ABSTRACT

Title of Dissertation: AN EXAMINATION OF THE WORKING CONDITIONS, CHALLENGES, AND TENSIONS EXPERIENCED BY MATHEMATICS TEACHERS

Ming Chang Tomayko, Doctor of Philosophy, 2007

Dissertation Directed by: Professor James T. Fey
Education Curriculum and Instruction

To make the professional work of teachers more effective and personally satisfying, it is important to better understand the nature and effects of the evident stresses in their work. The purpose of this study was to describe the quality of work life of mathematics teachers in Maryland, with an eye on ultimately helping the mathematics teaching profession and the broader education community to improve both the effectiveness and satisfaction of K-12 teachers of mathematics.

Since school systems share many features with large organizations, the design of the present study utilized prior research from industry on stress in the workplace to help in understanding the strains of mathematics teaching. A review of literature suggested five potential stressors which formed the basis of the study. The five stressors were: the congruence of individual and organizational goals, teachers' sense of agency, teachers' sense of efficacy and respect, the level of professional interactions between teachers, and

the appropriateness of teachers' work load. From these stressors, Likert-type survey statements were generated and organized into a 77-item, online survey instrument.

Participants were solicited through flyers and e-mails. The survey data was analyzed in two ways. First, teacher working conditions were evaluated in terms of the five potential stressors. Then, a factor analysis of the survey data identified six underlying components of stress in the work lives of mathematics teachers. Teacher working conditions were then re-evaluated with respect to these six components. Finally, a few of the survey participants were selected for follow-up interviews to provide additional insights into their responses.

Statistical analysis using ANOVA and multiple comparison procedures resulted in several findings. Mathematics teachers expressed having a lack of agency, particularly with respect to decisions impacting instruction and assessment. Participants reported feeling overloaded by their job responsibilities and many even cited interruptions to both planning time and instructional time as serious obstacles to teaching. On the other hand, mathematics teachers felt a strong sense of accomplishment. Comments provided by participants indicate that they thrive on seeing students learn, grow, and succeed in mathematics.

AN EXAMINATION OF THE WORKING CONDITIONS, CHALLENGES, AND TENSIONS EXPERIENCED BY MATHEMATICS TEACHERS

by

Ming Chang Tomayko

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Dissertation Committee:

Dr. James Fey, Chair
Dr. Ken Berg
Dr. Lisa Boté
Dr. Anna Graeber
Dr. Denny Gulick

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DEDICATION

I dedicate this dissertation to

my grandparents, my parents, and my husband

for their love and support.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1: INTRODUCTION

Rationale

Nearly all teachers enter the profession of education with a strong belief that their efforts will make a positive contribution to society and to the lives of individual students (Farber, 1991; Lortie, 2002; Stiegelbauer, 1992). However, inspired beginning teachers are often confronted with working conditions that frustrate their efforts and diminish their belief that they will be able to make a difference. Changes in societal expectations and control of education have had similar discouraging effects on capable experienced teachers, leading to feelings of conflict and stress that too often culminate in burnout and resignation from the profession.

The conflicts and frustrations of work in schools today are especially acute for teachers in high stakes fields like mathematics. Those tensions of contemporary mathematics teaching are expressed with passion and eloquence in recent words of an Ohio middle school teacher who is involved in field tests of a *Standards*-based reform curriculum.

> As a user of CMP for the past 9 years I've never been shy about giving credit to CMP for giving me knowledge, tools, and strength to teach middle school math to middle school children. Now, with the coming of the new units, I have become even more committed to teaching children for understanding! Over the past year I have begun to feel the stress of the "new" state tests we're going to give in Ohio at grades 6, 7, and 8 and with this stress I've often felt like I was going to have to give up some of what I love to teach so much … *Connected Math*. In fact, for the two weeks prior to my visit to East Lansing, I had succumbed to my fears and

> began "drilling" my kids [in] symbolic algebra at grade seven. I knew my methods weren't right as I could see the "deer in [the] headlights" eyes I saw throughout my room. But, I couldn't see what I knew was right … teaching for understanding is so much more important than drilling for no understanding. (J. Mamer, personal communication, February 28, 2005)

In addition to the stress induced by pressures of high stakes external assessments, today's mathematics teachers experience tensions caused by institutional policies that dictate curriculum goals and teaching practices, non-academic school responsibilities that detract from teaching, and conflict with parents and community activists who have strong ideas about educational practices.

To make the professional work of teachers more effective and personally satisfying, it is important to better understand the nature and effects of the evident stresses in their work. The purpose of this study was to describe the quality of work life of mathematics teachers in one diverse state, with an eye on ultimately helping the mathematics teaching profession and the broader education community to improve both the effectiveness and satisfaction of K-12 teachers of mathematics.

Because teaching shares many elements of work in all social service professions and complex organizations, there is a useful body of prior research in social psychology and organizational behavior to guide approaches to study of tension in mathematics teaching. Using models from social psychology and organizational behavior theory on quality of work life (QWL) and stress in organizations, these tensions can be clustered around five strands. These tension strands are:

1. Goal Congruence
    - To what extent are individual teacher and institutional beliefs, goals, and values congruent?
2. Agency
    - To what extent do teachers play a role in decision-making that affects their work?
    - To what extent are teachers able to apply their personal skill and knowledge in teaching mathematics?
3. Teacher Efficacy and Respect
    - To what extent do teachers feel they have the power to produce results?
    - To what extent do teachers feel they are viewed as competent professionals by students, parents, colleagues, administrators, and the media?
4. Professional Interaction
    - To what extent do teachers have opportunities for collegial interaction?
5. Load Appropriateness
    - To what extent are teachers pressured for time from both academic and non-academic responsibilities?

While these tensions exist across content areas and grade levels, they have become particularly prominent in mathematics due to recent changes. Mathematics has historically been considered essential as it is one of the three R's – Reading, wRiting, and aRithmetic. However, mathematics is now under increased scrutiny as a result of efforts to ensure a mathematically literate citizenry. Calls for increased accountability and higher standards have led to changes in mathematics testing and curriculum. The sometimes

conflicting pressures caused by these changes calls for a fresh take on the workplace tensions of mathematics teachers.

Research Questions

In light of the current state of mathematics education and the existing research on stress and tension in organizations, this research sought to answer the following research questions.

1. What specific aspects of the professional working environment for mathematics teaching are especially stressful and discouraging?
2. When tension is measured by the strands of goal congruence, agency, teacher efficacy and respect, professional interaction, and load appropriateness, to what extent do teachers of mathematics feel tensions in the conditions of their professional working environment?
3. When tension is measured by the strands of goal congruence, agency, teacher efficacy and respect, professional interaction, and load appropriateness, are there statistically significant differences in the feelings of tension perceived by mathematics teachers when examined in terms of demographic variables?

Since the five strands of goal congruence, agency, teacher efficacy and respect, professional interaction, and load appropriateness were derived from literature in social psychology and organizational behavior, it could be argued that the strands may not adequately capture the sources of tension experienced by mathematics teachers. To explore what underlying variables (sources of tension) could explain how participants responded, I conducted a factor analysis. Ideally, the underlying variables would match the five hypothesized strands. However, there could be differences. Once I identified the

underlying variables, I felt it appropriate to interpret the survey responses by re-analyzing the data using the new item groupings. Therefore, the second phase of the study addressed the following research questions:

4. When tension is measured by the factors identified through factor analysis, to what extent do teachers of mathematics feel tensions in the conditions of their professional working environment?
5. When tension is measured by the factors identified through factor analysis, are there statistically significant differences in the feelings of tension perceived by mathematics teachers when examined in terms of demographic variables?

Theoretical Perspective

The theoretical framework for this research draws upon a social-psychological perspective as well as an organizational perspective. Social psychology is "the study of the manner in which the personality, attitudes, motivations, and behavior of the individual influence and are influenced by social groups" (Webster's Ninth New Collegiate Dictionary, 1990, p. 1119). For the purposes of this study, the individuals of interest are mathematics teachers and the social group is the educational institution. A social-psychological perspective is appropriate because it is the interaction between mathematics teachers and the educational institution and the resulting impact on beliefs, attitudes, and behaviors which is at the heart of this research study.

Besides social psychology, an organizational perspective is also relevant when considering teacher working conditions. The organizational perspective is based on organizational behavior theory, the study of the structure, processes, and performance of organizations, and the behaviors of and relationships between individuals and groups

within the organization (Katz & Kahn, 1978; Nelson & Quick, 2000). While there is some overlap between the social-psychological and organizational perspectives, the key difference is the emphasis on the role of the organization in the latter. For the current study, the organizational perspective was used to investigate the work stress perceived by mathematics teachers and the coping mechanisms they used as a result.

Definition of Strands

The present study was centered on five tension strands identified from organizational research. These tension strands were goal congruence, agency, teacher efficacy and respect, professional interaction, and load appropriateness. A description of each strand is presented below.

Goal Congruence

The goal congruence strand assesses the extent to which mathematics teachers perceive that their beliefs, goals, and values are in line with the beliefs, goals, and values of the school, district, and state (Louis & Smith, 1990). Teachers' beliefs, goals, and values are shaped by their training and their experiences regarding the best ways to teach and the ways students learn. The policies and rhetoric from schools, districts, and states, however, often point to beliefs, goals, and values guided by efficiency, orderliness, and measurable results. This dilemma is exemplified by Jim Mamer's description of feeling pulled in opposite directions by curriculum and testing (see page 1). In Jim's case, he recognizes what is educationally sound (teaching for understanding) but his instruction falters under pressure from state tests. For some teachers, the pressures from policies can be so paralyzing that they are unable to do what they know is best for students. This "simultaneous occurrence of two or more role expectations", in this case personal and

institutional role expectations, "such that compliance with one would make compliance with the other more difficult" has been termed *role conflict* by social psychologists (Katz & Kahn, 1978, p. 204).

The goal congruence strand also measures the congruence between the demands of teaching and the abilities of teachers to meet those demands. For example, in any given classroom, teachers work with students who are at a variety of levels mathematically and students who have a variety of learning modalities. In addition, for each grade level or course, the school and district prescribe expectations and timelines for student achievement. Teachers are under pressure for all students to meet these requirements. As a result, teachers can feel conflicted and overwhelmed by the demands of teaching. Researchers have previously labeled this congruence or incongruence between the teacher and the work environment as the Person-Environment (P-E) fit model (French, Rodgers, & Cobb, 1974).

Another component of goal congruence is role ambiguity. For teachers, role ambiguity manifests as a lack of clarity regarding their teaching objectives and methods. For example, mathematics teachers are directed to follow: the guidelines of the National Council of Teachers of Mathematics (NCTM) *Principles and Standards for School Mathematics* (PSSM), the Maryland Voluntary Curriculum (MVC), and the local district course objectives, while also keeping in mind the Maryland State Assessments (MSA), the Maryland High School Assessments (HSA), and the local district course assessments. In addition, a mandated textbook, administrators, and parents can all influence the content and instructional methods a teacher employs. These numerous and varied

directions in which teachers are guided can result in a troublesome sense of role ambiguity.

Agency

The agency strand measures how autonomous, empowered, and utilized teachers feel. For example, autonomy can be gauged by asking mathematics teachers who determines what content they teach and assess and how they teach and assess that content. Do teachers feel they can modify lessons to better suit their own class? In conjunction with autonomy is the idea of uniformity. Teachers are often pressured to teach the same things the same way they are tested.

Another key aspect of the agency strand is a teacher's role in decision-making. In a recent survey of teachers in a Maryland school district, 91% of respondents said they wanted to be involved in decision-making at their school, but only 48% felt as though they were involved (Surface, 2005). Decision-making in the present study will be evaluated with respect to curriculum, assessments, textbooks, pedagogy, and standards of achievement. Connected to decision-making is the concept of locus of control. Do teachers perceive that the locus of control resides with the teacher (internal) or with others (external)?

A component of the agency strand is the extent to which teachers sense that their skills and knowledge are required. If not, teachers can feel underutilized (Ingersoll, 2003; Katz & Kahn, 1978) and dissatisfied (Hemmings & Metz, 1990). An extreme example of underutilization is where districts prescribe curriculum guides so detailed and scripted that they are mocked as teacher-proof, meaning anyone could "teach" from such a guide

(Feiman-Nemser & Floden, 1986). These highly specified guides can make teachers feel disempowered and essentially reduce their role to a set of mundane, routine procedures.

In one study, Conley, Bacharach, and Bauer hypothesized that "[i]n schools in which teachers report higher levels of work routinization, they will also report higher levels of career dissatisfaction" (1989, p. 61). In this study, the researchers sought to confirm Louis and Smith's claim that one's sense of skill and knowledge utilization is a key facet of job satisfaction (1990). The researchers used a four-item scale to measure the independent variable of routinization. The correlations and regressions conducted showed that routinization was associated with career dissatisfaction at both the elementary and secondary level and that routinization was a significant predictor of career dissatisfaction at both levels.

Teacher Efficacy and Respect

The concept of teacher efficacy was first described in research by the RAND organization (Armor et al., 1976). Since then, researchers have defined teacher efficacy as "the extent to which the teacher believes he or she has the capacity to affect student performance" (Berman, McLaughlin, Bass-Golod, Pauly, & Zellman, 1977, p. 137) or as the "belief in their ability to have a positive effect on student learning" (Ashton, 1985, p. 142).

Teacher efficacy is derived from Bandura's theory of self-efficacy. Bandura described self-efficacy as "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performance" (Bandura, 1986, p. 391). One's sense of self-efficacy is formed from several sources (Bandura, 1977). The most influential source is from one's own experiences. Perceptions of efficacy

can be raised by successful experiences while failures, particularly repeated failures, decrease such perceptions. For example, teachers whose students consistently fail to pass state tests are likely to feel less and less efficacious. Another source is vicarious experiences. In this case, if someone who I perceive is similar to me experiences success, I will feel more capable of achieving success. However, if that person is unsuccessful, I will feel less likely to be effective at the same task. For instance, a teacher may hear from their colleague how difficult it is to teach students about fractions. This can cause the teacher to have doubts about their own ability to teach fractions. Positive reinforcement in the form of verbal or written feedback from supervisors or colleagues can also impact one's sense of self-efficacy. In teaching, such feedback could come from classroom observations. However, these observations typically occur on an infrequent basis, reducing the opportunities for teachers to receive comments on their skills.

Related to teacher efficacy is the concept of respect. A lack of respect can lead to feelings of inefficacy. For example, teachers may feel bombarded by negative publicity. They may hear on the radio that American students are lagging behind their international counterparts on tests. They may read articles in the newspaper which ask why our students cannot do better when the test items seem simple. Teachers may also find test results published in the newspaper by school, district, or state. When teachers turn on the television, they hear how student performance declines as students progress from grade 4 to grade 8 to grade 12, with the implication that more schooling leads to drops in scores. In light of such disheartening news, this strand seeks to investigate how teachers perceive they are respected by peers, parents, administrators, students, and the community.

Professional Interaction

The professional interaction strand considers how well the school culture encourages professional growth and interaction. Such opportunities for frequent and stimulating contact have been shown to reduce the feelings of isolation (Seeman, 1972) created by the cellular structure of schools (Feiman-Nemser & Floden, 1986; Lortie, 2002). Teachers can also develop a sense of ownership and a vested interest in the effectiveness of instruction by participating in meaningful collaborations with peers (Louis & Smith, 1990). These collaborations may occur in many ways. For example, classes can be scheduled such that teachers have common planning time to share and discuss teaching ideas. Also, teachers can be given the chance to observe their peers in the classroom to learn new or different instructional methods. Collaboration with peers can also occur when teachers are encouraged to attend professional conferences. To make these initiatives effective, it is important to have qualified substitute teachers available to allow teachers time away from the classroom. Finally, another way schools can promote professional growth is by subscribing to mathematics teaching publications to help teachers stay abreast of research in the field.

Load Appropriateness

The term role overload comes from the study of stress in organizations (Kahn & Byosiere, 1992). Role overload occurs when legitimate expectations are practically impossible to fulfill within the given time constraints (Kahn, Wolfe, Quinn, Snoek, & Rosenthal, 1964). The combination of high job demands and low resources results in strain that is often referred to as role overload. In this study, the load appropriateness strand assesses the extent to which teachers feel pressured for time from both academic

and non-academic responsibilities. The essence of this strand can be summed up by the phrase, “and I’m supposed to do this while …” spoken by teachers when they receive new expectations.

Role overload can stem from a variety of factors. For example, the district curriculum guide can cause teachers to feel overloaded due to the amount of content included and the pacing of that content. If teachers find their students are struggling with the content, they may not feel able to spend more than the allotted time because of the sheer quantity of material in the curriculum. Often, the curriculum content and pacing is related to a district or state assessment. The need to prepare students for such tests can also lead to feelings of overload, especially when students are having difficulty with the concepts. Poor student performance on past assessments can also contribute to role overload because of the additional demands of improving student proficiency.

Teachers can also feel overwhelmed by the numerous intrusions into teaching time. Whether a mathematics class is scheduled to last 30 minutes, 50 minutes, or 90 minutes, the actual teaching time is significantly less due to various interruptions. For example, instructional time is impacted when teachers must follow attendance procedures, handle tardy students, listen to announcements, discipline disruptive students, help struggling students, send students to receive special resources, allow students to use the bathroom or health room, and sign field trip permission forms.

Teachers also experience intrusions in their planning time which can contribute to feelings of role overload. Instead of being able to plan lessons or grade papers, teachers are frequently asked to help students, proctor make-up assessments, cover class for an absent colleague, copy handouts, and make phone calls for attendance issues, behavior

issues, or issues regarding student performance. Teachers may also be assigned hall duty, lunch duty, or bus duty during periods when they are not teaching. Planning time can also be reduced when teachers are required to attend Individualized Education Program (IEP) meetings.

Role overload is not a new phenomenon. In 1963, Lortie interviewed 94 teachers from Boston, Massachusetts and found that tasks and time use were common complaints (Lortie, 2002). As part of the interview, Lortie asked participants, "What are the things which you like least about teaching," "What are the things which bother you most in your work," and "What are the little things that irritate you in your work?" In response, teachers mentioned clerical duties, interruptions, time pressures, duties outside class, large classes, and grading papers among other things. These findings led Lortie to comment, "There is a note of hurt, of dignity offended, in this talk about disruption and managing time. Intrusions on teaching carry a symbolic meaning – they depreciate the importance of those tasks the teacher considers central" (Lortie, 2002, p.179). This statement captures my personal feelings that the main purpose in teaching, namely instruction of students, is often sacrificed because of the numerous other responsibilities placed upon teachers. Not only does this contribute to role overload, but it also negatively impacts the feeling that one is a professional.

Summary

Mathematics has traditionally been viewed as a cornerstone of American education. However, concern over student performance on national and international mathematics assessments has led to increased scrutiny of teachers and more stringent policies regarding teaching practices. As a result, mathematics teachers today face new

challenges, tensions, and stresses which impact their ability to teach students. The purpose of this study was to describe the working conditions of mathematics teachers in an effort to identify and understand the tensions they face.

Since school systems share many features with large organizations, the design of the present study utilized prior research from industry on stress in the workplace to help in understanding the strains of mathematics teaching. A review of literature produced a collection of five potential stressors which formed the basis of the study. From these five stressors, Likert-type survey statements were generated and organized into an online survey instrument.

The survey was administered to a sample of mathematics teachers and the resulting data was analyzed in two ways. First, teacher working conditions were evaluated in terms of the five potential stressors. Then, a factor analysis of the survey data identified six underlying components of stress in the work lives of mathematics teachers. Teacher working conditions were then re-evaluated with respect to these six components. Finally, a few of the survey participants were selected for follow-up interviews to provide additional insights into their responses.

Limitations

As with any research, there were limitations to this study which need to be considered when interpreting the results. These limitations can be categorized as those which impacted who participated and those which impacted how participants responded.

There were a number of factors that could have biased the composition of the sample. First, the location of the Maryland Council of Teachers of Mathematics (MCTM) annual conference may have restricted the participation of teachers from distant school

districts since flyers advertising the survey were distributed there. Second, the use of an online survey instrument may have prevented teachers without computer or internet access from responding. Similarly, teachers who are uncomfortable using technology may have been dissuaded from participating because of the survey format. It is also conceivable that the length of the survey may have caused teachers to exit the survey prematurely. Some teachers may have been uncomfortable rating statements about working conditions and either elected not to participate or stopped taking the survey. The small proportion of elementary school teachers in the sample may stem from how they see themselves (as generalists rather than math teachers). Finally, the small number of private school teachers in the sample could be due to insufficient solicitation.

Several structural aspects of the survey could have influenced the results. First, the survey was administered from mid-October to mid-November. This time-frame may mute teacher perceptions of stress and tension in comparison to the spring when mandated testing is in full swing. Second, teachers may be reluctant to seem critical of their school or district and therefore, underreporting of stress or tension could have occurred. Another factor that could affect the results is the fact that many participants teach multiple classes. The design of the survey items did not permit teachers to distinguish between their different classes as they responded. Lastly, the small number of teachers selected for interviewing prohibits generalization of their experiences to the sample or to teachers at large.

CHAPTER 2: LITERATURE REVIEW

Introduction

As with all new research, it is important to start by looking back at what others have already discovered. This chapter highlights the findings which shaped my theoretical perspective, hypothesized tension strands, and research questions. First, a review of the history of stress and burnout is presented, both of which are key concepts to studying the working conditions of teachers. Second, background information on organizational behavior theory and a description of two areas which are particularly salient to this investigation – the quality of work life model and the study of stress in organizations – is provided. Third, some key research findings regarding sources of stress and barriers to teaching are discussed. These results lend credence to the selection and inclusion of the five tension strands (i.e., goal congruence, agency, teacher efficacy and respect, professional interaction, and load appropriateness). Finally, the stage will be set for the current study by detailing the state of mathematics education reform in Maryland over the past several decades.

Stress

The study of stress has historical roots in the research of Hans Selye, an endocrinologist. Selye found that stress caused "certain changes in the structure and chemical composition of the body" (Selye, 1978, p. 1). Together, these changes are known as the stress syndrome which Selye termed the general adaptation syndrome (also known as G.A.S.). There are three stages to the general adaptation syndrome: the alarm reaction; the stage of resistance; and the stage of exhaustion. This syndrome suggests that when faced with a stressor, or stress-producing factor, the first response will be to react.

The person will then seek to resist the stressor by making adaptations. If the person is unsuccessful at resisting the stressor through these adaptations, they will eventually exhaust their resources and succumb. Selye went on to state: “In the course of a normal human life, everybody goes through these first two stages many, many times. Otherwise we could never become adapted to perform all the activities and face all the demands which are man’s lot” (Selye, 1978, p. 79).

Selye viewed stress as a dependent variable. He defined stress as “the nonspecific response of the body to any demand, whether it is caused by, or results in, pleasant or unpleasant conditions” (Selye, 1978, p. 74). To help distinguish between stress caused by pleasant conditions and stress caused by unpleasant conditions, Selye coined the terms ‘eustress’ (good stress) and ‘distress’ (detrimental stress). As shown in Figure 1, Hebb (1972) also seemed to suggest that stress could be both positive and negative. At the lower extreme, a lack of pressure will result in poor task performance. As pressure increases to a moderate level (e.g., eustress), task performance improves. However, if pressure is excessive (e.g., distress), task performance will suffer and feelings of anxiety, frustration, fatigue, and even burnout can occur.

While Selye delineated two types of stress, it is not surprising that what researchers are more intrigued by is distress, not eustress. As a result, researchers typically use the more common term ‘stress’ even when they are only referring to harmful stress. In keeping with the majority of the literature, I will use ‘stress’ in the negative sense.

Stress specific to teachers has also been described in the literature. In keeping with Selye’s view that stress is a dependent variable, teacher stress has been defined as “a

response by a teacher of negative affect (such as anger, anxiety or depression) accompanied by potentially pathogenic physiological changes (such as increased heart rate, or release of adrenocorticotrophic hormone into the bloodstream) as a result of the demands made upon the teacher in his role as a teacher" (Kyriacou & Sutcliffe, 1977, p. 299). The model of teacher stress which stems from this definition is represented in Figure 2.

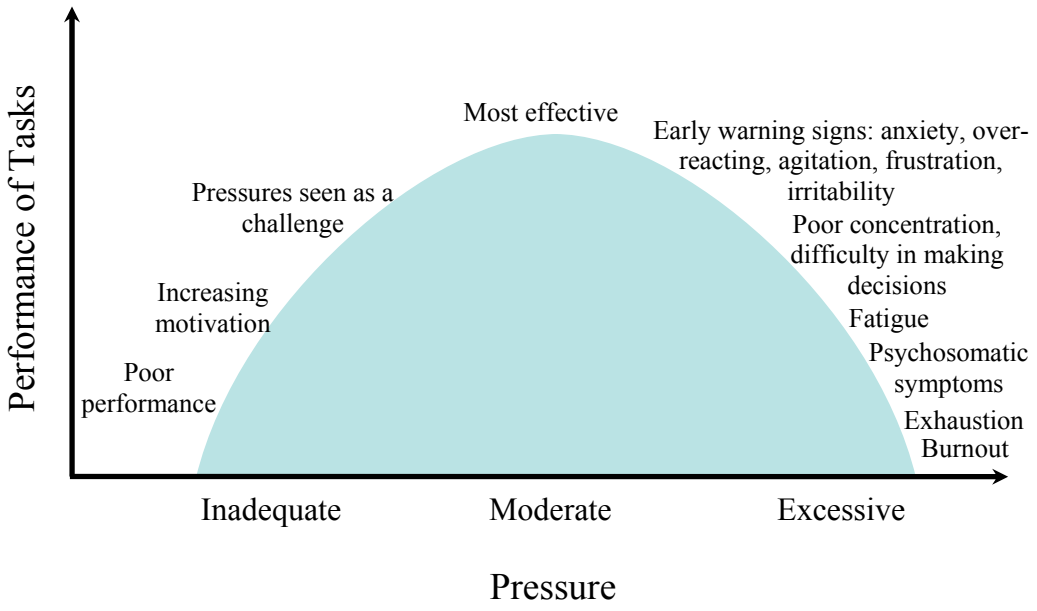


Figure 1. The relationship between pressure and task performance (Hebb, 1972, p. 95).

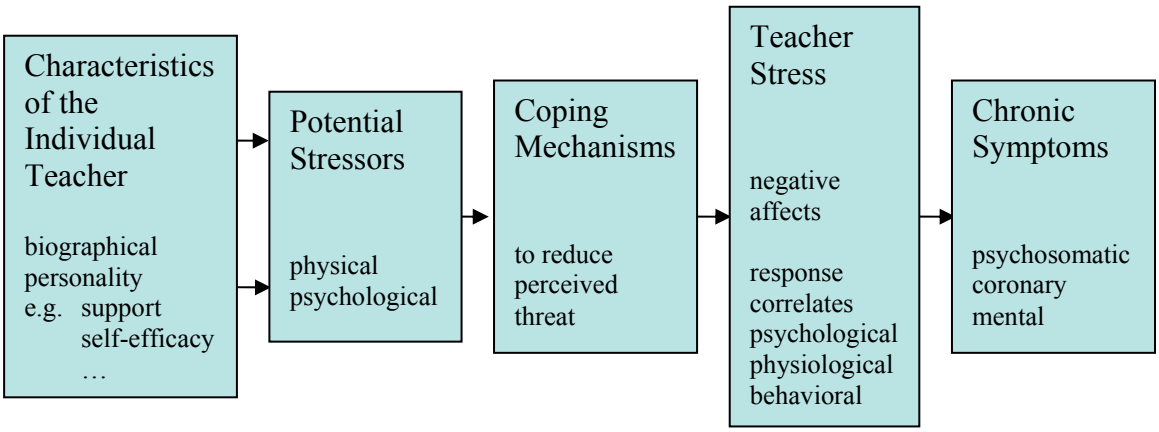


Figure 2. A model of teacher stress (Kyriacou & Sutcliffe, 1978, p. 3).

At the center of this model are the potential stressors, the coping mechanisms employed, and the resulting teacher stress when the coping mechanisms fail. The stressors may be physical (e.g., poor facilities, lack of materials) or psychological (e.g., poor relationships with administrators, peers, students, etc.) and can be influenced by characteristics of the teacher (e.g., personality type, self-esteem, etc.). The build-up of stress can lead to chronic symptoms. More recently, Kyriacou has modified his definition of teacher stress to be "the experience by a teacher of unpleasant, negative emotions, such as anger, anxiety, tension, frustration or depression, resulting from some aspect of their work as a teacher" (2001, p. 28).

Critics of the early work in stress research argue that a unidirectional, response-based model fails to address the variations in frequency, intensity, and duration of the stimulus. As a result, researchers have theorized a different model of stress. In the transactional model, stress is a "relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being" (Lazarus & Folkman, 1984, p. 19). Dunham refers to this model as an interactionist approach (1992). Using this model, individuals are viewed as both

responsive and influential as they cycle through phases of appraisal of the stressor and coping with the stressor. Stress is defined as an individual's ability to meet the demands of the environment (Travers & Cooper, 1996). Some have described this as the degree of fit between the individual and the environment (Edwards & Cooper, 1990; Lazarus & Folkman, 1984; Travers & Cooper, 1996). The interactive nature of the transactional model is in line with the social-psychological perspective used in the present study. Figure 3 provides a graphical representation of this model.

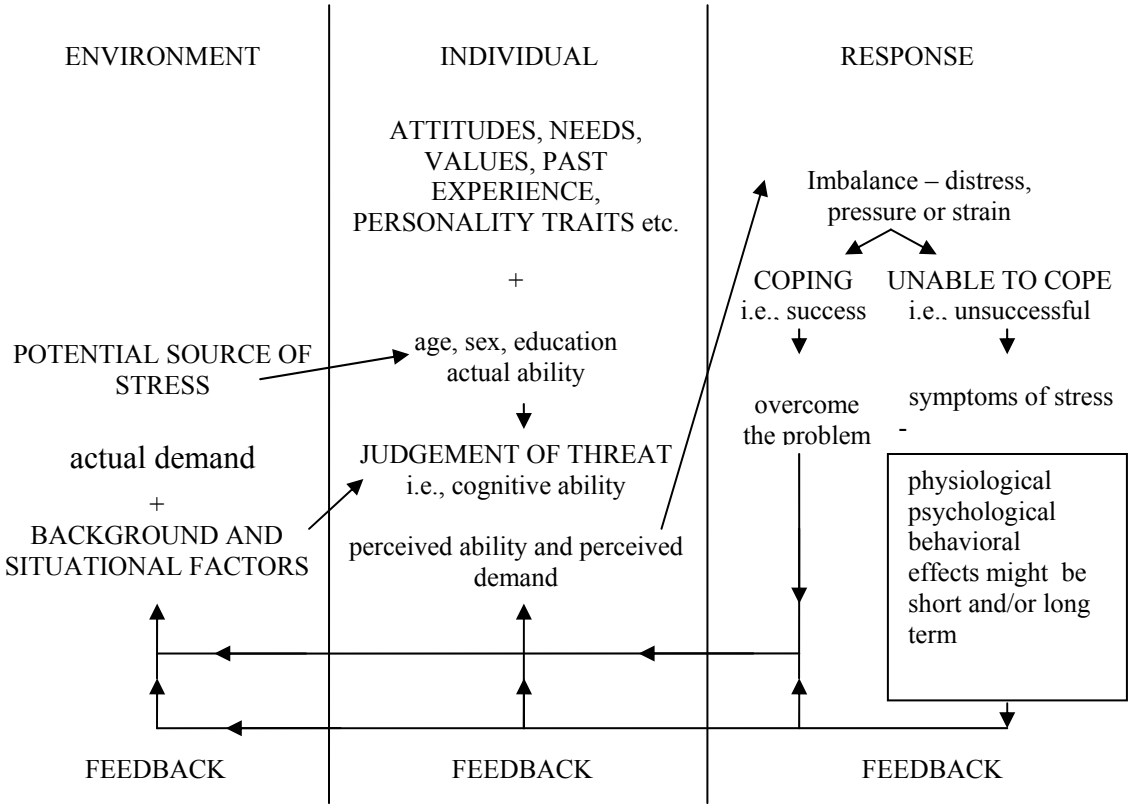


Figure 3. A revised model of teacher stress by Sutherland and Cooper (as cited in Travers & Cooper, 1996, p. 17).

Unlike the unidirectional model, the revised model of teacher stress includes a feedback loop from the coping response back to the individual and the environment. For example, if an individual's coping strategy is unsuccessful, the feedback arrow implies that the individual can adapt and attempt to use a different strategy. It may also be the

case that the feedback causes changes in the environment which in turn impact the perception of stress.

Burnout

Chronic stress can lead to burnout. Probably the most notable figure in the study of burnout is Christina Maslach. Maslach's initial interest was to uncover how individuals maintain their composure and accomplish their tasks when faced with a difficult situation (Maslach & Jackson, 1984). For instance, how do rescue workers at the scene of a gruesome accident manage their emotions so as not to interfere with their job? Maslach began by interviewing doctors and nurses and found that they often felt their training had left them ill-equipped to handle the stresses of the job. Curious to see if individuals in other service-oriented professions experienced similar phenomena, Maslach then interviewed ministers, prison guards, teachers, and probation officers and surveyed social workers through a questionnaire. A theory of burnout was beginning to form. It appeared that burnout was manifested in the emotional exhaustion of workers and the depersonalized nature of their interactions with clients. There also appeared to be relationship between burnout and a decreased sense of personal accomplishment.

To test this theory, a 47-item instrument was constructed and administered to 605 people from a variety of service occupations (e.g., counselors, teachers, police, doctors, attorneys, psychologists, nurses, and social workers) (Maslach & Jackson, 1981). Subjects rated each item for frequency and intensity on a Likert-type scale. Factor analysis resulted in ten factors for both the frequency and intensity scales. Four of these ten factors explained over 75% of the variance. These four factors were emotional exhaustion, depersonalization, personal accomplishment, and involvement. Each item

was evaluated on the following criteria: having "a factor loading greater than 0.40 on only one of the four factors, a large range of subject response, a relatively low percentage of subjects checking the 'never' response, and a high item-total correlation" (Maslach & Jackson, 1981, p. 101). Using these standards, the instrument was reduced to a set of 25 items.

The revised instrument was then administered to a new sample of 420 individuals from the same types of service professions. A factor analysis was done on the new data with similar results. It is common practice to only extract factors with eigenvalues greater than one (Kim & Mueller, 1978). In this analysis, the involvement factor was excluded for this reason. Using data from the second sample, reliability coefficients for the remaining factors were calculated and ranged from 0.72 to 0.89 (Maslach & Jackson, 1981). The resulting 22-items covering the three subscales of emotional exhaustion, depersonalization, and personal accomplishment became the Maslach Burnout Inventory (MBI) which has been widely used (Brissie, Hoover-Dempsey, & Bassler, 1988; Byrne, 1994; Friedman, 1991; Schwab & Iwanicki, 1982). Due to the desire to quantify burnout in various settings, the MBI has been adapted for use with educators and non-service occupations. The MBI Educators Survey (MBI-ES) measures the same three dimensions as the original survey but replaces instances of the term 'recipient' with 'student.' The MBI General Survey (MBI-GS) is comprised of 16 items and focuses on the performance of work rather than on the service between individual and recipient. The dimensions for the MBI-GS are exhaustion, cynicism, and professional efficacy.

Derived from her empirical research findings, Maslach defines burnout as "a psychological syndrome of emotional exhaustion, depersonalization, and reduced

personal accomplishment that can occur among individuals who work with other people in some capacity"(Maslach, Jackson, & Leiter, 1997, p. 192). The first and most significant component is emotional exhaustion, which occurs when one has 'given it all they can.' Burnout can also lead to negative, or even cynical, feelings and attitudes toward clients. The third component of burnout is the tendency to be dissatisfied with one's work and to evaluate oneself in a negative light. Burnout is a serious issue because it can result in the "deterioration in the quality of care or service that is provided" (Maslach & Jackson, 1981, p. 100). In the case of teachers, burnout is a subject we should all be concerned about because the education of our youth is at stake.

Organizational Behavior Theory

Systematic analysis of organizational behavior first began during the Industrial Revolution when the advent of large factories gave rise to issues related to managing large numbers of people and vast quantities of equipment and resources. Frederic Taylor (1856-1915), one of the classical organizational theorists, focused on improving efficiency and production by breaking tasks into their smallest components, determining the best method for accomplishing that job, and standardizing that routine. Another classical theorist, Max Weber (1864-1920), studied organizations to determine the core characteristics that made them efficient and reliable at achieving their goals. Weber used these characteristics to define the term bureaucracy to describe an organization where: a) tasks were specialized, b) processes, procedures, and roles were standardized, c) decision-making was centralized, and d) authority was structured hierarchically (Katz & Kahn, 1978). Such bureaucratic organizations featured merit-based awards rather than selection or promotion based on favoritism. In attempting to make organizations as

efficient as machines, the classical theorists failed to consider the people involved in the organizations and the humanistic needs of those workers.

As a result of the criticisms of Taylorism and the Weberian model of bureaucracy, researchers proposed an organizational structure that emphasized human relations. One of these researchers was Elton Mayo (1880-1949) who is best known for his Hawthorne experiments. The Hawthorne studies were designed to look at the effects of physical conditions on workers' productivity but had the surprising result that human factors were more significant than environmental factors in determining yield (Nelson & Quick, 2000). Consequently, organizational theorists came to believe that improvements in productivity were linked to enhanced morale and that morale was dependent on workers feeling that they had job security, that they belonged, that they had a good relationship with management, and that they received recognition for their work. Throughout the twentieth century, such revelations continued to shape the field of organizational behavior.

Unlike classical theorists who sought to find the one best way to structure organizations in general, the goal of modern-day organizational theorists is to find the best fit between structure, size, function, and environment for each individual organization. With this is mind, researchers involved in organizational behavior have studied attributes of effective organizations. For example, effective organizations tend to: a) recruit quality people, b) structure the organization and tasks to enable workers to achieve their goals, and c) reward employees for their accomplishments (Conley et al., 1989). In addition, organizations cognizant of issues surrounding the quality of work life (QWL) appear to be more effective at retaining their employees and achieving their goals (Louis & Smith, 1990). Some of the findings related to QWL seem particularly useful

when considering the tensions teachers face in schools and how best to alleviate those tensions.

Quality of Work Life

The QWL model comes from work in social psychology and draws on ideas from the humanistic organizational behavior theories of Mayo and his contemporaries. There are seven dimensions of QWL that pertain to the status of teachers' work (Louis & Smith, 1990). These dimensions of QWL are illustrated in Figure 4. First, teachers must perceive that they are respected by their peers, the school and district administrators, the parents, and the community. Without this respect, teachers can feel demoralized. Second, teachers need to feel that they have a role in the decision-making surrounding schools. This empowers teachers and provides them with a sense of control over their work setting.

The third dimension of QWL is that teachers need opportunities for frequent and stimulating professional interaction. Such interactions can promote a sense of ownership and a vested interest in the effectiveness of instruction (Louis & Smith, 1990) while reducing feelings of isolation (Seeman, 1972). The perception of a higher sense of efficacy is the fourth dimension of QWL. This certainty and the associated impact on teacher motivation can be attained through frequent feedback about student growth and development (Lortie, 2002). Acknowledgments from peers, administrators, and parents as well as learning opportunities which help teachers become and feel more knowledgeable can also contribute to generating a heightened sense of efficacy (Rosenholtz, 1989).

The fifth dimension of the QWL model is that teachers must sense that skills and knowledge are required. Having been trained in both the content and pedagogy of mathematics, teachers can feel underutilized (Ingersoll, 2003; Katz & Kahn, 1978) if they

are required to follow scripted lesson plans and use assessments provided by the district. This dissatisfaction can be avoided if teachers have opportunities to use their talents and to grow professionally (Louis & Smith, 1990). In addition, when teachers feel that their expertise is considered necessary and desirable, they are less likely to leave the field.

Figure 4. The seven dimensions of the Quality of Work Life (QWL) model.

Having the resources to fulfill the duties of the job is the sixth dimension of QWL. For teachers, this equates to having comfortable facilities, access to necessary materials, and the absence of disruptions related to students and administration (Conley et al., 1989; Gold & Roth, 1993; Rosenholtz, 1989). The final dimension of QWL is goal congruence between the employee and the institution. In other words, teachers must perceive that the beliefs, goals, and values of the school and district are consistent with their own beliefs,

goals, and values (Louis & Smith, 1990). These dimensions are useful in examining some of the existing research on teaching tensions.

Stress in Organizations

Another facet of organizational behavior that is useful is the study of stress in organizations. The study of stress is not a new phenomenon (Kahn et al., 1964) and is not restricted to the field of education. "There is no doubt that job-related stress [is] rapidly becoming one of the most pressing occupational safety and health concerns in the country today" (Millar, 1992, p. 5). In particular, a framework for the study of stress in organizations designed by Kahn and Byosiere (1992) is quite relevant to teaching tensions. This framework is outlined in Figure 5.

The framework starts by considering the characteristics of the organization: its structure, size, output, and finances. These characteristics can cause both physical and psychosocial stress for members of the organization. For teachers, physical stress can be exhibited in classrooms where noise, light, temperature, or layout cause problems. Psychosocial stress is a result of pressures aimed at changing the behavior of employees and has three possible components: role ambiguity, role conflict, and role overload (Landy, 1992). Role ambiguity is when employees are unclear about the extent of their responsibilities or when employees are unsure of whose expectations they are required to fulfill (Kahn et al., 1964; Katz & Kahn, 1978). Role conflict happens when a person's role expectations are perceived to be at cross-purposes or are contradictory (Katz & Kahn, 1978). Role overload occurs when time constraints make it difficult, or even impossible, to complete the required job tasks (Kahn et al., 1964). In the case of mathematics teachers, these stressors are manifested in the push and pull between standardized testing and the

vision outlined in curriculum standards. This tension is clearly articulated in Jim Mamer's quote on teaching to the test versus teaching for understanding (see page 1).

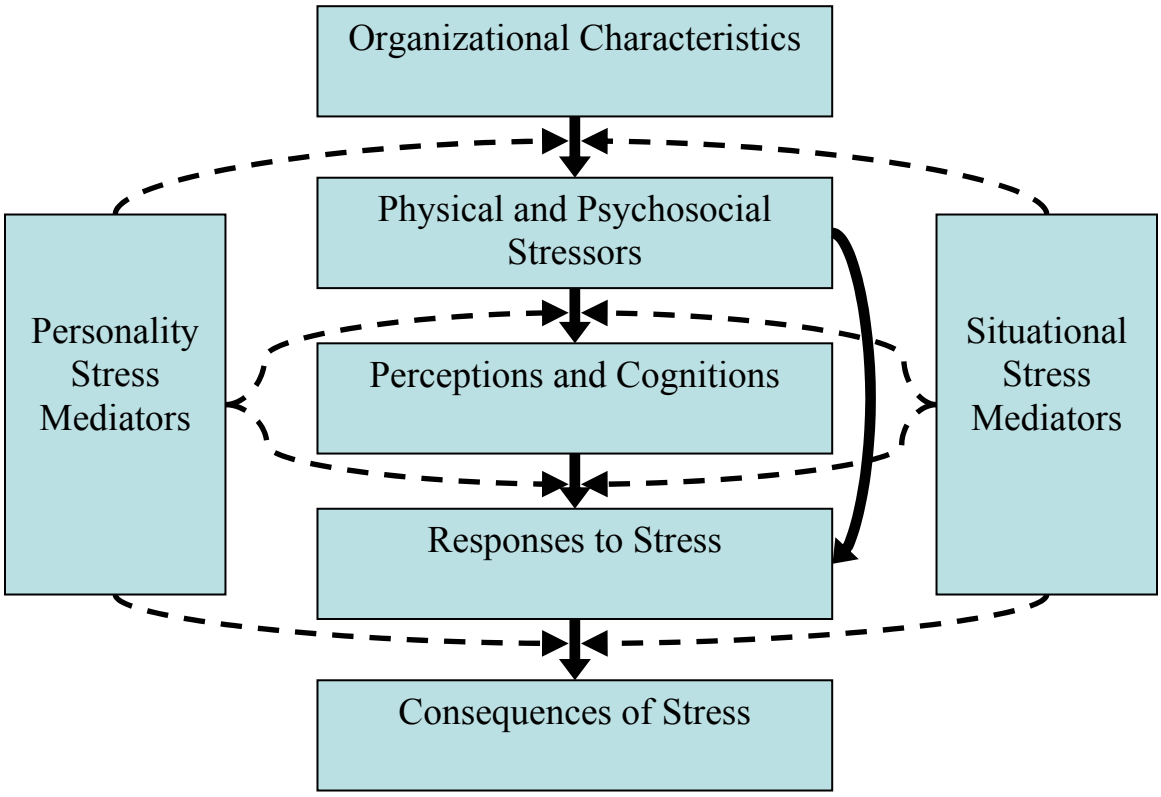


Figure 5. Kahn and Byosiere's framework for the study of stress in organizations.

Another consideration introduced in the framework is when and how an employee perceives or is cognizant of the stressors. Either way, there is a response to the stress which can be physiological (e.g., cardiovascular, biochemical, gastrointestinal, musculoskeletal), psychological (e.g., depression, anxiety, low job satisfaction, sense of futility, high tension), or behavioral (e.g., turnover, absenteeism) (Landy, 1992). These responses compromise the health of the individual and the effectiveness of the organization.

At any point in this framework, personal and situational factors can act as stress mediators. For example, personal factors which may impact perceived stress and the

resulting response include having: type A/B personality, self-esteem concerns, issues with locus of control, and demographic characteristics (Kahn et al., 1964; Landy, 1992). Situational properties could include patterns of interaction with supervisors or peers. For instance, if a cooperative and respectful relationship existed between the employee and supervisor, the employee may handle the stress differently than if this were not the case. Taken as a whole, this framework provides a means of understanding the influence of stress in organizations.

In summary, the perspective presented in this paper for examining the issue of teaching tensions is partially grounded in organizational behavior theory and the study of stress in organizations. This perspective focuses on "how organizations and their sociocultural environments affect a person's response to work" (Byrne, 1999, p. 18). My particular interest is in how features of the work environment are perceived by mathematics teachers as barriers to teaching.

Research on Barriers to Teaching

This section presents relevant research related to each of the five tension strands (goal congruence, agency, teacher efficacy and respect, professional interaction, and load appropriateness).

Goal Congruence

The goal congruence strand seeks to measure the relationship between teacher beliefs and institutional beliefs. Jeffrey and Woods (1998) found stark differences between primary school teacher values and institutional values when investigating the impact of school inspections in England. For example, teachers sought flexibility and autonomy in their practice while the Office for Standards in Education wanted teachers to

follow a controlled and prescribed national curriculum. In terms of assessing students, teachers favored qualitative, locally created measures rather than mass produced standardized ones. The institution's desire for control and uniformity was also at odds with teachers' need to feel utilized and recognized as professionals.

Teacher values were also considered in research by Bachkirova (2003). In her study of teacher stress and personal values, Bachkirova categorized participants on three factors: the match (m) or mismatch (mm) between their personal values and those of educational authorities; their level of ambition to succeed professionally (A+ for high and A- for low); and their sensitivity threshold (S+ for sensitive and S- for placid). She hypothesized that mm, A+, S+ individuals would be the most prone to stress. Bachkirova invited 97 university lecturers and teachers from a partner school to complete an anonymous questionnaire. The response rate was quite high (over 80%) resulting in a sample of 36 lecturers and 36 teachers. Based on the questionnaire responses, 20 lecturers and 20 teachers were classified as mm, A+, S+. The group of mm, A+, S+ participants had a significantly higher level of work related stress when compared to all the other groups combined at the $p<.001$ level, supporting the original hypothesis.

Role conflict and role ambiguity are also part of the goal congruence strand and have been studied in numerous settings. Schwab and Iwanicki (1982) investigated the relationship of role conflict and role ambiguity to teacher burnout using a sample of 469 classroom teachers from the Massachusetts Teachers Association. Participants completed the Teachers' Stress Survey which consisted of the MBI and a role questionnaire. The researchers found that role conflict accounted for the most variance in the emotional exhaustion component of burnout (20% for frequency and 24% for intensity). Role

ambiguity explained a significant amount of the variance in the personal accomplishment aspect of burnout with 6% for frequency and 3% for intensity. In a study of 339 teachers from the New Hampshire National Education Association, Schwab, Jackson, and Schuler (1986) looked at causes of stress as they related to burnout. They found both role conflict and role ambiguity to be significantly related to burnout.

Role conflict and role ambiguity have also been studied with regard to job dissatisfaction. Sutton (1984) found role conflict correlated with job dissatisfaction ($r=.41$, $p<.05$) from a sample of 200 classroom teachers from 25 public schools in Michigan. However, results for role ambiguity have been mixed. Sutton reported a weak correlation between role ambiguity and job dissatisfaction ($r=.25$, $p<.05$) while Conley et al. (1989) found a strong correlations at both the elementary and secondary level ($r=.64$ and $.74$, $p<.001$). In fact, role ambiguity explained the most variance in dissatisfaction out of all independent variables (41% for elementary, 55% for secondary). The findings from Conley et al. came from questionnaires administered in 42 elementary schools and 45 secondary schools in New York.

Agency

Research on the agency strand highlights the lack of autonomy as a significant source of stress. Archbald and Porter (1994) surveyed high school mathematics and social studies teachers from selected urban districts in California, Florida, and New York. They were interested in whether curriculum control policies affect teachers' sense of autonomy and job satisfaction. Their findings indicate that teachers in low-control districts felt more freedom to decide the content and pedagogy used in their classes than teachers in high-control districts. Teachers were also asked about influences to their

course content. Archbald and Porter reported that teachers in high-control districts felt state and district tests and curriculum guides had a greater impact on course content then their peers in low-control districts.

This strong influence of tests was supported by the research of Abrams, Pedulla, and Madaus (2003) when they examined teachers' attitudes and opinions about state-mandated testing programs. The 28 states included in the study were classified as either high- or low-stakes based on their testing policies. Of the 12,000 teachers who were mailed surveys, over 4,000 responded. The researchers found striking differences in the responses of teachers in the two types of settings. For example, 44% of teachers in high-stakes states compared to 10% of teachers in low-stakes states said they spent more than 30 hours per year preparing students for the state test. Similarly, 41% of teachers in high-stakes states strongly agreed that the pressure of testing has left them with little time to teach anything not on the test compared to only 18% of teachers in low-stakes states. Over half of all teachers surveyed stated that if they teach to the state objectives and curriculum guide, students will be successful on the state test.

Teacher Efficacy and Respect

Research on teacher efficacy has also been conducted. In general, studies have shown that job dissatisfaction is related to feelings of diminished efficacy and respect. Rudd and Wiseman (1962) surveyed 590 teachers in England to determine their main sources of professional dissatisfaction. Rudd and Wiseman found feelings of inadequacy as a teacher were among the most frequent responses. In the Archbald and Porter (1994) study of curriculum control and job satisfaction, no significant differences in self-efficacy were found between teachers in the high- and low-control settings. Conley et al. (1989)

looked at efficacy by considering the impact of interactions with supervisors on job dissatisfaction. They found a strong correlation between lack of positive feedback from supervisors and job dissatisfaction at both the elementary and secondary level. The correlation between negative feedback and job dissatisfaction was not as strong and lacked statistical significance at the elementary level. Research by Abrams, Pedulla, and Madaus (2003) also considered feedback from supervisors. In that study, roughly half of all teachers strongly agreed that they felt pressure by the district superintendent to raise state test scores. However, at the building level, the pressure from principals to raise scores was more pervasive in high-stakes areas (41% vs. 17%).

Professional Interaction

There is little research to support the claim that professional interaction can reduce stress. In fact, Conley et al. (1989) found no correlation between peer contact and job satisfaction and Sutton (1984) found no correlation between peer support and job satisfaction. However, isolation is often brought up by teachers as a contributing factor in job stress.

Role Overload

The research on role overload supports what we often hear teachers say, "There's too much to do and too little time." Research by Conley et al. (1989) looked at class size, student learning problems, and student behavior problems. At the elementary level, job dissatisfaction was correlated with unmanageable class sizes, an abundance of student learning problems, and an abundance of student behavior problems. The same was true of secondary teachers except there was no correlation regarding class sizes. Schwab, Jackson, and Schuler (1986) found that teachers in their study experienced feelings of

emotional exhaustion every week and became detached from their students several times a year. In a study conducted in 1990, Campbell and Neill kept a time record of 95 teachers for 14 consecutive days. The participants reported lack of time, large classes, and poor resources as obstacles to implementing the national curriculum. Over half the teachers worked more than 50 hours a week and ten teachers reported working over 60 hours a week. These are just some of the reasons why teachers feel overloaded.

Mathematics Education in Maryland – A Brief History

For the past 30 years, Maryland has been involved in a variety of efforts to reform education in public schools (Maryland State Department of Education, 1996). These statewide efforts were embedded in reform movements taking place on a national level.

Education Reform at the National Level

In 1965, President Johnson signed the Elementary and Secondary Education Act (ESEA). This act was significant because it authorized a large amount of funding and it signaled the beginning of federal involvement in local educational policies (Anderson, 2005). Notable aspects of ESEA included: Title I, which provided additional educational resources to schools with a high concentration of low-income students; Head Start, a pre-school program aimed at helping disadvantaged students prepare for first-grade; and the Eisenhower Professional Development Program, an effort to improve the teaching and learning of students by expanding the knowledge and skills of teachers. While the original ESEA was funded through 1970, numerous presidents have reauthorized modified versions of the act.

In the 1980s, the publication of *A Nation at Risk* (The National Commission on Excellence in Education, 1984) brought renewed attention to the issue of education

reform. As a result, President George H.W. Bush convened the first Governor's Education Summit in 1989 by inviting all state governors to discuss possible solutions to the problems they saw in education (U.S. Department of Education, 1994). At the summit, participants established six national education goals to attain within ten years. For example, by the year 2000 "American students will leave grades four, eight, and twelve having demonstrated competency in challenging subject matter, including English, mathematics, science, foreign languages, civics and government, economics, art, history, and geography" and "U.S. students will be first in the world in science and mathematics achievement." These education goals formed the basis of President Bush's proposed *America 2000: Excellence in Education Act*. This act called for the creation of content standards in math, science, English, history, and geography and voluntary national tests in these subject areas for grades 4, 8, and 12 (Vinovskis, 2005). Without sufficient legislative support, *America 2000* was never approved.

As Governor of Arkansas, Bill Clinton had attended the Education Summit in 1989 and was a proponent of standards-based reforms. After being elected President, he submitted to Congress an education reform package called *Goals 2000* that was very similar to Bush's *America 2000*. The main premise of *Goals 2000* was to raise academic expectations for students, thereby increasing student achievement (*Goals 2000: Educate America Act*, 1994). Part of Goals 2000 was to develop and establish voluntary national standards in all content areas similar to the *Curriculum and Evaluation Standards* (National Council of Teachers of Mathematics, 1989) for mathematics. In 1994, Congress approved *Goals 2000* as well as President Clinton's reauthorization of ESEA which he named the Improving America's Schools Act (IASA). The IASA was a significant

amendment from previous reauthorizations because it linked student achievement as measured by state content standards to federal funding access (Improving America's Schools Act of 1994, 1994). These education reforms put increasing pressure on states and local school systems.

Another reauthorization of the ESEA was enacted in 2002 when President Bush signed the No Child Left Behind Act (NCLB). One of the key features of NCLB is the strong emphasis on accountability (U.S. Department of Education, 2004). States are required to test students in mathematics in grades three through eight and high school annually. Adequate yearly progress (AYP) for individual schools is measured based on attainment of proficiency goals set by each state. Failure to make AYP can result in corrective action, restructuring, or even state takeover.

Education Reform in Maryland

The changes occurring on the national level were mirrored at the state level. In the 1970s, there was growing concern at both the local and national levels that high school graduates were unable to function as productive citizens. To improve the quality of education, attention was placed on basic skills and minimal competencies. In Maryland, the result was the creation of functional tests in reading, writing, mathematics, and citizenship. For mathematics, the functional test was un-timed and consisted of multiple choice questions covering grade-school content. By 1989, passing all four functional tests became a requirement for high school graduation.

In the late 1980s, state policy-makers argued that advances in technology had substantially changed the job skills needed in the workforce. Instead of needing just minimal competence, the perception was that workers needed analytical and problem-

solving skills to handle the increased demands they faced on the job. To address the changing needs of the workforce, the focus of educational reform in Maryland shifted from basic skills to an emphasis on higher-level, performance-based education and assessment (Maryland State Department of Education, 1996). At the same time, the issue of holding districts and schools accountable for student learning grew increasingly important.

In 1990, the State Board of Education took the first step towards these goals by adopting the Maryland Learning Outcomes for grades 3, 5, 8, and 11 in reading, mathematics, writing/language arts, science, and social studies (Maryland State Department of Education, 1996). A year later, pilot testing began for the Maryland School Performance Assessment Program (MSPAP) in grades 3, 5, and 8. The MSPAP, a criterion-referenced test based on the Learning Outcomes, assessed the application of skills in authentic contexts, higher-order thinking, and the integration of knowledge across disciplines. During nine hours of testing time, students worked both individually and in groups to respond to open-ended and short answer questions. Touted as one of the most rigorous assessments in the country, the more challenging questions of the MSPAP were a dramatic departure from previous assessments.

The changes in assessment had a significant impact in schools across the state. Teachers were under increased pressure to prepare students for the new test. It is likely that some teachers resorted to switching out of tested grade levels (Sutton, 1984). In that case, it is often brand new teachers who are relegated to teaching in the tested grade levels. It is important to note that the design of the MSPAP was intentional. State officials wanted to alter instructional methods to reflect what they believed good

classroom instruction should be (Maryland State Department of Education, 1996). Knowing that teachers teach to the test, the MSPAP was created to model the desired pedagogy and content. After being piloted for several years, the State Board outlined accountability standards for the MSPAP and ramifications for underperforming schools. Schools which failed to make progress towards the standards were subject to state intervention or reconstitution. Districts and schools also faced growing public scrutiny as MSPAP scores were highly publicized by the media.

During the 1990s, significant changes were also underway at the high school level. Core Learning Goals in English, mathematics, science, and social studies were adopted by the State Board in 1996 (Maryland State Department of Education, 2003b). The Core Learning Goals for mathematics outlined the desired skills and knowledge for high school graduates and were strongly influenced by the NCTM *Curriculum and Evaluation Standards* (National Council of Teachers of Mathematics, 1989). Work also began at that time on the development of end-of-course tests which reflected the Core Learning Goals. In mathematics, High School Assessments (HSAs) were developed in Algebra/Data Analysis and in Geometry. Those tests consist of both selected- and constructed-response items and are administered in three-and-one-half hour sessions.

Stakes for the HSA were phased in gradually (Maryland State Department of Education, 2003a). In 1998, the State Board made the HSA a requirement for students graduating in the class of 2005. Then in 2000, the Board delayed linking the HSA to high school diplomas until the class of 2007. The first field test of the HSA was conducted in 2000 with no scores reported. The following year, field test scores were reported on transcripts of ninth-graders as a percentile rank. That same year, the State Board made it

mandatory for all students enrolled in an HSA course to take the HSA. When the HSA was implemented in 2002, percentile rank scores were reported on transcripts for ninth- and tenth-graders. A year later, the State Board established passing scores for the HSA. That year, mean scores were reported for schools, districts, and the state and pass/fail results were reported for students. Also, HSA scores were printed on transcripts for ninth-, tenth-, and eleventh-graders. In June 2004, the Board again delayed the use of the HSA as a graduation requirement until the class of 2009.

In Maryland, NCLB has altered both testing and curriculum. The MSPAP, designed to assess schools, not students, did not meet the requirements of NCLB and therefore was discontinued after 2002. Instead, the state now uses the Maryland School Assessment (MSA) in grades three through eight. Students are tested in mathematics for 90 minutes each day for two days and the test consists of selected- and constructed-response items. At the high school level, the Algebra/Data Analysis HSA is used to measure AYP. Maryland no longer requires students to pass the Maryland Functional Mathematics Test to graduate from high school although some districts continue to use the test for placement purposes in middle and high school. In 2004, the State Board enacted graduation requirements for the class of 2009 which included a passing score on the Algebra/Data Analysis HSA. The same year, the Board approved a Voluntary State Curriculum (VSC) for mathematics in grades K-8 and for Algebra/Data Analysis and Geometry. School districts can either adopt the VSC or ensure that the VSC is included in the district curriculum.

Over the past forty years, education initiatives at both the state and national level have had an impact on the job of math teachers. The standardization of curricula

diminished teachers' ability to decide what content to teach and how to teach that content. Each implementation of a new assessment required teacher training regarding test material and question formats. The higher stakes associated with the assessments meant increased time and effort on preparing students for the test. At the same time, each initiative seemed to indicate that schools were failing. In light of this context, it is worthwhile to investigate the effect these pressures may have on math teachers.

Summary

The study of working conditions of mathematics teachers is guided by prior work on stress, burnout, and organizations. While a body of research exists regarding sources of stress, the current state of education in the United States and Maryland suggests that a reexamination of the challenges teachers face is warranted.

CHAPTER 3: METHODOLOGY

Introduction

The purpose of this study was to describe the working conditions of mathematics teachers in order to identify and understand the critical challenges and problematic tensions that arise in the course of fulfilling their responsibilities. The study used mainly quantitative methods to survey teachers' views of the systemic and external constraints that shape their curriculum goals, instructional methods, and assessment techniques and the tensions caused by conflict between their individual professional judgments and institutional policy recommendations or mandates.

Data from a questionnaire survey of Maryland mathematics teachers provided a broad view of teacher perceptions about working conditions for mathematics instruction. Subsequent interviews with a selected sample of teachers illuminated some of the stories behind survey responses.

The basic plan of the study had six phases:

1. Create an online survey instrument to probe teacher perceptions of five key sources of workplace tension.
2. Administer the survey to a sample of mathematics teachers to collect data on perceived working conditions.
3. Analyze the survey data.
4. Interview selected survey participants to expand on and clarify responses from the survey.
5. Analyze the interview data in light of the results from the survey data.
6. Summarize descriptive insights gained from the data sources.

What follows in this chapter is a description of the sample, instrumentation, data collection, and data analysis procedures for this study. To support the selection of the sample, information about the setting is provided. This information details the demographics of Maryland schools, students, and teachers.

Setting

Maryland is comprised of 24 school districts which range in enrollment from just over 2,000 students to almost 140,000 students (Maryland State Department of Education, 2004a). Public school enrollment across the state has grown from 698,806 students in 1989 to 865,561 students in 2004. Statewide, approximately 50% of the students are White, 38% African American, 7% Hispanic, 5% Asian/Pacific Islander, and less than 1% American Indian/Alaskan Native. Nationally, public school enrollment is 60% White, 17% African American, 18% Hispanic, 4% Asian/Pacific Islander, and 1% American Indian/Alaskan Native (U.S. Department of Education, National Center for Education Statistics, 2005). Of the public schools in Maryland, there are roughly 800 elementary schools, 200 middle schools, and 200 high schools.

There are 54,583 public school teachers in Maryland, with a range of educational background, certification, and experience that is similar to that of the United States as a whole (U.S. Department of Education, National Center for Education Statistics, 2005). Almost half of Maryland teachers hold a Master's degree, slightly higher than the national figure of 42%. According to data from the 1999-2000 Schools and Staffing Survey (SASS), 68% of Maryland mathematics teachers in grades 7 to 12 have an undergraduate or graduate degree in mathematics or mathematics education (Council of Chief State School Officers, 2003). The national statistic is similar at 67%. In terms of

certification, 88% of Maryland mathematics teachers at the secondary level are certified to teach mathematics. Across the United States, this figure ranges from 65% to 100% with a national average of 88%. Of the mathematics teachers in Maryland, 64% have both a teaching certificate in mathematics and a degree in mathematics or mathematics education, compared to 63% nationally. The SASS reported that 14% of Maryland teachers had less than 3 years teaching experience, 31% had 3 to 9 years, 25% had 10 to 20 years, and 30% had over 20 years (U.S. Department of Education, National Center for Education Statistics, 2005). These figures are comparable to the nationwide statistics of 13%, 29%, 28%, and 30%, respectively.

The characteristics of Maryland's school districts, students, and teachers make the state a desirable study site. The 24 districts span areas that are urban, suburban, and rural. The school districts range in size from quite small (2,500 students and 175 teachers) to quite large (139,000 students and 9,300 teachers). Overall, the state is mid-size in terms of the number of students and teachers and the student population is fairly diverse. While certification rates and experience levels in Maryland are on par with teachers in the United States as a whole, Maryland teachers have slightly more education. The attributes of Maryland suggest that an investigation of teachers in the state can help shed light on issues affecting teachers across the country.

Sample

In order to get a clear picture of working conditions of Maryland mathematics teachers, it was desirable to study teachers in a variety of school districts (small, medium, and large districts; urban, suburban, and rural settings). However, given that the focus of this study was on teaching tensions, school districts may have been reluctant to

participate due to the possibility that the results of the study could be construed as negative publicity. To achieve the desired breadth and depth for this study without risk of stigmatizing any individual school district, my sample consisted mostly of members of the Maryland Council of Teachers of Mathematics (MCTM), the local affiliate of the National Council of Teachers of Mathematics (NCTM).

The MCTM membership represents teachers who are interested in improving education. These teachers are more likely to subscribe to educational journals, attend educational conferences, and reflect upon their own teaching and issues surrounding tensions that exist in schools today. As members of a professional organization, these teachers may be more willing to participate in research that can help advance the profession. Although their membership in MCTM may exaggerate the findings, the qualities that make these teachers desirable for this study – their involvement and dedication to education – are the same qualities that make them vital to the profession. Therefore, it is important to examine the tensions these teachers face so that we can identify possible remedies and keep these valuable teachers in the classroom.

Currently, there are approximately 500 members of MCTM. Roughly one-third are elementary school teachers, one-third are middle school teachers, and one-third are high school teachers. Study participants were solicited in two ways. First, I distributed flyers in the exhibit hall of the MCTM annual conference held on October 20, 2006. Second, MCTM sent an e-mail on October 31, 2006 to the membership asking for their participation in the study. While the MCTM membership was the target population, non-member mathematics teachers were not restricted from participating. The flyer and e-mail may have been shared by MCTM members with other mathematics teachers or non-

MCTM members may have attended the MCTM annual conference and picked up a flyer. Interviewees were selected from the pool of participants who completed the online survey instrument and indicated interest in being interviewed.

Survey Instrument Development

One way to describe the tensions teachers experience in the workplace is to use a survey instrument consisting of a broad array of statements and a Likert scale. To create such an instrument, I adapted items from existing surveys and supplemented them with new items based on my own teaching experiences and the teaching experiences of my peers. The statements were all linked to one or more of the tension strands (goal congruence, agency, teacher efficacy and respect, professional interaction, and load appropriateness). I alternated between positively- and negatively-worded statements and then randomized the order of the statements to mask my intent.

In the fall of 2005, I piloted an initial draft of the survey instrument with a group of four colleagues, all former teachers. From the pilot, I was able to determine how much time was needed to complete the survey, which statements were ambiguous and confusing, and if there were tensions not addressed by the statements. Besides these issues, the participants pointed out that they were tripped up by the random order of the statements. For the items that were worded similarly but not placed in close proximity, the participants felt they were rating the same statement twice. The random order also slowed them down because the statements jumped from topic to topic. As a result of this feedback, I rearranged the statements and grouped them by context. The first set of statements revolved around the state, the next set centered on the district, then the school, and finally the classroom.

After modifying the instrument, I shared the new version with the same group of colleagues. The arrangement of global to local context appealed to the group and seemed to resolve the issue they had raised. I also shared information about the online survey tool I had decided to use. During the discussion, it was suggested that the length of the instrument might seem daunting to teachers and that the presentation of statements was a factor to consider, particularly for a survey given online. I agreed with these comments and made formatting changes to limit each page to roughly ten statements.

For the third version of the survey instrument, the group focused on the choices for each statement. Originally, the choices were 'Strongly Disagree', 'Disagree', 'Neutral', 'Agree', and 'Strongly Agree.' On the second version, I had also included 'Not Applicable because _____' as a choice for those statements that might not apply to all teachers. Since my study was investigating teacher perceptions, it was recommended that I remove the 'Neutral' category and force participants to agree or disagree with the statements. This would also result in more insightful findings. The group also felt that the 'Not Applicable' category was unnecessary and would detract from the research by reducing the number of participants sampled for those statements.

I made modifications and created the fourth version of the instrument. As I looked over the instrument, I realized that some of my original tension strands were more represented than others in the statements. I went through the document and labeled each statement with the appropriate strand(s). I found that I had an overabundance of statements for Agency and for Teacher Efficacy and Respect. I began to think about which items to remove. At the same time, I continued to work on formatting the

document to make it easier to read. I decided to use bold font or italics to highlight key words that would distinguish one statement from the next.

I then piloted this revised survey to a different colleague who was teaching at a middle school. The teacher found the positively- and negatively-worded statements confusing. He was not sure if what he had selected was in fact what he meant because the differences between statements seemed subtle. I took this feedback back to the group for advice. I was concerned that the results might be skewed if I worded all of the statements in one direction. However, the group pointed out that if I kept the mixed statements and teachers were not sure what they selected, the results would not be accurate. After some debate, the consensus was to format similar statements using a parallel structure and to orient them generally in the same direction. As a result, while many of the statements are positively-worded, there are some negatively-worded statements scattered throughout the survey.

The length of the survey continued to be an issue. Many statements were similar but specific to context (state, district, or school). This was done originally to get detailed information about sources of tension. However, it could be argued that the benefits of additional detail did not offset the costs of teacher time and frustration. I also felt that if necessary, the follow-up interviews could be used to get more information. The final version of the survey combines statements about the state and district and about the district and school where appropriate.

Survey Instrument

The survey instrument consisted of two parts. The first part elicited background information on the participant and the second part was a 77-item questionnaire. For the

background information, participants were asked to provide their gender, school district, years of teaching experience, instructional grade level placement, and the subject(s) they were currently teaching. The questionnaire was made up of statements that span the five tension strands (goal congruence, agency, teacher efficacy and respect, professional interaction, and load appropriateness). Some statements were relevant to multiple strands and were analyzed for each strand accordingly. The statements are listed by strand below. Almost all the statements used the choices 'Strongly Disagree', 'Disagree', 'Agree', and 'Strongly Agree' with exceptions noted.

The survey items for goal congruence are presented in Table 1. These items were intended to measure the extent of alignment or conflict between individual teacher beliefs, goals, and values and institutional beliefs, goals, and values. The institutions represented in these items are the state, the district, the school, and NCTM.

Table 1. *Goal Congruence Survey Items*

Item no.	Statement
1	The tests I am required to give reflect what I believe is important in mathematics.
6	The curricular materials I am required to use reflect what I believe is important in mathematics.
10	The NCTM *Principles and Standards for School Mathematics* reflect what I believe is important in mathematics.
21	My school and my district have the same values regarding math content.
22	My school and my district have the same philosophy regarding math instruction.
25	My own beliefs about what mathematical topics are important significantly impact the content of my math course(s).[a]
34	The content of my math course(s) is determined by what my students are capable of understanding.[a]
41	The students I work with are placed in the math course most appropriate for them.
42	The school's mathematics program enables students to work at the pace that is best for them.
53	My students' gains on math achievement tests are a good way for others to judge my instructional effectiveness.[b]

Item no.	Statement
54	My students' gains on math achievement tests are a good way for me to judge my instructional effectiveness.[b]
65	I am philosophically at odds with ways that I am expected to teach math.[c]
77	I know exactly what is expected of me in math instruction.[d]

[a]Adapted from Archbald and Porter (1994) with permission of the author. [b]Adapted from Rosenholtz (1989) with permission from the publisher. [c]Statement was reverse coded (1 = Strongly Agree, 2 = Agree, 3 = Disagree, 4 = Strongly Disagree). [d]Adapted from Rizzo, House, and Lirtzman (1970).

The agency strand had two facets. One facet examined the extent to which teachers played a role in decision-making that affected their work. To gauge the teacher's sense of empowerment and control, these survey items sought to establish the level of teacher participation regarding curriculum, instructional materials, and assessments. The second facet considered the extent to which teachers felt they were able to apply their personal skill and knowledge in teaching mathematics. These feelings of autonomy were identified through items about the value and utilization of teachers' expertise. The agency items are listed in Table 2.

Table 2. *Agency Survey Items*

Item no.	Statement
2	The tests I am required to give significantly influence the content of my math course(s)**.**[a,b]
3	The tests I am required to give significantly influence the methods of instruction used in my math course(s).[a]
4	I teach topics that are not on the required math tests.
5	I spend more than 30 hours per year preparing students specifically for the required math tests.[a,c]
7	The curricular materials I am required to use significantly influence the content of my math course(s).[a,b]
8	The curricular materials I am required to use significantly influence the methods of instruction used in my math course(s).[a]
9	I teach topics that are not in the required mathematics curriculum.
11	The NCTM *Principles and Standards for School Mathematics* significantly influence the methods of instruction used in my math course(s).
12	The NCTM *Principles and Standards for School Mathematics* significantly influence the content of my math course(s).
13	Teachers participate actively in selecting math texts and materials that are used in my school.[d]

Item no.	Statement
14	Teachers participate actively in making decisions about what will be taught in math courses.
15	Teachers participate actively in determining what mathematical topics will be tested.
16	Teachers participate actively in determining appropriate instructional methods for mathematics.[d]
17	Uniformity and standardization of instructional methods is important in my district.[a]
18	Uniformity and standardization of mathematical content is important in my district.[a]
24	At my school, I am allowed to teach math in my own style.[d]
25	My own beliefs about what mathematical topics are important significantly impact the content of my math course(s).[b]
26	My own knowledge of mathematical topics significantly impacts the content of my math course(s).[b]
27	I can decide which particular topics are taught in my math course(s).
28	I am encouraged to modify the mathematics curriculum to meet my own students' needs.[d]
29	I can decide when particular topics are taught in my math course(s).
30	I have control over setting standards for achievement in my math classes.[b]
31	The main course textbook significantly influences the methods of instruction used in my math course(s).[a]
32	The main course textbook significantly influences the content of my math course(s).[a,b]
33	The content of my math course(s) is determined by what my students need for future study and work.[b]
40	I feel pressure from parents regarding the math placement of their child.[a]
47	If I spend the majority of my time helping students develop proficiency in math skills and procedures, then the students will perform well on accountability tests.[a]
65	I am philosophically at odds with ways that I am expected to teach math.[a]
73	I often feel frustrated by uncontrollable factors of my job.[a]

[a]Statement was reverse coded (1 = Strongly Agree, 2 = Agree, 3 = Disagree, 4 = Strongly Disagree).[b]Adapted from Archbald and Porter (1994) with permission from the author. [c]Adapted from Abrams, Pedulla, and Madaus (2003). [d]Adapted from Rosenholtz (1989) with permission from the publisher. .

The teacher efficacy and respect strand had two components. One component looked at the extent to which teachers felt they had the power to produce positive results for students. The second component considered the extent to which others viewed them

as competent professionals. These other groups included students, parents, colleagues, and administrators. The items for this strand are presented in Table 3.

Table 3. *Teacher Efficacy and Respect Survey Items*

Item no.	Statement
13	Teachers participate actively in selecting math texts and materials that are used in my school.[a]
14	Teachers participate actively in making decisions about what will be taught in math courses.
15	Teachers participate actively in determining what mathematical topics will be tested.
16	Teachers participate actively in determining appropriate instructional methods for mathematics.[a]
17	Uniformity and standardization of instructional methods is important in my district.[b]
18	Uniformity and standardization of mathematical content is important in my district.[b]
19	I feel pressure from my district superintendent to raise scores on required math tests.[b,c]
20	I feel pressure from my principal to raise scores on required math tests.[b,c]
23	At my school, teachers maintain high standards of performance for themselves in teaching mathematics.[d]
24	At my school, I am allowed to teach math in my own style.[a]
25	My own beliefs about what mathematical topics are important significantly impacts the content of my math course(s).[d]
26	My own knowledge of mathematical topics significantly impacts the content of my math course(s).[d]
27	I can decide which particular topics are taught in my math course(s).
28	I am encouraged to modify the mathematics curriculum to meet my own students' needs.[a]
29	I can decide when particular topics are taught in my math course(s).
30	I have control over setting standards for achievement in my math classes.[d]
35	The curriculum for my math course(s) is too difficult for my students.[b]
36	The curriculum for my math course(s) is not challenging my students.[b]
37	Uniformity and standardization of mathematics curriculum is important to the parents at my school.[b]
38	Uniformity and standardization of instructional methods in math is important to the parents at my school.[b]
39	Most of my students' parents support the things I do in teaching math.[a]
40	I feel pressure from parents regarding the math placement of their child.[b]
41	The students I work with are placed in the math course most appropriate for them.
45	I often feel satisfied with my job in teaching mathematics.

Item no.	Statement
48	I feel as though I am positively influencing other people's lives through my work as a math teacher.[e]
49	I feel as though I am making significant academic progress with my math students.[a]
50	My success or failure in teaching students math is due primarily to factors beyond my control rather than to my own effort and ability.[b,d]
51	Teachers are a very powerful influence on student math achievement when all factors are considered.[d]
52	Evaluation of my math teaching is used to help me improve.[a]
53	My students' gains on math achievement tests are a good way for others to judge my instructional effectiveness.[a]
54	My students' gains on math achievement tests are a good way for me to judge my instructional effectiveness.[a]
55	The methods used in evaluating my math teaching are objective and fair.[a]
56	My principal recognizes the good math teaching I do.[a]
57	Other teachers in my school recognize my math teaching competence.[a]
58	The parents at my school recognize the good math teaching I do.
59	My students recognize the good math teaching I do.
60	My students show that they appreciate me as a math teacher.
63	My experience in the teaching profession has diminished my enthusiasm for teaching math.[b]
64	I am less idealistic about teaching now, then when I entered the profession.[b]
70	I enjoy teaching.[a]
71	I often feel frustrated by teaching in general.[b,e]
72	I am pleased with the progress my students make in math.[a]
74	I feel a sense of pride in my work at my school.[a]
75	I often feel burned out from my work.[b,e]
76	I feel good about my math teaching style and strategies.[a]

[a]Adapted from Rosenholtz (1989) with permission from the publisher. . [b]Statement was reverse coded (1 = Strongly Agree, 2 = Agree, 3 = Disagree, 4 = Strongly Disagree). [c]Adapted from Abrams et al. (2003). [d]Adapted from Archbald and Porter (1994) with permission from the author. [e]Adapted from Maslach and Jackson (1981).

The strand on professional interaction looked at the opportunities teachers have for collegial interaction. The items for professional interaction are presented in Table 4. For item 66, teachers were given the option of '0', '1-2', '3-4', or '>4'. On item 67a, teachers selected either 'yes' or 'no'. If 'yes' was selected, participants were asked item 67b.

Table 4. *Professional Interaction Survey Items*

Item no.	Statement
43	I attend professional conferences on a regular basis.
44	I subscribe to and frequently use mathematics teaching publications.
61	Other teachers at my school often seek my advice about professional issues.[a]
62	I often observe other teachers to gain insights about mathematics content and pedagogy.
66	I regularly share teaching ideas with ___ other teachers.[a]
67a	I have common planning time with other mathematics teachers.
67b	I make effective use of my common planning time.

[a]Adapted from Rosenholtz (1989) with permission of the publisher.

The load appropriateness strand examined the extent to which teachers were pressured from both academic and non-academic responsibilities. The survey items for this strand are listed in Table 5.

Table 5. *Load Appropriateness Survey Items*

Item no.	Statement
19	I feel pressure from my district superintendent to raise scores on required math tests.[a,c]
20	I feel pressure from my principal to raise scores on required math tests.[a,c]
35	The curriculum for my math course(s) is too difficult for my students.[c]
46	My class time for math is often constrained by administrative tasks (taking attendance, tardy students, public announcements).[c]
47	If I spend the majority of my time helping students develop proficiency in math skills and procedures, then the students will perform well on accountability tests.[c]
49	I feel as though I am making significant academic progress with my math students.[b]
68	My planning time is often taken away due to academic responsibilities (IEP meetings, helping students, proctoring make-up assessments, covering class for an absent colleague, grading papers).[c]
69	My planning time is often taken away due to non-academic responsibilities (hall duty, lunch duty, bus duty, etc.).[c]

[a]Adapted from Abrams et al. (2003). [b]Adapted from Rosenholtz (1989) with permission of the publisher. . [c]Statement was reverse coded (1 = Strongly Agree, 2 = Agree, 3 = Disagree, 4 = Strongly Disagree).

Items 78 and 79 asked participants to list the top three assets to teaching and the top three obstacles to teaching. These items were intended to help identify possible

candidates to interview. On each page of the survey, there was an opportunity for teachers to elaborate on or clarify any of their earlier responses.

Survey Format

I decided to conduct the survey through a web-based tool for a number of reasons. Compared to a paper survey, an online survey can be distributed quickly and administered easily to teachers from a large geographic area. Teachers can access an online survey at any time of day and from any computer with internet access. Online surveys are less likely to be lost in transit because they are easy to submit. Once the data is submitted to a web-based tool, it is immediately accessible and downloadable by the researcher. The data can be exported directly from the web-based tool to a Microsoft Excel spreadsheet, thereby avoiding data entry errors. Since the data output is in spreadsheet form, it is easy to analyze using a statistical program.

There are a few drawbacks to online surveys. Potential participants may be dissuaded if they are inexperienced web users. Others may choose not to complete the survey for fear that data transmitted through the web is not secure. Some teachers may have limited access to computers with internet access or may feel uncomfortable completing the survey if the computer that is available is in a public location.

Ultimately, I believe that the benefits of online surveys far outweigh the disadvantages.

Procedures

In the fall of 2005, I submitted a proposal to the MCTM executive board requesting permission to survey the membership. The proposal was accepted.

The proposal outlined the following plan for data collection:

1. MCTM members would be contacted by e-mail requesting their participation in a survey. To address the board's concerns about privacy, I would not have access to the e-mail addresses of MCTM members. Instead, the e-mail to members would be sent by the MCTM President.
2. The e-mail would include a hyperlink to the survey instrument and a deadline for completing the survey.
3. As part of the survey, subjects would indicate if they would be willing to participate in a follow-up interview and if they would like to be sent a copy of the results. In either case, the subjects would provide their e-mail address. By providing this e-mail address, the subjects would automatically be entered in a drawing to win a prize.

Initially, I planned for the e-mail to MCTM members to be sent in late September or early October 2006. However, the MCTM board recommended sending the e-mail after the annual conference since memberships are established or renewed at that time. I agreed to this plan and the e-mail was sent on October 31, 2006 (see Appendix A). To increase survey participation, I also requested permission to staff a table in the exhibit hall at the annual conference and distribute flyers advertising the survey. The MCTM board agreed and I distributed 400 flyers during the conference on October 20, 2006 (see Appendix B).

The survey instrument was maintained by SurveyMonkey (www.surveymonkey.com), a web-based tool for creating surveys and collecting data. When participants accessed the SurveyMonkey website using the hyperlink in the e-mail, they were prompted to complete a consent form (see Appendix C). If they consented to participate in the research, they were directed to the questionnaire (see Appendix D).

Otherwise, they exited the website. The first page of the questionnaire solicited background information about the participant's job placement and their teaching experience. Each subsequent page consisted of approximately ten statements to rate. Participants were required to rate all the statements shown before moving to the next page. At the bottom of each page, participants had the opportunity to elaborate on any of their responses.

The survey was open and available for participants for four weeks from mid-October to mid-November. Teachers could access the survey from school or home, day or night. I anticipated that multiple teachers might use the same school computer to complete the survey and I wanted to allow this to occur. However, allowing multiple responses from the same computer meant that teachers could not stop part-way through the survey and come back at a later time with their responses saved. Instead, teachers would have to start all over again. I believe this restriction did result in the loss of some data. Of the 323 attempts to access the survey, 71 resulted in premature exits. One teacher did not consent to participate and 20 teachers consented but did not provide any identifying information. There were 21 teachers who completed some demographic information and 29 teachers who completed some of the survey statements. For those teachers who provided an e-mail address and completed a portion of the survey statements, I sent an e-mail asking that they take the survey again (see Appendix E). Two teachers did in fact return and complete the survey.

I used the survey responses to identify five cases to illuminate through individual interviews. I computed strand scores for each participant by averaging their responses to items on the hypothesized strands (i.e., goal congruence, agency, teacher efficacy and

respect, professional interaction, and load appropriateness). I then calculated the sample mean for each strand. Finally, I ranked participants based on the square root of the sum of the squared deviations of their strand scores with the sample means. Teachers with a small sum of squares were more representative of the sample than teachers with a large sum of squares. Of the five cases selected, three involved teachers whose survey responses were representative of the sample and whose teaching experience ranged from early-career to late-career. The other two cases consisted of an early-career teacher and a late-career teacher whose survey responses were outliers compared to the rest of the sample.

Once the cases were identified, I attempted to contact the teachers and arrange the logistics of the interview. I contacted the selected teachers by e-mail to confirm their interest in being interviewed (see Appendix F). The late-career outlier case responded immediately and we agreed to meet at her residence that weekend. Soon afterwards, the early-career representative case responded. He also wanted to meet that weekend and we decided to meet at a lounge on the campus of a local university. The early-career outlier case also responded to my e-mail and we scheduled an interview after school at a local coffee shop two weeks later. The late-career representative case replied several weeks later but did express interest in being interviewed. However, subsequent repeated attempts to contact her and finalize the details of the interview went unanswered. The mid-career representative case did not respond to the initial e-mail request, possibly signifying that she was no longer interested in being interviewed.

The purpose of the interview was to understand in detail, how teachers "think and how they came to develop the perspectives they hold" (Bogdan & Biklen, 1998, p. 3). At

the beginning of each interview, participants completed a consent form (see Appendix G). Each interview lasted approximately 60 minutes and participants were compensated $100 for their time. During the semi-structured interviews (Gall, Borg, & Gall, 1997), I asked teachers to elaborate or explain selected responses on their survey (see Appendix H for sample interview protocol). I worked at getting participants to "freely express their thoughts around particular topics" (Bogdan & Biklen, 1998, p. 3). This approach allowed "the subjects to answer questions from their own frame of reference" (Bogdan & Biklen, 1998, p. 3). I audio taped and transcribed each interview. The quotes from the interviews are included in Chapter 5 to provide further insight into some of the working conditions that math teachers currently face.

Coding of Independent and Dependent Variables

At the conclusion of the survey period, I downloaded the data from SurveyMonkey into a Microsoft Excel spreadsheet. I separated the data into two files, one for complete survey responses and one for incomplete survey responses. The complete responses were further separated into two files, one with item responses and one with elaborating comments from the participants. I assigned a variable name to each item and then coded the data for the purpose of analyzing the responses.

Independent Variables

For the demographic items with response choices, SurveyMonkey automatically assigned codes. For instance, gender was coded '1' for female and '2' for male and school type was coded '1' for public school and '2' for private school.

I assigned codes to demographic items with participant provided responses, such as school district name. To ensure participant confidentiality, I grouped districts by size

and location and assigned a code to each group. I ranked districts from smallest to largest by using the Maryland State Department of Education (MSDE) student enrollment data (2004b). Then, I clustered the districts by size into quartiles. Quartile 1 had 16 districts with an average enrollment of 11,856 students. Quartile 2 had four districts with an average enrollment of 50,498 students. Quartiles 3 and 4 each had two districts with average enrollments of 98,051 and 137,744, respectively. Codes for the school district size variable were as follows: '1' for quartile 1, '2' for quartile 2, '3' for quartile 3, and '4' for quartile 4.

The districts were also grouped by geographic location according to U.S. Census categorizations (U.S. Department of Commerce, 2002). The six categories used by the Census were: Baltimore Region, Suburban Washington, Southern Maryland, Western Maryland, Upper Eastern Shore, and Lower Eastern Shore. The Baltimore Region consisted of six counties and Suburban Washington was made up of three counties. The Southern Maryland districts were three counties bordering the Potomac River and the Chesapeake Bay. The Western Maryland districts were 3 counties bordering Pennsylvania and West Virginia. The Upper Eastern Shore and Lower Eastern Shore classifications were combined for this study and called Eastern Shore. The Eastern Shore districts were nine counties bordered by the Atlantic Ocean, Delaware, and the Chesapeake Bay. Codes for the school district location variable were as follows: '1' for Baltimore region, '2' for suburban Washington, '3' for Southern Maryland, '4' for Western Maryland, and '5' for Eastern Shore.

Participants also entered information regarding their years of teaching experience. I created six categories for teaching experience: 0 – 1 year, 2 – 4 years, 5 – 9 years, 10 –

19 years, 20 -29 years, and 30+ years. I purposely constructed these delineations to permit fine-grain analysis such as whether differences exist between first year teachers and new but not first year teachers. Then, I coded the categories consecutively with '1' for the 0 – 1 year group and '6' for the 30+ group.

For the teaching placement variable, the original categories and codes were modified as a result of the data collected. Elementary school teachers had been separated into grades K - 2 and 3 - 5 to capture any differences between grades where high stakes tests were or were not involved. However, due to the small number of K - 2 teachers who responded, the two groups were combined for purposes of analysis. The groups were coded: '1' for grades K - 5, '2' for grades 6 – 8, and '3' for grades 9 – 12.

Dependent Variables

All of the Likert-scale items were automatically coded by SurveyMonkey. On statements where participants rated their level of agreement, the codes were '1' for strongly disagree, '2' for disagree, '3' for agree, and '4' for strongly agree. For item 66, teachers selected the number of teachers they shared teaching with. The codes for the choices were '1' for zero teachers, '2' for one or two teachers, '3' for three or four teachers, and '4' for more than four teachers. Item 67 required a yes/no response with yes coded as '1' and no coded as '2'.

Prior to running statistical tests, modifications to the coding system were necessary for items that did not match the direction of the strands. Strands were defined such that higher values indicated more alignment with the strand. Thus, any item that negated the relevant strand was re-coded using the following algorithm: five minus the original code = the new code. As a result, the codes became 5 – 1 = 4, 5 – 2 = 3, 5 – 3 = 2,

and 5 – 4 = 1. To summarize, participants who strongly agree with an item that affirms the strand or strongly disagree with an item that negates the strand would have their response coded as a '4'. On the other extreme, participants who strongly disagree with an item that affirms the strand or strongly agrees with an item that negates the strand would have their response coded as a '1.'

A few examples will help clarify this coding scheme. On the goal congruence items, the more a teacher perceives a match between personal and institutional beliefs, the higher the score. For example, if a participant strongly agreed with the statement "The tests I am required to give reflect what I believe is important in mathematics", a '4' would be recorded. On the other hand, a '1' would be noted if the participant strongly agreed with the statement "I am philosophically at odds with ways that I am expected to teach math." Similarly for the agency items, the more a teacher feels empowered and autonomous in their position, the higher the score. For instance, strongly agreeing with the statement "I teach topics that are not on the required math tests" results in a score of '4.'

Data Analysis

Descriptive Analyses

I chose to analyze the data with the program Statistical Package for the Social Sciences (SPSS) Version 15.0 for Windows. I exported the Microsoft Excel data file of variable names and coded responses into SPSS. I created a profile of the respondents by tallying frequencies and percentages for each demographic variable (gender, school type, school district size, school district location, teaching experience, and grade level placement). From this analysis, I decided to remove the variable 'school type' because

there were too few cases of private school teachers to conduct any statistical tests. I generated a distribution of responses for the remaining survey items by computing frequencies, means, and standard deviations. I supplemented the distribution of responses with relevant, elaborating comments voluntarily offered by the survey participants. Although I had not anticipated that many teachers would use the comment boxes, I was pleasantly surprised with the quantity and quality of the annotations. I believe that the comments provide a more detailed snapshot of teacher perceptions, so I have included them in the results.

Analysis using Hypothesized Strands

To test my hypothesized strands of goal congruence, agency, teacher efficacy and respect, professional interaction, and load appropriateness, I conducted a series of analyses. First, I evaluated the internal consistency reliability of each strand because many of the survey items were new and those that had been previously used represented only selected portions of other surveys. Internal consistency is the likelihood that participants will respond in a consistent way to all of the questions (e.g., teachers with low agency in fact score low on all of the agency items). I chose to have SPSS compute Cronbach's alpha coefficient as a way to measure internal consistency. This coefficient is computed by calculating all of the possible split-half reliabilities. For each split-half reliability, the strand of items is divided in two. Then, scores on each half are correlated. A high correlation indicates that the two halves are in agreement and that there is good internal consistency. Cronbach's alpha can range from a low of 0 (not reliable) to a high of 1 (completely reliable). Due to the exploratory nature of this study, I used a liberal cut off of 0.60 for the Cronbach alpha coefficient (Garson, 2006).

Then, I created five new variables in the SPSS data file, one for each strand. For example, I defined the goal congruence variable as the composite score for items in the goal congruence strand. A participant's composite score is the mean of their responses for the items in a strand. Since I reverse coded the negatively worded items, a high composite score indicates a high level of agreement with the essence of the strand. I used the composite scores to make histograms to look at trends in the data.

Next, I used one-way ANOVA procedures to compare means between demographic subgroups to establish if differences in the strand scores existed. For example, I used ANOVA to determine whether gender of the participant (an independent variable) seemed to influence the perception of agency as measured by the agency strand score (a dependent variable). I selected ANOVA rather than t-tests because some of the independent variables have more than two groups. In order to use t-tests with more than two groups, multiple t-tests would be necessary and that would inflate the Type I error rate, the probability that the null hypothesis is rejected when the null hypothesis is true. ANOVA detects "the systematic treatment variability over and above the noise (random error variability) in the data" (G. Hancock, personal communication, July 21, 1998). Before conducting the ANOVA, I verified that all assumptions for the procedure were met. The assumptions are: (1) the observations are independent of each other; (2) the scores in populations are normally distributed; and (3) the variances in the populations are homogeneous (G. Hancock, personal communication, July 23, 1998). If the assumptions were satisfied for a given strand, I ran an ANOVA using SPSS. The resulting F ratio reported by SPSS led to a decision about retaining or rejecting the null hypothesis of equal means.

When significant mean differences were detected, further evaluation was needed to identify exactly where differences existed. In the case of only two groups (such as male and female), simply looking at the group means could establish the relationship between the groups (e.g. males have a higher mean than females). With more than two groups, post hoc multiple comparisons were required to establish precisely which pairings had statistically significant mean differences. I opted to use the Bonferroni post hoc procedure because it is robust to unbalanced designs where there are a different number of participants in each subgroup (Lomax, 1992). To maintain an overall, experiment-wise alpha level of .05, the Bonferroni procedure conducts each pair-wise comparison (t-test) at an alpha level of .05 over the number of comparisons. For instance, there are six pairs of comparisons for four groups (1 vs. 2, 1 vs. 3, 1 vs. 4, 2 vs. 3, 2 vs. 4, and 3 vs. 4) so the pair-wise alpha would be .05/6 or .0083. To conduct the Bonferroni procedure in SPSS, the researcher selects an experiment-wise alpha and the program automatically divides the alpha by the number of comparisons so each pair-wise comparison is done at the appropriate alpha level. SPSS then adjusts the reported significance by multiplying by the number of comparisons to make it easier to interpret. The sign (positive or negative) of the mean difference reported by SPSS indicates the direction of the relationship between the groups. Thus, if the comparison is group 1 vs. group 2 and the mean difference is negative, then the mean for group 1 is less than the mean for group 2.

Factor Analysis

Factor analysis is a set of procedures that can be used to infer "the existence of underlying 'latent' variables as an explanation for the observed relations among

measured variables" (G. Hancock, personal communication, September 19, 2002). Latent variables, such as job satisfaction, are not directly observable. Instead, researchers use observable measures, such as survey statements which elicit information about job satisfaction, to make inferences about the latent variables. For the present study, I used the factor analysis extraction method of principal components analysis (PCA) to determine how many and what kind of latent factors existed. Ideally, the factors would represent the five strands derived from the literature (goal congruence, agency, teacher efficacy and respect, professional interaction, and load appropriateness). Figure 6 illustrates a simple model of PCA. In the diagram, the three measured (observable) variables are each influenced by a common latent factor and some error. The measured variables can be used to form a composite factor that is a reflection of what underlies the data. The composites of interest are those which explain the largest portion of variance in the original variables.

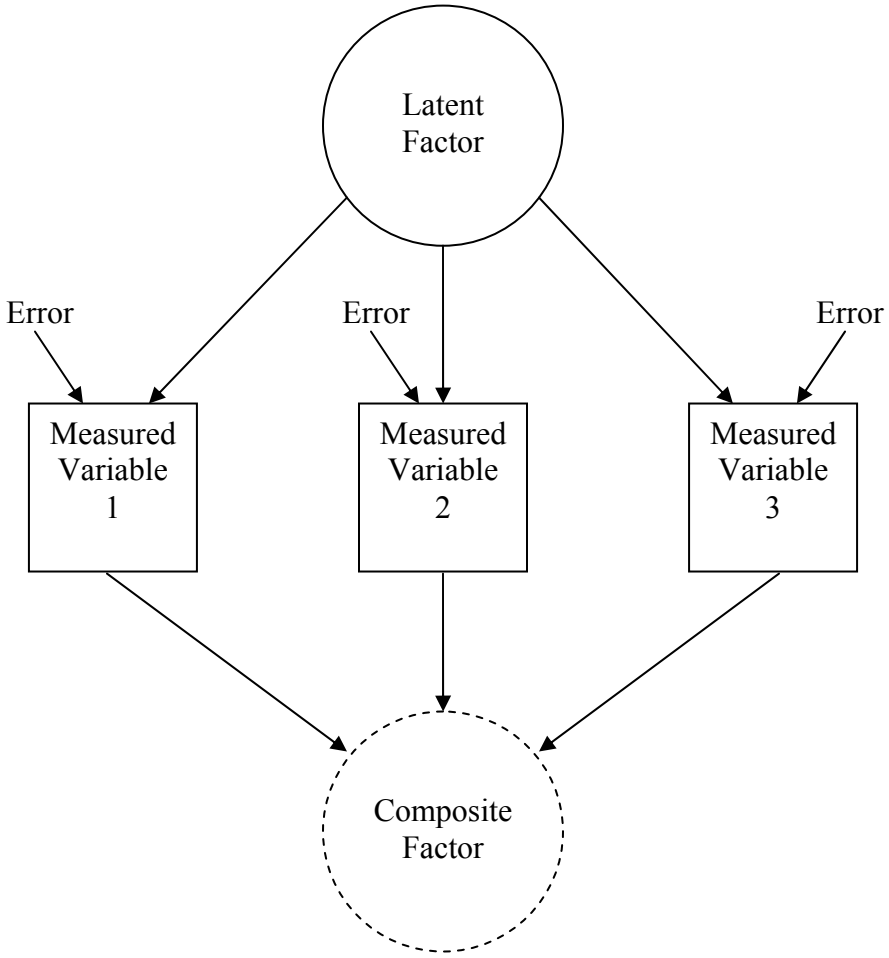


Figure 6. Model of factor analysis using principal component analysis (PCA) as the extraction method (G. Hancock, personal communication, September 19, 2002).

Mathematically, PCA creates orthogonal axes which are linear composites of the measured variables. The first composite axis is situated such that the perpendicular distance from the data points to the composite axis is minimized. A graphical example with two variables is presented in Figure 7. Then the second composite axis is placed so that it is perpendicular to the first composite axis and the perpendicular distance from the data points to the second composite axis is minimized. Each subsequent axis is created in the same manner.

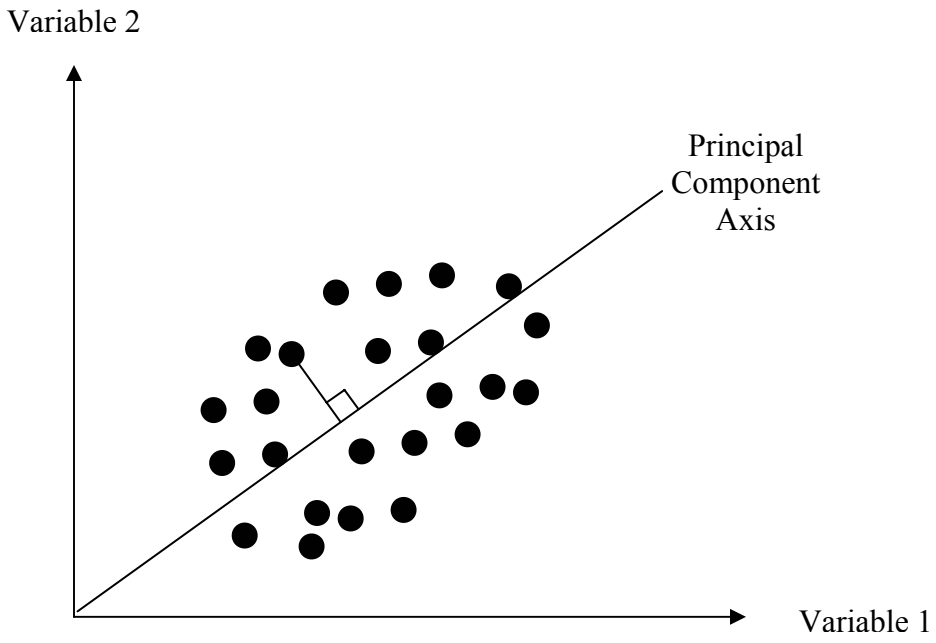


Figure 7. Principal component axis in a two variable model (Kim & Mueller, 1978).

Identification of Factors

Before running a factor analysis, I used SPSS to calculate the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy. The KMO value "serves as a qualitative index of the strength of relations among the variables" (G. Hancock, personal communication, October 3, 2002). If the KMO value for a system of variables is below .6, factor analysis would not be recommended. In the present study, the variables were the responses to 77 of the survey items. The item on effective use of planning time was not included because it was only answered by participants who had common planning time. The KMO for the system of 77 variables was .795, adequate for factor analysis.

After verifying the adequacy of the sample, I ran an unconstrained factor analysis in SPSS using PCA as the extraction method. In an unconstrained analysis, SPSS will report as many composite factors as there are variables. The factors are listed in

descending order by the amount of total variance explained. Then I ran Velicer's Minimum Average Partial procedure (see Appendix I for program code) to determine exactly how many factors were salient and therefore worth extracting. Velicer's procedure relies on the correlation matrix reported in the initial factor analysis. Based on the results of Velicer's procedure, I ran a second factor analysis extracting six factors and selecting Varimax rotation to make the factors more clear and interpretable. Varimax rotation is an iterative process that maintains the orthogonal relationship between the factors while maximizing the variance of squared loadings for each factor. Loadings are the correlation coefficients between the observed variable and the composite factor. The Varimax rotation converged in nine iterations and the resulting six factors explained 40% of the total variance in the 77 variables.

Once factors are identified, the reliability of the factors can be evaluated. Reliability is based on the strength of the loadings and the sample size. As the number of variables loading strongly per factor increases, the sample size required decreases (G. Hancock, personal communication, November 7, 2002). Guadagnoli and Velicer (1988) created the following criteria for reliability: (1) any factor with at least three loadings above .80 will be reliable regardless of sample size; (2) factors with four or more loadings above .60 are reliable regardless of sample size; (3) factors with ten or more low (.40) loadings are reliable as long as sample size is greater than about 150; and (4) factors with only a few loadings should not be interpreted unless sample size is at least 300. Using these criteria, factors 1, 2, and 3 in the present study are considered reliable. A larger sample size is necessary in order for the remaining three factors to possibly be

reliable. For the purposes of this exploratory study, I chose to include all six factors in the statistical analysis while taking note of the issue of reliability.

Interpretation of Factors

I interpreted the six factors based on the variables whose loadings were the largest (.50 and above). For the variables with large loadings, I considered the wording of the original survey item and the coding of the responses when labeling each factor. Table 6 displays the survey statements and loadings used to interpret factor 1. All of the statements in this group were also part of the teacher efficacy and respect strand. However, the teacher efficacy and respect strand label seemed too broad for this collection of statements. Thus, I interpreted factor 1 as "sense of accomplishment" because the cluster of statements seemed to focus on recognition from others, teaching effectiveness, and job satisfaction.

Table 6. *Survey Statements and Loadings for Factor 1*

Statement	Loading
My students recognize the good math teaching I do.	.739
I feel as though I am positively influencing other people's lives through my work as a math teacher.	.710
The parents at my school recognize the good math teaching I do.	.687
I feel as though I am making significant academic progress with my math students.	.669
I feel a sense of pride in my work at my school.	.667
Other teachers in my school recognize my math teaching competence.	.664
My students show that they appreciate me as a math teacher.	.641
I feel good about my math teaching style and strategies.	.627
Most of my students' parents support the things I do in teaching math.	.610
Teachers are a very powerful influence on student math achievement when all factors are considered.	.602
I enjoy teaching.	.581
I often feel satisfied with my job in teaching mathematics.	.561
I am pleased with the progress my students make in math.	.552
Other teachers at my school often seek my advice about professional issues.	.533

There were 11 variables with loadings of .50 or higher for factor 2. The variable statements and loadings are shown in Table 7. I interpreted factor 2 as "locus of instructional control" because the items described the level of teacher involvement in decision-making about issues related to math teaching. It is worth noting that there are connections between factor 2 and the hypothesized agency strand.

Table 7. *Survey Statements and Loadings for Factor 2*

Statement	Loading
Teachers participate actively in making decisions about what will be taught in math courses.	.697
Teachers participate actively in determining what mathematical topics will be tested.	.673
I have control over setting standards for achievement in my math classes.	.652
I can decide when particular topics are taught in my math course(s).	.639
The curricular materials I am required to use reflect what I believe is important in mathematics.	.614
Teachers participate actively in selecting math texts and materials that are used in my school.	.577
I can decide which particular topics are taught in my math course(s).	.568
The content of my math course(s) is determined by what my students are capable of understanding.	.563
The content of my math course(s) is determined by what my students need for future study and work.	.560
My school's mathematics program enables students to work at the pace that is best for them.	.556
I am encouraged to modify the mathematics curriculum to meet my own students' needs.	.510

Factor 3 had nine variables with high loadings as shown in Table 8. This group of survey statements describes feelings of emotional exhaustion and obstacles to teaching math. All of the statements had been reverse coded for the analysis so I interpreted factor 3 as "degree of contentment with teaching" rather than "degree of frustration with teaching".

Table 8. *Survey Statements and Loadings for Factor 3*

Statement	Loading
I often feel burned out from my work.[a]	.647
I often feel frustrated by teaching in general.[a]	.642
My planning time is often taken away due to academic responsibilities (IEP meetings, helping students, proctoring make-up assessments, covering class for an absent colleague, grading papers).[a]	.623
I often feel frustrated by uncontrollable factors of my job.[a]	.621
I am less idealistic about teaching now, then when I entered the profession.[a]	.595
I am philosophically at odds with ways that I am expected to teach math.[a]	.594
My experience in the teaching profession has diminished my enthusiasm for teaching math.[a]	.584
My success or failure in teaching students math is due primarily to factors beyond my control rather than to my own effort and ability.[a]	.518
My class time for math is often constrained by administrative tasks (taking attendance, tardy students, public announcements).[a]	.508

[a] Statement was reverse coded (1 = Strongly Agree, 2 = Agree, 3 = Disagree, 4 = Strongly Disagree).

Table 9 presents the survey statements for the variables with loadings of .50 or higher for factor 4. Two of the items were reverse coded and two were not. Three of the statements refer directly to the impact of mandated testing on math instruction and the fourth statement deals with the impact of a mandated math curriculum. Like factor 2, this set of statements seemed consistent with the hypothesized agency strand. I interpreted factor 4 as "level of autonomy".

Table 9. *Survey Statements and Loadings for Factor 4*

Statement	Loading
The tests I am required to give significantly influence the content of my math course(s).[a]	.531
I teach topics that are not in the required mathematics curriculum	.531
I teach topics that are not on the required math tests.	.520
The tests I am required to give significantly influence the methods of instruction used in my math course(s).[a]	.514

[a] Statement was reverse coded (1 = Strongly Agree, 2 = Agree, 3 = Disagree, 4 = Strongly Disagree).

Factor 5 consists of five variables related to involvement in professional activities. The statements and associated loadings for these variables are displayed in Table 10. Although not identical, factor 5 is quite similar to the hypothesized professional

interaction strand. I interpreted factor 5 as "professional growth" rather than "professional interaction" (one of the hypothesized strands) primarily because of the statements regarding the influence of the NCTM *Standards*.

Table 10. *Survey Statements and Loadings for Factor 5*

Statement	Loading
I attend professional conferences on a regular basis.	.692
I subscribe to and frequently use mathematics teaching publications.	.678
The NCTM *Principles and Standards for School Mathematics* significantly influence the content of my math course(s).	.578
The NCTM *Principles and Standards for School Mathematics* significantly influence the methods of instruction used in my math course(s).	.555
I regularly share teaching ideas with ___ other teachers.	.517

Table 11 shows the four variables with high loadings for factor 6. The statements center around the influence of textbooks and mandated curricular materials on math teaching. All four survey items had been reverse coded for analysis. Therefore, I interpreted factor 6 as "freedom to innovate".

Table 11. *Survey Statements and Loadings for Factor 6*

Statement	Loading
The main course textbook significantly influences the methods of instruction used in my math course(s).[a]	.608
The main course textbook significantly influences the content of my math course(s).[a]	.568
Uniformity and standardization of mathematics curriculum is important to the parents at my school.[a]	.525
The curricular materials I am required to use significantly influence the methods of instruction used in my math course(s).[a]	.511

[a] Statement was reverse coded (1 = Strongly Agree, 2 = Agree, 3 = Disagree, 4 = Strongly Disagree).

After identifying and interpreting the composite factors which resulted from the factor analysis, I repeated the analysis of the data using the factors as dependent variables.

Analysis using Factors

I began the analysis by evaluating the internal consistency reliability of the factors. Using SPSS, I calculated Cronbach's alpha coefficient for each factor. Factors with alpha

values of 0.60 and above were considered reliable for this study. Then, I created six new variables in the SPSS data file to represent the factors. Each variable was defined as the composite score for the items loading on the factor. For instance, a participant's composite score for the freedom to innovate variable is the mean of their responses for the four items associated with that factor. With these six new dependent variables, I conducted one-way ANOVAs to compare means between demographic subgroups to establish if differences in the factor scores existed. When significant differences were present, I ran post hoc comparisons to determine exactly which pairs were different and how they were different.

Summary

A summary of the research questions and analysis methods used is presented in Table 12.

Table 12. *Summary of Research Questions and Analysis Procedures*

Research Question	Analysis Methods
1. What specific aspects of the professional working environment for mathematics teaching are especially stressful and discouraging?	Descriptive analyses
2. When tension is measured by the strands of goal congruence, agency, teacher efficacy and respect, professional interaction, and load appropriateness, to what extent do teachers of mathematics feel tensions in the conditions of their professional working environment?	Descriptive analyses
3. When tension is measured by the strands of goal congruence, agency, teacher efficacy and respect, professional interaction, and load appropriateness, are there statistically significant differences in the feelings of tension perceived by mathematics teachers when examined in terms of demographic variables?	ANOVA
4. When tension is measured by the factors identified through factor analysis, to what extent do teachers of mathematics feel tensions in the conditions of their professional working environment?	Descriptive analyses
5. When tension is measured by the factors identified through factor analysis, are there statistically significant differences in the feelings of tension perceived by mathematics teachers when examined in terms of demographic variables?	ANOVA

CHAPTER 4: RESULTS

This study examined the nature of working conditions of mathematics teachers. In particular, we surveyed mathematics teachers in Maryland to gain insight into the critical challenges and problematic tensions that arise in the course of fulfilling their responsibilities. Chapter Four provides a profile of the participants and presents the results of this study.

Participants

Participants for this study were solicited through flyers distributed at the annual MCTM conference and an e-mail distributed to the MCTM membership. Interested teachers visited the link provided on the flyer and in the e-mail. Of the 323 teachers who accessed the on-line survey, a total of 252 (78%) completed the survey. Summary statistics were tabulated to provide a profile of study participants. The study participants were assigned to teach in predominantly middle (40.5%) and high (46.4%) school grade levels. The teaching experience of participants ranged from novice to veteran. Among early-career teachers, 9.5% (24) were first-year teachers and 15.9% (40) were second-, third-, or fourth-year teachers. The mid-career teachers (5-19 years of experience) accounted for roughly half of the participants. Of the participating teachers, 26.2% (66) reported 5 – 9 years of experience and 22.2% (56) reported 10-19 years of experience. Late-career teachers composed one-fifth of the participants and were equally split between those with 20-29 years experience and those with over 30 years of experience. Over three-quarters of the participants were female and almost all of the participants reported teaching in a public school. These results are shown in Table 13.

Table 13. *Demographic Characteristics of Study Participants*

	Frequency	Percent
Grade Level Assignment		
Elementary, K - 5	33	13.1
Middle, 6 - 8	102	40.5
High, 9 - 12	117	46.4
Teaching Experience[a]		
0 - 1 year	24	9.5
2 - 4 years	40	15.9
5 - 9 years	66	26.2
10 - 19 years	56	22.2
20 - 29 years	27	10.7
30+ years	28	11.1
Gender		
Female	193	76.6
Male	59	23.4
School Type		
Public	242	96.0
Private	10	4.0

[a] Percents do not add up to 100 because of missing data.

Table 14 displays the districts grouped by size and location and the number of respondents associated with each of these groups. Geographic information about the MCTM membership was not available to verify if the participation rates were representative. The discrepancy in participation among districts may be attributed to how participants were solicited. While the e-mail was distributed to all MCTM members, the flyers were only available to teachers who attended the annual MCTM conference, held in a Quartile 2 district within the Baltimore Region.

Table 14. *Size and Location of School Districts of Survey Participants*

	Percent of Student Population	Frequency of Participants	Percent of Participants
Ranked Size[a]			
Quartile 1	22.0	56	22.2
Quartile 2	23.4	80	31.7
Quartile 3	22.7	25	9.9
Quartile 4	31.9	83	32.9
Geographic Location[a]			
Baltimore Region	44.9	132	52.4
Suburban Washington	36.5	86	34.1
Southern Maryland	7.0	10	4.0
Western Maryland	4.1	0	0.0
Eastern Shore	7.6	16	6.3

[a] Percents do not add up to 100 because of missing data.

Research Question 1

What specific aspects of the professional working environment for mathematics teaching are especially stressful and discouraging?

The survey participants completed a 77-item questionnaire made up of statements representing the five hypothesized tension strands (goal congruence, agency, teacher efficacy and respect, professional interaction, and load appropriateness). I computed descriptive statistics to identify specific aspects of the professional working environment that are particularly stressful and discouraging for Maryland mathematics teachers. The results of this analysis are arranged by strand in the following order: goal congruence, agency, teacher efficacy and respect, professional interaction, and load appropriateness. For all items, the response distribution percentages reflect actual participant selections. However, the mean response is calculated using a coding scheme. Responses to items that affirm the strand are coded as follows: Strongly Disagree = 1, Disagree = 2, Agree = 3, Strongly Agree = 4. Responses to items that negate the strand are reverse coded so that Strongly Disagree = 4, Disagree = 3, Agree = 2, and Strongly Agree = 1. Therefore, a

high mean occurs in two ways. Either many teachers agree with an item that affirms the strand or many teachers disagree with an item that negates the strand. Survey statements with reversed codes are identified in their respective tables.

In presenting response distribution data, I recognize that different readers will draw somewhat different conclusions. For some, the glass will appear half full while for others the glass will appear half empty. I relied on and liberally included the comments that participants added throughout the survey to help interpret the results of the item analysis.

Goal Congruence

The goal congruence strand consisted of three components: role conflict (when expectations conflict), person-environment fit (when teachers feel unable to meet teaching demands), and role ambiguity (when expectations are unclear). The distributions of responses for items assessing teachers' sense of goal congruence are presented in Table 15. These 13 survey items elicited how well teachers' beliefs, goals, and values matched the beliefs, goals, and values of the various institutions to which they may belong (i.e., the school, district, state, and NCTM).

Table 15. *Response Distributions for Goal Congruence Items*

Item no.	Statement	Strongly Disagree	Disagree	Agree	Strongly Agree	*M*	*SD*
Role Conflict Sub-strand							
1	The tests I am required to give reflect what I believe is important in mathematics.	3.17%	28.97%	60.71%	7.14%	2.72	0.64
6	The curricular materials I am required to use reflect what I believe is important in mathematics.	6.75%	22.62%	61.51%	9.13%	2.73	0.72
10	The NCTM *Principles and Standards for School Mathematics* reflect what I believe is important in mathematics.	1.98%	8.33%	64.68%	25.00%	3.13	0.63
21	My school and my district have the same values regarding math content.	3.17%	13.89%	52.78%	30.16%	3.10	0.75
22	My school and my district have the same philosophy regarding math instruction.	3.17%	21.83%	52.78%	22.22%	2.94	0.75
25	My own beliefs about what mathematical topics are important significantly impact the content of my math course(s).	11.11%	38.10%	36.90%	13.89%	2.54	0.87
53	My students' gains on math achievement tests are a good way for others to judge my instructional effectiveness.	12.30%	46.43%	36.51%	4.76%	2.34	0.75
54	My students' gains on math achievement tests are a good way for me to judge my instructional effectiveness.	6.75%	34.52%	49.21%	9.52%	2.62	0.75
65	I am philosophically at odds with ways that I am expected to teach math.[a]	9.52%	41.67%	30.95%	17.86%	2.43	0.89
Person-environment Fit Sub-strand							
34	The content of my math course(s) is determined by what my students are capable of understanding.	16.67%	42.06%	35.32%	5.95%	2.31	0.82
41	The students I work with are placed in the math course most appropriate for them.	9.52%	28.97%	55.16%	6.35%	2.58	0.75
42	My school's mathematics program enables students to work at the pace that is best for them.	20.63%	42.46%	32.54%	4.37%	2.21	0.82

Item no.	Statement	Strongly Disagree	Disagree	Agree	Strongly Agree	*M*	*SD*
Role Ambiguity Sub-strand							
77	I know exactly what is expected of me in math instruction.	1.19%	10.32%	59.52%	28.97%	3.16	0.64

[a] Statement was reverse coded (1 = Strongly Agree, 2 = Agree, 3 = Disagree, 4 = Strongly Disagree).

Role Conflict

Within the goal congruence strand, items 1, 6, 10, 21, 22, 25, 53, 54, and 65 relate to role conflict. Although the unsolicited comments from a number of participants reflected some conflict, the survey responses tended to show that participant beliefs were compatible with the beliefs of their school, district, and state as well as the beliefs of NCTM.

Close to 90% of participants indicated that the NCTM *Principles and Standards for School Mathematics* matched their own beliefs (see item 10). This high level of agreement may be because the participants were mostly MCTM members, a local chapter of the NCTM. However, some of the comments provided by participants reflect some role conflict even though they marked "Agree" with the statement. For instance, one teacher wrote about a perceived conflict with the content of the *Standards*: "Although I agree with many of the *Standards* of NCTM, I believe that there is a lot of value in having students know their math facts cold" (A female, mid-career, public high school teacher from a quartile 4, suburban Washington district, personal communication, October 31, 2006). Another teacher alluded to conflicts between the *Standards* and the curriculum pacing guide: "I am intrigued by the NCTM *Principles and Standards*, although I am uncertain that they are attainable if one adheres to the pacing guide" (A female, early-career, public high school teacher from a quartile 2, Baltimore region district, personal communication, November 3, 2006).

Items on curricular materials and tests also showed little role conflict. Approximately 7 out of 10 participants agreed that "The curricular materials I am

required to use reflect what I believe is important in mathematics" and 2 out of 3 participants agreed that "The tests I am required to give reflect what I believe is important in mathematics." The response to these items seems to indicate general agreement with the mathematical content of both the curriculum and tests. The similar ratings may stem from the trend among districts to align the curriculum with the mandated tests. However, the results may have been different if the statement on testing was separated into two items, one on state tests and one on district tests. For example, one participant agreed with the item on tests yet commented, "The county tests do not assess the students fairly" (A male, early-career, public middle school teacher from a quartile 4, suburban Washington district, personal communication, November 13, 2006). Even though most teachers held beliefs consistent with the required tests, only 41% agreed that "My students' gains on math achievement tests are a good way for others to judge my instructional effectiveness" and 59% agreed that "My students' gains on math achievement tests are a good way for me to judge my instructional effectiveness." These responses show that there is some conflict regarding how test scores are used.

For some participants, responses clearly indicated the presence of role conflict. One teacher indicated on her survey that the *Standards* were compatible with her beliefs and the district curriculum was not. She then explained her response by stating:

> There is a direct conflict between NCTM *Standards* and the [district] expectations for teaching curriculum. [The district] forces breadth over depth, a huge problem for our students as they move into higher level course work. I'm disappointed at the short sightedness of the curriculum planning and lack

> of depth from [the district]. (A female, mid-career, public middle school teacher from a quartile 2, Baltimore region district, personal communication, October 31, 2006)

Again, this type of role conflict may be more prevalent in this sample than in the general teaching population because the sample consisted of MCTM members.

Role conflict also assessed the harmony between institutions to which the participants belonged, namely schools and districts. Most of the participants perceived consistency between school and district values and philosophies as evidenced by the high levels of agreement. This may be a result of the alignment between the Maryland Voluntary Curriculum and the individual district learning objectives as well as an emphasis on uniformity within districts.

One striking result among the role conflict items was the response to the statement "I am philosophically at odds with ways that I am expected to teach math." Almost half of the participants agreed with this statement. In fact, 18% of the participants marked "Strongly Agree". The response to this item seems to indicate a mismatch between teacher beliefs and school and/or district beliefs about how to teach math. One participant included the following elaborating comment on her survey: "The statement on this entire survey that I most agree with is the one indicating that I am philosophically at odds with the ways I am expected to teach math" (A female, mid-career, public middle school teacher from a quartile 2, Baltimore region district, personal communication, October 17, 2006). Another participant also elaborated on her response to this item:

> When I agree to being 'philosophically at odds with ways that I am expected to teach math' ---I just mean that sometimes, children do not fall into the 'cookie cutter' expectations. If a child is really behind, I would like to modify their assignments daily and do some intervention. Realistically, those types of things can be looked down upon. Philosophically, I have a problem moving on when I know a student isn't understanding a concept. I would prefer to continue to work with that student longer. The curriculum frowns on that. We have a timeline to follow. (A female, early-career, public elementary school teacher from a quartile 3, Baltimore region district, personal communication, October 24, 2006)

This comment is consistent with findings by Jeffrey and Woods (1998) that primary school teachers in England desired flexibility and autonomy in their practice while they felt constrained by a government controlled, prescribed national curriculum.

Person-environment Fit

Items 34, 41, and 42 of the goal congruence strand assess person-environment fit. This fit represents the balance between the demands of teaching and the abilities of teachers to meet those demands. Teacher responses showed a lack of fit resulting from course content, student placement, curriculum pacing, and instructional time.

Approximately 61% of teachers agreed that their students were appropriately placed. However, only 41% of teachers agreed that the course content was suitable for their students and 37% of teachers agreed with the statement “My school’s mathematics program enables students to work at the pace that is best for them.” The

responses to these items seem to suggest that a large number of teachers face additional burdens due to the needs of their students. One participant eloquently expressed her concern about the long term ramifications of inappropriate student placement, course content, and pacing:

> …My greatest concern is that children are being pushed into Algebra I too soon. Although, a child may be able to handle Algebra I in 7th or 8th grade, especially with its current emphasis on data analysis instead of the rigor that used to be in Algebra I (factoring, solving equations, graphical analysis). Taking Algebra I at this age forces a student to take Precalculus in 10th or 11th grade and they are definitely not prepared for the rigor of a true mathematics course such as this. They are lost and feel they are stupid, which just isn't the case. Instead, they have been ill prepared by a system that only wants to count how many heads are in advanced mathematical classes. It is a travesty for which the student pays in frustration, tears and an overall decrease in motivation for learning mathematics. (A female, mid-career, public high school teacher from a quartile 4, suburban Washington district, personal communication, November 1, 2006)

Although lack of instructional time was not specifically addressed in the survey, a number of participants alluded to this issue as an environmental factor hampering their efforts to teach. One teacher wrote: "I cannot possibly cover everything in my curriculum because there is not enough time in the semester" (A female, late-career, public high school teacher from a quartile 1, Baltimore region district, personal communication, November 10, 2006). These time constraints impact

what is taught as well as how it is taught as evidenced by the following comment: "NCTM *Standards* fall by the wayside because in order to cover everything, a teacher needs to find the quickest way to present material, not the best way" (A female, late-career, public middle school teacher from a quartile 2, Baltimore region district, personal communication, October 19, 2006). Teachers can feel torn between following the prescribed pacing guide and doing what is best for their students. One teacher remarked on this dilemma:

> … I do not feel the mandatory time allotment given by my county meets my students' needs. I am constantly having to move on because the calendar says so. I am a strong believer in a healthy balance of conceptual and procedural knowledge and not in teaching a new indicator each day and hope the students get the procedure as we 'fly' by it. (A female, mid-career, public middle school teacher from a quartile 4, suburban Washington district, personal communication, November 1, 2006)

These comments seem to suggest that pacing guides play an important role in the fit between teachers and their environment.

The responses and comments related to person-environment fit show that teachers perceive that they are often placed in the uncomfortable position of having a wide-range of student abilities and a challenging, fast-paced curriculum.

Role Ambiguity

The final aspect of the goal congruence strand, role ambiguity, is addressed in item 77. Role ambiguity did not appear to be a source of stress among participants with almost 90% agreeing or strongly agreeing with the statement "I know exactly

what is expected of me in math instruction." The high rate of agreement may be a result of structured curriculum guides, detailed pacing guides, and publicized passing rates for mandated tests.

Agency

The agency strand consists of 29 survey items designed to gauge how autonomous, empowered, and utilized teachers feel. Table 16 displays the distributions of responses for the items measuring teachers' sense of agency. For ease of interpretation, the following five categories were established: (1) items related to individual teacher power, (2) items related to collective teacher power, (3) items on teacher utilization, (4) items about influences on course content, and (5) items about influences on course methods.

Table 16. *Response Distributions for Agency Items*

Item no.	Statement	Strongly Disagree	Disagree	Agree	Strongly Agree	*M*	*SD*
Individual Teacher Power							
4	I teach topics that are not on the required math tests.	11.51%	21.43%	50.79%	16.27%	2.72	0.87
9	I teach topics that are not in the required mathematics curriculum.	14.68%	33.73%	40.08%	11.51%	2.48	0.88
24	At my school, I am allowed to teach math in my own style.	3.57%	13.10%	48.02%	35.32%	3.15	0.78
27	I can decide which particular topics are taught in my math course(s).	38.89%	44.84%	11.90%	4.37%	1.82	0.81
28	I am encouraged to modify the mathematics curriculum to meet my own students' needs.	18.65%	26.98%	33.33%	21.03%	2.57	1.02
29	I can decide when particular topics are taught in my math course(s).	34.52%	35.71%	20.63%	9.13%	2.04	0.96
30	I have control over setting standards for achievement in my math classes.	14.29%	30.56%	40.08%	15.08%	2.56	0.91
40	I feel pressure from parents regarding the math placement of their child. [a]	9.52%	38.89%	30.95%	20.63%	2.37	0.92
73	I often feel frustrated by uncontrollable factors of my job. [a]	3.97%	16.27%	43.65%	36.11%	1.88	0.82
Collective Teacher Power							
13	Teachers participate actively in selecting math texts and materials that are used in my school.	25.79%	38.10%	26.19%	9.92%	2.20	0.94
14	Teachers participate actively in making decisions about what will be taught in math courses.	31.35%	35.32%	26.19%	7.14%	2.09	0.93
15	Teachers participate actively in determining what mathematical topics will be tested.	42.46%	35.32%	17.86%	4.37%	1.84	0.87
16	Teachers participate actively in determining appropriate instructional methods for mathematics.	7.54%	19.44%	53.97%	19.05%	2.85	0.82

Item no.	Statement	Strongly Disagree	Disagree	Agree	Strongly Agree	*M*	*SD*
Teacher Utilization							
25	My own beliefs about what mathematical topics are important significantly impact the content of my math course(s).	11.11%	38.10%	36.90%	13.89%	2.54	0.87
26	My own knowledge of mathematical topics significantly impacts the content of my math course(s).	9.92%	21.03%	42.06%	26.98%	2.86	0.93
Influences on Course Content							
2	The tests I am required to give significantly influence the content of my math course(s).[a]	0.40%	1.98%	31.35%	66.27%	1.37	0.54
5	I spend more than 30 hours per year preparing students specifically for the required math tests.[a]	1.98%	8.33%	33.33%	56.35%	1.56	0.73
7	The curricular materials I am required to use significantly influence the content of my math course(s).[a]	2.38%	9.52%	46.03%	42.06%	1.72	0.73
12	The NCTM *Principles and Standards for School Mathematics* significantly influence the content of my math course(s).	2.78%	22.62%	57.94%	16.67%	2.88	0.70
18	Uniformity and standardization of mathematical content is important in my district.[a]	0.79%	4.37%	40.08%	54.76%	1.51	0.62
32	The main course textbook significantly influences the content of my math course(s).[a]	13.89%	35.71%	34.92%	15.48%	2.48	0.92
33	The content of my math course(s) is determined by what my students need for future study and work.	10.32%	29.76%	44.84%	15.08%	2.65	0.86
47	If I spend the majority of my time helping students develop proficiency in math skills and procedures, then the students will perform well on accountability tests.[a]	3.97%	23.81%	50.40%	21.83%	2.10	0.78

Item no.	Statement	Strongly Disagree	Disagree	Agree	Strongly Agree	*M*	*SD*
Influences on Course Methods							
3	The tests I am required to give significantly influence the methods of instruction used in my math course(s). [a]	1.98%	19.84%	45.63%	32.54%	1.91	0.77
8	The curricular materials I am required to use significantly influence the methods of instruction used in my math course(s). [a]	4.76%	19.84%	52.78%	22.62%	2.07	0.78
11	The NCTM *Principles and Standards for School Mathematics* significantly influence the methods of instruction used in my math course(s).	3.57%	29.76%	53.17%	13.49%	2.77	0.72
17	Uniformity and standardization of instructional methods in math is important in my district. [a]	3.57%	29.76%	41.27%	25.40%	2.12	0.83
31	The main course textbook significantly influences the methods of instruction used in my math course(s). [a]	14.29%	40.48%	32.54%	12.70%	2.56	0.89

[a] Statement was reverse coded (1 = Strongly Agree, 2 = Agree, 3 = Disagree, 4 = Strongly Disagree).

Individual Teacher Power

Items 4, 9, 24, 27-30, 40, and 73 consider the extent of power individual teachers have. Among these items, participant responses varied. The statement "At my school, I am allowed to teach math in my own style" garnered the highest level of agreement at 83%. This strong response seems to reflect a perception by teachers that they can close their classroom door and teach in a manner that suits them with little outside interference. For example, one participant commented:

> I am able to teach math in my own style only because I have a classroom where the principal and assistant principal do not go in frequently until right before the test. As a result I feel more freedom in the beginning of the year to teach math in my own style, however as the test draws nearer I become more and more restricted. After the test (April to the beginning of June) I am able to decide what topics are taught in my math course but not before. (A female, early-career, public elementary school teacher from a quartile 3, Baltimore region district, personal communication, October 30, 2006)

Another teacher felt the amount of outside interference was dependent on student test scores. She wrote:

> It has been my experience that if a teacher can deliver good scores on the MSA, the district, principal, and powers that be will 'leave the teacher alone' and allow them to bring in other materials or even modify the curriculum. If you have not delivered good scores from your students on standardized tests, you will NOT be allowed to deviate from the curriculum timeline at ALL. (A

female, early-career, public elementary school teacher from a quartile 3, Baltimore region district, personal communication, October 24, 2006)

There was less agreement regarding individual power over the type of topics taught. Two out of three participants taught topics not on the required tests and about half of the participants taught topics not in the required curriculum. These responses seem to indicate that a number of teachers feel free to stray from testing and curricular mandates. It is possible that the choice of sample (MCTM members) inflates these values. Just over half of the participants agreed that they could set standards of achievement in their classes. However, over 14% of the participants marked "Strongly Disagree" suggesting that for some teachers, they have no say in how standards are set. Teachers were also split on the statement: "I am encouraged to modify the mathematics curriculum to meet my own students' needs." In fact, this item had the greatest dispersion of responses of all items on the survey. The fact that close to half of the respondents disagree seems to imply that for many teachers, the school culture promotes strict adherence to the curriculum. Participants felt the least amount of power on the issue of deciding when and what to teach. Only 30% of the teachers surveyed expressed that they decided when topics were taught and a mere 16% said they decided which particular topics were taught. The prevalence of detailed curriculum and pacing guides may explain why teachers responded this way. Lack of power may also contribute to feelings of frustration. Eight out of ten teachers agreed that they were frequently frustrated by uncontrollable factors of teaching.

Teacher power was also considered with respect to student placement. About half of the participants agreed with the statement: "I feel pressure from parents

regarding the math placement of their child." Teachers commented that their recommendations were disregarded when parents intervened. A high school teacher remarked: "It is obvious though that teacher recommendations are largely ignored" (A male, mid-career, public school teacher from a quartile 4, suburban Washington district, personal communication, November 1, 2006). Another high school teacher noted: "Every parent wants their child in honors classes (I think they know that their child is not 'gifted', they just want their child to interact with gifted students). If they insist, we must let them" (A female, mid-career, public school teacher from a quartile 1, Baltimore region district, personal communication, November 3, 2006).

Collective Teacher Power

The four items related to collective teacher power (the perceived power of teachers as a whole) were items 13, 14, 15, and 16. In general, participants expressed a lack of power regarding the selection of math texts and materials and the determination of what is taught and tested. The one area where teachers felt they had input was in deciding what instructional methods to use. Several participants commented that textbook and curriculum decisions were typically made at the district level with limited if any teacher involvement. A teacher with 27 years of experience wrote: "Although I have participated in several textbook selection committees, most teachers do not have that opportunity. The decisions are made on a county level" (A female, public high school teacher from a quartile 2, Baltimore region district, personal communication, November 3, 2006). Another teacher stated: "Textbooks are chosen by a 'committee' of teachers experienced in the course content. Not every school had a teacher on every course committee" (A female, mid-career, public high

school teacher from a quartile 2, Baltimore region district, personal communication, October 23, 2006). A public middle school teacher described the top-down system of decision-making in her district as follows: "The curriculum is created by district's math department. Materials and textbooks are disseminated and that is what we are to use" (A mid-career teacher from a quartile 4, suburban Washington district, personal communication, October 26, 2006). These responses and comments seem to imply a top-down system where teachers have little input in curricular decisions which impact instruction.

Teacher Utilization

Another aspect of the agency strand was the utilization of teacher knowledge and beliefs. Teacher utilization was assessed through items 25 and 26. Approximately seven out of ten teachers agreed that their own knowledge of mathematical topics significantly impacted their course content. However, only half of the participants agreed with the statement: "My own beliefs about what mathematical topics are important significantly impact the content of my math course(s)." This response likely reflects the widespread use of prescribed curriculum guides geared towards mandated tests. In fact, a few teachers expressed strong feelings about the lack of utilization. One middle school teacher wrote: "All I do is teach to the test because that is all that is talked about!!" (A female, early-career, public school teacher from a quartile 2, Baltimore region district, personal communication, November 1, 2006). Another middle school teacher described her curriculum as 'scripted' and mentioned serious consequences for teachers who disobeyed: "There is no deviation on what is taught and when. It is all scripted and must be followed or the teacher is reported to

the Board of Education by the math text book's 'coach'" (A female, mid-career, public middle school teacher from a quartile 2, Baltimore region district, personal communication, November 1, 2006). These comments seem to indicate dissatisfaction due to routinization which is consistent with findings from Conley, Bacharach, and Bauer (1989).

Influences on Course Content

Items 2, 5, 7, 12, 18, 32, 33, and 47 assessed the influence on course content of factors other than teacher beliefs and knowledge. Almost all of the participants agreed that uniformity and standardization of math content was important in their district. Several participants cited the use of pacing guides to enforce the content and speed of delivery. For example, one teacher wrote, "We have 'pacing guides' that are used throughout our county. Each teacher should be within 2 days (ahead or behind) at any given time" (A female, mid-career, public high school teacher from a quartile 2, Baltimore region district, personal communication, October 23, 2006). Another teacher commented, "We teach by the Pacing Guide. We have required weekly meetings to verify that we are all in the same place and using the same assessment materials when not provided by the board" (A female, early-career, public high school teacher from a quartile 2, Baltimore region district, personal communication, November 3, 2006).

Testing appeared to have a strong role in determining course content. There was close to unanimous agreement that the required tests significantly influence course content. A middle school teacher lamented, "Course content has become test driven … I can't take time to do the creative things that make math fun and

interesting and make my class memorable" (A female, mid-career, public school teacher from a quartile 2, Baltimore region district, personal communication, October 17, 2006). A high school teacher stated, "All of my instruction directly relates to the required tests" (A female, mid-career, public school teacher from a quartile 4, suburban Washington district, personal communication, October 18, 2006). Another teacher went as far as to say, "Tests drive it ALL. Timing, content, and methods" (A female, mid-career, public middle school teacher from a quartile 2, Baltimore region district, personal communication, October 31, 2006). Nine out of ten teachers agreed that they spent over 30 hours per year preparing students for required tests. One teacher confessed:

> I actually spend way more than 30 hours per year preparing students for required math tests. I spend a minimum of 1 hour 25 min. daily for 5 days per week preparing students for their tests. All instruction focuses on the required results. (A female, mid-career, public elementary school teacher from a quartile 4, suburban Washington district, personal communication, November 7, 2006)

Over 70% of teachers agreed with the statement "If I spend the majority of my time helping students develop proficiency in math skills and procedures, then the students will perform well on accountability tests." Several teachers mentioned that the emphasis on teaching to the test had increased with time. A teacher from the Eastern Shore wrote:

> I feel as if every year I am required to teach more and more to the Maryland state test that my students take in March. We spend almost every minute of

> instruction on the topics that will be on the state test. It isn't until after the test that I feel that I can teach some 'other' topics. (A female, public middle school teacher with unknown teaching experience from a quartile 1 district, personal communication, October 25, 2006)

Another teacher expressed her concern that student learning was being sacrificed for test scores:

> More and more I am forced to teach to the test and given very little time to do so. It seems every year one more thing is crammed in leaving no time to elaborate on anything. I feel that I am only skimming the surface and the kids aren't truly learning the in depth parts…just how to pass an exam." (A female, mid-career, public high school teacher from a quartile 2, Baltimore region district, personal communication, November 1, 2006)

The survey responses and numerous comments from participants indicate that testing heavily influences course content.

Besides testing, course content was also shaped by the curriculum, the *Standards*, textbooks, and student needs. Close to 90% of participants agreed that the required curricular materials influenced content. For instance, a late-career teacher said, "There is no time to teach objectives other than what is on mandated curriculum and tests. Sometimes there is not enough time to teach what is required" (A female, public middle school teacher from a quartile 2, Baltimore region district, personal communication, October 19, 2006). Three out of four teachers agreed that the *Standards* influenced the content of their courses and half of the teachers agreed that the textbook influenced the content of their courses. Six out of ten teachers agreed

with the statement "The content of my math course(s) is determined by what my students need for future study and work." The responses to this set of items indicate that pacing, testing, and curriculum play a larger role in shaping course content then the *Standards*, textbooks, and student needs.

Influences on Course Methods

Influences on course methods were measured by items 3, 8, 11, 17, and 31. Overall, there was less influence by tests, curricular materials, textbooks, and the *Standards* on instructional methods than there was on course content. About three out of four participants felt that tests and curricular materials had a considerable impact on teaching methods. Two out of three teachers cited the *Standards* and less than half of the teachers cited their textbook as having an affect on instructional methods. A majority of teachers reported that uniformity and standardization of teaching methods was important in their district, however the level of agreement was much lower than it was for a similar item on content.

The responses to the agency strand items point to a heavy emphasis on testing and a limited voice for teachers on issues related to instruction. The locus of control appears to reside with others more than it does with the teacher. Teachers are told what and when to teach as well as what and when to assess. Teachers felt the most power in the manner with which they taught. With this backdrop, it is understandable why close to 50% of the participants stated they were philosophically at odds with the ways they were expected to teach math.

Teacher Efficacy and Respect

The distributions of responses for the items evaluating teachers' sense of efficacy and respect are presented in Table 17. Of the 45 items in this strand, 20 measured how effective teachers felt and 25 measured how respected teachers felt.

Table 17. *Response Distributions for Teacher Efficacy and Respect Items*

Item no.	Statement	Strongly Disagree	Disagree	Agree	Strongly Agree	*M*	*SD*
Efficacy							
19	I feel pressure from my district superintendent to raise scores on required math tests. [a]	1.98%	11.11%	29.76%	57.14%	1.58	0.77
20	I feel pressure from my principal to raise scores on required math tests. [a]	1.98%	9.92%	32.14%	55.95%	1.58	0.75
35	The curriculum for my math course(s) is too difficult for my students. [a]	11.90%	50.79%	28.57%	8.73%	2.66	0.80
36	The curriculum for my math course(s) is not challenging my students. [a]	23.81%	64.68%	9.92%	1.59%	3.11	0.63
41	The students I work with are placed in the math course most appropriate for them.	9.52%	28.97%	55.16%	6.35%	2.58	0.75
45	I often feel satisfied with my job in teaching mathematics.	2.38%	18.25%	57.14%	22.22%	2.99	0.71
48	I feel as though I am positively influencing other people's lives through my work as a math teacher.	1.19%	5.56%	52.78%	40.48%	3.33	0.64
49	I feel as though I am making significant academic progress with my math students.	0.79%	16.27%	59.13%	23.81%	3.06	0.66
50	My success or failure in teaching students math is due primarily to factors beyond my control rather than to my own effort and ability. [a]	10.71%	39.68%	31.35%	18.25%	2.43	0.91
51	Teachers are a very powerful influence on student math achievement when all factors are considered.	0.79%	5.56%	51.98%	41.67%	3.35	0.62
53	My students' gains on math achievement tests are a good way for others to judge my instructional effectiveness.	12.30%	46.43%	36.51%	4.76%	2.34	0.75
54	My students' gains on math achievement tests are a good way for me to judge my instructional effectiveness.	6.75%	34.52%	49.21%	9.52%	2.62	0.75

Item no.	Statement	Strongly Disagree	Disagree	Agree	Strongly Agree	*M*	*SD*
63	My experience in the teaching profession has diminished my enthusiasm for teaching math. [a]	23.02%	44.84%	23.81%	8.33%	2.83	0.88
64	I am less idealistic about teaching now, then when I entered the profession. [a]	13.10%	30.16%	36.51%	20.24%	2.36	0.95
70	I enjoy teaching.	0.40%	4.76%	47.62%	47.22%	3.42	0.60
71	I often feel frustrated by teaching in general. [a]	9.52%	37.70%	40.48%	12.30%	2.44	0.83
72	I am pleased with the progress my students make in math.	1.19%	18.65%	63.49%	16.67%	2.96	0.63
74	I feel a sense of pride in my work at my school.	0.00%	4.76%	55.56%	39.68%	3.35	0.57
75	I often feel burned out from my work. [a]	9.13%	30.95%	38.10%	21.83%	2.27	0.91
76	I feel good about my math teaching style and strategies.	0.00%	7.14%	53.97%	38.89%	3.32	0.60
Respect							
13	Teachers participate actively in selecting math texts and materials that are used in my school.	25.79%	38.10%	26.19%	9.92%	2.20	0.94
14	Teachers participate actively in making decisions about what will be taught in math courses.	31.35%	35.32%	26.19%	7.14%	2.09	0.93
15	Teachers participate actively in determining what mathematical topics will be tested.	42.46%	35.32%	17.86%	4.37%	1.84	0.87
16	Teachers participate actively in determining appropriate instructional methods for mathematics.	7.54%	19.44%	53.97%	19.05%	2.85	0.82
17	Uniformity and standardization of instructional methods in math is important in my district. [a]	3.57%	29.76%	41.27%	25.40%	2.12	0.83
18	Uniformity and standardization of mathematical content is important in my district. [a]	0.79%	4.37%	40.08%	54.76%	1.51	0.62
23	At my school, teachers maintain high standards of performance for themselves in teaching mathematics.	0.79%	8.73%	44.84%	45.63%	3.35	0.67
24	At my school, I am allowed to teach math in my own style.	3.57%	13.10%	48.02%	35.32%	3.15	0.78

Item no.	Statement	Strongly Disagree	Disagree	Agree	Strongly Agree	*M*	*SD*
25	My own beliefs about what mathematical topics are important significantly impacts the content of my math course(s).	11.11%	38.10%	36.90%	13.89%	2.54	0.87
26	My own knowledge of mathematical topics significantly impacts the content of my math course(s).	9.92%	21.03%	42.06%	26.98%	2.86	0.93
27	I can decide which particular topics are taught in my math course(s).	38.89%	44.84%	11.90%	4.37%	1.82	0.81
28	I am encouraged to modify the mathematics curriculum to meet my own students' needs.	18.65%	26.98%	33.33%	21.03%	2.57	1.02
29	I can decide when particular topics are taught in my math course(s).	34.52%	35.71%	20.63%	9.13%	2.04	0.96
30	I have control over setting standards for achievement in my math classes.	14.29%	30.56%	40.08%	15.08%	2.56	0.91
37	Uniformity and standardization of mathematics curriculum is important to the parents at my school. [a]	5.95%	36.11%	50.40%	7.54%	2.40	0.72
38	Uniformity and standardization of instructional methods in math is important to the parents at my school. [a]	7.54%	47.22%	39.29%	5.95%	2.56	0.72
39	Most of my students' parents support the things I do in teaching math.	1.19%	3.97%	67.46%	27.38%	3.21	0.56
40	I feel pressure from parents regarding the math placement of their child. [a]	9.52%	38.89%	30.95%	20.63%	2.37	0.92
52	Evaluation of my math teaching is used to help me improve.	1.98%	18.65%	53.17%	26.19%	3.04	0.73
55	The methods used in evaluating my math teaching are objective and fair.	4.37%	24.60%	56.35%	14.68%	2.81	0.73
56	My principal recognizes the good math teaching I do.	4.37%	10.32%	50.00%	35.32%	3.16	0.78
57	Other teachers in my school recognize my math teaching competence.	0.79%	4.76%	60.32%	34.13%	3.28	0.59
58	The parents at my school recognize the good math teaching I do.	1.59%	9.92%	61.51%	26.98%	3.14	0.64

Item no.	Statement	Strongly Disagree	Disagree	Agree	Strongly Agree	*M*	*SD*
59	My students recognize the good math teaching I do.	1.19%	12.30%	57.54%	28.97%	3.14	0.66
60	My students show that they appreciate me as a math teacher.	1.19%	13.10%	56.75%	28.97%	3.13	0.67

[a] Statement was reverse coded (1 = Strongly Agree, 2 = Agree, 3 = Disagree, 4 = Strongly Disagree).

Efficacy

Teacher beliefs about efficacy are reflected in their responses to items 19, 20, 35, 36, 41, 45, 48-51, 53, 54, 63, 64, 70-72, and 74-76. These responses showed that the majority of participants believed they had the capacity to affect student performance. Almost all of the participants agreed that teachers were a very powerful influence on student achievement. Over 90% of the participants felt they were positively influencing others by teaching math. Eight out of ten teachers felt they were making significant progress with their students and expressed pleasure with their students' progress in math. Nine out of ten teachers agreed with the statement "I feel good about my math teaching style and strategies" and eight out of ten teachers agreed with the statement "I often feel satisfied with my job in teaching mathematics." In general, most teachers feel effective in their work as math teachers. However, the participants were evenly split on the statement "My success or failure in teaching students math is due primarily to factors beyond my control rather than to my own effort and ability." A high school teacher who strongly agreed with this statement added:

> We as teachers are the only professionals whose success and failure, and ultimately how they are judged, is determined by something over which we have no control. I can be the most brilliant teacher in the world, but if a student does not care about the results of a standardized test then *I* am a failure because that child didn't pass. When many of our students don't care about the state test (for whatever reasons they may be), then the school as a whole is a failure. Imagine if a public defender's quality was based on how

> many criminals he got off. Imagine if the quality of a doctor was determined by the percentage of her patients who never got sick again. Imagine if the quality of a stock broker was based on him having to pick 38 stocks that would rise on one specific day in May. (A male, early-career, public school teacher from a quartile 2, Baltimore region district, personal communication, October 31, 2006)

These survey responses and comments reveal that while teachers feel efficacious in their math teaching, some teachers take issue with equating their own success or failure solely to student test scores. If fact, only four out of ten teachers agreed that "My students' gains on math achievement tests are a good way for others to judge my instructional effectiveness." There was a higher level of agreement among participants that these gains on tests were useful for self-evaluation.

Participants expressed mixed feelings about teaching. Nearly all of the participants indicated that they enjoyed teaching and felt a sense of pride in their work. However, 60% of the teachers often felt burned out from teaching and 53% of the teachers often felt frustrated by teaching. These responses seem to suggest that teachers face a difficult work environment. Teachers with varying levels of experience provided elaborating comment on their feelings of frustration. An early-career teacher wrote:

> The pressure of teaching a conceptual curriculum in an environment where a procedural understanding can be obtained faster, easier and result in a positive outcome is frustrating. Especially when one knows that the positive outcome is known to be only short term. This conundrum often leaves me unsatisfied.

(A female, public high school teacher from a quartile 3, Baltimore region district, personal communication, October 29, 2006)

A mid-career teacher stated, "Teaching math has become a lesson in frustration" (A female, public middle school teacher from a quartile 2, Baltimore region district, personal communication, October 17, 2006) and a late-career teacher explained, "I often feel frustrated by teaching in that the demands/expectations/responsibilities continue to increase. Nothing is ever 'taken off the plate,' yet no additional time is given" (A female, late-career, public middle school teacher from a quartile 4, suburban Washington district, personal communication, November 7, 2006). It seems that some teachers may have a love-hate relationship with teaching. For example, one teacher commented, "I often feel burned out and tired, especially after a particularly bad day. But when I consider working in another field, I can't come up with a career that I would love more than teaching" (A female, early-career, public high school teacher from a quartile 2, Baltimore region district, personal communication, November 1, 2006).

For some participants, there were changes in beliefs regarding their ability to positively impact students. About one-third of the teachers agreed that "My experience in the teaching profession has diminished my enthusiasm for teaching math" and over half of the teachers agreed that "I am less idealistic about teaching now, then when I entered the profession." These responses may be a reflection of the rigid, inflexible nature of the teaching environment. A middle school teacher even went as far as to say, "I believe I will retire instead of trying to come to terms with

what is happening to education" (A female, mid-career, public school teacher from a quartile 2, Baltimore region district, personal communication, November 1, 2006).

A portion of the efficacy items considered whether student placement, curriculum, and testing were problematic, thereby reducing teachers' effectiveness. Regarding student placement, 61% of the participants agreed that their students were in the appropriate math course. Just over 10% of the teachers felt that the curriculum was not challenging enough for their students and almost 40% felt that the curriculum was too difficult. Faced with perceptions of inappropriately placed students and a curriculum that does not match the needs and abilities of students, teachers can feel unable to provide effective math instruction. Pressure to raise scores can also negatively impact a teacher's sense of efficacy. Close to 90% of the participants responded that they had experienced pressure from their district superintendent and school principal to raise test scores. In fact, well over 50% strongly agreed with each of these items. Taken together, pressure to raise scores for students who are not suitably placed in courses can certainly lead a teacher to feel ineffective.

Respect

Teacher views on respect are represented in their responses to items 13-18, 23-30, 37-40, 52, and 55-60. Several of the respect items overlap with items from the agency strand. In general, teachers reported low levels of participation in decision-making activities and widely varying levels of input on what, when, and how topics were taught. Teachers also indicated that the content and instructional methods used were highly uniform and standardized. These comments are often viewed as an apparent lack of respect for teachers by the district and possibly the administration.

Teachers were by and large positive about evaluations of their teaching. Over 70% of participants agreed that "The methods used in evaluating my math teaching are objective and fair." Close to 80% of participants agreed with the statement "Evaluation of my math teaching is used to help me improve."

Survey participants expressed high levels of agreement on items measuring recognition from their principal, colleagues, parents, and students. Most teachers agreed that parents were supportive although roughly half had experienced pressure from parents about the math placement of their child. Participants were fairly split on whether uniformity and standardization of content and methods was important to parents.

Professional Interaction

The seven items of the professional interaction strand assessed the degree to which the school culture encouraged professional growth and interaction. The distributions of responses for these items are displayed in Table 18.

Table 18. *Response Distributions for Professional Interaction Items*

Item no.	Statement	Strongly Disagree	Disagree	Agree	Strongly Agree	*M*	*SD*
Teacher Collaboration Within Schools							
61	Other teachers at my school often seek my advice about professional issues.	2.38%	18.25%	54.76%	24.60%	3.02	0.73
62	I often observe other teachers to gain insights about mathematics content and pedagogy.	9.13%	37.70%	38.89%	14.29%	2.58	0.85
		0	1-2	3-4	>4		
66	I regularly share teaching ideas with ___ other teachers.	1.59%	21.43%	36.51%	40.48%	3.16	0.81
		Yes		No			
67a	I have common planning time with other mathematics teachers.[a]	73.02%		26.98%		2.73	0.45
67b	I make effective use of my common planning time.[b]	1.09%	17.39%	54.89%	26.63%	3.07	0.69
Professional Activities							
43	I attend professional conferences on a regular basis.	5.95%	31.35%	46.43%	16.27%	2.73	0.80
44	I subscribe to and frequently use mathematics teaching publications.	9.52%	44.05%	33.73%	12.70%	2.50	0.83

[a] "Yes" responses were coded as '3' and "no" responses were coded as '2'. [b] This statement was only given to teachers who responded that they had common planning time (n = 184).

Teacher Collaboration Within Schools

Items 61, 62, 66, 67a, and 67b address teacher collaboration within schools. Most participants expressed that they had opportunities to work with other teachers. Virtually all of the teachers said that they share teaching ideas with at least one other teacher and 40% of the teachers share ideas with more than four other teachers. Several teachers described structured opportunities provided to them. For example, one teacher wrote, "My school has a schedule that provides time for collaboration. In my opinion, this is invaluable. We share plans, resources, strategies, etc. We do all we can to support each other, thus supporting our students" (A female, late-career, public middle school teacher from a quartile 4, suburban Washington district, personal communication, November 7, 2006). Another teacher stated, "All 5 8th grade math teachers meet 2 X a week for 45 minutes. It's wonderful to brainstorm & share ideas, projects, etc" (A female, late-career, public middle school teacher from a quartile 1, Eastern Shore district, personal communication, October 27, 2006). Nearly three-quarters of the participants had common planning time with other math teachers and of those, over 80% felt that the time was well-spent. Common planning was so important to one teacher that she explained, "I make planning time after school with my teammates…it's not provided in my 'work day'" (A female, early-career, public elementary school teacher from a quartile 4, suburban Washington district, personal communication, November 17, 2006). Close to 80% of the participants agreed that "Other teachers at my school often seek my advice about professional issues." These responses and comments seem to imply that the school culture generally encourages collaboration among teachers.

Although many teachers shared ideas with others, participants were less likely to observe their peers. Only 53% of the participants frequently observed other teachers to gain insights about math content and pedagogy. Some teachers cited a lack of time. A middle school teacher said, "I don't feel that I have time to observe or share ideas with other teachers" (A female, late-career, public school teacher from a quartile 1, Baltimore region district, personal communication, November 6, 2006). A high school teacher agreed, "I wish I had the time to observe other teachers!" (A female, mid-career, public school teacher from a quartile 1, Baltimore region district, personal communication, November 3, 2006). Teachers from all grade levels cited a lack of qualified substitutes. An elementary school teacher commented, "I would love to observe other teachers, but whenever I have asked I was told that I could not be provided coverage" (A female, early-career, public school teacher from a quartile 3, Baltimore region district, personal communication, October 30, 2006). A middle school teacher said, "We have been offered release time to observe others, I just hate giving up time to a sub. I know it is something I should do" (A female, mid-career, public school teacher from a quartile 2, Baltimore region district, personal communication, November 6, 2006). A high school teacher wrote, "Since we do not have many competent substitute teachers in my district, I am encouraged to be in class as much as possible and cannot take time away from my students to observe other teachers unless absolutely necessary" (A female, early-career, public school teacher from a quartile 2, Baltimore region district, personal communication, November 1, 2006). It appears that while half of the participants observe other

teachers, there are a number of teachers who desire these opportunities or feel unable to take advantage of these opportunities.

Professional Activities

Attendance at professional conferences and use of math teaching publications were measured by item numbers 43 and 44. Over 60% of the participants regularly attended professional conferences. Almost half of the participants subscribe to and frequently use math teaching publications. Since this survey was aimed at MCTM members, these responses do not seem unreasonable.

In general, most participants had opportunities to share ideas and plan with other teachers. Some teachers lacked common planning time and many teachers expressed a desire to observe other teachers. Rates of attendance at conferences and subscriptions to publications were neither high nor low.

Load Appropriateness

The last strand, load appropriateness, consisted of seven items. These items considered the balance between job demands and available time. Table 19 displays the distributions of responses for items measuring teachers' sense of load appropriateness.

Table 19. *Response Distributions for Load Appropriateness Items*

Item no.	Statement	Strongly Disagree	Disagree	Agree	Strongly Agree	*M*	*SD*
19	I feel pressure from my district superintendent to raise scores on required math tests. [a]	1.98%	11.11%	29.76%	57.14%	1.58	0.77
20	I feel pressure from my principal to raise scores on required math tests. [a]	1.98%	9.92%	32.14%	55.95%	1.58	0.75
35	The curriculum for my math course(s) is too difficult for my students. [a]	11.90%	50.79%	28.57%	8.73%	2.66	0.80
46	My class time for math is often constrained by administrative tasks (taking attendance, tardy students, public announcements). [a]	9.52%	38.89%	35.71%	15.87%	2.42	0.87
47	If I spend the majority of my time helping students develop proficiency in math skills and procedures, then the students will perform well on accountability tests. [a]	3.97%	23.81%	50.40%	21.83%	2.10	0.78
49	I feel as though I am making significant academic progress with my math students.	0.79%	16.27%	59.13%	23.81%	3.06	0.66
68	My planning time is often taken away due to academic responsibilities (IEP meetings, helping students, proctoring make-up assessments, covering class for an absent colleague, grading papers) [a]	6.35%	21.03%	40.87%	31.75%	2.02	0.89
69	My planning time is often taken away due to non-academic responsibilities (hall duty, lunch duty, bus duty, etc.) [a]	24.21%	45.24%	18.25%	12.30%	2.81	0.94

[a] Statement was reverse coded (1 = Strongly Agree, 2 = Agree, 3 = Disagree, 4 = Strongly Disagree).

Teachers' job demands are more complex than simply teaching math content. From the items in the agency strand, some teachers indicated that they are required to use a standardized curriculum, follow a strict pacing guide, and prepare students for assessments. In the load appropriateness strand, responses to items revealed that teachers face additional challenges. Over a third of the teachers reported teaching content which they see as too difficult for their students. While this may not seem alarming, keep in mind that the response represents teacher perceptions of the majority of their students, not just a select few. When the curriculum is too difficult for most students in a class, there is an extra burden on teachers to bridge the gap between the expectations of the curriculum and the achievement level of the students. Almost 90% of the participants indicated that they felt pressure from their superintendent and principal to raise test scores. In fact, over 50% of the participants marked "Strongly Agree." Evidently, the message to teachers about the importance of raising test scores is being heard loud and clear.

In conjunction with the increases in responsibility and pressure, teachers reported having less instructional time and less planning time then schedules might suggest. Over half of the participants stated that their class time was often constrained by administrative tasks. Almost one-third of the participants agreed that their planning time was taken away due to non-academic responsibilities such as hall duty, lunch duty, and bus duty. Close to three-quarters of the participants agreed that their planning time was often taken away due to academic responsibilities such as meetings, helping students, proctoring make-up assessments, covering class for an absent colleague, and grading papers. Taken together, the responses to the load

appropriateness items seem to imply that a considerable portion of participants feel overloaded by the demands of teaching.

Many participants provided elaborating comments on the pressure they experienced due to testing. A teacher from the Eastern Shore wrote, "Our school has not made AYP for three years and are facing major consequences should we fail to meet the standards this year. The pressure from all angles on the math department is incredible" (A female, mid-career, public middle school teacher from a quartile 1 district, personal communication, October 25, 2006). A suburban Washington teacher also described severe consequences and the resulting effect on teaching:

> Since the inception of NCLB, states are required to administer standardized tests and expected to have all students performing at the proficient level by a certain year. That mandate trickles down to the local school board placing demands and high stress on the teachers to prepare the students to be successful on these tests. With the threat of losing a job or going into school improvement, the only hope is to teach the contents of the tests." (A female, mid-career, public middle school teacher from a quartile 4 district, personal communication, October 26, 2006)

Teachers from high-performing districts also expressed feeling pressure. A teacher from a Baltimore region district explained, "There is pressure to raise scores…at this time [my district] ranks [very high] and the principals and superintendent do not want to lose that prestige…no matter what the cost! Everyone feels the pressure" (A female, late-career, public middle school teacher from a quartile 2, personal communication, October 31, 2006). The pressure from testing is both pervasive and intense. A teacher

wrote, “It is ALL ABOUT THE SCORES!” (A female, mid-career, public high school teacher from a quartile 1, Baltimore region district, personal communication, November 2, 2006) and another wrote, “It’s all about making AYP (adequate yearly progress) period” (A female, mid-career, public high school teacher from a quartile 2, Baltimore region district, personal communication, November 1, 2006). Teachers described receiving clear directives regarding testing. A mid-career teacher commented, “I have been told on several occasions that the only things we are looking at is 80% of students successfully completing Algebra I by the end of 8th grade, and making AYP (adequate yearly progress) on the MSA” (A female, public middle school teacher from a quartile 4, suburban Washington district, personal communication, November 1, 2006). Another teacher put it bluntly, “I have been told to teach to the test.” (A female, late-career, public high school teacher from a quartile 1, Baltimore region district, personal communication, November 10, 2006).

Participants also commented on their planning time. One teacher described how ‘planning time’ was a misnomer:

> Duties are arranged so that planning time still exists each day. However, much of my planning time is taken up with grading papers, recording grades, running copies, and the occasional class coverage. I do very little actual planning during school hours. (A male, early-career, public high school teacher from a quartile 2, Baltimore region district, personal communication, October 31, 2006)

Teachers also mentioned how meetings frequently intruded into planning time. One participant stated, “I feel that many meetings we have take away from a teacher’s

time to plan for more successful math instruction" (A female, late-career, public middle school teacher from a quartile 4, suburban Washington district, personal communication, November 7, 2006). As a result of lost planning time, teachers must use additional time to complete their work. For example, one teacher explained, "I feel I am a good teacher but I am overwhelmed with outside influences such as duties and the millions of meetings we have to do. I am rarely out of the building by 5" (A female, early-career, public high school teacher from a quartile 2, Baltimore region district, personal communication, November 1, 2006).

The issue of load appropriateness seemed to strike a chord with one particular teacher. He wrote at length about his struggle to manage his responsibilities in the time allotted:

> I've been thinking a lot about these questions lately, so much so that you'll either be especially interested in my responses, or want to ignore them all together. Frankly, I do not feel that I am a positive influence in any of my students' lives at the moment. I feel too tired and overworked to do anything that might actually get a student back on track. I give up my lunch period (5A), and my lunchtime planning period (5B), and I stay after school to work with students who need help and to administer re-assessments, but most of this just feels like I'm putting my proverbial finger in the proverbial dyke- those same students are still failing, still needing academic support, and ultimately still needing to reassess the next quiz instead of finding success in their first attempt. Those students who do at least raise their grades on a reassessment bring me no real comfort either, as I just chalk their improvement up to the

> practice effect and the fact that the new quiz was a carbon copy of the old one. It doesn't help that they confirm my suspicions only days later by asking the same questions again. It all just seems like so many hoops to jump through- I'm finding it hard to see the point anymore. Those students who are legitimately interested in math are grossly outnumbered by those who hide their disdain of it poorly, or they have been shipped out my classroom and into a special program anyway. I recognize that I could be doing more- er, strike that, not so much more as- different things for my students, but right now academic support and reassessments are taking all of my time. I do intend to curtail academic support this quarter, hopefully scale it back to about half as much, and also set predetermined times for reassessing instead of walk-ins. This will hopefully buy me some time to get back to what matters more and could actually have more effect on my students. Things like better planned and more engaging lessons, more group activities, more time to grade things and give meaningful feedback. I recognize that these are things I need to be doing, but I just couldn't find the time this quarter. This is due largely to county duties, but also other activities I have taken on..." (A male, mid-career, public high school from a quartile 4, suburban Washington district, personal communication, November 1, 2006)

The responses and elaborating comments on load appropriateness items support the notion that teachers have high job demands to meet within difficult time constraints.

Research Question 2

When tension is measured by the strands of goal congruence, agency, teacher efficacy and respect, professional interaction, and load appropriateness, to what extent do teachers of mathematics feel tensions in the conditions of their professional working environment?

The five hypothesized strands (goal congruence, agency, teacher efficacy and respect, professional interaction, and load appropriateness) resulted from a review of literature. The items assigned to each strand were either adapted from other instruments or created for the purpose of this study. Therefore, it is necessary to measure the reliability of the collection of items in each strand before analyzing the extent to which the tensions represented by the strands exist. I used Cronbach's alpha to evaluate the internal reliability for the set of items in each strand. The values computed using SPSS are displayed in Table 20. All alpha values exceed the minimum 0.60 used to evaluate exploratory research.

Table 20. *Internal Reliability Coefficients of Hypothesized Strands*

Strand	Number of Items	Cronbach's Alpha (α)
Goal Congruence	13	.770
Agency	29	.823
Teacher Efficacy and Respect	45	.894
Professional Interaction	6	.629
Load Appropriateness	8	.610

Upon verifying the internal consistency reliability of each strand, I computed participant composite scores for the five strands. Responses to items which affirmed a given strand were coded: Strongly Disagree = 1, Disagree = 2, Agree = 3, Strongly Agree = 4. Responses to items which negated a given strand were reverse coded: Strongly Disagree = 4, Disagree = 3, Agree = 2, Strongly Agree = 1. A participant

composite score is the participant's mean response for items in a strand. High composite scores correspond to high levels of agreement with the strand.

To evaluate the extent of tension experienced by teachers of mathematics, I created histograms of composite scores for each of the five strands. The composite scores for the goal congruence strand are symmetrical and have a mean of 2.68 as shown in Figure 8. The distribution of scores shows that participants generally agree that their beliefs and goals are consistent with those of the school, district, state, and NCTM. The composite scores for the agency strand are also symmetrical but much lower (see Figure 9). With a mean of 2.25, the agency scores represent a perceived lack of decision-making power. The histogram for teacher efficacy and respect is presented in Figure 10. The scores show that by and large, participants feel they are teaching effectively and are well-respected by administrators, colleagues, parents, and students. The scores for the professional interaction strand had both the highest mean (2.81) and the largest spread (0.44). As shown in Figure 11, the scores indicate that most participants have adequate opportunities to interact professionally with colleagues. Composite scores for the load appropriateness strand have a mean of 2.28 which suggests that teachers are faced with an overwhelming workload (see Figure 12). The shape of the load appropriateness histogram is quite normal with a single outlier on the high end of the scale. Taken together, the five histograms point to agency and load appropriateness as areas in the working environment that are sources of tension for teachers.

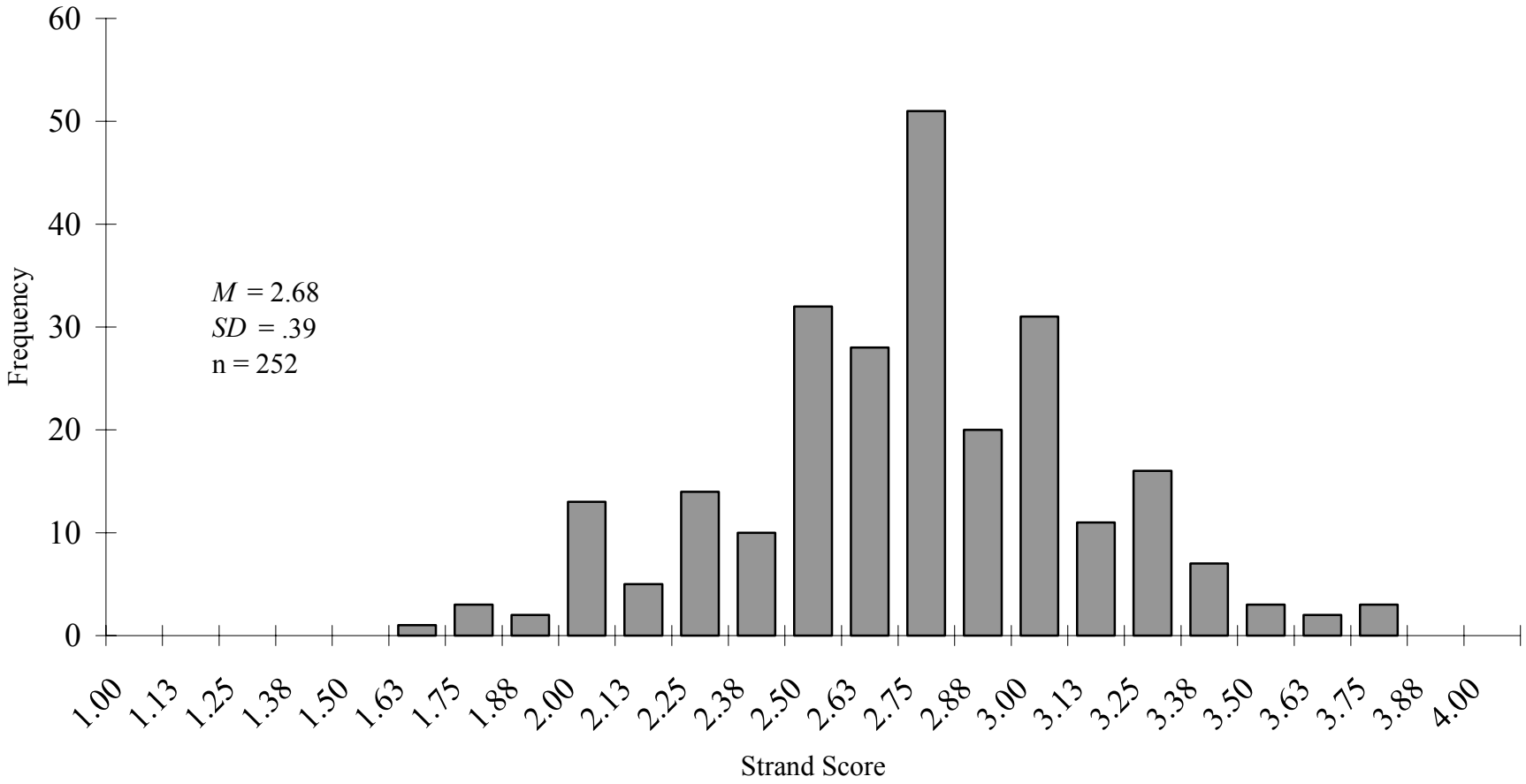


Figure 8. Participant composite scores for the goal congruence strand. Scores represent the mean response to the goal congruence items for a given participant. Lower scores indicate less goal congruence and higher scores represent more goal congruence.

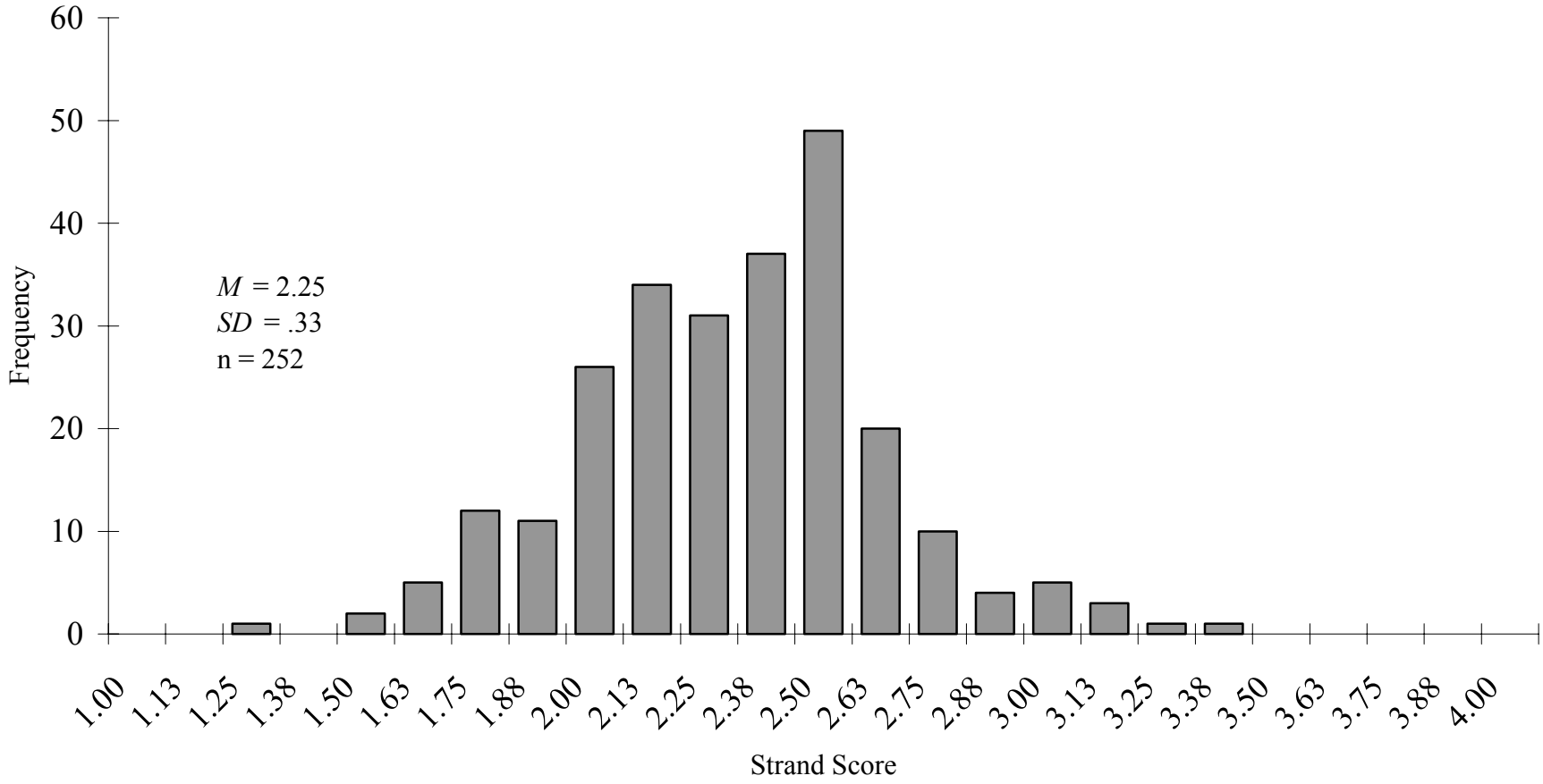


Figure 9. Participant composite scores for the agency strand. Scores represent the mean response to the agency items for a given participant. Lower scores indicate less agency and higher scores indicate more agency.

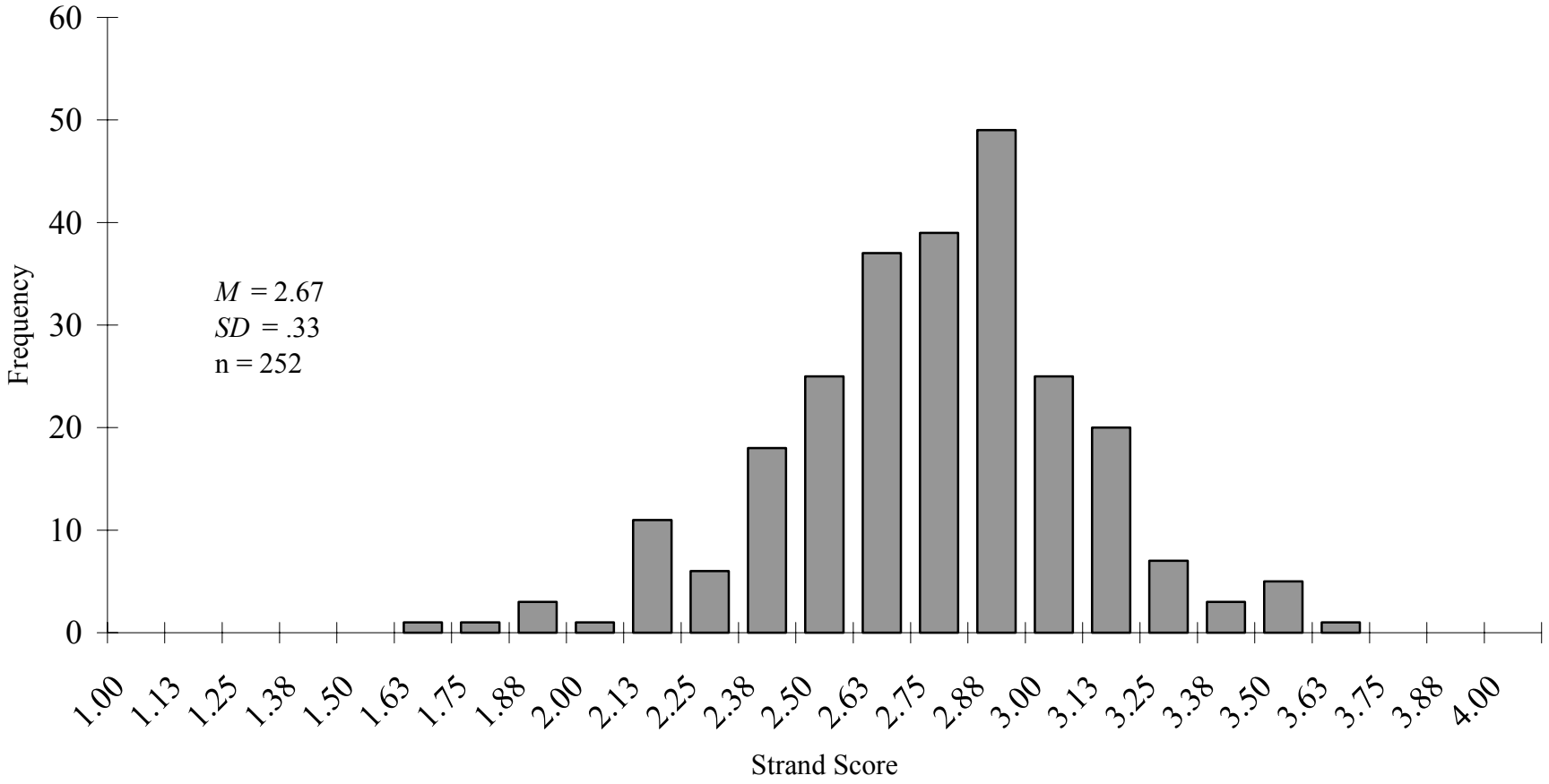


Figure 10. Participant composite scores for the teacher efficacy and respect strand. Scores represent the mean response to the teacher efficacy and respect items for a given participant. Lower scores indicate less efficacy and respect and higher scores indicate more efficacy and respect.

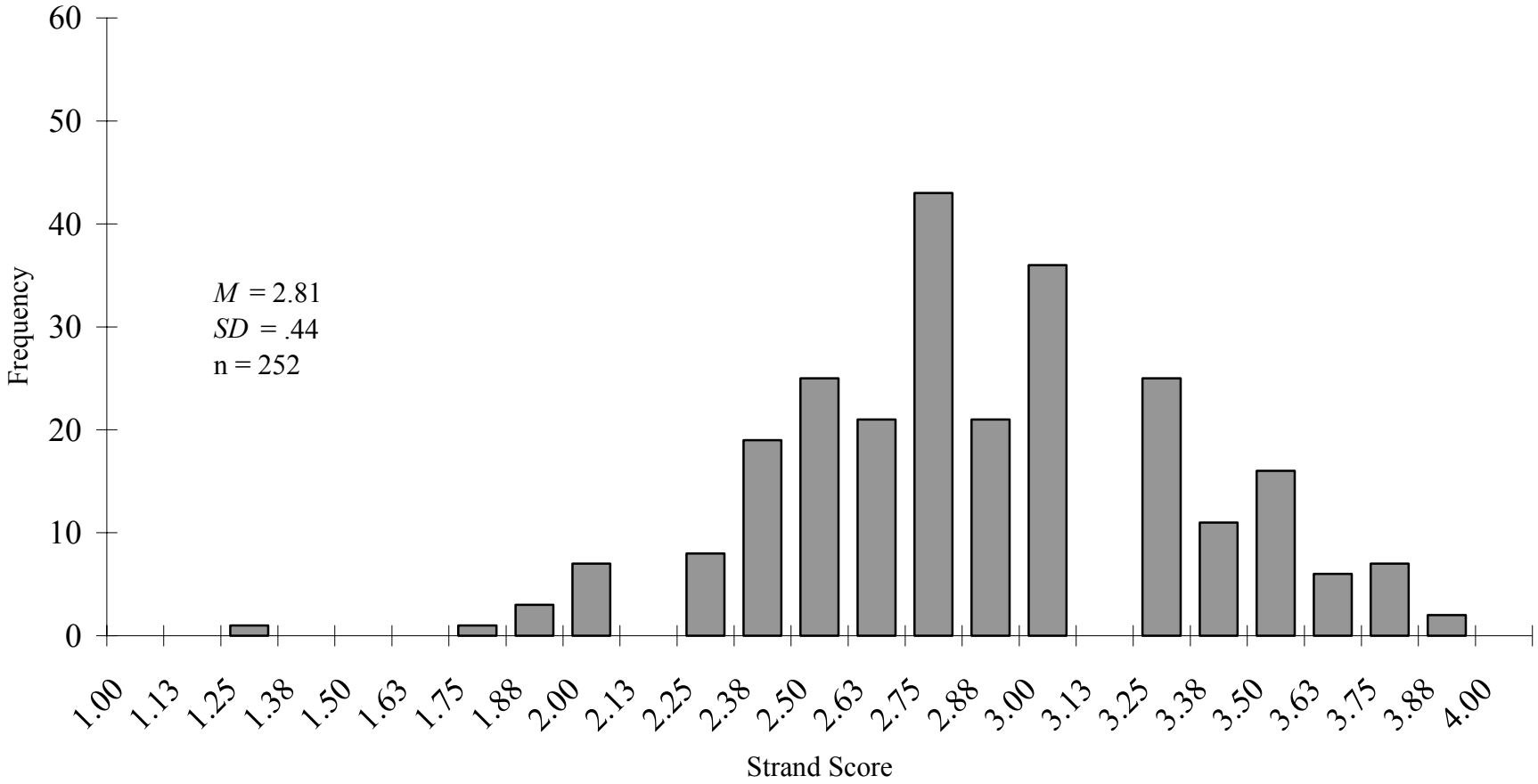


Figure 11. Participant composite scores for the professional interaction strand. Scores represent the mean response to the professional interaction items for a given participant. Lower scores indicate fewer professional interactions and higher scores indicate more professional interactions.

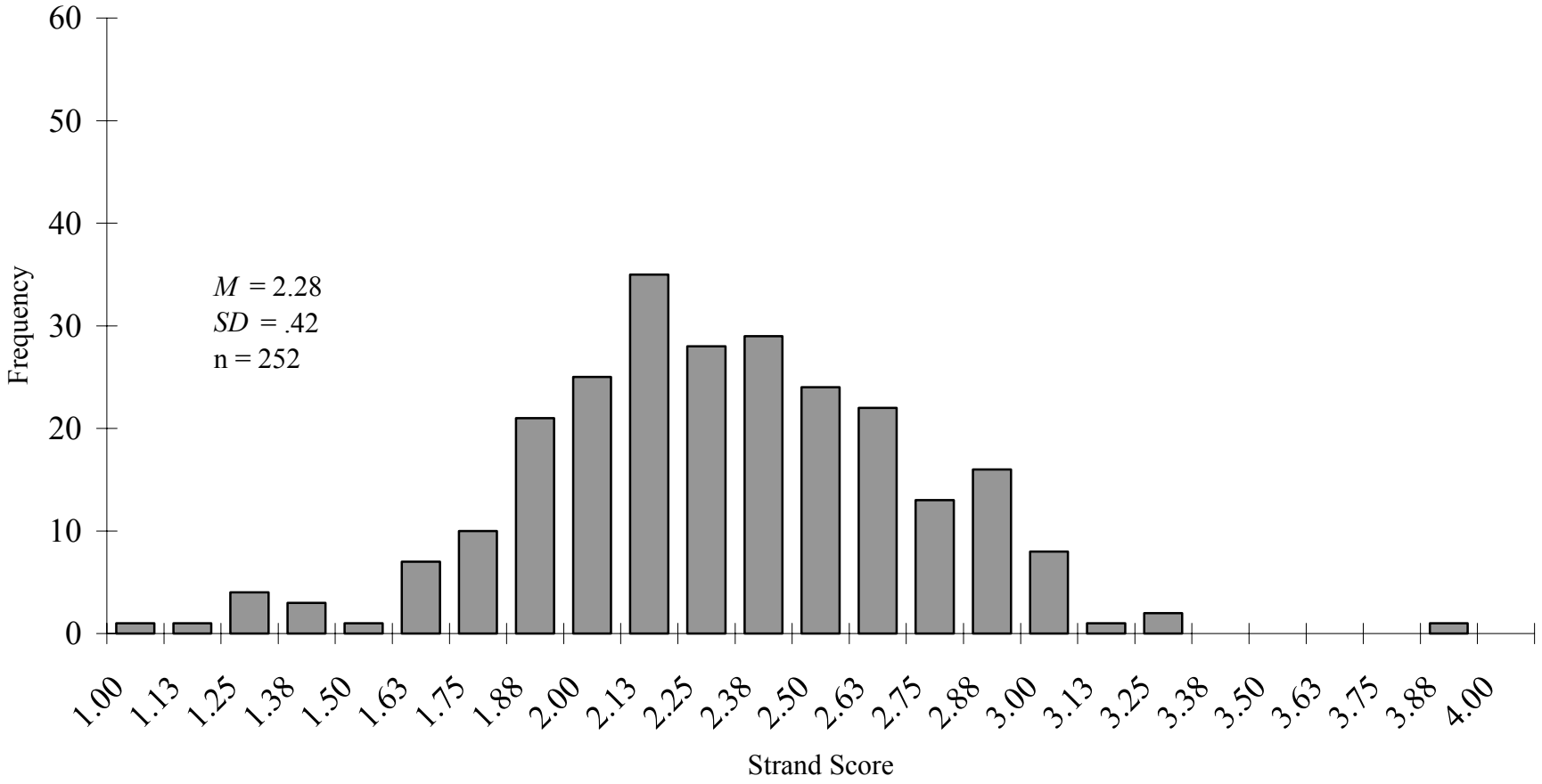


Figure 12. Participant composite scores for the load appropriateness strand. Scores represent the mean response to the load appropriateness items for a given participant. Lower scores indicate an inappropriate load and higher scores indicate an appropriate load.

Research Question 3

When tension is measured by the strands of goal congruence, agency, teacher efficacy and respect, professional interaction, and load appropriateness, are there statistically significant differences in the feelings of tension perceived by mathematics teachers when examined in terms of demographic variables?

I used ANOVA analyses to answer the third research question. The ANOVA testing sought to determine if the mean strand scores differed among demographic groups.

ANOVA using Strand Scores

Before conducting the ANOVAs, I evaluated the sample to verify that all of the assumptions of ANOVA (i.e., independent observations, normally distributed populations, and homogeneous variances) were satisfied. In all cases, the observations were independent as a result of the design of the survey. Teachers individually responded to the items through an online survey instrument. Therefore, how one participant responded had no bearing on how other participants in the same group responded. I then calculated the skewness and kurtosis statistics to detect violations of the normality assumption. For the five strands, skewness ranged from -0.315 to 0.058 and kurtosis ranged from -0.070 to 0.683. These skewness and kurtosis values are within the expected range of chance fluctuations so the normality assumption is satisfied. The final assumption, homogeneity of variance, was determined using Levene's test. I conducted Levene's test at the .05 level with a null hypothesis that the variances were equal. The results from SPSS 15.0 are reported by

demographic variable and followed by ANOVAs and post hoc multiple comparisons where appropriate.

Gender

Table 21 presents the test of homogeneity of variances when the sample is grouped by gender. For each of the five strands, the significance of the Levene statistic was greater than .05. Therefore, the variance differences between males and females on the strands were not significant and I retained the null hypothesis. Since all strand scores satisfied the homogeneity of variance assumption, further evaluation using ANOVA techniques was warranted.

Table 21. *Test of Homogeneity of Variance of Strands When Grouped by Gender*

	Levene Statistic	*df1*	*df2*	Sig.
Goal Congruence	.414	1	250	.520
Agency	.119	1	250	.730
Teacher Efficacy and Respect	.046	1	250	.831
Professional Interaction	3.448	1	250	.065
Load Appropriateness	.080	1	250	.777

I ran a one-way ANOVA at the .05 level with gender as the independent variable and strand score as the dependent variable. The null hypothesis stated that the means were equal (i.e., H_0: $\mu_{male} = \mu_{female}$). The results of the ANOVA are displayed in Table 22. The observed F did not exceed the critical F of 3.879 for any of the five strands. Thus, there were no significant differences in strand scores between males and females. From this, I inferred that the null hypothesis stating that the population means were equal remained tenable.

Table 22. *ANOVA of Strands When Grouped by Gender*

	Source	*SS*	*df*	*MS*	*F*	Sig.
Goal Congruence	Between Groups	.320	1	.320	2.107	.148
	Within Groups	37.928	250	.152		
	Total	38.248	251			
Agency	Between Groups	.363	1	.363	3.116	.079
	Within Groups	29.088	250	.116		
	Total	29.450	251			
Teacher Efficacy and Respect	Between Groups	.262	1	.262	2.490	.116
	Within Groups	26.273	250	.105		
	Total	26.534	251			
Professional Interaction	Between Groups	.202	1	.202	.968	.326
	Within Groups	52.282	250	.209		
	Total	52.484	251			
Load Appropriateness	Between Groups	.279	1	.279	1.589	.209
	Within Groups	43.950	250	.176		
	Total	44.229	251			

School District Size

I also ran Levene's test with participants grouped by school district size (i.e., quartile 1, quartile 2, quartile 3, and quartile 4). I retained the null hypothesis that variances were equal because the significance values were all greater than .05, as shown in Table 23. In other words, there were no significant differences in variance between participants from districts of varying sizes on any of the five strands.

Table 23. *Test of Homogeneity of Variance of Strands When Grouped by School District Size*

	Levene Statistic	*df1*	*df2*	Sig.
Goal Congruence	.718	3	240	.542
Agency	1.876	3	240	.134
Teacher Efficacy and Respect	2.134	3	240	.097
Professional Interaction	.813	3	240	.488
Load Appropriateness	.520	3	240	.669

With the homogeneity of variance requirement met, I ran a one-way ANOVA at the .05 level with school district size as the independent variable and strand scores as the dependent variable. The ANOVA results when participants were grouped by school district size are presented in Table 24. The observed F did not exceed the

critical F of 2.6422 for the goal congruence and professional interaction strands. Consequently, there were no statistically significant differences among the sample means on these two strands and I retained our null hypothesis that the population means were equal. For the agency, teacher efficacy and respect, and load appropriateness strands, the observed F exceeded the critical F. This signified that there were statistically significant differences somewhere among the sample means on these strands. I rejected the null hypothesis and concluded that strand scores for agency, teacher efficacy and respect, and load appropriateness appeared to be somehow related to school district size. To determine exactly which means differed, post hoc multiple comparison testing was necessary.

Table 24. *ANOVA of Strands When Grouped by School District Size*

	Source	*SS*	*df*	*MS*	*F*	Sig.
Goal Congruence	Between Groups	.562	3	.187	1.305	.274
	Within Groups	34.436	240	.143		
	Total	34.998	243			
Agency	Between Groups	2.297	3	.766	7.782***	.000
	Within Groups	23.611	240	.098		
	Total	25.908	243			
Teacher Efficacy and Respect	Between Groups	1.557	3	.519	5.512**	.001
	Within Groups	22.599	240	.094		
	Total	24.156	243			
Professional Interaction	Between Groups	1.570	3	.523	2.601	.053
	Within Groups	48.279	240	.201		
	Total	49.848	243			
Load Appropriateness	Between Groups	1.340	3	.447	2.790*	.041
	Within Groups	38.412	240	.160		
	Total	39.752	243			

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

I selected the post hoc Bonferroni option on the one-way ANOVA to make multiple comparisons on the relevant strands. Table 25 displays the results of the post hoc Bonferroni analysis at the .05 experiment-wise level. The analysis revealed significant mean differences for five of the comparisons. Participants from quartile 1

districts had significantly higher mean agency scores ($M = 2.43$) than participants from quartile 2 districts ($M = 2.18$) and participants from quartile 4 districts ($M = 2.22$). I concluded that on average, teachers in the smallest districts feel more empowered and able to make decisions than teachers in the small/medium districts and the largest districts. Teacher efficacy and respect scores from participants in quartile 1 districts ($M = 2.80$) were significantly higher than scores from participants in quartile 2 districts ($M = 2.60$) and in quartile 4 districts ($M = 2.61$). Thus, I inferred that teachers in the smallest districts feel more effective at teaching math and more respected by administrators, colleagues, parents, and students than teachers in the small/medium districts and the largest districts. On the load appropriateness strand, participants from quartile 1 districts had significantly higher scores ($M = 2.39$) than participants from quartile 2 districts ($M = 2.19$). Therefore, teachers in the smallest districts feel a more appropriate balance between job demands and their ability to meet those job demands than their peers in slightly larger districts. None of the other contrasts revealed significant mean differences.

Table 25. *Multiple Comparisons of Strands When Grouped by School District Size Using Bonferroni*

Dependent Variable			Mean Difference	*SE*	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Agency	Quartile 1	Quartile 2	.25351*	.05465	.000	.1081	.3989
		Quartile 3	.15808	.07545	.223	-.0426	.3588
		Quartile 4	.20753*	.05424	.001	.0632	.3518
	Quartile 2	Quartile 1	-.25351*	.05465	.000	-.3989	-.1081
		Quartile 3	-.09543	.07187	1.000	-.2866	.0958
		Quartile 4	-.04598	.04914	1.000	-.1767	.0848
	Quartile 3	Quartile 1	-.15808	.07545	.223	-.3588	.0426
		Quartile 2	.09543	.07187	1.000	-.0958	.2866
		Quartile 4	.04946	.07156	1.000	-.1409	.2398
	Quartile 4	Quartile 1	-.20753*	.05424	.001	-.3518	-.0632
		Quartile 2	.04598	.04914	1.000	-.0848	.1767
		Quartile 3	-.04946	.07156	1.000	-.2398	.1409
Teacher Efficacy and Respect	Quartile 1	Quartile 2	.19742*	.05346	.002	.0552	.3397
		Quartile 3	.10803	.07381	.868	-.0883	.3044
		Quartile 4	.18532*	.05307	.003	.0442	.3265
	Quartile 2	Quartile 1	-.19742*	.05346	.002	-.3397	-.0552
		Quartile 3	-.08939	.07031	1.000	-.2764	.0977
		Quartile 4	-.01210	.04808	1.000	-.1400	.1158
	Quartile 3	Quartile 1	-.10803	.07381	.868	-.3044	.0883
		Quartile 2	.08939	.07031	1.000	-.0977	.2764
		Quartile 4	.07729	.07001	1.000	-.1089	.2635
	Quartile 4	Quartile 1	-.18532*	.05307	.003	-.3265	-.0442
		Quartile 2	.01210	.04808	1.000	-.1158	.1400
		Quartile 3	-.07729	.07001	1.000	-.2635	.1089

Dependent Variable			Mean Difference	*SE*	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Load Appropriateness	Quartile 1	Quartile 2	.19464*	.06970	.034	.0092	.3801
		Quartile 3	.17339	.09623	.437	-.0826	.4294
		Quartile 4	.10526	.06918	.777	-.0788	.2893
	Quartile 2	Quartile 1	-.19464*	.06970	.034	-.3801	-.0092
		Quartile 3	-.02125	.09167	1.000	-.2651	.2226
		Quartile 4	-.08938	.06268	.931	-.2561	.0774
	Quartile 3	Quartile 1	-.17339	.09623	.437	-.4294	.0826
		Quartile 2	.02125	.09167	1.000	-.2226	.2651
		Quartile 4	-.06813	.09127	1.000	-.3109	.1747
	Quartile 4	Quartile 1	-.10526	.06918	.777	-.2893	.0788
		Quartile 2	.08938	.06268	.931	-.0774	.2561
		Quartile 3	.06813	.09127	1.000	-.1747	.3109

* Experiment-wise $p < .05$.

School District Location

When the sample was grouped by school district location (i.e., Baltimore region, suburban Washington, Southern Maryland, Western Maryland, and Eastern Shore), the Levene statistic was not significant for any of the strands (see Table 26). Hence, the variances were homogeneous and further analysis using ANOVA was appropriate.

Table 26. *Test of Homogeneity of Variance of Strands When Grouped by School District Location*

	Levene Statistic	*df1*	*df2*	Sig.
Goal Congruence	.947	3	240	.418
Agency	1.760	3	240	.155
Teacher Efficacy and Respect	.697	3	240	.555
Professional Interaction	1.088	3	240	.355
Load Appropriateness	.525	3	240	.665

Table 27 presents the results of the one-way ANOVA with school district location as the independent variable and strand score as the dependent variable. At the .05 level, the observed F for goal congruence, agency, professional interaction, and load appropriateness failed to exceed the critical F of 2.6422. I retained the null hypothesis that the means were equal for these strands. For the teacher efficacy and respect strand, the observed F did exceed the critical F leading us to reject the null hypothesis. I concluded that there were statistically significant differences among the sample means and that teacher efficacy and respect was somehow related to school district location. To identify which exact locations had mean differences on the teacher efficacy and respect strand, I ran post hoc multiple comparison tests.

Table 27. *ANOVA of Strands When Grouped by School District Location*

	Source	*SS*	*df*	*MS*	*F*	Sig.
Goal Congruence	Between Groups	.613	3	.204	1.426	.236
	Within Groups	34.385	240	.143		
	Total	34.998	243			
Agency	Between Groups	.654	3	.218	2.071	.105
	Within Groups	25.254	240	.105		
	Total	25.908	243			
Teacher Efficacy and Respect	Between Groups	.919	3	.306	3.162*	.025
	Within Groups	23.237	240	.097		
	Total	24.156	243			
Professional Interaction	Between Groups	.287	3	.096	.464	.708
	Within Groups	49.561	240	.207		
	Total	49.848	243			
Load Appropriateness	Between Groups	.942	3	.314	1.941	.124
	Within Groups	38.810	240	.162		
	Total	39.752	243			

* $p < .05$.

The results of the post hoc Bonferroni are displayed in Table 28. Using an experiment-wise alpha of .05, the post hoc Bonferroni test detected one significant contrast. Participants from Southern Maryland districts had significantly higher teacher efficacy and respect scores ($M = 2.92$) than participants from suburban Washington districts ($M = 2.62$). I concluded that Southern Maryland teachers feel more respected and efficacious than their suburban Washington counterparts. It is important to note that all of the Southern Maryland districts are quartile 1 districts and the suburban Washington districts are quartile 2 and quartile 4 districts. I found similar significant differences when the districts were grouped by size. Therefore, it is unclear whether the differences are due to size, location, or a combination of those attributes. The remaining contrasts did not prove to be significant.

Table 28. *Multiple Comparisons of Strands When Grouped by School District Location Using Bonferroni*

Dependent Variable			Mean Difference	*SE*	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Teacher Efficacy and Respect	Baltimore Region	Suburban Washington	.02395	.04312	1.000	-.0908	.1387
		Southern	-.26980	.10206	.052	-.5413	.0017
		Eastern Shore	-.10063	.08237	1.000	-.3198	.1185
	Surburban Washington	Baltimore Region	-.02395	.04312	1.000	-.1387	.0908
		Southern	-.29375*	.10396	.031	-.5703	-.0172
		Eastern Shore	-.12458	.08472	.856	-.3500	.1008
	Southern	Baltimore Region	.26980	.10206	.052	-.0017	.5413
		Suburban Washington	.29375*	.10396	.031	.0172	.5703
		Eastern Shore	.16917	.12543	1.000	-.1645	.5029
	Eastern Shore	Baltimore Region	.10063	.08237	1.000	-.1185	.3198
		Suburban Washington	.12458	.08472	.856	-.1008	.3500
		Southern	-.16917	.12543	1.000	-.5029	.1645

* Experiment-wise $p < .05$.

Teaching Experience

The sample was sorted into six teaching experience categories: 0-1 year, 2-4 years, 5-9 years, 10-19 years, 20-29 years, and 30+ years. At the .05 level, Levene's test showed no significant differences in variances for the goal congruence, professional interaction, and load appropriateness strands (see Table 29). Since the assumption of homogeneity of variance was satisfied for these three strands, further analysis using ANOVA was warranted.

Table 29. *Test of Homogeneity of Variance of Strands When Grouped by Teaching Experience*

	Levene Statistic	*df1*	*df2*	Sig.
Goal Congruence	1.364	5	235	.239
Agency	2.352	5	235	.042
Teacher Efficacy and Respect	1.946	5	235	.088
Professional Interaction	1.510	5	235	.187
Load Appropriateness	1.385	5	235	.231

The ANOVA table for the strands when the sample is grouped by teaching experience is shown in Table 30. The observed F's for goal congruence, professional interaction, and load appropriateness did not exceed the critical F of 2.2525. Therefore, the null hypotheses regarding the equality of sample means remained tenable.

Table 30. *ANOVA of Strands When Grouped by Teaching Experience*

	Source	*SS*	*df*	*MS*	*F*	Sig.
Goal Congruence	Between Groups	1.094	5	.219	1.491	.194
	Within Groups	34.492	235	.147		
	Total	35.586	240			
Agency	Between Groups	1.194	5	.239	2.044	.073
	Within Groups	27.450	235	.117		
	Total	28.643	240			
Teacher Efficacy and Respect	Between Groups	.634	5	.127	1.181	.319
	Within Groups	25.236	235	.107		
	Total	25.871	240			
Professional Interaction	Between Groups	1.946	5	.389	1.905	.094
	Within Groups	48.012	235	.204		
	Total	49.958	240			
Load Appropriateness	Between Groups	.356	5	.071	.406	.845
	Within Groups	41.222	235	.175		
	Total	41.578	240			

Teaching Placement

The significance of the Levene statistic was greater than .05 for all five strands when the sample was categorized according to teaching placements (i.e., elementary school, middle school, high school). Hence, the null hypotheses were retained and the homogeneity of variance assumption for ANOVA was satisfied. The results of the homogeneity of variance test are presented in Table 31.

Table 31. *Test of Homogeneity of Variance of Strands When Grouped by Teaching Placement*

	Levene Statistic	*df1*	*df2*	Sig.
Goal Congruence	.673	2	249	.511
Agency	1.630	2	249	.198
Teacher Efficacy and Respect	.242	2	249	.785
Professional Interaction	.295	2	249	.745
Load Appropriateness	1.218	2	249	.298

Having satisfied all of the assumptions, I conducted a one-way ANOVA with teaching placement as the independent variable and strand scores as the dependent variable. The null hypothesis stated that the means were equal (i.e., H_0: $\mu_{elementary} = \mu_{middle} = \mu_{high}$). As shown in Table 32, four of the observed F's exceeded the critical F

of 3.032. I inferred that there were significant differences in means for goal congruence, agency, teacher efficacy and respect, and load appropriateness. In other words, teaching placement was somehow related to these four strands. To answer the question of which contrasts were significant, I ran post hoc multiple comparison tests.

Table 32. *ANOVA of Strands When Grouped by Teaching Placement*

	Source	*SS*	*df*	*MS*	*F*	Sig.
Goal Congruence	Between Groups	1.049	2	.525	3.512*	.031
	Within Groups	37.198	249	.149		
	Total	38.248	251			
Agency	Between Groups	1.077	2	.538	4.726*	.010
	Within Groups	28.373	249	.114		
	Total	29.450	251			
Teacher Efficacy and Respect	Between Groups	.714	2	.357	3.445*	.033
	Within Groups	25.820	249	.104		
	Total	26.534	251			
Professional Interaction	Between Groups	.665	2	.332	1.597	.205
	Within Groups	51.820	249	.208		
	Total	52.484	251			
Load Appropriateness	Between Groups	1.364	2	.682	3.962*	.020
	Within Groups	42.865	249	.172		
	Total	44.229	251			

* $p < .05$.

Table 33 displays the results of the Bonferroni multiple comparison tests using an experiment-wise alpha of .05. The analysis revealed three significant mean differences. Elementary school teacher participants had significantly higher mean scores on goal congruence ($M = 2.82$) than middle school teacher participants ($M = 2.62$). Teachers in elementary schools seem to feel more aligned with the goals of the school, district, state, and national math organizations than teachers in middle schools. Participants who were high school teachers had significantly higher mean agency scores ($M = 2.34$) than participants who were middle school teachers ($M = 2.20$). I concluded that while none of the groups expressed much agency, on average, high school teachers felt more freedom to make decisions regarding their instruction than

middle school teachers. This result may be due to the large number of high school courses that are not subject to high-stakes assessments. On the load appropriateness strand, participants from elementary schools had significantly higher mean scores (M = 2.45) than participants from middle schools (M = 2.21). I inferred that elementary school teachers sense a better fit between job responsibilities and job resources than middle school teachers even though both groups fall on the low side of the scale. No other significant mean differences were found.

Table 33. *Multiple Comparisons of Strands When Grouped by Teaching Placement Using Bonferroni*

Dependent Variable			Mean Difference	*SE*	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Goal Congruence	Elementary	Middle	.20369*	.07741	.027	.0171	.3903
		High	.13843	.07618	.211	-.0452	.3220
	Middle	Elementary	-.20369*	.07741	.027	-.3903	-.0171
		High	-.06526	.05236	.641	-.1915	.0609
	High	Elementary	-.13843	.07618	.211	-.3220	.0452
		Middle	.06526	.05236	.641	-.0609	.1915
Agency	Elementary	Middle	.08799	.06760	.583	-.0750	.2509
		High	-.05227	.06654	1.000	-.2126	.1081
	Middle	Elementary	-.08799	.06760	.583	-.2509	.0750
		High	-.14026*	.04573	.007	-.2505	-.0300
	High	Elementary	.05227	.06654	1.000	-.1081	.2126
		Middle	.14026*	.04573	.007	.0300	.2505
Teacher Efficacy and Respect	Elementary	Middle	.13005	.06449	.134	-.0254	.2855
		High	.02991	.06347	1.000	-.1231	.1829
	Middle	Elementary	-.13005	.06449	.134	-.2855	.0254
		High	-.10014	.04362	.068	-.2053	.0050
	High	Elementary	-.02991	.06347	1.000	-.1829	.1231
		Middle	.10014	.04362	.068	-.0050	.2053
Load Appropriateness	Elementary	Middle	.23251*	.08309	.017	.0322	.4328
		High	.15958	.08178	.156	-.0375	.3567
	Middle	Elementary	-.23251*	.08309	.017	-.4328	-.0322
		High	-.07293	.05621	.587	-.2084	.0625
	High	Elementary	-.15958	.08178	.156	-.3567	.0375
		Middle	.07293	.05621	.587	-.0625	.2084

* Experiment-wise $p < .05$.

Up to this point, the data has been analyzed using my initial theory that working conditions of mathematics teachers could be represented in five dimensions (strands). To explore whether these five dimensions adequately describe working conditions of mathematics teachers, I conducted a factor analysis. The six factors which resulted were in fact conceptually quite similar to the hypothesized strands. For instance, the locus of instructional control and level of autonomy factors share key attributes with the agency strand. The benefit of using the six factors is that they appear to provide a clearer perspective on the working conditions of mathematics teachers. What follows then is an analysis of the survey data using the six factors derived from factor analysis.

Research Question 4

When tension is measured by the factors identified through factor analysis, to what extent do teachers of mathematics feel tensions in the conditions of their professional working environment?

Factor analysis, using principal components analysis as the method of extraction, produced six composite factors. Before conducting statistical analysis with these factors as dependent variables, I assessed the internal consistency reliability of the set of items in each factor. Table 34 contains Cronbach's alpha coefficients for the six factors. The items in the first three factors are highly reliable and the items in the last three factors are sufficiently reliable for the purposes of this study.

Table 34. *Internal Reliability Coefficients of Theorized Factors*

Factor	Number of Items	Cronbach's Alpha (α)
Sense of Accomplishment	14	.901
Locus of Instructional Control	11	.867
Degree of Contentment with Teaching	9	.840
Level of Autonomy	4	.649
Professional Growth	5	.695
Freedom to Innovate	4	.615

Once the factors were deemed internally consistent, I created a histogram of composite scores for each of the six factors to evaluate the extent of their prevalence. As shown in Figure 13, the scores on the sense of accomplishment factor have a high mean (3.19), suggesting that teachers generally feel successful about their job teaching math. However, the mean for the locus of instructional control factor is 2.27, indicating that teachers tend to feel that control resides with others (see Figure 14). The distribution of scores in Figure 15 shows that some participants are fairly content while others are frustrated with teaching. From Figure 16, it is apparent that teachers sense a lack of autonomy regarding how they teach and what they teach. On the other hand, teachers seem to have a high level of involvement in activities that promote professional growth as evidenced by the histogram in Figure 17. The scores on the freedom to innovate factor, shown in Figure 18, are striking because of the large number of participants who feel constrained in their instruction by the course curriculum and course textbook. It is worth pointing out that the three factors with the lowest means are freedom to innovate, level of autonomy, and locus of instructional control. All three factors have clear ties to agency, one of the strands from the initial analysis that appeared to be a source of tension for teachers.

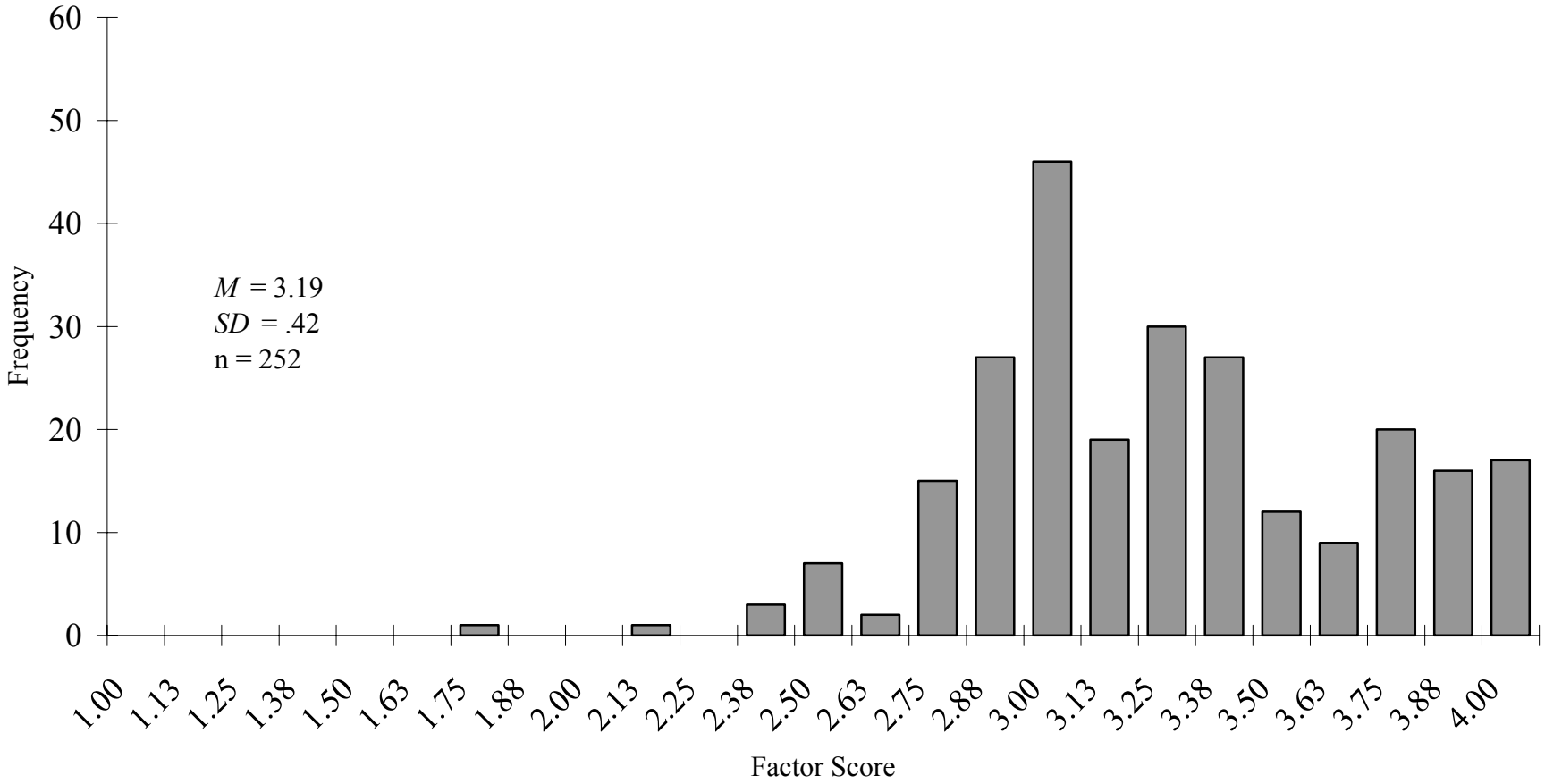


Figure 13. Participant composite scores for the sense of accomplishment factor. Scores represent the mean response to the factor items for a given participant. Lower scores indicate a lower sense and higher scores indicate a greater sense of accomplishment.

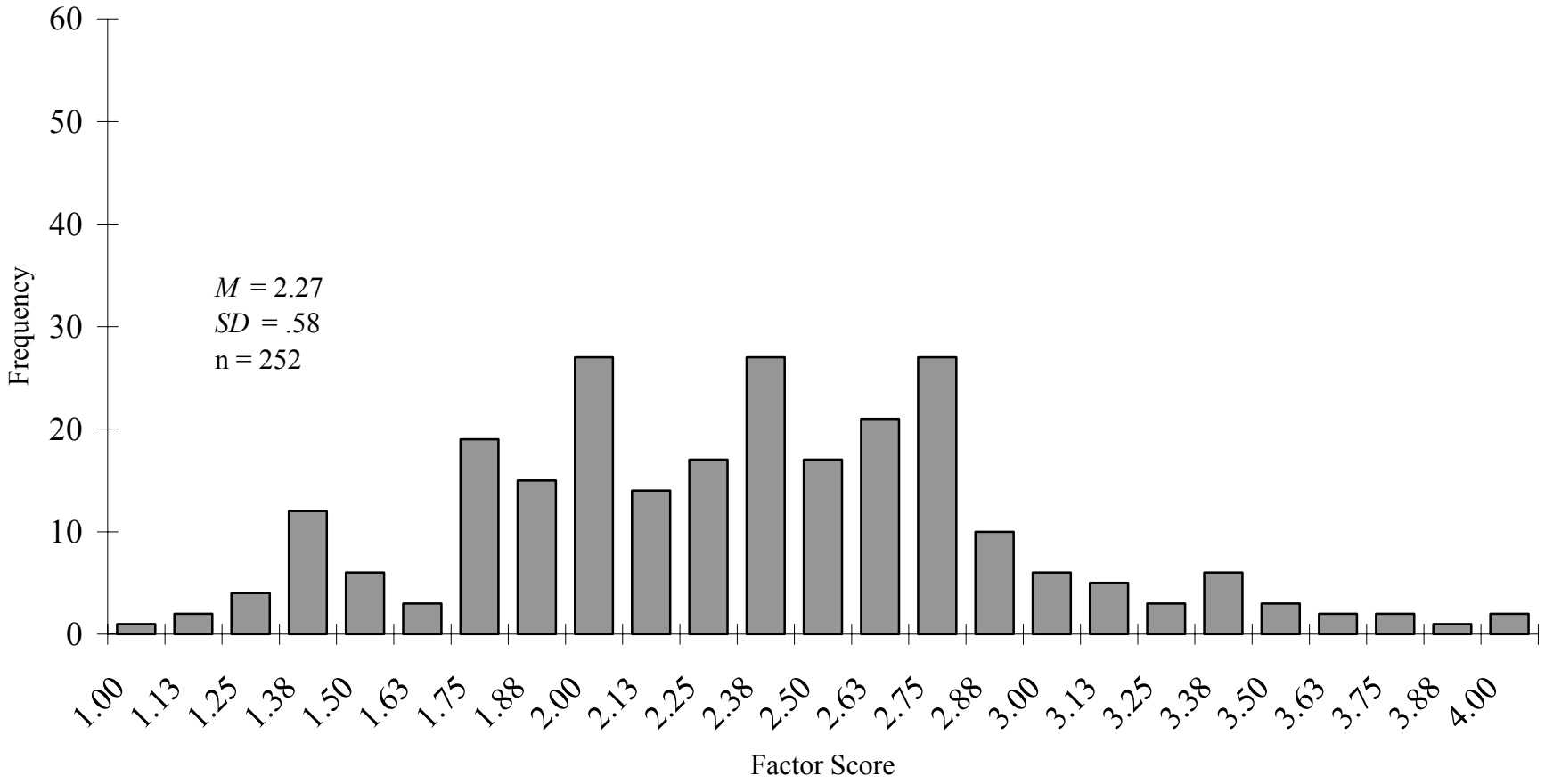


Figure 14. Participant composite scores for the locus of instructional control factor. Scores represent the mean response to the factor items for a given participant. Lower scores indicate an external locus of control and higher scores indicate an internal locus of control.

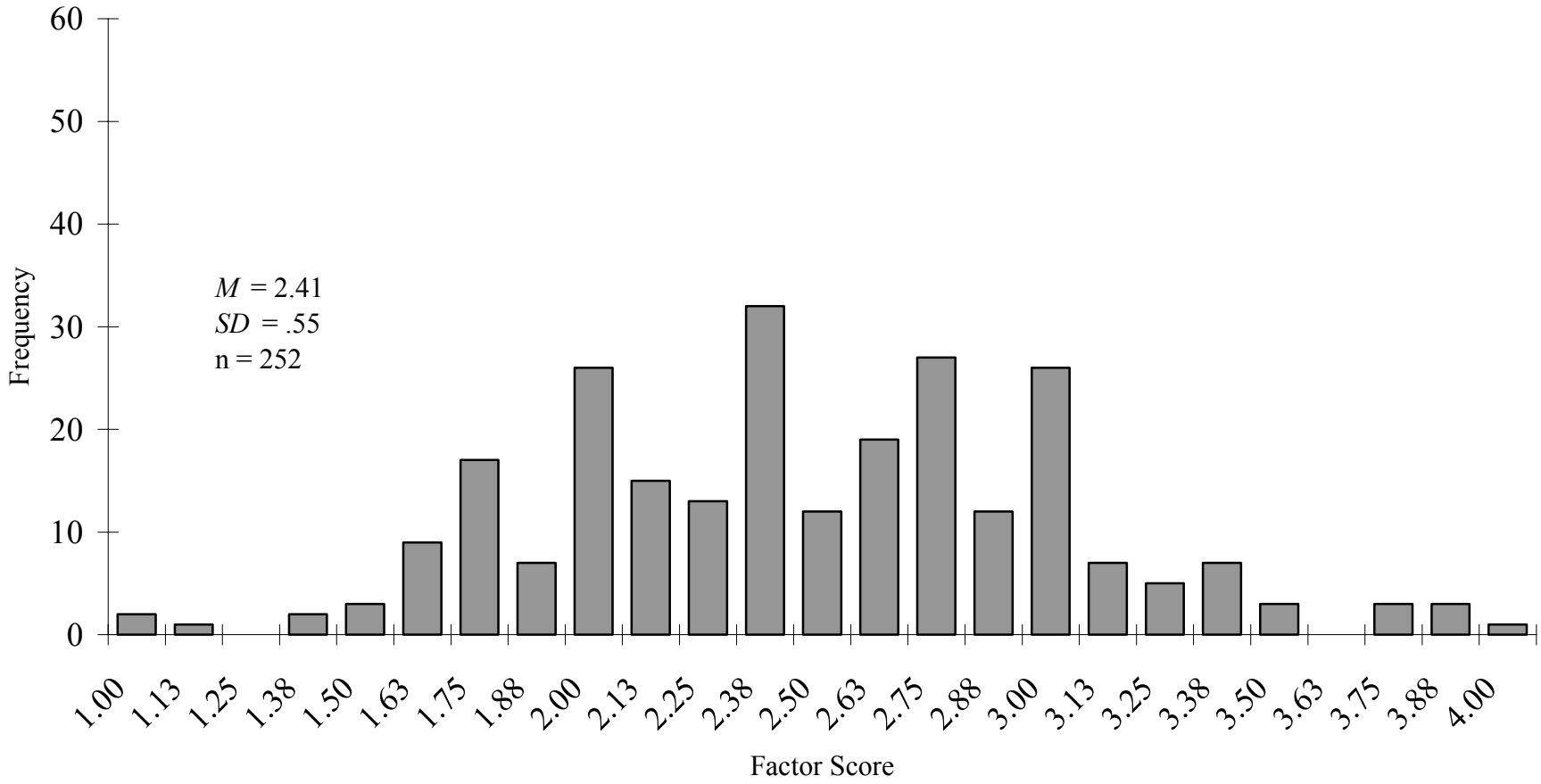


Figure 15. Participant composite scores for the degree of contentment with teaching factor. Scores represent the mean response to the factor items for a given participant. Lower scores indicate being less content and higher scores indicate being more content.

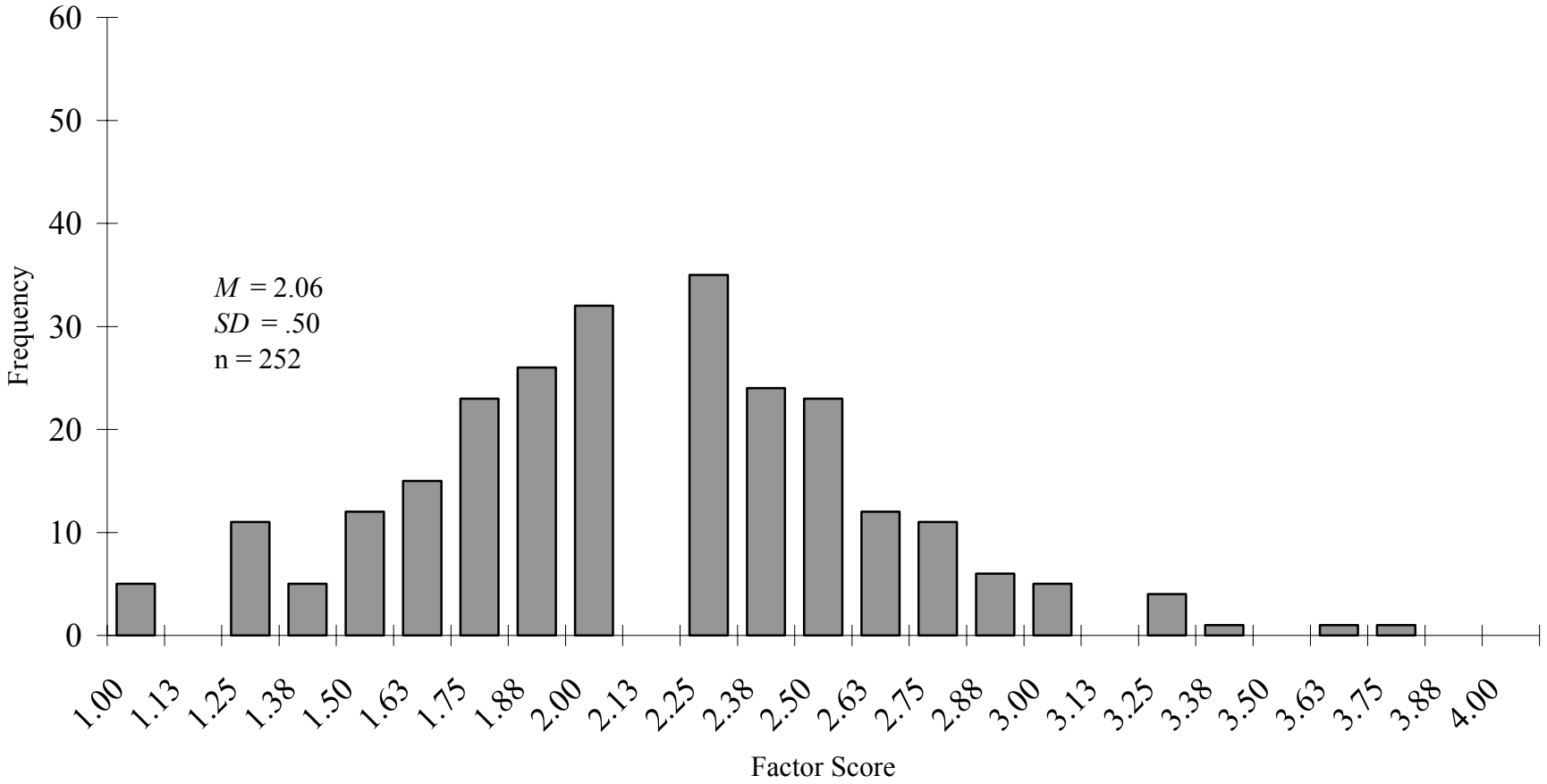


Figure 16. Participant composite scores for the level of autonomy factor. Scores represent the mean response to the factor items for a given participant. Lower scores indicate feeling less autonomous and higher scores indicate feeling more autonomous.

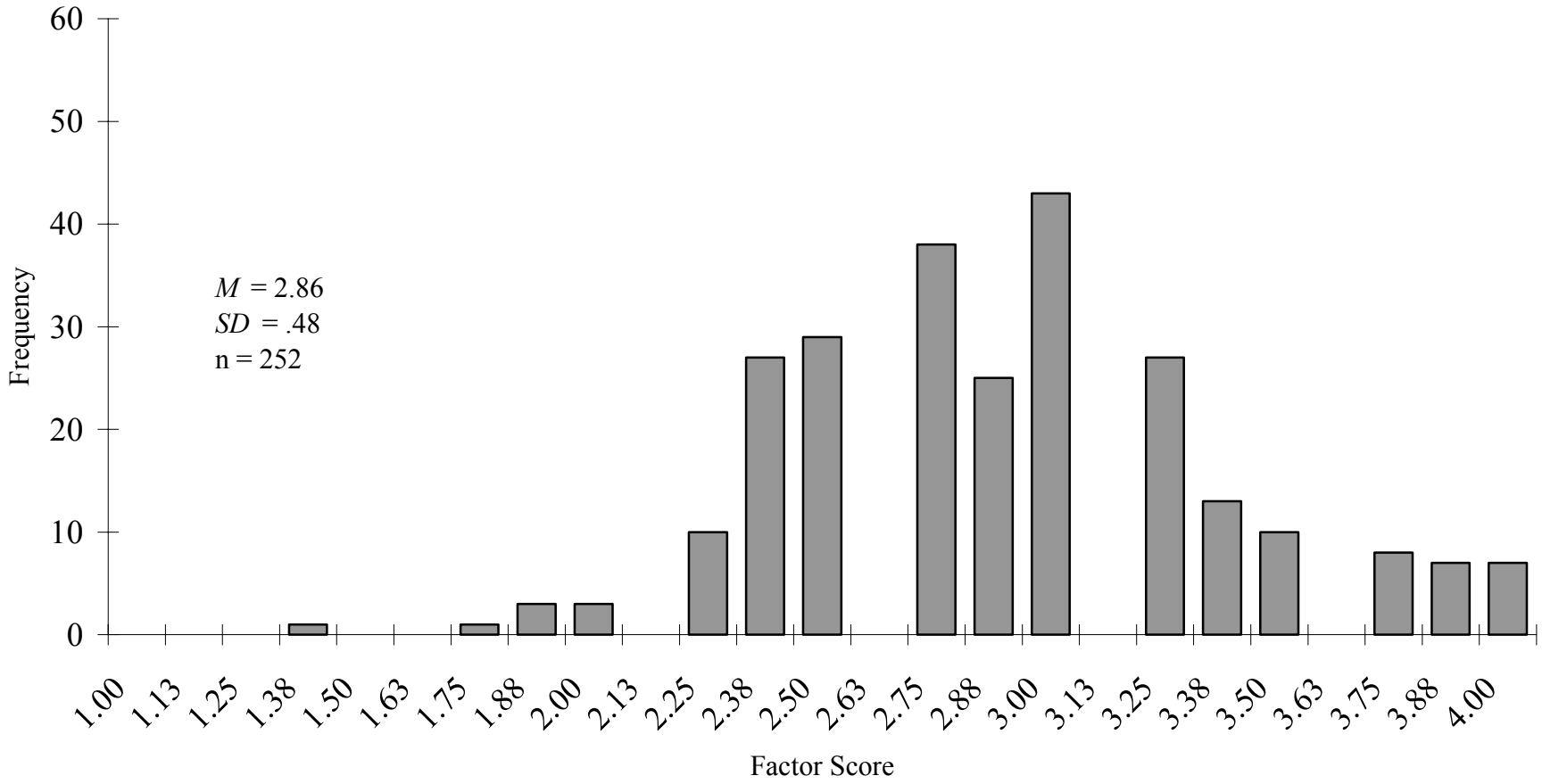


Figure 17. Participant composite scores for the professional growth factor. Scores represent the mean response to the factor items for a given participant. Lower scores indicate less involvement and higher scores indicate more involvement in professional activities.

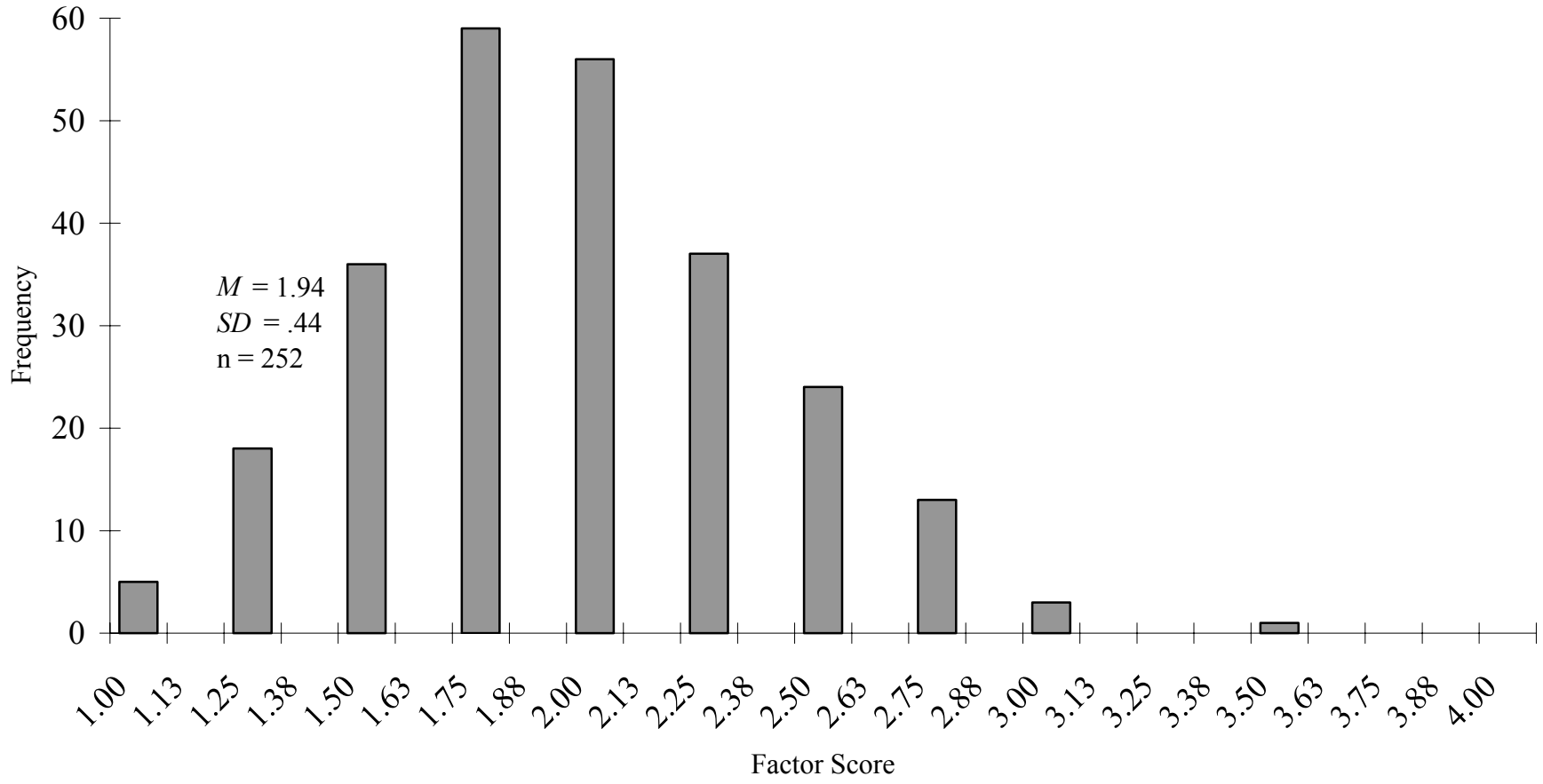


Figure 18. Participant composite scores for the freedom to innovate factor. Scores represent the mean response to the factor items for a given participant. Lower scores indicate less freedom and higher scores indicate more freedom.

Research Question 5

When tension is measured by the factors identified through factor analysis, are there statistically significant differences in the feelings of tension perceived by mathematics teachers when examined in terms of demographic variables?

I used ANOVA analyses to answer the fifth research question. The ANOVA testing sought to determine if the mean factor scores differed among demographic groups.

ANOVA using Factor Scores

I began by evaluating the sample to verify that all of the assumptions of ANOVA (i.e., independent observations, normally distributed populations, and homogeneous variances) were met. Participants completed the surveys individually meaning that how one participant responded had no bearing on how other participants responded. As a result, the observations were independent. To detect violations of the normality assumption, I computed the skewness and kurtosis statistics. Skewness ranged from 0.004 to 0.312 and kurtosis ranged from -0.158 to 0.252 for the six factors. These skewness and kurtosis values are within the expected range of chance fluctuations so the normality assumption is satisfied. I used Levene's test to verify that the variances were homogeneous. For each of the demographic variables, I conducted the test at the .05 level with a null hypothesis that the variances of the factor scores were equal. The results from SPSS 15.0 are reported by demographic variable and followed by ANOVAs and post hoc multiple comparisons where appropriate.

Gender

The results of the homogeneity of variance tests when the sample is grouped by gender are displayed in Table 35. The significance of the Levene statistic is greater than .05 for all six factors. This indicates that the null hypothesis of equal variances should be retained. Since the equal variances assumption is satisfied, an ANOVA to compare male and female means is appropriate.

Table 35. *Test of Homogeneity of Variance of Factors When Grouped by Gender*

	Levene Statistic	*df1*	*df2*	Sig.
Sense of Accomplishment	.806	1	250	.370
Locus of Instructional Control	.246	1	250	.620
Degree of Contentment with Teaching	.509	1	250	.476
Level of Autonomy	.255	1	250	.614
Professional Growth	1.749	1	250	.187
Freedom to Innovate	.049	1	250	.826

Table 36 presents the results of the one-way ANOVA at the .05 level with gender as the independent variable and factor score as the dependent variable. The null hypothesis for this analysis was that the male and female means were equal. For five of the six factors, the observed F did not exceed the critical F of 3.879 and the null hypothesis was retained. For the remaining factor, locus of instructional control, the observed F did exceed the critical F. Therefore, a significant difference in means exists between males and females on the issue of locus of instructional control. With only two groups (males and females), the relationship of the means can be deduced without post hoc multiple comparisons. Male participants had significantly higher mean scores ($M = 2.44$) on the locus of instructional control factor than females ($M = 2.22$). This means that while both groups perceive the locus of instructional control to be more external (residing with others) than internal (residing with themselves),

males feel more control than females. This result may be linked to the fact that all but two of the male teachers work at the secondary level and a third of male secondary mathematics teachers do not teach courses associated with high stakes assessments.

Table 36. *ANOVA of Factors When Grouped by Gender*

	Source	*SS*	*df*	*MS*	*F*	Sig.
Sense of Accomplishment	Between Groups	.097	1	.097	.544	.461
	Within Groups	44.447	250	.178		
	Total	44.544	251			
Locus of Instructional Control	Between Groups	2.067	1	2.067	6.336*	.012
	Within Groups	81.545	250	.326		
	Total	83.611	251			
Degree of Contentment with Teaching	Between Groups	.731	1	.731	2.421	.121
	Within Groups	75.502	250	.302		
	Total	76.233	251			
Level of Autonomy	Between Groups	.716	1	.716	2.920	.089
	Within Groups	61.327	250	.245		
	Total	62.043	251			
Professional Growth	Between Groups	.008	1	.008	.034	.853
	Within Groups	57.946	250	.232		
	Total	57.954	251			
Freedom to Innovate	Between Groups	.106	1	.106	.556	.456
	Within Groups	47.597	250	.190		
	Total	47.703	251			

* $p < .05$.

School District Size

With the sample grouped by school district size (i.e., quartile 1, quartile 2, quartile 3, and quartile 4), I computed the Levene statistic to test for homogeneity of variance. As shown in Table 37, all factors have non-significant values (values greater than .05) and the null hypotheses can be retained. Thus, the variances are homogeneous and further evaluation by ANOVA is warranted for all six factors.

Table 37. *Test of Homogeneity of Variance of Factors When Grouped by School District Size*

	Levene Statistic	*df1*	*df2*	Sig.
Sense of Accomplishment	.460	3	240	.711
Locus of Instructional Control	.299	3	240	.826
Degree of Contentment with Teaching	2.088	3	240	.102
Level of Autonomy	.772	3	240	.511
Professional Growth	.178	3	240	.911
Freedom to Innovate	.699	3	240	.553

The results of the one-way ANOVA with school district size as the independent variable and factor scores as the dependent variable are presented in Table 38. The analysis, conducted at the .05 level, revealed that one factors locus of instructional control, had an observed F value which exceeded the critical F of 2.6422. I rejected the null hypothesis for this factor and concluded that scores on this factor are somehow related to school district size. Although the ANOVA indicated significant differences existed, post hoc multiple comparison testing was needed to establish exactly which pairs of groups (i.e., quartile 1 vs. quartile 3) differed. For the remaining five factors (sense of accomplishment, degree of contentment with teaching, level of autonomy, professional growth, and freedom to innovate), the observed F did not exceed the critical F and as a result, the null hypotheses that the sample means are equal remain tenable.

Table 38. *ANOVA of Factors When Grouped by School District Size*

	Source	*SS*	*df*	*MS*	*F*	Sig.
Sense of Accomplishment	Between Groups	.554	3	.185	1.055	.369
	Within Groups	41.991	240	.175		
	Total	42.545	243			
Locus of Instructional Control	Between Groups	5.661	3	1.887	7.084***	.000
	Within Groups	63.928	240	.266		
	Total	69.589	243			
Degree of Contentment with Teaching	Between Groups	1.127	3	.376	1.297	.276
	Within Groups	69.477	240	.289		
	Total	70.603	243			
Level of Autonomy	Between Groups	.254	3	.085	.366	.778
	Within Groups	55.598	240	.232		
	Total	55.852	243			
Professional Growth	Between Groups	1.354	3	.451	2.029	.110
	Within Groups	53.401	240	.223		
	Total	54.755	243			
Freedom to Innovate	Between Groups	1.005	3	.335	1.796	.149
	Within Groups	44.759	240	.186		
	Total	45.763	243			

*** $p < .001$.

I selected the Bonferroni procedure for the post hoc contrasts. Results from the Bonferroni procedure are displayed in Table 39. Conducted at the .05 experiment-wise level, the analysis indicated that two comparisons had significant mean differences. Participants from quartile 1 districts had higher mean scores on locus of instructional control items ($M = 2.50$) than participants from quartile 2 districts ($M = 2.10$) and participants from quartile 4 districts ($M = 2.18$). This implies that on average, teachers in the smallest districts perceive they have more control regarding instructional decisions than their peers in small/medium districts and in large districts. Even so, a mean of 2.50 for teachers from quartile 1 districts does not indicate a high level of control on the part of the teachers. None of the other contrasts revealed significant mean differences.

Table 39. *Multiple Comparisons of Factors When Grouped by School District Size Using Bonferroni*

Dependent Variable			Mean Difference	*SE*	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Locus of Instructional Control	Quartile 1	Quartile 2	.39886*	.08992	.000	.1596	.6381
		Quartile 3	.26000	.12414	.224	-.0703	.5903
		Quartile 4	.32475*	.08925	.002	.0873	.5622
	Quartile 2	Quartile 1	-.39886*	.08992	.000	-.6381	-.1596
		Quartile 3	-.13886	.11826	1.000	-.4535	.1757
		Quartile 4	-.07411	.08086	1.000	-.2892	.1410
	Quartile 3	Quartile 1	-.26000	.12414	.224	-.5903	.0703
		Quartile 2	.13886	.11826	1.000	-.1757	.4535
		Quartile 4	.06475	.11775	1.000	-.2485	. 3780
	Quartile 4	Quartile 1	-.32475*	.08925	.002	-.5622	-.0873
		Quartile 2	.07411	.08086	1.000	-.1410	.2892
		Quartile 3	-.06475	.11775	1.000	-.3780	.2485

* Experiment-wise $p < .05$.

School District Location

Table 40 shows the results of the test of homogeneity of variance when the sample was grouped by school district location (i.e., Baltimore region, suburban Washington, Southern Maryland, Western Maryland, and Eastern Shore). Using Levene's test, none of the factors was significant indicating that the groups of school districts had equal variances. Therefore, subsequent analysis using ANOVA was appropriate.

Table 40. *Test of Homogeneity of Variance of Factors When Grouped by School District Location*

	Levene Statistic	*df1*	*df2*	Sig.
Sense of Accomplishment	.210	3	240	.889
Locus of Instructional Control	.712	3	240	.545
Degree of Contentment with Teaching	.843	3	240	.471
Level of Autonomy	.548	3	240	.650
Professional Growth	2.390	3	240	.069
Freedom to Innovate	.353	3	240	.787

With all assumptions satisfied, I ran a one-way ANOVA at the .05 level with school district location as the independent variable and factor score as the dependent variable. The results from this analysis are presented in Table 41. For all but the sense of accomplishment factor, the observed F did not exceed the critical F of 2.6422 and as a result, I retained the null hypotheses that the means were equal. Since the observed F did exceed the critical F for the sense of accomplishment factor, I rejected the null hypothesis and concluded that the factor was somehow related to school district location. To more precisely define the relationship, I conducted post hoc multiple comparison testing.

Table 41. *ANOVA of Factors When Grouped by School District Location*

	Source	*SS*	*df*	*MS*	*F*	Sig.
Sense of Accomplishment	Between Groups	1.662	3	.554	3.252*	.022
	Within Groups	40.883	240	.170		
	Total	42.545	243			
Locus of Instructional Control	Between Groups	.942	3	.314	1.098	.351
	Within Groups	68.647	240	.286		
	Total	69.589	243			
Degree of Contentment with Teaching	Between Groups	.963	3	.321	1.106	.347
	Within Groups	69.640	240	.290		
	Total	70.603	243			
Level of Autonomy	Between Groups	.424	3	.141	.612	.608
	Within Groups	55.427	240	.231		
	Total	55.852	243			
Professional Growth	Between Groups	.852	3	.284	1.264	.287
	Within Groups	53.904	240	.225		
	Total	54.755	243			
Freedom to Innovate	Between Groups	.279	3	.093	.490	.689
	Within Groups	45.485	240	.190		
	Total	45.763	243			

* $p < .05$.

The results of the post hoc Bonferroni on the sense of accomplishment factor are shown in Table 42. At an experiment-wise alpha of .05, two significant contrasts were detected. Participants from districts in Southern Maryland had a significantly higher mean ($M = 3.57$) on the sense of accomplishment factor than participants from districts in the Baltimore region ($M = 3.15$) and participants from districts in suburban Washington ($M = 3.18$). While most participants feel a sense of accomplishment, it can be inferred that Southern Maryland teachers have a particularly strong feeling of accomplishment when compared to their peers in the Baltimore region and in suburban Washington. As mentioned in the analysis of the strands, the results when districts are grouped by size and location may be similar because Southern Maryland districts are small and suburban Washington districts are mostly large. Therefore it is unclear whether the significant differences are due to size, location, or a combination of these characteristics. The remaining contrasts did not prove to be significant.

Table 42. *Multiple Comparisons of Factors When Grouped by School District Location Using Bonferroni*

Dependent Variable			Mean Difference	*SE*	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Sense of Accomplishment	Baltimore Region	Surburban Washington	-.03308	.05720	1.000	-.1852	.1191
		Southern	-.42262*	.13537	.012	-.7827	-.0625
		Eastern Shore	-.03869	.10926	1.000	-.3293	.2520
	Suburban Washington	Baltimore Region	.03308	.05720	1.000	-.1191	.1852
		Southern	-.38953*	.13790	.031	-.7564	-.0227
		Eastern Shore	-.00561	.11237	1.000	-.3046	.2933
	Southern	Baltimore Region	.42262*	.13537	.012	.0625	.7827
		Suburban Washington	.38953*	.13790	.031	.0227	.7564
		Eastern Shore	.38393	.16638	.131	-.0587	.8265
	Eastern Shore	Baltimore Region	.03869	.10926	1.000	-.2520	.3293
		Suburban Washington	.00561	.11237	1.000	-.2933	.3046
		Southern	-.38393	.16638	.131	-.8265	.0587

* Experiment-wise $p < .05$.

Teaching Experience

Table 43 displays the results of the test for homogeneity of variance when the sample is grouped by teaching experience. The sense of accomplishment, locus of instructional control, degree of contentment with teaching, professional growth, and freedom to innovate factors showed no significant differences in variances and therefore warranted further evaluation by ANOVA.

Table 43. *Test of Homogeneity of Variance of Factors When Grouped by Teaching Experience*

	Levene Statistic	*df1*	*df2*	Sig.
Sense of Accomplishment	2.120	5	235	.064
Locus of Instructional Control	2.150	5	235	.060
Degree of Contentment with Teaching	2.170	5	235	.058
Level of Autonomy	2.299	5	235	.046
Professional Growth	1.492	5	235	.193
Freedom to Innovate	.788	5	235	.559

The ANOVA table for the factors when the sample is grouped by teaching experience is shown in Table 44. For the factors that met the assumptions of ANOVA, only the observed F for sense of accomplishment exceeded the critical F of 2.2525. Hence, post hoc tests for the sense of accomplishment factor were necessary. The null hypotheses for the other factors regarding the equality of sample means remained tenable.

Table 44. *ANOVA of Factors When Grouped by Teaching Experience*

	Source	*SS*	*df*	*MS*	*F*	Sig.
Sense of Accomplishment	Between Groups	2.420	5	.484	2.839*	.016
	Within Groups	40.075	235	.171		
	Total	42.495	240			
Locus of Instructional Control	Between Groups	2.425	5	.485	1.497	.192
	Within Groups	58.569	235	.249		
	Total	60.679	240			
Degree of Contentment with Teaching	Between Groups	1.479	5	.296	.995	.422
	Within Groups	69.886	235	.297		
	Total	71.365	240			
Level of Autonomy	Between Groups	1.831	5	.366	1.469	.201
	Within Groups	58.579	235	.249		
	Total	60.410	240			
Professional Growth	Between Groups	1.973	5	.395	1.746	.125
	Within Groups	53.111	235	.226		
	Total	55.084	240			
Freedom to Innovate	Between Groups	.241	5	.048	.251	.939
	Within Groups	45.200	235	.192		
	Total	45.441	240			

* $p < .05$.

Table 45 presents the results of the post hoc Bonferroni on the sense of accomplishment factor when the sample is grouped by teaching experience. A significant contrast between brand new and veteran teachers was found at an experiment-wise alpha of .05. Participants with 30 or more years of teaching experience had a significantly higher mean ($M = 3.39$) on the sense of accomplishment factor than participants in their first year of teaching ($M = 2.97$). It can be inferred that one's sense of accomplishment is lowest as a novice teacher and generally increases with time and experience. The remaining contrasts were not significant.

Table 45. *Multiple Comparisons of Factors When Grouped by Teaching Experience Using Bonferroni*

Dependent Variable			Mean Difference	*SE*	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Sense of Accomplishment	0 – 1 year	2 – 4 years	-.15714	.10662	1.000	-.4733	.1591
		5 – 9 years	-.22700	.09843	.330	-.5189	.0649
		10 – 19 years	-.24617	.10075	.229	-.5450	.0526
		20 – 29 years	-.21462	.11585	.978	-.5582	.1289
		30+ years	-.41454*	.11487	.006	-.7552	-.0739
	2 – 4 years	0 – 1 year	.15714	.10662	1.000	-.1591	.4733
		5 – 9 years	-.06986	.08275	1.000	-.3152	.1755
		10 – 19 years	-.08903	.08549	1.000	-.3426	.1645
		20 – 29 years	-.05747	.10286	1.000	-.3625	.2475
		30+ years	-.25740	.10175	.181	-.5591	.0444
	5 – 9 years	0 – 1 year	.22700	.09843	.330	-.0649	.5189
		2 – 4 years	.06986	.08275	1.000	-.1755	.3152
		10 – 19 years	-.01917	.07503	1.000	-.2417	.2033
		20 – 29 years	.01239	.09434	1.000	-.2674	.2921
		30+ years	-.18754	.09314	.678	-.4637	.0887
	10 – 19 years	0 -1 year	.24617	.10075	.229	-.0526	.5450
		2 – 4 years	.08903	.08549	1.000	-.1645	.3426
		5 – 9 years	.01917	.07503	1.000	-.2033	.2417
		20 – 29 years	.03156	.09675	1.000	-.2554	.3185
		30+ years	-.16837	.09558	1.000	-.4518	.1151
	20 – 29 years	0 – 1 year	.21462	.11585	.978	-.1289	.5582
		2 – 4 years	.05747	.10286	1.000	-.2475	.3625
		5 – 9 years	-.01239	.09434	1.000	-.2921	.2674
		10 – 19 years	0.03156	.09675	1.000	-.3185	.2554
		30+ years	-.19992	.11138	1.000	-.5302	.1304

Dependent Variable			Mean Difference	*SE*	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Sense of Accomplishment	30+ years	0 – 1 year	.41454*	.11487	.006	.0739	.7552
		2 – 4 years	.25740	.10175	.181	-.0444	.5591
		5 – 9 years	.18754	.09314	.678	-.0887	.4637
		10 – 19 years	.16837	.09558	1.000	-.1151	.4518
		20 – 29 years	.19992	.11138	1.000	-.1304	.5302

* Experiment-wise $p < .05$.

Teaching Placement

Results from Levene's test when the sample is grouped by teaching placement (elementary, middle, or high school) are shown in Table 46. With the exception of the professional growth factor, the significance of the Levene statistic was greater than .05 for all the factors. Thus, the assumption of homogeneity of variances was satisfied for five out of the six factors and conducting an ANOVA was appropriate for these factors.

Table 46. *Test of Homogeneity of Variance of Factors When Grouped by Teaching Placement*

	Levene Statistic	*df1*	*df2*	Sig.
Sense of Accomplishment	.161	2	249	.851
Locus of Instructional Control	.173	2	249	.841
Degree of Contentment with Teaching	.421	2	249	.657
Level of Autonomy	.067	2	249	.935
Professional Growth	3.809	2	249	.023
Freedom to Innovate	.289	2	249	.749

I conducted a one-way ANOVA with teaching placement as the independent variable and factor scores as the dependent variable. The null hypothesis stated that the elementary school, middle school, and high school means were equal. Table 47 presents the results of the ANOVA. The observed F for the locus of instructional control factor exceeded the critical F of 3.032. I concluded that there were significant differences in means for the locus of control factor. To identify which specific contrasts were significant, I conducted post hoc multiple comparison tests.

Table 47. *ANOVA of Factors When Grouped by Teaching Placement*

	Source	*SS*	*df*	*MS*	*F*	Sig.
Sense of Accomplishment	Between Groups	.659	2	.330	1.870	.156
	Within Groups	43.885	249	.176		
	Total	44.544	251			
Locus of Instructional Control	Between Groups	2.965	2	1.482	4.577*	.011
	Within Groups	80.647	249	.324		
	Total	83.611	251			
Degree of Contentment with Teaching	Between Groups	.883	2	.441	1.458	.235
	Within Groups	75.351	249	.303		
	Total	76.233	251			
Level of Autonomy	Between Groups	1.139	2	.570	2.329	.099
	Within Groups	60.904	249	.245		
	Total	62.043	251			
Professional Growth	Between Groups	.109	2	.054	.234	.791
	Within Groups	57.845	249	.232		
	Total	57.954	251			
Freedom to Innovate	Between Groups	.705	2	.352	1.867	.157
	Within Groups	46.998	249	.189		
	Total	47.703	251			

* $p < .05$.

The results of the post hoc Bonferroni multiple comparison test on the locus of instructional control factor are shown in Table 48. The analysis revealed one significant contrast when tested with an experiment-wise alpha of .05. High school teacher participants had a significantly higher mean factor score ($M = 2.37$) than middle school teacher participants ($M = 2.14$). It can be inferred that high school teachers perceive more control than middle school teachers. However, none of the group means were high meaning that teachers generally feel that the locus of control resides more with others than with themselves. There were no statistically significant mean differences between elementary school and middle school teachers or elementary school and high school teachers.

Table 48. *Multiple Comparisons of Factors When Grouped by Teaching Placement Using Bonferroni*

Dependent Variable			Mean Difference	*SE*	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Locus of Instructional Control	Elementary	Middle	.20175	.11397	.234	-.0730	.4765
		High	-.02395	.11217	1.000	-.2943	.2464
	Middle	Elementary	-.20175	.11397	.234	-.4765	.0730
		High	-.22570*	.07709	.011	-.4115	-.0399
	High	Elementary	.02395	.11217	1.000	-.2464	.2943
		Middle	.22570*	.07709	.011	.0399	.4115

Summary

Analysis of the survey data using the five hypothesized strands yielded a number of findings. First, item analysis of participant responses revealed generally low levels of agency. The results from subsequent statistical tests using ANOVA identified that teachers in the smallest districts feel significantly more agency than teachers in both small/medium districts and large districts. ANOVA tests also showed that high school teachers feel significantly more agency than middle school teachers. Second, participants reported feeling overloaded by their job responsibilities. ANOVA tests on the load appropriateness strand scores indicated that teachers in the small/medium districts feel significantly more overloaded than teachers in the smallest districts. ANOVA testing also showed that middle school teachers are significantly more overloaded than elementary school teachers. Third, statistically significant mean differences in teacher efficacy and respect scores were noted from ANOVA tests. Specifically, teachers from the smallest districts feel more effective and more respected than their counterparts in small/medium districts and large districts. It was also determined that teachers from Southern Maryland districts feel more efficacious and respected than teachers from suburban Washington districts. Finally, ANOVA tests showed that elementary school teachers feel more goal congruence than middle school teachers.

Factor analysis of the survey data resulted in the identification of six factors. The data was re-analyzed using these factors, which yielded additional findings. First, participants have a strong sense of accomplishment. Not surprisingly, ANOVA tests revealed that teachers with 30 or more years of teaching experience have a

significantly greater sense of accomplishment than first year teachers. The tests also indicated that Southern Maryland teachers feel a greater sense of accomplishment than Baltimore region teachers and suburban Washington teachers. Second, participants generally feel a low level of instructional control. ANOVA tests showed that middle school teachers have significantly less control than high school teachers. Also, teachers in small/medium and large districts have significantly less instructional control than teachers in the smallest districts.

Whether the data is analyzed using the five strands or the six factors, there appears to be some consistent relationships. For one, teachers from the smallest districts seem to feel less tension and stress than teachers in larger districts. Another is that middle school teachers seem to feel more tension and stress than their peers in elementary and high schools. There also seems to be more tension and stress reported by teachers in districts located near urban centers when compared to their more rural counterparts.

CHAPTER 5: CONCLUSIONS

The purpose of this study was to describe the quality of work life of mathematics teachers, in an effort to help the mathematics teaching profession and the broader education community improve both the effectiveness and satisfaction of K-12 teachers of mathematics. This study utilized research from social-psychology and organizational behavior to investigate the interplay between mathematics teachers and the educational institution in which they reside. In particular, this study investigated five potential sources of stress and tension: the congruence of individual and organizational goals, teachers' sense of agency, teachers' sense of efficacy and respect, the level of professional interactions between teachers, and the appropriateness of teachers' work load.

This concluding chapter describes the nature and extent of mathematics teachers' perceived sense of tension and stress and discusses the relationship of their perceptions to the predictions of social-psychological and organizational research. The main findings from the quantitative analysis are presented along with excerpts from follow-up interviews with a few selected teachers. Pseudonyms have been used to protect the identity of the teachers. While comments from the interviews are not meant to represent the beliefs of all mathematics teachers, they do provide some interesting insights and help to shed light on the survey responses of these particular individuals. Finally, comments from survey participants on the top assets and obstacles to teaching are included when relevant because I felt the tone and language used was quite powerful and meaningful.

Summary of Findings

Low Agency

Mathematics teachers reported having low levels of agency where agency referred to their participation in decision-making and utilization of their skills and knowledge. This finding is consistent with results from a recent survey by a Maryland school district where teachers expressed a lack of decision-making opportunities (Surface, 2005). Perceptions of low agency have previously been linked to increases in teacher stress, job pressure, and job dissatisfaction (Bacharach, Bauer, & Conley, 1986; Kyriacou & Sutcliffe, 1979; Travers & Cooper, 1996). However, Conley, Bacharach, and Bauer found mixed results regarding agency when they concluded that routinization, but not powerlessness, was associated with career dissatisfaction (1989).

Comments from the teachers I interviewed also reflect a sense of low agency. The use of descriptors such as 'prescribed' curriculum and 'filtered down' decisions by Jane, a late-career teacher who had a lower than average agency score, is quite telling:

> I don't know about who makes those decisions any more. For years and years I used to write curriculum in the summer and I used to write assessments so I would be on that group. But it was always prescribed from supervisors or resource teachers that had connections with the state department. So our curriculum and our decisions are made from the state level and filtered down to us and I don't see us having an awful lot of say because there is a national agenda. (Jane, a late-career outlier, personal communication, March 17, 2007)

Samantha, an early-career teacher who also had an agency score below the mean, echoed Jane's sentiment that teachers lack input and that there is just a small group of decision-makers:

> I know there's the [regional] math coordinator. I don't know if there's more than one of them but I know that within the region, they write tests together, the chapter test and then within the county someone writes the county benchmarks because the benchmarks aren't written by the same people as the MSAs. As far as the curriculum…there's like 10 or 12 names on there of people who worked on the curriculum. (Samantha, an early-career outlier, personal communication, March 29, 2007)

Several survey participants communicated similar feelings when they listed the top three obstacles to teaching. Teachers reported being 'micromanaged' and having 'very little influence' on what, how, and when topics are taught. A number of teachers mentioned a 'top-down approach' from administrators and the superintendent.

The interviewed teachers also shared experiences where they felt their professional knowledge was not appreciated or valued. In Jane's case, a principal's actions left her feeling frustrated and insulted:

> He moved a child up that was failing my class. And I'm on the on grade level class. And this is an African American child and he moved him up to GT so he didn't just move him up one level, he moved him up two – with no input from me. And I never went to him and I never asked him why but other people did because it wasn't just math. He was put in GT everything. And I think that's why we got the blue ribbon because we had some subgroups that had African Americans in it

> and that one child made all the difference. And I thought – that's not right. That's not right to the child, that's manipulating the numbers, that kid is failing GT. His reasoning was, "Well, he's got the ability, let's let him fail at a higher level". And I don't know if I bought into that. And then I had parents calling me and saying "How do I get my child moved up?" And of course you can't say, "This was the decision that the principal did." You just say, "Well I look at the child's performance in April and then I make a decision in April and I sure really want your child to move up if they're ready to move up." But in that particular class, I got 5 parent calls. Because they're all saying, "How did Monty move up? How did he move up? He was failing this class." And what do you say? What is your answer? And that's where you feel like – my input didn't count. If I'm a physician and I'm diagnosing a medical condition – would they have done that to me? No. Part of it is … my career, and I'm coming to the end of it because I'll probably teach for 5 or 6 more years – but you feel like "Gee, I'm a professional that's got a lot of education – why is it that my expertise is not called on. Why are my feelings on this not validated?" (Jane, a late-career outlier, personal communication, March 17, 2007)

Although this incident occurred early in the school year, the hurt Jane suffered was still fresh and painful when she described it to me nearly five months later. For Samantha, feeling underutilized was a result of the rigid structure of the assessments and the mandatory grading system:

> I hate the county tests because I can't assess what I want to assess. I would definitely like to make my own tests and quizzes. And then by county standards

> we're supposed to make the tests worth 70% of the grade so that's another thing. We have these really hard tests and then they affect the grade so much. I try to balance that out by making quizzes. I'll give one test and one quiz per chapter that kind of balance each other out because I make my quizzes intentionally easier to try and help the grades. The testing is awful. (Samantha, an early-career outlier, personal communication, March 29, 2007)

While the district assessment system promotes standardization, teachers can be left feeling out of the loop. Furthermore, teachers can feel that they are not trusted by the district to create meaningful assessments or to set appropriate standards of achievement.

The impact of testing and curriculum guides was also frequently listed as an obstacle to teaching. Teachers expressed that they felt 'constricted by state tests', that there was 'too much emphasis on scoring high on state tests rather than looking at individual improvement', and that the state tests 'dictate what is taught'. One teacher went as far as to state that teaching is shut down in February to 'teach to the MSA'. In terms of curriculum, teachers were just as critical. Teachers explained that having a 'standard curriculum' meant a 'loss of creativity' and a 'loss of control' regarding what is taught each day. Not only is the curriculum 'inflexible', but the pacing guides force teachers to feel as though they 'can't slow down to review or show alternate ways of doing problems' and the result is that '1 day = 1 objective'. Mathison and Freeman found this same sense of resentment and frustration in teachers when the implementation of state tests reduced the decision-making control of teachers (2006).

Overloaded

Survey responses indicated that participants felt overloaded by their job responsibilities. One teacher put it succinctly – 'too much to do, too little time'. Teachers reported being held more accountable for student learning while having less time to plan, less time to teach, larger class sizes, and less prepared students. Many teachers remarked that 'planning time is being taken by meetings' and one teacher even pleaded 'just leave me along to do what I was hired to do…teach!' Lack of time has long been a concern raised by teachers (Campbell & Neill, 1990; Lortie, 2002; Travers & Cooper, 1996) and class size has frequently been cited as a source of pressure (Campbell & Neill, 1990; Conley et al., 1989; Travers & Cooper, 1996). Although individually these issues may not be cause for alarm, it is the compounding effect which can result in feelings of role overload.

Having been a teacher myself, I thought I had a good sense of the burden teachers were reporting. It was my interview with Samantha that truly opened my eyes to what some teachers now face. Samantha detailed her planning time as follows:

> Ok, a typical planning period I have a meeting almost, I guess out of the five days a week, I have a meeting three days a week during planning. During the two that I don't have meetings, I do actually plan. The first fifteen minutes I usually clean up my room a little, erase the boards, put up what I want for the next day. Then I'll work on anything that I need to work on for the next day if I haven't done it or later in the week. The other days, Tuesdays we have collaborative planning. So all the 8th grade math teachers get together and we're supposed to plan lessons together. But because we're all at different stages, sometimes we plan some things,

> we talk about games that we could use, but usually not much gets done. We just complain about how the kids aren't learning anything. Then Wednesdays we have team meetings just to go over general school information. Then Thursdays sometimes we have a technology meeting, sometimes we have a triple ST which I don't even know what that is. But it's basically to talk about students who we think are having problems at school. Bring up any new students, talk about how the old students who we've tried to intervene see if they're doing better or not. Monday and Friday we have to plan. On Mondays and Fridays, I usually get almost everything done that I want to get done unless I have a lot of grading to do then I have to do some at home. But I think that if I had every day, if I had an hour and a half of planning, I think that I would probably get most of it done. Because of the meetings, I do have to do work outside of school. (Samantha, an early-career outlier, personal communication, March 29, 2007)

While the lack of planning time is not enough to drive someone out of teaching, Samantha faced other obstacles which did ultimately lead to her quitting at the end of the year. She had been assigned classes with the lowest-ability students in a school that consistently failed to meet adequate yearly progress. She was criticized by the principal as needing to work on classroom management. When the regional math coordinator visited, she was chastised for falling behind the pacing guide. As a mathematics educator, it was disheartening to find out about Samantha's decision. I had been her teacher in a university course a year earlier and knew what a loss this was for the profession.

However, I know the losses are not just with novice teachers. Veteran teachers are also being driven out of teaching. Jane shared the following example of how the intense pressure from testing is impacting her personally:

> My principal said, "Boy, those test scores had better go up or someone will have it." But that's kind of a threatening thing to say "Those test scores had better go up." So you feel…as a person who has worked really, really hard "Oh my gosh, what am I doing wrong? I better be doing a better job than what I've been doing in the past." So you're pressured to get those kids to pass. Whether the kids like the math or not, those tests scores have got to go up. So I had the kids buy MSA prep books this year. And not that we went through every little lesson, but we had sample practice for the MSA and I thought "Boy, this is not how I used to teach." That was my answer to his "Those test scores had better go up." I sent a little letter home and had him approve it. And I said - we're going to get this, and it was lovely, it was a nice MSA coach book. $10 a child and we just practiced. That's like practicing for the SAT. That's like, every day in your math class, practicing for the SAT. Not discovering math, and not exploring concepts in math, and not gee, why is math important? (Jane, a late-career outlier, personal communication, March 17, 2007)

The same sense of pressure was mentioned by countless other survey participants in their list of obstacles to teaching. They described 'pressure from above', 'pressure to teach to the test', 'assessment stress', and 'being judged by the value of one test'. The recent shift towards increased accountability has certainly impacted the work load of teachers.

Strong Sense of Accomplishment

If mathematics teachers are overloaded with responsibilities and deprived of decision-making power, what makes them continue to teach? Based on participant responses to the survey items, I believe the overwhelming sense of accomplishment is a key factor. A number of participants cited ‘making a lasting impact on students’ and ‘positively influencing students’ as key assets to teaching. Mathematics teachers seemed particularly proud of ‘seeing students gain confidence in their abilities’ and ‘watching students brighten when they comprehend something for the first time’. One teacher remarked that it was ‘rewarding to see students who come into my classroom afraid of math suddenly start to enjoy math’. There appeared to be a common theme among participants of finding ‘satisfaction in helping others’ and ‘feeling good about helping the future of society’. What draws people to be mathematics teachers seems to also sustain many of them during difficult circumstances.

Comparison of Findings with Prior Research

In some ways, my findings regarding the working conditions of mathematics teachers confirm the general pattern of findings from other research. The lack of agency that I identified is consistent with Archbald and Porter’s conclusion that the more control districts assert (in terms of curriculum guides, centralized textbook adoptions, and standardized student testing), the less influence teachers have and the more influence state and district tests have on course content (Archbald & Porter, 1994). Work by Jeffrey and Woods determined that where instructional control resides was a source of tension (1998). As was the case with my participants, the researchers found that teachers desire flexibility and autonomy in their practice instead of a controlled and prescribed

curriculum pushed by the institution (school, district, state, or federal agency). The teachers I surveyed indicated that they would prefer creating their own assessments for students rather than using standardized ones. This belief was also shared by the teachers in the study by Jeffrey and Woods. In addition, the fact that teachers in my study felt more agency in instructional methods matches similar findings by Archbald and Porter.

The feeling of being overloaded was more prevalent in my study than in previous research. Almost 90% of my participants indicated that they felt pressure from the superintendent and the principal to raise test scores. In a similar survey of 4,000 teachers from 28 states, researchers found roughly half of teachers felt pressure from the superintendent and 40% felt pressure from the principal (Abrams et al., 2003). One ramification of increased accountability is the tendency to spend more time preparing for the test. Close to 90% of the teachers in my study reported spending more than 30 hours per year preparing students for the mandated tests. In comparison, fewer than half of the teachers surveyed by Abrams et al. responded similarly. Besides pressure from testing, teachers also face interruptions during class time and planning time which contribute to feelings of overload. More than half of my participants stated that their class time was reduced and over 70% stated that their planning time was often taken away. My findings on lack of time are consistent with results from numerous studies (Campbell & Neill, 1990; Lortie, 2002; McLaughlin & Shea, 1960; Rudd & Wiseman, 1962).

The finding which appears to be least compatible with previous research is the strong sense of accomplishment. Work by Maslach and her colleagues resulted in a definition of burnout consisting of emotional exhaustion, depersonalization, and reduced personal accomplishment (Maslach & Jackson, 1981, 1984; Maslach et al., 1997).

Although 60% of my participants reported feeling burned out, their responses do not completely fit Maslach's definition. For instance, depersonalization should appear as negative feelings toward clients if one is burned out (in the case of teachers, the clients are students). However, the teachers I surveyed expressed negative feelings directed at supervisors, not students. According to Maslach, teachers who are burned out would have a reduced sense of personal accomplishment indicated by dissatisfaction with their work. This was not the case for teachers in my study. Rather, almost 95% said they enjoyed teaching, over 90% felt they were a positive influence, and over 80% felt they were making significant progress with their students. The difference in findings may indicate that Maslach's Burnout Inventory is not entirely appropriate for teachers since it was created from data from people in a variety of service occupations and not specific to educators.

Implications

In just about any occupation, employees face a certain amount of pressure and stress. While a moderate degree of pressure can be effective, excessive pressure tends to be detrimental and possibly even debilitating (Hebb, 1972). Consequently, it is no wonder that many scholars have investigated issues of job stress and burnout. However, much has changed in society and in the field of education since Lortie published his classic work and Maslach created her well-known burnout inventory. What sets the present study apart from prior research is the focus on mathematics teachers within the current climate of accountability.

This study set out to describe the quality of work life of mathematics teachers. So what is the verdict? It is mixed - there are aspects which should be praised and continued and then there are aspects which are concerning and need action.

The Good News

A number of promising findings give me hope for the future of our mathematics teacher corps. First, mathematics teachers feel a strong sense of accomplishment. They thrive on seeing students learn, grow, and succeed in mathematics. Second, previous calls for increased professional interaction appear to be making a difference. Almost 75% of participants reported have common planning time with other mathematics teachers. Mathematics teachers are working with their peers to plan lessons, seek advice, and share ideas. These interactions provide teachers with a vital support system and should therefore continue to be maintained if not expanded.

Third, teachers generally agree with the mathematical content of the required tests and curriculum. Teachers believe that the content represents important concepts in mathematics. However, some teachers expressed concern that the content may not adequately prepare students for future work in mathematics. This seems to be a valid concern and one that should be investigated further. Finally, mathematics teachers feel good about the level of respect they receive from colleagues and parents. The sense of respect from colleagues is probably due to the interactions teachers reported having with their peers. For parents, respect for mathematics teachers seems to stem from the common perception of mathematics as both a challenging subject to learn and a difficult subject to teach.

The Bad News

Other findings are not quite so rosy and many appear linked in some manner to the push for accountability in mathematics. First, mathematics teachers do not feel that they are viewed as professionals by school and district administrators. This stance is conveyed by the dummy-proofing of teaching. For instance, more and more districts are removing teachers from the process of making assessments, creating curriculum, and even designing lessons. Instead, a select group of individuals dictates what, when, and how topics are taught and tested. Some mathematics teachers view this as a reduction of their role to simply delivering a set curriculum. Not only do teachers feel disempowered, they are also strongly opposed to what they see as exclusively teaching to the test. To address this source of tension, it is imperative that districts restructure the way curricula and assessments are designed. In particular, any new arrangement should provide teachers with more of a voice and more freedom to utilize their skills and knowledge in the classroom.

Second, lack of time surfaced as a serious problem. Planning time was taken up by mandatory meetings and instructional time was plagued by interruptions. at the same time, the amount of paperwork and the number of students needing extra support increased. If the situation is not remedied, the current shortage of mathematics teachers could reach a dire state. We must work to protect planning time so teachers are able to prepare quality lessons that address the diverse needs of their students. By reclaiming planning time, teachers can be free to improve their practice by observing and collaborating with peers. We must also take a firm stance against interruptions to

instruction. It is unreasonable to raise expectations while hindering teachers' ability to do their job.

Third, we must rethink how we hold mathematics teachers accountable for student learning. If we continue to focus solely on outcomes, we will erode teachers' sense of efficacy. Over and over again, participants decried that looking at outcomes was only half the picture. To teachers, progress is measured by where students start and how much they have grown. So rather than penalize teachers for the deficiencies of students, we should recognize and reward teachers' accomplishments. In this way, mathematics teachers will truly feel like effective practitioners.

Finally, we need to improve the support system for novice mathematics teachers. Samantha's first-year teaching experiences are not uncommon. In many schools, new teachers are assigned the most challenging students. The fortunate teachers are quickly taken under someone's wing, mentored, and looked after. However, many are left to fend for themselves. Even in schools where mentoring programs exist, new teachers may find that mentors are too busy to offer any help. During the critical first years of a teacher's career, we need full-time mentors who can offer suggestions, provide assistance, and give guidance. As teachers develop, the level of support can be gradually reduced. With proper support, it is likely that we can reduce the number of new teachers who quickly leave the profession.

Suggestions for Future Research

I can envision a number of valuable and interesting extensions of the current study. Due to the small proportion of elementary teachers in my sample, I believe it would be worthwhile to design and conduct a similar survey targeted specifically at

elementary teachers in order to more accurately assess their perception of tension. It would also make sense to expand the participant pool to include teachers from states across the nation. Such a study could provide a broader view of the impact of the No Child Left Behind Act. Likewise, I believe that a longitudinal study, measuring teacher working conditions over the course of a school year, could offer insights about sources of stress that a one-time survey cannot determine. In addition, the upcoming implementation of high-stakes testing in science education provides a unique opportunity to study the influence of the No Child Left Behind Act. A modified version of the survey could be created and administered to science teachers before and after mandated testing is implemented. No matter what direction any future research takes, I think it's important to consider what Jane said to me at the conclusion of her interview: "This is probably a really good study. This is not a typical math study, though. This is more of a - people's feelings and their attitudes. And it's nice that someone's doing a study like this" (Jane, a late-career, public middle school teacher, from a quartile 2, Baltimore region district, personal communication, March 17, 2007). Ultimately, it is important to give teachers a voice and essential to listen to what they have to say.

APPENDIX A: E-MAIL TO MCTM MEMBERSHIP

From:
Sent: Tuesday, October 31, 2006 12:34 PM
To:
Subject: Survey

Dear MCTM Member,

Teaching students mathematics is not an easy job. We deal with curriculum and pacing guides, standardized tests, parents, and administrators, just to name a few. While there is often media attention on policies and test scores, we rarely hear mention of the impact these and other issues have on teachers. This is your chance to share your perspective. I value your thoughts and I want to know more about what it feels like to teach math in an era of accountability and reform. Please fill out a brief survey about your perspectives.

To participate, visit the following website now or at a more convenient time
www.surveymonkey.com/s.asp?u=807472067978

By completing the survey, you could win a prize!
One $50 Target gift card
Twenty $20 Target gift cards

Many of the statements in this survey come from my own experiences teaching mathematics in Maryland. Your responses will be summarized and the findings shared with the MCTM executive board so that they can better serve as a voice for Maryland mathematics teachers. The results of this survey will also be used for my dissertation research. In all cases, your responses will remain confidential.

Responses will be accepted until November 17, 2006. If you have any questions about the survey, please contact me at tomayko@umd.edu

Thank you in advance for your support in this effort.

To participate, visit the following website now or at a more convenient time
www.surveymonkey.com/s.asp?u=807472067978

Sincerely,

Ming Tomayko
College of Education
University of Maryland, College Park

APPENDIX B: FLYER DISTRIBUTED AT MCTM ANNUAL CONFERENCE

Do you teach math?

Then voice YOUR perspective!

Go online to
www.surveymonkey.com/s.asp?u=807472067978
and take a brief survey.
Your responses will provide valuable information
about teaching math in an era of accountability and reform.
All responses will be confidential.

YOU could **WIN:**

- **A $50 Target gift card**
- **One of twenty $20 Target gift cards**

Complete the survey by November 17, 2006.
Questions?
Contact Ming Tomayko at tomayko@umd.edu

YOUR input is important

Please copy and circulate this flyer

APPENDIC C: CONSENT FORM FOR ONLINE SURVEY

Working Conditions of Maryland Mathematics Teachers Exit this survey >>

Consent Form

Project Title
An Examination of the Working Conditions, Challenges, and Tensions Experienced by Mathematics Teachers

Purpose
I, Ming Tomayko, a doctoral student at the University of Maryland, College Park, am conducting this research project as a dissertation study under the direction of my advisor, Dr. James Fey. The purpose of this research project is to describe the working conditions of mathematics teachers in Maryland. I am inviting you to participate in this research project because you are a mathematics teacher.

Procedures
The procedures involve completing an Internet survey which will take approximately **15** minutes. The survey includes statements such as "The tests I am required to give reflect what I believe is important in mathematics" and "My school's math program enables students to work at the pace that is best for them". You will be asked to indicate if you agree or disagree with the statements. As part of the survey, you will be asked if you would be willing to participate in a follow-up interview. If you agree to be considered for the follow-up interview, you will be asked to provide your e-mail address so that I may contact you. By completing the survey and providing your e-mail address, you will be entered in a drawing to win a **$50** Target gift card or one of twenty **$20** Target gift cards.

Confidentiality
I will do my best to keep your personal information confidential. The following procedures will be used to maintain your confidentiality: (1) the survey is anonymous and will not contain information that may personally identify you; (2) the survey data will be stored on a password-protected personal computer at my home; (3) the survey data you provide will be grouped with the data of others for reporting and presentation; (4) all print data will be stored in locked filing cabinets in my home; and (5) only my dissertation committee and I will have access to this data. After fifteen years, all computer files containing survey data will be deleted and all print data will be shredded. If I write or present a report or article about this research project, your identity will be protected to the maximum extent possible. Information that I collect will only be shared with representatives of the University of Maryland, College Park or governmental authorities if you or someone else is in danger or if we are required to do so by law.

Risks and Benefits
The survey statements may prompt you to reflect on or recognize possible tensions in your work. This may lead to dissatisfactions you might not otherwise have considered. While this research is not designed to help you personally, it will give you the opportunity to be involved in professional research and to voice your thoughts and opinions. I hope that in the future, other people might benefit from this study through improved understanding of issues related to teaching mathematics in Maryland.

Freedom to Withdraw

Your participation in this research is completely voluntary. You may choose not to participate and complete the survey. If you decide not to participate in this study, you will not be penalized or lose any benefits to which you otherwise qualify.

Contact Information

If you have any questions about this research study, please contact Ming Tomayko (tomayko@umd.edu; 301-537-6809) or Dr. Fey (jimfey@umd.edu; 301-405-3151) at 2311 Benjamin Building, Department of Curriculum and Instruction, University of Maryland, College Park. If you have questions about your rights as a research subject or wish to report a research-related injury, you can contact: Institutional Review Board Office, University of Maryland, College Park, Maryland, 20742; (e-mail) irb@deans.umd.edu; (telephone) 301-405-0678. This research has been reviewed according to the University of Maryland, College Park IRB procedures for research involving human subjects.

Statement of Age of Subject and Consent

Your consent below indicates that: You are at least 18 years of age; the research has been explained to you; your questions have been fully answered; and you freely and voluntarily choose to participate in this research project.

*** Please respond to one of the following:**

- ◡ I have read the statement above and agree to participate.
- ◡ I am not willing to participate.

<< Prev **Next >>**

APPENDIX D: ONLINE SURVEY INSTRUMENT

Working Conditions of Maryland Mathematics Teachers Exit this survey >>

Demographic Information

Thank you for volunteering to fill out this survey on working conditions of Maryland mathematics teachers.
To help us better analyze the data, we need to collect some demographic information.

* **Gender**

Female Male

* **I currently teach in a**

Public school Private school

* **Please enter the name of the school district where you are currently employed in the space below.**

* **Please state your teaching experience in years in the space below.**

* **My primary teaching responsibility is in grades**

K-2 3-5 6-8 9-12

* **Please state the grade(s) and/or subject(s) you are currently teaching in the space below.**

<< Prev Next >>

Working Conditions of Maryland Mathematics Teachers

Exit this survey >>

* As part of this study, we are interested in interviewing participants about their survey responses. If selected, you will be interviewed at a time and place convenient to you for approximately 1 hour and given a **$100** stipend for your time.

I would be willing to participate in a follow-up interview about my survey responses.

- No, thank you.
- Yes, I can be contacted at the following e-mail address

* **I would like to be sent a copy of the survey results.**

- No, thank you.
- Yes, please send the results to the following e-mail address

****

By providing your e-mail address, you will be entered in a drawing to win a $50 Target gift card or one of twenty $20 Target gift cards.

****

<< Prev Next >>

Working Conditions of Maryland Mathematics Teachers

Exit this survey >>

*

	Strongly Disagree	Disagree	Agree	Stongly Agree
The **tests** I am required to give reflect what I believe is important in mathematics.	○	○	○	○
The **tests** I am required to give significantly influence the **content** of my math course(s).	○	○	○	○
The **tests** I am required to give significantly influence the **methods of instruction** used in my math course(s).	○	○	○	○
I teach topics that are not on the required **math tests**.	○	○	○	○
I spend more than 30 hours per year preparing students specifically for the required **math tests**.	○	○	○	○
The **curricular materials** I am required to use reflect what I believe is important in mathematics.	○	○	○	○
The **curricular materials** I am required to use significantly influence the **content** of my math course(s).	○	○	○	○
The **curricular materials** I am required to use significantly influence the **methods of instruction** used in my math course(s).	○	○	○	○
I teach topics that are not in the required **mathematics curriculum**.	○	○	○	○
The NCTM *Principles and Standards for School Mathematics* reflect what I believe is important in mathematics.	○	○	○	○

Please use this space to elaborate on any of your responses.

<< Prev Next >>

Working Conditions of Maryland Mathematics Teachers

Exit this survey >>

*	Strongly Disgree	Disagree	Agree	Strongly Agree
The NCTM *Principles and Standards for School Mathematics* significantly influence the **methods of instruction** used in my math course(s).	○	○	○	○
The NCTM *Principles and Standards for School Mathematics* significantly influence the **content** of my math course(s).	○	○	○	○
Teachers participate actively in **selecting math texts and materials** that are used in my school.	○	○	○	○
Teachers participate actively in making decisions about **what will be taught** in math courses.	○	○	○	○
Teachers participate actively in determining **what mathematical topics will be tested**.	○	○	○	○
Teachers participate actively in determining appropriate **instructional methods** for mathematics.	○	○	○	○
Uniformity and standardization of **instructional methods** in math is important in my **district**.	○	○	○	○
Uniformity and standardization of **mathematical content** is important in my **district**.	○	○	○	○
I feel pressure from my district **superintendent** to raise scores on required **math tests**.	○	○	○	○
I feel pressure from my **principal** to raise scores on required **math tests**.	○	○	○	○

Please use this space to elaborate on any of your responses.

<< Prev Next >>

Working Conditions of Maryland Mathematics Teachers

Exit this survey >>

*	Strongly Disagree	Disagree	Agree	Strongly Agree
My **school** and my **district** have the **same values** regarding math **content**.				
My **school** and my **district** have the **same philosophy** regarding math **instruction**.				
At my **school**, teachers maintain high standards of performance for themselves in teaching mathematics.				
At my **school**, I am allowed to teach math in my own style.				
My own **beliefs** about what mathematical topics are important significantly impacts the **content** of my math course(s).				
My own **knowledge** of mathematical topics significantly impacts the **content** of my math course(s).				
I can decide **which** particular **topics** are taught in my math course(s).				
I am encouraged to **modify** the **mathematics curriculum** to meet my own students' needs.				
I can decide **when** particular **topics** are taught in my math course(s).				
I have control over setting standards for achievement in my math classes.				

Please use this space to elaborate on any of your responses.

<< Prev Next >>

Working Conditions of Maryland Mathematics Teachers

Exit this survey >>

	Strongly Disagree	Disagree	Agree	Strongly Agree
The main course **textbook** significantly influences the **methods of instruction** used in my math course(s).	○	○	○	○
The main course **textbook** significantly influences the **content** of my math course(s).	○	○	○	○
The **content** of my math course(s) is determined by what my students need for future study and work.	○	○	○	○
The **content** of my math course(s) is determined by what my students are capable of understanding.	○	○	○	○
The **curriculum** for my math course(s) is **too difficult** for my students.	○	○	○	○
The **curriculum** for my math course(s) is **not challenging** my students.	○	○	○	○
Uniformity and standardization of mathematics **curriculum** is important to the **parents** at my school.	○	○	○	○
Uniformity and standardization of **instructional methods** in math is important to the **parents** at my school.	○	○	○	○
Most of my students' **parents** support the things I do in teaching math.	○	○	○	○
I feel pressure from **parents** regarding the **math placement** of their child.	○	○	○	○

Please use this space to elaborate on any of your responses.

<< Prev Next >>

Working Conditions of Maryland Mathematics Teachers

Exit this survey >>

	Strongly Disagree	Disagree	Agree	Strongly Agree
The students I work with are placed in the math course most appropriate for them.				
My school's mathematics program enables students to work at the pace that is best for them.				
I attend professional conferences on a regular basis.				
I subscribe to and frequently use mathematics teaching publications.				
I often feel satisfied with my job in teaching mathematics.				
My class time for math is often constrained by administrative tasks (taking attendance, tardy students, public announcements).				
If I spend the majority of my time helping students develop proficiency in math skills and procedures, then the students will perform well on accountability tests.				
I feel as though I am positively influencing other people's lives through my work as a math teacher.				
I feel as though I am making significant academic progress with my math students.				
My success or failure in teaching students math is due primarily to factors beyond my control rather than to my own effort and ability.				

Please use this space to elaborate on any of your responses.

Working Conditions of Maryland Mathematics Teachers

Exit this survey >>

	Strongly Disagree	Disagree	Agree	Strongly Agree
Teachers are a very powerful influence on student math achievement when all factors are considered.	○	○	○	○
Evaluation of my math teaching is used to help me improve.	○	○	○	○
My students' gains on math achievement tests are a good way for **others** to judge my instructional effectiveness.	○	○	○	○
My students' gains on math achievement tests are a good way for **me** to judge my instructional effectiveness.	○	○	○	○
The methods used in evaluating my math teaching are objective and fair.	○	○	○	○
My **principal** recognizes the good math teaching I do.	○	○	○	○
Other teachers in my school recognize my math teaching competence.	○	○	○	○
The **parents** at my school recognize the good math teaching I do.	○	○	○	○
My **students** recognize the good math teaching I do.	○	○	○	○
My **students** show that they appreciate me as a math teacher.	○	○	○	○

Please use this space to elaborate on any of your responses.

<< Prev Next >>

Working Conditions of Maryland Mathematics Teachers

Exit this survey >>

*	Strongly Disagree	Disagree	Agree	Strongly Agree
Other teachers at my school often seek my advice about professional issues.				
I often observe other teachers to gain insights about mathematics content and pedagogy.				
My experience in the teaching profession has diminished my enthusiam for teaching math.				
I am less idealistic about teaching now, then when I entered the profession.				
I am philosophically at odds with ways that I am expected to teach math.				

*	0	1-2	3-4	>4
I regularly share teaching ideas with ___ other teachers.				

*** I have common planning time with other mathematics teachers.**

Yes No

Please use this space to elaborate on any of your responses.

<< Prev Next >>

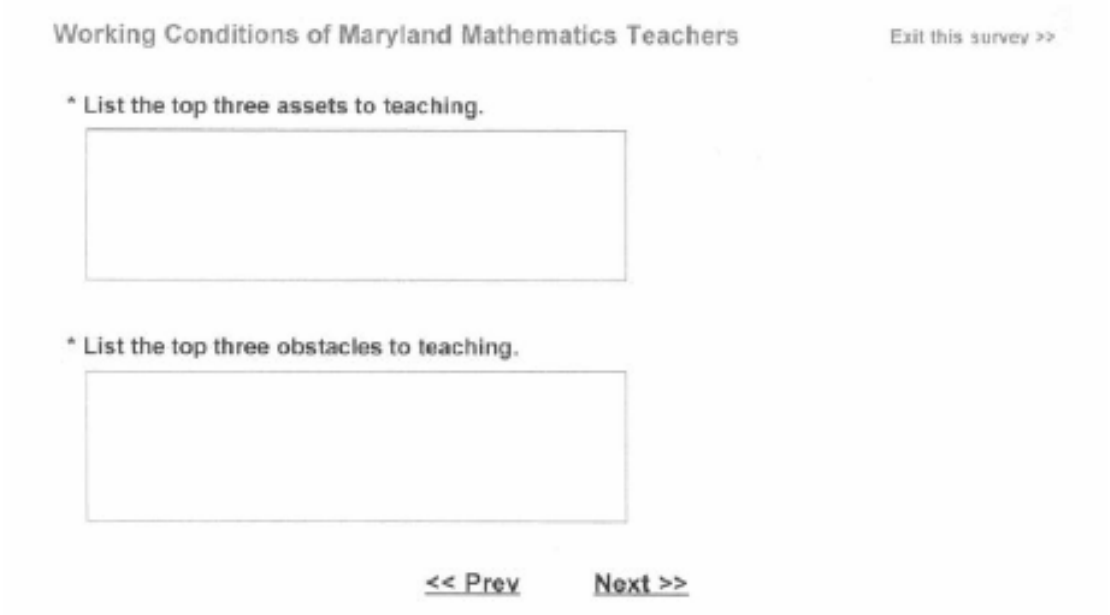
Working Conditions of Maryland Mathematics Teachers

Exit this survey >>

*	Strongly Disagree	Disagree	Agree	Strongly Agree
My planning time is often taken away due to academic responsibilities (IEP meetings, helping students, proctoring make-up assessments, covering class for an absent colleague, grading papers)	○	○	○	○
My planning time is often taken away due to non-academic responsibilities (hall duty, lunch duty, bus duty, etc.)	○	○	○	○
I enjoy teaching.	○	○	○	○
I often feel frustrated by teaching in general.	○	○	○	○
I am pleased with the progress my students make in math.	○	○	○	○
I often feel frustrated by uncontrollable factors of my job.	○	○	○	○
I feel a sense of pride in my work at my school.	○	○	○	○
I often feel burned out from my work.	○	○	○	○
I feel good about my math teaching style and strategies.	○	○	○	○
I know exactly what is expected of me in math instruction.	○	○	○	○

Please use this space to elaborate on any of your responses.

<< Prev Next >>


Working Conditions of Maryland Mathematics Teachers
Exit this survey >>
* List the top three assets to teaching.
* List the top three obstacles to teaching.
<< Prev
Next >>

APPENDIX E: E-MAIL TO RESPONDENTS WITH INCOMPLETE SURVEYS

From: Ming Tomayko [tomayko@umd.edu]
Sent: Monday, November 13, 2006 9:27 PM
To:
Subject: Working Conditions Survey

Dear Teacher,

Recently, you began taking but did not complete a survey about working conditions of math teachers. Due to the nature of the study I am conducting, it is necessary to have complete responses. I hope you will consider revisiting the following website before Friday, November 17th. www.surveymonkey.com/s.asp?u=807472067978

Again, thank you for taking time out of your very busy schedule to share your perspectives on this important issue. If you have any questions about the survey, please contact me at tomayko@umd.edu

Sincerely,

Ming Tomayko
College of Education
University of Maryland, College Park

APPENDIX F: E-MAIL TO TEACHERS SELECTED FOR AN INTERVIEW

From: Ming Tomayko [tomayko@umd.edu]
Sent: Monday, March 05, 2007 4:26 PM
To:
Subject: Math Teacher Survey Interview Request

Dear Math Teacher:

Last fall, you participated in an online survey of Maryland Math teachers. You indicated your willingness to participate in a follow-up interview about your survey responses. I am writing because you have been selected as one of the teachers I would like to interview. The interview can be scheduled at a time and place convenient to you and will last approximately one hour. Your responses will remain confidential and you will be compensated with a $100 stipend for your time.

Please contact me by Monday March 12th at tomayko@umd.edu if you are still willing to participate or if you have any questions about the interview.

Thank you,

Ming Tomayko
tomayko@umd.edu
College of Education
University of Maryland, College Park

APPENDIX G: CONSENT FORM FOR INTERVIEW

TEACHER INTERVIEW CONSENT FORM

Project Title

An Examination of the Working Conditions, Challenges, and Tensions Experienced by Mathematics Teachers

Purpose

This is a research project being conducted by Ming Tomayko, a doctoral student at the University of Maryland, College Park as a dissertation study under the direction of her advisor, Dr. James Fey. The purpose of this research project is to describe the working conditions of mathematics teachers in Maryland. I am inviting you to participate in this research project because you are a member of the Maryland Council of Teachers of Mathematics and you are a mathematics teacher.

Procedures

The procedures involve being interviewed by the researcher for approximately one hour. The interview will be audio taped and include questions regarding selected responses from your survey. You will be asked to provide more information about your responses to the survey. If you choose to participate in this interview, you will be compensated with a $100 stipend for your time. To qualify for the stipend, you must provide your Social Security number.

Confidentiality

This research project involves making audiotapes of you. I will do my best to keep your personal information confidential. The following procedures will be used to maintain your confidentiality: (1) you will be assigned another name (a pseudonym) in all written records of this research; (2) transcripts of the interview will be stored on a password-protected personal computer at my home; (3) all print data and audiotapes will be stored in locked filing cabinets in my home; and (4) only my dissertation committee and I will have access to the audio taped and transcribed data. After fifteen years, all computer files containing transcripts will be deleted and all audiotapes will be destroyed by breaking the case and cutting the tape. If I write or present a report or article about this research project, your identity will be protected to the maximum extent possible. The information that I collect will only be shared with representatives of the University of Maryland, College Park or governmental authorities if you or someone else is in danger or if I am required to do so by law.

Please check next to the appropriate statement below:

__ I agree to be audio taped during my participation in this study

__ I do not agree to be audio taped during my participation in this study

Risks and Benefits

The interview questions may prompt you to reflect on or recognize possible tensions in your work. This may lead to dissatisfactions you might not otherwise have considered. While this research is not designed to help you personally, it will give you the opportunity to be involved in professional research and to voice your thoughts and opinions. I hope that in the future, other people might benefit from this study through an improved understanding of issues related to teaching mathematics.

Freedom to Withdraw

Your participation in this interview is completely voluntary. You may choose not to take part at all. If you decide not to participate in this interview you will not be penalized. If you decide to participate in this interview, you may refuse to answer any question. If you refuse to answer any question, you will not lose any benefits to which you otherwise qualify.

Contact information

If you have any questions about this research study, please contact Ming Tomayko (tomayko@umd.edu; 301-537-6809) or Dr. Fey (jimfey@umd.edu; 301-405-3151) at 2311 Benjamin Building, Department of Curriculum and Instruction, University of Maryland, College Park. If you have questions about your rights as a research subject or wish to report a research-related injury, you can contact: Institutional Review Board Office, University of Maryland, College Park, Maryland, 20742; (e-mail) irb@deans.umd.edu; (telephone) 301-405-0678. This research has been reviewed according to the University of Maryland, College Park IRB procedures for research involving human subjects.

Statement of Age of Subject and Consent

Your signature below indicates that: You are at least 18 years of age; the research has been explained to you; your questions have been fully answered; and you freely and voluntarily choose to participate in this research project.

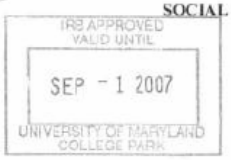
Signature and Date

NAME OF SUBJECT: _____

SOCIAL SECURITY NUMBER OF SUBJECT: _____

SIGNATURE OF SUBJECT: _____

DATE: _____



APPENDIX H: SAMPLE INTERVIEW PROTOCOL

I'll start by giving you a little background about myself and how I became interested in studying the working conditions of math teachers. From an early age, I knew I wanted to teach math. I was successful with math and enjoyed helping others when they had difficulty. After earning a teaching degree, I worked as a substitute and then as a high school math teacher in a public school district in Maryland. From my own experiences and from conversations with other math teachers, issues surrounding the impact of working conditions kept coming up. As a result, I decided to investigate further and found a lack of recent research about this topic. Given the increased emphasis on assessment and standards over the past few years, I felt that not only would this be worth studying but the findings from my research might help improve the working conditions of teachers.

Now that you know a little about me, I'd like to find out more about you as a math teacher. I just want to reiterate that anything that is said during the interview will be treated confidentially and if at any time you would rather not answer a question, you may choose to pass. Do you have any questions before we begin?

I thought we could begin by having you tell me about how you came to be a math teacher.

Describe for me what happens during your typical planning period.

How do you decide what to teach on any given day?

Could you tell me about your feelings regarding the state test and how it impacts your teaching? Do you agree with the content of the test? Is it appropriate for your students?

You stated on your survey that you felt pressure from the superintendent and principal to raise test scores. In what ways do the superintendent and principal pressure you to raise scores on required math tests? Are test scores related to your job evaluations?

Let's talk about your feelings regarding the curriculum you use and how it impacts your teaching. (how appropriate is the content, how does it influence your methods, how appropriate is it for your students in terms of difficulty and usefulness, can you modify it for your students)

Who decides what, when, and how topics will be taught and tested?

On your survey, you stated that your school and your district had different values regarding math content and different philosophies regarding math instruction. Can you tell me more about these differences?

You indicated on your survey that uniformity and standardization of teaching methods and content were very important in your district. How is this message conveyed to you?

Do you feel that your skills and knowledge are being utilized as a math teacher? Could you give me an example of this?

Do you feel that the principal, other teachers, parents, and students recognize the good math teaching that you do? If so, how?

Could you tell me about your interactions with parents (how are they supportive, how do they pressure you, is it easy to contact them, are they involved)?

On your survey; you indicated that you felt your success or failure in teaching students math was due primarily to factors beyond your control. Could you tell me about some of these factors?

Teachers often experience change in their beliefs or practices over time. I realize that it's been less than a year since you started teaching but could you tell me about changes you have already noticed in your own beliefs or practices?

What do you consider to be the ideal teaching environment?

I'd like to show you some of the data from the survey and get your thoughts on the responses. Why do you think teachers responded this way? (Show histograms of strand scores and provide examples of items in each strand)

If you can recall, what were your feelings when you completed the survey?

I really appreciate you taking the time to meet and talk with me about your teaching experiences. Do you have any questions for me?

APPENDIX I: PROGRAM CODE FOR VELICER'S MINIMUM AVERAGE PARTIAL PROCEDURE

O'Connor, B. P. (2000). SPSS and SAS programs for determining the number of components using parallel analysis and Velicer's MAP test. *Behavior Research Methods, Instrumentation, and Computers, 32*, 396-402.

```
set printback=none width=80  seed = 1953125   mxloops=9000.

compute cr = {due to the large number of variables in the data set, the correlation matrix
is not included here}.

call eigen (cr,eigvect,eigval).
compute loadings = eigvect * sqrt(mdiag(eigval)).
compute fm = make(nrow(cr),2,-9999).
compute fm(1,2) = (mssq(cr)-ncol(cr))/(ncol(cr)*(ncol(cr)-1)).
loop #m = 1 to ncol(cr) - 1.
compute a = loadings(:,1:#m).
compute partcov = cr - (a * t(a)).
compute d = mdiag( 1 / (sqrt(diag(partcov))) ).
compute pr = d * partcov * d.
compute fm(#m+1,2) = (mssq(pr)-ncol(cr))/(ncol(cr)*(ncol(cr)-1)).
end loop.

* identifying the smallest fm value & its location (= # factors).
compute minfm = fm(1,2).
compute nfactors = 0.
loop #s = 1 to nrow(fm).
compute fm(#s,1) = #s -1.
do if ( fm(#s,2) < minfm ).
compute minfm = fm(#s,2).
compute nfactors = #s - 1.
end if.
end loop.

print /title="Velicer's Minimum Average Partial (MAP) Test:".
print eigval  /title="Eigenvalues" /format "f12.6".
print fm /title="Velicer's Average Squared Correlations"/format "f12.6".
print minfm/title="The smallest average squared correlation is"/format "f12.6".
print nfactors /title="The number of components is".

end matrix.
```

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