required to make any computations. Other than the survey questions, only general demographic information (race, gender, age, etc.) will be asked. Teachers will be instructed to administer the instruments by giving general instructions, handing the instruments to the participants, and collecting and placing the instruments into an envelope which will be sealed and given to the investigator. Once returned to the investigator, the instruments will be sorted by school for analyses.

(Principal's Approval Letter continued)

**Student Agreement to Participate in the Study:** The proposed study will be explained to the students and volunteers will be asked to participate. No student will have to participate if they do not want to and no student will be allowed to participate without having first returned the consent form with parental approval.

Thanking you in advance for your support. I can be reached by phone at home in Kenner at 504-466-0069, by fax at 504-464-7655 or by e-mail at *tclaiborne@aol.com*; at my office at LSU in Baton Rouge at 225-388-2182, by fax at 225-388-6918 or by e-mail at *tclaibl@lsu.edu*.

Sincerely,

Thaddeus T. Claiborne

## **APPENDIX B:**

### **ITEM LOCATION INDICES FOR ORIGINAL AND FACTORED SUBSCALES OF THE SMSEI, AEMPI, OEI, MSELEI - HF, AND MSELEI - CF MEASURES**

**Table B.1**  
**Item Location Index for Original Measures**  
**(The SMSEI, AEMPI, OEI, MSELEI-HF, and MSELEI-CF Measures)**

Subscale	Instrument Section
SMSEI (17) <sup>a</sup>	Part I
AEMPI (5)	Part II
OEI (6)	Part V
MSELEI-HF (18)	Part III
MSELEI-CF (20)	Part IV
Instrument Item Total (66)	
<sup>a</sup> Number of items on the measure	

Table B.2

**Item Location Index for Factored Measures and Subscales of the SMSEI, AEMPI, OEI, MSELEI-HF, and MSELEI-CF**

Subscale	Instrument Section	Instrument Item Number
SMSEI (16) <sup>a</sup>	Part I	
Arithmetic (6) <sup>b</sup>		1, 2, 4, 6, 13, 14
Fractions (6)		9, 10, 11, 12, 15, 16
Equations (4)		3, 7, 8, 17
AEMPI (5)	Part II	
Effort (3)		1, 2, 3
Persistence (2)		4, 5
OEI (5)	Part V	1, 3, 4, 5, 6
MSELEI-HF (16)	Part III	
Home Support (8)		4, 5, 6, 7, 8, 9, 12, 13
Home/Positive Affect (4)		11, 15, 16, 17
Home/Negative Affect (4)		2, 3, 14, 18
MSELEI-CF (18)	Part IV	
Teacher Modeling (6)		4, 5, 8, 10, 11, 13
Class/Negative Affect (4)		3, 14, 18, 20
Class/Positive Affect (3)		15, 16, 17
Student Independence (2)		1, 2
Student Models (3)		7, 9, 12
Instrument Item Total (60)		

\* Item loading does not meet original criteria established for item retention

\*\* Item loading meet original criteria established for item retention but the item was eliminated because of nonconformity to theory

<sup>a</sup> Number of items on the measure

<sup>b</sup> Number of items on the subscale

## **APPENDIX C:**

### **DESCRIPTIVE STATISTICAL TABLE FOR RAW DATA**

Table C.1

Summary of Measurement Subscales: Descriptive Statistics for the Raw Data on the SMSEI, AEMPI, OEI, MSELEI - HF, and MSELEI - CF for Students in all Schools (n=663)

Instrument/Item Number	Maximum Item Rating	M	SD	M% Max <sup>a</sup>
SMSEI (17) <sup>b</sup>	9 <sup>c</sup>			
1 <sup>d</sup>		8.72	1.09	.97
2		8.52	1.34	.95
3		5.91	3.11	.66
4		8.59	1.34	.95
5		7.70	2.12	.86
6		8.04	1.80	.89
7		4.87	2.78	.54
8		5.34	2.94	.59
9		6.74	2.35	.75
10		6.63	2.55	.74
11		6.33	2.77	.70
12		6.67	2.74	.74
13		8.64	1.36	.96
14		8.70	1.26	.97
15		6.83	2.62	.76
16		7.23	2.47	.80
17		5.12	2.95	.57
AEMPI (5)	9			
1		5.47	2.72	.61
2		5.80	2.80	.64
3		6.04	2.80	.67
4		6.69	2.17	.74
5		6.36	2.52	.71
OEI (6)	4			
1		3.19	.97	.80
2		1.42	.82	.36
3		3.17	.96	.79
4		3.57	.80	.89
5		2.90	1.05	.73
6		2.82	.97	.71



(Table continued)

Instrument/Item Number	Maximum Item Rating	M	SD	M% Max <sup>a</sup>
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MSELEI - HF (18)	4			
1		3.26	.88	.82
2		3.23	.93	.81
3		1.99	.90	.50
4		2.77	1.12	.69
5		2.87	1.12	.72
6		2.56	1.14	.64
7		1.61	.95	.40
8		2.21	1.09	.55
9		1.90	1.06	.48
10		2.94	1.11	.74
11		3.39	.93	.85
12		1.94	1.11	.49
13		2.61	1.12	.65
14		2.41	1.07	.60
15		2.81	1.06	.70
16		3.33	.98	.83
17		2.63	1.17	.66
18		2.68	1.08	.67
MSELEI - CF (20)	4			
1		3.00	.86	.75
2		2.48	.88	.62
3		2.04	.87	.51
4		2.93	.93	.73
5		3.15	.96	.79
6		3.02	.88	.76
7		2.31	.97	.58
8		3.25	.90	.81
9		2.19	.96	.55
10		2.65	1.11	.66
11		3.02	1.01	.76
12		1.99	1.04	.50
13		2.56	1.04	.64
14		2.24	1.06	.56

(Table continued)

Instrument/Item Number	Maximum Item Rating	M	SD	M% Max <sup>a</sup>
15		2.86	1.07	.72
16		3.23	.96	.81
17		2.74	1.10	.69
18		2.47	1.06	.62
19		2.11	1.00	.53
20		2.38	1.12	.60

<sup>a</sup> Percentage of maximum is calculated by dividing the item mean by the maximum possible score for the item

<sup>b</sup> Total number of items on the instrument

<sup>c</sup> Maximum possible score for the item

<sup>d</sup> Instrument item number

**APPENDIX D:**  
**DESCRIPTIVE STATISTICAL TABLE FOR FACTORED SUBSCALES**  
**OF MEASURES**

Table D.1

**Summary of Measurement Subscales: Descriptive Statistics for the SMSEI, AEMPI, OEI, MSELEI - HF, and MSELEI - CF for Students in all Schools (n=663)**

Instrument/Subscale	Maximum Item Rating	M	SD	M% Max <sup>a</sup>
SMSEI (16) <sup>b</sup>	9			
Arithmetic (6) <sup>c</sup>	9	51.25	6.19	.95
Fractions (6)	9	40.54	12.73	.75
Equations (4)	9	21.20	8.94	.59
AEMPI (5)	9	30.50	10.36	.68
AEMPI (5)	9			
Effort (3)	9	17.34	7.62	.64
Persistence (2)	9	13.06	4.29	.73
OEI (5)	4	15.68	3.60	.78
MSELEI - HF (16)	4			
Home Support (8)	4	18.44	6.14	.58
Home/Positive Affect (4)	4	12.15	3.19	.76
Home/Negative Affect (4)	4	11.16	2.82	.70
MSELEI - CF (18)	4			
Teacher Modeling (6)	4	17.65	4.37	.74
Class/Negative Affect (4)	4	10.91	3.21	.68
Class/Positive Affect (3)	4	8.82	2.82	.74
Student Independence (2)	4	5.48	1.53	.69
Student Models (3)	4	6.46	2.38	.54

<sup>a</sup> Percentage of maximum is calculated by dividing the subscale mean by the maximum possible score for that subscale

<sup>b</sup> Total number of items on the instrument

<sup>c</sup> Number of items on Instrument Subscales

## VITA

Thaddeus Theodore Claiborne was born August 30, 1953, in Tallulah, Louisiana. He graduated from Reuben McCall Senior High School (1971) in Tallulah, Louisiana, received a bachelor of science degree in civil engineering (1975) from Southern University and A & M College, Baton Rouge, Louisiana, and a master of arts degree (1994) from Xavier University of Louisiana, New Orleans, Louisiana.

Thaddeus is currently married to Deborah Althea Foote-Claiborne and the proud father of two daughters. His oldest daughter, Thadra Rene' Claiborne, is a year 2000 graduate of Xavier University Preparatory School in New Orleans, Louisiana and a freshman at Southern University in Baton Rouge expecting to graduate with the class of 2004. His youngest daughter, LaToya Denise Claiborne, is a member of the 2001 graduating class of Xavier University Preparatory School in New Orleans, Louisiana.

Thaddeus worked for Procter and Gamble, Cincinnati, Ohio, from 1975 to 1981 as a civil engineer in the construction department in a number of different capacities, i.e. cost estimator, civil engineer in charge of construction specifications and construction management, and as a civil design engineer. He resigned from Procter and Gamble in 1981 and moved to New Orleans to pursue a career in the petrochemical industry with Shell Offshore Incorporated.

As an employee of Shell Offshore Incorporated, Thaddeus worked in a number of different job assignments which included facilities engineering, designing offshore oil and gas production equipment, managing land and offshore construction projects and serving as an offshore maintenance foreman.

In 1988, Thaddeus experienced a life threatening accident when he was burned over 90% of his body. After returning to work a year later, he was offered a severance package and accepted it. He then began a quest to explore a new career in education.

Thaddeus enrolled in an alternative education degree program at Southern University in New Orleans. After he successfully completed a few classes in the alternative degree program, he was advised to pursue a masters degree in education. This he did, obtaining a master of arts degree in 1994 and in 2001, the doctor of philosophy degree.

Most recently, Thaddeus has served as the assistant to the editor of the Journal of Personnel Evaluation in Education. This journal which is published by Kluwer Academic Publishers is maintained on the campus of Louisiana State University in Baton Rouge, Louisiana. The JPEE publishes articles which deal with significant issues and topics that are specific to the field of personnel evaluation in education.

# DOCTORAL EXAMINATION AND DISSERTATION REPORT

**Candidate:** Thaddeus Theodore Claiborne

**Major Field:** Educational Leadership and Research

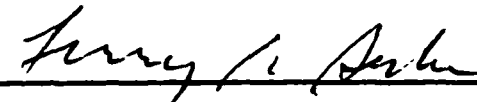
**Title of Dissertation:** Home and Classroom Learning Environment Correlates  
of Academic Self-Efficacy in Middle School Mathematics

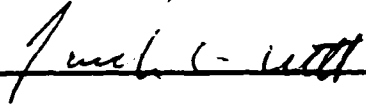
**Approved:**


  
Major Professor and Chairman

  
Dean of the Graduate School

## EXAMINING COMMITTEE:











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**Date of Examination:**

April 3, 2001

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