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Middle Level Science: A Mixed-Methodology Study of the Impact of the Pennsylvania System of School Assessment (PSSA) on Curriculum and Instruction

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MIDDLE LEVEL SCIENCE: A MIXED-METHODOLOGY STUDY OF THE IMPACT OF THE PENNSYLVANIA SYSTEM OF SCHOOL ASSESSMENT (PSSA) ON CURRICULUM AND INSTRUCTION

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Title: Middle Level Science: A Mixed-Methodology Study of the Impact of the Pennsylvania System of School Assessment (PSSA) on Curriculum and Instruction

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Using a mixed methodology approach, this study examined the impact of the implementation of the science PSSA on the curriculum and instructional practice of eighth-grade teachers. It was hypothesized that despite the specter of PSSA influence on the academic climate, teachers are not necessarily influenced to change instructional practices, even if the curriculum has changed. A tripartite framework of change theory, motivational theory, and efficacy beliefs provided the lens through which this study was analyzed.

Eleven eighth-grade science teachers from south central Pennsylvania completed an online survey composed of questions to ascertain change followed by four modified surveys to assess motivation and efficacy beliefs. For analysis, respondents were placed into two groups. Group 1 was defined by whether or not there was a change in the curriculum. Group 2 was defined by an expectation of change to instructional practices. The motivation and self-efficacy and collective efficacy beliefs of these teachers were analyzed using descriptive statistics for both Group 1 and Group 2.

Supporting data was acquired through a focus group discussion and interviews with five volunteers from the eleven participants. The same questions were used for the focus group discussion and the interviews. The researcher transcribed the conversations and supporting statements were used to strengthen conclusions.

The results from this study reveal that the majority of these teachers experienced a change in the science curriculum and more than half were expected to change their instructional methods. Their motivation is positively affected by the financial, administrative and professional supports they receive; their context beliefs were high. For those who experienced a change in curriculum, their motivation was negatively affected very slightly; those who did experience a change in curriculum showed slightly motivated. Self-efficacy beliefs were above average for both Groups of participants and collective efficacy beliefs were high for both groups.

In summary, despite the changes made to curriculum and expectation of change to instructional practices, the participants remain motivated and believe that as individuals and as a group, they felt they were capable of helping students learn.

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The past six years have marked the final, uphill part of a journey that began in 1994. After graduation, when I received my Master's degree, I turned to my husband Terry and emphatically stated: "I WANT THOSE [doctoral] STRIPES!" This became my goal and one I could not accomplish by myself. The support and encouragement I received from the people in my life has been phenomenal and I would like to acknowledge them now.

There are no words to express the depth of my gratitude for my husband, Terry, for the support and encouragement he gave me while I worked for my stripes. He spent many evenings alone while I worked in the next room, shouldered the bulk of the household chores, and took our son to his soccer games while I traveled to Monroeville to attend my classes. I am grateful to my son, James, who, when I expressed doubt about my decision to start this journey when he started high school, told me I could not quit. "We are proud of you!" Finally, though grown and living on their own, I am grateful for the encouragement and support from my daughters Jackie and Stephanie. There were times when I had to choose my doctoral work over time with my "girls". I can't wait to do this again. I love you all very deeply.

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To those of you who have a dream: Just do it! (Nike) One step at a time, one bite at a time, one small goal at a time- it is possible...and so worth it.

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CHAPTER ONE

THE PROBLEM

Children are sent to school to learn a wide variety of subjects, but school reform has shifted the focus of learning to what essentialists consider to be the core subjects (Ornstein, 2007). Public schools are currently mandated to assess student progress in these core areas of reading, writing, math, and science (Paige & Hickok, 2004). Pennsylvania's science assessment, added within the last few years, has brought additional attention to science instruction. Effective science instruction is an important factor influencing the outcome of these assessments. A sense of urgency to achieve successful assessment results places added pressure on science teachers and may affect their individual and collective instructional practices.

Introduction

In 2002, President George W. Bush signed the No Child Left Behind (NCLB) Act. The purpose of NCLB is to ensure that all children are provided with the opportunity to receive a high quality education (Paige & Hickok, 2004) and to achieve and leave school proficient in state achievement standards and academic assessments ("The Pennsylvania Bulletin: Compliance with the No Child Left Behind Act of 2001," 2002). To measure and report academic achievement and to satisfy public demand for accountability, these standardized assessments are used to test students (Black & Wiliam, 2007). Assessment results and state progress objectives are disaggregated by poverty level, race, and ethnicity; disability; and limited English proficiency to ensure no group is left behind ("The No Child Left Behind Act of 2001," 2002). These assessments measure

a child's annual progress in reading and math in grades 3 through 8 and at least once in grades 9 through 12. Pennsylvania science assessments are required once during grades 3 through 5, 6 through 9, and 9 through 12 (Paige & Hickok, 2004).

In 1999, before the enactment of NCLB, Pennsylvania introduced the Pennsylvania System of School Achievement (PSSA) to measure student success in meeting state standards. These first tests targeted writing, speaking, listening, reading, and mathematics and required testing of all students in grades 5, 8, and 11. When NCLB was passed in 2002, adjustments were made to the PSSA to comply with the mandates of NCLB. The PSSA provides an annual update on students' strengths and weaknesses and allows teachers to monitor student progress (Pennsylvania Department of Education, n.d.a).

Academic standards vary state to state. In order to provide students with consistent and rigorous expectations for knowledge and skills that high school graduates need to succeed in college and career, the Council of Chief State School Officers (CCSSO) and the National Governors Association (NGA) Center developed the Common Core Standards for Best Practices. These Standards were written with input from representatives of participating states, educators, curriculum experts, researchers, national organizations, and community groups. The general public, parents, business leaders, and teachers provided feedback for development of the final draft. The standards of other high-performing nations provided the model for the Common Core (Common Core State Standards Initiative, 2010a).

In 2010, the Pennsylvania State Board of Education joined 46 other states in adopting the Common Core State Standards (Common Core State Standards Initiative,

2010b) in English, language arts, and mathematics which replaced the state standards first adopted in 1999 and later modified in 2002. Transition began during the 2010-2011 academic year and full implementation is expected by July 1, 2013 (Pennsylvania Department of Education, 2011a). As of this writing, the Common Core Standards also call for literacy in science. Students must be able to read, write and communicate scientific knowledge (Common Core State Standards Initiatives, 2010b). Common Core Standards are anticipated for science, and they will replace Pennsylvania's current standards when developed.

Statement of the Problem

The No Child Left Behind Act established the expectation that all students achieve at a "proficient" or "advanced" level on state assessments in language arts, reading, math, and science by 2014 (Paige & Hickok, 2004; "The No Child Left Behind Act of 2001," 2002). Each State was charged with developing the tests to assess student learning for adequate yearly progress (AYP), a measure of the minimum levels of improvement in student performance. The resulting PSSA assessments were based on challenging standards and statewide progress objectives in the core subjects. The number of students who meet AYP continues to be used as the measure of a school's performance (Pennsylvania Department of Education, n.d.b).

Pennsylvania determined AYP according to the following algorithm:

1. The lowest-achieving school or demographic group in the state is used to set a start point.
2. The level of achievement that marks AYP is then determined.

3. Subsequent thresholds must increase at least once every three years for 12 years (Paige & Hickok, 2004).

A second stipulation of NCLB requires each state to define performance levels in narrative and numerical forms. The narrative descriptors for the PSSA are Advanced, Proficient, Basic, and Below Basic. Performance Level Cut Scores numerically define each performance level with a range of scores. For eighth-grade science, as an example, a cut score below 1275 indicates students have not met AYP; a cut score above 1274 indicates proficient or advanced levels (Pennsylvania Department of Education, 2010). The cut scores will increase at least once every three years until 2014 (Paige & Hickok, 2004). In other words, as of this writing, schools continue to be challenged to see to it that their students make AYP.

According to Paige and Hickok (2004), NCLB mandated that ***all*** (emphasis) students in each state are to "be achieving at the proficient level in reading, language arts, math, and science (p. 27)". When AYP reports are published there is a note in the opening paragraphs preceding links to the reports that states "students must be 100% proficient in reading and math" (Pennsylvania Department of Education, 2011, 2012). Science is not mentioned, though it is mentioned by Paige and Hickok (2004). Though the expectation of 100% proficiency expectation is not explicitly stated by the Pennsylvania Department of Education, there same pressure to reach these levels in science is likely.

A summary of the challenges faced by middle schools presented by the PSSA follows:

- The cut scores increase at least once every three years until 2014 Paige & Hickok, 2004);
- The measure of AYP increases every year until it reaches 100% in 2014 (Hickok, 2004); and,
- The PSSA is administered to different groups of eighth-grade students each with their unique educational needs and differences.

An examination of PSSA scores in reading, math, science, and writing for the 2010-2011 and 2011-2012 years (see Table 1), reveals some interesting findings. The districts granting site approval are identified with letters for the purpose of anonymity; letters and numbers were used to identify a district's middle schools. The eighth-grade students in school districts A, C, E, G, and H met AYP in all tests. In school district B, middle school B2 met AYP for Reading in 2011 and failed to meet the increased AYP level.

The PSSA will continue to be used to measure AYP through grade 11. In addition, the Keystone Exams -- one component of Pennsylvania's new requirements for graduation -- are end-of-course exams that will be used to measure proficiency in the subject areas of algebra I, algebra II, geometry, biology, U.S. history, world history, civics and government, literature, and English composition. The Keystone Exams will be used as exit exams beginning with the graduating classes of 2015 and 2016 (Pennsylvania Department of Education, 2011b). Though the Keystone Exams are to be used as exit exams while the PSSA tests are used to measure yearly progress, PSSA scores may be viewed as a predictor for success on the Keystone Exam. As a result, eighth-grade science teachers may feel added pressure to prepare their students for the PSSA tests.

Table 1

2011 and 2012 AYP Results for Writing, Math, Reading, and Science PSSA Tests in Site Approved School Districts in South Central Pennsylvania

School District		PSSA Writing				PSSA Math				PSSA Reading				PSSA Science			
		2011		2012		2011		2012		2011		2012		2011		2012	
SD		Adv %	Pro %	Adv %	Pro %	Adv %	Pro %	Adv %	Pro %	Adv %	Pro %	Adv %	Pro %	Adv %	Pro %	Adv %	Pro %
A	MS1	17.5	66.7	14.4	66.4	61.3	27.5	63.4	23.4	73.2	16.7	67.9	21.3	38.4	40.3	33.8	39.5
	MS2	10.9	71.3	8.7	74.3	80.5	15.6	81.7	10.2	80.0	14.3	73.8	18.4	40.1	42.7	40.2	35.9
B	MS1	4.4	62.3	4.8	58.4	47.4	30.5	46.2	35.6	61.7	19.5	57.0	27.4	32.0	35.3	27.9	33.1
	MS2	19.2	64.2	7.1	76.0	44.0	35.6	47.4	29.3	63.4	17.8	52.1	27.2	26.9	39.4	24.7	40.9
	MS3	0.9	60.0	7.5	71.2	39.6	21.7	47.3	28.2	57.5	22.6	59.1	26.5	15.0	35.4	19.7	40.2
	MS4	7.3	72.5	3.3	73.6	37.6	26.6	48.4	29.8	58.3	25.0	68.8	11.2	31.5	22.2	25.0	37.1
C	MS1	18.3	62.1	24.7	61.7	58.5	28.0	69.9	21.2	66.7	21.4	75.0	16.7	26.8	36.0	35.1	38.3
	MS2	6.0	60.9	10.3	64.2	57.1	33.3	63.2	25.2	63.8	26.0	60.3	26.3	28.7	35.4	24.2	36.9
D	MS1	5.2	59.0	9.3	64.3	34.7	30.2	33.9	29.8	45.7	31.7	41.7	28.6	18.0	30.0	10.2	32.3
	MS2	8.6	61.2	9.5	74.2	55.0	24.9	70.4	20.7	58.4	25.1	44.3	37.9	21.0	41.0	25.1	42.5
	MS3	18.4	59.7	6.1	67.4	49.0	28.9	63.6	21.1	66.3	21.1	72.9	19.3	23.0	37.0	22.4	46.8
	MS4	4.9	66.7	8.7	76.4	28.6	31.6	35.5	25.3	38.1	28.4	40.9	23.1	9.8	21.1	11.5	29.1
E	MS1	3.2	77.4	14.1	70.6	47.3	35.2	47.6	32.1	58.2	27.5	61.9	29.8	21.1	40.0	28.0	43.9
F	MS1	0.7	75.9	2.2	55.1	46.2	34.2	49.6	24.8	45.1	32.8	46.3	37.3	19.7	40.2	26.1	38.4
G	MS1	17.5	70.1	16.2	66.5	53.8	33.3	47.2	34.2	65.9	21.8	69.5	18.4	32.2	41.6	30.5	38.3
H	MS1	12.9	68.1	16.2	66.5	73.4	18.5	47.6	32.1	80.0	13.6	61.9	29.8	43.9	39.5	44.3	40.2

In addition to their use as a measure of yearly progress, State assessments can also be an important part of the individual school's improvement plan (Stiggins, 1995). Assessments that measure AYP identify areas in which improvement is needed (Pennsylvania Department of Education, 2010). If AYP is not met after one year, teachers and administrators within the school have the option to develop and implement curricular and instructional changes. The goal is to improve test scores so that AYP is met before the school is labeled "in need of improvement." Under NCLB, a school is labeled "in need of improvement" when its students fail to reach AYP for two consecutive years in a particular subject area. When this happens, the school's administrators must create an improvement plan aimed at improving student achievement, thereby resulting in higher test scores (Paige & Hickok, 2004; Pennsylvania Department of Education, 2010).

Implementing a school or district-wide improvement plan or professional development program for teachers requires financial support from the state and the school district (Paige & Hickok, 2004; Pennsylvania Department of Education, 2010). In addition, the process of implementing change brings a level of anxiety and uncertainty to teachers (Fullan, 1985). Mandating that teachers engage in instructional or curricular changes to secure improvement is not likely to succeed because it is difficult, if not impossible, to order teachers to change their core, pedagogical beliefs. Such mandates for individual change induce concern, frustration, confusion, and disillusionment (Fullan, 2007). An understanding of teachers' beliefs and attitudes is important, therefore, in facilitating the change process (Pajares, 1992). Staff development programs and moral support from principals, colleagues, and administrators are necessary in order to bolster

confidence. However, the majority of staff development programs often fail because administrators tend to ignore two critical factors: (a) what motivates teachers to change, and (b) the process used to motivate teachers to implement change (Fullan, 2007; Guskey, 1986).

Motivation, however, is not the only variable to consider when curricular changes cause changes in instructional practices. It is teachers who control their level of involvement and engagement during reform (Beltman, 2009). When teachers feel a sense of control over the process and that their involvement will produce positive change, it is easier to affect their beliefs and attitudes, maintenance of motivation, and understanding about the importance of reform (Fullan, 1985; Guskey, 1986).

The time frame inherent in the process of change presents an additional challenge for teachers. Evidence of success comes months, sometimes the next year, after changes are implemented at the start of the school year, yet teachers are expected to maintain their motivation to modify instructional practices and change their attitudes and beliefs before experiencing the fruits of their efforts (Lumpe, Haney, & Czerniak, 2000).

Purpose of this Study

The Pennsylvania System of School Assessment (PSSA) measures student progress in math, language arts, reading, and science. Adequate Yearly Progress (AYP) results are sorted by subject and grade level (Pennsylvania Department of Education, n.d.b). The purpose of this study is to examine the impact of the science Pennsylvania System of School Assessment on the curricular and instructional practices of public school science teachers (see Figure 1). The subjects of this study will be eighth-grade science teachers who will be expected to implement mandated curricular changes and

strengthen instructional practices in order to improve or maintain PSSA scores and attain AYP. Since there is a link between effective instruction and student achievement (Pennsylvania Department of Education, 2010b), with students of effective teachers having better scores on standardized tests (Hines & Kristonis, 2010), then this link will be examined.

While it is more likely that only the middle schools that have not attained AYP in science will be the schools to implement curricular and instructional changes, it is possible that other middle schools will implement these changes to strengthen their science programs in an effort to maintain or improve AYP. In either situation, successful implementation of curricular and instructional changes could result in school improvement (Medina, 2010).

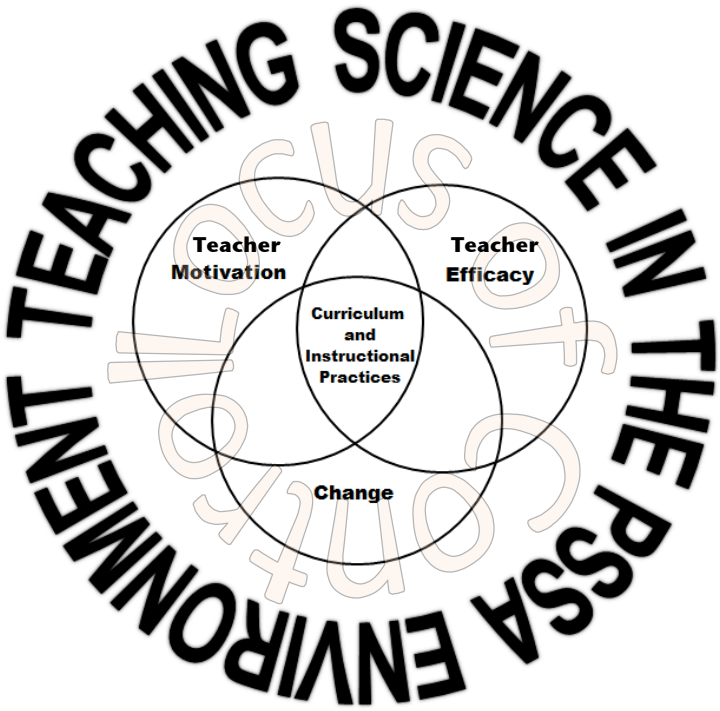

Figure 1. Graphic representation of this study's purpose.

Questions Addressed in this Study

The research questions that will frame this study are:

1. What is the impact of the science PSSA on the eighth-grade science curriculum?
2. What is the impact of the science PSSA on the instructional practices of eighth-grade science teachers?
3. How does teaching science in a PSSA environment affect teacher motivation?
4. How does teaching in a PSSA environment affect teacher efficacy beliefs (both self- and collective)?

Significance of this Study

As stated, the purpose of this study is to examine the impact of the Pennsylvania System of School Assessment (PSSA) on the curricular and instructional practices of eighth-grade science teachers who are expected to implement district-mandated curricular changes to eighth-grade science programs in an effort to improve or maintain adequate yearly progress (AYP). The science PSSA is a high-stakes test for which preparation can yield the negative effects of teaching to the test and narrowing of the science curriculum. Teacher motivation and self-efficacy beliefs are eroded if a perception of external control, rather than support, permeates the school culture during times of change (Ryan & Weinstein, 2009).

Change is a difficult, complex process (MacDonald, 2009) fraught with anxiety (Guskey, 1986). It involves changing belief systems (Pajares, 1992) and attitudes about teaching, as well as changing the culture in which teachers work (Ng, 2009). In order for instructional change to occur, teachers must be motivated to make needed changes, hold strong efficacy beliefs, believe they have control over the changes they are implementing

(Guskey, 1986; Ignat & Clipa, 2010), and expect a high probability for success (McClelland, 1989). Gibson and Dembo (1984) reported a positive correlation between teacher efficacy and student achievement.

At the time of Gibson and Dembo's study, little research existed on the topics of change, teacher efficacy, and motivation. Since then, more studies have been completing and more information has been learned. Teachers become learners when they become agents of reform (Ayendiz, 2009; Fullan & Hargreaves, 1992; MacDonald, 2009). In order to maximize successful implementation of change initiatives, an understanding of both personal factors and reform components is required (Beltman, 2009). It must be remembered that external controls and top-down mandates do little to cause real change (MacDonald, 2009); successful reform efforts first require that teachers possess a sense of control of their learning processes.

With this in mind, professional development programs that use a constructivist approach to engage participants facilitate change and bolster capability beliefs (Fullan and Hargreaves, 1992; Haney, Lumpe, Czerniak, & Egan, 2002; Johnson, 2009; Lanka, 2009; Ng, 2009) and cultivate an atmosphere of collegiality and collaboration that reinforces context beliefs (Haney et al., 2002; Ng, 2009).

Achieving competence, which leads to effective teaching and subsequent student achievement, requires motivation for change (Johnson, 2009). Successful reform involves giving attention to factors that influence teacher motivation (Lanka, 2009; Macdonald, 2009). One of these factors is teachers' self-efficacy beliefs (Bandura, 1993). Self-efficacy beliefs are developed through experience, reflection, and observations of colleagues. They play a vital role in the decision-making processes of

teachers that involve curricular planning and creating learning environments that promote learning and motivate students to achieve academically (Bandura, 1993; Ignat & Clipa, 2010; Pajares, 1992). Teachers' self-efficacy beliefs depend more on their intrinsic motivation toward teaching than on their intrinsic motivation toward performing complementary tasks. Complementary tasks are tasks associated with planning lessons, and grading papers but involve no student interaction (Fernet, Senecal, Guay, Marsh, and Dowson, 2008).

Teachers with a high internal *locus of control* possess high self-efficacy beliefs. They strive to gain knowledge as how to become better practitioners and are better able to implement change. They believe their success is a result of their efforts (Ignat & Clipa, 2010). Self-efficacy beliefs contribute to a faculty's collective efficacy beliefs, which contribute to their school's level of academic achievement (Bandura, 1993; Tschannen-Moran & Barr, 2004). Mutually, the "personality" of the student body influences school-wide achievement by altering collective efficacy beliefs directly through effects on academic achievement (Bandura, 1993).

In summary, this study is significant because findings of this study may aid principals and administrators in their roles as supervisors by providing knowledge of what is necessary to motivate science teachers to change their attitudes and beliefs in support of developing more efficacious practices. Teachers, too, may better understand the process of change as well as the need to change. This in turn, increases the probability of student achievement. This study is focused on teaching in a PSSA environment because the PSSA is currently used to measure AYP in compliance with NCLB. However, the findings of this study can be applied to teaching in any

standardized assessment environment. This will be of practical significance when the Common Core standards replace the state standards currently in use and a different standardized assessment is implemented.

Theoretical Framework

The purpose of this study is to examine the impact of the science PSSA on the curriculum and instructional practices of eighth-grade public school science teachers using a three-part framework. The first leg of the triad examines the challenges of implementing curricular or instructional changes. The second leg elucidates the role of motivational processes when teachers implement changes to their instructional methods. An examination of efficacy beliefs completes the triad.

Improving student achievement so that AYP is met provides the impetus for change (Fullan, 2007). Teachers, though, need to believe that the changes are necessary (Fazio & Melville, 2008). However, focusing solely on test scores can lead to a narrowed curriculum, decreased motivation, and teacher burnout (Fullan, 2001). Considerations regarding how to initiate and sustain motivation help to explain why teachers behave the way they do (MacDonald, 2009; McClelland, 1989; Schunk, 1996). Motivation – a process by which behavior is initiated and directed toward attaining meaningful goals (Woolfolk, 1987) – affects implementation of district- or school-mandated curricular changes and strengthens instructional practices. Eighth-grade science teachers, the subjects in this study, must, therefore, be motivated to adopt these goals as their own if they are to succeed (Ford, 1992; Ryan & Deci, 2002). Theories about educational change, motivational processes, and efficacy beliefs form the framework for this study.

Change Theory

The mention of educational reform alone elicits a certain amount of anxiety. Implementing educational change challenges teachers' core beliefs developed through classroom experiences. As teachers gain experience and their beliefs and practices develop, it becomes more difficult for them to change their ways (Fullan, 2006). Many teachers are reluctant to change unless the probability of success is high; a high risk of failure serves to reinforce their reluctance (Guskey, 1986).

Implementing change poses a dilemma for teachers in that they are asked to adjust their understanding of how things work, change their attitudes and alter their beliefs before they change their behaviors (Bandura, 1994; Fullan, 1985; Guskey, 1986). A permanent change in behavior requires evidence that the reform will bring success, but teachers are expected to change their behaviors to implement a change before they see evidence of success (Guskey, 1986).

Successful educational reform efforts focus on changing the individual as well as the culture in which teachers work. This creates a situation in which everyone involved becomes a learner; solid leadership for direction and professional development for knowledge building become necessary. The administrator of needed changes, usually the building principal, must keep two questions in mind during this time: (a) "Under what conditions will continuous improvement occur?" and (b) "How do we change culture?" (Fullan, 2006, p. 4). If these are forgotten or ignored, the risk for failure is high.

Effective principals know who their teacher-leaders are and recognize that their acquired knowledge can be valuable in shaping education reform strategies (Fullan, 2006). Assertive leadership is important in creating positive working relationships as

well as an organized workplace that offers opportunities for capacity building, positive pressure, feedback, experiences, and peer support (Beltman, 2009; Fullan, 1985, 2007; Guskey, 2007).

Teachers need time to develop new skills as well as opportunities for practice. They have to develop the internal commitment necessary for success; forcing or trying to implement a change too quickly frequently results in unsuccessful implementation (Fullan, 1985, 2007). Effective principals pay attention to their teachers' mind-sets and take the time to develop and invest in their capacity-building through the use of any policy or action that improves collective efficacy. This creates an environment that motivates the majority so that there is little reason not to be successful. Removing distracters; eliminating unnecessary paperwork; providing constructive, critical feedback; and affording positive experiences improve teachers' self- and collective efficacy and strengthen their resolve (Fullan, 2001, 2007).

Motivational Theory

Humans, by nature, pursue activities that are intrinsically challenging and interesting. Experiences that promote autonomy, relatedness, and competence enhance the performance, persistence, and creativity that provide satisfaction in life (Ryan & Deci, 2000), a source of joy, and a sense of flow (Csikszentmihaly, 1997). Motivation is the engine that sustains engagement in satisfying activities and explains the why of behavior and the processes involved (McClelland, 1989). Motivation, therefore, is the second leg of this framework's triad. There are many theories of motivation, two of which are used to inform this study: Self-Determination Theory (SDT; Deci & Ryan, 1985), and Motivational Systems Theory (MST; Ford, 1992).

Motivational processes emanate from qualities of the teacher, not the situation. They are future-oriented and help teachers decide between keeping things the same, restoring the status quo, or working towards a new, improved situation. Teachers employ motivational processes when they set goals and engage in new behaviors constructed to reach their goals (Ford, 1992). Personal beliefs, values, and emotions supply the energy that makes motivational systems so strong and persistent in changing behavior (Ford, 1992; McClelland, 1989).

Self-Determination Theory. Self-Determination Theory (SDT; Deci & Ryan, 1985) provides an explanation as to how and to what degree science teachers are motivated to implement instructional changes aimed at improving student performance. Teachers who have a deep sense of commitment to their students and their students' achievement will place a high personal value on the importance of reform. They view this as a new, challenging activity that presents an opportunity for exploration and learning. External motivators are only necessary to provide support for continued engagement. Positive feedback, meaningful professional development, and favorable evaluations boost their decision-making ability, initiative, sense of well-being, and quality of performance (Ryan & Deci, 2000).

Deadlines, directives, threats, pressured evaluations, or negative feedback diminish teachers' intrinsic motivation. In addition, external motivators such as tangible rewards, awards, and salary increases tend to erode autonomy. External motivators contingent on a successful outcome shift the focus from developing effective instructional practices to the test results themselves. Because of this, motivation is

deflated and performance declines (Ryan & Deci, 2000). The joy of teaching is gone and the sense of flow dissipates (Csikszentmihaly, 1990).

Many, if not most, teachers are not interested in or challenged by a mandate for change and so are not intrinsically motivated. Extrinsic motivators become necessary to regulate their behaviors. Teachers' reactions to extrinsic motivators range from amotivation on one end of the continuum to active personal commitment at the other end. These points represent to what degree the teachers value the mandated behavior change and how well they internalize and integrate expectations (Deci & Ryan, 2000; Ryan & Deci, 2000).

Amotivation, defined here as a lack of motivation, is found at the far left of the continuum. It is difficult, if not impossible, to externally regulate expected behaviors of amotivated teachers (Deci & Ryan, 2000). They do not respect mandates, may not feel competent (Bandura, 1993), or are simply unwilling to engage in the change process (Deci & Ryan, 2000; Ryan & Deci, 2000).

The stages of extrinsic regulation begin to the right of amotivation on the continuum. This marks the place where it becomes possible to motivate teachers in the direction of change. Careful attention to delivery of extrinsic motivators is warranted in order to nudge teachers further along the continuum to states of *identification* and *integration* (Ryan & Deci, 2000). Teachers who consciously value a mandate and accept the importance of implementing change have reached a point called identification, a more autonomous form of extrinsic motivation. When teachers fully assimilate and accept the expectations as their own, they have achieved integration, the most autonomous form of extrinsic motivation when behaviors become self-determined. Support for autonomy

allows individuals to actively transform values into their own (Ryan & Deci, 2000).

Motivational Systems Theory. Competence in teaching comes from an interaction among teachers' skills, environments, and motivations (Colbeck & Wharton-Michael, 2006; Lumpe et al., 2000). Skill is acquired through education and experience; the classroom provides the environment. Motivational Systems Theory (MST; Ford, 1992) posits that motivation is a function of the interaction among a person's goals, emotions, and personal agency beliefs (Ford, 1992). This interaction of variables powers the motivation of teachers to help their students achieve AYP.

Teachers who believe in the importance of science education reform possess the critical first component of motivation–a personal goal. Personal goals cannot be imposed on the teacher (Ford, 1992; Ryan & Deci, 2002). Ford (1992) defines goals as "the thoughts about desired states or outcomes that one would like to achieve" (p. 248). Personal goals are composed of two components–content and direction. The need for educational reform provides both content and direction, paving the way for making the goals personal.

Emotions, the second component of motivation, supply the energy source directing achievement-oriented behaviors; they work to initiate and shape the goals and personal agency beliefs of the teacher. They create a state of readiness and play a role in the organization of motivational processes. Additionally, emotions and goals are closely linked; events that lead to goal achievement produce positive emotions; obstacles that threaten achievement produce negative emotions. Four instrumental emotions (i.e., satisfaction, curiosity, downheartedness, and disinterest) control the instigation, persistence, recurrence, and termination of goal-oriented behaviors (Ford, 1992).

Personal agency beliefs, the third variable in the equation, play a vital role in situations involving challenging but attainable goals. There are two types of personal agency beliefs–capability beliefs and context beliefs. Capability beliefs are teachers' beliefs pertaining to the skills needed for effective instruction. Perceptions about professional and material supports for effective instruction are context beliefs. Motivation levels range from robust (when both beliefs are positive) to hopeless (when both beliefs are negative; Haney et al, 2002; Lumpe et al., 2000).

Efficacy Beliefs

The ultimate aim of science teachers is the improvement or maintenance of PSSA science scores indicating AYP. Belief in one's abilities to complete a task and do it well is a definitive indicator of self-efficacy and influences motivation (Bandura, 1994; Schunk, 1996). Self-efficacy is closely related to personal agency beliefs (Haney et al., 2002; Lumpe et al., 2000). Teachers with strong beliefs in their capabilities are motivated to tackle challenging tasks rather than avoid them (Hines & Kristonis, 2010). This attitude enhances interest and contributes to total involvement in the activity (Bandura, 1994), as well as the sense of *flow* (Csikszentmihalyi, 1997) which is characterized by such complete involvement in an activity that a sense of time is lost. Teachers who experience flow are more likely to feel strong, creative, concentrated, and motivated (Csikszentmihalyi, 1990) and are more likely to use new and varied methodologies in their classrooms. Highly efficacious teachers are less critical of student struggles and mistakes. They have a stronger commitment to teaching than their colleagues with weak self-efficacy beliefs (Hines & Kristonis, 2010).

Teacher self-efficacy and collective efficacy are concepts that are "positively and

strongly related" (Skaalvik & Skaalvik, 2007). Because AYP results are reported by school name, eighth-grade students' performance is a concern to all teachers in a school. Collective efficacy refers to teachers' beliefs in their ability, as a faculty, to positively affect student achievement (Goddard, Hoy & Woolfolk Hoy, 2000; Tschannen-Moran & Barr, 2004). The relationship between self- and collective efficacy establishes the academic climate of a school. High collective and self-efficacy beliefs lead teachers to set and persist at attaining challenging goals (Klassen, Tze, Betts, & Gordon, 2011; Skaalvik & Skaalvik, 2007). Generally, achievement levels are higher for students with highly efficacious teachers (Hines & Kristonis, 2010), though high efficacy beliefs do not guarantee change will occur or that students will learn (Chong, Klassen, Huan, Wong, & Kates, 2010).

Collective efficacy is only as strong as the self-efficacy beliefs of the teachers who compose the faculty. Mastery experiences, gained from many years of service, provide the biggest boost to self-efficacy beliefs; a lack of mastery experiences weakens them, as do experiences of failure (Tschannen-Moran, Woolfolk Hoy, & Hoy, 1998). Since teaching is an interactive activity, collective efficacy can benefit the individual teacher for whom self-efficacy is diminished. Self-efficacy beliefs can be boosted by observing successful behaviors of teachers within the group (Klassen et al., 2011; Skaalvik & Skaalvik, 2007; Tschannen-Moran et al., 1998). Motivational talks, faculty room discussions, and constructive feedback are also useful (Tschannen-Moran et al., 1998).

Locus of Control, Motivation, and Efficacy: A Synergistic Relationship.

While not a separate piece of the framework, the concept, locus of control,

bridges the constructs of motivation and efficacy. Locus of control is the perception of personal control in any situation, and it is the emotional mediator of efficacy and motivation. Strong efficacy beliefs are directly related to the degree in which teachers believe their abilities and efforts cause students to achieve (e.g., AYP; Tschannen-Moran & Woolfolk Hoy, 2001). Allowing teachers some authority in the decision-making process; and providing them with positive, constructive feedback gives teachers a sense of control over what they are doing. This, in turn, strengthens their self-efficacy beliefs. Teachers who believe they exert control in whatever they are doing do not experience the same anxiety as those who believe they exert little control over their situation (Tschannen-Moran & Woolfolk Hoy, 2001). They are more intrinsically motivated and experience feelings of competence (Deci & Ryan, 1985; Ryan & Deci, 2002). They become more engaged and more satisfied in their work, increasing their effectiveness (Fernet et al., 2008).

Conversely, an external locus of control diminishes the motivation to achieve, detracts from the enjoyment of teaching, and distracts teachers from doing their best work (Akın, 2010). Excluding teachers from the pedagogical decision-making process leads to a decline in motivation, as does the enforcement of frequent changes with a lack of professional support (Müller, Alliata, & Benninghoff, 2009). Excessive control by administrators, threats, frequent surveillance, deadlines, negative or harsh evaluations, and a compete-to-win atmosphere erode perceptions of control and diminish self-efficacy beliefs (Atkinson, 1974; Atkinson & Birch, 1978; Bandura, 1994; Deci & Ryan, 1985; McClelland, 1989; Weiner, 1986).

Theoretical Framework Summary

In the current Pennsylvania System of School Assessment (PSSA) environment, schools are assessed by student test scores indicating whether AYP has been reached. Students are assessed in reading, mathematics, writing, and science. This study focuses on the consequences of the eighth-grade science assessment. In an effort to maintain or improve science PSSA scores to meet AYP, school districts or the schools within them are likely to mandate curricular changes that include strengthening of instructional practices.

A triad of concepts forms the theoretical framework of this study. An examination of change theory is the first segment of the triad. Successful implementation of instructional and curricular changes that result in improvement or maintenance of PSSA science scores is a meaningful outcome that teachers strive to achieve (Ford, 1992). Successful implementation of change requires that teachers possess a sense of control over their roles during this process; external controls and top-down mandates do little to cause real change (MacDonald, 2009).

The second segment of the triad examines motivational theories. While many theories of motivation are described in the literature, this piece of the framework's triad is limited to an examination of two theories: Self-Determination Theory (Deci & Ryan, 1985) and Motivational Systems Theory (Ford, 1992). Teacher beliefs, attitudes, and motivation need to be given careful consideration during the change process. Motivation is personal, and at the individual level, a teacher's psychological state makes a difference as to how predisposed that teacher is to consider and act on implementing a change (Fullan, 2007). Motivation is a function of the interaction between teachers' capability

beliefs and the context in which they work (Ford, 1992). Motivated teachers are more engaged in their work and have higher job satisfaction (Fernet, et al., 2008).

The third and final segment of the triad examines efficacy beliefs and their impact on student achievement. Both self- and collective efficacy beliefs are powerful influences on how teachers think, feel, and motivate themselves. There is a strong connection between strong teacher efficacy and behaviors that support student achievement (Goddard et al., 2000). Teachers who possess a high internal *locus of control* have high self-efficacy beliefs. They work to become better teachers, are better able to implement change, and believe their success is a result of their efforts (Ignat & Clipa, 2010).

Methodology

A mixed-methodology approach was used to conduct this study. After permissions were secured, a web-based Likert-type survey was sent to eighth-grade public school teachers in school districts from four counties in south central Pennsylvania in order to collect data. The following research variables were considered: (a) the impact of the science PSSA AYP results on the eighth-grade science curriculum; (b) the impact of curricular changes to their instructional practices (c) the impact of the science PSSA on motivation, efficacy (both self- and collective), and teachers' sense of responsibility for student achievement. From those who responded to the survey, the researcher asked for volunteers willing to be a part of a focus group for the purpose of discussing their instructional practices in a PSSA environment. A focus group is a useful tool to generate and collect data when engaged in qualitative research (Barbour & Katizinger, 1999; Stewart, Shamdasani, & Rook, 2007). It is in the interaction among the participants and

the moderator - the researcher in this study- that allows for exploration of deeper ideas and feelings. A major advantage of the focus group is the interactions and synergy among participants increase spontaneity in a focus group discussion. In addition, this format is less intimidating than an individual interview where the person does not have to speak unless the he or she has something to say (Kolb, 2008). The focus group allows a researcher to encourage participants to talk to one another (Barbour & Kitzinger, 1999). The composition of this focus group was homogenous- eighth-grade science teachers; this was a common experience for them.

There were volunteers who were unable to attend the focus group meeting, but were willing and able to meet for an interview. An interview is a useful tool when engaged in qualitative research. It is highly adaptable for data collection and allows a researcher to follow-up on ideas and probe further into emotions and motives of the interviewee. Additionally, body language provides clues and information not revealed in a survey (Bell, 2005; Blaxter, Hughes, & Tight, 2001). Participants were anonymous unless they volunteered to meet with the researcher for a face-to-face interview. Pseudonyms were used for the names of the counties, school districts, schools, and teachers to maintain the confidentiality of those who volunteered to participate in a face-to-face interview.

The researcher of this study examined the data for relationships among the research data as well as possible relationships between the research variables and demographic data including: school, school district, age, and years of service. Based on this background information, it is hypothesized that, despite the specter of PSSA

influence on the academic climate, teachers are not necessarily influenced to change instructional practices, even if the curriculum has changed.

Limitations to the Study

The limitations of this study include the following: (a) the willingness of school district superintendents to grant site approval, (b) the number of participants, (c) collective belief that curricular and instructional changes were necessary, (d) the data provided by the participants were self-reported and may be prone to bias as they pertain to self-evaluation of job performance, and (e) participants may have reported on practices as they would have liked them to be in contrast with how those practices were actually performed.

In addition, the researcher has been active with the Capital Area Science and Engineering Fair (CASEF). Those teachers who work in middle schools in the CASEF catchment area may recognize the researcher's name or may know the researcher. This knowledge may cause potential participants to accept or decline participation. As the primary data collector and analyst, the researcher will need to identify and avoid any bias when objectively analyzing data.

The science PSSA has been administered for four years as of this writing. There were teachers with one or two years of experience who have only known professional life with the PSSA, as well as teachers with pre-No Child Left Behind experience. Findings of this study will only be related to the sample of teachers who participated; application to the larger population is not to be assumed.

Finally, this study surveyed teachers regarding their beliefs and behaviors in an environment of curricular and instructional change. These data are anecdotal. With no

quantitative data to use for comparison regarding instructional practices prior to PSSA, there is no way to be certain that PSSA pressure caused the changes reported or if a change in practices even occurred.

Definitions of Terms

Adequate Yearly Progress (AYP) – This is a measure of the academic progress students make in one academic year in specific subjects (Pennsylvania Department of Education, 2002).

Amotivation – Amotivation is defined as a state in which people do not possess intent to behave in a way that would bring about a desired outcome due to either an absence of a sense of efficacy or a sense of control with respect to this desired outcome (Deci & Ryan, 2000).

Curriculum – Curriculum is the sum of all the experiences learners have under the guidance of school. This includes assessments (Marsh & Willis, 2003).

Extrinsic Motivation – Extrinsic motivation originates from outside of the person. It is designed to motivate a person to act. An example of extrinsic motivation would be a reward for completing a task (Woolfolk, 1987).

Intrinsic Motivation – Intrinsic motivation originates within a person. This motivation comes from pleasure and/or satisfaction of being engaged in or completing a task (Woolfolk, 1987). It is the source of energy that causes a person to act rather than react (Deci & Ryan, 1985).

Motivation – Motivation is a process by which behavior is begun with the intent of reaching a goal (Woolfolk, 1987). Motivation is concerned with the why of behavior rather than the how and what of behavior (McClelland, 1989).

Motivational Systems Theory (MST) –"Motivation provides the foundation for learning, skill development, and behavior change by determining how, where, and to what ends people will invest their capabilities for behavioral self-construction" (Ford, 1992, p. 22).

Pennsylvania State System of School Assessment (PSSA) – This is a standards-based, criterion-referenced assessment used to measure student attainment of academic standards as well as a school's ability to help students attain proficiency (Pennsylvania Department of Education, n.d.a).

Performance Level Cut Scores – These are the numerical descriptors of the performance levels of the PSSA (Pennsylvania Department of Education, n.d.c).

Performance Levels of Achievement – These are the narrative descriptors indicating levels of skills and knowledge students have acquired as measured by the PSSA. The descriptors are as follows: advanced, proficient, below basic, and basic (Pennsylvania Department of Education, n.d.c).

Personal Agency Beliefs – These are composed of capability beliefs (perceptions of one's own skills) and context beliefs (perceptions of whether or not one's environment provides needed support) (Ford, 1992).

Self-Determination Theory (SDT) – Deci & Ryan's (1985) theory focuses on the quality as well as quantity of motivation and differentiates between self-controlled and extrinsically controlled motivation.

State Standards – These are the academic standards set by the state of Pennsylvania that include the outcomes that students must know at grades four, seven, and eleven. The standards are linked to anchors (Pennsylvania Department of Education, 2010).

Chapter One Summary

The No Child Left Behind Act (NCLB) was passed in 2002 by President George W. Bush. One of its mandates called for accountability in education. Each state became responsible for setting standards and developing assessments that measured adequate yearly progress and proficiency in math, reading, and science. The Pennsylvania State System of Assessment (PSSA) was created in 1999 and later modified to comply with NCLB. PSSA measures student achievement necessary to meet state standards and show adequate yearly progress in math, writing, reading, and science (Pennsylvania Department of Education, n.d.b). Whereas schools are assessed through the AYP of their students, it is the teachers who are held accountable for student learning and achievement. In schools that seek to maintain or improve PSSA scores necessary for AYP, pressure is often placed on teachers to implement curricular changes and strengthen their instructional practices.

The purpose of this study was to examine the impact of the science PSSA on eighth-grade public school science teachers' curriculum and instructional practices. Participants in this study are the science teachers at schools in which curricular and instructional changes were implemented as reported by the administrators, science supervisors, principals, or science department chairs of these schools. Data were collected by survey and focus groups.

Chapter Two is a review of the literature for this study providing an explanation of change theory, two theories of motivation—Self-Determination Theory (Deci & Ryan, 1985) and Motivation Systems Theory (Ford, 1992)—and an examination of efficacy beliefs within the context of the PSSA environment. The literature review concludes

with an examination of how the interaction of these domains affected teachers' beliefs and behaviors, which ultimately affected student achievement.

CHAPTER TWO

LITERATURE REVIEW

Introduction

This mixed-methodology study examined the effects of the implementation of the science Pennsylvania System of School Assessment (PSSA) on the curriculum and the instructional practices of eighth-grade science teachers, looking through a framework of change theory, motivational theories, and efficacy beliefs. The literature review begins with a report on change and educational reform, elucidating the need for change, the challenges that change present for those expected to make changes, and tactics for implementing change.

The second section of the literature review investigates two theories of motivation. Self-Determination Theory (SDT; Deci & Ryan, 1985) found that teacher motivation is enhanced in an environment that supports their needs for autonomy, relatedness, and competence. Motivational Systems Theory (MST; Ford, 1992) suggests that teacher motivation results from the interaction among goals, emotions, and personal agency beliefs.

The third and final section of the literature review explores teacher efficacy and its impact on student achievement, defined as the belief in one's ability to bring about student learning. Effective instructional practices have been linked to student achievement (Fazio & Melville, 2008). Teachers with high efficacy beliefs have a strong internal locus of control. They believe their student successes or failures are a result of their actions and behaviors. They strive to gain knowledge and are better able to implement change (Ignat & Clipa, 2010).

Change and Educational Reform

Need for Change

The science PSSA is administered to eighth-grade science students in Pennsylvania's public schools. A percentage of students in any public school are expected to show adequate yearly progress (AYP) at the level of proficiency that complies with NCLB of 2002. The performance cut level scores have increased every year since 2007 when the science test was first begun (Pennsylvania Department of Education, n.d.c). Increases will continue until the 2013 – 2014 academic school year when it is expected that 100% of public school students will reach, at minimum, this level of adequate yearly progress (Paige & Hickok, 2004).

When students do not show AYP after one year, the school is not labeled "in need of improvement"—the designation reserved for schools that fail to reach AYP for two years—but it does serve as a red flag to a school that changes need to be made so that students are supported in their learning and AYP is achieved when the next year's students take the tests. Because the performance cut level scores are increasing annually, reaching AYP in one year does not guarantee that AYP will be met in the ensuing years. Public schools in which scores show evidence of marginal student proficiency may need to look ahead and make plans to improve test scores and maintain AYP in the face of increasing performance level cut scores.

Marginal or substandard test scores on the science PSSA often lead to changes in the curriculum and instructional practices of eighth-grade science teachers such as: the classroom teacher using new or revised curricular materials; implementing new, more

effective strategies and techniques to increase student interest; and engaging students in learning so that they are successful on the PSSA science test (Fullan, 2007).

The Challenges of Change

Change is both an organizational and an individual process. In order to change the organization (school), the individual (teacher) must first change (Guskey, 2007). It is very easy to say what changes need to be made but very difficult to carry through with successful implementation. Teachers are resistant to change for a variety of reasons (Fazio & Melville, 2008).

Loose-coupling. Shen and Ma (2006) and Young (2006) found that change was perceived as an unsettling process fraught with challenges, one of which was the "loose-coupling" (Shen & Ma, p. 232) that existed in school systems. This loose-coupling was caused by the division of labor that existed between administrators (usually the principal) and teachers. Principals, concerned with budgets and community relations, reacted to disturbances in the external environment. Teachers, concerned with the internal environment of the classroom, were shielded from these factors (Shen & Ma, 2006). As a result, teachers worked independently of principals' direct supervision and were not responsive to administrative commands or directives (Young, 2006). Loose-coupling made reform difficult and inhibited successful systemic change intended to bring change to the level of the classroom. Systemic change penetrated only to school level, not the classroom level (Shen & Ma, 2006).

Teachers as learners and a paradigm shift. Fullan and Hargreaves (1992) noted that change transformed teachers into learners whose goal became to find meaning and satisfaction in the new ways of doing things (Bolster, 1983; Fullan, 1985). The

initial stages involved uncertainty and anxiety (Fullan, 1985) because they required teachers to change their core beliefs about the purposes of education (Fullan, 2007; Young, 2006). Since beliefs and knowledge influence decisions about instructional practice, it became more difficult for teachers to make this shift when their beliefs and knowledge were not consistent with reform efforts. Teachers were required to keep an open mind as they unlearned what they believed to be sound educational practices while they formed new beliefs, gained new knowledge, and mastered new skills (Fazio & Melville, 2008; Pajares, 1992). Teachers appreciated the need for change when they began to experience positive results.

A high probability of success. In addition to the aforementioned challenges, Guskey (1986) found that teachers were reluctant to attempt to implement a change unless there was a high probability of success. A realistic timetable that set the pace of the change contributed to a higher probability of success (Guskey, 1986; Ng, 2009). Probability of success declined if expected changes were too ambitious (Guskey, 2007) or if the pace was too fast. When rushed, teachers became resistant or overwhelmed; there was little or no time for providing support, clear directions, or constructive, positive feedback. Tensions then developed between administrators and teachers (Ng, 2009). Success depended on positive peer relationships and interactions with administrators (Fullan, 1985). Many innovations failed because no reason or rationale for change was provided (Fazio & Melville, 2008; Guskey, 1986; MacDonald, 2009).

Tactics for Implementing Change

Several strategies are mentioned in the literature for implanting change. Three of these strategies are: Professional Learning Communities (PLC), action research projects, and theory-based reform. Each one provides ways of facilitating change.

The first to be discussed here is the Professional Learning Community (PLC). PLCs are useful for implementing and developing a culture of change (Fullan, 2006). Successful change efforts are more likely to happen when the whole culture is affected (Purkey & Smith, 1982) and teachers come to realize that the new way is the better way (Fullan, 1985). The best strategy is one that promoted collaboration in planning, collegial work, and an environment conducive to experimentation and evaluation (Purkey & Smith, 1982).

Fazio and Melville (2008) reported that an action research project was a successful way to improve classroom teaching. Action research was a reflective process involving the social, professional, and personal development components of teacher development. It was an ongoing process of systemic study in which teachers engaged in examination of their practices with colleagues through problem-solving, reflection, collaboration, cooperation, planning, and evaluation. The social aspect of action research helped build knowledge; fostered collegiality; and provided an environment for sharing ideas and resources, and receiving critical feedback. The opportunity for collaboration provided an important social component (Guskey, 1986) that provided teachers with the time and space needed to be able to work as a team. Resources, such as financial support, provided additional support while keeping teachers free of administrative matters such as needs assessments or frequent committee meetings (Ng, 2009).

The PLC approach brought more success than a theory-based reform studied by McLaughlin and Mitra (2001). A top-down, externally-driven, theory-based approach employed reformers from an outside agency who had little or no knowledge of school-culture. Their goal was to reach *scale*, defined as implementing, maintaining, and supplementing change. However, teachers needed more than being told how change would help or having their awareness raised (Borrego, Froyd, & Hall, 2010). Teachers knew what did or did not work through experience and were distrustful of knowledge gained quickly through research. This created resistance to the program and made it more difficult to implement sustainable changes (Bolster, 1983).

Theory-based reform requires ongoing financial, administrative, and professional support from the school system. Critical to its success is the need to nurture teacher-leaders who would continue the program after reformers departed. In addition, if these changes are not compatible with their core values, teachers lose their motivation to continue with reform efforts and revert to their old ways of teaching (McLaughlin & Mitra, 2001).

Summary of Literature Related to Change Theory

A need to maintain or improve science PSSA scores served as an impetus for change in schools where eighth-grade students either did not or only marginally demonstrated adequate yearly progress (AYP). Anxiety and uncertainty, teacher resistance, the division of labor between administrators and teachers, and teachers needing to become learners were a few of the challenges that were faced. Changing the internal culture of the school and approaching change as action research were more successful than using a top-down, external agent of change such as theory-based reform.

There was a greater chance of change being successfully implemented when teachers were active participants in the change process (Guskey, 1986). Successful change increases the chance for student learning (MacDonald, 2009).

Theories of Motivation

Students must score at the level of "proficient" on the state-designed standardized tests in order to meet AYP. Many schools find themselves needing to improve or maintain test scores so that AYP is met or maintained. To ensure this outcome, some schools may require a change to the curriculum and/or instructional methodology of the grade level that is tested. Change is unsettling, challenging, invigorating, downright scary, or a combination of these emotional states. Only with excellent professional development, positive feedback, and development of a belief in the need for and value of change can successful implementation be accomplished. Teacher motivation is a variable that can make or break successful implementation of required changes. One part of this study's framework involved two theories of motivation: Self-Determination Theory (Deci & Ryan, 1985) and Motivational Systems Theory (Ford, 1992). The following sections describe how application of the principles of these theories can help implement change.

Self-Determination Theory

According to Self-Determination Theory (SDT; Deci & Ryan, 1985), the different levels of motivation are located along a continuum. Amotivation is found at the far left; intrinsic motivation at the far right. The progressive states of extrinsic motivation are found between these two extremes (Deci & Ryan, 1985; 2000).

The motivation continuum. Deci and Ryan (1985) define amotivation as "without motivation." No amount of external regulators or rewards will spark motivation

in the amotivated individual. At the opposite end of the continuum is intrinsic motivation. Individuals experience intrinsic motivation when they have an authentic interest in the activity in which they are engaged; when they believe in and value the activity. They are driven by internal sources of motivation and need no outside sources for maintaining their motivation (Deci & Ryan, 1985).

Very few situations present the challenge and interest that are required for intrinsic motivation. For situations such as implementing change in curriculum and instructional methodology, change frequently requires external sources of motivation. There are three progressive levels of extrinsic motivation–external regulation, introjected regulation, and identified regulation (Deci & Ryan, 1985; Ryan & Weinstein, 2009).

Externally-regulated motivation causes teachers to do what is expected in order to avoid punishment or for reward in the way of a bonus. They engage in activities in order to avoid censure or termination. They hold no authentic interest in the activity (Deci & Ryan, 1985, 2000; Ryan & Weinstein, 2009).

The next level of regulated motivation is introjected motivation, a more autonomous level of motivation at which teachers have begun to develop a belief in and value for the changes being made.

Identified regulation, or integration, is the most self-determined level of extrinsic motivation. At this level of motivation, the teacher comes to value the reason for, and believes in the need for, change even though the motivation originated with an external source. A supportive environment aids regulation of motivation (Deci & Ryan, 1985).

SDT and the classroom environment. Several studies report the administrative use of the principles of SDT when bringing about educational reform. Motivation was

increased in an autonomy-supportive environment. "Changing the school conditions from those that undermine to those that enhance teachers' support of autonomy should be an important priority of reforms aimed at changing the educational system" (Pelletier, Seguin-Levesque, & Legault, 2002, p. 195). Administrators, usually the principal, had the power to create an environment that was either autonomy-supportive or controlling (Deci, Koestner, & Ryan, 1999; Sorebo, Halvari, Gulli, & Kristiansen, 2009).

Principals established a supportive environment when they took the time to learn the needs of teachers and developed the organizational structure and environment that supported their sense of autonomy, competence, and relatedness (Roth, Assor, Kanat-Maymon, & Kaplan, 2007). Participation in the decision-making process strengthened the teachers' sense of autonomy, such as when they were given a choice as to how they applied what they learned and how they integrated the changes into practice (Deci et al.,1999; Deci, 2009).

Relatedness was supported when teachers worked together in small learning communities (Deci et al., 1999; Roth et al., 2007); they shared their visions for success, established their goals, and developed the plan to reach their goals (Roth et al., 2007). Teachers reached the highest level of external motivation when they internalized their goals so that they became a part of their core beliefs (Alfi, Assor, & Katz, 2004).

Administrators who were sensitive to the teachers' learning needs provided relevant and necessary professional development (Alfi et al., 2004; Deci et al., 1999). Teachers developed a competence when they were given the freedom to learn from their mistakes as well as successes. They asked questions and shared doubts and negative feelings through constructive criticism, emphatic listening, and consultation (Roth et al.,

2007). Positive feedback provided in an informational, non-controlling manner further supported motivation (Deci et al., 1999; Roth et al., 2007), enhanced beliefs, and affirmed instructional choices (Alfi et al., 2004; Sorebo et al., 2009).

Teachers who worked in an autonomy-supportive environment provided the same environment for their students who, as a result, had a greater chance of academic success (Roth et al., 2007). Student success increased, which fed their teachers' sense of competence (Deci, 2009) and motivated them to continue to provide a supportive environment for their students (Alfi et al., 2004; Deci, 2009; Roth et al., 2007; Sorebo et al., 2009), thus a symbiotic learning relationship had been established.

In contrast with a supportive environment, a controlling environment diminished motivation. Roth et al. (2007) reported that a controlling environment existed when teachers were not consulted about impending changes or given the power of choice with respect to changes, and when they worked in an atmosphere that demanded results under threats of unsatisfactory evaluations. Professional development was inadequate or non-existent.

The meta-analyses conducted by Deci et al. (1999) explored the negative effects of tangible rewards on motivation. They reported that tangible rewards, pressure, threats, and unrealistic deadlines were perceived as being controlling. Feedback that implied incompetence as well as positive feedback administered in a controlling way weakened motivation. Tangible rewards undermined a teacher's sense of personal responsibility for motivation and self-regulation of behaviors (Pelletier & Vallerand, 1996). Other sources of pressure included being underpaid, teaching a subject with little preparation, or having to use new technologies with little or no training (Pelletier et al., 2002).

Furthermore, teachers who were used to working in an autonomy-supportive environment experienced dissonance in a high-stakes testing atmosphere where adequate test scores became the measure of success. They developed anger, resentment, and exhaustion (Deci, Spiegel, Koestner, & Kaufman, 1982; Pelletier et al., 2002; Roth et al. 2007). They experienced a loss of autonomy in their teaching (Roth et al., 2007).

Teachers who worked in a controlling environment were shown to be more controlling with their students (Deci et al.,1982; Roth et al., 2007). Students subsequently lost interest and motivation became disengaged, and their test scores declined (Pelletier et al., 2002; Roth et al., 2007).

Motivational Systems Theory

Whereas Self-Determination Theory (Deci & Ryan, 1985) asserts that personal motivation is found at any point along a continuum of states ranging from amotivation to intrinsic motivation, Motivational Systems Theory (Ford, 1992) is constructed from a combination of theories based on the idea that motivation provides the psychological basis for an individual's development of competence. Competence in any given area (science teaching in this study) comes from an interaction among a person's skill, environment, and motivation (Colbeck & Wharton-Michael, 2006; Lumpe et al, 2000). Skill and experience are acquired and experience; the classroom provides the environment. Ford (1992) expressed his theory of motivation mathematically as the product of goals, emotions, and personal agency beliefs. Goals were defined as an individual's objectives. Personal agency beliefs were defined as belief in one's competence coupled with perceived support from the environment (see Figure 2).

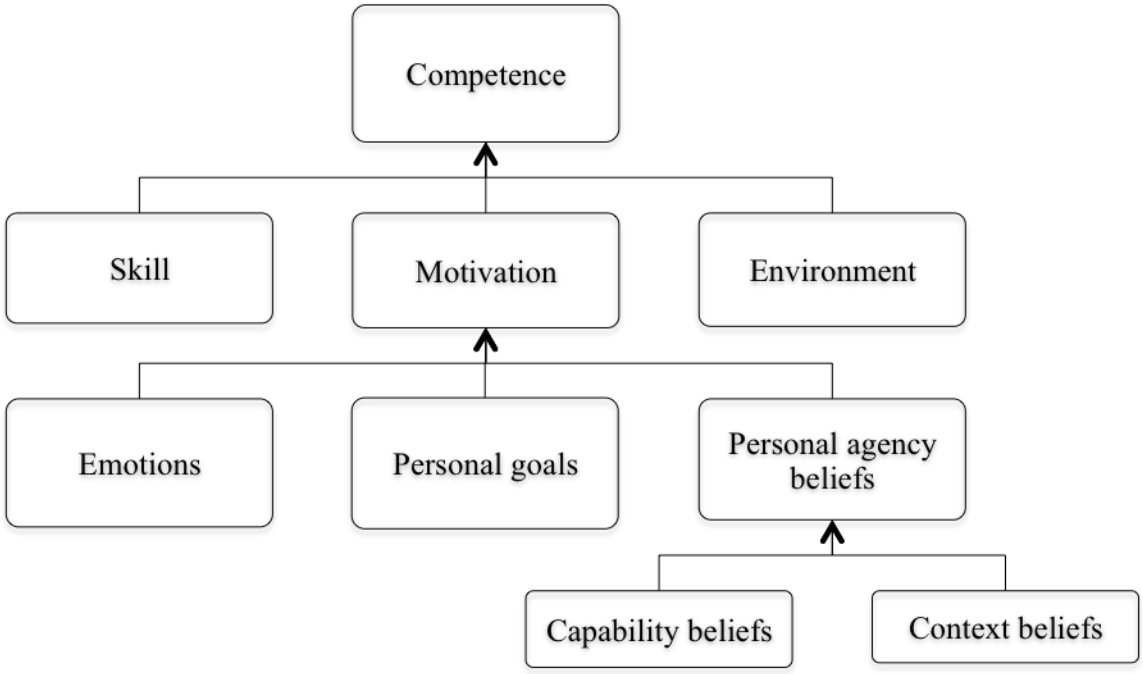

Figure 2. Graphic organizer showing the relationship among the factors feeding into motivation and competence.

When teachers are involved in change, they will likely have to learn new methodology, policies, or curricular updates. Commitment and persistence are needed for successful learning; motivation is required to maintain these qualities. The three factors in Ford's (1992) motivation equation offered the best prediction of persistence strength during learning, problem solving, and other performance goals (Clark, 1999):

1. Personal goals related to how achievement increased control or effectiveness and increased persistence.
2. Emotions influenced persistence. Positive emotions facilitated persistence (i.e. as mood became more positive, persistence became stronger, even in the face of distractions). Negative emotions were

characterized by sadness, fear, anger, or depression. These negative emotions discouraged persistence.

3. Personal agency beliefs were constructed from a combination of capability beliefs (e.g. "How capable am I?") and context beliefs (e.g. "Will I receive financial, material, and moral support?"). Strong personal agency beliefs enhanced the chance of success, which fortified persistence (Clark, 1999).

What follows is a review of the literature highlighting research that used Ford's Motivational Systems Theory as the framework for these studies. This is organized by the factors of Ford's equation: Motivation = personal goals x emotions x personal agency beliefs (Ford, 1992).

Factor one: personal goals. A goal is defined as an expected outcome resulting from hard work. Goals that are too difficult or too easy do not motivate. When a goal is appropriately challenging there is a high probability of success. The goal then becomes a personal goal. Personal goals have content and direction. The content is the goal's expected outcome and must be internalized before a direction for reaching the goal can be calculated (Clark, 1999).

Colbeck, Cabrera, & Marine (2002) used MST as a framework for their study about what influenced engineering faculty in their choice of instructional practices (i.e., traditional or collaborative). The faculty possessed high capability beliefs and the majority believed that teaching the fundamentals was a more important goal than teaching for the professional development of the engineering students. The authors hypothesized that faculty members' choice of teaching practices was a function of their

backgrounds, training, experiences, teaching goals, capability beliefs, and context beliefs. They concluded that faculty members' individual goals for teaching and their capability beliefs strongly influenced the extent to which they used either traditional teaching methods (i.e., the lecture and textbook problem sets) or a collaborative approach involving teamwork and group-designed projects.

Colbeck et al. (2002) found that those with prior experience working outside of the academic setting had a better understanding of the teamwork ethic in the work place: they supported and actively participated in academic reform efforts. The authors learned that faculty members whose goal was to teach lifelong learning and teamwork used a collaborative methodology. Those faculty members whose goal for their students was a learning of engineering fundamentals were more likely to use traditional methods. Prior experience as practicing engineers was positively related to the use of traditional methods, whereas receiving funding for curricular development or instructional innovations was negatively related to the use of traditional methodology. Confidence in interpersonal skills was positively related to the use of collaborative methodology; confidence in presentation skills was associated with traditional methodology. Personal goals were reinforced when student successes resulted from the teacher's preferred methodology (Colbeck et al., 2002).

Factor two: emotions. Emotions work to initiate and shape goals and personal beliefs, and they affect behaviors that are critical to achieving goals (Clark, 1999). In their review of the literature, stimulated by the changes in teachers' lives due to educational reform, Sutton and Wheatley (2003) found that different cultures held different perceptions about emotions. In the culturally-diverse environment of a school,

teachers with varying cultural backgrounds were likely to experience different emotions in very similar classroom events. These varying emotions influenced how teachers interacted with their students.

Meyer and Turner (2006) examined the role of emotions in motivation. Since emotions were an integral part of teachers' lives, gaining knowledge of emotions was essential to understanding teachers and teaching. Positive and negative emotions had an effect on goal attainment (Sutton & Wheatley, 2003).

Happiness and satisfaction were positive emotions associated with caring for students. Student success provided additional sources of satisfaction, especially when the students struggled their way to success. Reciprocally, students were responsive to the care shown by their teachers, fueling the sense of joy experienced by the teachers (Sutton & Wheatley, 2003).

Joy was a positive emotion that contributed to the sense of flow (Csikszentmihalyi, 1990) experienced when teachers felt they made progress toward their personal goals. They reported being highly focused, almost effortlessly focused, on goal-oriented activities. They felt their skill sets were well matched to the challenges of their goals and their abilities to be successful. Finally, teachers experienced positive emotions when they completed their tasks, when colleagues were supportive, or when they believed that parents supported their efforts and respected their judgments (Sutton & Wheatley, 2003). Positive emotions led to setting more challenging goals (Meyer & Turner, 2006), improving skills, and enhancing teaching strategies (Sutton & Wheatley, 2003).

Positive emotions were beneficial to teacher performance and student

achievement. Anger and frustration were common negative emotions that distracted teacher attention from instructional goals and eroded teachers' sense of efficacy and created feelings of helplessness (Sutton & Wheatley, 2003).

Perceptions of student misbehavior and violation of rules were primary sources of negative emotions that made it difficult to teach well. Additionally, implementing reform often involved participating in after-school workshops and classes, attending additional meetings, and devoting more time to planning. These activities reduced the amount of time that teachers had to enjoy interacting with students. Other sources for negative emotions included uncooperative colleagues, difficult and unsupportive parents, and the belief that students' poor academic progress was due to laziness or inattention. Negative emotions were exacerbated by fatigue and stress. Negative emotions were also associated with external administrative control (Sutton & Wheatley, 2003).

Laboratory studies indicated that anticipated emotions guided choices (Mellers & McGraw, 2001). Associating change with negative emotions made teachers less motivated to implement change. When they anticipated that new teaching strategies were more likely to bring emotional pain rather than pleasure, they were less likely to adopt and use these strategies. Because negative experiences eroded positive emotions, teachers fell into an avoidance mode of behavior and played it safe in order to experience positive emotions about what they were doing. Teachers who were constantly frustrated by an ineffective, controlling administration; disruptive students; difficult parents; or changing assessment standards were less intrinsically motivated (Sutton & Wheatley, 2003).

Finally, positive emotions were necessary but not solely sufficient for generating

intrinsic motivation (Sutton & Wheatley, 2003). Ryan and Deci (2000) included autonomy, competence, and relatedness as necessary preconditions for intrinsic motivation.

Factor three: personal agency beliefs. Ford (1992) defined personal agency beliefs as the combination of capability beliefs and context beliefs. Emotions were linked to capability beliefs. Confident teachers were sure of their ability to teach due to creativity and knowledge base (Haney et al., 2002).

Haney et al. (2002) executed a study whose purpose was to examine the relationship between elementary teachers' personal agency beliefs about teaching science and their ability to effectively teach science. Generally, teachers with high capability and context beliefs were more likely to carefully plan lessons that incorporated inquiry while giving thought to their students' prior experiences and knowledge. They gave attention to equity issues within the classroom while encouraging a collaborative approach among their students. They used appropriate and available resources and assessed learning in a way that matched the purpose of the instruction.

Additionally, teachers with high capability and context beliefs delivered accurate science content that was developmentally appropriate, meaningful, and with real-world connections. These science teachers were more likely to reach an appropriate point of closure by the end of class. Conversely, teachers with weak personal agency beliefs seemed to struggle with all areas of effective teaching practices (Haney et al., 2002).

The self-reporting instrument used in this study proved to be a weakness. Some teachers believed they were effective teachers when, in fact, this was not the case. They had scored highly in teacher-centered domains and not student-centered ones while

holding the belief of the reverse. No teachers were told of the actual results (Haney et al., 2002) leaving a false impression of capabilities and effectiveness intact.

Colbeck et al. (2002) analyzed the aspects of personal agency beliefs that influenced faculty members' choice between the use of lecture or collaborative project activities. They found that rewards for course innovations, grant procurements, or promise of publication were not factors when choosing methodology. When context beliefs were reinforced by evidence of support for both financial and material resources, teachers became motivated to make changes in methodology. Alternative methods of teaching required more administrative and clerical support than did delivering lectures.

Colbeck et al. (2002) also looked at the beliefs teachers held regarding their skills. Data suggested that faculty used teaching methods that were consistent with their perceptions of their own skill strengths. Efforts, such as building confidence through training and professional development that focused on increasing teachers' capability beliefs, enhanced motivation.

Finally, in his study of special education teachers, Ford (1995) found that tenacious teachers demonstrated persistence when dealing with challenges if they possessed strong capability and context beliefs.

Summary of Two Motivational Theories

According to Self-Determination Theory (SDT; Deci & Ryan, 1985), an autonomy-supportive environment enhanced motivation. In turn, teachers who worked in an environment that supported their needs for autonomy, relatedness, and competence provided a supportive learning environment for their students and student achievement increased. Conversely, teachers who worked in a controlling environment of demands,

deadlines, rewards, and sanctions showed a tendency to establish a controlling environment for their students. Students subsequently lost interest, became disengaged, and their level of achievement declined.

According to Ford's Motivational Systems Theory (1992), competence is derived from the interaction between a person's skill, environment, and motivation (Colbek & Wharton-Michael, 2006; Lumpe et al., 2000). Enhancing teacher motivation within the framework of goals, emotions, and personal agency beliefs (i.e., capability beliefs coupled with perceived support from the environment) supported the development of teacher competence, which subsequently led to increased student achievement.

Successful implementation of change requires more than motivation; it demands skill and self-confidence and support from the environment. The third and final segment of this study's triad examined the concepts relating to efficacy.

Efficacy

Bandura (1994) defined efficacy as people's beliefs in their capabilities to be the source of behaviors that influence events that affect their lives. Self-efficacy beliefs determine how people think and feel, how they motivate themselves, and how they behave. People with high self-efficacy beliefs tackled difficult tasks as challenges to be mastered rather than avoided. They set challenging goals and were committed to reaching their goals. Failures and setbacks did not deter them. They attributed their failures to their insufficient efforts, knowledge, or skill level, and by doing so, were able to fully take personal credit for their successes.

Conversely, people with low self-efficacy beliefs felt threatened by challenging tasks. They did not set challenging goals for themselves; instead, they dwelled on their

personal deficiencies and the obstacles in their way. Efforts to succeed diminished, and they gave up quickly when a task became difficult (Bandura, 1994).

Teacher Efficacy

In the context of an educational setting, teacher efficacy was defined as the extent to which a teacher feels capable to help students learn. Efficacy beliefs influenced teachers' job performance and commitment to teaching (Guskey, 1988; Tschannen-Moran & Woolfolk Hoy, 2001). This commitment was related to a teacher's motivation to influence student learning (Ware & Kitsantas, 2007).

Teachers with high efficacy beliefs held high expectations for their students. They were persistent, provided a greater academic focus in their classrooms, and displayed feedback techniques that differed from teachers who held low expectations for student achievement (Gibson and Dembo, 1984; Ross & Bruce, 2007). High-efficacy teachers held a stronger commitment to teaching, possessed positive attitudes toward, built friendly relationships with, and set high academic standards for low-achieving students (Hines & Kristonis, 2010). Their students experienced higher achievement than those taught by low-efficacy teachers (Gibson & Dembo, 1984; Ware & Kitsantas, 2007).

Collective Efficacy

Most teachers did not work in isolation. Through their interaction with other teachers they developed collective efficacy which was defined as the group's belief in its ability to have a positive effect on student achievement. A strong collective efficacy was related to high expectations for students and increased student achievement (Adams & Forsyth, 2006; Skaalvik & Skaalvik, 2007; Stajkovic, Lee, & Neiberg, 2009). Student achievement was significantly and positively related to collective efficacy (Bandura,

1993). Collective efficacy was maintained by a supportive school structure (Klassen et al., 2011; Ware & Kitsantas, 2007).

Collective efficacy and self-efficacy were positively and strongly related (Klassen et al., 2011; Ware & Kitsantas, 2007). Skaalvik and Skaalvik (2007) studied the relationship between collective teacher efficacy and individual teacher self-efficacy and hypothesized that the former was predictive of the latter. High collective efficacy led teachers to set challenging goals for themselves and to persist in meeting their goals. Being a member of a group with strong collective efficacy beliefs boosted self-efficacy beliefs after experience with individual failure. The source of this boost was the observation of successful behavior of teachers within the group. Goddard and Goddard (2001) quantified the positive relationship between teacher self-efficacy and collective efficacy. They found a one standard deviation increase in collective efficacy resulted in a one-fourth standard deviation increase in teacher self-efficacy.

Goddard et al., (2000) tested the hypothesis that collective teacher efficacy was positively related to differences in student achievement between schools. Data analysis supported this hypothesis. A one-unit increase in collective efficacy resulted in an 8.62 point average gain in math achievement and an 8.49 point average gain in reading achievement. This one-unit increase in teacher collective efficacy resulted in an increase greater than 40% of a standard deviation in student achievement.

Goddard (2001) found that mastery experience accounted for nearly two-thirds of the variance between schools in collective efficacy. In addition, collective efficacy was significantly and positively related to differences in student achievement, even after

adjusting for prior achievement as well as demographic characteristics. In short, Goddard found a strong relationship between collective efficacy and student achievement.

Collective Efficacy and Job Satisfaction

Klassen (2010) examined the relationship between collective efficacy and stress and job satisfaction for elementary and secondary teachers. Teacher stress was defined as the "experience of negative emotions resulting from their work" (p. 343). Causal stressors included student misbehavior, task difficulty, and task overload. Collective efficacy served as a buffer between job stress and job satisfaction (Betoret, 2006; Klassen, 2010). Collaboration was the best way to mediate stress levels, which boosted self-efficacy beliefs. This, in turn, increased collective efficacy and improved job satisfaction, which helped to avert teacher burn-out. Teachers perceived fewer barriers to achieving learning objectives (Betoret, 2006). Consequently, a stable work force benefited students (Betoret, 2006; Klassen, 2010).

Efficacy and Student Achievement

Students taught by highly efficacious teachers who held high expectations for them and possessed a strong sense of responsibility for their success experienced higher achievement than did those with low-efficacy teachers. Efficacious teachers designed engaging lessons and put forth efforts aimed at students' academic success (Gibson & Dembo, 1984; Ware & Kitsantas, 2007). Additionally, high-efficacy teachers were more likely to try new ideas and did not shy away from ideas that involved a level of risk (Gibson & Dembo, 1984; Goddard et al., 2000; Tschannen-Moran et al., 1998). They used classroom management approaches that stimulated student autonomy (Ross & Bruce, 2007). Highly efficacious teachers had a stronger commitment to teaching (Hines

& Kristonis, 2010), possessed positive attitudes toward low-achieving students, built friendly relationships with their students, and set higher academic standards for them than did low-efficacy teachers. High-efficacy teachers exhibited persistence because they viewed student failures as incentives for improved teaching. These behaviors led to a change in students' attitudes about their academic abilities (i.e., increased student efficacy beliefs) resulting in student achievement (Ross & Bruce, 2007).

In contrast, low-efficacy teachers exhibited a tendency to blame external factors for stressors and shortcomings. They dwelled on their deficiencies and felt threatened by disciplinary challenges in the classroom as well as by lower student achievement (Skaalvik & Skaalvik, 2007). Besides not generating student achievement, low-efficacy teachers had a custodial view of classroom instruction. Feeling little or no control pertaining to the classroom environment, they were easily angered by student behavior and used coercive practices to maintain discipline in the classroom. They were also suspicious of student motivation; any successes or failures were felt to be due to external factors such as chance or the influences of others (Ignat & Clipa, 2010; Martin, McCaughtry, Hodges-Kulinna, & Colthran, 2008).

Gibson and Dembo (1984) documented the differences in behavior patterns of high- and low-efficacy teachers with respect to student engagement and focus, feedback patterns, and persistence. High-efficacy teachers were more effective at keeping all students engaged in on-task behaviors. They spent almost twice as much time in whole group instruction. They frequently monitored seatwork and made sure every student was engaged in learning. Conversely, low-efficacy teachers spent a significant amount of

time in small group instruction and, as a result, the rest of the class spent more time engaged in off-task behaviors.

Gibson and Dembo (1984) documented feedback communications with students and found that high-efficacy teachers did not criticize when students answered questions incorrectly, whereas low-efficacy teachers did. They further found that feedback was related to teacher persistence. Persistence was defined as the "ratio of feedback interactions to student failures during which a teacher either gave a clue or asked a new question" (p. 577). Both high- and low-efficacy teachers provided opportunities for answering questions correctly (e.g., by providing clues or asking leading questions), but low-efficacy teachers demonstrated a lack of persistence in doing so and were more likely to give the answer or call on another student.

Strengthening Efficacy

Professional development was found to contribute to teacher efficacy, especially when teachers diligently applied professional development ideas in their classrooms (Ross & Bruce, 2007). Henson (2001) studied a form of professional development known as teacher research, which resulted in teachers reporting an increase in efficacy. Ross and Bruce (2007) found that professional development increased the efficacy of math teachers who were expected to implement a new math program. Similarly, Martin et al. (2008) reported a positive relationship between professional development and teacher efficacy during a time curriculum change.

Summary of Literature Related to Efficacy Beliefs

Teacher efficacy was defined as the belief in one's abilities to bring about student learning. Strong self-efficacy beliefs enhanced collective efficacy. On the flip-side, a

strong collective efficacy worked to bolster the self-efficacy of a struggling teacher. Highly efficacious teachers designed engaging lesson plans, persisted in their efforts to improve student learning, held high expectations for their students, and felt personally responsible for student achievement. Students taught by highly efficacious teachers showed increased achievement.

The relationship between self- and collective efficacy establishes the academic climate of a school. Schools seeking to maintain or improve student achievement were motivated to strengthen teacher efficacy by providing a supportive school environment that included professional development.

Chapter Two Summary

The purpose of this study was to examine the impact of the science PSSA on the curriculum and instructional practices of eighth-grade science teachers using an interlocking framework of change theory, motivational theories, and teacher efficacy. This chapter presented a review of the research literature relevant to this study.

Change presents challenges of anxiety, uncertainty, teacher resistance, and role reversals (i.e., teachers as learners). Changing the school culture and providing professional development proved more successful than using top-down, administrative mandates. The chances for successful implementation of change improved when teachers actively participated in the change process (Guskey, 1986).

Motivation is that necessary force that enables change to be successfully implemented. There are many theories of motivation; this study examined two: Self-Determination Theory and Motivational Systems Theory. In their Self-Determination Theory, Deci & Ryan (1985) viewed motivation as a continuum book-ended by

amotivation and intrinsic motivation with the various degrees of external motivation in between. An environment that supported teacher autonomy enhanced teachers' motivation to implement changes. In turn, these teachers provided a supportive learning environment for their students resulting in an increase in student achievement (Alfi et al., 2004; Deci, 2009; Roth et al., 2007; Sorebo et al., 2009). Motivational Systems Theory (Ford, 1992) was defined as the interaction among personal goals, emotions, and personal agency beliefs (i.e., capability beliefs coupled with perceived support from the environment). When goals were appropriately challenging, emotions positive, and personal agency beliefs strong, teacher motivation was strong and student achievement increased.

Highly-efficacious teachers increased student achievement. By strengthening teachers' beliefs in their abilities to impact student learning, teacher efficacy was enhanced, both individually and collectively. Financial and material support from the school or district, coupled with strong professional development programs, proved to be the best source for both implementing change and strengthening efficacy.

When teachers are supported throughout the change process, when motivational factors are cultivated and efficacy beliefs are high, the likelihood for student achievement is increased (MacDonald, 2009). Chapter Three presents the methodology used in this study to examine the effects of the implementation of the science PSSA on the curriculum and instructional practices of eighth-grade science teachers.

CHAPTER THREE

METHODOLOGY

After reviewing the literature relating to the concepts supporting this framework, the researcher realized there were many studies that related, individually, to each part of this study's framework, but there was no single study that assessed teachers' motivation and efficacy beliefs and the resulting feelings of responsibility for their students' achievement experiences. This necessitated the creation of an instrument suitable for this study which was developed by assembling, in order, the following four individual instruments: (a) Self-Determination Scale (SDS; Deci & Ryan, 1985), (b) Context Beliefs About Science Teaching Survey (CBATS; Lumpe et al., 2000), (c) Science Teachers' Efficacy Beliefs Instrument-A (STEBI-A; Riggs & Enochs, 1990), and the (d) Collective Teacher Beliefs Scale (CTBS; Tschannen-Moran & Barr, 2004). Each one of these is described in more detail later in this chapter.

Research Design and Variables

This study examined the impact of the implementation of the science Pennsylvania System of School Assessment (PSSA) on the curriculum and the instructional practices of eighth-grade science teachers. This was done using the interaction of change theory, motivational theories, and efficacy beliefs (both self- and collective) as this study's framework. A mixed-methodology was used to answer research questions not easily answered by using a single method. A survey provided breadth; a focus group provided depth of data. The mixed methodology also strengthened the quality of the analyses.

The research questions that will be informed by this research are:

1. What is the impact of the science PSSA on the eighth-grade science curriculum?
2. What is the impact of the science PSSA on the instructional practices of eighth-grade science teachers?
3. How does teaching science in a PSSA environment affect teacher motivation?
4. How does teaching science in a PSSA environment affect teacher efficacy beliefs (both self- and collective)?

Participants

Public schools are required to administer the PSSA to their students. Accordingly, participants were eighth-grade teachers from 9 public school districts with 17 middle schools located in 5 counties in south central Pennsylvania. This included the researcher's home district but excluded any teacher with whom the researcher worked. These districts were chosen because of their familiarity to the researcher as well as their geographical proximity to the researcher for ease of organizing a focus group at a central location; this was a convenience sample. The age of the participants ranged from 22 to 65 years. Both men and women participated because there was no gender restriction in this study. In addition, participants in this study received no compensation and were exposed to no known risks. No vulnerable subjects participated in this study.

After gaining approval to complete the study from the Institutional Review Board (IRB) at Indiana University of Pennsylvania, the researcher was able to begin the process of soliciting participants for this study. To develop a list of potential participants, the

researcher first gained site approval by contacting the superintendents of 15 area school districts by email (Appendix A). Contact information for the superintendents was obtained from Education Names and Addresses (Pennsylvania Department of Education, n.d.d). Site approval provided the necessary permission to contact the eighth-grade science teachers of each district's middle schools and ask them to participate in this study.

While the names of the public school districts and their middle schools were easily obtained from the aforementioned website, the names of the counties, school districts, schools, and teachers were purposely withheld to maintain confidentiality and anonymity. Participants were anonymous unless they volunteered to meet with the researcher during a focus group meeting. Pseudonyms were used for the names of the counties, school districts, schools, and teachers to maintain the confidentiality of those who volunteered to participate in a focus group.

Data Collection Instruments

The instruments in this mixed-methodology study were Likert-type surveys used to gather data about teachers' general feelings regarding the contributing factors to self-determined behaviors, context beliefs, and efficacy beliefs (Vanek, 2012). Since these data only provided the breadth of information to inform this study, a focus group discussion and interviews were done in order to provide the depth of feeling lacking in the answers to survey items. A focus group discussion, as well as an interview, is highly adaptable for data collection allowing a researcher to follow-up on ideas and probe further into emotions and motives of the group's participants. Additionally, body language provides clues and information not revealed in a survey (Bell, 2005; Blaxter,

Hughes, & Tight, 2001).

Data collection for this study was accomplished by developing a survey instrument (see Table 2) constructed by combining questions pertaining to science PSSA implementation with a compilation of the following instruments: (a) Self-Determination Scale (SDS; Deci & Ryan, 1985), (b) Context Beliefs About Science Teaching Survey (CBATS; Lumpe et a., (2000), (c) Science Teachers' Efficacy Beliefs Instrument-A (STEBI-A; Riggs & Enochs, 1990), and the (d) Collective Teacher Beliefs Scale (CTBS; Tschannen-Moran & Barr, 2004).

Prior to its construction, permissions were obtained for modification and use of each individual survey tool electronically (see Appendices B-E). The following sections describe each instrument's validity, and reliability, and detail the modifications made by the researcher.

Table 2

Individual Instruments Used in the Construction of This Study's Survey

Instrument	Corresponding Research Question(s)	What it is	What it measures	Authors of survey	Theory
General questions	RQ 1 RQ 2		Implementation of changes to curriculum and instructional practices	Researcher	Change Theory (Fullan)
SDS	RQ 3	Self-Determination Survey; consists of 2 subscales	Perception of control subscale and	Deci and Ryan, (n.d.b.)	Self-Determination Theory (SDT; Deci & Ryan, 1985)
CBATS	RQ 3	Context Beliefs about Teaching Science Survey	Context beliefs linked to motivation	Lumpe et al., (2000)	Motivational Systems Theory (MST; Ford, 1992)
STEBI	RQ 4	Science Teaching Efficacy Belief Instrument	Self-efficacy beliefs	Riggs and Enochs (1990)	Self-efficacy beliefs (Bandura, 1977; Tschannen-Moran, Woolfolk Hoy, & Hoy, 1998)
CTBS	RQ 4	Collective Teacher Beliefs scale	Collective efficacy beliefs	Tschannen-Moran and Barr (2004)	Collective efficacy beliefs (Bandura, 1977; Goddard et al., 2000)

Initial Questions

The initial questions, labeled *general questions*, were designed to gather demographic information as well as data related to the implementation of the science PSSA (see Appendix F, p. 151). Specifically, participants responded *yes* or *no* to questions and were given the opportunity to expand on their affirmative answers (see Table 3). The "force answer" option was engaged for the *yes* or *no* questions.

Table 3

Sample Questions from the General Questions Section of the Survey Instrument

G4	Since the implementation of the science PSSA, has there been a change in the curriculum you are expected to teach?
G5	(If G4 is answered with the *yes* response, then the following is displayed.) Please describe the changes.

The Self-Determination Scale

"To be self-determined is to endorse one's actions at the highest level of reflection. When self-determined, people experience a sense of freedom to do what is interesting, personally important and vitalizing" (Deci & Ryan, n.d.a). Self-Determination Theory (Deci & Ryan, 1985) is a theory of motivation having to do with human tendencies to behave in ways that cause a desired result.

Of the many instruments designed to assess motivation in a variety of settings and situations, the Self-Determination Scale was constructed to measure individual differences in the extent to which people tend to function in a self-determined way. The scale was shown to be valid and reliable (Elliot & McGregor, 2001). The SDS has been used to examine the role of self-determination in motivation in a variety of settings (Elliot & McGregor, 2001; Sheldon, 1995; Sheldon, Ryan & Reis, 1996; Thrash & Elliot, 2002)

The SDS is a short, ten-item survey consisting of two subscales. One subscale examines feelings of self; the other subscale examines perception of control over choices. Each subscale can be used individually or collectively (Deci & Ryan, n.d.b). The researcher used only those statements related to perception of control over choices (see Appendix G). Additionally, the directions were rewritten by the researcher as described in Table 4.

Table 4

Modifications to the Directions of the Self-Determination Scale (Deci & Ryan, n.d.b)

Original statement	Modified statement
Please read the pairs of statements, one pair at a time, and think about which statement feels more true to you at this time in your life.	Please read the pairs of statements, one pair at a time, and think about which statement feels more true to you at this *point in your teaching career.*

Context Beliefs About Teaching Science Survey

A second theory of motivation used in the framework of this study was the Motivational Systems Theory (Ford, 1992). Ford expressed his theory by way of the equation: Motivation = personal goals x emotions x personal agency beliefs. The third factor, personal agency beliefs, is the combination of capability beliefs and context beliefs and these regulate the level of motivation a person has in reaching a goal (Ford, 1992). Ford also referred to context beliefs as "perceptions of control" (p. 277).

In the educational milieu, teacher's context beliefs are defined as a function of the support teachers received from the administration, students, administrators, parents, institutions, organizations, and physical environment. Lumpe et al. (2000) developed the Context About Teaching Science survey to assess the context beliefs of science teachers. They received partial funding from the National Science Foundation (NSF) "to develop

and apply an assessment strategy designed to gauge teachers' beliefs about the potential influence of specific environmental factors on their science teaching behaviors" (p. 278).

The researcher reviewed the construction of the CBATS and the results of the study in which it was used in order to justify its use in this study. Specific to science education and educators, three groups of teachers were used in its development. The first group was used to identify beliefs and develop the categories of environmental factors and people who were considered to influence science teaching. The second group was used to pilot-test the instrument while the third group was used to assess the validity and reliability of the CBATS.

The final instrument (see Appendix H) was adapted from the CBATS, a Likert-type survey comprised of 26 environmental factors listed in two subscales. One subscale was marked according to how these factors would enable one to become an effective teacher (strongly agree to strongly disagree); the other was marked according to how likely it was that these same factors would occur in the teachers' schools (ranging from very likely to very unlikely). The third group, made up of 262 science teachers participating in professional development programs, participated in the study that provided partial evidence for reliability and validity of the instrument (Lumpe et al., 2000). The instrument's validity and reliability was further established by Haney et al. (2002) and used in Bhattacharyya, Volk, and Lumpe's (2009) study of elementary pre-service teachers' personal agency beliefs related to teaching science. The researcher modified, with permission, the CBATS survey by combining survey items and shortening the survey from 26 to 5 items (see Table 5). Items 6-7, and 17-25 were eliminated because they did not have a direct correlation to any of the research questions.

Table 5

Modifications of CBATS Items

Original Statement	Modification by researcher
1. Professional staff development on Teaching (workshops, conferences, etc.) 14. Support from administrators 28. Teacher input and decision making	Items 1 and 28 were combined: 1. Support from administration: Professional staff development on teaching (workshops, conferences, etc.); allowing teacher input for decision-making process.
2. Support from other teachers (coaching, advice, mentoring, modeling, informal discussions, etc.)	No change 2. Support from other teachers (coaching, advice, mentoring, modeling, informal discussions, etc.)
4. Team planning time with other teachers. 9. Planning time.	Items 4 and 9 were combined: 3. Planning time, both individual and planning time with other teachers.
5. Hands-on science kits (activities and equipment). 10. Permanent science equipment (microscopes, glassware, etc.). 11. Classroom physical environment (room size, proper furniture, sinks, etc.). 13. Expendable science supplies (paper, chemicals). 16. Technology (computers, software, Internet).	Items 5, 10, 11,13, and 16 were combined: 4. Hands-on science kits (activities and equipment), permanent science equipment and consumable science supplies, and technology (computers, software, Internet).
2. State and national guidelines for science education (standards and goals). 12. Adoption of an official school science curriculum (goals, objectives, topics, etc.) 15. Science curriculum materials (textbooks, lab manuals, activity books, etc.).	Items 2, 12, and 15 were combined: 5. Adoption of an official school science curriculum (goals, objectives, topics, etc.) and corresponding curriculum materials (textbooks, lab materials, etc.), state and national guidelines for science education (standards and goals).

When used in conjunction with the Science Teachers' Efficacy Beliefs Instrument (STEBI) instrument (Riggs & Enochs, 1990), the CBATS has been useful for identifying the personal agency beliefs that are strong motivating factors for teachers (Haney et al., 2002). The STEBI was used to measure self-efficacy and outcome expectancy when the CBATS was developed (Lumpe et al., 2000). The STEBI is the next survey tool included in this study's instrument and its description follows.

Science Teaching Efficacy Beliefs Instrument

The third component of this study's framework, efficacy beliefs, necessitated the inclusion of instruments that measured both self- and collective efficacy beliefs. Efficacy beliefs refer to the degree to which teachers believe they have the capability to positively affect student achievement (Riggs & Enochs, 1990). Teachers with high efficacy beliefs had high expectations for their students. They were persistent, provided a greater academic focus in their classrooms, and displayed feedback techniques that differed from teachers who held low expectations for student achievement (Gibson & Dembo, 1984; Ross & Bruce, 2007). High-efficacy teachers held a stronger commitment to teaching, possessed positive attitudes toward, built friendly relationships with, and set high academic standards for low-achieving students (Hines & Kristonis, 2010). Their students experienced higher achievement than those taught by low-efficacy teachers (Gibson & Dembo, 1984; Ware & Kitsantas, 2007). Self-efficacy and its relationship with collective efficacy and student achievement are discussed in the next section–Collective Teacher Beliefs scale (CTBS; Tschannen-Moran & Barr, 2004).

Riggs and Enochs (1990) created the STEBI to quantitatively assess the efficacy beliefs of elementary teachers in their study. Eventually two versions were developed.

The STEBI-A was developed for use with in-service teachers; the STEBI-B was developed for use with pre-service teachers. The STEBI-A was used in the present study.

Riggs and Enochs (1990) developed and validated the STEBI as a self-reporting instrument. Administered to 86 teachers, results indicated that the STEBI was a valid and reliable tool for assessing the efficacy beliefs of elementary teachers toward science teaching and learning. The instrument has since been widely used by many researchers to study self-efficacy (Bhattacharyya et al., 2009; Bleicher, 2004; Gibson & Dembo, 1984; Hechter, 2010; Lakshmanan, Heath, Perlmutter, & Elder, 2011; Riggs, 1991; Roberts, Henson, Tharp, & Moreno, 2000).

The STEBI includes two subscales: the Personal Science Teaching Efficacy Belief (PSTE) subscale and the Science Teaching Outcome Expectancy (STOE) subscale. It is comprised of 25 items, each of which has a five-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). Since the STEBI was created to study the beliefs of elementary teachers—and this study was concerned with eighth-grade teachers' efficacy beliefs—the researcher removed those questions specific to teaching science in a self-contained elementary classroom where the teacher teaches more than science. In addition, items unrelated to teacher effectiveness were also removed. Table 6 lists a few examples of retained and eliminated items. The modified STEBI survey was then incorporated into this study's survey instrument (see Appendix I)

Table 6

Examples of Eliminated and Retained STEBI Items

Examples of retained items	Examples of eliminated items
If students are underachieving in science, it is usually due to ineffective teaching.	When a low achieving child improves in science, it is usually due to extra attention given by the teacher.
When the science grades of students improve, it is most often due to their teacher having found a more effective teaching approach.	If parents comment that their child is showing more of an interest in science at school, it is probably due to the performance of the teacher.

Collective Teacher Beliefs Scale

Collective efficacy is defined as the group's belief in its ability to have a positive effect on student achievement (Goddard et al., 2000; Klassen et al., 2011; Tschannen-Moran, & Barr, 2004; Ware & Kitsantas, 2007). It is as strong as the self-efficacy beliefs of the teachers who compose the faculty (Tschannen-Moran et al., 1998). Skaalvik and Skaalvik (2007) and Goddard and Goddard (2001) established a positive link between self-efficacy and collective efficacy. This was significant because high collective efficacy beliefs were linked to holding high expectations for students. The research of Goddard et al. (2001) supported the positive relationship between teachers' high collective efficacy beliefs and student achievement.

As a component of this study's framework, the researcher searched for and found an instrument to assess collective efficacy beliefs. The Collective Teacher Beliefs scale (Tschannen-Moran & Barr, 2004) was developed using the Teacher Self-Efficacy Scale (Tschannen-Moran & Woolfolk Hoy, 2001) as its foundation. It is comprised of items on

a 9-point Likert Scale with anchors ranging from *nothing* to *a great deal* located at 1, 3, 5, 7, and 9.

The CEBS consists of two subscales: One pertains to instructional strategies and the other pertains to student discipline. An example from the first subscale is "How much can teachers in your school do to produce meaningful student learning?" An example from the second subscale is "To what extent can school personnel in your school establish rules and procedures that facilitate learning?" (Tschannen-Moran & Barr, 2004, p. 199).

When used in a study of 66 middle schools drawn from the population of middle schools in Virginia, the Collective Efficacy Belief Scale produced a reliability coefficient of .97. Teachers had been asked about perceptions of collective efficacy then personal efficacy beliefs. The instructional strategies subscale had a reliability of .96 and the student discipline subscale had a reliability measurement of .94. The "analysis revealed a significant relationship between teachers' perceptions of collective teacher efficacy and student achievement" (p.201). The researcher eliminated items related to maintaining social order and following the rules and retained those items related to academic behavior and learning (see Appendix J).

The Focus Group

The researcher also asked for volunteers willing to be members of a focus group to discuss their experiences teaching in a PSSA environment. When used as a supplement to a survey, a focus group is a way to expand and illuminate specific issues (Eriksson & Kovalainen, 2008). The meeting was conducted in an informal setting to put participants at ease (Barbour & Katizinger, 1999; Eriksson & Kovalinen, 2008; Stewart,

Shamdasani, & Rook, 2007). The advantages to using a focus group were: (a) participants developed ideas collectively, bringing individual perspectives and priorities; (b) participants created theory grounded in the actual experiences and language of the participants; and (c) participants produced data and insights that would be less accessible without the interactions typical of the group (Alasuutari, Bickman, & Brannen, 2008). Additionally, body language provided clues and information not revealed in the survey (Eriksson & Kovalainen, 2008).

The researcher was less concerned with collecting individual opinions rather than interested in the interaction among group's members. These interactions included the manner in which participants responded to each other, how they responded to each other's questions and comments, handled differing opinions, and how they constructed shared conceptions during the discussion. The researcher paid close attention to *how* things were said in addition to *what* was said (Eriksson & Kovalainen, 2008).

For all of the advantages, there are drawbacks to using focus groups. There is a potential to be highly subjective and biased as the researcher/transcriber is the one to decide the relevance of statements (Jayanthi, & Nelson, 2002; Stewart, Shamdasani, & Rook, 2007). To avoid bias during analysis, the researcher kept an open mind; she assumed all information was valid. Careful consideration was given before discarding any statements made and attention was given only to personal frame-of-reference items (Jayanthi, & Nelson, 2002).

The Interview

The questions used to generate discussion in the focus group were also used for the interviews. Interviews are designed with one of three formats: structured, semi-

structured, and unstructured. Structured interviews are restrictive; unstructured interviews allow the interviewee to wander off topic. The semi-structured interview was used in this study which allowed the researcher to ask guiding questions and the respondent to answer them uninterrupted. Caution was exercised to avoid asking questions in a way that led the participants to answer questions with responses they might have thought the researcher wanted to hear, or put them on the defensive (Bell, 2005; Blaxter et al., 2001).

Audio-taping was used to collect data from the focus group discussion and the interviews and later transcribed for analysis. The goal of analysis was to sift through and identify relevant information directly related to research questions of this study, and to summarize and interpret the information (Jayanthi, & Nelson, 2002). The transcripts were read and statements relevant to the research questions were grouped and coded (Jayanthi, & Nelson, 2002; Stewart, Shamdasani, & Rook, 2007). Coded materials were composed of phrases, sentences, or long exchanges whose single requirement was to have relevance to one of the research questions. For the sake of reliability and accuracy, the transcript was read more than once (Stewart, Shamdasani, & Rook, 2007). The transcribed text was used as supporting material within the analysis. Quotations were also identified for possible use in Chapter Four; the final decision was made during final stages of analysis when the data were interpreted according to how research questions were answered (Jayanthi & Nelson, 2007).

Procedure

Once the researcher obtained site approval from the superintendents of the public school districts that had been contacted, the researcher contacted the potential participants

via an email that explained the focus of the study and contained a link to the online survey (see Appendix K). Follow-up emails were sent to non-respondents two weeks after the initial contact. Of the seven site approvals obtained, 29 eighth-grade science teachers were invited to participate in this study. Of these, 11 surveys were completed for data analysis.

The surveys were completed online in a place and at a time convenient to the participants. In order to access the online survey, each participant was asked for informed consent on the first screen of the survey (see Appendix L). Those who did not give consent were exited from the survey; those who did consent were directed to the survey which included details for exiting the survey at any time.

Once the survey was completed, respondents were sent to another survey with a request for participation in a focus group. The request for participation in a focus group was accomplished through a link to a separate survey to ensure responses to the main survey could not be linked to the identity of the participants (see Appendix M). Since data was collected in Qualtrics, there was no interaction between the participant and the researcher except by way of the initial contact email. In addition, the identities of the counties, school districts, participating schools, and participants remained anonymous, and the results were shown as aggregated data or by pseudonym as necessary for data collected during a focus group discussion.

The focus group was employed in this study. Volunteer participants supplied the researcher with an email address or phone number, and a meeting was scheduled at a mutually agreed-upon time and location. Approximately one hour was allotted for this focus group session. Prior to the meeting, informed consent for recording the meeting

(see Appendix N) was obtained. Sessions were recorded and transcribed for accuracy. The researcher spoke with xx is in order to elicit more detailed information regarding their perceptions and reactions to the implementation of the science PSSA. Participants responded to questions (see Appendix O) allowing the researcher to gain insights and information relating to the research questions (see Table 7) that were not revealed in the online qualitative survey. Probing and follow-up questions were asked for clarification and elaboration.

Table 7

Alignment of Focus Group Questions with Corresponding Research Question

Focus Group Questions	*Corresponding Research Question*
1-4	N/A
5-6	RQ1 and RQ2
7-8	RQ3
9-10	RQ4

Data Analyses

The purpose of this study was to examine the impact of the implementation of the science Pennsylvania System of School Assessment (PSSA) on the curriculum and instructional practices of eighth-grade, public school teachers looking through a framework of motivation, efficacy beliefs, and responsibility for student achievement. The analysis of the data was the next step in the completion of this study. Preparation for analysis had been done during the construction of the study's instrument when the items of each subscale were labeled with an identifier. For example, the first general question was labeled as G1; the first item of the Self-Determination Scale (Deci & Ryan, 1985)

was labeled as SDS1. This identification was used to aid the researcher when the data was imported to SPSS, a statistical analysis software package.

Each item in the survey was assigned a "force response" designation in order to ensure that all items of each subscale received a response. When the participation period ended, the data were imported to SPSS. The following paragraphs will describe the data analysis of each individual instrument. A detailed explanation of findings can be found in Chapter Four.

Phase 1

Initially, a demographic profile was used to familiarize the researcher with the sample. The profile was developed when the data were aggregated according to gender, number of years of experience teaching science, and years of experience teaching eighth-grade science. After this, each piece of this study's instrument was analyzed separately.

Phase 2

General questions about changes to the curriculum and expectations of change in instructional methods since the implementation of the PSSA were used to answer research questions one and two. Descriptive statistics were used to test these variables. Specifically, participants responded to *yes* or *no* questions and were given the opportunity to provide explanations. Data was aggregated according to frequency of *yes* and *no* responses; explanations were examined and sorted by commonalities.

Focus group volunteers provided additional data for addressing the first two research questions. The recorded discussions were transcribed, which enabled the researcher to identify and examine themes among the participants' answers. These data were coded and analyzed by for consistency with survey responses.

Phase 3

The five final instruments that were part of this study's survey were used to answer research question three. Descriptive statistics and correlation analysis was used to test the variables of this research question.

The descriptive statistics were used to analyze The Self-Determination Scale (SDS; Deci & Ryan, 1985), the Context Beliefs About Teaching Science survey (CBATS; Guskey, 1981), the Science Teacher Efficacy Beliefs Instrument (STEBI; Riggs & Enochs, 1990) and the Collective Teacher Beliefs scale (CTBS; Tschannen-Moran & Barr, 2004). These were Likert-type surveys that provided non-interval, ordinal data. Descriptive measures included calculating the frequency of each response and the mean, and standard deviation of the data of each instrument.

The data were insufficient to run a correlation analysis. Most of Likert-type surveys used a 5-point scale, one used a 9-point scale. Survey scores for each participant were converted mathematically to a value between 0 and1.0. These converted scores were used when creating two graphs. These line graphs were generated to visually inspect the relationship among the variables for those who experienced a change in curriculum and for those who were expected to change their instructional practices.

Chapter Three Summary

The research design in this study allowed the researcher to collect valuable information relating to the research variables. Making use of an online survey instrument allowed the researcher to gather data from 29 participants. Descriptive statistics and analyses provided an avenue for the researcher to examine the relationship among

research variables. Chapter Four will detail the results obtained through the research design discussed in this chapter.

CHAPTER FOUR

RESULTS

Introduction

This mixed-method study investigated the impact of the implementation of the Pennsylvania System of State Assessment (PSSA) science test on the instructional practices and curriculum of eighth-grade public school science teachers. A tripartite framework of teacher motivation, change theory and efficacy beliefs was used to address the study's research questions:

1. What is the impact of the science PSSA on the eighth-grade science curriculum?
2. What is the impact of the science PSSA on the instructional practices of eighth-grade science teachers?
3. How does teaching science in a PSSA environment affect teacher motivation?
4. How does teaching in a PSSA environment affect teacher efficacy beliefs (both self and collective)?

Participants completed a survey, constructed from a compilation of four Likert-type surveys, in order to assess change, self-determining behavior and context beliefs, components of motivation, and self- and collective efficacy beliefs (see Table 8 for the survey names and point scales). Two of the eleven survey participants volunteered to participate in a focus group discussion for the purpose of elaborating on the answers to the survey and to provide a depth of explanation to the survey responses. Additionally,

interviews were conducted for three individuals who could not attend the focus group discussion. Pseudonyms were used to ensure the anonymity of the participants.

Table 8

Identification of the Likert-Type Surveys Used in this Study

Code	Measure Title	
M1	Self-Determination Scale	SDS; 5-point scale
M2	Context Beliefs About Teaching Science -enable	CBATS en; 5-point scale
M3	Context Beliefs About Teaching Science- receive	CBATS rec; 5-point scale
M4	Science Teacher Efficacy Beliefs Instrument	STEBI; 5-point scale
M5	Collective Teacher Beliefs Scale	CTBS; 9-point scale

Each component of the survey was chosen to gather data for each one of the research questions. After receiving IRB approval, the researcher sent surveys to 29 eighth-grade teachers from 5 south central Pennsylvania counties. Of the 29 teachers contacted, 13 consented to participate and 11 completed the survey. This represented a 38% return and though it is an acceptable return figure, the sample size was too small to be representative of the general population of eighth-grade public school science teachers. However, the findings of this study do provide a snap shot of how motivational factors and efficacy beliefs affect a small group of eighth-grade science teachers in south central Pennsylvania.

Before analyses, reverse scorings were calculated where needed so that higher numbers signified the most positive responses. In other words, a positive response was associated with a higher score. After reverse scoring, the data from each of the survey components were analyzed using IBM's SPSS software program for descriptive statistics, t-tests and supporting statements from the focus group discussion and interviews. For the purpose of analysis, two groups were established. Each group was defined by

participants' answers to two key questions. Group 1 was defined by whether or not there was a change to the eighth-grade curriculum since the implementation of the science PSSA. Nine participants reported a change in the curriculum; two reported no change to the curriculum. Group 2 was defined by whether or not there was an expectation to change instructional practices since the implementation of the science PSSA. In this case, seven participants were expected to change their practices; four were not (see Table 9).

At this point, an explanation for the small sample size is in order. The number of eighth-grade teachers to whom the survey was sent was limited first by the number of districts granting site approval, and second, by the number of eighth-grade teachers in each middle school within those districts. Frequent requests for participation were sent to potential participants. After a two-month period of time, the survey was closed.

Independent samples t-tests were used to look for significant differences in the means of each measure score for Group 1 and Group 2. Since the sample size was small, t-test results were, with one exception, not statistically significant. In each analysis, if Levene's test for equality of variances was greater than .05, eta squared was calculated to determine the level of the effect of one variable (change) on the other (measure). Finally, graphs were created to display the patterns of scores for each measure between two groups of participants. Since one of the measures employed a 9-point scale, while the other used a 5-point scale, it was necessary to convert the scores of each measure to render all scores as being equivalent for the sake of comparison. The analyses of each measure are explained in the paragraphs that follow.

Table 9

Separation of Participants in Group 1 and Group 2

	Group 1 Curriculum N = 11	Group 2 Instructional Practices N = 11
Change	9	7
No change	2	4

Demographic Data

Survey Participants

The first four items of the survey pertained to the teachers' demographic information and science-teaching experience. Six of the participants were male; five were female. Four participants reported 1-5 years of teaching experience, with seven reporting 11-15 years of teaching experience. Four of the participants reported 1-5 years of experience teaching science. Of the seven teachers with 11-15 years of experience teaching science, three have been teaching eighth-grade science for 6-10 years, and five for 11-15 years (see Table 10).

Table 10

Demographic Data of Survey Participants

	Sex	Years of experience teaching science	Years of experience teaching eighth-grade science
Male	6		
Female	5		
1-5		4	4
6-10			3
11-15		7	4

Focus Group Participants

Emily has been teaching in a public school for 16 years, 11 years at the eighth-grade level. She teaches in a rural school district serving approximately 2,000 students. Heather has 12 years of experience teaching science. Following an eight-year hiatus to raise her children, this is her fourth consecutive year teaching eighth-grade science in a suburban school district serving approximately 3,700 students.

Interview Participants

Since the sample size was low for the quantitative portion of this study, it became necessary to expand the qualitative aspect of this study. This was accomplished by contacting the IRB and requesting permission to contact respondents willing but unable to participate in a focus group discussion. After obtaining IRB approval and contacting potential participants, interviews were conducted with three teachers at a time and location convenient to them. The same questions that were used for the focus group discussion were also used for the interviews. The participants received the questions before the interview via email.

Daniel is a teacher with 5.5 years of experience all spent as an eighth-grade teacher. He teaches in a suburban school district that services 3,600 students, K-12. Natalie is a teacher with 12 years of experience with this being her only assignment. She teaches in a rural school district with approximately 2,000 students. Seth is a teacher with 17 years of experience in a large, suburban school district. He teaches at one of the four middle schools in a large, suburban school district with more than 10,000 students (see Table 11 for summary of teacher information).

Table 11

Summary of Teacher Information

Name	Participant Role	Years of eighth-grade teaching experience	School district type and size
Emily	Focus group	11	Small rural
Heather	Focus group	4	Midsized suburban
Daniel	Interview	5.5	Midsized suburban
Natalie	Interview	12	Small rural
Seth	Interview	17	Large suburban

Eighth-Grade Curriculum and Instructional Practices

Items 3-16 from the online survey were used to gather information about the curriculum of the school in which the participant taught. Four participants reported the current science curriculum had been in place for 1-2 years, six reported 3-5 years and one reported 6-8 years. No curriculum had been in place for 9 or more years without undergoing a change. Six participants reported the superintendent had been in their districts for 1-2 years, and five reported 3-5 years with the current superintendent. Item 7 asked how many years the principal had been in their school. Five responded 1-2 years; six responded 3-5 years.

Curriculum Change

Online survey results. When asked if there had been changes in the curriculum they were expected to teach, nine participants (82%) responded that there were changes to the science curriculum while two participants reported no changes had been made (see Table 12 for compilation of data). Explanations of these changes included the following responses:

- Complete grade 6-8 rewrite
- More alignment with state standards and science PSSA

- We've always taught this curriculum in eighth-grade but needed to go back and align other departments (tech ed, math) regarding which of the anchors THEY teach.
- We have shifted eighth-grade science to covering more environmental science. We also moved environmental science to be the beginning of the school year and physical science to the second half of the school year.
- Astronomy pared down; physical science or chemistry unit without book or resources added; human impact on environment reshaped
- Caused a reexamination of the science standards and reemphasizing areas, removing topics and adding material
- At the middle school we adopted, after opposition from the teachers, FOSS (Full Option Science System) kits to teach our science curriculum. We also formed professional learning communities (PLCs) in order to standardize instruction among grade level teachers.
- Updates to the curriculum as to what to include or delete
- Curriculum was aligned to standards and anchors. Some content was removed. We have expanded some content.

Focus group and interview responses. Heather reported that the teachers designed their curriculum "to answer to the PSSA." While major changes had to receive committee approval via the school board, a process enabled by the department chair, members of the science department were free to tweak the curriculum. They revised it in the past two years by teaching chemistry topics before teaching physics topics to more

closely align with the percentage of these questions on the PSSA, and admitted this was a "knee-jerk reaction that will go by the wayside once the Keystones come around."

Daniel initially answered this question in the affirmative. The curriculum had been changed in his school; the FOSS (Full Option Science System) science curriculum was implemented the year before Daniel's arrival at the middle school. (FOSS is a research-based, hands-on K-8 science curriculum that was developed at Lawrence Hall of Science at the University of California at Berkeley [The Regents of the University of California, 2011].) Daniel was required to use this curriculum and its companion, FOSS Labs. Upon further explanation, the year this was implemented was Daniel's first full year of teaching. While this was not a change in curriculum for him, it presented a change for his colleagues.

Natalie reported being in a similar situation. When she began teaching, the curriculum had not been changed, but the emphasis was on preparing students for the PSSA, which loomed in the then near future. As a department, the science teachers met and examined the science curriculum for gaps and overlaps in their teaching. The curriculum was tweaked as needed, but that was the extent of any changes. The challenge for Natalie was "trying to cover everything."

Seth reported the curriculum had recently undergone a third revision. The most recent revision was done to align with the Common Core. He commented that one of the biggest challenges was matching the curriculum with the science PSSA. Students had been assessed in April and there were units in the curriculum that were taught after testing had taken place.

Change to Instructional Practices

Online survey results. The next online survey question asked: Since the implementation of the science PSSA, have you been expected to change your instructional practices? Seven participants (64%) responded that they were expected to change their instructional practices while four did not experience the same expectation. Four elaborated their responses as follows:

- We are currently under the practice of common assessments and common grading practices.
- More writing
- We have been expected to follow LFS (Learning Focused Schools) model. Also, we are now looking at making changes for the Keystone exams, including placing more rigor into our instruction.
- NCLB faded. LFS was introduced.
- Other than the FOSS curriculum having been adopted, my PLC (Professional Learning Community) gives common assessments, grades alike, creates course maps for individual units.
- We are supposed to use more graphic organizers and implement more reading strategies.
- More emphasis has been placed on science process skills.

Of the four participants who were not expected to change their instructional practices, two reported doing so anyway and provided the following comments:

- Practices have changed more due to new initiatives. Using Learning Focused Schools (LFS) and personal learning network (PLN) strategies shown by the district to be the best instructional practices.

Focus group and interview responses. While not being directed to change instructional practices, methodologies could not help but be changed with a change in the curriculum. Emily reported that she is expected to cover a lot more material; effectively, she had to be done with her curriculum in early April because the PSSA was in mid-April. Depth was sacrificed for breadth. Heather added that "...where I used to have this wonderfully, flowing, reasonably-paced course, I feel like now I have more of a checklist of things to cover. The transition between concepts is not nearly as important as coverage. It's a lot more disjointed, and I think the kids see it that way, too."

Heather also noted that one unintended change in her instructional practices pertained to assessments. She felt her tests were more finely-honed because of the PSSA. Referring to a professional development day presented by McTighe on using Backwards Design, Heather designed her tests according to what her students had to learn and instruction was fine-tuned to these learning outcomes.

Daniel, the teacher from the midsized, suburban school, was not expected to change his instructional methods. Methodology suggestions were built into the FOSS science curriculum. Labs were set up to teach questioning and process skills and designed to encourage scientific thinking. This was not a change for Daniel as it meshed with his instructional style.

Both Natalie and Seth stated they were expected to adopt the Learning Focused Schools (LFS) model of instruction. This was not a major change for either of them;

their instructional practices fit well with this model. Seth commented that the "LFS model doesn't seem to be coordinated with the curriculum changes."

The Keystone Exams and Common Core

Online survey results. When asked if administrators talk about the Keystone Exams in relation to the PSSA, three answered in the affirmative and three answered in the negative. Elaboration from those who answered affirmatively are listed here:

- We currently take Keystones in math and reading.
- They're coming, pending funding. They are more genuine types of assessment.
- I can't recall specific information. I do recall that it being said that the students must pass the Keystone Exams in order to graduate.
- Simply that they will be similar but instructional practices would not need to be changed because of them.
- Not an extensive amount. Possibility of Keystones eventually replacing PSSAs in the high school. Would not really affect 8th grade PSSAs.
- The Keystone Exams will replace the PSSAs at some point.
- Additional changes to the middle school curriculum were needed as course sequencing at the high school level changed.

Seven of the eleven participants had been advised of the Keystone Exams. All but one of the participants had been advised that the state would adopt the Common Core, replacing the standards currently in place. Their elaborations are listed here:

- We are rewriting the curriculum again with Common Core Standards.
- We need to do it [to follow common core standards].

- Coming
- PA Department of Education will continue to require public schools to institute curriculum based on state-aligned standards.
- We have been told that the common core and the state standards go together.
- We had a PowerPoint to discuss it and explain the general landscape. Our new curriculum is going to be based on common assessments throughout all schools.
- Just that the Common Core will eventually be rolled in and they will be similar to previous standards.
- Our science department and PLCs have been working to align our language used and lessons [more writing] to move towards Common Core Standards.
- Our curriculum should be aligned to the Common Core Standards.

Focus group and interview responses. Emily reported that eighth-grade students take the Keystone Exam in the same year that they take algebra. Heather reported the same but added that younger, gifted students also take the same Keystone Exam; this is dependent on when they take algebra. If Algebra I is their math course in sixth grade, they take the algebra Keystone exam as sixth-grade students.

Natalie added that the curriculum once, driven by the PSSA, was more recently driven by the Common Core.

Table 12

Compilation of Data Used in Statistical Analyses

Participant	Curriculum Change?	Change Instructional Practices?	Measure Scores				
			M1	M2	M3	M4	M5
1	Yes	Yes	2.00	5.00	2.40	3.67	7.40
2	Yes	Yes	3.40	4.20	3.60	3.50	6.00
3	Yes	No	3.40	5.00	4.40	3.17	6.80
4	No	No	3.60	5.00	3.20	3.50	8.40
5	Yes	Yes	3.20	4.60	3.20	3.67	8.00
6	Yes	Yes	4.00	4.40	2.80	3.50	6.40
7	Yes	No	3.60	4.00	4.00	4.00	7.60
8	No	No	3.20	4.80	4.60	3.83	9.00
9	Yes	Yes	2.00	4.60	5.00	3.33	7.00
10	Yes	Yes	2.00	4.80	3.60	3.33	7.60
11	Yes	Yes	3.00	2.80	3.00	3.67	8.00

Note. M1 = Self-determination Scale (SDS; 5-point scale)* ; M2 = Context Beliefs About Teaching Science, enable (CBATS; 5-point scale)*; M3 = Context Beliefs About Teaching Science, receive (CBATS; 5-point scale)*; M3 = Science Teacher Efficacy Beliefs Instrument (STEBI; 5-point scale)*; M4 = Collective Teacher Belief Survey (CTBS; 9-point scale); * = reverse scoring applied.

Table 13

Means and eta Squared Values for Each Group of Each Component of the Survey.

Survey Component	Statistic	Group 1		Group 2	
		Since implementation of the PSSA has there been a change in the curriculum you are expected to teach?		Since the implementation of the PSSA have you been expected to change instructional practices?	
		Yes	No	Yes	No
		N = 9	N = 2	N = 7	N = 4
SDS	Mean	2.96	3.4	2.80	3.45
	Eta squared	.06			
CBATS rec	Mean	3.56	3.90	3.37	4.05
	Eta squared	.03		.18	
CBATS en	Mean	4.38	4.90	4.34	4.70
	Eta squared	.16		.08	
STEBI	Mean	3.54	3.67	3.52	3.63
	Eta squared	.05			
CTBS	Mean	7.20	8.70	7.20	7.95
	Eta squared	.16		.18	

Measures of Motivation

The third research question of this study asked: How does teaching science in a PSSA environment affect teacher motivation? Motivation is the engine that sustains engagement in satisfying activities and explains the why of behavior and the processes involved (McClelland, 1989). There are many theories of motivation, two of which were used to inform this study. Self-Determination Theory (SDT; Deci & Ryan, 1985) defines motivation as a continuum with extrinsic motivation at one end and intrinsic motivation at the other and explains to what degree behavior is self-determined. Motivational Systems Theory (MST; Ford, 1992) explains motivation as a function of the interaction among a person's goals, emotions, and personal agency beliefs.

Self-Determined Behavior

Online survey results. The Self-Determination Scale (SDS; Deci & Ryan) was used to measure participants' sense of choice with respect to their behavior. The scale consisted of five pairs of statements (A and B) which the participant rated using a 5-point scale. If *Only A feels true*, 1 was selected; if *Only B feels true*, 5 was selected. Participants chose 3 if both statements were equally true.

There was no significant difference between the means of scores for those who experienced a change in the curriculum (N_1=9) (M = 2.96 SD = .767) and those who experienced no change to the curriculum (N_2 = 2) M = 3.40, SD = .283; t (9) = -.780, p = .455, two-tailed). The magnitude of the differences in the means (mean difference = -.36, 95% CI; -1.285 to .571) was moderate (eta squared = .06). In other words, 6% of the variance in this measure was explained by a change in the curriculum.

There was no significant difference in SDS scores for those who were expected to change their instructional practices ($M = 2.80$, $SD = .808$) and those who were not expected to change their instructional practices $M = 3.45$, $SD = .191$; t (7.099) = -2.03, p = .081, two-tailed). Eta squared was not calculated; Levene's test for Equality of Variances was < .05; equal variances were not assumed.

Focus group and interview responses. Comments made during the focus group meeting added depth to the data analysis. Emily commented that content and curriculum was completely driven by the state. Methodologies were still a matter of choice even if the content taught was not. She also stated that, at least at the high school level, choosing methodologies may not be an option once the Common Core is in place. She reasoned that, if the state dictates what is taught, to some degree, they would dictate how it is to be taught.

Heather explained that she was the subject of a case study and she and the other eight-grade teacher were "polar opposites." Though she felt she was not expected to change her instructional practices, she reported being frequently questioned about her practices if she and her colleague were not teaching the same thing on the same day during observation. "That uniformity is starting to kick in. Uniformity deflates creativity." She felt pressure to "better not be teaching something not a part of the standards when they come through" on an observation.

She also heard comments from the superintendent who questioned her about differences between Heather and her colleague. Heather provided an explanation about the differences when asked. Heather was responsible for the 15 students who needed learning support; no students were so identified in her colleague's class. This difference

in population was one reason for the observed differences in instruction. In her words, "there's definitely a push to make sure that every eighth-grade student going through this school district has the same experience and so we're losing team identities."

Additionally, her district was to beginning to practice Backwards Design (Wiggins & McTighe, 2005) and instruction was designed according to the assessment. "Currently, the PSSA is what drives our assessments which drive instruction. The natural consequence of this is that methodologies may become more uniform."

Both Daniel and Natalie reported they have control in the choices they make regarding their instructional processes. There were some similarities as well as differences in their methodologies compared with their colleagues. Unlike Heather, they were not questioned about these differences. Natalie was required to use the Learning Focused Classroom (LFC) model and, as long as she adhered to that program, she had the freedom to tweak the curriculum and choose methodologies.

"Tweak" was the operative word; the curriculum basics were expected to be taught. In a previous year, the administration imposed the use of the Standard Aligned System [SAS]. The teachers found they needed more resources than they possessed and transition among the topics was categorized as being very "jumpy." Their misgivings were heeded by the administration and they moved back to using the more familiar benchmarks and standards. The participant speculated that the reason for this turnaround was due to the fact that acquiring more resources involved unbudgeted expense for the district.

Seth reported being restricted to the curriculum that was in place. The curriculum committee that worked on the latest revision was composed of one person per building of

19 buildings in this district. The science department chair was the person from Seth's school assigned to this committee, so Seth was not able to actively participate in making any changes. He was, however, permitted to contribute his ideas by way of postings on the share drive in his district. Methodologies were required to fall within the framework of LFS; Seth did not feel restricted in his instructional practices.

Context Beliefs

Self-determined behavior is one component of one of many theories of motivation. Whereas SDT (Deci & Ryan, 1985) defined personal motivation as a point along a continuum of states ranging from extrinsic to intrinsic motivation, Ford's MST (1992) mathematically expresses motivation as the product of goals, emotions, and personal agency beliefs. Goals are defined as an individual's objectives. Personal agency beliefs are defined as belief in one's competence coupled with perceived support from the environment--context beliefs.

Online survey results. The Context Beliefs About Teaching Science (CBATS; Lumpe et al., 2000) was used to measure context beliefs. The Likert-type survey consisted of two overarching statements, the first of which was: *The following factors would enable me to be an effective teacher*. Five statements followed and the participant rated each with a 5-point scale ranging from 1 (*strongly agree*) to 5 (*strongly disagree*).

The data revealed that teachers believed that the supports listed in this survey (Appendix H) would enable them to be better teachers. With one exception, all participants agreed or strongly agreed that these factors/supports would enable science teachers to be more effective. There was no significant difference in CBATS enable scores for those who were expected to change curriculum ($N_1 = 9$) ($M = 4.38$, $SD = .682$)

and those who were not expected to change curriculum (N_2 = 2) M = 4.90, SD = .141; t (9) = -1.037, p = .327, two-tailed). The magnitude of the differences in the means (mean difference = -.52, 95% CI; -1.661 to .617) was large (eta squared = .16).

There was no significant difference in CBATS scores for those who were expected to change instructional practices (M = 4.34, SD = .728) and those who were not expected to change instructional practices M = 4.70, SD = .476; t (9) = -.870, p = .407, two-tailed). The magnitude of the differences in the means (mean difference = -.36, 95% CI; -1.285 to .571) was moderate (eta squared = .0775).

The second overarching statement of the CBATS was: *How likely is it that these factors will occur in your school?* The same five statements followed; however, the rating scale was slightly different. Response choices ranged from 1 (*very likely*) to 5 (*very unlikely*).

There was no significant difference in CBATS receive scores for those who were expected to change curriculum (M = 3.56, SD = .817) and those who were not expected to change curriculum (M = 3.90, SD = .990; t (9) = -.526, p = .612, two-tailed). The magnitude of the differences in the means (mean difference = -.344, 95% CI; -1.827 to 1.138) was small (eta squared = .03).

There was no significant difference in CBATS scores for those who were expected to change instructional practices (M = 3.37, SD = .836) and those who were not expected to change instructional practices M = 4.05, SD = .619; t (9) = -1.405, p =.19, two-tailed). The magnitude of the differences in the means (mean difference = -.679, 95% CI; -1.77 to .414) was large (eta squared = .18).

Focus group and interview responses. Participants in the focus group and the interviewees reported that, while there was no extra money for wish-list items, each teacher received the materials needed to do lab activities and teach science effectively.

Heather shared that the science department enjoys a "great relationship with our [school] board." She indicated that, despite the budget cuts in the district, money had never been taken from the science budget. They have a new middle school, which includes a fully equipped laboratory for 24 students. As long as teachers provided a solid rationale for what was needed and why it was needed, their requests were filled. Seth, along with his colleagues, reported some creative-problem solving in order to maximize a strained budget. They taught the sequence of their courses in opposite directions so that there was no competition for the necessary materials. Daniel indicated he always received everything he needed to teach his students as long as he placed his order on time. Natalie stated now that adequate yearly progress in science has become part of the district's report card, financial support has been moved back into the science department and she received what she needed without question. "Still, the overall feeling that science was not as important as language arts and math remained."

It is interesting to note that, after an unfortunate laboratory accident in another middle school in the area, Emily's request for updated safety equipment was promptly filled. This same accident instigated questions about Natalie's lab safety procedures. "There were lots of questions about what I do lab-wise and why [did I] need this? . . . You seem to know what you're talking about- so okay."

For many of these teachers, off-site professional development opportunities were extremely limited due to budget constraints. Instead, many in-service opportunities for

the faculties were held in any district school. Seth taught in a large district with many buildings and professional development was also held in-house. He was required to attend at least three workshops per academic year from a list of options to which he contributed ideas. The workshops he attended were required to be related to science. Conference attendance opportunities were very limited due to the expense involved. Daniel was reimbursed his entry fee to attend an NSTA (National Science Teachers Association) conference; he attended on a Saturday, which eliminated the need for a substitute, nor did he submit an expense report.

All study participants reported unconditional colleague support within their buildings. Teachers worked together to teach the middle school science curriculum. They freely shared their ideas and their materials with one another.

Efficacy Beliefs

Teacher efficacy is defined in this study as the extent to which a teacher feels capable to help students learn. Collective efficacy, defined as the group's belief in its ability to have a positive effect on student achievement, develops as a result of interactions with other teachers. Self-efficacy and collective efficacy beliefs were the focus of the fourth research question: How does teaching in a PSSA environment affect teacher efficacy beliefs?

Self-Efficacy Beliefs

Online survey results. Self-efficacy beliefs were assessed using the Science Teacher Efficacy Beliefs Instrument (STEBI; Riggs & Enochs, 1990). Participants were asked to rate five items as to the degree to which they agreed or disagreed with each statement. (1=strongly agree; 5 = strongly disagree)

There was no significant difference between the mean STEBI scores for those who had experienced a change in curriculum ($N_1 = 9$) ($M = 3.54$, $SD = .247$) and those who did not experience a change in the science curriculum ($N_2 = 2$) $M = 3.67$, $SD = .236$; t (9) = -.675, $p = .517$, two-tailed). The magnitude of the differences in the means (mean difference = -.13, 95% CI; -.564 to .304) was small (eta squared = .05).

Likewise, there was no significant difference in STEBI scores for those who were expected to change instructional practices ($M = 3.52$ $SD = .150$) and those who were not expected to change instructional practices $M = 3.63$, $SD = .370$; t (3.575) = -.524, $p = .19$, two-tailed). Eta squared was not used. Levene's test for Equality of Variances was < .05; equal variances were not assumed.

Focus group and interview responses. During the focus group discussion, Emily attributed "a great deal" of what she does in the classroom as the cause for her students' success. "I think that what we do as teachers, especially in science, is what helps the kids become as effective as they are at learning things." She felt fortunate to teach a subject in which it was possible to motivate the unmotivated.

Daniel seemed to be uncomfortable giving himself too much credit for student learning. He reasoned there will always be students who are successful, and there will always be students who are not successful, in spite of opportunities presented or his best efforts. While not the sole reason for student success, he felt his work did contribute to his students' learning.

Natalie commented that she "would like to think" that her efforts contributed "a good bit" to student learning. She tried to consistently demonstrate her interest in the subject matter and make the subject matter as interesting as possible for her students. She

received positive feedback from parents who expressed surprise at their children's interest in science. Parents reported that their children's high school scheduling choices included science courses, demonstrating their newfound interest in the subject

Seth expressed his contribution to student success as a ratio: 50/50. Like the other interview participants, he seemed almost embarrassed by the question and was reluctant to give himself too much of the credit for student learning. Seth strove to reach all his students by varying the delivery of the lessons. He reasoned that students do not learn the same way; his instructional methods were varied so that all could learn. "Half of it [reason for academic success] falls on them, the other half, I would be the cause."

Collective Efficacy

Online survey results. The Collective Teachers Beliefs Scale (CTBS; Tschannen-Moran & Barr, 1994) was used to assess collective efficacy beliefs. Like the STEBI, it was a 9-point, Likert-type survey that asked participants to indicate an opinion about each of six questions by marking any one of the nine responses on a continuum ranging from (1) "None at all" to (9) "A great deal."

In this case, the independent samples t-test did reveal a significant difference in CTBS scores for those who were expected to change curriculum ($N_1 = 9$) ($M = 7.20$ $SD = .700$) and those who were not expected to change curriculum ($N_2 = 2$) $M = 8.70$, $SD = .424$; $t\ (9) = -2.843$, $p = .019$, two-tailed). The magnitude of differences in the means (mean difference = -1.50, 95% CI; -2.693 to -.306) was large (eta squared = .16).

There was no significant difference in SDS scores for those who were expected to change instructional practices ($M = 7.20$, $SD = .775$) and those who were not expected to change instructional practices $M = 7.95$, $SD = .957$; $t\ (9) = -1.425$, $p = .19$, two-tailed).

The magnitude of the differences in the means (mean difference = -.75, 95% CI; -1.94 to .441) was large (eta squared = .184). The effect of the expectation of change accounted for 18% of this difference.

Focus group and interview responses. Statements made during the focus group discussion and interviews reinforced these survey results. Heather stated, "We *are* their teachers so we *are* going to take credit for student learning." She added that she thought the team concept contributed to collective efficacy.

A team is composed of the core subject teachers and the group of students who these teachers teach. Common planning time is built into the teachers' schedules for planning, collaboration, or meeting with students or parents. Collaboration has been shown to reduce stress levels and boost collective efficacy beliefs. Students, too, benefit from a strong collective efficacy because their teachers hold high expectations for them which leads to increased student achievement (Adams & Forsyth, 2006; Skaalvick & Skaalvik, 2007; Stajkovic et al., 2009).

While Emily's school no longer used the team approach, Heather's school is "clinging to the team concept." As a point of interest, she was a participant in her principal's case study about differences between the two eighth-grade teams. One of the team goals was to prepare their students for high school. There was a level of rigor, a set of expectations and a level of responsibility to which the students are held. Though they struggled with these expectations at the beginning of the year, there was evidence that the team is successful in meeting the goal. An end-of-year letter-writing activity provided the evidence. Students wrote letters to any of their teachers and a common sentiment included in these letters was "I worked really hard this year and while I didn't make the

straight As that I made in seventh grade, I really feel like I'm prepared for next year." Heather summed it up by saying, "And we are going to feel good about that. And so we're sold on ourselves." While she could not speak for the other team of teachers, the occasional letter sent to her by students of the other team did not contain the same level of sentiments.

According to the participants, the team concept contributed to collective efficacy. Curriculum changes and increasing performance levels have started the decline of the team concept. The teachers did not feel like a true team any longer. A true team was able to use a common block of time for the integration of curricula or for team-building and learning activities and this was no longer the case. The addition of content, increasing performance cut scores, limited planning time, and changing curricula have put into motion the decline of the team.

Seth had a variety of teaching assignments within his district, different grade levels and different science courses. His present assignment has been his favorite. "The cooperation of the staff, and the all-in type of attitude is conducive to student success. The structure and the organization here are definitely conducive to student success."

Natalie cited the contribution of "data days" to collective efficacy. Once a month her team convened to review test scores. The focus of these meetings was not the improvement of PSSA scores, but an increase in student learning. They examined their methods and curricula on a regular basis, making changes as needed for the benefit of their students. There was a high level of concern and caring for their students and, as a team, the faculty worked together to ensure student success. Work sessions and flex periods—study hall time designated for help–were used to provide tutoring and

individual attention. These sessions were not limited to teaching content; process and organizational skills were also a goal for tutoring. When learning improved, the PSSA scores improved as a result. Daniel reported the same experience in his school. Again, the primary purpose of monitoring student progress was student learning; improvement of PSSA scores was the logical outcome. This high level of cooperation and concern held true for the departments as well as within the grade level teams in his building.

Putting It All Together

With such a small sample group size, a correlation analysis of the quantitative results was not a realistic expectation. Rather, converted participant scores (see Table 14) for each measure were plotted for the two groups to reveal possible patterns or trends (see Figures 3 and 4). A converted score of .8 and above was considered to be strong, .6 to .8 was considered above neutral, .5 was the neutral point, .3 to .49 was considered below average, and 0 to .2 was considered to be weak.

As stated earlier in this chapter, Group 1 was defined by whether or not there was a change in the science curriculum; Group 2 was defined by whether or not there was an expectation of change to instructional practices. Focus group and survey participants were not linked to participant numbers. The online survey, featuring no identifiers, guaranteed anonymity.

Participants 4 and 8 experienced no change in curriculum and were not expected to change their instructional practices. Participants 3 and 7 were not expected to change their instructional practices, but did experience a change in the curriculum. All other participants experienced both a change in the science curriculum as well as the expectation to change their instructional practices.

Most of the Likert-type surveys used in this study's instrument included a 5-point scale; one used a 9-point scale. All the individual survey scores were converted through mathematical calculations and results ranged from 0 to 1. These equivalent scores were used for graphing.

Table 14

Converted Scores for Graphical Representation of Group Comparison

Participant	Curriculum Change?	Change Instructional Practices?	Converted Measure Scores				
			M1	M2	M3	M4	M5
1	Yes	Yes	.40	1.00	.48	.73	.82
2	Yes	Yes	.68	.84	.72	.70	.67
3	Yes	No	.68	1.00	.88	.63	.76
4	No	No	.72	1.00	.64	.70	.93
5	Yes	Yes	.64	.92	.64	.73	.89
6	Yes	Yes	.80	.88	.56	.70	.71
7	Yes	No	.72	.80	.80	.80	.84
8	No	No	.64	.96	.92	.77	1.00
9	Yes	Yes	.40	.92	1.00	.67	.78
10	Yes	Yes	.40	.96	.72	.67	.84
11	Yes	Yes	.60	.56	.60	.73	.89

Note. M1 = Self-determination Scale (SDS; 5-point scale)* ; M2 = Context Beliefs About Teaching Science, enable (CBATS; 5-point scale)*; M3 = Context Beliefs About Teaching Science, receive (CBATS; 5-point scale)*; M3 = Science Teacher Efficacy Beliefs Instrument (STEBI; 5-point scale)*; M4 = Collective Teacher Belief Survey (CTBS; 9-point scale); * = reverse scoring applied.

The first measure assessed participants' beliefs that their behaviors were self-determined. Participants 1, 9, and 10 experienced a change in curriculum and scored low in believing their behaviors were self-determined (*M1* = .40). The other participants scored on the higher end of the neutral point; they believed (even if only slightly) their behaviors were self-determined.

The next measures involved a 2-sided survey about the context beliefs of the participants. Context beliefs were a part of Ford's Motivation Systems Theory (MST;

1991). On the one hand, participants were asked to rate how receiving financial, professional, and administrative support would enable them to be effective teachers. On the other hand, they were asked how likely it was to receive these supports. Not surprisingly, most participants from both groups believed that receiving financial, administrative, and professional support would enable them to be more effective teachers. Participant 11 did not share as strong a belief as the others, but was on the positive side of neutral, if only slightly (*M2* = .56). The participants did not indicate as strong a belief in the likelihood of receiving these supports. Participant 8 (no change in both groups) believed that support was likely to be received (*M3* = .92). Since there had been no change to the curriculum and there was no expectation of change to instructional practices, perhaps there was no reason to believe that receiving these supports would change. For those who experienced a change in the curriculum, only participants 3 and 9 believed the likelihood of receiving these supports was high (M3 = .88 and 1.00, respectively). Participant 3 was not expected to change instructional practices, as was Participant 9. Finally, except for Participant 1 (*M3* = .46), the belief that the participants were likely to receive the supports needed to be effective was on the higher side of neutral.

Self-efficacy beliefs were assessed using the Science Teachers Efficacy Beliefs Instrument (STEBI; Riggs & , Enochs,1990). While all participants scored on the positive side of neutral no one participant held strong self-efficacy beliefs (M4 scores ranged from .63 to .80). Participants 7 (change in curriculum only) and 8 (no change for both group definitions) held the two highest scores (M4 = .80 and .77, respectively). Participant 3 held the lowest score for self- efficacy beliefs. Participant 3, like Participant

7, was not expected to change instructional practices even though a change in the curriculum had occurred. These results suggested that self-efficacy beliefs were independent of external variables in the academic environment.

The final measure of this study was teacher collective efficacy beliefs. All participants held high collective efficacy beliefs. Participant 8, who experienced no change to the curriculum and was not expected to change instructional practices, scored high for collective efficacy beliefs (*M5* = 1.00). Participants scored on the higher side of neutral for collective efficacy beliefs than self-efficacy beliefs, except for Participant 2 who was expected to both change instructional practices and experienced a change to the curriculum (*M4* = 70, *M5* = .67). This was a small decline and may not represent a significant difference; however, it is interesting to note it represented a decline.

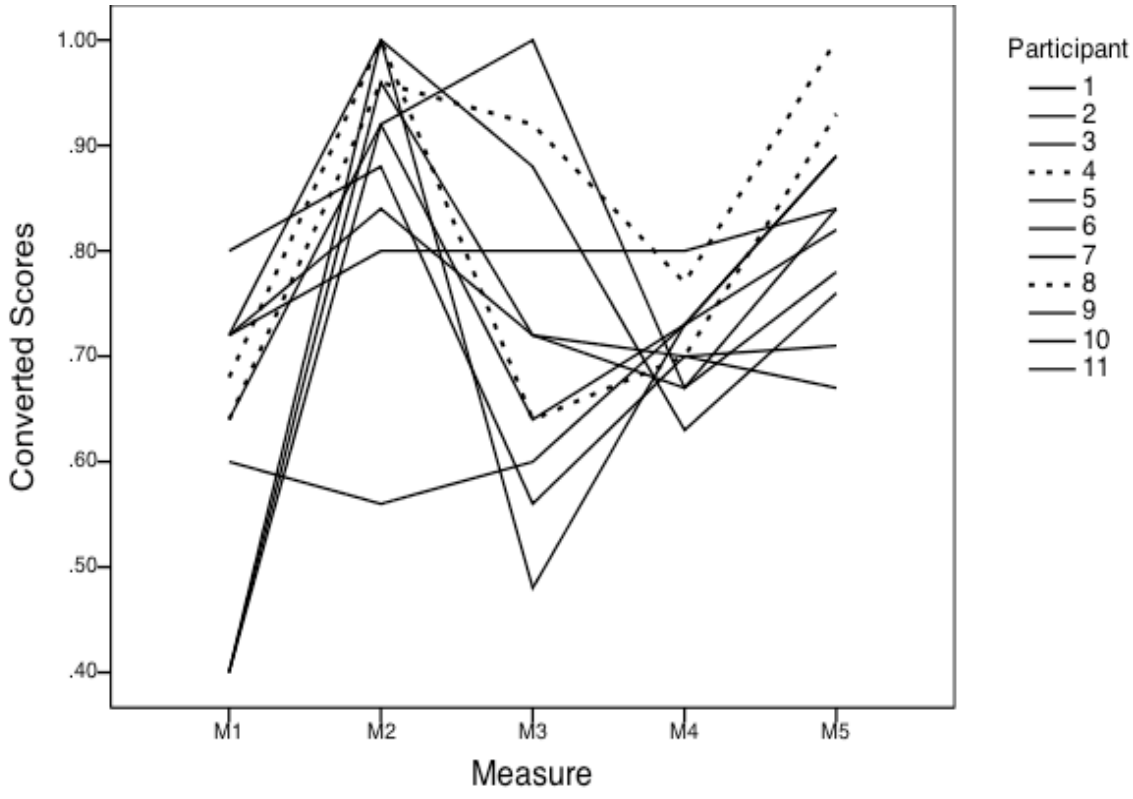

Figure 3. Graphical representation of converted measure scores for each participant of Group 1 regarding curricular change. ----- = no change

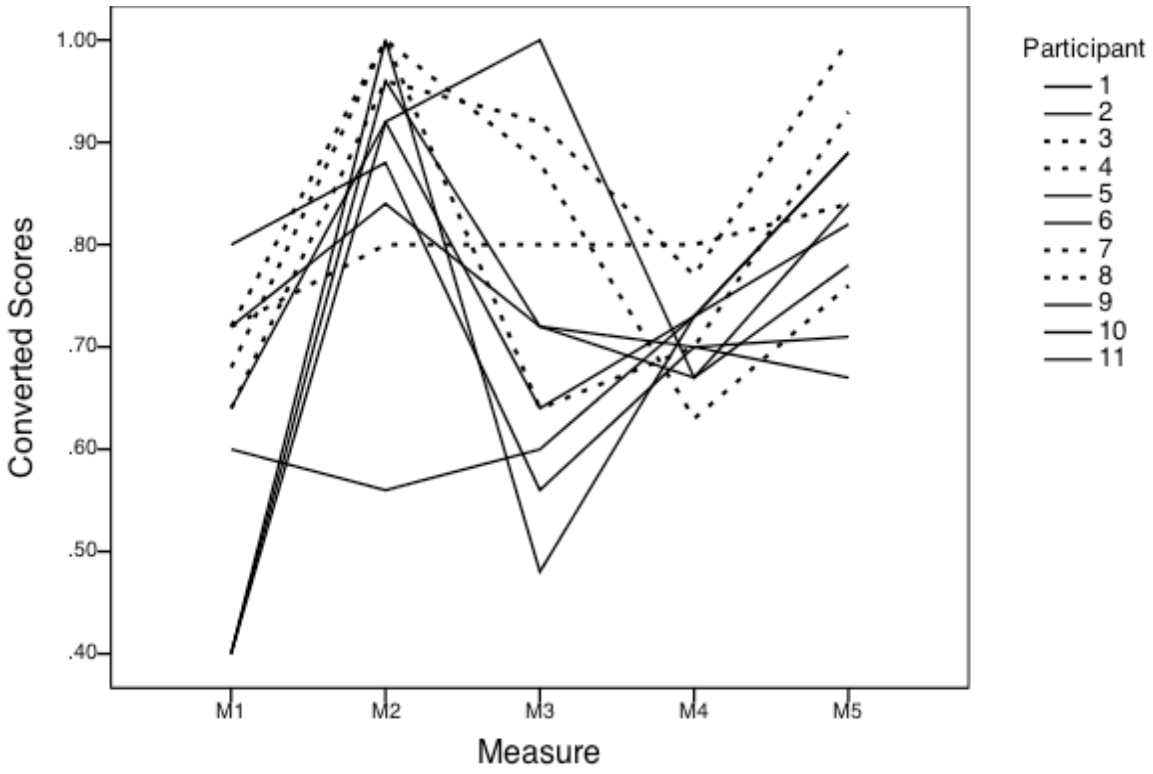

Figure 4. Graphical representation of converted measures scores for Group 2 regarding the expectation of change to instructional practices. ----- = no expectation of change

Summary of Analyses

The purpose of this study was to assess how the implementation of the science PSSA affected the curriculum, instructional practices, motivation, and efficacy beliefs of eighth-grade public school science teachers. This was a mixed-methodology study. Quantitative data were collected by way of an online survey that was distributed to 29 eighth-grade science teachers in south central Pennsylvania. Qualitative data were collected by way of a focus group discussion and interviews.

Eleven teachers completed the survey; this was a 38% return. Nonetheless, this was a small sample and the results of these data cannot be generalized to the population of eighth-grade science teachers in Pennsylvania.

Two teachers participated in a focus group discussion and three individuals who, while unable to attend the focus group meeting, agreed to meet for interviews. The focus group discussion and interviews provided depth of explanation to survey responses and bolstered the analyses of the quantitative data.

Descriptive statistics and independent-samples t-tests were used to determine if there was a significant difference between the means of each component of the survey. The two groups were defined as those who either experienced a change in the science curriculum, were expected to change their instructional practices or both.

Generally, the differences of the means were not significant. There was one exception in that there was a significant difference between the means of the measure of collective efficacy beliefs in Group 1.

Because sample size was small, eta squared statistics were used to ascertain the magnitude of the differences between the groups. This value was calculated when the means showed no significant difference and the Levene's Test for Equality of Variances was greater than .05.

Finally, a graphical representation of the data was analyzed for patterns in the measure scores among the participants for the two groups. In the next chapter, these analyses will be used to discuss implications and insights gained from this study.

CHAPTER FIVE

SUMMARY AND DISCUSSION

Introduction

This chapter summarizes the results of this mixed-methodology study that investigated the impact of the implementation of the science PSSA test on the curriculum and instructional practices of eighth-grade public school science teachers. A tripartite framework of teacher motivation, change theory and efficacy beliefs was used to address the study's research questions.

The data were analyzed using descriptive statistics, independent sample t-tests, and eta squared calculations. Qualitative data, which supplemented the quantitative data, were obtained from a focus group discussion and interviews with five of the survey's participants.

Discussion of the Findings

The number of participants in this study was small, and generalizations about the motivating factors and efficacy beliefs cannot be extrapolated to include all eighth-grade science teachers. However, these results do provide a snapshot of the experiences of a few eighth-grade science teachers in south central Pennsylvania who teach science in a PSSA environment and the following conclusions can be made. The participants, who responded to the survey, are dedicated, and motivated teachers who believe financial, administrative, and professional supports made them more effective teachers. They credit the efficacy of the group more than they do the efficacy of the individual for student success.

This mixed-methodology study was designed to test the hypothesis that, despite the specter of PSSA influence on the academic climate, teachers are not necessarily influenced to change instructional practices, even if the curriculum has changed. The survey used for the quantitative portion of this study was a compilation of general questions designed to gather demographic data and ascertain the changes that participants had experienced and four modified Likert-type surveys for assessing two of the many factors affecting motivation and self- and collective efficacy beliefs that influence teacher behavior (see Table 8 for the identification key). Focus group discussion and interview questions were designed to elicit responses that provided more in-depth explanations to the survey responses.

Research Questions 1 and 2

Research questions 1 and 2 were designed to determine whether or not there was a change in curriculum or an expectation of change to instructional practices.

Expectations of change. The participants were separated into two groups. Group 1 was defined by whether or not there was a change to the eighth-grade curriculum since the implementation of the science PSSA. Nine participants reported a change in the curriculum; two reported no change to the curriculum. Independent samples t-tests were used to determine any significant differences in the means of each measure's score for those who responded "yes" to change and those who responded "no".

Group 2 was defined by the expectation to change instructional practices since the implementation of the science PSSA. In this case, seven participants were expected to change their practices; four were not. Again, independent samples t-tests were used to

look for significant differences between the means of each measure's score for those who responded "yes" to change and those who responded "no."

Research Question 3

Measures of motivation. Implementing change is a process that is unsettling, challenging, invigorating, scary, or any combination of these states. Teacher motivation is a critical variable that can make or break the successful implementation of change. Two theories of motivation were used in this study. They were Deci and Ryan's Self-Determination Theory (SDT; 1985) and Ford's Motivational Systems Theory (MST; 1992).

No statistically-significant differences were found between the means of scores for measures of motivation for Group 1 and Group 2. This indicates that teacher motivation was not influenced by changes to the curriculum, nor by the expectation of change in instructional practices. The graphical representations of these data reveal no definitive pattern among the scores of each measure for each participant.

Self-determined behavior. The Self-Determination Scale (SDS; Deci & Ryan, 1985) was used to assess how much of teachers' behavior was self-determined regarding curricular choices and their instructional practices. Participant scores for self-determined behavior ranged from one point below neutral to one point above neutral.

The mean for those who reported a change in curriculum (N = 9) was slightly below the neutral point of self-determined behavior. In other words, they had a slightly higher tendency to believe that behavior was not self-determined. For the two who did not experience the same change of curriculum, the mean of the SDS was 3.40 or slightly above neutral. In other words, they believed that their behaviors were self-determined,

but only slightly. Eta squared calculations indicated that the change in curriculum had a moderate effect on self-determined behavior. This was supported by data collected from the focus group discussion and interviews. Science curriculum was determined by the state and, therefore, these teachers reported having no control in choosing what was to be taught in their classrooms. Any possible input was through participation on a curriculum committee, and this was not an option for most of the participants. This parallels the findings of MacDonald's study (2009) that concluded top-down mandates and external controls do little to cause authentic change because they negatively affect motivated behavior.

The mean for those who reported an expectation of change to their instructional practices change in curriculum (N = 7) was slightly below the neutral point of self-determined behavior. In other words, they had a slightly higher tendency to believe that behavior was not self-determined. For the four who did not experience the same expectation of change, the mean of the SDS was slightly above neutral. They believed that their behaviors were self-determined, if only slightly. Eta squared calculations could not be run for the measure of self-determined behavior in this group; the criteria were not met. The effect of the expectation of change on the perception of self-determined behavior could not be ascertained.

Though, statistically, it could not be determined if an expectation of change in instructional practices (N=7) had a significant effect on perceptions of self-determined behaviors, anecdotal data was used to provide support for these findings.

Participants expressed fear that a change in curriculum would eventually be accompanied by the expectation to change instructional practices. A few reported feeling

pressure to conform their practices to match methodologies such as Learning Focused Schools (LFS; Learning Focused, 2010-2013) or Backward Design (Wiggins & McTighe, 2005). The pressure to meet AYP had shifted the focus from developing effective instructional practices to PSSA results themselves.

Context beliefs. Context beliefs is the variable in Ford's Motivational Systems Theory (MST; 1992) motivation equation that factors in the external supports that contribute to an individual's motivation. The Context Beliefs About Teaching Science (CBATS; Lumpe et al., 2000) survey was used to measure the context beliefs of the participants. The Likert-type survey consisted of two overarching statements: 1) The following factors would enable me to be an effective teacher and 2) How likely is it that these factors will occur in your school? Each component of this survey is discussed individually in the paragraphs that follow.

As was the case for the Self-Determination Scale, there were no significant differences, for either Group 1 or Group 2, between the means for the CBATS that measured to which degree the participants felt that financial, administrative, and professional supports would enable them to be effective teachers. Individual scores were high for this part of the survey; participants, with one exception, believed that receiving financial, administrative, and professional supports would enable them to be effective teachers. Eta squared calculations indicated that a change in curriculum (Group 1) accounted for a large effect on the belief that receiving these supports would enable the participants to be effective teachers. In Group 2, the expectation of change in instructional practices accounted for a moderate effect on this belief.

The second part of the CBATS assessed teachers' belief in the likelihood of receiving the financial, administrative, and professional supports enabled them to be effective teachers. Eta squared calculations revealed that a change in the curriculum (N = 2) had a small effect on this measure while the expectation of change in instructional practices (N = 7) exerted a large effect on this belief.

In conclusion, teachers were neutral in the belief that their behaviors were self-determined. What they did and how they did it were not of their choosing, nor were their behavior choices determined by external sources. This neutral result did not boost or deflate motivation. In contrast, context beliefs were high. Teachers believed receiving administrative, financial, and colleague support would enable them to be more effective teachers. They also held a high belief that they would receive these supports. The positive relationship between context beliefs and motivation was a logical outcome; strong context beliefs contributed to teacher motivation. This conclusion was supported by the literature. Provision of financial and material support has been linked in previous studies to strengthened motivation by enabling effective instructional practices (Colbeck et al., 2002; Ford, 1995; Haney et al., 2002).

Research Question 4

Measures of efficacy beliefs. Teacher efficacy was defined as the extent to which a teacher feels capable to help students learn. Efficacy beliefs influenced both job performance and commitment to the teaching profession (Guskey, 1988; Tschannen-Moran & Woolfolk Hoy, 2001), which was related to teacher motivation (Ware & Kitsantas, 2007). Since most teachers do not work is isolation, interaction with other teachers results in the development of collective efficacy beliefs. These were defined as

the group's belief in its ability to have a positive effect on student achievement (Adams & Forsyth, 2006; Skaalvik & Skaalvik, 2007; Stajkovic et al., 2009). Self-efficacy and collective efficacy were positively and strongly related (Ware & Kitsantis, 2007; Klassen et al., 2011).

Self-efficacy beliefs. Self-efficacy beliefs were assessed using the Science Teachers' Efficacy Beliefs Instrument (STEBI; Riggs & Enochs, 1989). There was no statistical difference between the means for STEBI scores in either Group 1 or Group 2. The eta squared calculations revealed that a change in curriculum (N = 9) exerted a small on self-efficacy beliefs. Eta squared calculations were not done for Group 2; the data did not meet the criteria for this test.

All individual scores for the STEBI fell above, but no higher than one point above, the neutral point. The focus group participants and the interview participants, while they expressed high self-efficacy beliefs, seemed reluctant to give themselves all the credit for student success. While they strove to make lessons interesting, thus engaging students in the learning process, they would not accept all the credit for student success. They cited their students as also responsible for their success.

Collective efficacy beliefs. The collective efficacy beliefs of this study's participants were measured using The Collective Teachers Beliefs Scale (CTBS; Tschannen-Moran & Barr, 1994). This was the only measure to show a significant difference in the means of the scores for those who had to change the curriculum (N = 9) opposed to those who saw no change in curriculum. The change in curriculum had a significant effect on the collective efficacy beliefs of teachers. Eta squared calculations

revealed that the effect of the expectation of change in instructional practices (N = 7) on collective efficacy beliefs was large.

The converted scores for the measure of collective efficacy were consistently higher than the converted scores for self-efficacy beliefs, which were also higher than neutral. Conversation with the focus group participants and the interviewees provided insight into the reasons for these results. Though reluctant to take credit for their individual contribution to student success, these teachers consistently credited their collective efficacy as the reason for student success. They felt they were stronger as a group rather than as individuals and credited their efforts as a group as the stronger contributor to student success. High expectations for their students, regular team meetings, common planning time, and regular analysis of student data were used to create meaningful lesson plans, which created positive learning experiences for their students.

Implications

Children are sent to school to receive a high-quality education (Paige & Hickok, 2004) and to achieve and leave school proficient in achievement standards. Learning is assessed by standardized tests, and this is how schools are held accountable for student learning. The purpose of this study was to examine the effect of the science PSSA on the curricular and instructional practices of eighth-grade teachers. This was examined through a trifocal lens of change theory, motivation, and efficacy beliefs. The hypothesis was that teacher motivation, self- and collective efficacy beliefs would not be affected by a change to the science curriculum or the expectation of change to their instructional practices.

The Self-Determination Scale (SDS) scores were not indicative of self-determined behavior. The teachers in this study felt that the curriculum was one aspect of education over which they exercised no control. It was reported that teachers "were allowed to tweak curriculum and make changes on their own" but they were subjected to "lots of micromanagement." This contradiction led to the conclusion that, for all the work and discussion of teacher committees, and regardless of the committee recommendations, decisions made are top-down decisions. When the committee made recommendation of which the administration approved, the appearance of autonomy was maintained; if not, then top-down decision-making occurred. This controlling environment diminished feelings of autonomy and eroded motivation.

The expectation of change in instructional practices was reported by seven of the eleven participants. Prescribed programs, such as Learning Focused Schools (Learning Focused, 2010-2013) or the Full Option Science System (FOSS; The Regents of the University of California, 2011) curriculum, along with the ancillary lab activities, were to be used for instruction. This did not pose a threat to motivation to those teachers who were familiar with these programs and used them in their classrooms. For those teachers who were mandated to change their methodologies, this created an autonomy-controlling environment, which negatively affected their motivation.

Not surprisingly, the teachers believed that receiving support would enable them to be effective teachers; the CBATS en score was above average. The respondents also indicated that they believed they were likely to receive the supports they needed in order to be more effective. Their beliefs were reinforced by past experiences. Even with

budget cuts, they had always received what they needed to provide their students with a meaningful learning experience.

Self-efficacy beliefs were above average, but not what would be considered high. Focus group participant and interviewee remarks revealed a level of humility in these teachers. One participant commented that there will always be students who succeed, even in a classroom with an ineffective teacher; and there will always be students who struggle, even in a classroom taught by a highly-effective teacher. As a whole, they were reluctant to attribute their capability as the major cause of their students' success. Instead, they credited the efforts of the group or team of teachers as the reason for student success.

Of all the measures taken in this study, the highest scores were for the measure of collective efficacy beliefs. The team concept contributed to collective efficacy beliefs and, sadly, it has been eliminated in a few participants' schools. Even so, these teachers still found a way to collaborate. They recognized the importance of providing a strong academic experience for their students.

Recommendations

Children are sent to school to learn. Schools are responsible for hiring the teachers who are expected to use sound instructional practices so that children do, indeed, learn. Schools are measured against a standard of student learning known as adequate yearly progress (AYP). Standardized assessments measure AYP, thereby indicating whether or nor schools have been successful. The Pennsylvania System of School Assessment (PSSA) uses a battery of tests to measure learning in terms of AYP in the core subjects of reading, writing, math, and science.

If students do not demonstrate AYP, teachers and administrators have the option of implementing curricular and instructional changes so that AYP is met before that school is labeled as being "in need of improvement." It is more likely that these are the schools to implement change; however, it is also possible that there are schools that implement change in order to maintain or improve AYP.

Change is a difficult and complex process (MacDonald, 2006) fraught with anxiety (Guskey, 1986). Change involves uncertainty (Guskey, 2007) and teachers are resistant to change (Fazio & Meliville, 2008) for a number of reasons. Teachers need to see the value of change, and there has to be a high probability of success for implementation (Guskey, 1986; Ng, 2009). If changes are to be successfully implemented, teacher motivation and efficacy beliefs must be cultivated because, ultimately, successful change increases the chance for student learning (MacDonald, 2009).

There is a greater chance of success when teachers are active participants in the change process (Guskey, 1986). They must believe they exert some control over the changes they are implementing (Guskey, 1986; Ignat & Clipa, 2010) and expect a high probability of success (McClelland, 1986). Teacher motivation and efficacy beliefs are eroded in an atmosphere of external control (Ryan & Weinstein, 2009). Administrators need to keep in mind that top-down decisions do not motivate (Guskey, 2006).

The first recommendation related to the findings of this study is to create an autonomy-supportive environment. An autonomy-supportive environment is marked by involvement in the decision- making process (Deci, 2009; Deci et al., 1999), establishment of professional learning communities to promote collaboration (Fullan,

2006), and making change part of action research. An environment that supports autonomy, competence and relatedness (Roth et al., 2007) increases motivation. This environment is further supported by clear communications, common goals, and positive and frequent feedback on progress (Fazio & Melville, 2008; Purkey & Smith, 1982). Roadblocks such as unnecessary paperwork and distractions should be eliminated (Fullan, 2001, 2007).

A second recommendation is that districts either strengthen or reinstate the team-teaching model. Teachers in this study consistently credited this model as being a major reason for their success in the classroom. Creating positive working relationships among teachers and administrators in an organized workplace sets the stage for capacity-building opportunities, providing feedback and sharing experiences, and giving peer support (Beltman, 2009; Fullan, 1985, 2007; Guskey, 2007) all of which enhance motivation and efficacy beliefs. Supportive school structures are ones where teachers are encouraged to interact and are provided with the time to interact in an appropriate academic setting (Klassen et al., 2011; Ware & Kitsantas, 2007). Through their interactions with colleagues, teachers develop collective efficacy beliefs that have been shown to be positively and strongly related (Ware & Kitsantas, 2007; Klassen et al., 2011). Efficacy beliefs influence teachers' job performance and commitment to teaching (Guskey, 1988; Tschannen-Moran & Woolfolk Hoy, 2001). A supportive environment also includes professional development opportunities that cultivate the development of increased efficacy beliefs (Ross & Bruce, 2007).

A third recommendation of this study is to provide the professional, administrative, and financial supports that are known to increase motivation (Ford, 1992).

When combined with the materials necessary for a solid learning environment, capability beliefs increase. Capability beliefs also feed self-efficacy beliefs and, as a result of interaction with like-minded teachers, also reinforce collective efficacy beliefs.

Teachers with high-context beliefs and high-capability beliefs are strong, effective science teachers (Haney et. al, 2002). Students have a greater chance of academic success when their teachers work in a supportive environment (Roth et al., 2007). Student successes feed their teachers' sense of competence, motivating their teachers to continue to provide a supportive academic environment for their students (Alfi et al., 2004; Deci, 2009; Roth et al., 2007; Sorebo et al., 2009).

These factors create a strong learning environment that results in student achievement. Teachers who are provided with an autonomy-supportive environment provide the same type of environment for their students, providing them with a greater chance of success (Roth et. al., 2007). Student success feeds teacher competence feelings (Deci, 2009). Teachers with high-efficacy beliefs hold high expectations for students and provide greater academic focus in their classrooms. Their students experience higher achievement than students who are taught by teachers with low-efficacy beliefs (Gibson & Dembo, 1984; Ware & Kitsantas, 2007). Clearly, this is a win-win situation for all if these recommendations are put into practice.

Further Study Is Needed

Future study of this subject could take many directions. The results of this study, while informative, were not statistically significant. The results inform readers about a small group of eighth-grade science teachers in south central Pennsylvania and cannot be extrapolated to speak for all eighth-grade science teachers. One possible modification of

this study is to include all middle school science teachers; do not limit the study to eighth-grade science teachers. Though the science PSSA test is administered to only eighth-grade students, it cannot be assumed that there is no effect on the curricula or instructional practices of sixth- and seventh-grade science teachers.

The second suggestion for future study would be to examine the possible reasons for the small number of participants in this study. This small sample size skewed the conclusions that were drawn. Further study is needed to gain a more realistic understanding and answer a new research question that may explain why participation rates were so low in this study. What are the pressures placed on eighth-grade public school science teachers? The crux of the problem in completing this study lies in data collection methods; they would have to be designed to maximize participation rate.

A third suggestion would be to include gender differences as a variable to be examined. The data were not analyzed with gender differences as a variable. It would be interesting to learn if they influence motivation and efficacy beliefs of teachers.

A fourth suggestion would be to conduct a study that includes teachers of all middle school subjects from rural and urban school districts in addition to the participating districts of this study. This would reveal an interesting contrast in terms of available resources and workload, factors that affect motivation and efficacy beliefs, and provide a more balanced understanding of the burdens placed on middle school science teachers.

A fifth and final suggestion would to be to ask the question "How much change is too much?" This should examine the answers of three groups of teachers, those for

whom retirement is close-at-hand; those who have recently begun their careers; and, seasoned teachers with experience but still far retirement.

Conclusion

Though the small sample size prevents the formation of any significant conclusions from this study, the following statements can be made about this small group of science teachers from south central Pennsylvania. They are a dedicated group of science teachers whose motivation is affected more by the supports they receive than by autonomous behaviors. The curriculum taught is outside of their control. Most were expected to change their instructional practices to a prescribed model such as the FOSS (The Regents of the University of California, 2011) curriculum or LFS (Learning Focused, 2010-2013).

These teachers are reluctant to attribute student success to their teaching methods, while they enthusiastically credit their collective efforts as the reason for student success. Self-efficacy beliefs are above average while their collective efficacy beliefs are high.

They are enthusiastic, love what they do and are dedicated to their students. They are also spread very thin. The researcher heard stories to support this statement during interviews and the focus group discussion. One teacher reported that a colleague taught four different science courses and was given only one preparation period per day. With one preparation period per day, there was not enough time to fulfill obligations and evenings and weekends were used to grade papers, evaluate and provide feedback on student work, design lesson plans and gather materials for successful execution of those plans. More than one of the survey participants responded that they would have liked to participate in the focus group discussion but "just could not find the time- too busy."

In conclusion, the results of this study provide a limited overall picture of how change to curriculum and instructional practices have affected the motivation and efficacy beliefs of science teachers in south central Pennsylvania. This study does, however, show that PSSA testing and a push for AYP have not squashed the spirit and dedication to their students of eleven eighth-grade science teachers in nine middle schools from four counties in south central Pennsylvania.

References

Adams, C. M., & Forsyth, P. B. (2006). Proximate sources of collective teacher efficacy. *Journal of Educational Administration*, *44*(6), 625-642. doi:10.1108/09578230610704828

Akın, A. (2010). Achievement goals and academic locus of control: Structural equation modeling. *Eurasian Journal of Educational Research, 38*(1), 1-18. Retrieved from http://web.ebscohost.com/ehost/pdf?vid=1&hid=6&sid=b6a9a291-9ba0-44e8-bbfa-968480240c45%40sessionmgr11

Alasuutari, P., Bickman, L., & Brannen, J. (2008). *The SAGE handbook of social research methods*. London, England: SAGE.

Alfi, O., Assor, A., & Katz, I. (2004). Learning to allow temporary failure: Potential benefits, supportive practices and teacher concerns. *Journal of Education for Teaching, 30*(1), 27-41. doi:10.1080/0260747032000162299

Atkinson, J. W. (1974). The mainsprings of achievement-oriented behavior. In J. W. Atkinson & J. O. Raynor (Eds.), *Motivation and achievement* (pp. 11-39). Washington, DC: V. H. Win.

Atkinson, J. W., & Birch, D. (1978). *Introduction to motivation* (2nd ed.). New York, NY: D. VanNostrand Co.

Aydeniz, M. (2009). *Understanding the challenges to the implementation of assessment reform in science classrooms: A case study of science teachers' conceptions and practices of assessment* (Unpublished doctoral dissertation). The Florida State University, Tallahassee, FL.

Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. *Educational Psychologist, 28*(2), 117-148. Retrieved from http://web.ebscohost.com/ehost/pdfviewer/pdfviewer?sid=a4c5c23d-d288-4b13-93cf-f82b5d1c091b%40sessionmgr113&vid=3&hid=110

Bandura, A. (1994). Self-efficacy. In V. S. Ramachaudran (Ed.), *Encyclopedia of human behavior* (Vol. 4, pp. 71-81). New York, NY: Academic Press.

Barbour, R. S., & Kitzinger, J., (1999). *Developing focus group research.* London, England: SAGE.

Bell, J. (2005). *Doing your research project: A guide for first-time researchers in Education, Health, and Social Science* (4th ed.). Maidenhead, England: Open University Press. http://www.questiaschool.com/PM.qst?a=o&d=113694203

Beltman, S. (2009). Educators' motivation for continuing professional learning. *Issues in Educational Research*, *19*(3), 193-211. Retrieved from http://web.ebscohost.com/ehost/pdf?vid=7&hid=11&sid=511ecc47-c37f-4db9-8104-0ddc4191f852%40sessionmgr12

Betoret, F. D. (2006). Stressors, self-efficacy, coping resources, and burnout among secondary school teachers in Spain. *Educational Psychologist*, *26*(4), 519-539. doi:10.1080/01443410500342492

Bhattacharyya, S., Volk, T., & Lumpe, A. (2009). The influence of an extensive inquiry-based field experience on pre-service elementary student teachers' science teaching beliefs. *Journal of Science Teacher Education, 20,* 199-218. doi:10.1007/s10972-009-9

Black, P., & Wiliam, D. (2007). Large-scale assessment systems: Design principles drawn from international comparisons. *Measurement: Interdisciplinary Research and Perspectives, 5*(1), 1-53.

Blaxter, L., Hughes, C., & Tight, M. (2001). *How to research.* Philadelphia, PA: Open University Press. Retrieved from http://www.questiaschool.com/PM.qst?a=o&d=115085731

Bleicher, R. E. (2004). Revisiting the STEBI-B: Measuring self-efficacy in pre-service elementary teachers. *School Science and Mathematics, 104*(8), 383-391. Retrieved from http://ret.fsu.edu/Files/Tools/new_stebi-b.pdf

Bolster, A. S. (1983). Toward a more effective model of research on teaching. *Harvard Educational Review, 53*(3), 294-308.

Borrego, M., Froyd, J. E., & Hall, T. S. (2010). Diffusion of engineering education innovations: A survey of awareness and adoption rates in U.S. engineering departments. *Journal of Engineering Education, 99*(3), 185-207. Retrieved from http://web.ebscohost.com.navigator-iup.passhe.edu/ehost/pdfviewer/pdfviewer?sid=d35a5b4a-6c77-4a55-8257-c5eced16bfbc%40sessionmgr12&vid=3&hid=9

Chong, W. H., Klassen, R. M., Huan, V. S., Isabella Wong, & Kates, A. (2010). The relationships among school types, teacher efficacy beliefs, and academic climate: Perspective from Asian middle schools. *Journal of Educational Research, 103*(3), 183-190. doi: 10.1080/00220670903382954

Clark, R. E. (1999). Yin and yang cognitive motivational processes operating in multimedia learning environments. In J. van Merrienboer (Ed.), *Cognition and multimedia design*. Herleen, Netherlands: Open University Press.

Colbeck, C. L., Cabrera, A. F., & Marine, R. J. (2002, April). *Faculty motivation to use alternative teaching methods*. Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA.

Colbeck, C. L., & Wharton-Michael, P. (2006). Individual's and organizational influences on faculty members' engagement in public scholarship. *New Directions for Teaching and Learning, 105*, 17-26. doi:10.1002/tl.220

Common Core State Standards Initiative. (2010a). *In the States*. Retrieved from http://www.corestandards.org/in-the-states

Common Core State Standards Initiative. (2010b). *Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science and Technical Subjects*. Retrieved from http://www.corestandards.org/assets/CCSSI_ELA%20Standards.pdf

Csikszentmihaly, M. (1990). *Flow: The psychology of optimal experience*. New York, NY: Harper and Row.

Csikszentmihaly, M. (1997). *Finding flow: The psychology of engagement with everyday life*. New York, NY: BasicBooks.

Deci, E. L. (2009). Large-scale school reform as viewed from the self-determination theory perspective. *Theory and Research in Education, 7*(2), 244-252. doi:10.1177/1477878509104329

Deci, E. L., Koestner, R., & Ryan, R. M. (1999). A meta-analytic review of experiments

examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin, 125*(6), 627-668. doi:10.1037/0033-2909.125.6.627

Deci, E. L., & Ryan, R. M. (n.d.a.) *Self-Determination Theory: An approach to human motivation and personality*. Retrieved from http://selfdeterminationtheory.org/

Deci, E. L., & Ryan, R. M. (n.d.b.) *Self-Determination Theory: An approach to human motivation and personality*. Retrieved from http://selfdeterminationtheory.org/questionnaires/10-questionnaires/54

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and Self-Determination in human behavior.* New York, NY: Plenum Press.

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and self-determination of behavior. *Psychological Inquiry, 11*(4), 227-268. Retrieved from http://www.psych.rochester.edu/SDT/documents/2000_DeciRyan_PIWhatWhy.pdf

Deci, E. L., Speigel, N. H., Koestner, R., & Kaufman, M. (1982). Effects of performance standards on teaching styles: Behavior of controlling teachers. *Journal of Educational Psychology, 74*(6), 852-859. doi:10.1037/0022-0663.74.6.852

Elliot, A. J., & Harackiewicz, J. M. (1994). Goal setting, achievement orientation, and intrinsic motivation: A meditational analysis. *Journal of Personality and Social Psychology, 66*(5), 968-980. doi:10.1037/0022-3514.66.5.968

Elliot, A. J., & McGregor, H. A. (2001). A 2x2 achievement goal framework. *Journal of Personality and Social Psychology, 80*(3), 501-519. doi:10.1037//0022-3514.80.3.501

Elliot, A. J., & Thrash, T. M. (2001). Achievement goals and the hierarchical model of

achievement motivation. *Educational Psychology Review, 13*, 139-156. Retrieved from http://web.ebscohost.com.navigator-iup.passhe.edu/ehost/pdfviewer/pdfviewer?sid=ced3298e-4330-4dd4-8ae7-929e27e1d440%40sessionmgr11&vid=1&hid=9

Eriksson, P., & Kovalainen, A. (2008). *Qualitative methods in business research.* London, England: SAGE.

Fazio, X., & Melville, W. (2008). Science teacher development through collaborative action research. *Teacher Development, 12*(3), 193-209. doi:10.1080/13664530802259222

Fernet, C., Senecal, C., Guay, F., Marsh, H., & Dowson, M. (2008). The Work Tasks Motivation Scale for Teachers (WTMST). *Journal of Career Assessment, 16*(2), 256-279. doi:10.1177/1069072707305764

Ford, M. E. (1992). *Motivating humans: Goals, emotions and personal agency beliefs.* Newbury Park, CA: Sage.

Ford, M. E. (1995). Motivation and competence development in special and remedial education. *Intervention in School and Clinic*, *31*(2), 70-83. doi:10.1177/105345129503100203

Fullan, M. (1985). Change processes and strategies at the local level. *Elementary School Journal, 85*(3), 391-424.

Fullan, M. (2001). *Leading in a culture of change*. San Francisco, CA: Jossey-Bass.

Fullan, M. (2006). Change theory: A force for school improvement. *Centre for Strategic Education*, *157,* n.p. Retrieved from http://www.michaelfullan.ca/Articles_06/06_change_theory.pdf

Fullan, M. (2007). *The new meaning of educational change*. New York, NY: Teachers'

College Press.

Fullan, M., & Hargreaves, A. (1992). Teacher development and educational change. In M. Fullan & A. Hargreaves (Eds.), *Teacher development and educational change*. (pp. 1-9). Washington, DC: The Falmer Press.

Gibson, S., & Dembo, M. H. (1984). Teacher efficacy: A construct validation. *Journal of Educational Psychology, 76*(4), 569-582. doi:10.1037/0022-0663.76.4.569

Goddard, R. D. (2001). Collective efficacy: A neglected construct in the study of schools and student achievement. *Journal of Educational Psychology, 93*(3), 467-476. doi:10.1037//0022-0663.93.3.467

Goddard, R. D., & Goddard, Y. L. (2001). A multilevel analysis of the relationship between teacher and collective efficacy in urban schools. *Teaching and Teacher Education, 17*, 807-818. doi:10.1016/S0742-051X(01)00032-4

Goddard, R. D., Hoy, W. K., & Woolfolk Hoy, A. (2000). Collective teacher efficacy: Its meaning, measure, and impact on student achievement. *American Educational Research Journal, 37*(2), 479-507. doi:10.3102/00028312037002479

Guskey, T. R. (1981). Measurement of the responsibility teachers assume for academic successes and failures in the classroom. *Journal of Teacher Education, 32*(3), 44-51. doi:10.1177/002248718103200310

Guskey, T. R. (1986). Staff development and the process of teacher change. *Educational Researcher, 15*(5), 5-12. doi:10.2307/1174780

Guskey, T. R. (1988). Teacher efficacy, self-concept, and attitudes toward the implementation of instructional innovation. *Teaching And Teacher Education: An International Journal Of Research And Studies, 4*(1), 63-69.

Guskey, T. R. (2007). Results-oriented professional development. In A. C. Ornstein, E. F. Pajak, & S. B. Ornstein (Eds.), *Contemporary issues in curriculum* (4th ed., pp. 334-346). New York, NY: Pearson.

Haney, J. J., Lumpe, A. T., Czerniak, C. M., & Egan, V. (2002). From beliefs to actions: The beliefs and actions of teachers implementing change. *Journal of Science Teacher Education, 13*(3), 171-187. Retrieved from http://web.ebscohost.com/ehost/pdfviewer/pdfviewer?vid=9&hid=105&sid=d0964ae1-71b1-4fcf-bc74-3232357c86d2%40sessionmgr114.

Hechter, R. P. (2010). Changes in pre-service elementary teachers' personal science teaching efficacy and science teaching outcome expectancies: The influence of context. *Journal of Science Teacher Education, 22,* 187-202. doi:10.1007/s10972-010-9199-7

Henson, R. K. (2001). The effects of participation in teacher research on teacher efficacy. *Teaching and Teacher Education, 17*, 819-836. doi:10.1016/S0742-051X(01)00033-6

Hines, M. T., & Kristonis, W. (2010). The interactive effects of race and teacher self-efficacy on the achievement gap in school. *National Forum of Multicultural Issues Journal, 7*(1), 1-14. Retrieved from http://web.ebscohost.com.navigator-iup.passhe.edu/ehost/pdfviewer/pdfviewer?sid=05647344-1709-457f-8309-b97a425e3df3%40sessionmgr13&vid=3&hid=9

Ignat, A. A., & Clipa, O. (2010). The impact of self-efficacy and locus of control on the professional development of the teachers. *Petroleum - Gas University Of Ploiesti Bulletin, Educational Sciences Series, 62*(1A), 180-185. Retrieved from

http://web.ebscohost.com/ehost/pdfviewer/pdfviewer?sid=c64045dc-28e0-41c8-ade1-8fac8f99aaf5%40sessionmgr111&vid=3&hid=110

Introduction to the Common Core State standards. (2010). Retrieved from http://www.corestandards.org/assets/ccssi-introduction.pdf

Jayanthi, M., & Nelson, J. S. (2002). *Savvy decision making.* Thousand Oaks, CA: SAGE.

Johnson, C. C. (2009). An examination of effective practice: Moving toward elimination of achievement gaps in science. *Journal of Science Teacher Education, 20*, 287-306. doi:10.1007/s10972-009-9134-y

Klassen, R. M. (2010). Teacher stress: The mediating role of collective efficacy beliefs. *The Journal of Educational Research, 103*, 343-350. doi:10.1080/00220670903383069

Klassen, R. M., Tze, V. M. C., Betts, S. M., & Gordon, K. A. (2011). Teacher efficacy research 1998–2009: Signs of progress or unfulfilled promise? *Educational Psychology Review, 23*(1), 21-43. doi:10.1007/s10648-010-9141-8

Kolb, B. (2008). *Planning and conducting focus groups*. London, England: SAGE.

Lakshmanan, A., Heath, B. P., Perlmutter, A., & Elder, M. (2011). The impact of science content and professional learning communities on science teaching efficacy and standards-based instruction. *Journal of Research in Science Teaching, 48*(5), 534-551. doi:10.1002/tea.20404

Lanka, A. (2009). VET teachers in the context of professional growth: Reality and aspirations. *Vocational Education: Research & Reality*, *17*, 96-105. Retrieved from http://web.ebscohost.com.navigator-

iup.passhe.edu/ehost/pdfviewer/pdfviewer?sid=bb11bd49-b474-4690-aa7f-ce0408c15fa3%40sessionmgr15&vid=1&hid=9

Learning Focused. (2010-2013). *Learning Focused: Increase teacher effectiveness and accelerate learning.* Retrieved from http://www.learningfocused.com/

Lumpe, A. T., Haney, J. J., & Czerniak, C. M. (2000). Assessing teachers' beliefs about their science teaching context. *Journal of Research in Science Teaching, 37*(3), 275-292. doi:10.1002/(SICI)1098-2736(200003)37:3<275::AID-TEA4>3.0.CO;2-2

McDonald, L. (2009). Teacher change: A dynamic interactive approach. *International Journal of Learning 16*(10), 623-636. Retrieved from http://web.ebscohost.com.navigator-iup.passhe.edu/ehost/pdfviewer/pdfviewer?sid=07445685-3743-4c03-94cd-afb42817549c%40sessionmgr4&vid=1&hid=9

Martin, J. J., McCaughtry, N., Hodges-Kulinna, P., & Cothran, D. (2008). The influences of professional development on teachers' self-efficacy toward educational change. *Physical Education and Sport Pedagogy, 13*(2), 171-190. doi:10.1080/17408980701345683

Marsh, C. J., & Willis, G. (2003). *Curriculum: Alternative approaches, ongoing issues.* Retrieved from http://coefaculty.valdosta.edu/stgrubbs/Definitions%20of%20Curriculum.htm

McClelland, D. C. (1989). *Human motivation*. NewYork, NY: Cambridge University Press.

McLaughlin, M. W., & Mitra, D. (2001). Theory-based change and change-based theory: Going deeper, going broader. *Journal of Educational Change, 2*, 301-323.

Retrieved from http://web.ebscohost.com.navigator-iup.passhe.edu/ehost/pdfviewer/pdfviewer?sid=af983419-68f5-46e4-95c7-5e3fe865f962%40sessionmgr12&vid=1&hid=9

Medina, J. (2010, July 28). Standard raised, more students fail tests. *The New York Times*. Retrieved from http://www.nytimes.com/2010/07/29/education/29scores.html?_r=1&ref=education

Mellers, B. A., & McGraw, A. P. (2001). Anticipated emotions as guides to choice. *Current Directions in Psychological Science, 10*(6), 210- 214. Retrieved from http://filer.case.edu/users/org/demaree/Papers/Emotions,%20Outcomes,%20and%20Decising-Making/Mellers%20et%20al.,%202001.pdf

Meyer, D., & Turner, J. (2006). Re-conceptualizing emotion and motivation to learn in classroom contexts. *Educational Psychology Review, 18*(4), 377-390. doi:10.1007/s10648-006-9032-1

Müller, K., Alliata, R., & Benninghoff, F. (2009). Attracting and retaining teachers: A question of motivation. *Educational Management Administration & Leadership, 37*(5), 574-599. doi:10.1177/1741143209339651

Ng, S. W. (2009). Why did principals and teachers respond differently to curriculum reform? *Teacher Development, 13*(3), 187-203. doi:0.1080/13664530903335558

Ornstein, A. C. (2007). Philosophy as a basis for curriculum decisions. In A. C. Ornstein, E. F. Pajak, & S. B. Ornstein (Eds.), *Contemporary issues in curriculum* (4th ed., pp. 5-13). New York: NY: Pearson.

Paige, R., & Hickok, E. W. (2004). No Child Left Behind: A toolkit for teachers. Retrieved from http://www2.ed.gov/teachers/nclbguide/nclb-teachers-toolkit.pdf

Pajares, M. F. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research, 62*(3), 307-332. doi: 10.3102/00346543062003307

Pallant, J. (2010). SPSS survival manual (4th ed.). New York, NY: McGraw-Hill.

Pelletier, L. G., Seguin-Levesque, C., & Legault, L. (2002). Pressure from above and pressure from below as determinants of teachers' motivation and teaching behaviors. *Journal of Educational Psychology, 94*(1), 186-196. doi:10.1037//0022-0663.94.1.186

Pelletier, L. G., & Vallerand, R. J. (1996). Supervisors' beliefs and subordinates' intrinsic motivation: A behavioral confirmation analysis. *Journal of Personality & Social Psychology, 71*(2), 331- 340. doi: 10.1037/0022-3514.71.2.331

Pennsylvania Department of Education. (n.d.a). *Assessment.* Retrieved from http://www.pde.state.pa.us/portal/server.pt/community/Pennsylvania_System_of_School_Assessment_(PSSA)/8757/

Pennsylvania Department of Educaton. (n.d.b). *2008-2009 Assessment Handbook 2010*. Retrieved from http://www.portal.state.pa.us/portal/server.pt/community/pennsylvania_system_of_school_assessment_(pssa)/8757/resource_materials/507610

Pennsylvania Department of Education. (n.d.c). *PSSA and PSSA-M performance level descriptors and cut scores.* Retrieved from http://www.portal.state.pa.us/portal/server.pt?open=514&objID=507628&mode=2

Pennsylvania Department of Education. (n.d.d). *Education Names and Addresses*. Retrieved from www.edna.ed.state.pa.us

Pennsylvania Department of Education. (2002). *The Pennsylvania Bulletin: Compliance with the No Child Left Behind Act of 2002*. Retrieved from http://www.pabulletin.com/secure/data/vol32/32-50/2219.html

Pennsylvania Department of Education. (2010). *Academic achievement report*. Retrieved from http://paayp.emetric.net/Home/About

Pennsylvania Department of Education. (2011). 2010-2011 PSSA and AYP Results. Retrieved from http://www.education.state.pa.us/portal/server.pt/community/school_assessments/7442/2010-2011_pssa_and_ayp_results/1014980

Pennsylvania Department of Education. (2011a). *State Academic Standards*. Retrieved from http://www.portal.state.pa.us/portal/server.pt/community/state_academic_standards/19721

Pennsylvania Department of Education. (2011b). *Keystone exams program overview* Retrieved from http://static.pdesas.org/Content/Documents/Keystone_Exam_Program_Overview.pdf

Pennsylvania Department of Education. (2012). 2011-2012 PSSA and AYP Results. Retrieved from http://www.education.state.pa.us/portal/server.pt/community/school_assessments/7442/2011-2012_pssa_and_ayp_results/1235182

Purkey, S. C., & Smith, M. S. (1982). Too soon to cheer? Synthesis of research on effective schools. *Educational Leadership, 40*(3), 64-69.

Retelsdorf, J., Butler, R., Streblow, L., & Schiefele, U. (2010). Teachers' goal orientations for teaching: Associations with instructional practices, interest in teaching, and burnout. *Learning & Instruction, 20*(1), 30-46. doi:10.1016/j.learninstruc.2009.01.001.

Riggs, I. M. (April, 1991). *Gender differences in elementary science teacher self-efficacy.* Paper presented at the Annual meeting of the American Educational Research Association, Chicago, Il. Retrieved from http://www.eric.ed.gov/PDFS/ED340705.pdf

Riggs, I. M., & Enochs, L. G. (1990). Toward the development of an elementary teacher's science teaching efficacy belief instrument. *Science Education*, 74, 625-637. doi: 10.1002/sce.3730740605

Roberts, J. K., Henson, R. K., Tharp, B. Z., & Moreno, N. (2000). An examination of change in teacher self-efficacy beliefs in science education based on the duration of inservice activities. *Journal of Teacher Education, 12*(3), 199-213. Retrieved from http://www.eric.ed.gov/PDFS/ED438259.pdf

Ross, J., & Bruce, C. (2007). Professional development effects on teacher efficacy: Results of randomized field trial. *The Journal of Educational Research, 101*(1), 50-60. doi:10.3200/JOER.101.1.50-60

Roth, G., Assor, A., Kanat-Maymon, Y., & Kaplan, H. (2007). Autonomous motivation for teaching: How self-determined teaching may lead to self-determined learning. *Journal of Educational Psychology, 99*(4), 761-774. doi:10.1037/0022-0663.99.4.761

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of

intrinsic motivation, social development, and well-being. *American Psychologist*. doi: 10.1037/0003-066X.55.1.68

Ryan, R. M., & Deci, E. L. (2002). Overview of self-determination theory: An organismic dialectical perspective. In R. M. Ryan & E. L. Deci (Eds.), *Handbook of self-determination research.* Woodbridge, UK: University of Rochester Press.

Ryan, R. M., & Weinstein, N. (2009). Undermining quality teaching and learning. *Theory & Research in Education, 7*(2), 224-233. doi:10.1177/1477878509104327

Schlechty, P. C. (2011). The threat of accountabalism. *Educational Leadership, 69*(1), 80-81.

Schunk, D. H. (1996). Learning theories: An educational perspective. Englewood Cliffs, NJ: Merrill.

Sheldon, K. M. (1995). Creativity and self-determination in personality. *Creativity Research Journal, 8*(1), 25-36. Retrieved from http://web.ebscohost.com.navigator-iup.passhe.edu/ehost/pdfviewer/pdfviewer?sid=e1885a71-fcff-431b-b0b9-1642db1d7f0d%40sessionmgr10&vid=1&hid=9

Sheldon, K. M., Ryan, R. M., & Reis, H. (1996). What makes for a good day? Competence and autonomy in the day and in the person. *Personality and Social Psychology Bulletin, 22,* 1270-1279. doi:10.1177/01461672962212007

Shen, J., & Ma, X. (2006). Does systemic change work? Curricular and instructional practice in the context of systemic change. *Leadership and Policy in Schools, 5*, 231-256. doi: 10.1080/15700760600805832

Skaalvik, E. M., & Skaalvik, S. (2007). Dimensions of teacher self-efficacy and relations

with strain factors, perceived collective teacher efficacy, and teacher burnout. *Journal of Educational Psychology, 99*(3), 611-625. doi:10.1037/0022-0663.99.3.611

Sorebo, O., Halvari, H., Gulli, V. F., & Kristiansen, R. (2009). The role of self-determination theory in explaining teachers' motivation to continue to use e-learning technology. *Computers and Education, 53*, 1177-1187. doi:10.1016/j.compedu.2009.06.001

Stajkovic, A. D., Lee, D., & Neiberg, A. J. (2009). Collective efficacy, group potency, and group performance: Meta-analyses of their relationships, and test of a mediation model. *Journal of Applied Psychology, 94*(3), 814-828. doi:10.1037/a0015659

Stewart, D. W., Shamdasani, P. N., & Rook, D. W. (2007). *Focus groups*. Thousand Oaks, CA: SAGE.

Stiggins, R. J. (1995). Assessment as a school improvement "innovation"? In J. H. Block, S. T. Everson, & T. R. Guskey (Eds.), *School improvement programs: A handbook for educational leaders.* (pp. 111-128). New York, NY: Scholastic.

Sutton, R., & Wheatley, K. (2003). Teachers' emotions and teaching: A review of the literature and directions for future research. *Educational Psychology Review, 15*(4), 327-358. doi:10.1023/a:1026131715856

The No Child Left Behind Act of 2001. (2002). Retrieved from http://www.ed.gov/nclb/overview/intro/execsumm.pdf

The Pennsylvania Bulletin: Compliance with the No Child Left Behind Act of 2002. (2002). Retrieved from http://www.pabulletin.com/secure/data/vol32/32-50/2219.html

The Regents of the University of California (2011). *Welcome to FOSSweb for FOSS* (2nd ed.). Retrieved from http://www.fossweb.com/index.html

Thrash, T. M., & Elliot, A. J. (2002). Implicit and self-attributed achievement motives: Concordance and predictive validity. *Journal of Personality, 70*(5), 729-755. Retrieved from http://web.ebscohost.com.navigator-iup.passhe.edu/ehost/pdfviewer/pdfviewer?sid=23692491-ef8d-4c1a-b5c8-59156cb0831e%40sessionmgr13&vid=1&hid=9

Tschannen-Moran, M., & Barr, M. (2004). Fostering student learning: The relationship of collective teacher efficacy and student achievement. *Leadership & Policy in Schools, 3*(3), 189-209. doi: 10.1080/15700760490889484

Tschannen-Moran, M., & Hoy, A. W. (2001). Teacher efficacy: Capturing an elusive construct. *Teaching and Teacher Education, 17*, 783-805. Retrieved from http://wps.ablongman.com/wps/media/objects/2347/2404137/Megan_Anita.pdf

Tschannen-Moran, M., Woolfolk Hoy, A., & Hoy, W. K. (1998). Teacher efficacy:Its meaning and measure. *Review of Educational Research, 68*(2), 202-248. Retrieved from http://www.jstor.org.navigator-iup.passhe.edu/stable/i249752

Vanek, C. (2012). *Likert Scale- What is it? When to use it? How to analyze it?* Retrieved from http://www.surveygizmo.com/survey-blog/likert-scale-what-is-it-how-to-analyze-it-and-when-to-use-it/

Ware, H., & Kitsantas, A. (2007). Teacher and collective efficacy beliefs as predictors of

professional commitment. *The Journal of Educational Research, 100*(5), 47-48. doi:10.3200/JOER.100.5.303-310

Weiner, B. (1986). An attributional theory of motivation and emotion. New York, NY: Springer-Verlag.

Woolfolk, A. E. (1987). *Educational psychology* (3rd ed.). Englewood Cliffs, NJ: Prentice-Hall.

Young, V. M. (2006). Teachers' use of date: Loose coupling, agenda setting, and team norms. *American Journal of Education, 112*, 521- 548. Retrieved from http://web.ebscohost.com.navigator-iup.passhe.edu/ehost/pdfviewer/pdfviewer?sid=bf462f46-85d2-4518-810d-b49fd7ce9a25%40sessionmgr11&vid=1&hid=9

Appendix A

District Site Approval Request Letter

School of Professional Studies in Education

Dear (insert name of superintendent or science supervisor):

I am a student in the Doctoral Program in Curriculum and Instruction in the Department of Professional Studies in Education at Indiana University of Pennsylvania. I am writing to ask permission to invite the eighth-grade science teachers of your district to participate in a study to examine the impact of the implementation of the science PSSA on the science curriculum and the instructional practices of eighth-grade science teachers.

Based upon your designation as one of the public school districts in the Capital Area Science and Engineering Fair (CASEF) catchment area, I am asking permission to invite the eighth-grade science teachers of your district to participate in my study. As a secondary education science teacher myself, it is my goal to report the findings with the utmost accuracy and validity. Be assured, if you choose to grant permission for asking participation, all of the information provided (including names of the teachers, schools, district and county participating) will be held in the strictest of confidence. Also, all results from the study will only be reported as aggregated data or with the use of pseudonyms.

As stated, the purpose of this study is to examine the impact of implementation of the science PSSA on the curricular expectations and the instructional practices of eighth-grade science teachers. The analysis of this study will be based on information obtained through an online survey. The survey will take approximately 15-30 minutes to complete, and will focus on determining the participants' level of motivation and their levels of self- and collective efficacy with regards to science instruction. Teachers' participation in this study poses no known risk, and their involvement is essential in providing insight on the impact of this change to the middle school science program. The results of this study may be used to support and strengthen science instruction so that all students demonstrate achievement in science as measured by the PSSA. The following link is provided should you wish to view the survey. The consent portion of the survey has been removed for your ease of access to the survey; however, teachers will have to give consent in order to gain access to the survey.

https://iup.qualtrics.com/SE/?SID=SV_3mw5SicrW1vkFh2

Appendix A

If you give site approval, please contact me by email at p.s.britton@iup.edu. I ask that you notify the principals of the middle schools in your district and inform them of your approval. However, if you prefer, and with your permission, I could notify the principals using your response email as proof of permission. I will follow up with you when the IRB from Indiana University of Pennsylvania has given approval for this study.

Thank you for your consideration.

Sincerely,

Tricia S. Britton, Principal Investigator
Indiana University of Pennsylvania
Professional Studies in Education
308 Indiana Creek Drive
Mechanicsburg, PA 17050
(717) 763-0999
p.s.britton@iup.edu

Dr. Valeri Helterbran, Faculty Sponsor
Indiana University of Pennsylvania
Professional Studies in Education
323 Davis Hall
Indiana, PA 15705
(724) 357-2400
vhelter@iup.edu

Appendix B

Permission to use the Self-Determination Scale (Deci & Ryan, 1985)

Subject: selfdeterminationtheory.org - New User Details

From: User Registration <drew@immersyve.com>

Date: 05/07/12 09:54 AM

To: kzbp@iup.edu

Welcome Tricia Britton,
Your application has been approved by our administration team.
Your account with the following details:
Email : kzbp@iup.edu
Username : tbritton

has been activated.
We welcome you to our online community and trust that together
we will grow.
Enjoy the experience!
Kind Regards,
Self Determination Theory team

NOTE: This email was automatically generated from selfdeterminationtheory.org (http://selfdeterminationtheory.org).

Appendix C

Permission to use the Context Beliefs About Teaching Science Survey (Lumpe, Czerniak, & Haney, 1990)

JOHN WILEY AND SONS LICENSE TERMS AND CONDITIONS

May 08, 2012

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License Number	2904310446103
License date	May 08, 2012
Licensed content publisher	John Wiley and Sons
Licensed content publication	Journal of Research in Science Teaching
Licensed content title	Assessing Teachers' Beliefs about Their Science Teaching Context
Licensed content author	Andrew T. Lumpe,Jodi J. Haney,Charlene M. Czerniak
Licensed content date	Mar 1, 2000
Start page	275
End page	292
Type of use	I don't see my intended use
Special requirements	I am a Curriculum and Instruction doctoral candidate at Indiana University of Pennsylvania. Please accept this letter as my written request for permission to modify and use the Context Beliefs About Teaching Science (CBATS) Instrument in the development of the survey instrument of my survey. My dissertation examines the effects of a standardized testing environment on the instructional practices of eighth-grade science teachers whose students must take the science portion of the Pennsylvania System of School Assessment (PSSA). Data will be collected during the fall of 2012. Participation in my study will be strictly voluntary. They will receive no monetary compensation nor will there be any cost to participants. The findings of this study may be published in academic journals or presented at professional conferences. The survey used will be properly cited and the authors will be acknowledged as the developer of the survey. If permission is granted to use the modified survey, I will need authorization from you in the form of a reply email. If you have any questions or need additional information, do not hesitate to contact me at home (717-763-0999) or by email (p.s.britton@iup.edu). The use of this survey is vital to my study. I look forward to hearing from you. I appreciate your time, attention and consideration of my request.
Order reference number	
Total	0.00 USD
Terms and Conditions	

Gratis licenses (referencing $0 in the Total field) are free. Please retain this printable license for your reference. No payment is required.

Appendix D

Email permission to use the Science Teachers Efficacy Beliefs Instrument

(Riggs & Enochs, 1990)

Subject: **Re: Permission to use STEBI**

From: IRIS RIGGS <iriggs@csusb.edu>

Date: 05/05/12 11:39 AM

To: Patricia S Britton <p.s.britton@iup.edu>

You are welcome to use and revise the STEBI. Good luck in your research endeavors!
Iris

----- Original Message -----
From: Patricia S Britton <p.s.britton@iup.edu>
Date: Saturday, May 5, 2012 8:38 am
Subject: Permission to use STEBI
To: iriggs@csusb.edu

>
>
> Dear Dr. Riggs,
>
> I am a Curriculum and Instruction doctoral candidate at Indiana
> University of Pennsylvania. Please accept this letter as my
> written
> request for permission to modify and use the Science Teacher
> Efficacy
> Beliefs Instrument (STEBI).
>

Appendix E

Email permission to use the Collective Teacher Beliefs Scale

(Tschannen-Moran & Barr, 1994)

Subject: **RE: permission**
From: Megan Tschannen-Moran <mxtsch@wm.edu>
Date: 05/21/12 11:15 AM
To: 'Patricia S Britton' <p.s.britton@iup.edu>

Attached Files
- MTMGuest instructions.pdf (819 KB)

Tricia,

You have my permission to use the Collective Teacher Beliefs scale that I developed with Marilyn Barr. You can access a copy for download at my site at http://wmpeople.wm.edu/site/page/mxtsch .

I have also attached the directions you would use to access my password-protected web site where you will find the article in which the instrument development is described, as well as my other articles on related topics. The scoring directions are just to take a grand mean of all of the items if you are interested in the full scale, and a grand mean of the items in each of the two subscales, if those are your interest, as described in the article I published with Marilyn Barr.

All the best,

Megan Tschannen-Moran

The College of William and Mary
School of Education
PO Box 8795
Williamsburg, VA 23187-8795
Telephone: 757-221-2187
http://wmpeople.wm.edu/site/page/mxtsch
-----Original Message-----
From: Patricia S Britton [mailto:p.s.britton@iup.edu]
Sent: Sunday, May 20, 2012 8:54 PM
To: mxtsch@wm.edu
Subject: permission

Dear Dr. Tschannen-Moran,

I am a Curriculum and Instruction doctoral candidate at Indiana University of Pennsylvania. Please accept this letter as my written request for permission to use the Collective Teacher Beliefs Survey.

Appendix F

General Questions and Questions Related to Change Due to the Implementation of the Science PSSA

General Questions

G1 **What is your gender?**

Male ○ Female ○

G2 **How many years have you been teaching?**

1-5 years ○ 6- 10 years ○ 11- 15 years ○ 16-20 years ○ more than 20 years ○

G3 **How many years have you been teaching 8th grade science?**

1-5 years ○ 6-10 years ○ 11-15 years ○ 16-20 years ○ more than 20 years ○

G4 **For how many years has the current curriculum been in place?**

1-2 years ○ 3-5 years ○ 6-8 years ○ 9-10 years ○ More than 10 years ○

G5 **How long has the current superintendent been in this position in your district?**

1-2 years ○ 3-5 years ○ 6-8 years ○ 9-10 years ○ longer than 10 years ○

G6 **How long has your current principal been in this position in your school?**

1-2 years ○ 3-5 years ○ 6-8 years ○ 9-10 years ○ longer than 10 years ○

G7 **Since the implementation of the science PSSA, has there been a change in the curriculum you are expected to teach?**

Yes ○ No ○

Display This Question:
If Since the implementation of the science PSSA, has there b... **Yes** Is **Selected**

G7A **Please describe the changes.**

Appendix F

G8 **Since the implementation of the science PSSA, have you been expected to change your instructional practices?**

- Yes
- No

Display This Question:
If Since the implementation of the science PSSA, have you be... **Yes** Is **Selected**

G8A **Please explain how the expectation has changed.**

Display This Question:
If Since the implementation of the science PSSA, have you be... **No** Is **Selected**

G8B **If no, have you changed your instructional practices anyway?**

- Yes
- No

Display This Question:
If If no, have you changed your instructional practices anyway? **Yes** Is **Selected**

G8C **Please explain how your practices have changed?**

G9 **Do administrators talk about the Keystone Exams in relation to the PSSA?**

- Yes
- No

Display This Question:
If Do administrators talk about the Keystone Exams in relati... **Yes** Is **Selected**

G9A **What has been said about this?**

G10 **Has there been any mention of the Common Core in relation to the State Standards?**

- Yes
- No

Appendix G

Self-Determination Scale (Deci & Ryan, 1985)

Self-Determination Survey
Please read the pair of statements, one pair at a time, and think about which statement within the pair seems more true to you at this point in your teaching career.
Indicate the degree to which statement A feels true, relative to the degree that Statement B feels true, on the 5-point scale shown after each pair of statements. If statement A feels completely true and statement B feels completely untrue, the appropriate response would be 1. If the two statements are equally true, the appropriate response would be a 3. If only statement B feels true, the appropriate response would be a 5.

SDS1
A. I always feel like I choose the things I do
B. I sometimes feel that it's not really me choosing the things I do.
Only A feels true Only B feels true
1 2 3 4 5

SDS2
A. I choose to do what I have to do
B. I do what I have to, but I don't feel like it is really my choice.
Only A feels true Only B feels true
1 2 3 4 5

SDS3
A. I do what I do because it interests me.
B. I do what I do because I have to.
Only A feels true Only B feels true
1 2 3 4 5

SDS4
A. I am free to do whatever I decide to do.
B. What I do is often not what I'd choose to do.
Only A feels true Only B feels true
1 2 3 4 5

SDS5
A. I feel pretty free to do whatever I choose to.
B. I often do things that I don't choose to do.
Only A feels true Only B feels true
1 2 3 4 5

Appendix H

Context Beliefs About Teaching Science Survey

(Lumpe, Czerniak, & Haney, 1990)

Suppose your goal is to be the most effective science teacher possible during the next school year. Listed below are a number of school environmental support factors that may have an impact on this goal. In the first column, please indicate the degree to which you believe each factor will enable you to be an effective science teacher. In the second column, indicate the likelihood that these factors will occur (or be available to you) during the next school year. Circle the corresponding descriptor that matches your belief.

	The following factors would enable me to be an effective teacher. Only A feels true SA= strongly agree; A= agree, UN= undecided; D=disagree; SD= strongly disagree					How likely is it that these factors will occur in your school? VL= very likely; SL= somewhat likely; N= neither; SU= somewhat unlikely; VU= very unlikely				
	SA	A	UN	D	SD	VL	SL	N	SU	VU
1. Support from administration: Professional staff development on teaching (workshops, conferences, etc.), allowing teacher-input for decision making process.	O	O	O	O	O	O	O	O	O	O
2. Support from other teachers (coaching, advice, mentoring, modeling, informal discussions, etc.).	O	O	O	O	O	O	O	O	O	O
3. Planning time, both individual and planning time with other teachers.	O	O	O	O	O	O	O	O	O	O
4. Hands-on science kits (activities and equipment), permanent science equipment and consumable science supplies, classroom physical environment, and technology (computers, software, Internet).	O	O	O	O	O	O	O	O	O	O
5. Adoption of an official school science curriculum (goals, objectives, topics, etc.) and corresponding curriculum materials (textbooks, lab manuals, etc.)	O	O	O	O	O	O	O	O	O	O

>>

Appendix I

Science Teaching Efficacy Beliefs Instrument (Riggs & Enochs, 1990)

Please indicate the degree to which you agree or disagree with each statement below by circling the appropriate letters to the right of the statement.

	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
1. I am continually finding better ways to teach science.					
2. Student achievement in science is directly related to their teacher's effectiveness in science teaching.					
3. I know the steps necessary to teach science concepts effectively.					
4. When a student has difficulty understanding a concept, I am usually at a loss as to how to help the student understand it better.					
5. I understand science concepts well enough to be effective in teaching science.					
6. If students are underachieving in science, it is usually due to ineffective teaching methods.					

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Appendix J

Collective Teacher Beliefs Scale (Tschannen-Moran & Barr, 1994)

Please indicate your opinion about each of the questions below by marking any one of the nine responses in the columns on the right side, ranging from (1) "None at all" to (9) "A great deal" as each response represents a degree on the continuum.
Please respond to each of the questions by considering the current ability, resources, and opportunity of the teaching staff in your school to do each of the following.

	None at all 1	2	Very Little 3	4	Some degree 5	6	Quite a bit 7	8	A great deal 9
1. How much can teachers in your school do to produce meaningful student learning?	○	○	○	○	○	○	○	○	○
2. How much can your school do to get students to believe they can do well in schoolwork?	○	○	○	○	○	○	○	○	○
3. To what extent can school personnel in your school establish rules and procedures that facilitate learning?	○	○	○	○	○	○	○	○	○
4. How much can teachers in your school do to help students master complex content?	○	○	○	○	○	○	○	○	○
5. How much can teachers in your school do to promote deep understanding of academic concepts?	○	○	○	○	○	○	○	○	○

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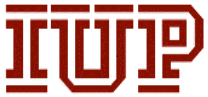
Appendix K

Request for Teacher Participation



November 1, 2012

Dear eighth-grade science teacher:

I am a student in the Doctoral Program in Curriculum and Instruction in the Department of Professional Studies in Education at Indiana University of Pennsylvania, and completing this research study to fulfill the requirements of my dissertation. As an eighth-grade science teacher in a public school in the Capital Area Science and Engineering Fair (CASEF) catchment area, you are invited to participate in this research. Your involvement in this mixed-method study will assist in providing information about how the implementation of the science PSSA has affected the curricular expectations and instructional practices of eighth-grade science teachers. The following information is provided so that you may make an informed decision regarding your participation in this study.

The Indiana University of Pennsylvania supports the practice of protection for human subjects engaged in research. While participation in the study is completely voluntary, I urge you to participate. Your involvement will provide administrators with information to inform their decisions about how to best support your efforts to help your students achieve AYP. The Indiana University of Pennsylvania Institutional Review Board (724-357-2223) has approved this project for the Protection of Human Subjects. If you choose to participate, please click on the survey link below.

https://iup.qualtrics.com/SE/?SID=SV_24fmH3K6ZWt5c0s

There are no known risks or discomfort associated with this study. The results of this mixed-method study will be held in strictest confidence. Neither your level of participation nor information regarding your instructional practices will be reported to the school district in which you are employed. Your participation is strictly voluntary, and you may withdraw from participation at any time by contacting me at p.s.britton@iup.edu or simply closing out of your browser. Participation in the online survey will require approximately 15 minutes of your time. After exiting the survey, you will be led to another one-question survey asking for volunteers to participate in a focus group discussion. This will be done at a time and a place chosen by the volunteer. A list of the questions will be sent to volunteers in advance.

Appendix K

The information obtained through this study may be published in an educational journal or presented at an educational conference. A summary of the findings of this study will be available upon request. Please do not hesitate to call me at home (717-763-0999) or email me (p.s.britton@iup.edu) if you have concerns or questions. Thank you for your time and consideration. It is greatly appreciated.

Sincerely,

Tricia S. Britton, Principal Investigator
Indiana University of Pennsylvania
Professional Studies in Education
308 Indian Creek Drive
Mechanicsburg, PA. 17050
(717) 763-0999
p.s.britton@iup.edu

Valeri R. Helterbran, Faculty Sponsor
Indiana University of Pennsylvania
Professional Studies in Education
323 Davis Hall
Indiana, PA 15705
(724) 357-2400
vhelter@iup.edu

Appendix L

Informed Consent Page

Middle level science: A mixed methodology study of the impact of the Pennsylvania System of School Assessment (PSSA) on curriculum and instruction.

Thank you so much for your willingness to participate in my study. I appreciate it. Before you you give consent and move on to the survey, I wanted to give you an idea of what to expect.

This instrument consists of five parts, each part collects a different type of data. The first section is labeled as "General Questions". This section consists of 11 questions whose purpose it is to collect demographic data and data related to curriculum and instruction. These are "yes" or "no" items. Three of these items have questions that allow you to expand on your answer should you choose to do so.

These General Questions are followed by four Likert-type surveys, each consisting of five or six items. You click in the circle indicating your level of agreement or disagreement with the statement.

This survey should take 15-30 minutes of your time. Again, thank you very much for your participation.

To continue: Read the voluntary consent form and click on the appropriate link in IF2 below. After you have started, you may also withdraw from this study by simply closing your browser.

VOLUNTARY CONSENT FORM:

I have read and understand the information on this letter of consent, and I consent to volunteer to be a subject in this study. I understand that my responses are completely confidential, and that I have the right to withdraw at any time by emailing Tricia Britton the principal investigator at p.s.britton@iup.edu. Also, if I have any questions in the future about this study, I can contact the principal investigator. I hereby agree to participate in this research study. Click on the appropriate consent link in IF2 below to continue.

I GIVE CONSENT ***I DO NOT GIVE CONSENT***

I certify that I have explained to the above individual the nature and purpose, the potential benefits, and possible risks associated with participating in this research study, and have answered any questions that have been raised.

Tricia S. Britton, Principal Investigator
Indiana University of Pennsylvania
Professional Studies in Education
308 Indian Creek Drive
Mechanicsburg, PA 17050
(717) 763-0999
p.s.britton@iup.edu

Dr. Valeri Helterbran, Faculty Sponsor
Indiana University of Pennsylvania
Professional Studies in Education
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Indiana, PA 15705
(724) 357-2400
vhelter@iup.edu

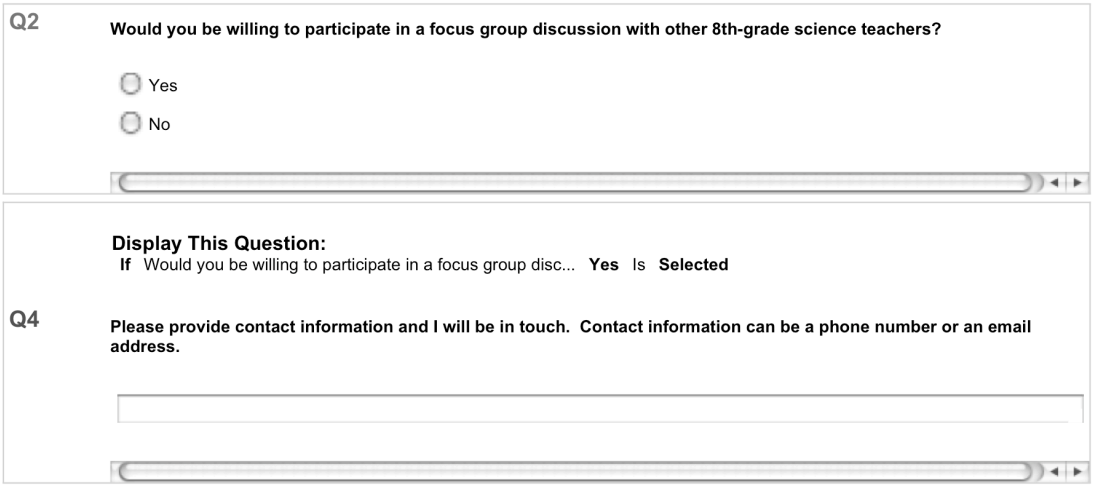
Do you give consent?

- ○ I give consent
- ○ I do not give consent

>>

Appendix M

Focus Group Participation Request



Appendix N

Participation Consent Form for Audio-Recording

Study title: Middle level science: A mixed methodology study of the impact of the Pennsylvania System of School Assessment (PSSA) on curriculum and instruction.

You have volunteered to participate in a focus group for this research study. This meeting should take approximately an hour and a half to two hours of your time. The researcher will ask you to discuss the concepts of change, motivation and efficacy and how these relate to general responses of the online survey. With your consent, you will be audio-recorded for transcription purposes only. Once the data have been analyzed, the transcription will be stored in a locked filing cabinet in the researcher's home for the three-year period mandated by the federal government. After this time, the transcripts will be destroyed securely. There are no known risks to your participation in this focus group.

The information you share will be kept confidential. The county, district, school and individual teacher will not be identified in any of the transcripts; pseudonyms will be used to provide confidentiality. Your participation is entirely voluntary. The questions have been provided before the meeting. You have the right to refuse to answer questions that you do not wish to answer; furthermore, you are free to leave the session at any time.

Transcripts will be provided to you and a summary of the research findings will be sent to you at the conclusion of the study on request. If you have questions about this study, you may contact Tricia S. Britton at 717-763-0999.

By signing below, you are agreeing to be a part of a focus group discussion for this study.

Again, thank you. Your participation is very much appreciated.

_____	_____	_____
Signature of Participant	Printed Name	Date

Appendix O

Focus Group and Interview Questions

General Questions

1. What are your teaching certifications?
2. For how many years have you been teaching?
3. For how many years have you been teaching eighth grade science?
4. Have you always taught in a public school? How long have you been in your present assignment?

Change Theory

5. How have the professional expectations changed of you changed since the science PSSA was implemented?
6. What has been the biggest challenge since the implementation of the science PSSA?

Motivational theory

7. How much control do you have over the choices you make regarding the science curriculum, the content you have to teach, and the methodologies you use?
8. How much support (financial, materials, professional and the physical plant) do you feel you have from the administration, your colleagues and the board to be an effective teacher?

Efficacy Beliefs

9. How much of what you do in the classroom, as an individual, is the cause of the success of your students in science?
10. How much of what the teachers do in your school is the cause of student success?