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The Initial Design and Validation of the Teachers' Emotions, Appraisals, and Coping Habits when Facilitating Inquiry-Based Instruction (TEACH-FIBI) Instrument for Science Education

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THE INITIAL DESIGN AND VALIDATION OF THE TEACHERS' EMOTIONS, APPRAISALS, AND COPING HABITS WHEN FACILITATING INQUIRY-BASED INSTRUCTION (TEACH-FIBI) INSTRUMENT FOR SCIENCE EDUCATION

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ABSTRACT

Since the mid 1900's, authors of science reform documents have advocated for teachers to engage in inquiry-based instruction. However, most science teachers, even highly qualified teachers, are not enacting teaching practices that align with what constitutes as proficient inquiry-based instruction. Currently, new science reform documents, in the form of *The Framework for K-12 Science Education* and the *Next Generation Science Standards (NGSS)*, are asking teachers and students to engage in even more rigorous and challenging teaching and learning. Inquiry-based instruction is once again an advocated strategy for accomplishing the high expectations set forth in both documents. Many science teachers are unfamiliar with how to facilitate this type of teaching and learning. This can result in teachers experiencing negative emotional episodes as they struggle to facilitate inquiry-based instruction. Unchecked, these emotional episodes have the potential to adversely alter teacher behavior which might subsequently undermine the goals stated in the most current reform documents. Therefore, it is critical that teachers' emotions and how they manage their emotions be further researched.

This study sought to design an instrument that assesses how science teachers appraise and emotionally respond to challenging situations that can occur when facilitating inquiry lessons. In order to accomplish this, a two phase exploratory sequential mixed methods instrument design and refinement process occurred. This process resulted in a preliminary version of the Teachers' Emotions, Appraisals, and Coping Habits when Facilitating Inquiry-based Instruction (TEACH-FIBI) instrument for

science education. Results show that TEACH-FIBI reliably and validly assesses seven appraisals and that it can also reliably assess the coping habits of the participating teachers. Previous research supports the inter-measurement correlations which speaks to the construct validity of the TEACH-FIBI. Implications and limitations of the study are discussed and future steps to progress the TEACH-FIBI are delineated.

DEDICATION

First and foremost, I would like to dedicate this dissertation to my Savior and God, Jesus Christ. Without Him, I would not have made it to the finish line. My family—Mom, Justin, Ebony, Dad, and Mazetta—was also a crucial part of me completing this degree. Thank you all for the constant prayers, support, advice, and love. Finally, I would like to dedicate this to my close friend Andy. You were a rock throughout this journey and put up with me when I was despondent, frustrated, and downright mean due to the struggles that come with completing a doctoral degree. Thank you for your patience, encouragement, selflessness, and prayers.

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CHAPTER 1: INTRODUCTION

Researchers have elucidated the implications of negative emotions on behavior and job satisfaction. Findings indicate that negative emotions can decrease teachers' satisfaction with their jobs and lead to burnout and attrition (Maslach & Jackson, 1981; Skaalvik & Skaalvik, 2009). According to recent research by Skaalvik and Skaalvik (2009), teacher burnout is influenced by three domains: 1) emotional exhaustion, 2) having cynical or negative attitudes regarding students and colleagues, and 3) feeling as though the work they are doing is no longer meaningful or fulfilling. Moreover, Schaufeli and Salanova (2007) purport that emotional exhaustion is a major contributor of teacher burnout.

Given the implications of negative emotions, interest has increased regarding the emotional aspects of teaching (Schutz, 2014; Sutton & Wheatley, 2003). Prior to this peak in researchers' interest, cognition was given priority because researchers understood that cognitions were stable and rational (Zembylas, 2004). However, as researchers investigated teachers and their environments, they began to realize that teaching is an emotionally-laden job and that denying the importance of emotions in education research would result in an incomplete understanding of the teaching profession (Hargreaves, 1998). Therefore, the concept that both emotion and cognition are important factors in teaching started to make headway. Zembylas (2004) provides an example of this thinking when she states that "Emotion and reason are interdependent because reason presupposes emotion – what is rational depends on emotional preferences – and emotion presupposes reason – our emotions require rational interpretation, if they are to come above ground"

(p. 187). Given the increased interest in how emotions influence teachers, it is important for educational researchers to understand the concept of emotions, why they are initiated, and what occurs when they are initiated.

In order to understand the emotions teachers experience, it is important to distinguish what emotions are not. While related to the concepts of mood and affect, there is a distinction between all these terms. Generally, it is understood that affect is the term which comprises moods and emotions. Moods are longer lasting and difficult to attribute to a single source, while emotions are shorter in duration and are focused on a specific object (Gross, 1998b; Schutz, Hong, Cross, & Osbon, 2006). Additionally, emotions are relational, occur as a result of attempting to reach goals, and arise in specific environments which are often referred to as activity settings. Specifically, Schutz et al. (2006) state that emotions are a result of "conscious or unconscious judgments regarding perceived successes at attaining goals or maintaining standards or beliefs during transactions as part of social-historical contexts" (p. 344).

Given these descriptions of emotions, researchers acknowledge that goals and the perception of goal attainment are crucial in the initiation of emotional episodes (Frijda & Mesquita, 1994; Lazarus, 1991; Schutz & Davis, 2000; Schutz & DeCuir, 2002). In education, school buildings and classrooms are the immediate environments where transactions typically occur and therefore where emotions are bound to occur. However, these environments, and the individuals who work and learn in them, are also impacted by overarching educational policies and laws (Zembylas, 2004) which form the broad socio-historical context (Schutz et al., 2006). Therefore, in order to fully understand

teachers' emotions and what occurs when these emotions are initiated, it is beneficial to reflect on the factors that can influence their classroom environments.

The current environment that teachers now find themselves in is a result of our educational history (Kliebard, 2004). One of the pieces that make up this history is the rising use of standards which encourage constructivist-style teaching methods (Achieve, 2013; NRC, 1996). Another important piece of educational history that impacts the school and classroom environments is accountability. Since the enactment of the No Child Left Behind Act (NCLB) in 2001, teachers and administrators have been expected to get all students to achieve at the proficient level. The NCLB Act led to the testing of standards and stated that schools' scores be accessible to public viewing and would be grounds for school ratings (Wei, 2012). The enforcement of standards and assessments (i.e., accountability) in addition to the push for constructivist-style education has led to school environments that can be pressure-filled and performance-based. Therefore, it is no surprise when teachers experience negative emotions during their teaching.

Constructivist-style learning prioritizes deeper understanding, while accountability expectations can encourage less depth and more breadth when it comes to learning goals (Blanchard, et al., 2010). Currently, the authors of the *Next Generation Science Standards* (*NGSS)* (Achieve, 2013) expect biology teachers to get their students to "[d]esign, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity" (Achieve, 2013, p. 71). Reading this performance indicator, a biology teacher may feel the need to plan and assign a constructivist-style group project that necessitates the use of some class time. However, this biology teacher

may know that the end-of-course test does not ask students to do any designing or evaluating but focuses more on remembering and understanding. Given the limitations of school days and the other concepts students need to know for the end-of-course test, this teacher may begin to feel the tension of the expectations of the standards and the reality of getting students ready for the test. If the teacher chooses to do the project and experiences challenges during implementation, finds that the project takes longer than intended, or finds the project to be an ineffective way for students to learn the concepts, he or she may become frustrated. The teacher may begin to feel like he or she cannot win in this environment or may sacrifice addressing the standards in the intended way as long as the expectations on the test are lower. This example provides an illustration of how the discrepancy between the expected practice of teachers (i.e., expectation in standards) and their actual practice which is impacted by other external factors can create environments that increase the chances of teachers experiencing negative emotions (Darby, 2008; Lee & Yin, 2010). Unchecked, these negative emotions have the potential to adversely alter teacher behavior which might subsequently undermine their goals and the goals stated in reform documents (Hargreaves, 1998).

Teachers have various goals for teaching and learning. These goals, as previously stated are influenced by educational laws and policies. Teachers will have positive or negative emotions based on the rate at which they approach these goals, or their perception of whether they are approaching goal attainment (Schutz, 2014). Specifically, the appraisals (i.e., judgments) teachers make regarding the classroom situations they experience on their way to attaining these goals impact the type of emotions felt (Schutz,

2014). Individuals engage in two types of appraisals when presented with situations. Primary appraisals regard the personal significance of the situation (i.e., does this situation threaten my goals, values, and resources?). Secondary appraisals have to do with the resources available to deal with a particular situation. Additionally, secondary appraisals register who is held responsible for the situation that has elicited the experienced emotion. These two types of appraisals interact and result in individuals feeling positive or negative emotions (Lazarus, 1991, 1999). If a teacher appraises that he or she is approaching his or her goal at an acceptable rate, that the goal impacted by the situation is personally significant, and that resources are available for goal attainment, this can lead to positive emotions. On the other hand, if teachers appraise even one of these factors (i.e., goal attainment, goal significance, available resources) as being threatened, this can lead to teachers experiencing negative emotions (Schutz, 2014; Sutton & Wheatley, 2003). For instance, being effective at classroom management is an important goal many new teachers have (Chang, 2013). If one of these new teachers, after several months of teaching, still has a class that is misbehaving regularly, he or she may judge that his or her goal regarding classroom management is not being approached at an acceptable rate. The administration at the school (i.e., resource in the form of support) consistently helps when this teacher needs it. In this case, the teacher may begin to feel negative emotions of helplessness or frustration. However, if he or she also did not receive support from the administration, the feelings of frustration or helplessness could be more intense.

As mentioned earlier, negative emotions can impact the vitality of teachers (Brien, Hass, & Savoie, 2012). Noting this relationship, educational researchers have become more interested regarding how teachers manage or regulate the negative emotions they experience while teaching (Sutton, 2004). At the foundation of emotional regulation lie the tenets of control theory (Carver & Scheier, 2002). Control theory holds that human behavior is goal-oriented and purposeful and that individuals behave in ways that allow them to approach the goals they have set for themselves or that have been set for them. In order to reach these goals, it is necessary that individuals engage in self-regulation (Zimmerman, 1989, 2000). Vukman and Licardo (2010) define self-regulation as a complex process which includes "the ability to control and regulate one's own actions, cognitions, and emotions" (p.259). Self-regulation becomes important when individuals encounter situations that have the potential to impede their goal attainment and initiate negative emotions (Zimmerman, 2000).

Boekaerts' (2007) Dual Processing Self-Regulation Model is built on the foundations of Self-regulated Learning (SRL) but focuses specifically on emotional aspects that can distract learners from their goals. In this model, appraisals about tasks, competence, and self-image are the initiation points regarding how individuals respond to situations they encounter during the learning process. During a challenging situation, appraisals are utilized to determine whether a person focuses on well-being (i.e., attention is only on restoring emotional well-being that has been challenged) or growth (i.e., attention is focused on reaching learning goals) (Boekaerts, 2007). Boekaerts argues that learners are constantly balancing between these two paths and that the regulation of

emotions (e.g., coping, emotional regulation) is critical in enabling a learner to stay on or return to the growth path once they find themselves on the well-being path. While research regarding the regulation of emotions is prevalent, studies on how teachers regulate their emotions while learning new and challenging teaching strategies are still lacking.

Researchers in various other fields have illustrated the importance of emotional regulation. Joseph and Newman (2010) stated that "within an organizational setting, emotional regulation is theoretically related to job performance through the induction of affective states that are beneficial to job performance" (p. 56). Specifically, Carmeli and Josman (2006) and Law, Wong, and Song (2004) showed that individuals who were able to identify the negative emotions initiated by challenging situations and then regulate them were more satisfied at work and productive according to organizational standards. However, individuals who were not adept at emotional regulation were more likely to engage in counter-productive work behavior and were less satisfied with their jobs. While there is still debate as to whether emotions or job satisfaction serve as the mediator which impacts job performance, there is agreement that an increase in negative emotions and lower job satisfaction decrease job performance (Brien et al., 2012).

Since emotions are related to teacher burnout and teacher performance, it is critical to lessen the negative emotions that teachers experience (Brien et al., 2012). One suggestion to accomplish this is developing teachers' ability to effectively regulate the negative emotions they experience in their current teaching environments (Folkman &

Lazarus, 1988); therefore, it is critical that teachers' emotions and how they manage their emotions be further researched (Sutton, 2004; Zembylas, 2004).

Statement of Problem

Since the late 1950s science teachers have been affected by reform movements that encourage more constructivist-style teaching practices (Anderson, 2007; Atkin & Black, 2007; Kliebard, 2004). Authors of science reform documents present during this sixty year period have often advocated for teachers to engage in a type of constructivist-style teaching referred to as inquiry-based instruction. To this day, inquiry instruction has maintained its prevalence as an encouraged constructivist-style teaching strategy in science education (Anderson, 2007). Given the long history of inquiry instruction being included in science reform documents, one might expect that the majority of science teachers would be using this teaching strategy. However, researchers note that most science teachers, even highly qualified teachers, are not enacting teaching practices that align with what constitutes as proficient inquiry-based instruction (Crawford, 2007; Marshall, Horton, Igo, & Switzer, 2009; Savasci & Berlin, 2012).

The question therefore emerges as to why the majority of science teachers have not embraced this instructional strategy. While inquiry-based instruction can be an impactful instructional strategy (Marshall & Alston, 2014; Minner, Levy, & Century, 2010), Harris and Rooks (2010) acknowledge that managing an inquiry-based classroom is challenging. They note that teachers can find it hard to manage the students, classroom culture, tasks, materials, and science ideas when engaging in inquiry-based instruction. Teachers must also have a command of science ideas and concepts. Along with these

aspects of classroom management, being patient and allowing students the time to come to a deeper understanding of science concepts is another challenge that teachers face when engaging in inquiry-based instruction (Anderson, 2007). This is especially the case when standards on a state test must be "covered" before an end-of-course test, where the teachers' reputation and evaluation are impacted.

Finding inquiry-based instruction difficult to manage is not the only barrier keeping science educators from engaging in this type of teaching; additionally, teachers' beliefs, goals, and values may not align with this type of teaching and learning (Haney & McArthur, 2002; Haney, Czerniak, & Lumpe, 1996; Haney, Lumpe, & Czerniak, 2003; Haney, Lumpe, Czerniak, & Egan, 2002; Savasci & Berlin, 2012). Anderson (2007) states that many teachers do not believe that inquiry-based instruction will prepare students for their next level of schooling. He states further that while teachers often see inquiry-based instruction as a good strategy, they believe that it is does not fit into the realities of teaching.

Regardless of the continued struggle of getting teachers to engage in this type of instruction, authors of science education reform documents continue to persist in their encouragement of this teaching strategy. Currently, new science reform documents, in the form of *The Framework for K-12 Science Education* (NRC, 2012) and the *(NGSS)* (Achieve, 2013), are asking teachers and students to engage in even more rigorous and challenging teaching and learning. Inquiry-based instruction is once again an advocated strategy which teachers can use to attain the high expectations set forth in both

documents. How then are we supposed to bridge the gap between reform expectations and current teacher practice?

As was the case in past reforms, engaging teachers in professional development (PD) programs which seek to improve science teachers' inquiry-based instruction is one solution that researchers and reformers highly advocate (Bybee, 2014; Loucks-Horsley, Stiles, Mundry, Love, & Hewson, 2010). Researchers find PD programs to be effective at improving or modifying teacher practice; however, researchers are also clear that this change often takes extended periods of time (Supovitz & Turner, 2000). They state that this time is needed because teachers' beliefs, goals, and values are not easily influenced, and these constructs are crucial to teachers choosing to enact newly learned practices (Loucks-Horsley et al., 2010). During this extended period of time, researchers say that teachers should be given opportunities to see inquiry-based instruction modeled and practice this instruction themselves. Given the long time required to change teachers' practice and the inevitable struggles with management that teachers will experience when attempting to practice inquiry-based instruction, it is surprising that science education researchers, with some exceptions (e.g., Ritchie, et al., 2013), have not paid more attention to aspects of emotion and emotional regulation.

Researchers support the idea that regulating emotions can help teachers positively cope with situations that initiate negative emotions (Ritchie, et al., 2013; Sutton, 2004). They also state that emotional regulation can negatively impact teacher burnout (Skaalvik & Skaalvik, 2009). Since engaging in inquiry-based instruction can cause negative emotions (Ritchie, et al., 2013) and it takes extended periods of time to bring teachers to

proficiency in inquiry-based teaching (Supovitz & Turner, 2000), it follows that developing science teachers' ability to emotionally regulate while facilitating inquiry-based teaching may allow them to persist in spite of experiencing negative emotions (Carmeli & Josman, 2006; Greenidge et al., 2014). This extra time persisting while developing inquiry-based instruction is necessary for science teachers to fully embrace and therefore improve in this instructional strategy. Currently, there exists no context-specific instrument to measure science teachers' coping habits that arise as the result of difficult situations that can occur during inquiry-based teaching. Therefore, without the ability to assess these habits and why they occur in relation to inquiry-based teaching, we cannot begin to discuss how to develop them in science teachers.

Purpose of the Study

The goal of this study is to gain knowledge concerning the appraisals, emotions, and coping strategies of middle and high school science teachers when faced with challenging situations that can occur when facilitating inquiry-based teaching. In order to begin accomplishing this goal I will engage in the following actions by reviewing relevant literature and research, as well as attending to previous classroom observations.

Action 1. Identify common challenging situations that occur during inquiry-based teaching;

Action 2. Identify the relationships between emotions, appraisals, and emotional regulation and relate them to inquiry-based instruction;

Action 3. Identify the strengths and limitations of emotional regulation instruments that have been used with teachers.

Completing each of the previously stated actions will lead to the accomplishment of the following objectives:

1. Develop and validate an instrument that measures science teachers' appraisals, emotions, and coping habits when presented with challenging situations that can occur when facilitating inquiry-based teaching;
2. Pilot, analyze, and refine the instrument so as to provide an initial step in creating a meaningful instrument for researchers to use as a component of their professional development.

Specifically, Action 1 will provide the situational prompts that will be provided on the instrument. These prompts (i.e., challenging situations that can occur during inquiry-based teaching) will be the basis from which teachers will answer questions regarding their emotions and coping strategies. Action 2 informs this study by providing the relationships between the constructs the instrument is designed to capture. Action 3 will serve to provide information about the most effective design of the instrument. Investigating other researchers' emotion and emotional regulation instruments will better enable the creation of an instrument that can collect valid and reliable data for this study. Accomplishing the objectives of this study will be a critical step in the creation of an instrument that can be used to assess teachers' appraisals, emotions, and coping strategies within the context of inquiry-based learning environments.

Significance of the Study

With the evident increase regarding the impacts of emotion on teaching (Chang, 2013; Sutton & Wheatley, 2003), this study could result in a measure which could be

combined with other study methods. This could facilitate a way for researchers to better understand why middle and high school science teachers differ in the quality of inquiry-based instruction they are enacting. In science education, researchers have mainly investigated emotions and emotional regulation utilizing qualitative methods (e.g., case studies, ethnographies). However, Sutton and Wheatley (2003) state that, "the interdependence of emotion components means that replacing interview techniques with observations is not the solution. Rather, multiple measure research is needed" (p. 355) Similarly, Ritchie et al. (2013) state,

> Logically, understanding the events that trigger emotional states should require additional and more fine-grained methods than interview. After all, there are recommendations that future research on teachers' emotions should focus on theoretical discussion, multiple methods, and new ways of representing research to illustrate emotional experiences better. (p. 140)

This instrument could serve as one of the multiple ways to measure emotions and coping strategies in science teachers within the context of inquiry-based instruction.

This instrument could also serve purpose in the science education community as a formative assessment tool. Loucks-Horsley et al. (2010) encourage PD facilitators to be knowledgeable regarding the teachers in their PD programs so that they can better design the PD around their participants' needs. Since inquiry-based instruction is a prominent strategy in science education that can address the expectations of *NGSS* (Achieve, 2013), it is reasonable to assume that PD programs will continue to strive to develop this teaching style in in-service teachers. This instrument could provide PD

facilitators with a fuller picture regarding the teachers they are trying to impact. Better understanding how these teachers appraise and emotionally respond to challenging events that can occur during inquiry-based teaching will equip PD facilitators with additional knowledge which they can use to design their PD programs (e.g., including the development of coping strategies). By ignoring the emotional facets of teachers, PD facilitators run the risk of damaging "some of the most fundamental aspects of what teachers do" (Hargreaves, 1998, p. 850).

That this instrument could be used to assess in-service teachers' appraisals and emotion responses and then help PD facilitators teach coping strategies to in-service teachers provides another way this study will be significant in science education research. Researchers have found that emotional regulation has the potential to down-regulate negative emotions, thus allowing for the experience of more positive emotions (Gross, 1998a; Gross & John, 2003). Bandura (1991) states that individuals tend to approach tasks that increase positive emotions and avoid tasks that increase negative emotions. This suggests that the development of in-service science teachers' emotional regulation strategies could lead to more positive emotions being evoked during inquiry-based instruction, which could lead to more persistence in trying this type of instruction. This extra time trying to enact inquiry-based instruction is critical given that it takes a substantial amount of time to influence science teachers' instructional practices (Supovitz & Turner, 2000).

Definitions of Terms

Affect: In this study, *affect* refers to the overarching category that includes negative and positive states that include emotions (e.g., sadness), moods (e.g., depression), dispositional states (e.g., liking), and traits (e.g., cheerfulness) (Gross, 1998b).

Constructivism is defined as a learning theory that emphasizes students' active participation in experiences that assist them in making meaning of the world around them. Students' prior knowledge and misconceptions are important in how they engage in meaning making and should be assessed in order to assist the learning process. Constructivism holds that learning does not occur as a solitary process but is furthered by social interaction and discussions (Cakir, 2008).

Coping is defined as how individuals cognitively and behaviorally manage their resources to deal with the negative emotions caused by stressful situations (Chang, 2013).

Emotions occur quickly, are of short duration, can be either positive or negative, and are directed at a specific object (Gross, 1998b).

Emotional Regulation refers to the influence that people have on their emotions, when they have their emotions, and what they do about their emotions (Schutz & DeCuir, 2002).

Inquiry-based Instruction refers to any intentional, student-centered instruction where a teacher designs and facilitates experiences that enable students the opportunity to deepen their understanding of scientific content and formulate an accurate conception of the process undergone by scientists to find out and validate new knowledge (Marshall & Horton, 2009; NRC, 2012).

Primary Appraisals are the judgments individuals make about the importance of a certain task or situation to their goals (i.e., goal importance), whether certain tasks or situations are aligned with their goals (i.e., goal alignment), and how involved their sense of being or identity is to a certain task or situation (i.e., ego-involvement). These appraisals are key in the initiation of emotions (Lazarus, 1991).

Secondary Appraisals concern what a person attributes the task or situation to (i.e., agency) and how confident a person is with dealing with the given task or situation (i.e., problem-efficacy) (Lazarus, 1991).

Self-Regulated Learning (SRL) is viewed with the social cognitive perspective. In this perspective, SRL refers to how people cyclically adapt what they think, feel, and do to obtain goals (Zimmerman, 2000).

CHAPTER 2: REVIEW OF THE LITERATURE

This section reviews the relevant literature related to inquiry-based instruction, emotions, and emotional regulation. This review will begin with a description and the purpose of inquiry-based instruction since the theoretical framework and corresponding constructs are situated within this context. This is followed by the theoretical framework of this study, Dual Processing Self-Regulated Model (Boekaerts, 2007). The remainder of this review focuses on emotion, emotional regulation, how these constructs are connected with the field of education, and how they have been assessed in the past. Consequently, this chapter includes the following sections: 1) the process for searching the literature, 2) description and purpose of inquiry instruction, 3) theoretical framework, 4) emotions and the teaching profession, 5) emotional regulation strategies utilized by teachers, and 6) an overview of emotional regulation instruments. While special attention will be given to science teachers and inquiry-based instruction, the limited research in this area necessitates the review and inclusion of other tangential but related research literature.

Strategy for Searching the Literature

The literature search was conducted digitally through the EBSCOHost research database. Keyword phrases used in different arrangements consist of *inquiry teaching, inquiry learning, teaching and emotion, teaching and inquiry and emotion, teaching and emotion and regulation,* and *teaching and inquiry and emotion and regulation.* Another keyword substituted for regulation during the literature search was *coping*.

Inquiry-based Instruction and Science Education

Dewey (1910) was one of the first individuals to encourage inquiry as a method for teaching science concepts. Between the early 1900s and mid-1940s, Dewey continued to recommend this teaching strategy (Barrow, 2006). However, it was not until the 1950s when science education reformers started strongly advocating for more constructivist-style teaching to occur in science classrooms in the U.S. (Anderson, 2007). Since then, authors of national science standards have continuously written documents which try to promote this style of teaching and learning (Achieve, 2013; NRC, 1996; NRC, 2012). While not the sole instructional method which teachers can use to address these standards, inquiry-based instruction has been a prominent instructional strategy found throughout reform documents for the past two decades (Anderson, 2007). This trend is maintained in the current reform document, *A Framework for K-12 Science Education* (NRC, 2012) and the corresponding national science standards, *Next Generation Science Standards (NGSS)* (Achieve, 2013). While the term *inquiry-based instruction* is not explicitly used in these documents, the essence of this instructional strategy is visible in the scientific practices. These documents extend and build upon the previous national science standards by increasing the expectations of what students have to do and therefore how teachers have to teach. No longer should students regurgitate information in the same form that it was given (e.g., recall, describe, summarize, identify). Now, students must engage in higher order thinking to show what they have learned (e.g., analyze data, plan and conduct an investigation, construct an argument, develop a model). Inquiry-based instruction once again becomes a key instructional method to effectively engage students in this type of learning. In order to accomplish Action 1—identify

common challenging situations that occur during inquiry-based teaching—the following paragraphs describe inquiry-based instruction as well as typical classroom situations that take place when teachers facilitate inquiry-based instruction. A portion of this section will also describe the barriers that teachers face regarding the enactment of inquiry-based teaching.

Inquiry-based instruction developed from the idea of getting students engaged in the process of science instead of a memorization of science facts. This type of instruction arose from the premise that learners create, understand, and modify knowledge based upon their experience with the world and other people. Additionally, individuals who ascribe to this instructional strategy believe that, in order for the learning process to occur, students need to be mentally and behaviorally engaged in the concepts they are studying (Cakir, 2008; Vygotsky, 1978).

Inquiry-based instruction has specific goals for student learning in the science classroom. These goals focus on learning science concepts while at the same time engaging students in the abilities of inquiry. The abilities of inquiry encompass the activities that scientists engage in as they seek to understand the natural and material world. These abilities focus on 1) identifying knowledge and concepts that can lead to scientific investigations; 2) formulating explanations from scientific evidence; 3) developing and conducting scientific investigations; 4) revising and analyzing explanations; 5) using math and technology to improve upon scientific investigations; and 6) communicating results and explanations (Chiappetta & Koballa, 2002; Llewellyn, 2002; NRC, 1996). Engaging in these abilities of inquiry will lead students to a better

understanding of inquiry. Thus students will better understand that scientific inquiry involves 1) using technology to improve upon the process of science; 2) designing investigations for multiple reasons; 3) building explanations from logical scientific evidence; 4) using mathematics to improve on models and explanations; 5) understanding scientific concepts and knowledge that lead to investigations; and 6) communicating with the community and scientific peers (Chiappetta & Koballa, 2002; Llewellyn, 2002; NRC, 1996).

Though the authors of the most current national reform documents, *The Framework* and the *NGSS*, do not explicitly reference the abilities or understandings of inquiry, these concepts exist within the new scientific practices (Achieve, 2013; NRC, 2012). Specifically, the scientific practices listed out in these two documents include 1) asking questions; 2) developing and using models; 3) planning and carrying out investigations; 4) analyzing and interpreting data; 5) using mathematics, information and computer technology, and computational thinking; 6) constructing explanations; 7) engaging in argument from evidence; and 8) obtaining, evaluating, and communicating information. While these scientific practices resemble the abilities of inquiry laid out in the *National Science Education Standards* (*NSES*) (NRC, 1996), the authors stress that these practices are geared towards getting students to deeply understand and engage in the work that scientists do to make sense of and validate scientific knowledge (NRC, 2012; Osborne, 2014). To further emphasize this point, the authors of *NGSS* intentionally embedded the scientific practices within the core ideas and crosscutting concepts. Given that both the abilities of inquiry and the scientific practices purpose to bring students to a

better understanding of what scientists do, this study continues under the assumption that inquiry-based instruction can accomplish the most current goals stated in *The Framework* and *NGSS.*

Levels and Essential Features of Inquiry-based Instruction

In order to get students to understand scientific concepts, abilities of inquiry (i.e., scientific practices), and understandings of inquiry teachers need to enact quality inquiry-based teaching. The literature on inquiry-based teaching typically acknowledges that there is a continuum of inquiry instruction (NRC, 2000; Bell, Smetana, & Binns 2005). Figures 2.1 and 2.2 provide illustrations of what the levels are as well as descriptions of some of the characteristics of the different levels of inquiry. As illustrated in Figure 2.1, the confirmation level is mainly teacher-centered and it focuses on students verifying concepts and processes they have already learned. As the levels of inquiry-based teaching increase, so does student ownership of learning. Open inquiry denotes instruction where students determine the direction and focus of the learning environment (i.e., formulating scientific questions and designing how to answer the questions). At this level, the teacher serves as a facilitator, helping out students when they need assistance. While open inquiry is at the top of the inquiry continuum, Marshall (2013) and Marshall and Horton (2009) speak to guided inquiry often being the goal of teachers' instructional practice. However, it is understood that other levels of inquiry instruction may be more suitable at certain times depending on the learning goals (Asay & Orgill, 2010).

Inquiry Level	Description and examples
1	**Confirmation**—Students confirm a principle through an activity in which the results are known in advance. "In this investigation you will confirm that the rate of a chemical reaction increases as the temperature of the reacting materials increases. You will use effervescent antacid tablets to verify this principle. Using the following procedure, record the results as indicated, and answer the questions at the end of the activity."
2	**Structure inquiry**—Students investigate a teacher-presented question through a prescribed procedure. "In this investigation you will determine the relationship between temperature and the reaction rate of effervescent antacid tablets and water. You will use effervescent antacid tablets and water of varying temperatures. Using the following procedure, record the results as indicated, and answer the questions at the end of the activity."
3	**Guided inquiry**—Students investigate a teacher-presented question using student designed/selected procedures. "Design an investigation to answer the question: What effect will water temperature have on the rate at which an effervescent antacid tablet will react? Develop each component of the investigation including a hypothesis, procedures, data analysis, and conclusions. Implement your procedure only when it has been approved by your teacher."
4	**Open inquiry**—Students investigate topic-related questions that are student formulated through student designed/selected procedures. "Design an investigation to explore and research a chemistry topic related to the concepts we have been studying during the current unit on chemical reactions. Implement your procedure only when it has been approved by your teacher."

Figure 2.1: Levels of inquiry. From Rezba, Auldridge, and Rhea, 1999.

Essential Features	More ◄- - - - - - Amount of Learner Self-Direction - - - - - -► Less Less ◄- - - Amount of Direction from Teacher or Material - - -► More **Variations**			
1. Learner engages in scientifically oriented questions	Learner poses a question	Learner selects among questions, poses new questions	Learner sharpens or clarifies questions by provided by teacher, materials, or other source	Learner engages in question provided by teacher, materials, or other source
2. Learner gives priority to evidence in responding to questions	Learner determines what constitutes evidence and collects it	Learner directed to collect certain data	Learner given data and asked to analyze	Learner given data and told how to analyze
3. Learner formulates explanations from evidence	Learner formulates explanation after summarizing evidence	Learner guided in process of formulating explanations from evidence	Learner given possible ways to use evidence to formulate explanation	Learner provided with evidence
4. Learner connects explanations to scientific knowledge	Leaner independently examines other resources and form the links to explanations	Learner directed toward areas and sources of scientific knowledge	Learner given possible connections	Learner given all connections
5. Learner communicates and justifies explanations	Learner forms reasonable and logical argument to communicate explanations	Learner coached in development of communication	Learner provided with broad guidelines to use to sharpen communication	Learner given steps and procedures for communication

Figure 2.2: Five essential features of inquiry. From NRC, 2000.

As Figure 2.2 illustrates, according to the National Research Council there are different essential features of inquiry-based instruction, and each of these features differs depending on the level of inquiry enacted (Asay & Orgill, 2010). These features include the following: 1) learner engages in scientifically oriented questions; 2) learner gives priority to evidence in responding to questions; 3) leaner formulates explanations from evidence; 4) learner connects explanations to scientific knowledge; and 5) leaner communicates and justifies explanations. Additionally, Crawford (2000) adds to this list after observing a biology teacher whom she considered proficient at developing a classroom culture of inquiry teaching and learning. She adds that during proficient inquiry instruction, learning is situated in authentic problems, students have to grapple with data, there is collaboration between teacher and students, there is connection with society, the teacher models the behaviors of a scientist, and there is the development of student ownership. Further, according to previous and current national science standards, inquiry classrooms should also exhibit learners engaging in mathematics and computational thinking, learners engaging in argumentation from evidence, and learners planning and carrying out investigations (Achieve, 2013; NRC, 1996; 2000).

Researchers, teacher educators, and reformers have put in energy to clarify and describe inquiry-based instruction (Anderson, 2002, 2007; Llewellyn, 2002; Marshall et al., 2010; NRC, 2000). One of the main reasons for this expenditure of energy is to increase the amount and quality of inquiry-based teaching that occurs in science classrooms. While it would appear that decades of attempting to increase inquiry-based teaching would result in the majority of science teachers enacting quality inquiry-based

instruction, many science teachers still do not embrace it (Marshall et al., 2009; Savasci & Berlin, 2012). This raises the question, why is it that inquiry-based instruction has yet to find footing in the majority of science classes in the U.S.? Researchers have attempted to answer this question by investigating the different barriers that keep teachers from engaging in inquiry-based instruction.

Barriers to and Challenges of Facilitating Inquiry-based Instruction

As the information about inquiry-based instruction illustrates, inquiry-based teaching is a complex process (Hollbrook & Kolodner, 2000; Magnusson & Palincssar, 2005); therefore, it requires more from teachers to enact. Many science teachers do not have experience teaching or learning in inquiry-based classrooms; hence, their knowledge of how to facilitate these types of learning environments is limited (Anderson, 2007; Blanchard et al., 2009; Capps & Crawford, 2013; Trumbull, Bonney, & Grudens-Schuck, 2005). Science teachers' misconceptions of inquiry-based instruction and the nature of science (NOS) are also a source of contention regarding their enactment of inquiry-based instruction (Abd-El-Khalick & BouJaoude, 1997; Ackerson & Donnelly, 2008; Capps, Crawford, & Constas, 2012; McLaughlin & MacFadden, 2014; Meyer, Meyer, Nabb, Connell, & Avery, 2013). Science teachers often misconceive inquiry as any hands-on activity or lab that allows a break from lectures or power points (McLaughlin & MacFadden, 2014). They also frequently think NOS is not creative, subjective, tentative, or socially and culturally embedded (Lederman & Lederman, 2012; McLaughlin & MacFadden, 2014). As accurate knowledge of NOS assists in the enactment of inquiry-based instruction, having misconceptions of both inquiry-based

instruction and NOS inhibit science teachers' facilitation of inquiry-based instruction. These factors, as well as many others serve as impediments. Additional factors include teachers valuing specific aspects of the teaching and learning process (Hasweh, 1996; Prosser & Trigwell, 1997), teachers having low confidence in their ability to enact inquiry instruction (Haney et al., 2002), teachers having more traditional views of teaching and learning (Crawford, 2007), teachers having goal orientations focused on performance instead of mastery (Butler, 2007), teachers lacking sufficient content and pedagogical knowledge (Jones & Carter, 2007), teachers finding inquiry-based classes harder to manage (Deters, 2004; Harris & Rooks, 2010; Windschitl, 2004), teachers not believing inquiry-based instruction can prepare students for high-stakes assessments (Blanchard, Southerland, & Granger, 2009), and teachers' perception that there is not enough time to cover content using inquiry instruction (Deters, 2004; Wallace & Kang, 2004).

The barriers to facilitating inquiry-based instruction can influence the challenges science teachers face when attempting to facilitate this instructional strategy. Teachers may find the ambiguity of facilitating inquiry-based instruction unsettling. Often teachers are used to knowing the "answer" in investigations and activities; however, there are instances when a teacher may not know how an investigation will turn out (McLaughlin & MacFadden, 2014). This more accurately illustrates the process of science but can cause teachers to feel insecure and fearful. Open-ended discussions can have the same impact on teachers. In traditional classrooms discussion are dominated by the teacher and the teacher often knows the answers to questions asked. More open-ended discussions

can challenge teachers because students are more active in the question posing and therefore the teacher is not always sure of the answers to students questions (Jones & Carter, 2007; McNeill & Pimentel, 2009). Scaffolding inquiry-based lessons can also be a challenge science teachers face when facilitating this type of instruction. As stated earlier, in inquiry-based instruction teachers are called to get students actively involved in constructing their own knowledge (e.g., asking questions, analyzing data, creating and justifying explanations). Many teachers are ill-equipped to scaffold or manage students in these processes and therefore struggle if or when they attempt inquiry-based lessons (Crawford, 2007; Harris & Rooks, 2010).

These challenges and barriers can increase the stress that teachers feel (Ritchie et al., 2013) and this stress has the potential of impeding science teachers from continuing to try inquiry-based instruction (Sutton & Wheatley, 2003). The theoretical framework for this study addresses how negative emotions and the regulating of these emotions can impact teachers' achievement of learning goals, such as facilitating a higher quantity and quality of inquiry-based instruction.

Theoretical Framework

Theoretical frameworks provide the lens through which a researcher approaches the issue being studied (Maxwell, 2008). Miles and Huberman (1994) explain theoretical frameworks by stating that frameworks "explain, either graphically or in narrative form, the main things to be studied-the key factors, concepts, or variables-and the presumed relationship among them" (p. 18). Theoretical frameworks are an interconnecting organization of assumptions, concepts, expectations, beliefs, and theories that research is

built upon. The framework for this study— Boakaerts' (2007) Dual Processing Self-Regulation Model—is situated within the realm of self-regulated learning (SRL). SRL was built on the understanding that humans are goal driven and have to regulate themselves in order to reach the goals they are pursuing (Carver & Scheier, 1982; Zimmerman, 2000; Zimmerman & Kitsantas, 1997). Specifically, Boekaerts' (2007) model focuses on the emotional aspects of regulating one's pursuit towards learning goals.

Dual Processing Self-Regulation Model

Boekaerts' (2007) Dual Processing Self-Regulation Model guides this research study. Boekaerts proposed an SRL model that brings to the forefront the concept of emotional regulation during the SRL process. In her model, Boekaerts (2007) states that a learner balances between growth goals and emotional well-being goals. Figure 2.3 illustrates her model and shows how learners are constantly balancing between these two goals.

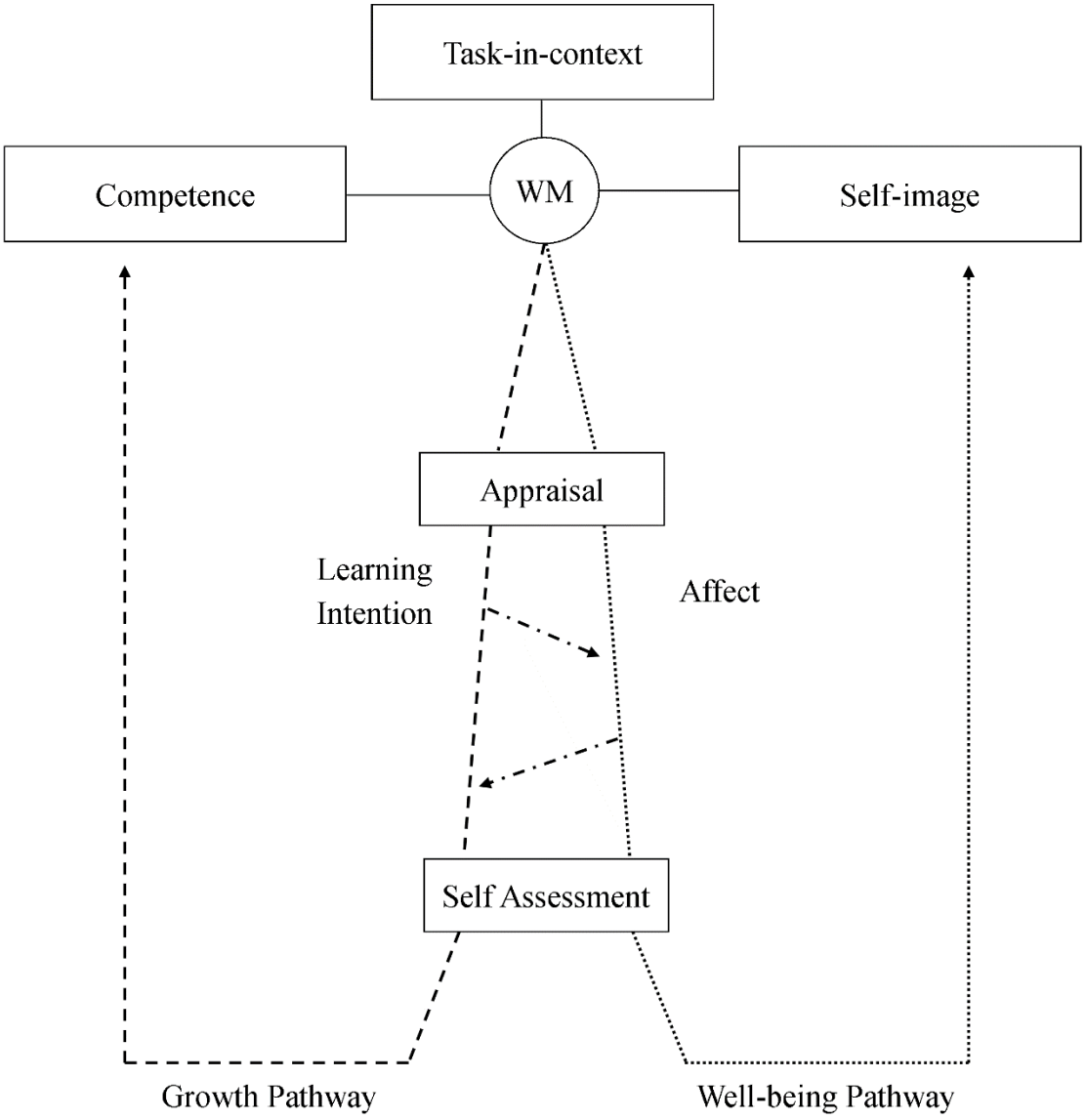

Figure 2.3: Dual Processing Self-Regulation Model. From Boekaerts, 2007.

The balancing between the two pathways is impacted by an individual's appraisal of three different components that make up an internal working model (dictated by the letters "wm" in Figure 2.3). *Task demands* is the first component and addresses the requirements of engaging in a task and the context in which the task will occur. The

second component is *competence*. This focuses on the knowledge and skills that are important in succeeding at the task. The third component is *traits and self-concept*, which entails personality traits and goals. Each of these components feeds into the working model (i.e., the perception of learning performance) which is used as a reference value to appraise current and future situations. These appraisals thus impact the decision to continue in or change behavior to achieve specified learning goals. Her model illustrates that overly focusing on emotional well-being can impede a person's ability to focus on approaching his or her learning goals. An increased focus on emotional well-being occurs when a learner senses that there is a discrepancy from a desired condition and he or she does not feel the resources are available to lessen this discrepancy. This can result in a threat appraisal which initiates negative emotions such as anxiety, anger, or disappointment. Threat appraisals can cause learners to focus on actions that will decrease the negative emotions (e.g., coping strategies) and thus restore well-being. When learners switch to the well-being track, it becomes critical for the learner to engage in emotional regulation strategies so they can return to the growth track. This switch can result in learners coming up with productive plans to achieve their learning goals.

Education reformers often call for teachers to pursue new or modified teaching goals (e.g., facilitating inquiry-based instruction). Changes in culture can also result in the evolution of teachers and their classrooms (Atkin & Black, 2007). Therefore, teachers are individuals who should be learning continually. Similar to other learners, teachers experience discrepancies when they pursue goal attainment. When teachers experience these discrepancies, they can feel negative emotions (Sutton & Wheatley, 2003). Thus,

they also have to choose between the two tracks (i.e., well-being, growth) and regulate themselves to effectively pursue goal attainment. The following sections review the literature regarding the impact of emotions and emotion regulation on the teaching profession. Within this review, specific connections are made within the context of inquiry-based instruction so as to attend to Action 2—identify the relationships between emotions, appraisals, and emotional regulation and relate them to inquiry-based instruction

Emotions and the Teaching Profession

Research regarding teachers and their emotions is emerging due to the realization that emotions have an impact on motivation and performance (Sutton, 2005). While research in this realm has been increasing in the last two decades, there is still much that needs to be determined when considering the impact of emotions on teachers. Due to the relatively recent increase in this field of research, few studies specifically explore teachers and their emotions in the realm of science education and inquiry-based teaching. Given this limitation, this section on teachers and their emotions also includes research from various other fields including educational sociology, educational psychology, and personality and social psychology. A discussion on emotions will begin this section in order to facilitate the subsequent review of teachers and their emotions.

The Concept of Emotions

Many researchers from various domains agree that emotions are composed of multiple components (Frijda, 2001; Lazarus 1991; Planalp, 1999; Sutton & Wheatley, 2003). These components include appraisals, subjective experience, physiological

change, emotional expression, and action tendencies. While each component contributes to the emotion process as a whole, researchers (e.g., Schutz et al., 2006) attribute the initiation of emotions and the possibility for emotional regulation to appraisals. Therefore, this review of emotions begins with an explanation of appraisals. Action tendencies or how an individual responds when emotions are felt are discussed in the emotional regulation section. Subjective experience (i.e., what emotions are felt by individuals) is addressed in context within the discussions of appraisals and emotional regulation. Physiological change (e.g., heart rate, blood pressure) and emotional expression (e.g., facial expression) are outside the realm of the current study and therefore will not be discussed (See Frijda, 2001 and Sutton, 2005 for a summary of these components of the emotional process).

Appraisals. Also called cognitive appraisals, appraisals are judgments that individuals make in regards to some transactional event. Specifically, these judgments are formed concerning people's beliefs, goals, and standards and result in the initiation of emotions (Schutz et al., 2006). There are primary and secondary appraisals, and each one influences the type and intensity of the felt emotion (Lazarus, 1991; Schutz & Decuir, 2003). Primary appraisals are composed of three features: goal relevance, goal congruence, and ego-involvement. Goal relevance is the importance that a transactional event has regarding an individual's goals and is critical in the initiation of emotions (Lazarus, 1991; Schutz & Decuir, 2003). Goal congruence is whether an individual sees a situation as benefitting his or her goals. Goal congruence leads to positive emotions whereas goal incongruence leads to negative emotions (Lazarus, 1991). The third feature

of primary appraisals, ego-involvement, is tied to a person's identity. If identity is threatened, a person feels negative emotions, while if his or her identity is bolstered, that person feels positive emotions. Student learning is one goal that many teachers hold as very important (Sutton & Wheatley, 2003). Therefore, if a teacher experiences a situation in class (e.g., student misbehavior, activity does not go well, internet is not working) that he or she thinks will hinder student learning (i.e., goal incongruence), he or she may experience negative emotions because of the struggle in achieving a very important goal. Being able to get students to learn is also important in the identity that teachers hold (Schutz & Lee, 2014). In the current example, teacher identity is threatened. Since the teacher feels the students are not learning he or she may struggle with feelings of being a bad teacher. This judgment increases the intensity of negative emotions felt.

Secondary appraisals are important in an individual making more detailed distinctions regarding which emotions are felt, as well as deciding how to respond to the felt emotions. The features important in secondary appraisals are agency and problem efficacy. Agency refers, for example, to whether teachers blame the transactional event on controllable (e.g., teaching method) or uncontrollable (e.g., school policy) and internal (e.g., ability to teach) or external (e.g., student misbehavior) factors. This term is similar to Heider's (1958) term *locus of control* in his attribution theory. People usually feel anger when they perceive their goals are blocked by controllable factors in other individual's behavior, whereas they tend to feel frustration when they perceived their goals are blocked by uncontrollable outside forces (e.g., school policy mandates). Problem efficacy denotes the confidence that people feel in dealing with a problem that

occurs during a situation. According to Smith (1991) problem efficacy can be the difference between anxiousness (goal relevant, goal incongruent, low problem efficacy) and challenge and hope (goal relevant, goal incongruent, high problem efficacy). As Crawford (2007) stated, many new teachers often think they are unable to scaffold inquiry-based learning environments. In other words, these teachers have a low problem efficacy which will impact how they judge challenges that occur when they attempt to facilitating this type of instruction. These individuals will feel more anxiety compared to their counterparts who believe they can effectively scaffold inquiry-based lessons.

Teachers and their Emotions

The primary and secondary appraisals that teachers make concerning transactional events that occur when they are teaching are critical in the emotions that teachers feel (Sutton & Wheatley, 2003). As stated earlier, teacher identity is important in determining which emotions teachers feel. Teachers' identities are composed of their beliefs and goals (Schutz et al., 2006). Teacher identities are the result of their past experiences as children, students, pre-service teachers, and new teachers (Knowles, 1992; Massey & Chamberlin, 1990; Pajares, 1992; Zeichner & Gore, 1990). Zembylas (2004) stated it this way,

> The emotions that teachers experience and express, for example, are not just matters of personal dispositions but are constructed in social relationships and systems of values in their families, cultures and school situations. These relationships and values profoundly influence how and when particular emotions are constructed, expressed, and communicated. (p. 186)

It is due to these individual differences in teachers' identities that result in teachers responding to the same transactional events in different ways (e.g., anger, challenge, pride). In their qualitative study on eight in-service math teachers, Williams-Johnson et al. (2008) found that teachers responded to emotional events in their classrooms in a way that aligned with the description of their teacher identity. While teacher identity may seem like an unchanging construct, there is some malleability in how teachers view themselves and the teaching profession due to changing social-historical contexts (Schutz & Lee, 2014; Zembylas, 2003). These changes can impact the goals and beliefs that teachers hold.

Teacher identity and emotions. The social-historical context in which science teachers are residing is a result of reformist explicitly encouraging constructivist-style teaching such as inquiry-based instruction in science education (Anderson, 2007; Atkin & Black, 2007). Studying science teachers' goals and beliefs (the components that make up teacher identity), researchers have found connections between science teachers' beliefs and goals and their choice to enact constructivist-style teaching such as inquiry-based instruction (Friedrichsen & Dana, 2005; Haney et al., 2002; Wallace & Kang, 2004). However, the importance of emotions in the equation has still largely been neglected. Seeing that teacher identity and emotion are closely linked, Schutz et al. (2006) argued that this should not be the case. They go on to say that "when teachers experience unpleasant emotions, those emotions may threaten their identity by challenging their existing beliefs" (p. 227). This can either lead to a goal approach (e.g., learning to enact inquiry-based teaching) or a goal avoidance (e.g., resisting the enactment of inquiry-

based teaching). Hargreaves (1998) agrees with the notion that emotions need to become a focus in educational reform movements. He states:

> It is time for educational change strategies and reform efforts, and for definitions of teaching and learning standards to come to terms with and embrace these emotional dimensions of teaching and learning – for without attention to the emotions, educational reform efforts may ignore and even damage some of the most fundamental aspects of what teachers do. (p. 850)

Rationale for studying teachers' emotions. Given the call from researchers (e.g., Hargreaves, 1998; Sutton & Wheatley, 2003) to include emotions in educational research and reform movements, the question arises as to what evidence there is in science education and education in general that supports this call? Even though this research study specifically focuses negative emotions, considering the evidence for both positive and negative emotions in education is beneficial since emotional regulation can result in the feeling of positive emotions.

Researchers have found that teachers' positive emotions can be due to increases in student learning (Hargreaves, 1998), students not misbehaving during the learning process (Sutton & Wheatly, 2003), and tying in current events to instruction (Hargreaves, 1998). In science education, teachers speak of similar events eliciting positive emotions. In a qualitative study that interviewed 11 secondary science teachers in London, Demetriou and Wilson (2009) found that teaches experienced positive emotions (e.g., joy, hope) when engaging students in active lessons that had identifiable learning outcomes for students. Additionally, these teachers felt positive emotions when

previously disengaged students became interested. In an ethnographic case study of a new science teacher, Ritchie (2011) and his colleagues found that the teacher experienced positive emotions when she achieved her expectations for teaching. Ritchie (2013) and his colleagues also found that beginning physics teachers experienced positive emotions (e.g., elation, pride, satisfaction) when their students were able to successfully engage in and learn from inquiry-based instruction. Turner (2007) stated that when individuals experience positive emotions due to others' actions or emotional displays, they reciprocate these positive emotions which results in a more positive environment for all. Therefore, in the classroom, teachers experiencing positive emotions can result in a positive classroom environment. Positive classroom environments can increase student learning (Shelton & Stern, 2004; Sutton & Weatley, 2003; Williams-Johnson et al., 2008), learning opportunities for teachers (Ritchie et al., 2013), and job satisfaction, and therefore less burnout for teachers (Borrachero, Brigido, Mellado, Costillo, & Mellado, 2014). Moreover, teachers who feel more positive emotions may be able to come up with more teaching strategies and coping skills (Fredrickson, 2001), may have a higher degree of intrinsic motivation (Csikszentmihalyi, 1990; Ryan & Deci, 2000), and may increase perceived self-efficacy (Kavanaugh & Bower, 1985)— all of which are important in improving appraisals teachers make during challenging situations. Furthermore, experiencing positive emotions enables learners such as teachers to remain on the growth pathway (Boekaerts, 2007).

While positive emotions are reported by teachers, negative emotions are also a reality in the teaching profession. Furthermore, negative emotions are often given

prominence since this valence of emotion seems to have a greater impact on individuals (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001). In the realm of education, managing student misbehavior is a major cause of negative emotions (Chang, 2013; Ritchie et al., 2011). Since one of the goals teachers have is effective instruction, a misbehaving student may be perceived as incongruous to this goal. Furthermore, a teacher may have to divert attention from instruction to the misbehavior when it occurs. The combination of this perception and action can lead to a teacher feeling negative emotions. The difficulty of managing student behavior is one of the challenges faced by science teachers attempting to engage in inquiry-based teaching (Harris & Rooks, 2010).

Reform efforts geared towards changing the standard of good teaching (e.g., NGSS) can also initiate negative emotions if the goals stated in reform documents are not aligned with teacher identities (Cross & Hong, 2009). In science teachers, educational changes can lead to perceptions of being underqualified, ill-prepared, and lacking support and resources. These perceptions can threaten their teacher identity and therefore contribute to the initiation of negative emotions (Beijaard, Verloop, & Vermunt, 2000; Borrachero et al., 2014; Zembylas, 2004). Being well prepared and qualified and having support are critical in inquiry-based instruction; researchers speak to the difficulties that both novice and veteran teachers experience when trying to engage in this type of teaching (Crawford, 2007; Blanchard et al., 2009).

Since negative emotions are an inherent aspect of teaching, it is important to look at what researchers have found regarding the impact of negative emotions on behavior. Derryberry and Tucker (1994) and LeDoux (1996) speak to negative emotions impeding

individuals' ability to focus on tasks. In a qualitative study looking at 28 pre-service teachers, Beach and Pearson (1998) found that negative emotions could distract teachers from focusing on the task of teaching. One of the teachers in their study stated

> I get very distracted when [students] are eyeballing each other across the room, even if they are not saying anything. I can't concentrate on what I'm saying and I screw up giving directions because I can't divide my attention that way. (p. 341)

Emmer (1994) states that when managing or disciplining students, teachers' negative emotions are a critical factor because they can monopolize focus. Additionally, there is literature that speaks to negative emotions impairing the resources of working memory, which can lead to a reduction of task-relevant processing (Ashcraft & Kirk, 2001; Eysenck & Calco, 1992). These findings give support to Boekaerts' (2007) dual processing model that suggests negative emotions have the ability to impede focus, which causes individuals to move from the growth track (i.e., focusing on the tasks at hand and moving toward learning goals) to the well-being track (i.e., focusing on diminishing the negative emotions that have been initiated).

Negative emotions can also influence teachers' motivation. Sutton and Wheatley (2003) suggest that negative emotions can decrease intrinsic motivation. Pekrun, Goetz, Titz, and Perry (2002) give credence to this idea when they state that "negative emotions tend to be incompatible with enjoyment as implied by interest and intrinsic motivation" (p. 97). As stated earlier, individuals who are more intrinsically motivated tend to maintain the pursuit toward their goals (Pintrich & Schunk, 1996). Additionally, being intrinsically motivated can increase esteem and therefore can positively impact how

transactional events are appraised (Lazarus, 1991). Science education and general education literature give evidence to the impact of negative emotions on motivation and behavior. In their study on mathematics teachers, Williams-Johnson et al., (2008) give reference to three of the participating teachers changing their behavior when they experienced negative emotions due to instruction not going well. They stated that

> [T]he teachers' awareness of a particular student or types of student emotions served as a cue to monitor and, in these examples, change what they were doing in an effort to reclaim what they perceived to be a classroom more conducive to student learning (p. 1598).

Also, Ritchie et al. (2011) found that Vicky (a seventh grade science and mathematics teacher) sought to change her instructional behaviors when she experienced negative emotions due to student misbehavior or unmet expectations for teaching. In another study focused on four Australian science teachers, Ritchie et al. (2013) found that three of the teachers' negative emotions led to teachers changing their planned teaching behavior (e.g., amount of scaffolding, organization).

The above information on teachers and emotions illustrates how teachers experiencing positive and negative emotions impacts student performance, teacher well-being, teacher motivation, and teacher instructional choices. Given the theoretical framework of the study, it is essential to investigate the concept of emotional regulation. Engaging in this discussion will provide information about how science teachers and teachers in general attempt to regulate their negative emotions in order to facilitate the achievement of their instructional and professional goals. Boekaerts (2007) argues that

regulating emotions can keep learners off the well-being track or return learners to the growth track. Therefore, discussing emotional regulation in regards to teachers addresses this piece of her theoretical model.

Regulating Emotions and the Teaching Profession

Gross (1998b) defines emotional regulation as "the process by which individuals influence which emotions they have, when they have them, and how they experience and express these emotions" (p. 276). He states that emotional regulation can take place consciously or unconsciously. Just as goals and standards are important in the initiation of emotions, the same connection is true of emotional regulation (Sutton, 2004). Without goals and standards, individuals have no reason to regulate their cognitions, emotions, or behaviors (Carver & Scheier, 2000; Zimmerman, 2000). Researchers often speak of the positive results of self-regulation (Twenge & Baumeister, 2001); however, Gross (2002) argued that emotional regulation is a neutral process that can be used both for positive and negative behaviors.

Emotional Regulation

Individuals can use many strategies to regulate their emotions. Gross (1998a) categorizes these strategies into the broad groups of antecedent-focused (preventative) or response-focused (responsive). Before an emotional episode takes place, an individual can use a number of preventative strategies: selecting situations (e.g., not choosing to engage in certain instructional strategies); modifying situations (e.g., sitting two students who talk to each other during class on opposite sides of the classroom); attention deployment (e.g., teachers focusing on positive thoughts when they know they are about

to teach a difficult set of students); and cognitive change (e.g., teachers focusing on growth rather than perfection when they are about to attempt a new instructional strategy). Responsive strategies occur when emotions are initiated and can include self-talk, deep breathing, and changing facial expressions. Grandey (2000) stated that attention deployment and cognitive change are deep acting strategies whereas the other strategies are surface acting. Deep acting involves consciously altering emotions and feelings so as to express the desired emotions and surface acting only serves to stop, mask, or fake felt emotions (Hochschild, 1983). Deep acting strategies such as cognitive change are considered positive in that they allow an individual to address negative emotions and move on. While surface acting strategies (e.g., expression suppression, faking) stop the expression of negative emotions, they do not impact the feeling of negative emotions and they "consume cognitive resources. This impairs memory for information presented during the emotion regulation period" (Gross, 2002, p. 289). In this way, surface acting strategies can result in emotional exhaustion (Chang, 2013). Researchers have studied the act of masking and faking emotions further under the concept of emotional labor which is a type of emotional regulation (Hochschild, 1983). However, emotional labor is beyond the scope of this research study and therefore will not be discussed.

Coping

Another responsive strategy that individuals use to deal with stressful situations is coping (Lazarus & Folkman, 1984). Lazarus and Folkman (1984) define coping as "cognitive and behavioral efforts to manage specific external and/or internal demands

that are appraised as taxing or exceeding the resources of the person" (p. 141). While similar to emotional regulation, coping is different in that "its primary focus [is] on decreasing negative emotion experience" (Gross, 1998a, p. 276). Some researchers have grouped coping into the two categories of problem-focused coping and emotion-focused coping (Chang, 2013; Gross, 1998a). *Problem-focused coping* seeks to solve the problem that is confronted in a stressful situation and therefore allow a person to move pass the stress; whereas *emotion-focused coping* focuses on decreasing the negative emotional experience. In the classroom, teachers who get frustrated and then choose to focus on the stressor in a situation and express those feelings to their students is engaging in emotion-focused coping. In this regard, the teacher is not focusing on moving pass the stressful event nor is he or she seeking out a solution to make the situation better. On the other hand, if this same teacher started making mental plans about what steps are needed to improve the situation, he or she would be engaging in problem-focused coping. In the latter example, this teacher is seeking to change the situation in order to move pass the stressful situation. Even though these coping strategies are split into separate groups, Carver and Scheier (1994) argue that they typically occur together.

While there are beneficial and maladaptive emotional regulation strategies, researchers debate whether this same dichotomy exists for coping (Lazarus, 2006). In describing her self-regulation model, Boekaerts (2007) argues that certain coping strategies increase the chances of staying on or moving to the well-being pathway; whereas other coping strategies do the opposite. In his 1999 publication, *Stress and emotion: A new synthesis*, Lazarus provides information from previous studies which

support and challenge Boekaerts' assertion. When split, emotion-focused coping strategies are often labeled maladaptive, while problem-focused coping strategies are labeled as beneficial. Lazarus (2006) argues that researchers should not dichotomize the coping strategies but see them as complimentary.

Researchers in teacher education have investigated emotional regulation, emotional labor, and coping in various ways. This is a result of realizing that the teaching profession is laden with situations that elicit negative emotions (Chang, 2009; Ritchie et al., 2011; Schutz & Zembylas, 2009) which, if not regulated, can lead to emotional exhaustion and burnout. The following sections discuss the literature regarding teachers and the ways in which researchers have studied how teachers regulate their emotions. By engaging in this review of literature, Action 3—identify the strengths and limitations of emotional regulation instruments that have been used with teachers—of this study will be accomplished.

Assessing Teachers' Use of Emotional Regulation and Coping

In the literature specifically focused on science teachers, Ritchie et al. (2011) and Ritchie et al. (2013) performed studies that purposed to better understand the emotional aspects of teaching. While Ritchie and his colleagues did not intentionally design these studies to look at how science teachers regulated their emotions, their findings shed light on this aspect of science teaching. It should be noted that both of these studies are qualitative in nature and therefore neither utilized any type of systematic quantitative survey instrument.

Their first study, published in 2011, was an ethnographic case study about a first year science teacher name Vicky. Vicky was a seventh grade science teacher in Australia who taught at an independent school. In order to better understand Vicky and the emotions she experienced when teaching science, Ritchie et al. (2011) observed and video recorded eleven classroom sessions. Following five of these observations, one of the researchers interviewed Vicky to determine how she was feeling during certain instances that occurred during the observed lesson. Additionally, the researchers interviewed Vicky seven other times during the analysis phase of the research process to make sure that analyses were accurate and to ask any follow-up questions. The lessons and interviews were the sources of data that the researchers used for analysis. As a result of their study, it became clear that Vicky used humor to improve the stressful situations that occurred in her class. By doing this, Vicky also cultivated the same behavior in her students. The researchers found that when humor was used, Vicky and her students were able to have fruitful conversations about science concepts. These conversations, what Ritchie et al. (2011) called interaction rituals, resulted in Vicky feeling positive emotions. Vicky used this regulation tactic when things were not going as she expected and she felt negative emotions of dissatisfaction. While not the focus of the research, Vicky also utilized self-talk to problem solve how to move forward when negative emotions of uncertainty were experienced.

Later, Ritchie et al. (2013) published a multiple case study about four Australian physics teachers. Two of the teachers were male and two were female. Each of these teachers was going to implement extended experimental investigations (EEIs) during the

upcoming school year. These investigations were inquiry-based and sought to get students investigating scientific questions and developing their own procedures to answer the questions. Each teacher was observed at least five times and post-interviews were performed. Video recording of the lessons also occurred. Researchers analyzed classroom and interview transcripts to determine the emotions that the teachers experienced when engaging in inquiry-based investigations. Additionally, the researchers analyzed facial features and voice intonations. Voice intonations (e.g., pitch, volume, and speed) were analyzed using the PRAAT program. PRAAT is a computer program individuals can use to analyze voice parameters (e.g., pitch, modulation, voice breaks). The result of their analyses revealed that three of the teachers were concerned and fearful when they learned they were going to have to engage in EEIs; however, this fear initiated proactive coping strategies where they made sure to plan better so that the management issues they were worried about would not occur (i.e., behavior and environmental regulation). Researchers also found that most of the teachers experienced negative emotions in relation to the scaffolding aspects of engaging their students in EEIs. However, as their students became more competent, the teachers' negative emotions turned into satisfaction and they were able to institute a more hands-off approach.

Both of these studies illustrate how researchers can use qualitative methods to study science teachers' emotions. The researchers of these studies were effective at determining the emotional events that can occur during the teaching of science and how science teachers judge and respond to these events. While studies like these are important, their use in determining the emotional regulation aspects of a large group of

teachers is unrealistic since observations, video recording, and interviews take many hours and typically necessitate the involvement of several individuals. Therefore, the call for more systematic ways to find out about the emotional aspects of teaching is justified (Chan, 1994; Cukur, 2009). The following studies utilized systematic quantitative measures to assess teachers' emotional experiences in different ways. It should be noted that due to the limited research regarding emotions in teaching, the following studies are not about science teachers specifically, but they do illustrate how researchers have utilized quantitative measures to better understand the emotions that arise during teaching and how teachers manage these emotions.

Chan (1994) performed a study to determine the coping strategies that secondary teachers and students used during stressful situations. In order to achieve this purpose, Chan assessed 657 secondary, Hong Kong, teachers (N=415) and students (N=242). Of the teachers, there were 180 males and 229 females and the age ranged between 21 and 61. Chan used the Ways of Coping Questionnaire (WCQ) which is composed of 66 items. He also used the General Health Questionnaire (GHQ) which contained 60 items. The WCQ was designed by Folkman and Lazarus (1988) and was translated in Chinese to be used by the selected population. Initially, the instrument was composed of eight scales for coping strategies: confrontive coping, distancing, self-control, seeking social support, accepting responsibility, escape/avoidance, plan-ful problem-solving, and positive reappraisal. Upon administering the WCQ, Chan found that the participants used all of the strategies. In his sample, plan-ful problem-solving was the most common strategy used and escape/avoidance was the least used. Chan's analysis of his sample's responses

revealed a four scale factor instead of an eight scale factor. His four scale factor consisted of rational problem-solving; seeking support and ventilation; resigned distancing; and passive wishful thinking. While Chan's (1994) study illuminates some of the coping strategies that teachers may use, his analysis does not segregate the teachers from the students, nor does his study specify what stressful situations his respondents were responding to. Therefore, his study is only partially helpful in identifying strategies teachers may use to regulate their emotions.

Cukur's study (2009) specifically focuses on emotional labor of teachers regarding stressful work events and therefore provides additional information to fill in some of the gaps of Chan's (1994) study. Cukur (2009) purposed to design an instrument that measured teachers' emotional labor strategies utilized during critical work events. These critical events focused on general stressors that teachers face when they are at school (e.g., discrimination, blame for bad grades, good or bad news about students). Based on previous qualitative studies and theoretical grounding, Cukur designed the Teacher Emotional Labor Scale (TELS) to measure four dimensions of emotional labor: surface acting, deep acting, automatic emotional regulation, and emotional deviance. In order to validate the TELS, Cukur administered the instrument to 190 teachers (88 females and 102 males) in Turkey. Participants also answered questions from another emotional labor scaled developed by Diefendorff, Croyle, and Gosserand (2005); the Maslach Burnout Inventory (MBI) (Maslach & Jackson, 1981), which measures emotional exhaustion; and questions regarding the perception of job autonomy from the Job Diagnostic Survey (Hackman & Oldham, 1975). These other instruments were used

to determine the discriminant and convergent validity of the TELS. Analysis (i.e., confirmatory factor analysis and correlation analysis) revealed that the four factor structure of the TELS was confirmed. The correlations with the other instruments were not fully supported and therefore Cukur (2009) calls for further replication of this study to determine consistency. Although the TELS shows promise in determining how teachers engage in emotional labor due to stressful events that occur at work —an improvement to the more general assessment performed by Chan (1994)—the instrument is still too holistic in nature to assess how teachers regulate their emotions in more context-specific ways.

Gonzalez-Morales, Rodriguez, and Peiro (2010) chose to add knowledge about whether coping is influence by gender. They assessed 303 female and 141 male teachers. All the teachers in this study were German. The researchers in this study used three different measures to determine if there were differences in the coping strategies of males and females. The stressful situations that teachers experienced were one of the aspects the researchers measured. This scale was designed from qualitative studies which identified the sources of stress experienced by teachers. The scale was named "teacher stressors"; it used fifteen Likert scaled items to measure teacher stressors anywhere from classroom management to social expectations and interpersonal relationships. This scale ended up having a high internal consistency (Cronbach's $\alpha = .88$) and was highly correlated with another valid and reliable instrument (Occupational Stress Indicator – OSI). Another aspect they measured was coping strategies. They operationalized coping in two dimensions: social support seeking (e.g., seek support and advice from my superiors) and

direct action (e.g., set priorities and deal with problems accordingly). These dimensions were modified from the original OSI instrument (Cooper, Sloan, & Williams, 1988; Lyne, Barret, Williams, & Coaley, 2000). Respondents answered these items using a seven point Likert scale ranging from "I have never used it" to "I have used it very frequently". To measure the association of teacher stressors and coping strategies to teacher burnout, Gonzales-Morales et al. (2010) used a Spanish version of the MBI General Survey. The researchers used ten items to measure two of the principal components of burnout (emotional exhaustion and cynicism). Items were measured on a Likert scale ranging from "never" to "always". After analyzing their data, the researchers found that while men and women used both strategies, men experienced decreased emotional exhaustion and cynicism in the long term when they utilized direct action coping. Furthermore, when men used social support seeking, this increased their emotional exhaustion. Women's emotional exhaustion was not significantly lowered by using social support strategies. The results of this study illustrate that there are gender differences in the usefulness of different coping strategies. As in the other studies, this study chose to look at broad stressors that impact teachers' lives inside and outside of the activity setting of the classroom.

Sutton and Knight (2006) presented their findings on teachers' emotional regulation strategies in relation to different efficacy beliefs (student engagement, classroom management, and instructional strategies). Additionally, they wanted to see if there was a difference in strategies and relationships regarding gender, age, teaching level, or experience. They used four instruments to measure these aspects in teachers. To

measure the intensity of emotions that teachers experienced, they modified an existing measure (Berkeley Expressivity Questionnaire) designed by Gross and John (1995). This measure contained six items written on a seven point Likert scale ranging from "Strongly Disagree" to "Strongly Agree". To measure the outcome beliefs of expressing emotions, the researchers created a two item measure which asked teachers what they believed about showing positive and negative emotions in class. These items were new and were yet to be tested. The third questionnaire dealing with emotions was the Teacher Emotion Regulation Questionnaire (TERQ) which was a ten item instrument. The questions were written using the same Likert scale as the intensity of emotions survey and measured teachers' reappraisal and emotion suppression strategies. The last instrument they used was an efficacy beliefs survey developed by Tschannon-Moran and Hoy (2001) called the Teachers' Sense of Efficacy Scale. Both the emotional intensity and the reappraisal scale portion of the TERQ scale had high reliability. The emotion suppression portion of the TERQ had a lower reliability score but supported findings from previous studies. Specifically, this study showed that there are gender differences in using emotion suppression and reappraisal. Additionally, teachers who were more likely to experience intense emotions in class did not advocate for suppression or reappraisal strategies (younger teachers and female teachers tended to have higher emotional intensity scores). The survey also revealed that these teachers were less confident in their ability to teach or manage a classroom. The study also found that elementary and middle school teachers engaging in reappraisals positively influenced their efficacy. High school teachers did not exhibit this relationship. Finally, Sutton and Knight recommend assessing positive and

negative emotions in separate instruments because the response patterns between the positive and negative regulation items were drastically different.

This study again illustrates that emotion and emotional regulation tools that researchers have created for general use can be modified and used in the context of teachers. This study also shows that gender is a variable that needs to be considered when determining the sample and results of future studies. Along with gender, the age and level of teachers may also be variables to consider when studying emotion and emotional regulation. While the study has many implications for future research into teachers and emotional regulation, it once again focuses on general emotional regulation strategies when teachers encounter stresses in the classroom (e.g., "When I am faced with a stressful situation in the classroom, I make myself think about it in a way that helps me stay calm.").

While these general assessments of teachers' emotional regulation skills are useful, Lazarus (2006) speaks to the need to assess emotions in situational contexts. In an attempt to fill this gap, Chang (2013) designed a study to look specifically at the context-specific aspect of challenging classroom disruptive events. In her study, she wanted to see how teachers appraised, regulated and coped with challenging events that initiated emotional episodes. Her sample was composed of 492 teachers. This sample was composed of all levels of teaching, 80% of the teachers were female, and 95% of the teachers were Caucasian-American. Additionally, all of the teachers in her sample were within their first five years of teaching and worked at a variety of school types (e.g., urban, suburban, rural). Chang started off the survey by instructing the respondents to

choose a challenging and disruptive event that caused them to experience negative emotions. It was this emotional experience that Chang then surveyed them about regarding their appraisals and coping strategies. Emotional regulation strategies were generally measured (i.e., they were asked to respond to the emotional regulation items regarding how they generally responded to disruptive classroom events). Teachers' appraisals were measured via a twelve item self-designed measurement. This measurement was used in a previous study and found to be a good fit. Items were rated on a Likert scale ranging from "Very Strongly Disagree to "Very Strongly Agree". Chang assessed the teachers' coping strategies by taking six social coping items retrieved from the COPE scale developed by Carver, Scheier, and Weintraub (1989). These items assessed teachers' emotion-focused and problem-focused copping strategies and were rated on a four-point Likert scale. Chang also found this modified coping scale to be a good fit. Emotional regulation was measured using the seven item emotional regulation scale developed by Gross and John (2003). These items were also rated on a Likert scale ranging from "Very Strongly Agree" to "Very Strongly Disagree". Four of the items were used to measure reappraisal strategies and the remaining items measured suppression strategies. This measure was also found to have a good fit. In order to measure proactive coping, Chang used a fourteen item coping scale developed by Greenglass (2005). These items were rated on a Likert scale ranging from "Very Strongly Agree" to "Very Strongly Disagree". For final analysis Chang only kept the three strongest items in the confirmatory factor analysis. Finally, Chang measure teacher burnout using a modified MBI-Educator Survey (Schaufeli & Salanova, 2007). This was a twelve item

measurement which also used a Likert scale. The Likert scale ranged from “Never” to “Almost Daily”. This measurement appeared to have an acceptable fit.

Findings from this study supported previous research regarding negative emotions and teacher burnout. Chang found that teachers who experienced a higher intensity of negative emotions also experienced a higher level of burnout. Lack of problem-solving efficacy (secondary appraisal) was found to be the driving force behind experiencing anger and frustration. Additionally, if the student misbehavior hindered teachers’ goals, then teachers experienced a higher intensity of negative emotions. However, goal relevance (primary appraisal) and agency (secondary appraisal) were not significant contributors to negative episodes. Regarding the relationship between emotional regulation and burnout, there was no mediating relationship found. Chang suggests that this may be due to the emotional regulation strategies being generally assessed. This gives justification to designing an instrument that makes sure that emotional regulation strategies and situational-context are matched. Teachers were found to use both problem- and emotion-focused coping, but problem-focused coping was the only strategy that assisted with teacher burnout. Additionally, teachers who used avoidance coping strategies reported having higher teacher burnout. Interestingly, there were no positive effects of cognitive reappraisals found in Chang’s study. Chang does state that one of the limitations of this study is that he had a skewed data set regarding race (95% Caucasian-Americans). Despite this limitation, Chang’s study illustrates the usefulness and necessity of context-specific measurement of teachers’ appraisals, regulation, and coping strategies.

The discussion of the previous studies shows that most of the research regarding teachers and their emotions and emotional regulation strategies are performed in a general sense (with the exception of Chang's (2013) study). Additionally, none of the systematic instruments created have been designed to be content-specific. While there are admittedly similar challenging situations that can occur across content domains, research shows that management issues with regards to inquiry-based instruction are a major barrier to engaging in this instructional strategy (Harris & Rooks, 2010). Furthermore, with the continued and even increased expectation for science teachers to engage in inquiry-based instruction, it is critical that we begin to design ways to assess how science teachers appraise and emotionally and cognitively respond to the challenging situations that can occur when facilitating inquiry-based instruction. It is the purpose of this study to design an instrument to fill this gap and apply the concepts in Boekaerts' Dual Processing Self-Regulation Model to the initial findings from piloting the instrument.

CHAPTER 3: METHODOLOGY

Overview

The purpose of this study originated from the past and current state of science education and inquiry-based instruction. To date, the majority of science teachers still have not fully embraced inquiry-based instruction even though authors of reforms have encouraged this teaching strategy for the past two decades (Marshall et al., 2009; Savasci & Berlin, 2012). While inquiry is not the only instructional strategy that can address the more rigorous expectations in the new national standards (i.e., *NGSS*), it is one of the prominent pedagogies encouraged. Given the research that describes the challenges that science teachers face when enacting inquiry-based teaching, the connection between challenging instruction and negative emotions, and the link between negative emotions and teachers' instructional practice, this study sought to develop an instrument to assist in determining why inquiry-based instruction has yet to be fully embraced. Specifically, the designed instrument assesses the appraisals and the emotional regulation strategies science teachers utilize due to challenging situations that can occur during inquiry-based instruction. Prior to this study most emotional regulation instruments were geared toward students (e.g., response to test-taking), teachers' response toward student misbehavior, or general stressful situations (e.g., emotional labor of teaching). Based on recent literature that supports the idea of emotions being relational and situational (Lazarus, 2006; Schutz, 2004; Smith & Kirby, 2001), this instrument measures appraisals and emotional regulation in the context of challenging situations that can occur during inquiry-based instruction.

This study utilized an exploratory sequential research design method to identify the appraisals and emotion coping strategies used by science teachers when facilitating inquiry-based instruction (Creswell & Plano Clark, 2011). This approach is built on the understanding that people perceive reality in different and meaningful ways. Research on emotions and emotional regulation illustrates this by acknowledging that peoples' differences (e.g., histories, beliefs, goals, values) influence how they appraise and therefore respond to certain situations (Sutton & Wheatley, 2003). It is of value to ascertain how science teachers appraise and emotionally respond to situations that can occur during inquiry-based instruction and cope with the emotions that are initiated. In agreement with Sutton (2005), this study begins to provide science education researchers with a better understanding regarding why the majority of science teachers still have not fully embraced reform-based teaching strategies such as inquiry-based instruction.

The foundation for this research most closely aligns with Dewey's *pragmatism* (Paul, 2005) which holds that concepts and theories are judged useful given their effectiveness in explaining phenomena. While designing and validating this instrument does not help to explain phenomena, its future use to develop better PD experiences for science teachers will prove helpful for science education researchers. Pragmatism, as Dewey and other researchers (e.g., Creswell & Plano Clark, 2007; Rorty, 1999) see it, holds that what is instrumental to answer research questions and practical problems in the real world should be used; therefore, this study utilized qualitative data retrieved from 1) the literature review, and 2) Phase 1 focus group interviews. Quantitative analytical methods were used to refine and determine the validity and reliability of this instrument.

Research Goals and Objectives

The goal of this research study was to gain knowledge regarding the appraisals, emotions, and coping strategies science teachers engage in as a result of facing challenging situations when enacting inquiry-based teaching. To accomplish this goal, the following objectives were addressed:

1. Develop and validate an instrument that measures science teachers' appraisals, emotions, and emotional regulation habits when presented with challenging situations that can occur during inquiry-based teaching;
2. Pilot, analyze, and refine the instrument so as to provide an initial step in creating a meaningful instrument for researchers to use as a component of their professional development.

Participants

Since the instrument was developed to focus specifically on the challenging situations that can occur during inquiry-based teaching in science, it was administered to middle and high school science teachers. Elementary science teachers were not in the sample for two reasons. The first is due to researchers finding that elementary teachers spend less time on science content due to accountability measures (Banilower, Heck, & Weiss, 2007; Griffith & Scharmann, 2008). Secondly, research has noted that, generally, in-service elementary teachers have negative attitudes and beliefs about science and their ability to teach it effectively (Watters & Ginns, 2000). These negative attitudes and beliefs toward teaching science could interfere with their ability to reflect on the specific

context of inquiry-based instruction; thus their responses could be the result of their general attitudes toward science.

In order to recruit the samples needed for this study, an email was sent out to rural and suburban school districts in a southeastern state explaining the objectives of this study (See Appendix A). Once the required actions were taken at the district level to contact specific schools, emails and phone calls were used to contact principals (See Appendix B). These methods of communication addressed the purpose and requirements of the study so that principals had a complete knowledge of the study before committing to involvement. Principals were given an email that they sent out to their teachers (See Appendix C). This email addressed the purpose and requirements of the study and asked for involvement. Research information forms were linked to this email (See Appendix D) and a positive response to this email (i.e., "I will participate in this study") served as an agreement to participate in the study (i.e., electronic signature).

The first phase of this study pulled a sample of middle and high school teachers from two rural school districts in a southeastern state. All individuals who participated in the focus groups were of Caucasian descent. Table 3.1 contains additional demographic information for each of these groups. All individuals were given pseudonyms to ensure anonymity. These teachers were participants in the focus groups conducted. In total, 2 focus groups were completed. One of the focus groups was made up of high school science teachers and the other was made up of middle school science teachers. Also important in the first phase was another group. This group consisted of two experts in inquiry-based instruction, two psychometric experts, one expert in emotion psychology,

and one high school science teacher. They provided needed information on the content validity of the items created for the instrument.

Table 3.1
Demographic Information for Focus Group Teachers

Name	Gender	School Level	Years Taught	Content Taught	Grade Level
Jenny	Female	Middle School	18	Earth & Space Science; Forces & Motion; Waves	8th
Allison	Female	Middle School	24	Plant and Animal Structure and Function; Earth's Atmosphere and Weather; Conservation of Energy	6th
James	Male	Middle School	6	Plant and Animal Structure and Function; Earth's Atmosphere and Weather; Conservation of Energy	6th
Andy	Male	Middle School	5	Cells; Genetics; Ecology; Body Systems; Chemical Properties of Matter	7th
Caleb	Male	High School	2	Chemistry	10th – 12th
John	Male	High School	18	Physics	11th - 12th
Rick	Male	High School	11	Biology	9th
Joseph	Male	High School	2	Environmental & Physical Science	9th – 10th
Rachel	Female	High School	5	Physics; Anatomy; & Physical Science	9th – 12th

Piloting the instrument occurred with 49 science teachers who teach at the middle or high school level. This sample was obtained from teachers who teach in a southeastern state. Table 3.2 contains demographic information on these teachers. While a factor analysis was completed for this phase, I acknowledge that the sample size is a limitation for this analysis. However, the prerequisite checks done before the factor analysis aided in determining how the results of the factor analysis should be interpreted. While demographics were collected (e.g., gender, years of teaching experience, subject taught), no names or other specific identifiers were obtained unless a teacher volunteered to retake the survey two weeks after the first administration. This option was made available in order to have another way to assess reliability.

Table 3.2
Demographics of Survey Participants

		Number of Participants	Percentage
School Level			
	Middle School	19	39%
	High School	30	61%
Gender			
	Male	9	18%
	Female	40	82%
Ethnicity			
	Caucasian	33	67%
	African American	12	24%
	Asian	3	6%
	Other	1	2%
Years Taught			
	1-5	17	35%
	6-10	8	16%
	11-15	12	24%
	16-20	4	8%
	20+	8	16%
Content Taught			
	Biology	28	57%
	Chemistry	17	35%
	Physics	7	14%
	Environmental	8	16%
	Anatomy & Physiology	11	22%
	Physical Science	15	31%
	Forensic Science	3	6%
	Other	12	24%

Research Design

The product of this study is a self-report instrument called Teachers' Emotions, Appraisals, and Coping Habits when Facilitating Inquiry-based Instruction (TEACH-FIBI). TEACH-FIBI was designed to assess middle and high school science teachers' appraisals, negative emotions, and coping strategies when presented with challenging

situations that can occur when facilitating inquiry-based instruction. Specifically, this instrument assesses primary and secondary appraisals (goal importance, goal congruence, ego-involvement, agency, and problem-efficacy), negative emotions (e.g., anger and frustration), and coping strategies (problem- and emotion-focused coping). This instrument includes these aspects due to the theoretical assumptions and the research that speaks to their impact on teachers during difficult classroom situations. Specifics regarding the design, the collection of data, and the analysis of the TEACH-FIBI are discussed below. Figure 3.1 provides a schematic of the research process.

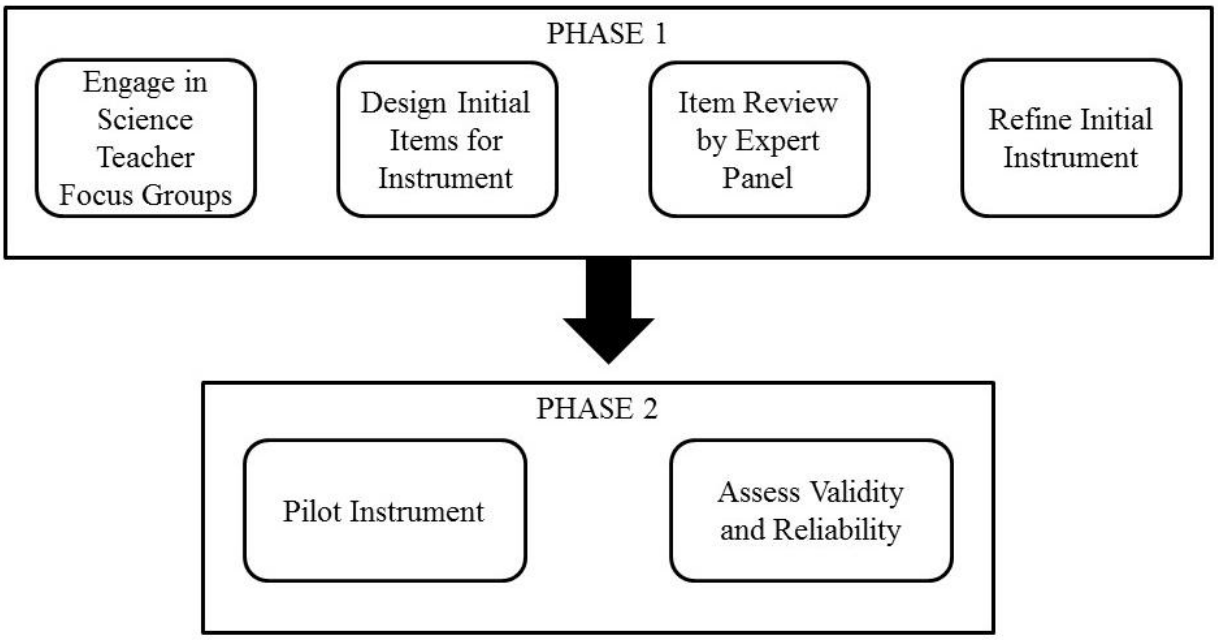

Figure 3.1: Research design for the initial design and validation of the TEACH-FIBI

Phase 1: Developing and Refining the Initial Instrument

Phase 1 was the qualitative portion of this study. This phase was dedicated to the initial development of the instrument. This occurred through the process of focus group interviews, a review of the relevant literature, and an expert panel review. Review of

relevant literature informed pre-focus group planning, scenario development, and post-focus group instrument development. The purpose of the focus group interviews was to determine whether designed scenarios were able to elicit emotional responses from middle and high school science teachers and what type of negative emotion responses were elicited. Additionally, these interviews helped determine the salient primary and secondary appraisals and coping strategies teachers used in response to the scenarios presented. The expert panel review occurred once the initial items for the instrument were created and served to assess content validity.

Development of challenging inquiry-based scenarios. Research literature regarding the features of inquiry-based instruction (Marshall et al., 2010; NRC, 1996, 2000, 2012) and the challenges science teachers face when engaging in this instructional strategy (e.g., Anderson, 2002; Harris & Rooks, 2010; Ritchie et al., 2013) was used to develop the challenging scenario prompts presented during the focus groups. Three scenarios were developed and used during the focus groups. Each of the prompts addressed various features of inquiry-based instruction and different challenges teachers face when trying to facilitate inquiry-based instruction. The three scenarios were designed to elicit a high, medium, and low stress (i.e., negative emotion) response.

Focus groups. Once the scenarios were developed, I prepared a script for the 2 focus groups that asked questions which sought to probe participants (see Table 3.1) about their appraisals of the scenarios, the emotions initiated by scenarios, and coping strategies they would use in each given scenario (see Appendix E). Following the questioning about the constructs of interest, I asked each group of teachers if there were

other challenging situations that were not represented during the interview that might elicit negative emotions. After the focus groups were completed, I had the interviews transcribed and then analyzed the interviews using NVivo 11.

Analyzing focus group interviews. Different coding strategies were used depending on the type of information obtained from the interview. The initial interview questions which determined certain pieces of demographic information were coded using Attribute Coding (Saldana, 2009). Values Coding (Saldana, 2009) was used to analyze the transition questions which sought to determine participants' values, attitudes, and beliefs about inquiry-based instruction when they first heard about and attempted this instructional strategy. Information retrieved from the key questions (i.e., what is presented in this study) were analyzed using Provisional Coding (Saldana, 2009). This qualitative analysis strategy uses a predetermined set of codes obtained from the review of literature on emotions, appraisals, and coping strategies. Emotions that teachers expressed feeling were coded using a condensed discrete emotions list developed by Byron Katie (2013). This list contained different words (e.g., frustrated, furious, mad) to described overarching discrete emotions (e.g., angry). Appendix F contains the condensed version of the emotions list used. The types of primary and secondary appraisals (i.e., goal importance, ego-involvement, goal congruence, agency, problem efficacy) were used to code pieces of the interview associated with how the teachers appraised the scenarios presented. Once phrases were coded as the different types of appraisals, open and emergent coding was used to determine the categories (i.e., themes) that existed in each appraisal type (Glaser & Strauss, 1967). The codes used to analyze

pieces of the interview associated with coping strategies came from the categories set by Carver's (1997) Brief COPE. Transcripts received three readings with coding to ensure no important phrases were not coded. A second coder was used to make sure my coding was reliable. Coding the transcripts three times and enlisting a second coder was done in order to increase the trustworthiness of the interpretations made from the qualitative data. All participants shared during each round of questions. While some talked more than others, I coded every time a construct, emotion, or coping strategy was mentioned. I did this in order to provide me with feedback regarding which constructs, emotions, and coping strategies were most salient. This informed which items to include in the new instrument. Matrix queries were run in Nvivo 11 for each scenario to determine the frequency of codes for each of the focus groups. These queries allowed me to determine the extent that each scenario was able to elicit emotions, appraisals, and coping strategies.

Instrument item development. Once coding and queries were accomplished, I used the frequency counts, as well as phrases from the transcript and topics from the phrases to begin developing the initial appraisal and coping items for the instrument. Frequency counts of emotions, appraisals, and coping strategies were used to decide which of the constructs and sub-constructs to create items for. The content from phrases of the transcripts was then used to determine the focus of the items. Additionally, relevant literature was used to support the inclusion and focus of the various items created.

Expert panel review. Seven experts reviewed the initial items. This group ensured the items that made up the initial instrument "provide an adequate and representative sample of all items that might measure the constructs of interest"

(Kimberlin & Winterstein, 2008, p. 2279). All scores, edits, and comments from the panel informed the modifications of the instrument before piloting it in Phase 2. In order to make this review as streamlined as possible, each expert had a table of the items geared to measure primary and secondary appraisals and coping strategies. Additionally, they were provided with the challenging inquiry-based scenarios and the different features of inquiry that were represented in each. Experts were instructed to measure each item or feature for clarity and representativeness. The experts used a four-point scale to rate each item with 1 being "item is not representative or clear" and 4 being "item is representative or clear". Experts also had the option of including comments if they wanted to make suggestions regarding items they rated as a 1 or 2. With all responses returned, inter-rater agreement (IRA) was calculated for both clarity and representativeness for each item and for each scale. IRA scores below .80 were considered unrepresentative and unclear and were deleted or modified based on experts' comments (Rubio, Berg-Weger, Tebb, Lee, & Rauch, 2003). The content validity index (CVI) then calculated the representativeness of each item and for each measure. These scores informed additional deletions or edits. After completing all the necessary revisions, the initial version of the instrument was completed and ready for piloting.

Phase 2: Piloting of the Instrument

In order to administer the survey to the chosen sample, I used Qualtrics. This online survey tool allows for the online administration of surveys. The items were input into Qualtrics and sent out to the middle and high school science teachers via an email link. The full survey the primary research input into Qualtrics is in Appendix G. The

primary purpose of piloting the instrument was to determine the construct validity and internal consistency of the instrument, as well as which scenario should be used in future administrations. Once responses were collected, I screened the data to determine if there were any issues with normality. In order to determine if the collected data was normally distributed, a Shapiro-Wilk's test and skewness and kurtosis *z* scores were used (Field, 2013).

Considerations of validity and reliability. When designing tests to measure constructs, a researcher needs to be cognizant of validity and reliability issues. Reliability is defined as the ability of a test or measurement to show the same results on multiple occasions. Validity refers to the ability of a test to measure what it claims to measure or whether individuals can make accurate decisions based on a test (Murphy & Davidshofer, 2005). While researchers refer to tests as valid and reliable, it should be noted that these are not properties of a test "but rather a function of what the scores on that test mean" (Murphy & Davidshofer, 2005, p. 154). Therefore, if a test is said to be reliable and valid, the conclusions or inferences made based upon the test are both reliable and valid, not that the test itself is reliable and valid. It should also be noted that tests and measurements are always in a state of flux regarding issues of reliability and validity. Simply put, establishing these aspects is an ongoing process. The reliability of a test factors into its validity as well; without reliability a test cannot be valid (Murphy & Davidshofer, 2005).

In order to clarify reliability and validity and how they are used to described tests or measurements, each of these terms needs to be understood. For this particular study reliability was measured through determining internal consistency. While there are

several ways to determine internal consistency, a widely used method involves administering a test one time, finding how all the items correlate, and then taking the average of those intercorrelations (Murphy & Davidshofer, 2005). In essence, this method takes all of the ways of splitting items on a test and provides the average of these different correlations scores. This resulting score is called the coefficient alpha, also known as, Cronbach's Alpha (Trochim & Donnelly, 2007).

Just as there are multiple ways to determine reliability, researchers also use multiple methods for determining validity. There are several types of validity, and each supports the validity of inferences or conclusion made based upon the results of a given test or measure (Murphy & Davidshofer, 2005). *Content validity* refers to whether the items on a test are representative of the domain being measured (Carmines & Zeller, 1979). While there is no statistical number used to determine this type of validity, researchers can use experts in the field of study to say whether the items on a test are representative of the domain (Kimberlin & Winterstein, 2008). Addressing the content validity of the items developed for TEACH-FIBI was discussed earlier when describing the expert panel in Phase 1.

Construct validity is another type of validity that depends on how the items on a test relate to other items on the measure (e.g., trait, behavior) (Murphy & Davidshofer, 2005). If relationships are consistent with theoretical assumptions, then this speaks to the construct validity of the instrument created. The relationships between the constructs being studied were described in the literature review; therefore, determining whether these relationships were supported by this instrument provided support for the construct

validity. In order to test the correlation between the items geared toward measuring the same construct, I performed an exploratory factor analysis and bivariate correlation analyses. This assisted in determining the construct validity of the instrument (Murphy & Davidshofer, 2005).

Analysis of new items. 44 new items were developed for this instrument. These 44 items measured teachers' primary and secondary appraisals (i.e., goal importance, ego-involvement, goal congruence, problem-efficacy, agency). In order to evalute the construct validity of the items, I performed a factor analysis on these items (Murphy & Davidshofer, 2005). Prior to performing a factor analysis, certain prerequisite checks had to be done.

Pre-factor analysis considerations. The first consideration for performing factor analysis is sample size. Comrey and Lee (1992) state that when performing a factor analysis, 200 responses is fair, 300 responses is good, and 500 responses is very good. Since only 49 teachers responded to the survey, I had to determine how effective performing a factor analysis would be. In order to determine if the sample size is adequate, the Kaiser-Meyer-Okin measure of sampling adequacy (KMO) was obtained. As KMO values approach 1, the sample size is considered increasingly more acceptable for a factor analysis (Field, 2013). Kaiser (1974) states that KMO values below 0.50 are unacceptable. A second consideration before performing a factor analysis is whether the items to be analyzed are interval data (Field, 2013). Likert scales are considered interval data and therefore the data for this study met this requirement (Rattray & Jones, 2007). A third consideration for performing factor analysis on a set of data is that they be

reasonably normally distributed to generalize the results beyond the current sample (Field, 2013). Normality issues are discussed in the section on screening of the data and therefore this consideration was addressed. The final consideration is whether the items are too highly or too lowly correlated with each other. If items are too highly correlated with each other (i.e., $r > .80$ or $r < -.80$), "it becomes impossible to determine the unique contribution to a factor of the variables that are highly correlated" (Field, 2013, p. 686). Items with correlations that are too low (i.e., $r < .30$ or $r > -.30$) are only an issue if these items are assumed to be measuring the same construct. Additionally, Bartlett's test is an objective measure of whether or not the correlation between items is too small. A significant Bartlett's test testifies to the fact that the correlations are not too low, and thus a factor analysis is permissible. Modifications regarding the inclusion or deletion of items based on correlations occurred and is reported in the results section.

Validity and reliability analysis of new items. Once I attended to the prerequisite considerations for engaging in a factor analysis, the items underwent a factor analysis. This exploratory factor analysis allowed me to obtain the smallest number of explanatory constructs to be determined by the common variance among items (Field, 2013). To determine the number of extracted factors, the scree plot was analyzed for where the inflexion occurred. Because very few psychological traits are thought to be completely independent, a promax rotation (an oblique rotation) was used to make the interpretation of factor loadings easier (Field, 2013). Since the sample size is 49, communalities were checked for items to see if they were all above 0.60. MacCallum, Widaman, Zhang, and Hong (1999) state that when communalities of items are above 0.60, then sample sizes

less than 100 may be acceptable for a factor analysis. Checking these numbers substantiates continuing with a factor analysis since certain earlier considerations made proceeding with a factor analysis an issue. For a sample size around 50, factor loadings above .722 are considered significant (Stevens, 2002) and will be used to place items within given factors. Once the items were placed in factors, I named the factors appropriately. In order to assess the construct validity of the new items, correlations between negative emotions and appraisals were considered. According to theory (Lazarus, 1991), when individuals feel their goals are threatened they tend to experience negative emotions. The more their goals are threatened, the more intense negative emotions they experience. Additionally, Lazarus and Folkman (1984) and Folkman and Lazarus (1988) spoke to coping strategies having associations with the appraisal process. Therefore, correlations between coping strategies and appraisals were considered for validation purposes as well. Lastly, researchers have stated that when individuals experience more intense negative emotions, they also are prone to engage in more emotion-focused coping (Boekaerts, 2007; Fredrickson, 2001; Sutton & Wheatley, 2003). This relationship was also considered to provide support for the validity of the data collected by the instrument. To ascertain the reliability of the factors, a Chronbach's alpha statistic was obtained for each factor. Additionally, some teachers retook the measurement two weeks after the initial administration and a correlation analysis between the first administration and the second was performed to assess reliability.

Reliability analyses of other instruments used. Mood can impact the emotions individuals report feeling (Ekkekakis, 2013). In order to determine if the mood of the

teachers impacted their responses, mood assessment items were included in the instrument. The mood assessment included was the Positive and Negative Affect Scale (PANAS) (Watson, Clark, & Tellegen, 1988). The PANAS is a 20-item mood scale. 10 of the items were designed to measure positive mood and the other 10 items were designed to measure negative mood. Table 3.3 contains the PANAS items.

Table 3.3
PANAS Positive and Negative Mood Items

Positive Mood Items	**Negative Mood Items**
Enthusiastic	Scared
Interested	Afraid
Determined	Upset
Excited	Distressed
Inspired	Jittery
Alert	Nervous
Active	Ashamed
Strong	Guilty
Proud	Irritable
Attentive	Hostile

The scale uses a 5-point Likert scale with 1 being "Very slightly or not at all" and 5 being "Extremely". Reliability and validity reported by Watson et al. (1988) was acceptable. Cronbach's alphas of the mood assessment for the moment were good. The positive affect scale (i.e., 10 items for positive mood) had a Cronbach's $\alpha = .89$ and the negative affect scale had a Cronbach's $\alpha = .85$. Additionally, positive mood items loaded together in a factor analysis with loadings ranging from .52 - .75. Negative mood items also loaded together with loadings ranging from .52 - .74. While the PANAS was found to be valid and reliable (Watson et al., 1988), Chronbach's alpha was calculated using the current sample to make sure reliability of the instrument still held.

Following conversations with the expert panel, I decided to use the Brief COPE (Carver, 1997) instead of coming up with entirely new items for coping strategies since this measure was found to be valid and reliable. Additionally, most of the strategies mentioned by teachers (teachers did not mention substance use, self-distraction, or religion) fell within the already predetermined categories delineated by the Brief COPE, so I felt confident in using this measure. Table 3.4 displays the Brief COPE scales, along with their reliability scores, definitions, and items. Based on the definitions of the two types of coping discussed in the literature review the primary research broke the coping scales into problem- and emotion-focus coping strategies. Scales 1, 2, 3, and 7 were categorized as problem-focused coping and items 4, 5, 6, 8, 9, 10, and 11 were categorized as emotion-focused coping.

Table 3.4
Items of the Brief COPE, by Scale and Definition

Scales and Items	Scale Definition
1. Active Coping (α = .68)	
I've been concentrating my efforts on doing something about the situation I'm in.	"Process of taking active steps to try to remove or circumvent the stressor or to ameliorate its effects" (p. 268).
I've been taking action to try to make the situation better.	
2. Planning (α = .73)	
I've been trying to come up with a strategy about what to do.	"Thinking about how to cope with a stressor" (p. 268).
I've been thinking hard about what steps to take.	
3. Positive Reframing (α = .64)	
I've been trying to see it in a different light, to make it seem more positive.	"Construing a stressful transaction in positive terms" (pp. 269-270).
I've been looking for something good in what is happening.	
4. Acceptance (α = .57)	
I've been accepting the reality of the fact that it has happened.	"Accepting the reality of a stressful situation" (p. 270).
I've been learning to live with it.	
5. Humor (α = .73)	
I've been making jokes about it.	*Finding humor in the stressful situation
I've been making fun of the situation.	
6. Using Emotional Support (α = .71)	
I've been getting emotional support from others.	"Getting more support, sympathy, or understanding" (p. 269).
I've been getting comfort and understanding from someone.	
7. Using Instrumental Support (α = .64)	
I've been trying to get advice or help from other people about what to do.	"Seeking advice, assistance, or information" (p. 269).
I've been getting help and advice from other people.	
8. Denial (α = .54)	
I've been saying to myself "this isn't real."	"Denying the reality of the event" (p. 270).
I've been refusing to believe that it has happened.	
9. Venting (α = .50)	
I've been saying things to let my unpleasant feelings escape.	"The tendency to ventilate those [negative] feelings" (p. 269).
I've been expressing my negative feelings.	
10. Behavioral Disengagement (α = .65)	
I've been giving up trying to deal with it.	"Reducing one's effort to deal with the stressor, even giving up the attempt to attain goals with which the stressor is interfering" (p. 269).
I've been giving up the attempt to cope.	
11. Self-Blame	

I've been criticizing myself.	*Focusing on one's inadequacies during a stressful situation.
I've been blaming myself for things that happened.	
Note. All scale definitions are from (Carver, Scheier, & Weintraub, 1989) except ones denoted with an *.	

Given the small sample for the pilot study, an additional item was added for each coping strategy to assist in the reliability of each coping strategy scale. These items were either taken from Carver, Scheier, & Weintraub's (1989) COPE instrument or developed by me. In order to determine the reliability of these items for the current sample, a Chronbach's alpha was calculated. Given the span of α mentioned by Carver (1997), α ranging from .50 to .90 is considered acceptable. To determine if all items of a given strategy were needed, I attended to the r statistics that showed if there was a significant decrease in the average correlation coefficient. Additionally, the item total correlation corrected (r.cor) provided information on whether items could be deleted from a specific coping strategy. Items that have r.cor scores below 0.3 were considered for deletion (Field, 2013). It should also be noted that all negatively phrased items were reverse coded to make sure the correct Chronbach's alpha was calculated.

CHAPTER 4: RESULTS

The results from this exploratory mixed methods study (Creswell & Plano Clark, 2011) are presented sequentially from the beginning of instrument design to the piloting of the instrument. The results of the qualitative data collected (Phase 1) are presented first, followed by the result from the quantitative portion of the study (Phase 2).

Phase 1: Initial Instrument Design

Development of challenging inquiry-based scenarios. The initial design of the instrument created in this study began with a literature search regarding the in-class challenges science teachers face when attempting to facilitate inquiry-based instruction. As discussed in the literature review, when science teachers have limited content and pedagogical knowledge, challenges can arise when attempting to facilitated inquiry-based instruction (Jones & Carter, 2007). These limitations can compound the complex management issues that are already a feature of inquiry-based classes (Harris & Rooks, 2010). Additionally, literature gives evidence that limited class time is a challenge teachers face when attempting to let students build their own conceptual knowledge of science concepts – a key feature of inquiry-based instruction (Wallace & Kang, 2004). Using the knowledge of these different challenges, I developed three inquiry-based scenarios. To make the scenarios as specific to inquiry-based classrooms as possible, I made sure to address the features of inquiry-based instruction described in Figure 2.6, Crawford's (2000) study, and national standards. Lastly, the scenarios were developed to initiate low, medium, and high negative emotional responses. Table 4.1 provides the developed scenarios along with which inquiry features were included in each. The

scenarios were then used in each focus group interview to determine how middle and high school science teachers appraised, emotionally responded to, and coped with them. The results of the focus groups are described in the next two sections.

Table 4.1:
Challenging Scenarios with Features of Inquiry-based Instruction and Emotion Intensity Level

<table>
<tr><td colspan="2">Scenario #1 (High Negative Emotion Response): Your students are engaging in an investigation that allows them to explore an important science concept before you have explained the concept. During this investigation, students are collecting and analyzing data. As you walk around and hear the groups working and talking, you notice that they are going in a totally different direction than you intended. What you thought they would have no problem understanding, they do not understand at all. The activity is not turning out the way you wanted it to.</td></tr>
<tr><td rowspan="5">Scenario #1:
Features of Inquiry-based Instruction</td><td>Students explore before explanation occurs</td></tr>
<tr><td>Teacher acts as a facilitator</td></tr>
<tr><td>Students collect and analyze data</td></tr>
<tr><td>Activity to build conceptual understanding</td></tr>
<tr><td>Student collaboration and discourse</td></tr>
<tr><td colspan="2">Scenario #2 (Low Negative Emotion Response): You are facilitating a discussion to make sense of an activity your students have just finished. You have questions planned and have studied the content so that you can facilitate a deep discussion that will allow your students to start putting the pieces together in their minds. In the middle of the discussion a student asks you a really thoughtful question about the concept they were exploring. You do not know the answer to the question.</td></tr>
<tr><td rowspan="5">Scenario #2:
Features of Inquiry-based Instruction</td><td>Discussion to build conceptual understanding</td></tr>
<tr><td>Teacher acts as a facilitator</td></tr>
<tr><td>Students forming explanations from evidence</td></tr>
<tr><td>Students explain/justify</td></tr>
<tr><td>Students engaging in discourse</td></tr>
<tr><td colspan="2">Scenario #3 (Medium Negative Emotion Response): Your students are engaging in an investigation that allows them to explore an important science concept in your domain before you have explained the concept. The students are working in groups and are having a hard time grasping what you intended for them to get out of the activity. You only expected the exploration to take 20 minutes but 30 minutes have passed and students are still struggling to make the connections despite the scaffolding you are providing. You only have 10 more minutes in class and you don’t have time tomorrow to spend on this exploration.</td></tr>
<tr><td rowspan="4">Scenario #3:
Features of Inquiry-based Instruction</td><td>Students explore before an explanation occurs</td></tr>
<tr><td>Student collaboration</td></tr>
<tr><td>Activity to build conceptual understanding</td></tr>
<tr><td>Teacher acts as a facilitator</td></tr>
</table>

Focus groups. The goal of the focus groups was to determine if the developed scenarios were effective at initiating a variety of emotions, appraisals, and coping strategies and therefore the results presented in the following section will address this goal. The results of the focus groups are presented in the context of each key question (see Appendix E). Results from all scenarios as well as the results for the middle school and high school teachers are presented together; however notations are used to distinguish between middle and high school teacher participants.

Key question 1: How did the scenarios make you feel? The scenarios elicited a variety of negative emotion responses among middle and high school science teachers. The results are organized by the salient emotions experienced by the teachers. Figures 4.1, 4.2, and 4.3 illustrate the frequency of emotion response codes for the high school and middle school teachers in each scenario. The presentation of the results begins with the angry emotion response.

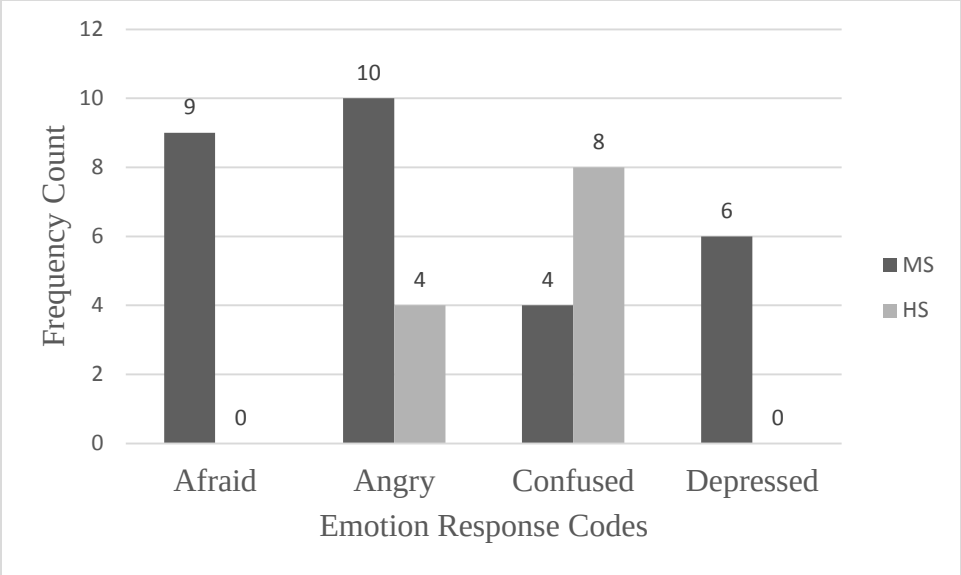

Figure 4.1. Scenario 1: Frequency of Emotional Responses

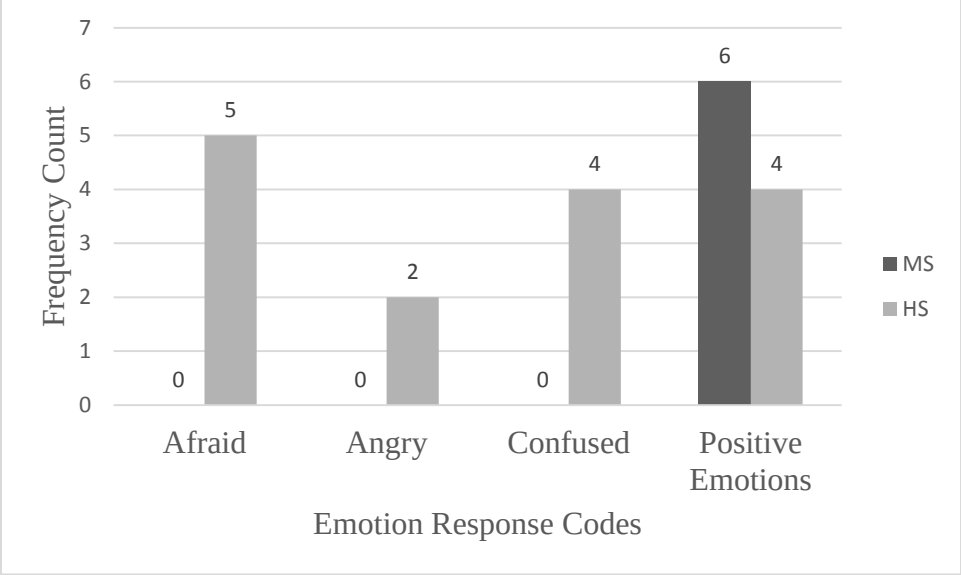

Figure 4.2. Scenario 2: Frequency of Emotional Responses

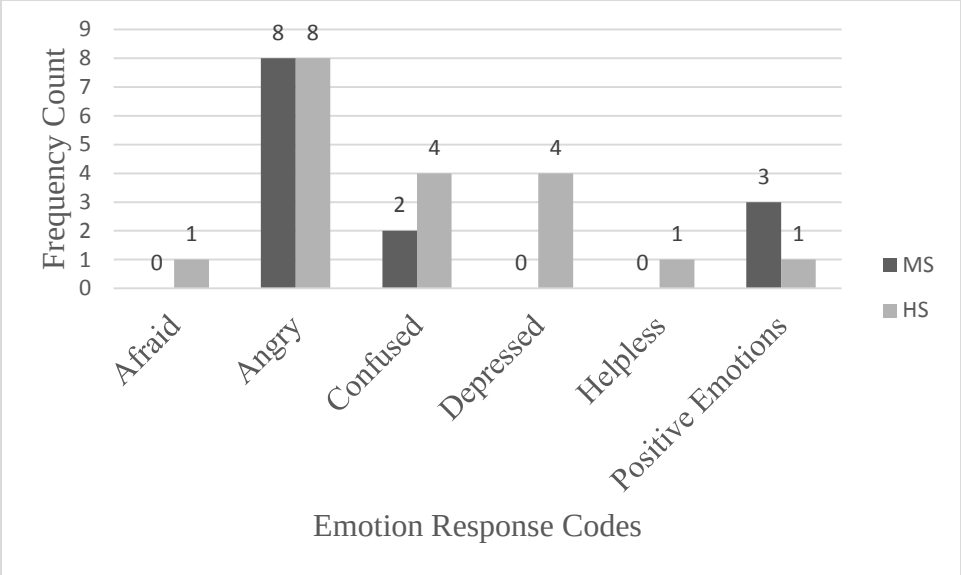

Figure 4.3. Scenario 3: Frequency of Emotional Responses

Afraid. While the figures show that all scenarios initiated feelings of fear, it also shows that the different scenarios did not initiate fear the same way in the participating high and middle school science teachers. In scenario 1, Jenny and James were the middle school teachers who expressed feelings of being afraid. Jenny stated, "Panic, that's my first initial thought. 'Really? Oh no!' That panic feeling. This is not right. [My PD facilitators] are going to be upset when they see me" (Jenny, MS Focus Group, October, 22, 2015). She goes on to admit, "I do panic, though, when the lessons don't go exactly like I thought they should. I shouldn't do that, but I do" (Jenny, MS Focus Group, October, 22, 2015). While not as verbose, James similarly admits "I get anxious" (James, MS Focus Group, October, 22, 2015). Scenario 2 initiates feelings of fear in Caleb and Rick. Rick stated, "I felt afraid…anxious and I panic" (Rick, HS Focus Group, November 11, 2015). Caleb also shares that he feels anxious due to the situation occurring in Scenario 2. Scenario 3 once again only initiates fear in one of the high school teachers.

Joseph shares that in the scenario "I have that panic mode" (Joseph, HS Focus Group, November 11, 2015).

Angry. The emotions of anger were experienced by both groups of teachers except for in scenario 2 where anger was only initiated in the high school group. Teachers in the middle and high school groups spoke of Scenario 1 initiating feelings of anger. While Allison, Rachel, and Caleb simply admitted that the scenario is frustrating, Andy stated, "I feel the same way…I'm extremely frustrated with it…I'm upset with the kids. My initial thing is I'm upset with the kids. Why aren't you getting this? It is obvious. Then you realize it's not them. It's me. The frustration is two-fold for me in the very beginning" (Andy, MS Focus Group, October, 22, 2015). Jenny's feeling of frustration changed slightly into a more positive form: "My feelings change as I go around and watch what [the kids are] doing. Maybe frustration turns into a little amusement" (Jenny, MS Focus Group, October, 22, 2015). Regarding Scenario 2, John spoke to feeling angry when he stated "I also put frustrated…I get frustrated" (John, HS Focus Group, November, 11, 2015). Figure 4.3 shows the extent to which Scenario 3 initiated feelings of anger in both sets of teachers. All of the middle school teachers experienced some type of anger due to Scenario 3. Allison shared her feelings of anger: "It's frustrating when you watch them spin their wheels and not go [anywhere]… It is frustrating. You have to think fast on your feet while you're running around answering fifty questions" (Allison, MS Focus Group, October 22, 2015). Andy mentioned that he was "frustrated mostly with the time that [he has], [yes,] the limited amount of time…I'm frustrated with the time, not the situation itself" (Andy, MS Focus Group, October 22, 2015). Jenny shared a similar feeling of

anger due to the time constraints of the situation. Joseph was the only high school teacher who did not express getting angry in Scenario 3. The remaining teachers talked succinctly of their feelings of getting very frustrated, ticked, irritated, and annoyed. Rachel shared a bit more when she stated, "I just get mad…and frustrated. It's not panic. It's just like, really? Why am I even wasting my time on this when I can lecture it to you, and then you're not going to make me stress out?" (Rachel, HS Focus Group, November 11, 2015). This statement reflected that the time factor initiated the anger she felt.

Confusion. Figures 4.1 – 4.3 illustrate that the feelings of confusion were present in both teacher groups for Scenario 1 (High Intensity) and Scenario 3 (Medium Intensity), but not for Scenario 2 (Low Intensity). In Scenario 1, all of the middle school teachers except for James mentioned the scenario causing feelings of confusion. Allison's comment embodied what the other two teachers succinctly expressed: "You do get tense, because your brain's racing…You're in that mode of, 'What do I do, what do I do?'" (Allison, MS Focus Group, October, 22, 2015). The high school teachers, Caleb, Rick, and Joseph, also expressed being confused as a result of Scenario 1. Joseph states, "Yeah, 'How did you get that [idea], out of this [exploration]? It doesn't say that anywhere' (Joseph, HS Focus Group, November, 11, 2015). Rick mentioned feeling baffled about what was occurring in the scenario. On the other hand, Scenario 2 only initiated confusion in the high school teachers. Caleb and John mentioned these feelings in the realm of feeling embarrassed and Rick directly stated that he is confused when experiencing this scenario. Scenario 3 only made one of the middle school teachers feel confused. Jenny stated, "Perhaps we could be perplexed that they didn't get it, but you see

just a lot when you're teaching, they're not getting it" (Jenny, MS Focus Group, October 22, 2015). All of the high school teachers except for Caleb expressed feelings of confusion in Scenario 3. John stated, "I'd be confused just as to why they're not getting it, because I expected them to" (John, HS Focus Group, November 11, 2015). Rachel shared similar feelings to those of John when she stated that she would ask herself "Why are they not getting it?" (Rachel, HS Focus Group, November 11, 2015). Joseph's feelings of frustration went deeper into the reasons for his confusion. Most of his confusion focused on what he did that might have caused this scenario. He stated,

> If I made the worksheet or made the activity or something, I would immediately say, 'What did I do wrong? What has gone wrong here? Did I not phrase it correctly? Did I not give them enough background information? Give them too much?' (Joseph, HS Focus Group, November 11, 2015).

Depressed and helpless. None of the high school teachers mentioned feeling depressed as a result of Scenario 1. However, the middle school teachers Jenny and Andy expressed feeling depressed as a result of Scenario 1. Andy states, "I get disappointed in myself for a little bit" (Andy, Focus Group, October, 22, 2015) and Jenny also mentioned that the scenario was disappointing and added that this was because she could be very self-critical. Scenario 2 did not initiate a depressed feeling in either of the teacher groups. However, Scenario 3 did initiate depressed feelings in the two of the high school teachers. Rachel shares that she feels "dissatisfied…disappointed… [I begin to ask] [w]hat did I do wrong? It's not that [I] necessarily did something wrong, but I always put it all on me if the kids don't get it" (Rachel, HS Focus Group, November 11, 2015).

Joseph agreed with Rachel and stated "Like she said, I would immediately blame myself…I become really self-critical" (Joseph, HS Focus Group, November 11, 2015). Scenario 3 (Medium Intensity) was the only one to initiate feelings of helplessness and only in one individual. Rick mentioned that during this scenario he felt trapped.

Positive emotions. Positive emotions, while not a focus of this study, were expressed during Scenarios 2 and 3. In Scenario 2, all middle school teachers expressed a happiness that their students were engaged enough to ask difficult questions. Andy even elaborated, "I love it. I love it. I look for days like that in my class" (Andy, HS Focus Group, October 22, 2015). While not all the high school teachers expressed positive emotions in response to Scenario 2, Caleb, Rachel, and Joseph expressed an excited and glad feeling when they read this scenario. In response to Scenario 3, Rick, Andy, James, and Jenny all expressed feelings of determination to get the students where they should be by the end of the period. James specifically states, "Oh yeah, I've gone beyond the point of no return" (James, MS Focus Group, October 22, 2015).

Key question 2: How do you appraise the challenging inquiry-based scenarios presented? In order to ascertain all the appraisals teachers used, teachers responded to specific sub-questions whose aim was to be as specific and clear as possible. (see Appendix E). Figures 4.4, 4.5 and 4.6 illustrate the appraisals of the teachers. The figures show that teachers held distinct primary and secondary appraisals during the developed scenarios. Findings regarding each scenario and the appraisals elicited are shared below. The primary appraisals (i.e., ego-involvement, goal relevance, goal congruence) are discussed first followed by the secondary appraisals (i.e., agency, problem efficacy).

Each type of appraisals is broken up into categories which emerged as a result of the coded phrases.

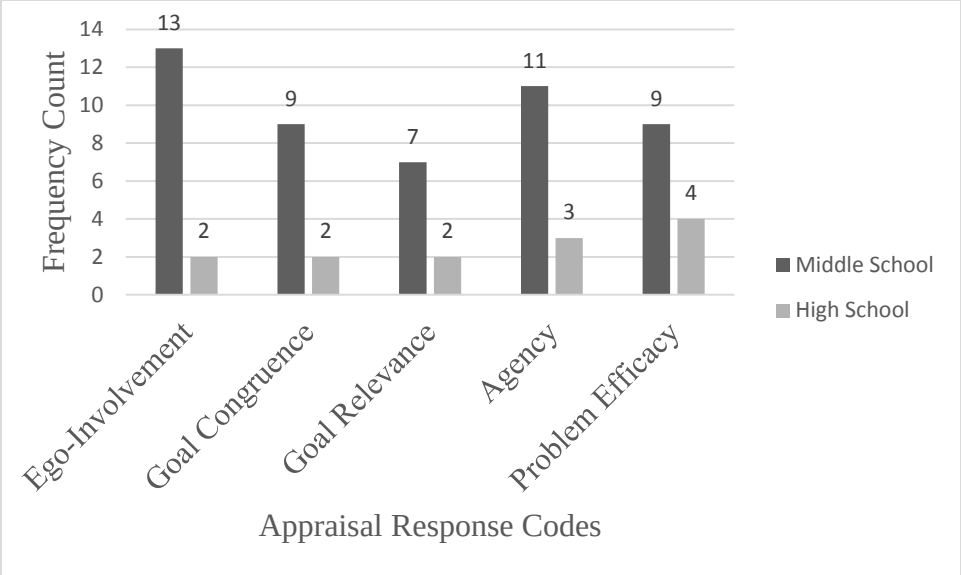

Figure 4.4. Scenario 1: Frequency of Primary and Secondary Appraisals

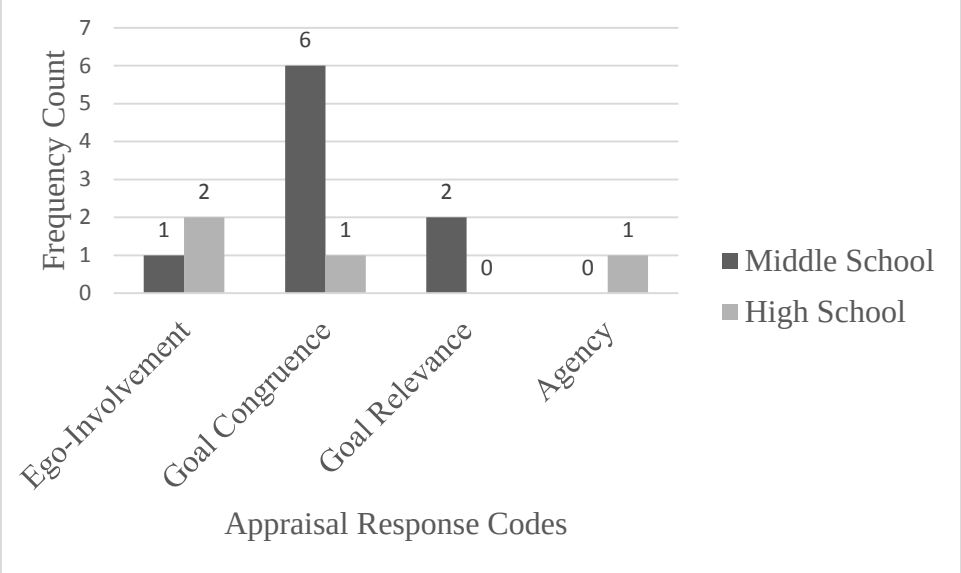

Figure 4.5. Scenario 2: Frequency of Primary and Secondary Appraisals

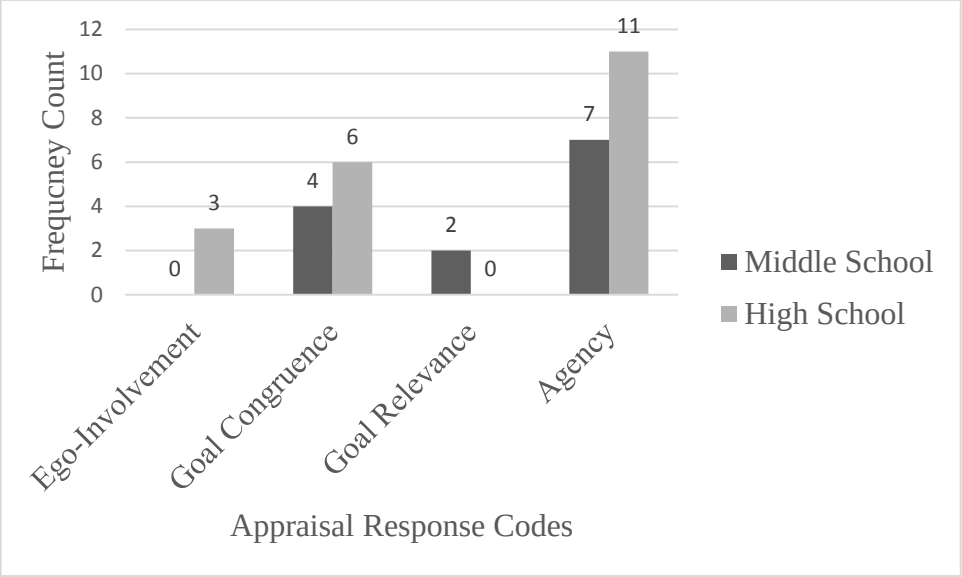

Figure 4.6. Scenario 3: Frequency of Primary and Secondary Appraisals

Goal relevance: Time. Time was a category that emerged as an important goal of the participating teachers. The middle school teachers spoke of how time was often in their minds when appraising Scenario 1. Allison recounted a conversation she had with her sixth grade teaching partner, James, about a similar situation. Her statement effectively represented how the other teachers said they felt about the time crunch they often faced. She stated,

> [James'] first couple years, I'd be, '[James], we've got to move on, we've got to move on.' [James is] saying, 'But they don't have it!' '[James], we've got to move on!' Now [James] knows. We have this time. We do the best we can. We teach all of them we can. There's some, 'You're not going to make it.' You do what you can. You've got to cut. You've got to move on, because you've got to go through all the process (Allison, Focus Group, October, 22, 2015).

Allison and John also spoke of time as being an important factor in the emotions they experienced as a result of Scenario 2. John stated, “I’m so focused on time and I’ve got my schedule” (John, HS Focus Group, November 11, 2015). Allison added, “Yeah. I think it depends if you feel like you've gotten something from your time” (Allison, MS Focus Group, October 22, 2015). Time was spoken of again as a result of reading Scenario 3. Jenny spoke to feeling the need to hurry up during this scenario so that she could get all the students on the same page before they left class. James agreed with her by adding “I’m with you on that one. [I’ve] invested too much time [to give up now]” (James, MS Focus Group, October 22, 2015). As mentioned earlier, Andy specifically stated that he felt frustration as a result of Scenario 3 due to the limited amount of time. At the end of the interview, Rick added an additional comment about how time is a factor which caused frustration. He stated,

> There's one big thing, we're probably all under the pressure, [and that] is we have multiple sections. We all want to keep them together…If I [have] a B-day class, and it has the top three percent of the Freshmen, but my A-day class doesn't have that; and an inquiry activity takes them 40 minutes, while the B-day class takes 10 minutes, all the sudden, my B days are in front of my A-days. That's frustrating. That's just maddening…That goes back to that managing of time with inquiry. If you do an 8-slide PowerPoint, 20 minutes, I'm good. I can move on. That inquiry [has] a lot [more] variables [to consider] (Rick, HS Focus Group, November 11, 2015).

Goal relevance: Student perception of teacher. The teachers also expressed that how their students perceived them was important in the initiation of their emotions. These perceptions centered on students' thinking regarding their teachers' content knowledge, whether their teachers were trustworthy, and whether their teachers valued student curiosity. Scenarios 1 and 2 elicited some of these appraisals. In Scenario 2, John stated, "[Students should feel that] I know all the content, even though sometimes that's obviously not [going to be the case]" (John, HS Focus Group, November 11, 2015). Allison disagreed with John's sentiment. She stated, "If you get upset because you don't know something in a classroom, maybe you shouldn't be in a classroom" (Allison, MS Focus Group, October 22, 2015). She went on to add in a comment about Scenario 1,

> I don't think it's bad for them to know, for us to say, "Look, guys, this didn't work. I didn't do something [right]." I think it's important for them to know that we don't know everything, and that we're not perfect. It's OK, they're not either… it's important that the kids know everything doesn't work the way you [plan] it. (Allison, MS Focus Group, October 22, 2015).

Caleb shared Allison's thinking in a statement regarding Scenario 2 when he said "They've accepted that I'm going to work through that [question] with them and not just brush it under the rug and say, 'Let's just move on'" (Caleb, HS Focus Group, November 11, 2015). James put himself in students' shoes and expressed how students might feel in situations similar to Scenario 2.. He states, "The teacher [is] an expert in what they [say]…If something like this [comes] up, man, I imagine this fear in what that teacher might [do] to me" (John, MS Focus Group, October 22, 2015). His statement reflected

that students have the perception that their teacher is the expert and their expertise should not be questioned.

While not as frequently expressed from the teachers, students trusting their teachers and feeling their curiosity is valued were also goals that were mentioned. The sentiment of students' trust in their teacher was shared by two of the high school teachers in response to Scenario 2. Joseph expressed how it is important that students know that their teacher will not lie to them. He stated,

> I just taught a lesson the other day that I had no idea about. It was about weather. Weather is weird. I've never taken a class on it, but it's in the AP syllabus so [I've] got to teach it. What I did was I used a lot of videos, so I didn't teach most of it. I don't want to teach them something wrong… I started out with stuff I was really good at, so they think I'm really smart now. Now, I'm like, 'I don't really like this topic,' and they're like, 'We understand' (Joseph, HS Focus Group).

This response showed how Joseph works to get his students to trust him by teaching material with which he is more comfortable at first. This way, his students did not mind when he supplemented his teaching with outside resources; their trust in him remained. Caleb agreed that students should feel they can trust their teacher when he referred to his earlier statement of allowing the students to see that he is still learning with them: "There's almost some trust built there, as well, and hopefully [I do] not get them frustrated [by working through the content with them]…[I think] [t]hey'd rather you be honest than teach something wrong" (Caleb, HS Focus Group, November 11, 2015). In valuing student curiosity, Andy captured the feelings of the teachers when he said,

> I want you [the students] to learn how to learn for the rest of your life and be inquisitive in things for the rest of your life. That's the lesson… Somebody asked a question outside of my lesson plan that they want to know a little bit more [than] I want them to know. That's the overall goal for any teacher: to have them forever learn" (Andy, MS Focus Group, October 22, 2015).

His statement showed that the goal of teaching is encouraging inquisitiveness and pushing students to being life-long learners. Jenny agreed with this in her statement regarding Scenario 2. She stated, "I think this is the norm in our classrooms. The kids feel [comfortable asking questions in class]" (Jenny, MS Focus Group, October 22, 2015).

Goal relevance: Learning environment. The learning environment was also a goal teachers mentioned that could impact the initiation of emotional episodes. The comments made about the learning environment centered on the idea of how much control the teacher has in the classroom. Additionally, the teachers' statements about their use of instruction like inquiry-based instruction highlighted their beliefs that they should be using different instructional strategies. Scenarios 1 and 2 initiated these thoughts. After reading Scenario 1, Jenny stated clearly the feelings of needing a learning environment that was easily controlled and predictable. She says,

> We've all touched on it. It's, "I must be perfect." My lesson must be perfect. My children must be perfect. We set ourselves up for that. That, "Everything should go the way we think it should go," and it's a surprise. Surprise! It wouldn't work like you thought it would! I feel like I have to control. It's a control aspect. I need to be able to control everything (Jenny, MS Focus Group, October 22, 2015).

James affirmed Jenny's feelings about Scenario 1 but added that he did think allowing some openness in the learning process was better for the students when he stated,

> That's what turns the pressure up on these kind of lessons -- that control factor. You don't have it when they're exploring on their own. Deep down I know it's better for them; on the other hand, dag gone it, I went to school. I'm the teacher here. They're supposed to hear what I say (James, MS Focus Group, October 22, 2015).

Andy and Allison agreed with this thinking. However, Allison also shared how letting go of control could be liberating. She stated, "It's easier when you can control everything. It's hard when you let it go, but the more you let it go, the less panicked you get if it doesn't work just right" (Allison, MS Focus Group, October 22, 2015). Some of the high school teachers mentioned the idea of control albeit in another way. Rachel shared, regarding Scenario 2, that she didn't mind giving the students a little freedom when questions arose. Specifically, she stated "I put that I was excited [the] students are [so] intrigued that they're questioning something out of the realm. My suggestion was [that] we would explore it together and find the answer" (Rachel, HS Focus Group, November 11, 2015). This statement implied that she could stray from a prescribed plan of action. Joseph agreed with Rachel. He shared,

> I feel excited or happy. I'm like, 'Wow, the kid actually connected this to something else that they know. They're making new connections in their brain.' I don't know. I'll take it there. Even if time doesn't allow, which is sometimes why I

> get behind, but I'll take it there and [allow us to] explore this question (Joseph, HS Focus Group, November 11, 2015).

Goal relevance: Beliefs about assessments. Another factor that emerged from analyzing the comments of goal relevance were the beliefs teachers had regarding assessments. These beliefs did not emerge solely in the teachers' comments about the different scenarios; both high school and middle school groups shared in conversation before and after talking about the scenarios. James made a statement that effectively expressed what many of the teachers said as well:

> But again, it's perspective, that the [learning process] you guys had established when I got here, our children, they scored very, very well on the tests that I'm assuming that I'm going to be judged on…[t]o take that knowing that it worked last year, and it's worked years before, and we're just going to change it? I lost my way. Was I there to help the kid learn [a goal of inquiry-based instruction], or was I there to teach them something that I know had worked, test results-wise, in the past? I think that's probably where my fear came in. If it's not broke, don't fix it. They're scoring well, but, you [colleagues] want me to do what in this classroom?" (James, MS Focus Group, October 22, 2015).

This statement highlighted the importance that James placed on test scores and the fear that inquiry-based teaching would not result in students doing well on tests. In Scenario 3, John stated a similar concern about the results of teaching using inquiry-based instruction when he said, "If it's the last day before a test and it's a review activity where they're supposed to understand it, then I'm freaking out" (John, HS Focus Group,

November 11, 2015). In a similar statement during one of the general conversations, Caleb shared,

> Which [allowing students to construct their own knowledge] is frustrating, because you know, good and well, you could probably lecture [and] give them that same bit of information in 20 minutes. It wouldn't stick as long, but it'd get in there. When you've got an AP Test or an EOC Test coming up in six weeks, guess which one you're going to pick? (Caleb, HS Focus Group, November 11, 2015).

In this statement, Caleb admits to one of the limitations of direct instruction (i.e., lower retention of information). He implied that he does consider choosing the lesser of two instructional strategies, thus showing the importance he placed on assessments which drive his instructional planning. This decision is due to the pressure of time and his belief that students can memorize enough for the test to do well even if they do not really understand the concepts. Not all the teachers gave test scores the same importance as the teachers mentioned above. Andy shared that

> I wasn't like you [James]…I was like, 'You know what, I'm going to do the best I can, then if I'm not doing [well] enough, they'll let me go,' kind of thing. That's just the way I felt about it, 'I'll give it 100 percent. I'm going to do everything that I can and let the chips, the test scores, fall [where they may]. Going through the [inquiry PD] and listening to all of you guys [year 2 PD participants] talk about the kids scoring well, and learning, and stuff, it was like, 'OK, it sounds like a good [instructional method] to me.' I don't worry about test scores as much (Andy, MS Focus Group, October 22, 2015).

These statements illustrated that there were teachers who placed much importance on assessments and provided an example of one teacher who had not ascribed to the beliefs that assessments were really important in his decisions about planning the instruction methods.

Goal congruence. Goal congruence is closely associated with goal relevance. Figures 4.4 – 4.6 illustrate that both groups of teachers expressed appraisals regarding goal congruence in each of the scenarios. These appraisals differed depending on the scenario, however, there was an alignment between the goal relevance appraisals and the goal congruence appraisals expressed. In other words, the same categories existed for each type of these appraisal types but the goal congruence appraisals the teachers made concerned whether their relevant goals (e.g., time, learning environment) were hindered or enhanced by the developed scenarios.

Ego-Involvement. Figures 4.4 – 4.6 present the codes of appraisals concerning ego-involvement in each scenario. High school teachers expressed these appraisals in all scenarios. The middle school teachers expressed these appraisals in Scenarios 1 and 2 but not in Scenario 3. These appraisals focused on whether or not the teachers felt they were doing a good job in the midst of the scenario. After reading over Scenario 1, James expressed, "[When] this happens, and it blows up, I take it personally…When it fails they're looking at me, saying, 'You failed.' I failed them…If I did it and it didn't work, I haven't been successful" (James, MS Focus Group, October 22, 2015). Scenario 1 caused James to feel like an unsuccessful teacher. In this moment, he was not feeling good about himself as a teacher. Caleb shared these feelings in Scenario 1 when he stated, "I'm

frustrated with myself. I probably spent a lot of time making, planning, or preparing this activity, that I hoped went really well…[and] [i]t just didn't work out" (Caleb, HS Focus Group, November 11, 2015). In this instance, Caleb expressed his frustration about his planning an activity that was unsuccessful; therefore, he felt like an unsuccessful teacher. In Scenario 2, John mentioned that he became embarrassed when a student asked him something he did not know. He mentioned that he should be able to answer questions, and when he cannot, he felt embarrassed. Again, this feeling of embarrassment arose from him not living up to his own or his students' expectations. When this occurred he did not believe he was doing a good job. Rachel shared that as a result of Scenario 3 she blamed herself and asked herself "What did I do wrong" (Rachel, HS Focus Group, November 11, 2015)? The value of the word "wrong" implied that Rachel believed she had not done a good job because the students were not getting what they should have out of the exploration activity.

Problem efficacy. The secondary appraisals associated with problem efficacy were only expressed in Scenario 1 (see Figure 4.4). These appraisals were expressed from both groups of teachers. These appraisals focused on teachers believing they had the resources and skills to deal with the challenging situation presented in Scenario 1. Caleb expressed that his frustration grew at times when he did not know what to do. He states, "I'm frustrated with myself. It just didn't work out…I'm frustrated, but not toward them…It would be more of a, "Aghh. What am I going to do about it" (Caleb, HS Focus Group, November 11, 2015)? This statement hits on Caleb's thinking that he does not have the resources (i.e., knowledge of what to do) to improve the situation. It is important

to remember that Caleb had only been teaching for 2 years. John responded to Caleb's comment. He stated,

> I think the longer you do activities, the emotions that you feel the first time you do an activity [are different from] the fifth time you do it. The fifth time you do it, you know the leading questions to ask them to get them to go [the] direction [you want them to go]. I think that's the key. That's why I don't really get that emotional, but I've been doing it 17 more times than [Caleb] has. When I get there, I kind of know where they're going, for the most part. It doesn't stress me out. It doesn't frustrate me anymore, because I've been there.

John's comment highlighted that because he had experienced situations like this before, he knows what to do (i.e., resources) and actually implemented that knowledge in the form of asking leading questions to get the students back on track (i.e., skills). Rachel supported John's comment but added that increasing resources (i.e. experience, knowledge) and skills (i.e., know how to facilitate the students effectively) could happen from one period or day to the next. She added,

> I see that between my A day and my B day. A day is the first time, 'Oh, you know this is not good.' [By] B day, normally, I've already conceptualized, 'This might happen. They might not get this part. Oh, if I tell them this, they're going to have an easier time with it.' I think it's all in experience (Rachel, HS Focus Group, November 11, 2015).

The middle school teachers shared similar thoughts. Andy, while not as firm in his beliefs about his ability to handle the problem in the scenario, stated "in that first year [it was

more difficult]. Now, I'm much more comfortable…I think I can get it out of the ditch most of the times, [I use] a little more guidance" (Andy, MS Focus Group, October 22. 2015). Andy shared that his experiences allowed him to deal with this scenario better, but he still held some doubt with the mention of "think". He was not like Rachel or John, whose comments expressed more confidence and assurance in their skills and resources. Andy also did not provide any specific mention of what he would do in this situation whereas Rachel and John shared actual skills they could implement. Allison also expressed some problem efficacy appraisals regarding Scenario 1. She expressed more confidence in her resources and skills when she stated "I don't think I've ever had one [a lesson] I couldn't pull out of the ditch" (Allison, MS Focus Group, October 22, 2015).

Agency: Internal vs. external. Internal and external agency appraisals were mentioned by both groups of teachers in Scenarios 1 and 3. Only the high school teachers expressed these agency appraisals in Scenario 2. A lack of time and student behavior were the external variables that the participating teachers held responsible for their emotional responses.

Teachers felt their emotions in each scenario were influenced by the external factor of time. Rachel was the only teacher who saw time as a factor which affected her emotions in Scenario 1. She noted "Time is of the essence, so take it [activity] to where it's going to make a connection for them [the students]. Teach that lesson [and] move on" (Rachel, HS Focus Group, November 11, 2015). John added some additional insights to Rachel's statement in his comment about time in Scenario 2.

> I think my higher level of intensity is with the frustration of time, because I'm a time guy. I want to follow a schedule. I know the right thing to do is to help that kid facilitate their curiosity, so I know I have to do that. [But], in the back of my head while I'm doing that, I'm thinking about, 'I really need to give this test on Thursday, and if I don't get through all of what I'm doing today, then I'm not going to get to that test, and then it's going to be put back. Then it's going to be after the long weekend.' That level of intensity is up there for me, because that's always in the back of my head with everything I do in my classroom. That's really driving a lot of what I feel. Not always necessarily what I do, but what I feel while I'm doing it (John, HS Focus Group, November 11, 2015).

Here, John clearly attributed time for the negative emotions he felt. While he knows what he should do, he admits to being frustrated when he as to do it because, like Rachel, he believes time is of the essence. There is a schedule he likes to keep and when events threaten to get him off that schedule, he gets highly frustrated. He made a similar claim when commenting on Scenario 3. Rick agreed with Rachel and John. As a result of reading Scenario 3, he mentioned "there's always that internal clock. I've got so many days, so many [standards] that I have to cover before the semester or the year's over" (Rick, HS Focus Group, November 11, 2015). Again, time as a motivator affected how Rick appraised the situation presented in Scenario 3. Andy also mentioned time as a factor in the emotions he experienced as a result of Scenario 3. He stated, "I'm frustrated that I only have 30 minutes. If I had another 20, it [the frustration] might be [for] them [students] or me. For us, the time is always, for inquiry-based learning, an issue" (Andy,

MS Focus Group, October 22, 2015). In response to Andy's comment, Jenny added succinctly, "Like you said, your time constraint is your big frustration" (Jenny, MS Focus Group, October 22, 2015).

While the teachers saw time as a factor which they blamed for the negative emotions they felt, they also saw student behavior as the other external factor which could lead to them experiencing negative emotions. Several examples of this thinking occurred throughout the different scenarios. Responding to Scenario 1, Allison related past experiences which impacted her appraisal of the current scenario. She stated,

> Sometimes when the kids are playing and they're not wanting to focus, it gets irritating. They're not even trying to go there. They're almost resisting. When you've got some kids that are doing that, and they're over [t]here playing poker with the cards you're trying to use for something, while you're trying to get them to open their minds and think, it can be irritating. They don't want to get on board (Allison, MS Focus Group, October 22, 2015).

This statement reflected how the additional external variable of student behavior can influence the emotions experienced during challenging inquiry-based scenarios. Andy shared Allison's feelings when he mentioned, "[It depends on] whether it's the kids being crazy and not wanting to do it" (Andy, MS Focus Group, October 22, 2015). He also added that students not engaging in cognitive focusing was another aspect of behavior to which he attributed his negative emotions. Andy said, "I was frustrated with the kids, 'Why aren't you getting this? Come on! This is obvious to you, isn't it?'" (Andy, MS Focus Group, October 22, 2015). In response to Scenario 3, Caleb and Rachel expressed

how student behavior influences the negative emotions they experienced. Caleb stated, “If they're not actually trying and they're not getting the concept is [because of] behavior or [their lack of] focus, then I'm getting real frustrated. Then my attitude changes to blaming them” (Caleb, HS Focus Group, November 11, 2015). Rachel shared, “I think it depends on the level that the kids are working. If the kids are trying, I might not be as frustrated or annoyed. If the kids shut down and then they're like, "Well, you're not giving me the answer," or, "How am I supposed to do this?" then I'm going to escalate pretty quickly” (Rachel, HS Focus Group, November 11, 2015). Each of these statements illustrated how putting the responsibility of the situation on the students and their behavior influences the intensity and type of the emotion initiated.

Teachers also attributed the initiation of their emotions to internal factors. These attributions focused on themselves, and they centered on their effectiveness in planning and facilitating the various scenarios. Internal attributions were only expressed for Scenarios 1 and 3. In response to reading Scenario 1, Allison shared how she would tell the students that she did not explain the activity/directions well enough. She focused the blame on her own inability to facilitate the lesson well, not her students’ behavior. James stated explicitly that he held himself and not the students accountable when he stated, “It blows up on me. Then I feel like I've done something wrong, as opposed to it's the kids’ [fault]” (James, MS Focus Group, October 22, 2015). As was explained earlier, in scenario 3, Rachel and Joseph both initially blamed themselves for the challenge they were reading about. Joseph’s comment agreed with Rachel’s as well. He stated,

> I would immediately blame myself. If I made the worksheet or made the activity or something, I would immediately say, "What did I do wrong? What has gone wrong here? Did I not phrase it correctly? Did I not give them enough background information? Give them too much (Joseph, HS Focus Group, November 11, 2015).

This statement shows that he holds his lack of planning (i.e., making of a worksheet) and facilitation (i.e., phrasing something correctly) accountable for the challenge he read about in scenario 3.

Agency: controllable vs. uncontrollable. Whether an individual sees the events taking place as controllable or not is also an aspect of agency. The teachers mentioned that time was something that could not be controlled. Andy concisely agreed with John's earlier thinking regarding time when he says "Time, nothing I can do about it" (Andy, MS Focus Group, October 22, 2015). Andy and John realized that while time was something they blame for some of the emotions they felt, they realized that they could control the amount of time they have in a class, and so they learned to deal with that being a constant but unchangeable pressure. In reference to Scenario 1, Allison mentioned "It's not a controlled situation at all. It's chaotic. You're dealing with personalities. You're dealing with emotions. You're dealing with learning levels. When you throw all that together, there is no controlling things" (Allison, MS Focus Group, October 22, 2015). Here Allison speaks to the different factors (e.g., personalities, learning levels) in the students that are uncontrollable. Jenny and Andy agreed with Allison's assessment in reference to Scenario 1. Altogether, several teachers' statements

refer to the skills they have when it comes to planning and facilitation. They saw these skills as being under their control. These statements also highlight that given more resources (e.g., experiences, PD, reflection with coworkers, administrative support), the teachers felt they could improve aspects of their instruction.

Key question 3: How do you cope with the challenging inquiry-based scenarios presented? As discussed in Chapter 3, this study examined coping strategies in two categories from the Brief COPE (Carver, 1997)—emotion-focused and problem-focused coping. Figures 4.7 – 4.12 provide the frequency data for the different types of coping strategies per scenario. These figures also divide these results into high school and middle school groups. This data shows that the developed scenarios were able to elicit various coping strategies in the teachers interviewed. At the end of this section, representative quotes from the participants of each coping strategy type are shared (see Table 4.2 and 4.3).

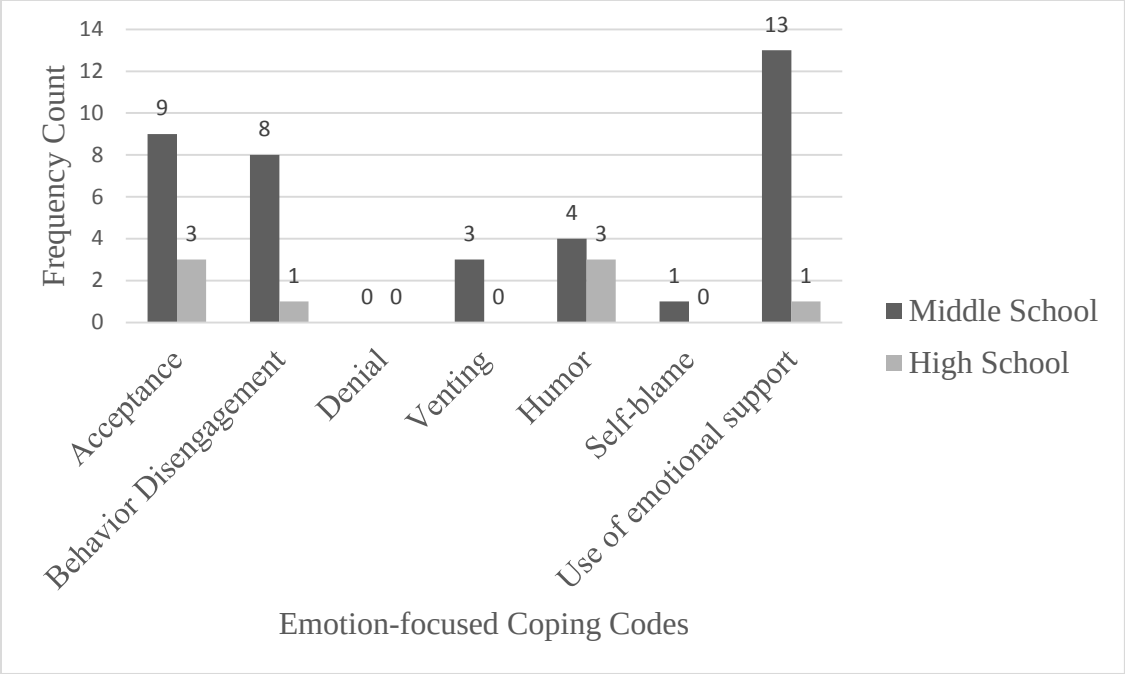

Figure 4.7. Scenario 1: Frequency of Emotion-focused Coping

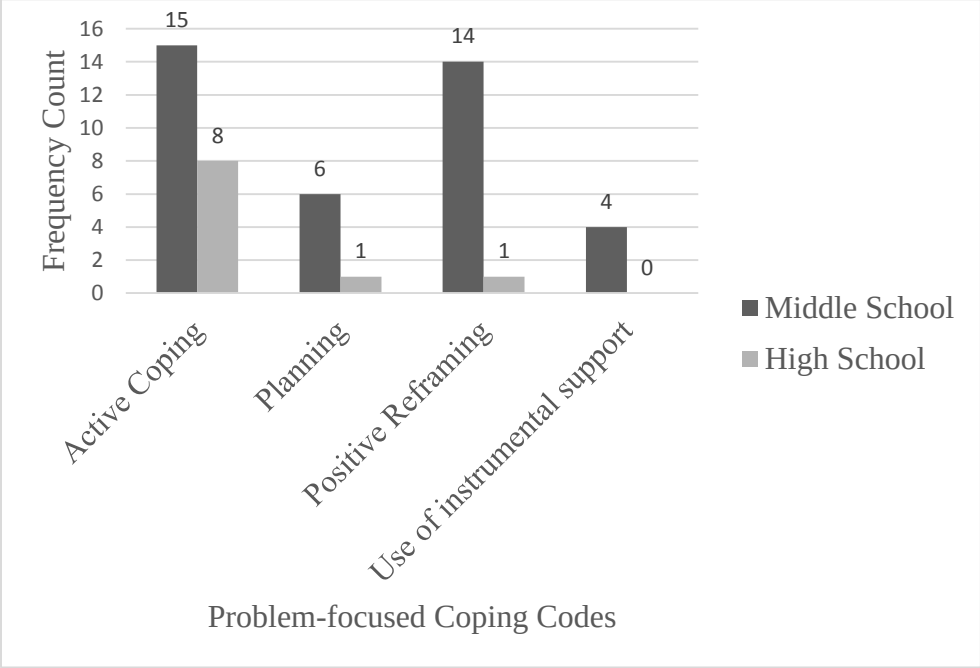

Figure 4.8. Scenario 1: Frequency of Problem-focused Coping

Figures 4.7 and 4.8 illustrate the frequency data for Scenario 1. In Scenario 1, the middle school teachers used more emotion- and problem-focused coping strategies than did the high school teachers. Acceptance, behavior disengagement, and seeking emotional support were the more frequent emotion-focused coping strategies used by the middle school teachers. Acceptance and humor were the emotion-focused coping strategies most used by the high school group. The most used problem-focused coping strategies in the middle school group were active coping and positive reframing. Active coping was also the most frequently used strategy by the high school group, and they also did a minimal amount of planning and positive reframing.

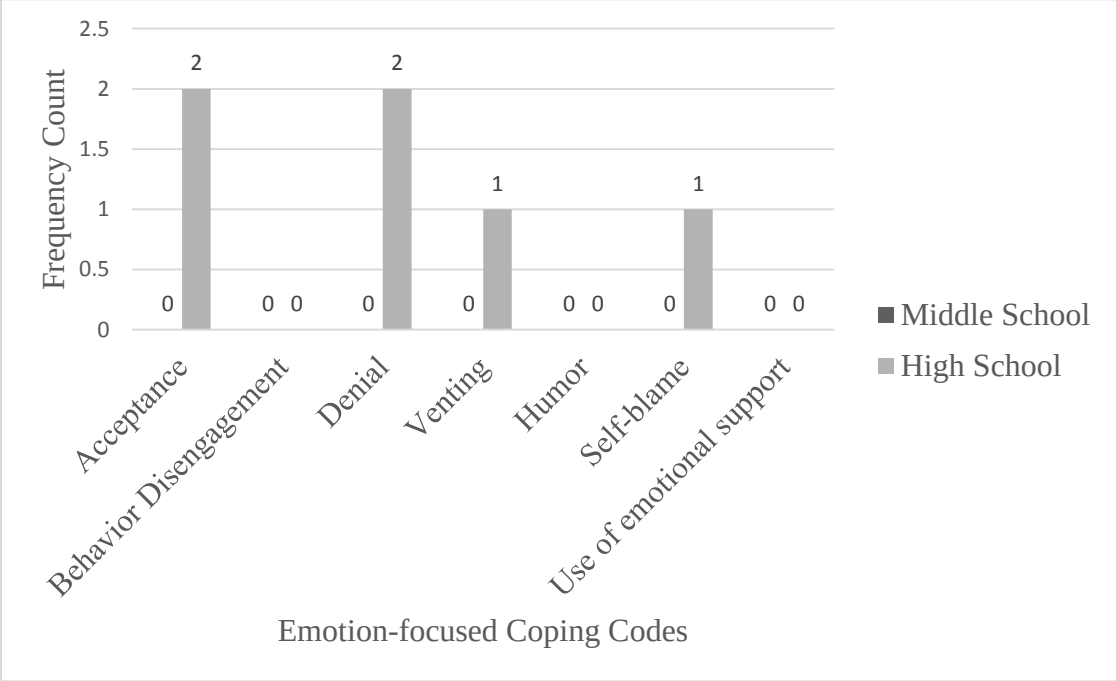

Figure 4.9. Scenario 2: Frequency of Emotion-focused Coping

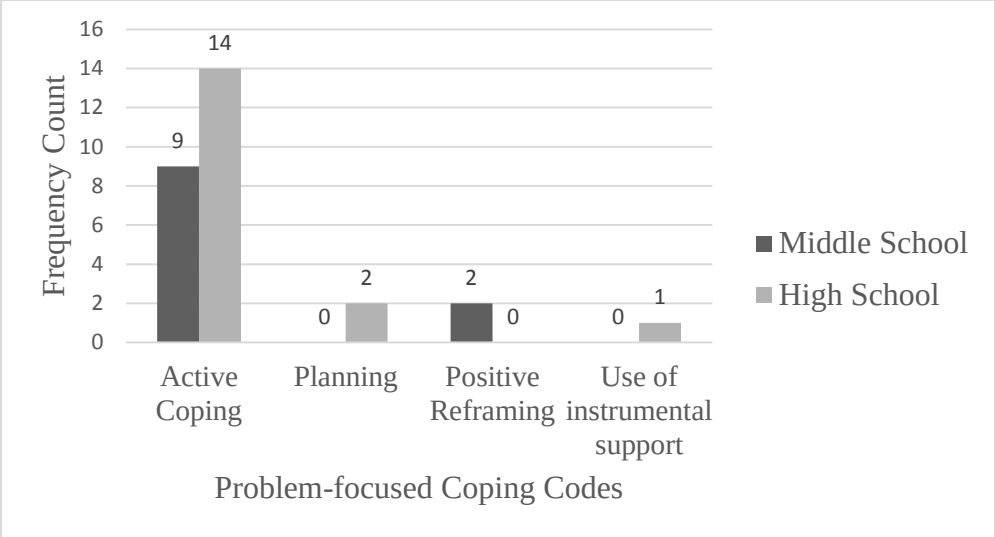

Figure 4.10. Scenario 2: Frequency of Problem-focused Coping

Figures 4.9 and 4.10 illustrate the frequency data for Scenario 2. Scenario 2 did not elicit any emotion-focused coping for the middle school teachers because they saw the scenario in a positive light; however, the high school teachers did show a slight usage of emotion-focused coping in the forms of acceptance, denial, venting, and self-blame. The high school group did not express behavior disengagement, humor, or the use of emotional support either. Regarding problem-focused coping, the middle school group only expressed using active coping and positive reframing to deal with the presented scenario. The problem-focused coping strategy with the highest frequency in the high school group was active coping; however, this group also expressed using some planning and instrumental support.

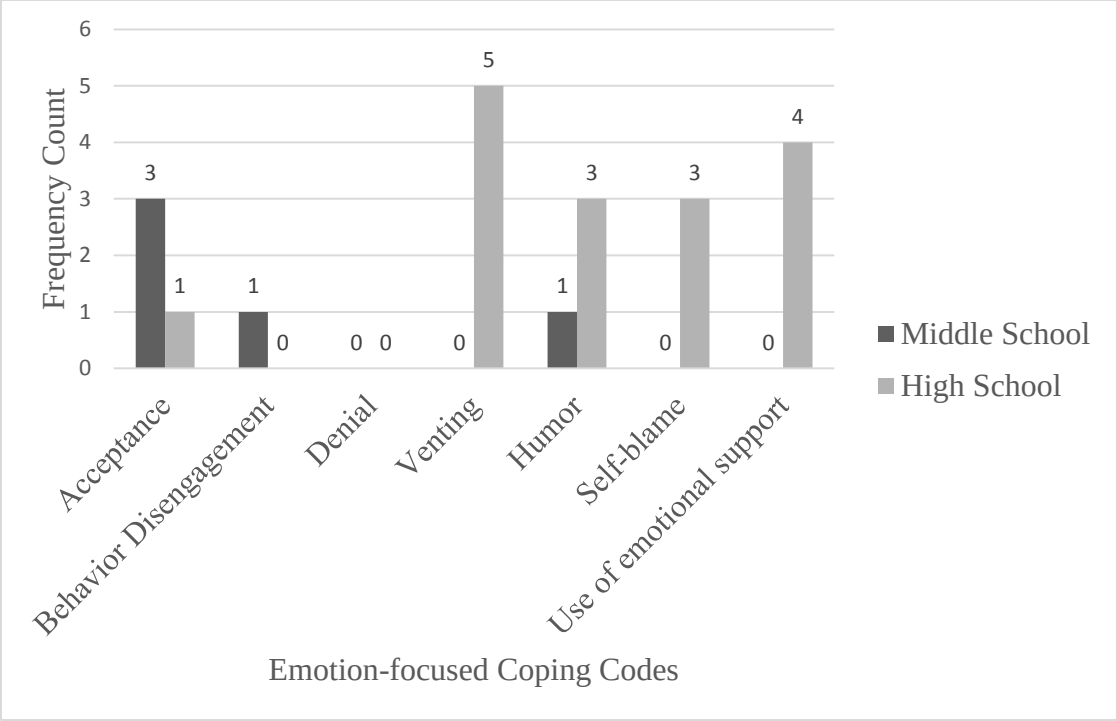

Figure 4.11. Scenario 3: Frequency of Emotion-focused Coping

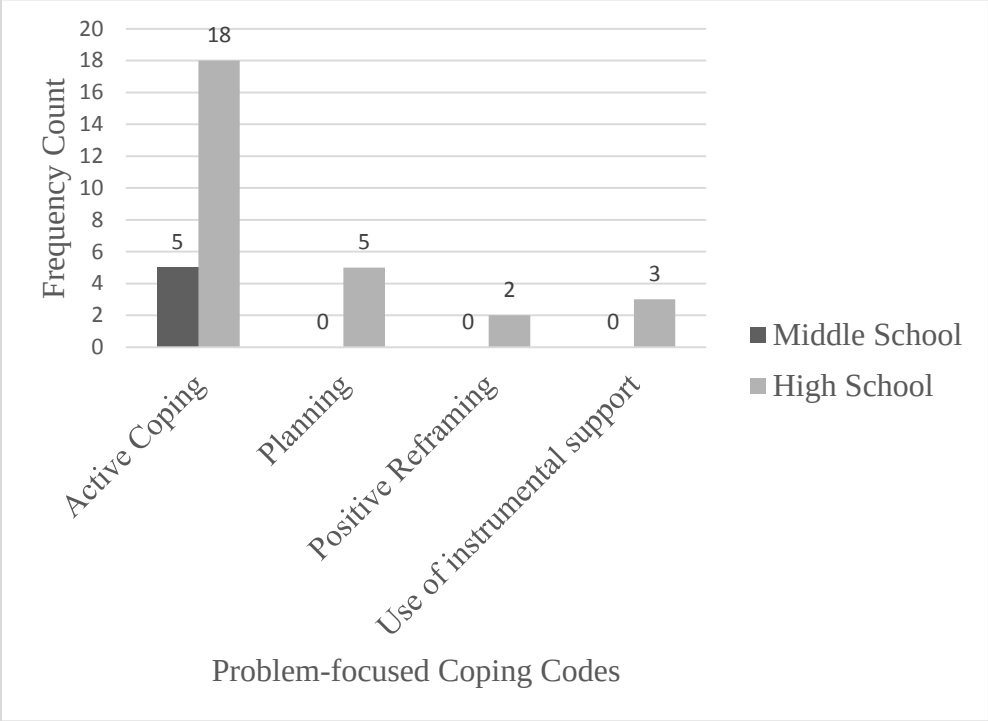

Figure 4.12. Scenario 3: Frequency of Problem-focused Coping

Figures 4.11 and 4.12 illustrate the frequency data for Scenario 3. Scenario 3 resulted in all groups expressing the use of both types of coping strategies. The middle school group only expressed using a minimal amount of acceptance, humor, and behavior disengagement. While the high school group also used a minimal amount of acceptance, they used more venting, humor, emotional support, and self-blame as a result of this scenario. Scenario 3 did not initiate much problem-focused coping for the middle school group. They did use some active coping. The high school group expressed using mostly active coping as a result of this scenario but also mentioned the use of positive reframing, planning, and use of instrumental support.

The general trends extrapolated from the figures were that the middle school teachers in this sample use more acceptance, behavior disengagement, and emotional support when it involved emotion-focused coping strategies. High school teachers also used acceptance when coping with the scenarios presented, but they used this strategy less than the middle school teachers. Additionally, in the high school group, the use of venting and humor were also top emotion-focused strategies used. Both the high and middle school group used the problem-focused coping strategy of active coping the most when presented with the scenarios. The second most frequent problem-focused coping strategy used in the middle school group was positive reframing. The high school group's next most frequently used problem-based coping strategy was planning.

Since the categories for these codes were already established by the Brief COPE, each category is represented by representative quotes in Table 4.2 and 4.3 to provide

evidence of how the teachers' statements fit into the pre-established set of coping codes. Table 4.2 focuses on emotion-focused coping and Table 4.3 focuses on problem-focused coping. The specific forms of each coping style are delineated in the tables.

Table 4.2
Representative Quotes of the Different Types of Emotion-focused Coping Strategies

Venting	"As ashamed as I am to say, I do number three. I get upset, and I let my emotions out" (James, MS Focus Group, October 22, 2015).
	"and then I have to express that frustration sometimes" (Caleb, HS Focus Group, November 11, 2015).
	"That's when I get loud" (Rachel, HS Focus Group, November 11, 2015).
Use of Emotional Support	"I talk to someone about how I feel, usually my other science teacher. Then I run down the hall and talk to Daryl. We commiserate…I don't feel so bad if it blew up for [him] too" (Allison, MS Focus Group, October 22, 2015).
	"Talk to coworkers about it" (Rachel, HS Focus Group, November 11, 2015).
	"Sometimes you can hold it together until after school or something when you can scream at like your coworker or something" (Joseph, HS Focus Group, November 11, 2015).
Denial	"I ignore mine. Bottle it up way down deep. Totally ignore it. After that little eight second of, 'What the heck am I doing teaching?' I'm like, 'All right, I'm all right.' and I move on to the next whatever we're moving on to" (Rick, HS Focus Group, November 11, 2015).
Behavior Disengagement	"I stopped today, in fact, during my fifth class of the day. It wouldn't flower. It's similar to that. I stopped. I said, 'That's it. Throw them away, throw them away.' Stopped completely, went to vocabulary. Chucked it on the spot" (James, MS Focus Group, October 22, 2015).
	"[I]s something that you just go, 'OK, that's it. We're through. We're not getting anywhere. We're not doing anything. Do we just need to stop it?'

	"I'll do something else. Go in an entirely different direction" (Andy, MS Focus Group, October 22, 2015).
Acceptance	"If it doesn't work, there's no need to fake it. They know it. Tell them, 'This didn't work.' Accept reality as it happens" (Allison, MS Focus Group, October 22, 2015).
	"That always happens, you get used to that" (Caleb, HS Focus Group, November 11, 2015).
	"I accept the reality that it did happen" (Rick, HS Focus Group, November 11, 2015).
Self-blame	"If I made the worksheet or made the activity or something, I would immediately say, 'What did I do wrong? What has gone wrong here? Did I not phrase it correctly? Did I not give them enough background information? Give them too much?' I don't know. Then I become really self-critical like overly critical." (Joseph, HS Focus Group, November 11, 2015).
	"What am I doing wrong? What am I not doing a good job at? Did I not prepare them for this? Did I not set it up right? Why are they not getting it" (Rachel, HS Focus Group, November 11, 2015).
Humor	"Yeah, I mean, we [my students and I] would all laugh out loud and have a good laugh at it" (Rick, HS Focus Group, November 11, 2015).
	"I kid around about it" (Jenny, MS Focus Group, October 22, 2015).
	"Then I'm going to make jokes about it and make light of the situations" (Joseph, HS Focus Group, November 11, 2015).

Table 4.3
Representative Quotes of the Different Types of Problem-focused Coping Strategies

Positive Reframing	"You go back, you pick up pieces, and you see what worked. You always get something out of it, it just may not be what you thought was going to happen. I definitely think I learn something from what happens" (Allison, MS Focus Group, October 22, 2015).
	"I use it as motivation to not do it again. If you can turn it around, instead of being the teacher be the student, at that point and say, 'Well, I have to learn from what didn't work.'" (James, MS Focus Group, October 22, 2015).
Use of Instrumental Support	"I've run down to [James'] room in the middle of class and said, '[James], what's happening here?' Because usually, if something doesn't work for one of us, the other one struggles with it, too, and we back up and try to recreate something" (Allison, MS Focus Group, October 22, 2015).
	"I'll call the calculus teacher down, and she'll come down the hall, and she'll walk in, and she'll explain it to us. We'll all learn it together, and then we'll move forward" (John, HS Focus Group, November 11, 2015).
Planning	"OK, that didn't work. What can we do next? How are we going to fix it" (Andy, MS Focus Group, October 22, 2015)?
	"You're in that mode of, 'What do I do, what do I do'" (Allison, MS Focus Group, October 22, 2015)?
	"[I] think about how I might best handle the problem" (Rachel, HS Focus Group, November 11, 2015).
Active Coping	"Especially if you back them up and say, 'Let's back up, put everything down, start again,' give them an idea of the direction you want them to go…Occasionally you've got to bring the whole class back for a question. The groups are going too many different ways… Usually if I explain it differently and give more guidelines, we go again. (Allison, MS Focus Group, October 22, 2015).
	"Stop them, point them in the right direction, pat them on the back and say, 'Think about this'… AP Chemistry this year, I've had to consult Google

	many a time in class… I get everybody on the same page or say, 'This is what we should have seen.' Ask them the questions to get them there" (Caleb, HS Focus Group, November 11, 2015).
	"But I'll take it there and [say] 'let's explore this question. I don't know the answer.' Maybe I'll look it up or [give them a chance to] look it up on [their] phone[s]" (Joseph, HS Focus Group, November 11, 2015).
	"If I don't have enough time, I'll always say, 'You can do that as an additional assignment. Look it up. Write me a paragraph on how it relates to what we're talking about right now. Turn it in next time.' I'll offer it as an additional homework grade" (Rachel, HS Focus Group, November 11, 2015).
	"[I] ask the students for the problem areas, what was hanging them up" (John, HS Focus Group, November 11, 2015).
	"I would try to find, like you said, get a group that is on the right track. You can say, 'OK you guys come up here and share with the class. Tell the class where you're going,' and [they] help the other kids get it without me having to say, 'OK guys, put your pencils down, here it is'" (Jenny, MS Focus Group, October 22, 2015).

Initial instrument items. The results of the two focus group interviews provided the information needed to develop a set of items focused on primary and secondary appraisals and coping strategies. Many of the items regarding appraisals came directly from the categories which emerged from the focus group interviews and from phrases teachers used to express their thinking and feelings. Items that did not come directly from focus group interview findings were added based upon theory from research presented in the literature review. While some direct phrases were used for coping strategies, much of these items were adapted from the COPE instrument (Carver, Scheier, & Weintraub, 1989). I intentionally created more items than would actually make it on to the piloted

instrument. Tables 4.4 – 4.7 explain those categories and items: Table 4.4 presents the categories and items for primary appraisals; Table 4.5 presents the categories and items for secondary appraisals; Table 4.6 contains the items for the emotion-focused coping strategies; and, Table 4.7 contains items for the problem-focused coping strategies.

The results from the focus groups also provided information regarding which scenarios to include as prompts in the initial instrument. Scenarios 1 and 2 were chosen because Scenario 1 initiated the highest amount of negative emotions while Scenario 2 elicited the lowest amount of negative emotions. When the instrument was piloted, the order of the scenarios was swapped so that the low negative emotion prompt was what the participants responded to first.

Table 4.4
Primary Appraisal Categories and Associated Items

Ego-Involvement	During this situation, I feel like I am a bad teacher.
	During this situation, I feel like a good teacher.
	During this situation, I feel like I should be better for my students.
	During this situation, I question my ability to teach.
	During this situation, I do not feel like I'm doing a good job.
	During this situation, I feel like I'm doing a good job.
	During this situation, my self-esteem is lowered.
	During this situation, my self-esteem is enhanced.
	During this situation, I feel like a better teacher.
Goal Importance	It is important for me to have a structured learning environment.
	It is important for me to have a controlled learning environment.
	It is important for my lessons to go the way I plan.
	It is important for my students to see me as competent.
	It is important for me to keep to a set scope and sequence of covering content.
	Covering content in a specified amount of time is important to me.
	It is important that my students feel confident in their learning.
	It is important for me to feel secure in my students' performance on assessments.
	It is important for me to feel successful as a teacher.
	It's important for my students to know that I don't know everything.
	It's important that I cultivate a mindset of curiosity in my students.
	It's important that I utilize class time efficiently.
	It is important for me to try different methods of instruction.
Goal Congruence	During this situation, my teaching goals are hindered.
	During this situation, my teaching goals are promoted.
	This situation disrupted the learning environment.
	This situation enhanced the learning environment.
	This situation promotes my feelings of being in control.
	This situation impairs me from keeping my schedule of covering content.
	This situation increases my certainty of how my students will perform on assessments.
	This situation makes me appear less competent to my students.
	This situation hinders me from wanting to try new methods of teaching.
	This situation increases my students' feelings of uncertainty in the learning process.
	During this situation, my feeling of being a successful teacher is enhanced.
	During this situation, I am utilizing class time efficiently.
	During this situation, the mindset of curiosity in my students is being promoted.
	The learning activities I had planned for this class are disrupted by this situation.

Table 4.5
Secondary Appraisal Categories and Associated Items

Problem Efficacy	During this situation, I have difficulty coming up with strategies to deal with what's occurring.
	During this situation, I know how to deal with what's occurring.
	I am confident I can deal with what's occurring.
	During this situation I am confident I can provide scaffolds to improve the situation.
Agency	The students are responsible for this situation.
	I am responsible for this situation.
	Limited time is responsible for this situation.
	If I facilitated this situation better, it never would have happened.
	If the students were better behaved, this situation would never have occurred.
	If the students were more focused, this situation would never have occurred.
	If I planned better, this situation would never have occurred.
	There's nothing I could do to have prevented the situation from occurring.
	There's nothing the students could do to have prevented the situation from occurring.
	There's nothing that can be done to prevent situations like these from occurring.
	If I had more resources, this situation never would have occurred.
	If I had more professional development, this situation never would have occurred.

Table 4.6
Initial Emotion-focused Coping Categories and Associated Items

Focus on Venting of Emotions	I let my feelings show to my students.
	I apologize to my students.
	I become very tense.
	I keep my feelings to myself.
	This will negatively impact my mood the rest of the day.
	I ignore the feelings I have.
	I am really aware of the negative feelings I am experiencing.
Use of Emotional Support	I plan on talking to someone later about how I feel during this situation.
	I try to get emotional support from my friends, colleagues, or relatives.
	I discuss my feelings with someone.
	I get sympathy and understanding from someone.
	I plan on getting sympathy and understanding from someone.
	I plan on complaining about the situation to a friend, colleague, or relative.
Denial	I say to myself "This isn't happening."
	I refuse to believe that this situation is happening.
	I go on as if nothing has happened.
	I refuse to acknowledge the problem.
Behavior Disengagement	I admit to myself that I can't deal with it, and quit trying.
	I give up my initial intentions.
	I reduce the amount of effort I'm putting into solving this situation.
Acceptance	I accept the situation has happened and that it can't be changed.
	I accept the reality that the situation has occurred.
	I learn to live with situations like this.
Self-critical	I criticize myself.
	I blame myself for what is going wrong.
	I focus on my inadequacies.
Wishful Thinking	I wish that the situation would go away.
	I tell myself "It's alright, it's alright".
	I think "Things will be better tomorrow".
Substance Abuse	I turn to a vice (e.g., chewing gum, drinking coffee, drinking Coke, snacking).
Humor	I laugh about the situation.
	I make jokes about the situation.

Table 4.7
Initial Problem-focused Coping Categories and Associated Items

Positive reinterpretation and growth	I try to grow as a teacher as a result of the situation.
	I try to see the situation in a different light, to make it seem more positive.
	I look for something good in what is happening.
	I learn something from the experience.
	I tell myself "It's okay that this is happening" and I learn from it.
Use of instrumental social support	I try to get advice from someone about what to do.
	I plan on trying to get advice from someone about what to do.
	I talk to someone who could do something concrete about the situation.
	I plan on talking to someone who could do something concrete about the situation.
	I ask people who have had similar experiences what they did.
	I plan on asking people who have had similar experiences what they did.
Planning	I try to come up with a strategy about what to do.
	I think about how I might best handle the situation.
	I think about what steps to take.
	I make a plan of action.
	I think about how I have solved similar situations.
	I plan on doing things differently in the future.
Active Coping	I concentrate my efforts on doing something about the situation.
	I take additional action to try to get rid of the problem.
	I take direct action to get around the situation.
	I do what has to be done one step at a time.
	I come up with several different solutions.
Restraint	I restrain myself from doing anything too quickly.
	I hold off doing anything about it until the situation permits.
	I make sure not to make matters worse by acting too soon.
	I weigh my options carefully.
	I try to carefully plan a course of action rather than acting on impulse.

Expert panel review and instrument refinement. Six individuals reviewed the initial items designed for the instrument as well as the two scenarios and the associated inquiry features included in the instrument. Among these reviewers were two science education faculty member who specialize in inquiry-based instruction; one high school physics teacher; one organizational psychologist who specializes in emotion and emotional regulation; and two educational psychologists who specialize in

psychometrics. Each reviewer provided a score for each item and feature regarding its clarity and representativeness. From these scores, I computed Inter-rater Agreement (IRA) for clarity (IRA-C) and representativeness (IRA-R) for each item and scale. Additionally, a Content Validity Index (CVI) score was computed. Some reviewers also provided comments for items that scored low on clarity and/or representativeness. The following section provides the results compiled from this panel, as well as how the instrument was refined based on the reviews made by the expert panel.

Review and refinement of primary appraisal items.

Table 4.8
IRA and CVI Scores for Ego-Involvement Appraisal Items

Item #	Item	IRA-R	IRA-C	CVI
1	During this situation, I feel like I am a bad teacher.	1.00	1.00	1.00
2	During this situation, I feel like a good teacher.	1.00	1.00	1.00
3	During this situation, I feel like I should be better for my students.	0.50	0.60	0.50
4	During this situation, I question my ability to teach.	0.83	0.83	0.83
5	During this situation, I do not feel like I'm doing a good job.	0.83	1.00	0.83
6	During this situation, I feel like I'm doing a good job.	0.83	1.00	0.83
7	During this situation, my self-esteem is lowered.	1.00	0.83	1.00
8	During this situation, my self-esteem is enhanced.	1.00	0.83	1.00
9	During this situation, I feel like a better teacher.	0.50	0.67	0.50
	Scale Score	0.78	0.78	0.83

Ego-involvement items. Table 4.8 illustrates the inter-rater agreement and content validity scores for the items and for the scale. Initially, there were nine ego-involvement items created for this measure. Items 3 and 9 were deleted from this scale due to the IRA scores being below 0.80 (Rubio et al., 2003). Deleting these two items increased the scale IRA and CVI scores. Based on the reviewers' comments about getting rid of one of the

dichotomous statements (e.g., items 1 and 2) since the instrument would be using a Likert Scale, I deleted items 1, 5, and 7. Based on comments from the emotion psychology expert, the definition for this sub-construct was sharpened to focus on how teachers felt about themselves as teachers. Thus, "good" in item 2 was changed to "effective"; item 8 was modified to "During this situation, I feel good about myself as a teacher"; and item 4 was modified to "During this situation, I do not feel like a successful teacher." These changes resulted in the ego-involvement scale being refined to only four items focused on what respondents believed about themselves as teachers (see Appendix H).

Table 4.9
IRA and CVI Scores for Goal Relevance Appraisal Items

Item #	Category/Item	IRA-R	IRA-C	CVI
Learning Environment				
1	It is important for me to have a structured learning environment.	1.00	1.00	1.00
2	It is important for me to have a controlled learning environment.	0.83	1.00	0.83
3	It is important for my lessons to go the way I plan.	0.83	1.00	0.83
13	It is important for me to try different methods of instruction.	1.00	1.00	1.00
Student Perception of Teacher				
4	It is important for my students to see me as competent.	0.67	1.00	0.67
10	It is important for my students to know that I don't know everything.	1.00	1.00	1.00
11	It's important that I cultivate a mindset of curiosity in my students.	1.00	1.00	1.00
Time				
5	It is important for me to keep to a set scope and sequence of covering content.	1.00	1.00	1.00
6	Covering content in a specified amount of time is important to me.	1.00	1.00	1.00
12	It's important that I utilize class time efficiently.	1.00	1.00	1.00
Beliefs about Assessments				
7	It is important that my students feel confident in their learning.	1.00	1.00	1.00
8	It is important for me to feel secure in my students' performance on assessments.	0.83	0.67	0.83
9	It is important for me to feel successful as a teacher.	1.00	1.00	1.00
	Scale Score	0.92	0.92	0.94

Goal relevance items. The expert panel reviewed 13 goal relevance items. Table 4.9 displays the IRA and CVI scores for these items. IRA and CVI scale scores were all acceptable as they were above 0.80 (Rubio et al., 2003). However, I made modifications based on comments that the reviews provided to further improve these scores. As a general change, all items were streamlined in their wording to make the reading of them

consistent. This change occurred based on comments by two reviewers mentioning the lack of consistency between items. Additionally, all personally worded statements (e.g., "see me") were made universal (e.g., "see their teacher") to make sure to capture general beliefs, not what teachers only believe about themselves. Also, compound questions were either split or deleted altogether. These modifications occurred based on the feedback from the expert in psychometrics, who also specializes in Educational Psychology. There were also specialized changes made to items. These changes are presented in the appraisal categories (e.g., learning environment, time) which emerged from the focus group interviews. Based on one of the psychometric expert's comments concerning the need for more items in the given categories for an effective factor analysis, items were also added to the goal relevance section. The goal for the final instrument was to have three to four items for each category that contained new items. Appendix H displays all of these changes.

The goal relevance items concerning the learning environment were 1, 2, 3, and 13. Of these items, reviewers had concerns regarding items 2, 3, and 13. Item 2 was modified to "It is important for teachers to control the events that take place in the classroom" because two reviewers commented that teachers might perceive a "controlled learning environment" in different ways. A reviewer questioned if item 3 assessed flexibility rather than a goal. As teachers can have goals about flexibility in the learning process, I felt it still belonged in this section; however, to make it more explicit to being a goal about flexibility, this item was modified to "It is important that students have a sense of freedom in the learning process." The only change made to item 13 was replacing the

word “try” with “use” to encourage teachers to see it more than just a one-time try of an instructional method.

The goal relevance items concerning how students perceived their teacher were items 4, 10, and 11. Two of the reviewers were concerned whether item 4 was more of an ego-involvement item. This explained its low IRA-R and CVI score (0.67). As it references student perceptions of their teacher instead of the solely the teacher’s perception of himself or herself, this item was not moved or deleted. Item 10 remained unchanged due to the teacher reviewer expressing enthusiasm about the inclusion of items like this. Item 11 was modified to “It is important that students feel their curiosity is cultivated by their teacher” due to one reviewer stating that “mindset” added more ambiguity to the item. One item was also added to this section due to statements made by the teacher focus groups about building trust with their students. The added item is “It is important for students to trust their teacher.”

The items for goal relevance that are associated with time were items 5, 6, and 12. While these items’ CVI and IRA scores are excellent, reviewer comments necessitated some modifications. Item 5 was replaced due to reviewers highlighting that it was a double-barreled question. The item that replaced it reads “It is important to cover all the standards before the course ends.” A reviewer offered a potential rewrite for item 6, and therefore it was changed to “It is important to cover content in a specified time”. The only modification on item 12 was replacing “utilize” with “use.” One additional item was added to reflect teachers concern with time due to factor analysis concerns. This item

came directly from an expressed concern for time found in the focus groups. It reads “It is important to keep multiple sections of the same course on track with each other.”

Goal relevance items regarding teachers’ beliefs about assessments were items 7, 8, and 9. Reviewers commented on item 8 being wordy and unclear. Based on comments made by the expert in psychometrics, this item became “It is important for teachers to predict how their students will perform on assessments.” While receiving excellent scores for IRA and CVI, Item 7 was modified due to reviewers stating that the phrase “confident in their learning” was too vague. This item was changed to “It is important that students feel prepared for assessments.” Item 9 was moved to the ego-involvement section because the emotion psychology reviewer highlighted that this item may be conflated with the ego-involvement category. I agreed with this assessment. To help with factor analysis, another item was added to this category since one was deleted. The item reads “It is important that students do well on assessments.”

Table 4.10
IRA and CVI Scores for Goal Congruence Appraisal Items

Item #	Category/Item	IRA-R	IRA-C	CVI
1	During this situation, my teaching goals are hindered.	1.00	1.00	1.00
2	During this situation, my teaching goals are promoted.	1.00	1.00	1.00
Learning Environment				
3	This situation disrupted the learning environment.	1.00	1.00	1.00
4	This situation enhanced the learning environment.	1.00	1.00	1.00
5	This situation promotes my feelings of being in control.	0.83	1.00	0.83
9	This situation hinders me from wanting to try new methods of teaching.	1.00	1.00	1.00
10	This situation increases my students' feelings of uncertainty in the learning process.	0.50	0.50	0.50
Time				
6	This situation impairs me from keeping my schedule of covering content.	1.00	0.83	1.00
12	During this situation, I am utilizing class time efficiently.	1.00	1.00	1.00
14	The learning activities I had planned for this class are disrupted by this situation.	1.00	1.00	1.00
Beliefs About Assessments				
7	This situation increases my certainty of how my students will perform on assessments.	1.00	0.83	1.00
Students' Perception of Teachers				
8	This situation makes me appear less competent to my students.	0.83	1.00	0.83
13	During this situation, the mindset of curiosity in my students is being promoted.	1.00	1.00	1.00
11	During this situation, my feeling of being a successful teacher is enhanced.	1.00	1.00	1.00
	Scale Score	0.93	0.93	0.94

Goal congruence items. The expert panel reviewed 14 items created for goal congruence. Table 4.10 displays the IRA and CVI scores for these items. IRA and CVI scale scores were all acceptable as they were above 0.80 (Rubio et al., 2003); however, I made modifications based on comments that the reviewers provided with the goal of

further improving these scores. While items 1 and 2 were scored as very clear and representative, one of the psychometrics expert's comments referred to having the items belong to specific categories (e.g., learning environment, time, belief about assessments) for factor analysis purposes. As these two items were broad and did not belong to one of the four categories (e.g., learning environment, time), they were deleted.

The goal congruent items concerning the learning environment included items 3, 4, 5, 9, and 10. Items 3 and 4 were dichotomous items, and since the instrument would use a Likert Scale, item 3 was deleted. Additionally, I modified item 4 to better align it to the goal relevant category (i.e., learning environment) it was associated with. Therefore, it was refined to "this situation promotes a structure learning environment." Item 5 had acceptable IRA and CVI scores; however, reviewers commented on the item being wordy; they thought that its phrasing assumed teachers wanted to be in control. To fix these issues, this item was modified to "I feel in control of the learning environment during this situation." Reviewers commented that item 9 left too much room for interpretation, and one reviewer stated that it should be changed to "This situation makes me want to use new methods of teaching." This suggested statement became the item on the scale. Item 10 had CVI and IRA scores below 0.50 and therefore it was deleted from the scale. The modifications suggested by reviewers left the assessment of the learning environment with three items.

The goal congruent items regarding time were items 6, 12, and 14. Item 6 became "This situation keeps me from covering content in a timely manner" due to a reviewer's comment about the flow of wording in the original item being confusing. Item 12 had

acceptable CVI and IRA scores; however, one reviewer suggested changing "utilize" to "use," and this change was made. Additionally, the item was changed to be reversely stated so that it reads "This situation keeps me from using class time efficiently". Item 14 was modified to "This situation allows me to move at the pace I want to go." This modification was based on a reviewer who was concerned whether teachers would know the "learning activities they had planned" since the situation is hypothetical.

Initially, only one item (item 7) regarded teachers' beliefs about assessment. The only suggestion that a reviewer made to this item was changing "certainty" to "confidence". I agreed with this assessment and changed the item. To address the need for at least three items in each category, I created two new items. See Appendix H for added items.

Items 8, 11, and 13 initially composed the goal congruence items regarding students' perception of their teachers. One of the reviewers questioned whether item 8 was more of a self-confidence item; however, since its focus is on how the situation may affect the perception students have of their teacher, it was retained for this category. Due to concerns of wordiness, I changed the final wording to "This situation makes me appear competent to my students." Item 13 received several comments, all of which in some way encouraged simplifying the statement. One reviewer also mentioned getting rid of the word "mindset" as it added ambiguity to the item. Therefore, this item became "This situation encourages my students to be curious". After a closer review, I concluded that item 11 was already asked in the ego involvement items, so this item was replaced with "This situation causes my students to trust my teaching ability." This added item allowed

for this category to more closely reflect the "students' perception of teachers" category of goal relevance.

Table 4.11
IRA and CVI Scores for Problem Efficacy Appraisal Items

Item #	Item	IRA-R	IRA-C	CVI
1	During this situation, I have difficulty coming up with strategies to deal with what's occurring.	0.83	1.00	0.83
2	During this situation, I know how to deal with what's occurring.	0.83	1.00	0.83
3	I am confident I can deal with what's occurring.	0.83	1.00	0.83
4	During this situation I am confident I can provide scaffolds to improve the situation.	0.83	1.00	0.83
	Scale Score	1.00	1.00	0.83

Problem efficacy items. The initial problem efficacy category contained four items. While the scale score and individual scores for these items was acceptable (see Table 4.11), reviewers' comments called for some modifications. One reviewer mentioned that the phrase "what's occurring" in items 1, 2, and 3 should be switched to "in this situation". The two psychometric/educational psychology experts suggested that the items were too vague and needed to include more specific mention of resources like knowledge and skills. Additionally, one of the educational psychology experts stated that the word "scaffolds" may confuse some teachers. Due to these comments, item 1 was modified to "I have difficulty coming up with strategies to deal with this situation". Items 2 and 3 were modified to reflect more specificity. Item 2 became "I have the skills to deal with this situation," and item 3 became "I have the resources to deal with this situation". Item 4 was deleted because the mentioning of "scaffolds" potentially confused teachers and "providing scaffolds" is a skill that would be represented in item 2.

Table 4.12
IRA and CVI Scores for Agency Appraisal Items

Item #	Category/Item	IRA-R	IRA-C	CVI
Agency: Internal vs. External				
1	The students are responsible for this situation.	0.83	0.83	0.83
2	I am responsible for this situation.	1.00	1.00	1.00
3	Limited time is responsible for this situation.	1.00	1.00	1.00
4	If I facilitated this situation better, it never would have happened.	0.83	0.67	0.83
5	If the students were better behaved, this situation would never have occurred.	1.00	1.00	1.00
6	If the students were more focused, this situation would never have occurred.	1.00	0.83	1.00
7	If I planned better, this situation would never have occurred.	1.00	0.83	1.00
Agency: Controllable vs. Uncontrollable				
8	There's nothing I could do to have prevented the situation from occurring.	0.67	0.67	0.67
9	There's nothing the students could do to have prevented the situation from occurring.	0.67	0.67	0.67
10	There's nothing that can be done to prevent situations like these from occurring.	0.83	0.67	0.83
11	If I had more resources, this situation never would have occurred.	1.00	0.83	1.00
12	If I had more professional development, this situation never would have occurred.	1.00	0.67	1.00
	Scale Score	0.83	0.58	0.90

Agency items. Initially there were 12 items created for the agency category. Seven of these were designed for the internal/external category of agency, and five were designed for the controllable/uncontrollable category of agency. Table 4.12 shows that there were several items which had issues with clarity, representativeness, and content validity. The only scale score that was not acceptable was the IRA-C score. In general, comments from reviewers focused on getting rid of the word "never," as its use could make responding to the items difficult. Therefore, all of the "never" words were replaced

with less difficult qualifiers (see Table 4.12). Item 1 was deleted due to a reviewer's comment that it was too vague. Additionally, the other items more specifically attributed the situation to students, and therefore I felt confident in removing this item. Items 2 and 3 remained the same; however, the emotion psychology expert did mention having a hard time seeing time (item 3) as an agent. Item 4 was modified to increase clarity because reviewers mentioned that the item was hard to follow. It was changed to "If I was a better facilitator, this situation would not have occurred". The remaining items in this agency category were modified based on general modifications mentioned earlier. Items 8 and 9 were deleted due to all scores being well below 0.80. Items 10, 11, and 12 were slightly modified to assist with clarity. Modifications resulted in the internal/external category having six items and the controllable/uncontrollable category having three items (see Appendix H).

Table 4.13
IRA and CVI Scores for Emotion-focus Coping Items

Item #	Category/Item	IRA-R	IRA-C	CVI
Venting				
1	I let my feelings show to my students.	0.83	0.83	0.83
2	I apologize to my students	0.83	0.83	0.83
3	I become very tense	0.83	0.83	0.83
4	I keep my feelings to myself.	0.83	0.83	0.83
5	This will negatively impact my mood the rest of the day.	1.00	0.83	1.00
6	I ignore the feelings I have.	1.00	1.00	1.00
7	I am really aware of the negative feelings I am experiencing.	1.00	1.00	1.00
	Scale Score	1.00	1.00	0.90
Use of Emotional Support				
8	I plan on talking to someone later about how I feel during this situation.	1.00	1.00	1.00
9	I try to get emotional support from my friends, colleagues, or relatives.	1.00	0.83	1.00
10	I discuss my feelings with someone	1.00	1.00	1.00
11	I get sympathy and understanding from someone.	1.00	1.00	1.00
12	I plan on getting sympathy and understanding from someone.	0.67	0.67	0.67
13	I plan on complaining about the situation to a friend, colleague, or relative.	1.00	1.00	1.00
	Scale Score	0.83	0.83	0.94
Denial				
14	I say to myself "This isn't happening."	0.83	0.83	0.83
15	I refuse to believe that this situation is happening.	1.00	1.00	1.00
16	I go on as if nothing has happened.	0.83	1.00	0.83
17	I refuse to acknowledge the problem.	1.00	1.00	1.00
	Scale Score	1.00	1.00	0.92
Behavioral Disengagement				
18	I admit to myself that I can't deal with it, and quit trying.	0.80	0.60	0.80
19	I give up my initial intentions.	1.00	0.80	1.00
20	I reduce the amount of effort I'm putting into solving this situation.	1.00	1.00	1.00
	Scale Score	1.00	0.67	0.93
Acceptance				
21	I accept the situation has happened and that it can't be changed.	0.80	0.80	0.80
22	I accept the reality that the situation has occurred.	1.00	1.00	1.00
23	I learn to live with situations like this.	0.80	1.00	0.80
	Scale Score	1.00	1.00	0.87
Self-blame				
24	I criticize myself.	1.00	1.00	1.00
25	I blame myself for what is going wrong.	1.00	1.00	1.00
26	I focus on my inadequacies	1.00	1.00	1.00
	Scale Score	1.00	1.00	1.00
Wishful Thinking				
27	I wish that the situation would go away.	1.00	1.00	1.00
28	I tell myself "It's alright, it's alright."	0.80	1.00	0.80
29	I think "Things will be better tomorrow."	1.00	1.00	1.00
	Scale Score	1.00	1.00	0.93
Substance Abuse				
30	I turn to a vice (e.g., chewing gum, drinking coffee, drinking coke, snacking).	1.00	0.83	1.00
Humor				
31	I laugh about the situation	1.00	1.00	1.00
32	I make jokes about the situation	1.00	1.00	1.00
	Scale Score	1.00	1.00	1.00

Emotion-focused coping items. Table 4.13 illustrates the CVI and IRA scores for the emotion-focused coping items. Initially, there were 32 emotion-focused coping items reviewed by the expert panel. Only two of the items (item 12 and 18) did not receive acceptable scores from the panel (see Table 4.13). For the remaining items, the general trend in the modification comments submitted by reviewers regarded making the statements specific to the situations the teachers were reading (i.e., "in this situation"), removing compound phrases, and changing wording to make items clearer. Additionally, after speaking with the emotion psychology expert, it was decided to use mainly the Brief COPE items (Carver, 1997) for the final version of the instrument. The primary expert agreed with this decision due to the Brief COPE providing a valid, reliable, and parsimonious measure for coping strategies. The Brief COPE scale has two items for every category. I did want at least three items for every category to see if this would assist with the reliability scores for the Brief COPE; therefore, certain items from this initial list remained in the instrument to bring categories to three items. These remaining items had acceptable CVI and IRA scores. Only three new items were created through this process. One more modification was made to the Brief COPE due to information obtained during the teacher focus groups and due to the specificity of the context of the study. Mental disengagement, substance use, and religion were not mentioned by the teachers in the focus groups, so these categories were removed. Appendix H provides the refined item list for each emotion-focused category.

Table 4.14
IRA and CVI Scores for Problem-focus Coping Items

Item #	Category/Item	IRA-R	IRA-C	CVI
Positive Reframing				
1	I try to grow as a teacher as a result of the situation.	1.00	1.00	1.00
2	I try to see the situation in a different light, to make it seem more positive.	1.00	0.83	1.00
3	I look for something good in what is happening.	1.00	1.00	1.00
4	I learn something from the experience.	1.00	1.00	1.00
5	I tell myself "It's okay that this is happening" and I learn from it.	0.50	0.67	0.50
	Scale Score	0.80	0.80	0.90
Use of Instrumental Support				
6	I try to get advice from someone about what to do.	1.00	1.00	1.00
7	I plan on trying to get advice from someone about what to do.	1.00	0.80	1.00
8	I talk to someone who could do something concrete about the situation.	0.83	0.83	0.83
9	I plan on talking to someone who could do something concrete about the situation.	0.80	0.80	0.80
10	I ask people who have had similar experiences what they did.	1.00	1.00	1.00
11	I plan on asking people who have had similar experiences what they did.	0.80	0.80	0.80
	Scale Score	0.67	0.50	0.91
Planning				
12	I try to come up with a strategy about what to do.	1.00	1.00	1.00
13	I think about how I might best handle the situation.	1.00	1.00	1.00
14	I think about what steps to take.	1.00	0.83	1.00
15	I make a plan of action	1.00	1.00	1.00
16	I think about how I have solved similar situations.	1.00	1.00	1.00
17	I plan on doing things differently in the future.	1.00	1.00	1.00
	Scale Score	1.00	1.00	1.00
Active Coping				
18	I concentrate my efforts on doing something about the situation.	1.00	1.00	1.00
19	I take additional action to try to get rid of the problem.	1.00	0.83	1.00
20	I take direct action to get around the situation.	1.00	0.83	1.00
21	I do what has to be done one step at a time.	0.83	0.83	0.83
22	I come up with several different solutions	1.00	1.00	1.00
	Scale Score	1.00	1.00	0.97
Restraint				
23	I restrain myself from doing anything too quickly.	0.83	0.83	0.83
24	I hold off doing anything about it until the situation permits.	0.83	0.80	0.83
25	I make sure not to make matters worse by acting too soon.	0.83	0.80	0.83

26	I weigh my options carefully.	1.00	1.00	1.00
27	I try to carefully plan a course of action rather than acting on impulse.	1.00	0.80	1.00
	Scale Score	1.00	1.00	0.90

Problem-focused coping items. Initially, there were 27 emotion-focused coping items reviewed by the expert panel. Only one of the items (item 5) did not receive acceptable scores from the panel (see Table 4.14). For the remaining items, the general trend in the modification comments submitted by reviewers regarded making the statements specific to the situations the teachers were reading (i.e., "in this situation"), removing double-barreled phrases, and changing wording to make items clearer. Additionally, after speaking with the emotion psychology expert, it was decided to use mainly the Brief COPE problem-focused items (Carver, 1997) for the final version of the instrument. The Brief COPE scale has two items for every category. I did want at least three items for every category to see if this would assist with the reliability scores for the Brief COPE. Therefore, certain items from this initial list were kept to bring categories to three items. These items which were kept had acceptable CVI and IRA scores. No new problem-focused coping items were created through this process. Appendix H provides the refined item list for each emotion-focused category.

Inquiry-based scenario features. The final aspect of the instrument that the expert panel reviewed was that of the features that were represented in each presented inquiry-based scenario. Tables 4.15 and 4.16 display the IRA and CVI scores for the different inquiry features associated with the scenarios. All IRA and CVI scores for scenario 1 (i.e., low intensity scenario) were acceptable. The feature of "students forming

explanations from evidence" received a comment from a reviewer that adding more detail would make this clearer. Therefore, I added more detail to the scenario in an attempt to clarify this feature (see Table 4.15 for the modified Scenario 1 prompt).

Table 4.15: IRA and CVI Scores for Scenario 1 Inquiry Features

You are facilitating a discussion to make sense of an investigation your students have just finished. You have questions planned so that you can facilitate a deep discussion that will allow your students to talk about the investigation. The goal of this discussion is to allow students the chance make sense of the exploration and therefore build their conceptual understanding of the science concepts investigated. During the discussion, you are getting students to explain their answers with evidence from the investigation. In the middle of the discussion, a student asks you a tough question about the science concept you all are discussing. You do not know the answer to the question.			
Inquiry Feature	IRA-R	IRA-C	CVI
Discussion to build conceptual understanding	1.00	1.00	1.00
Teacher acts as a facilitator	1.00	1.00	1.00
Students forming explanations from evidence	0.80	0.80	0.80
Students explain/justify	1.00	1.00	1.00
Students engaging in discourse	1.00	1.00	1.00
General inquiry-based instruction	0.80	0.80	0.80

Table 4.16: IRA and CVI Scores for Scenario 2 Inquiry Features

Your students are engaging in an investigation that allows them to explore an important science concept before an explanation of the concept has occurred. During this investigation, students are collecting and analyzing data. You have them doing this so that they can begin to see patterns that will build their conceptual understanding of the particular concept. As you walk around and facilitate the activity, you hear the groups working and talking about what they are noticing. You realize that they are going in a totally different direction than you intended. What you thought they would have no problem understanding, they are not understanding at all. The activity is not turning out the way you wanted it to.			
Inquiry Feature	IRA-R	IRA-C	CVI
Students explore before explanation occurs	1.00	1.00	1.00
Teacher acts as a facilitator	1.00	1.00	1.00
Students collect and analyze data	1.00	1.00	1.00
Builds conceptual understanding	0.80	0.80	0.80
Student collaboration and discourse	1.00	0.80	1.00
Student-centered instruction	0.60	0.60	0.60
General inquiry-based instruction	0.80	0.80	0.80

All IRA and CVI scores for Scenario 2 (i.e., high intensity scenario) were acceptable except the feature of "student-centered instruction." In order to improve upon this feature, I added to the scenario to make it clearer that students were active participants in this scenario and the teacher was acting as a facilitator. The feature of "builds conceptual understanding" received the next lowest score. Therefore, I added more detail to the scenario in an attempt to clarify this feature. One of the reviewers commented on the word "activity" potentially lessening the substantiality of inquiry-based instruction, so the word "activity" was replaced with "investigation." Table 4.16 displays the modified Scenario 2 prompt.

Phase 2: Pilot of the Instrument

The following section presents the results for the quantitative phase of this study. In order to statistically analyze the data collected, I used SPSS version 23. Data screening results for the entire instrument are reported first, followed by the validity and reliability analyses for the newly created items. After these findings are reported, reliability analyses for the items from pre-existing instruments are presented. All items are reported with their abbreviations. Abbreviations of items are found in Appendix H. In order to differentiate between responses on Scenario 1 and responses regarding Scenario 2, a "T" is placed before all abbreviations associated with Scenario 2. It should also be noted that the instrument started out with the lowest negative intensity scenario and then proceeded to the higher negative intensity scenario. Therefore, in the instrument, Scenario 1 is the low intensity scenario and Scenario 2 is the high intensity scenario. Quantitative results supported the finding of the qualitative study regarding the negative emotions elicited by each scenario. Scenario 1 elicited significantly less confusion $H(1) = 6.14$, $p = .013$ and frustration $H(1) = 12.30$, $p < .001$ than Scenario 2. There were no significant differences in the amount of fear elicited by the two scenarios. I ran a Kruskal-Wallis test to determine these differences. I used a Kruskal-Wallis test due to the emotion types not displaying a normal distribution.

Screening of the data. Screening of the data focused on finding the means, standard deviations, and ranges of the items in the instrument. Additionally, screening of the data resulted in finding out whether any items had issues with normality. Identifying outliers was unneeded due to the small sample size. Appendix I provides the mean, standard deviation, and range statistics for all the items.

A Shapiro-Wilk normality test was run for all of the items. Based on the Shapiro-Wilk test, all of the items were identified as having a distribution significantly different than a normal distribution. All items but two showed this difference at a $p < .001$. The other two items (i.e., mood1b, mood1j) showed this difference at a $p < .01$. Appendix J shows the results of the Shapiro-Wilk test for each item. Because of the small sample size, an analysis of the z-scores for skewness and kurtosis also checked the normality. In order to tell if there are normality issues, z-scores ($\alpha = .05$) for skewness and kurtosis should not exceed the absolute value of 1.96 (Field, 2013). Appendix K contains the skewness and kurtosis statistics along with the corresponding z-scores for each item. This data shows that all of the items are not different from a normal distribution. Table 4.17 displays the items that have normality issues based on *z*-scores. This table shows that many of the normality issues reside in the mood assessment items and the coping strategies items – all of which were from pre-existing instruments. However, Table 4.17 also shows that there were normality issues found in some of the goal relevance (GI) items for scenario 1. Some of the goal congruent (GC), problem efficacy (PE), and agency (AG) items for scenarios 1 and 2 also had normality issues. Additionally, there were normality issues for all of the emotion items for scenario 1 and for fear and confusion emotion items in scenario 2.

Table 4.17
Items with Normality Issues Based on Skewness and Kurtosis z-scores

Mood2a	Mood2b	Mood2c	Mood2d	Mood2e	Mood2f	BehDis2	Blame2
Mood1f	Mood2g	Mood2h	Mood1h	Mood1i	Mood2i	Blame3	PosRef2
Mood2j	GILE1	GISP1	GISP3	GITIME2	GILE4	Plan1	ConfS2
GIASSE3	GISP4	FEARS1	CONFS1	FRUSS1	GCAsse1	TAccpt2	TActive1
GCTIME2	GCSP2	GCSP3	PE2	AgInt2	AGEXT2	TBehDis1	TBehDis3
AGUC1R	Vent1	Vent2	Vent3	EmSpt1	EmSpt2	TDenial2	TPlan1
EmSpt3	Denial1	Denial2	Denial3	BehDis1	Blame1	TPosRef1	TVent2
BehDis3	Accpt2	Accpt3	THumor3	TBehDis2	PosRef1	TDenial3	TPosRef3
Humor1	Humor2	Humor3	TPlan2	TDenial1	FearS2	TPlan3	TActive2
Plan2	Active2	Active3	TBlame1	TPosRef2	TBlame2	TActive3	TBlame3
TPE1R	TAGEXT2	TGCTIME2	TEmSpt1	TVent1	THumor2	TEmSpt2	TEmSpt3

Table 4.18
Test of Homogeneity of Variances of Coping Strategies for Scenarios 1 and 2

	Levene Statistic	df1	df2	Sig.
Vent1	6.779	1	47	.012
EmSpt1	4.456	1	47	.040
EmSpt3	7.418	1	47	.009
BehDis2	4.451	1	47	.040
BehDis3	13.786	1	47	.001
Accpt3	7.000	1	47	.011
Blame3	8.143	1	47	.006
Humor2	7.318	1	47	.009
InSpt1	5.069	1	47	.029
InSpt3	7.636	1	47	.008
TBehDis1	10.866	1	47	.002
THumor3	28.666	1	47	.000
THumor2	10.343	1	47	.002
TBehDis3	16.558	1	47	.000
TInSpt2	4.387	1	47	.042
TBlame1	8.733	1	47	.005

The final screening consideration was whether there was homogeneity of variance between the middle school and high school groups of teachers. Table 4.18 displays the results of this screening analysis. In the goal relevant items, only two items had heterogeneity of variance between the two teacher groups. For the GILE2 scores, the

variances were unequal for middle and high school teachers, $F(1, 47) = 5.80$, $p = .02$. For the GISP4 scores, the variances were unequal for middle and high school teachers, $F(1, 47) = 10.67$, $p = .002$. There were no issues with homogeneity of variance for the emotion scales in Scenario 1. All remaining primary appraisal items (i.e., goal congruence, ego-involvement) showed no issues with homogeneity of variance between the middle and high school teacher groups. Only two secondary appraisal items (i.e., agency, problem efficacy) were found to have issues with homogeneity of variance. For AGC1 and AGC2 scores, the variances were unequal for middle and high school teacher groups, $F(1, 47) = 5.68$, $p = .021$ and $F(1, 47) = 4.75$, $p = .034$ respectively. Several of the coping items were found to have issues with homogeneity of variance between the middle and high school groups (see Table 4.18). In Scenario 2, there were no issues for homogeneity of variance for the emotion scale items. One ego-involvement appraisal item displayed heterogeneity of variance. For TEI1 scores, the variances were unequal between the two teacher groups, $F(1, 47) = 11.91$, $p = .001$. One goal congruent appraisal item (TGCTIME2) also displayed heterogeneity of variance [$F(1, 47) = 9.379$, $p = .004$]. Additionally, two agency items, TAGINT2 and TAGINT3 had issues with homogeneity of variance between the two teacher groups, $F(1, 47) = 6.96$, $p = .011$ and $F(1, 47) = 9.97$, $p = .003$ respectively. Six coping strategy items had issues with homogeneity (see Table 4.18). All items that did not have homogeneity of variance between the middle and high school groups were taken out of all further analyses.

Prerequisites for factor analysis. Before executing the factor analysis for this instrument, I checked certain prerequisites to ensure that an accurate factor analysis was completed.

Normal distribution. The first prerequisite to check was normality. As was mentioned in the previous section, normality of the items needs to be considered when interpreting the results of the exploratory factor analysis (Field, 2013). Given the results from the two checks concerning normality, certain sub-constructs containing items without a normal distribution were interpreted with caution. While a factor analysis can still occur, the findings from the analysis can only have implications for the current sample of 49 science teachers. This is especially the case for items without a normal distribution (see Table 4.17).

Item correlations. The next prerequisite checked was correlation among the items using a bivariate correlation for all the appraisal items. This included running the bivariate correlation analysis on each scenario separately and then summing the scores for like appraisals and running the analysis again. The items for the individual scenario items and the combined scenario items had no correlations that were too high (i.e., $r > 0.80$ or $r < -.80$). This showed that the factor analysis would not have an issue determining the unique contribution of items to a factor. (Field, 2013). However, some of the items designed to fit into the same category did have correlations that were too low. Correlations for each appraisal type are shared below.

Goal relevance correlations. The goal importance items were only assessed once at the beginning of the survey; therefore, there were no combined scores to analyze with a

bivariate correlation. In the learning environment scale, items GILE3 and GILE4 had an acceptable correlation, $r(49) = .37$. In the items concerning students' perception of teachers, GISP2 had an acceptable correlation with GISP3 $r(49) = .62$. GISP1 was too lowly correlated with all other GISP items. In the items concerning time, GITIME1 was acceptably correlated with GITIME3 and GITIME4 $r(49) = .55$ and $r(49) = .30$ respectively. GITIME2 was too lowly correlated with all other GITIME items. GITIME3 had an acceptable correlation with GITIME4 $r(49) = .30$. The items concerning teacher beliefs about assessment all had acceptable correlations with one another $.40 > r > .30$.

Goal congruence and ego-involvement appraisal correlations. The analysis for Scenario 1 items showed that some of the items created to be in the same category may not load as expected when the factor analysis is executed. The ego-involvement items all had acceptable correlations with one another $.70 > r > .35$. All of the learning environment items concerning goal congruence were too lowly correlated with one another $-.10 > r > -.16$. All of the time items concerning goal congruence were also too lowly correlated with one another $.080 > r > -.024$. All of the beliefs about assessment items concerning goal congruence had acceptable correlations with one another $.54 > r > .32$. Concerning the goal congruence items about students' beliefs about teachers, GCSP1 had an acceptable correlation with GCSP2 $r(49) = .35$, and with GCSP3 $r(49) = .30$. GCSP2 was too lowly correlated with GCSP3 $r(49) = .22$.

The analysis for Scenario 2 items showed that some of the items created to be in the same category may not load as expected when the factor analysis is executed. The ego-involvement items all had acceptable correlations with one another $.70 > r > .36$.

Concerning the learning environment items regarding goal congruence, TGCLE1 had an acceptable correlation with TCGLE2 $r(49) = .48$. All other correlations in this category were too lowly correlated with one another $.15 > r > -.10$. In the examination of the goal congruence items related to time, only TGCTIME1 and TGCTIME3 had an acceptable correlation with one another $r(49) = .30$. TGCTIME2 was deleted from the analysis due to this item having issues with homogeneity of variance. Concerning the goal congruence items about teacher beliefs about assessments, TGCASSE1 had an acceptable correlation with TGCASSE2 $r(49) = .62$. TGCASSE3 was insufficiently correlated with TGCASSE1 $r(49) = .11$ and TGCASSE2 $r(49) = .11$. All of the students' perceptions about teacher items concerning goal congruence had acceptable correlations with one another $.45 > r > .33$.

Table 4.19

Scenario 1: Correlation Among External vs Internal Agency Items

Items	AgInt1	AgInt2	AgInt3	AGEXT1	AGEXT2	AGEXT3
AgInt1	--					
AgInt2	-.021	--				
AgInt3	-.021	.37*	--			
AGEXT1	-.011	-.024	.020	--		
AGEXT2	.30*	-.20	-.16	.35*	--	
AGEXT3	.15	-.52**	-.32*	.004	.46*	--

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

Secondary appraisal correlations. The bivariate correlation analyses for Scenario 1 (see Table 4.19) showed that some of the secondary appraisal items created to be in the same category may not load as expected when the factor analysis is executed. All of the

problem efficacy items had acceptable correlations with each other .65 > *r* > .41. Table 4.19 shows the correlations among the internal/external agency item correlations. Due to reverse coding of the external agency items, any correlations with internal items should be negative. Table 4.19 shows that AGINT1 has an acceptable correlation with AGEXT2 $r(49) = .30$. However, it is a positive correlation when it should be negative. Also AGINT2 has an acceptable positive correlation with AGINT3 $r(49) = .37$ and negative correlation with AGEXT3 $r(49) = -.52$. AGINT3 has an acceptable negative correlation with AGEXT3 $r(49) = -.32$. AGEXT1 has an acceptable positive correlation with AGEXT2 $r(49) = .35$ and AGEXT2 has an acceptable positive correlation with AGEXT3 $r(49) = .46$. In the controllable/uncontrollable agency items, no correlations were observed because AGC1 and AGC2 were deleted from the analysis due to these items having homogeneity of variance issues.

Table 4.20

Scenario 2: Correlation Among External vs Internal Agency Items

Items	TAgInt1	TAGEXT2	TAGEXT3	TAGEXT1
TAgInt1	--			
TAGEXT2	-0.07	--		
TAGEXT3	-0.37*	0.55**	--	
TAGEXT1	-0.08	0.44*	0.59**	--

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

Table 4.20 shows the correlations among the internal/external agency item correlations for Scenario 2. The bivariate correlation analyses for Scenario 2 showed that some of the secondary appraisal items created to be in the same category may not load as expected when the factor analysis is executed. All of the problem efficacy items had acceptable correlations with each other $.58 > r > .33$. Due to reverse coding of the external agency items, any correlations with internal items should be negative. By looking at Table 4.20, TAGINT1 has an acceptable correlation with TAGEXT3 $r(49) = -.37$. TAGEXT1 has an acceptable positive correlation with TAGEXT2 $r(49) = .44$ and TAGEXT3 $r(49) = .59$. TAGEXT2 also has an acceptable positive correlation with TAGEXT3 $r(49) = .55$. Only two correlations were not acceptable (see Table 4.20). In the controllable/uncontrollable agency items, the only acceptable correlation occurred between TAGC1 and TAGC2 $r(49) = .47$. TAGUC1 correlated too lowly with TAGC1 and TAGC2 $r(49) = .21$ and $r(49) = .18$ respectively. Additionally, the direction of the correlation was expected to be in the negative direction due to reverse coding of TAGUC1, but this was not the case.

Sample size. In order to determine if the sample size is adequate for a factor analysis, a KMO was executed on the appraisal items for both Scenarios 1 and 2. The KMO measure for the Scenario 1 items was 0.420. According to Kaiser (1974), this number means that it is unacceptable to run a factor analysis with this sample size. However, MacCallum, Widaman, Zhang, and Hong (1999) state that when communalities of items are above 0.60, then sample sizes less than 100 may be acceptable for a factor analysis. Therefore, the communalities of the items were assessed. None of the communalities were below .654. Because the communalities were acceptable, I felt comfortable continuing with the factor analysis of the Scenario 1 items. The KMO measure for the Scenario 2 items was 0.396. Again, this number signifies that engaging in a factor analysis might not be acceptable; however, all communalities but for one item (GITIME2 = 0.596) were above 0.60 and therefore I felt comfortable cautiously engaging in a factor analysis with these items.

Factor analyses and reliability of new items. The results for the factor analyses of Scenarios 1 and 2 are reported below. The factor analysis results for Scenario 1 are presented first, followed by the results of the factor analysis for Scenario 2. Both factor analyses were run with a Promax rotation. This rotation was chosen due to the theoretical assumptions that the factors are correlated with one another (Field, 2013).

Scenario 1: Factor analysis results. An initial analysis was run to obtain eigenvalues for each factor in the data. Thirteen factors had eigenvalues over 1 and altogether explained 78.87% of the variance. The scree plot was indefinite. It showed inflexions that would justify retaining either seven or 12 factors. Another analysis was

executed that forced a 12 factor extraction. This was the amount of factors I predicted would be extracted. These twelve factors explained 75.94% of the variance. Appendix L shows the factor loading after the promax rotation. The items that cluster on the same factor suggest that factor 1 represent ego-involvement: teacher identity; factor 2 represents problem efficacy; factor 3 represents goal relevance: classroom culture of exploration; factor 4 represents goal congruence: teacher beliefs about assessments; factor 5 represents goal relevance: pressure of time; and, factor seven represents agency: internal attribution. The remaining factors were discarded since only one item loaded on these factors. This left the percent variance explained at 52.77%. Following the extraction, I obtained the Cronbach's alpha for each factor (see Appendix L). Ego-involvement: teacher identity; problem efficacy; goal relevance: classroom culture of exploration; and goal relevance: pressure of time scales acceptable reliabilities, Cronbach's $\alpha = .69$ and above. However, goal congruence: teacher beliefs about assessment and agency: internal attribution scales had reliabilities that were below .69, with Cronbach's $\alpha = .62$ and .65 respectively. While these alpha scores are typically suggested to dictate low reliability, Nunnally (1978) suggests that during the early phases of research, values as low as .50 are adequate. Further collection of data and analyses are needed to substantiate this claim.

Scenario 2: Factor analysis results. I ran an initial factor analysis to obtain eigenvalues for each factor in Scenario 2. Thirteen factors had eigenvalues over 1 and in combination explained 78.65% of the variance. The scree plot was indefinite and showed inflexions that would justify retaining either seven or 12 factors. Therefore, another was

run that forced 12 factors due to this being the amount of a factors predicted to be extracted. These twelve factors explained 75.56% of the variance. Appendix M shows the factor loading after the promax rotation. The items that cluster on the same factor suggest that factor 1 represent ego-involvement: positive teacher perception; factor 2 represents goal congruence: beliefs about assessments; factor 3 represents agency: external attribution; factor 4 represents goal congruence: need for structure; factor 5 represents problem efficacy; factor 6 represents goal relevance: classroom culture of exploration; and factor 7 represents goal relevance: efficiency of class time. The remaining factors were discarded since only one item loaded on these factors. This left the percent variance explained at 52.77%. All of the scales had acceptable reliabilities, Cronbach's $\alpha = .69$ and above.

Reliability analyses of other instruments used. Reliability analyses were run on the PANAS scale items and the Brief COPE scale items in order to determine if the results from these two scales were still reliable for the current study. For the sample of 49 teachers, the positive affect items ($M = 36.16$, $SD = 7.66$) had a high reliability with a Cronbach's $\alpha = .90$. The negative affect items ($M = 15.10$, $SD = 6.16$) had a high reliability as well with a Cronbach's $\alpha = .88$. However, two of the negative affect items (mood2e and mood2f) were deleted from the scale because the Cronbach's alpha increased if they were deleted. Therefore, the negative affect scale was now composed of 8 items ($M = 11.92$, $SD = 5.3$) and had a Cronbach's $\alpha = .89$.

Table 4.21
Cronbach's Alpha for Coping Scales

Scale	Scenario 1		Scenario 2	
	2 items	3 items	2 items	3 items
Venting	.48	.19	**.49**	.25
Emot. Support	.50	.67	.92	**.93**
Denial	-.06	.09	-.03	**.13**
Behav. Diseng.	**.65**	.48	.05	.05
Acceptance	.33	.52	.42	**.70**
Self- Blame	.66	.51	**.88**	.84
Humor	.82	**.87**	**.87**	.77
Pos. Reframe	.53	.63	**.67**	.59
Instr. Support	.81	.77	.79	**.88**
Planning	.38	.61	.28	**.65**
Active Coping	.54	.61	**.69**	.63

Note: Bold scores denote the highest Cronbach's α score between scenarios.

The reliability analyses on the Brief COPE were executed for Scenarios 1 and 2 separately. Table 4.21 displays the Cronbach's α scores for each of the scenarios. I ran analyses with all three items designed to measure each coping strategy. The Cronbach's α is also reported for the coping scales with the two items originally on the Brief COPE (i.e., 2 items). As Table 4.21 shows, there were instances when adding in a third item to measure the coping strategy increased the reliability of the scale in both scenarios. The table also shows that Scenario 2 resulted in more reliable scales (except for the Behavioral Disengagement scale). In comparison with previous studies (i.e., Carver, 1997 and Yusoff, Yow, and Lip, 2010), the Brief COPE was again found to be reliable in both scenarios with scores between .50 and 1.00. The only scale to show a drastically lower reliability score than previous studies was the Denial scale. Reliability scores for this scale never exceeded .13 in this study. As further analyses were run to determine the validity of the measure, coping scales were summed and averaged. I did this because I

used the number of items for each scale that produced the highest Cronbach's alpha score (see Table 4.21).

Whole instrument correlation analyses. Several correlation analyses were run in order to assess the patterns that existed for the entire instrument. The first correlation analysis examined whether the instrument was sensitive to teachers' moods. The second correlation analyses examined test-retest responses to determine the reliability of the entire instrument. The final analyses focus on the relationships between teachers' appraisals, emotions, and coping strategies for Scenarios 1 and 2.

Mood correlation analysis. In order to analyze the correlations between mood and the responses on the rest of the survey, the reliable positive affect scale (10 items) and negative affect scale (8 items) from the PANAS were averaged. The correlation analysis used these averaged scale scores. Additionally, appraisal scales determined from the exploratory factor analyses (see Appendices R9 and R10) were used in the correlation analysis. Finally, the correlation analysis used the most reliable scales of coping items (see Table 4.21). These scales were also averaged, and the scale averages were input into the correlation analysis. This analysis showed a significant ($\alpha = .05$) negative relationship between positive mood and Scenario 1's ego-involvement: teacher identity $r(49) = -.28$ and Scenario 2's acceptance coping strategy $r(49) = -.30$. This means, as teachers reported a more positive mood, they also reported that Scenario 1 promoted their teacher identity and they reported using less acceptance coping during Scenario 2. This analysis also found a direct relationship between the reporting of more negative mood orientation with the reporting of engaging in more internal attributions in Scenario 2 $r(49) = .31$ ($\alpha =$

.05), seeking emotional support in Scenario 1 $r(49) = .29$ ($\alpha = .05$), and venting in Scenario 1 $r(49) = .38$ ($\alpha = .01$).

Emotions and appraisals correlation analyses. In order to run these correlation analyses, the averages for the extracted appraisal scales were used, along with the emotions scales (i.e., fear, confusion, frustration) for Scenarios 1 and 2. The correlation analysis for Scenario 1 showed that there was a direct positive correlation between the teachers' fear and their problem efficacy $r(49) = .38$ at $\alpha = .01$. This means that as teachers reported more fear being initiated by Scenario 1, they also reported a decrease in their belief that they could handle the situation.

Table 4.22
Scenario 2: Bivariate Correlations between Emotions and Appraisals

		EIPosTeacherPecpt	GCAsseBelief	AGExternal	GCNeedforStructure
Fear	Pearson Correlation	.306*	.312*	.210	.220
Frus	Pearson Correlation	.436**	.245	.375**	.358*

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

Table 4.22 displays the correlation results for Scenario 2. In Scenario 2, significant positive correlations between fear and ego-involvement: positive teacher perception and goal congruence: assessment beliefs were found. This means that as teachers reported experience more fear, they also reported a decrease in seeing themselves as teachers in a positive way, and they reported that their beliefs were threatened related to students doing well on assessments. A significant positive correlation also exists between a teacher's frustration and the appraisals of ego-involvement, external attribution, and goal congruence: need for structure. This means

that as teachers reported an increase in frustration, they also reported a decrease in seeing themselves as teachers in a positive way, an increase in internal attribution of the situation, and a threat to their need for structure.

Emotions and coping strategies correlation analyses. In order to run these correlation analyses, the averages for the reliable coping scales were used, as well as the emotions scales (i.e., fear, confusion, frustration) for Scenarios 1 and 2. In Scenario 1, fear had a significant correlation with seeking instrumental support $r(49) = .33$ and active coping $r(49) = .32$ at $\alpha = .05$. This means that as teachers reported experiencing more fear as a result of reading Scenario 1, they also increased in their reporting of seeking out someone who could help them with the problem and in their trying to take action to make the situation better.

Table 4.23
Scenario 2: Bivariate Correlations between Emotions and Coping Strategies

	AvgCVentS2	AvgCEmsptS2	AvgCAccptS2	AvgCBlameS2	AvgCHumorS2
ConfS2	.061	.048	-.115	.403**	.284*
FrusS2	.286*	.466**	-.390**	.364*	.121

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

Table 4.23 shows the correlations between the teachers' negative emotions and reported coping strategies. In Scenario 2, confusion was significantly positively correlated with self-blame and use of humor. This means that as teachers reported feeling more confusion after reading Scenario 2, they also reported more instances of being critical of themselves and more times laughing about the situation. The correlation analysis also showed that frustration had significant positive correlations with seeking emotional support, venting, and self-blame. Additionally, frustration had a significant

negative correlation with the coping strategy of acceptance. This means that as teachers reported experiencing more frustration, they also reported that they would express their negative emotions somehow, seek emotional support from someone about what just occurred, become more critical of themselves as a teacher, and decrease their acceptance of the situation.

Appraisals and coping strategies correlation analyses. In order to run these correlation analyses, I used the averages for the reliable coping scales, as well as the averages for the extracted appraisal scales for each scenario. The analysis for Scenario 1 resulted in determining four significant relationships. The problem efficacy appraisal factor had significant negative correlations with the coping strategies of positive reframing $r(49) = -.37$ and planning $r(49) = -.41$ at $\alpha = .01$. This means that as teachers reported engaging in more positive reframing and planning, they also reported a lower problem efficacy appraisal (i.e., they felt they could not deal with the scenario well). The goal congruence: classroom culture of exploration had a significant negative relationship with positive reframing $r(49) = -.32$ at $\alpha = .05$. This means that as the participating teachers reported engaging in more positive reframing, they also reported that their goals regarding the culture of exploration in their classrooms were threatened by the scenario. The last significant relationship found in Scenario 1 was between goal congruence: beliefs about assessment and positive reframing $r(49) = -.44$ at $\alpha = .01$. Participating teachers reported that when they increased their used of positive reframing, they also reported that their goals regarding assessments were threatened by the scenario.

There were six significant relationships between the appraisal factors and coping strategies in Scenario 2. The coping strategy of self-blame was positively correlated with the ego-involvement appraisal $r(49) = .43$ at $\alpha = .01$.This means that the participating teachers reported a decrease in their ego-involvement appraisals when they also reported engaging in more self-blame. Participating teachers reported seeking more emotional support when they also reported decreasing their attribution of the situation to the external forces of time and student behavior. This was a significant positive relationship $r(49) = .36$ at $\alpha = .05$. The coping strategy of acceptance had a significant negative correlation with goal congruence: need for structure $r(49) = -.47$ at $\alpha = .01$. This means that as teachers used more acceptance, they also reported that their appraisals regarding a need for structure in the learning environment were enhanced. Humor had a significant positive correlation with the problem efficacy appraisal factor $r(49) = .30$ at $\alpha = .05$. This means that as teachers laughed more about the situation, they also reported an increase in their beliefs that they could deal with the situation effectively. Positive reframing was significantly negatively correlated with goal congruence: need for structure $r(49) = -.36$ at $\alpha = .05$. This means that as teachers reported using more positive reframing, they also reported that their appraisal regarding a need for structure was enhanced. The last significant correlation occurred between active coping and agency: external attribution $r(49) = -.33$ at $\alpha = .05$. This means that as teachers reported using more active coping, they also reported see the situation as attributed to external factors.

CHAPTER 5: DISCUSSION AND CONCLUSION

The purpose of this study was to design an instrument that would measure science teachers' appraisals, emotions, and coping strategies in the context of challenging inquiry-based scenarios. This purpose resulted from the knowledge that emotions are important in teachers' motivation and instructional behaviors (Sutton & Wheatley, 2003); inquiry-based instruction is an encouraged teaching strategy in science education (Achieve, 2013; NRC, 1996, 2000, 2012); teachers can experience negative emotions when facilitating inquiry-based instruction (Ritchie, et al., 2013); teachers regulating their negative emotions can decrease emotional exhaustion (Skaalvik & Skaalvik, 2009); and there is no context-based instrument that measures teachers' appraisals and emotion responses when facilitating inquiry-based instruction. Since researchers (e.g., Chang, 2013; Lazarus, 2006) have encouraged such context-based instruments be designed due to emotions and emotional regulation being relational and situational, I sought to fill this gap regarding inquiry-based instruction in science education.

In order to accomplish the research purpose, I used a sequential exploratory mixed methods approach (Creswell & Plano Clark, 2011). This study started out with a review of relevant literature to obtain information regarding the topics and constructs of interest (i.e., inquiry-based instruction, teachers and emotions, and teachers and coping strategies). Reviewing the literature led to the planning and conducting of two focus groups of middle school and high school science teachers. The purpose of the focus groups was to provide additional, context-based information for the initial design of the

instrument. Upon completing and analyzing the responses of the focus groups, the initial instrument items were designed and presented to an expert panel for review. This refinement process led to the piloted version of the Teachers' Emotions, Appraisals, and Coping Habits when Facilitating Inquiry-based Instruction (TEACH-FIBI) instrument for science education.

TEACH-FIBI was piloted with 49 middle and high school science teachers, and while this is a limitation that will be discussed, the results from the pilot are promising. The piloted version of the TEACH-FIBI contained two different inquiry-based scenarios to try to determine which would be best to use for the final administration of the instrument. Factor and bivariate correlation analyses for each scenario occurred using SPSS 23 ©. These analyses were run in order to evaluate scale and instrument validity and reliability for each scenario. Chapter 4 details the results of these analyses.

Discussion of Piloted TEACH-FIBI

The data from the pilot showed that the reading of Scenario 1 elicited responses from participating teachers that were less reliable and valid than the responses elicited from Scenario 2. It may be the case that Scenario 1 (i.e., low negative emotion intensity) was not able to initiate the intensity of negative emotions needed for participants to reliably respond to the appraisal and coping items. Much of the previous research regarding individuals reporting their negative emotions had participants focus on highly stressful events (Chang, 2013; Cukur, 2009; Gonzalez-Morales, Rodriguez, & Peiro, 2010). Scenario 1 focused on how teachers respond when students ask them a question they do not know. As was expressed during the focus groups, many of the teachers saw

this as a positive experience because students were engaged enough in the lesson to ask a thought-provoking question. This is supported by research where teachers have expressed feeling positive emotions when they are able to effectively engage students through inquiry-based instruction (Ritchie et al., 2011). Experiencing negative emotions can impede task-focused behavior, monopolize focus, and thus decrease the ability to engage in problem-focused coping (Boekaerts, 2007; Derryberry & Tucker, 1994; LeDoux, 1996). Additionally, when teachers experience more positive emotions, they are better able to come up with teaching strategies geared toward problem-focused coping (Fredrickson, 2001; Sutton & Wheatley, 2003). Therefore, the participants reporting the use of more problem-focused coping strategies suggests that Scenario 1 did not elicit high intensity negative emotions.

While participating teachers' emotional responses may not have been intense enough, the data collected from Scenario 1 was not completely unreliable and lacking in validity. Five of the six factors extracted for Scenario 1 made theoretical sense (see Appendix N). The agency: internal attribution factor contained two items that made this factor difficult to name and interpret. Additionally, this factor had a lower than acceptable Cronbach's α, which speaks to the unreliability of this factor. The other unreliable factor extracted in Scenario 1 was the goal congruence: teacher beliefs about assessment. It may be the case that the focus on one student in Scenario 1, did not provide the needed stimulation to elicit reliable responses from participants about assessments or agency. Contemporary research regarding inquiry-based instruction (e.g., Blanchard et al., 2009; Harris & Rooks, 2010) does not focus on one student being the

cause of difficulties that teachers experience when facilitating inquiry-based instruction. Perhaps, future scenarios should bring explicit attention to the whole class environment or a group instead of an individual student. In the items designed to measure coping strategies, data showed that only one coping scale—behavioral disengagement—was more reliable in Scenario 1. It could be the case that teachers can respond more reliably to giving up (i.e., behavioral disengagement) on the situation occurring in Scenario 1 because it has fewer consequences than if teachers gave up on the situation occurring in Scenario 2. In Scenario 1, one student would suffer from a teacher disengaging from the situation; however, the whole class could suffer if a teacher gave up on the situation occurring in Scenario 2. Other evidence that suggests Scenario 1 did not elicit completely unreliable and invalid data comes from the correlation analyses. The positive correlation found between teachers' fear and their problem efficacy is supported by a previous study which showed that science teachers experienced fear when they felt less than able to facilitate extended experimental investigations (Ritchie, et al., 2013). The same study supported the positive correlation found between fear and the use of problem-focused coping strategies (i.e., seeking instrumental support, active coping).

Even though some of the data from this study supports the validity and reliability of Scenario 1, I found that Scenario 2 elicited data that was more valid and reliable. This does not mean that all the data for Scenario 2 is reliable and supported by theoretical assumptions; however, based on the current data, moving forward with Scenario 2 in future administrations is suggested. Due to Scenario 2 eliciting data that was more valid and reliable than Scenario 1, the remainder of this discussion will focus on the results

obtained from Scenario 2—the situation where the students are not understanding the exploration they are engaging in.

Appraisal items and factors. Results from the analyses showed that the appraisal items created for the instrument did not all load acceptably on the 12 extracted factors for Scenario 2. Table 5.1 shows the extracted factors for Scenario 2. Appendix O displays the items that loaded onto each factor. Although the appraisal items in scenario 2 did not all load as expected, the loading of items did provide for seven factors that made sense theoretically; however, only 52.77% of the variance was explained by the seven meaningful factors extracted. This suggests that additional factors would aid in explaining the variation in responses of the participating teachers. As I predicted that 12 factors would be extracted, perhaps the other 5 predicted factors would aid in explaining the variance.

In view of the theoretical framework for this study—Boekaerts' (2007) Dual Processing Self-Regulation Model—these seven appraisals influence how the participating teachers in this study responded to the context-specific situation presented in Scenario 2. Boekaerts states that these appraisals have the important function of determining which track (i.e., growth or well-being track) the participating teachers will take in their pursuit of learning to facilitate inquiry-based instruction. As appraisals are threatened, teachers are expected to move towards the well-being pathway and thus expected to be distracted from the learning goal (i.e., facilitating quality inquiry-based instruction). The following sections provide more information on the appraisal factors themselves and how they support or challenge previous research about these concepts.

Table 5.1
Factors in Scenario 2

Scenario 2 – Factor 1	Ego-Involvement: Positive Teacher Self-Perception
Scenario 2 – Factor 2	Goal Congruence: Beliefs about Assessments
Scenario 2 – Factor 3	Agency: External Attribution
Scenario 2 – Factor 4	Goal Congruence: Need for Structure
Scenario 2 – Factor 5	Problem Efficacy: Able to Deal with Situation
Scenario 2 – Factor 6	Goal Relevance: Classroom Culture of Exploration
Scenario 2 – Factor 7	Goal Relevance: Class Time Used Efficiently

Primary appraisal factors. Primary appraisals are important in determining the type and intensity of emotions individuals feel. When teachers make judgments about whether situations positively or negatively impact their relevant goals and sense of self, they are making primary appraisals (Lazarus, 1991). The data from this study showed that the participating teachers did make primary appraisals after reading Scenario 2. Specifically, extracted factors of all types of primary appraisals were represented (i.e., ego-involvement, goal relevance, goal congruence).

Ego-involvement factor. The four items in the ego-involvement factor for Scenario 2 did not load as expected (i.e., the four ego-involvement items designed to measure this appraisal did not load together); however, they did attend to the self-perception (i.e., ego-involvement) that teachers had during the given scenario. The reliability coefficient was high for this item. Ego-involvement concerns how much of the self or one's identity is involved in a transactional event (Schutz et al., 2006). Two of the items that loaded on this factor were designed to measure whether teachers felt they had skills and resources to deal with the situation (i.e., PE2, PE3). Another item that loaded on this factor measured whether the teachers felt they appeared competent to their students during the scenario (i.e., GCSP1). The fourth item which loaded onto this factor

was originally designed to measure ego-involvement and asked about whether teachers felt successful during the scenario (i.e., EI4).

All of the ego-involvement items reflect a teacher's sense of teaching identity (Schutz & Lee, 2014). These results suggest that the participating teachers' identity is a complex construct which includes whether they believe they have skills and resources to deal with the current challenging situation. Teachers may have a better perception of their teaching identity if they feel they can manage challenging situations. This can result in an individual feeling like a more successful and competent teacher (Alsup, 2006). Furthermore, the data suggests that the participating teachers' identity does appear to be tied in with the perceptions that their students have of them but also whether they themselves believe they are successful teachers. While research on teacher identity has often attended to teachers' beliefs about themselves (e.g., Akkerman & Meijer, 2011; Avraamidou, 2014; Bryce, Wilmes, & Bellino, 2016; Buchanan, 2015; Cross & Hong, 2009; Holt-Reynolds, 2000;), this factor provides evidence which suggests student perceptions should also be attended to when trying to better understand teachers' identity.

Goal congruence factors. Goal congruence appraisals are another evaluation that is important in the initiation of emotions. This type of primary appraisal focuses on whether a person feels a situation impedes or enhances his or her goals (Lazarus, 1991). The goal congruence: belief about assessments factor that was extracted from Scenario 2 contained two items and the factor was highly reliable. I designed both items (i.e., GCASSE1, GCASSE2) to measure teachers' belief about whether the scenario will positively or negatively impact student performance on future assessments. Assessments

are important in the success of reform movements in science education (Bybee, 2014). Additionally, teachers' beliefs about the importance of assessments and their beliefs about whether they feel their teaching will prepare their students are major drivers in how they choose to teach (Crawford, 2007; Keys & Bryan, 2001). This data suggest that teachers in this study registered whether Scenario 2 would hinder or enhance student performance on future assessments. Even though a goal relevance factor regarding beliefs about assessments was not extracted, perhaps the extraction of the associated goal congruence factor shows that teachers consider this important. Either way, the data indicate that in the context of challenging inquiry-based instruction, participating teachers do make judgments which focus on assessments. Thus, these teachers and any professional assisting them with inquiry-based teaching should be aware and ready to deal with the existence of this appraisal factor.

Another reliable and valid goal congruence factor—need for structure—was extracted for Scenario 2 (see Table 5.1). There was a mixture of items in this extracted factor regarding how the situation impacted teachers' goals about time (i.e., GCTIME1) and the learning environment (i.e., GCLE1, GCLE2). Therefore, the factor was defined as measuring teachers' beliefs about whether the scenario enhanced or threatened their need for structure. Having a classroom environment that is easier to control, guide, and predict is something that many teachers are used to and therefore have a hard time letting go of (Crawford, 2007; Deters, 2004). As inquiry-based instruction can be unpredictable for teachers and students (Crawford, 2007; Ritchie, et al., 2013), it is important to be able to assess how a teacher is appraising this unpredictability. The data from this study suggest

that in the context of inquiry-based instruction, this instrument is able to reliably measure whether teachers feel a situation is hindering their need for structure Specifically, this factor could assess teachers' judgments about whether they are keeping to a set schedule and feel they are in control in a structure learning environment.

Goal relevance factors. Goal relevance refers to how important an individual registers certain goals (Lazarus, 1991). There were two valid and reliable goal relevance factors extracted from Scenario 2. One of the goal relevance factors was named classroom culture of exploration due to the loaded items focusing on student curiosity (i.e., GISP3) and how acceptable it is if students believe that teachers do not know everything (i.e., GISP2). I saw these two items as measuring whether a class has a concerted goal of finding out knowledge. This culture embraces a problem-solving mindset whose purpose is to ascertain answers or solutions to questions or problems that arise (Ross, Hogaboam-Gray, & Rolheiser, 2002). The other goal relevance factor extracted had to do with how important teachers viewed efficient use of class time (i.e., GITIME1m GITIME3). The presence of this goal relevance time factor is supported by past researchers who found that teachers often see time as a source of tension when enacting inquiry-based instruction (Anderson, 2007; Wallace & Kang, 2004). While previous research supports the goal relevance: class time used efficiently factor found in this study, the goal relevance: classroom culture of exploration factor extracted in this study suggests that the participating teachers do make appraisals regarding whether student curiosity is cultivated and whether they are seen as all-knowledgeable. The latter

appraisal is important as inquiry-based instruction may be more effective in classrooms where a culture of exploration is prioritized.

Secondary appraisal factors. While participating teachers engaged in primary appraisals upon reading Scenario 2, these were not the only types of appraisals expressed. Participating teachers also engaged in secondary appraisals. Secondary appraisals are important in making more detailed distinctions regarding which emotions are felt as well as in deciding how to respond to the felt emotions (Lazarus, 1991). The factors that were extracted suggest that both problem efficacy and agency appraisals were used by participating teachers after reading scenario 2.

Problem efficacy factor. The problem efficacy factor extracted from Scenario 2 also provided a valid and reliable measure of whether the participating teachers believed they could deal with the challenging situation (Schutz & Decuir, 2010). Two items loaded onto this factor in Scenario 2. While one of the items was initially designed to assess problem efficacy (i.e., PE1), the second item (similar to PE3) addressed the belief that teachers would feel more capable to deal with the situation if they had more resources (i.e., AGC1). Science teachers often have low confidence in their ability to facilitate inquiry-based instruction and lack the needed content and pedagogical knowledge to facilitate this type of instruction (Haney et al., 2002; Jones & Carter, 2007). While this factor is a broad measure of these issues, it appears to attend to this area regarding teacher beliefs. Specifically, this extracted factor addresses the resources and strategies teachers believe they do or do not have. Perhaps, items which are more specific

regarding particular resources (e.g., instructional materials, PD, administrative support) would be beneficial in future iterations.

Agency factor. Scenario 2 also presented a factor regarding agency. The three items that loaded on this factor were originally written to assess who and what the participating teachers held responsible for the occurrence of the scenario (see Appendix O). The current data for Scenario 2 suggest that time and students are agents that participating teachers consider when determining what or who is at fault for Scenario 2. Past research supports this finding. Specifically, time and managing student behavior are entities that science teachers often blame for the challenges they face when facilitating inquiry-based instruction (Anderson, 2007, Harris & Rooks, 2010). This factor was also impacted by the participating teachers' negative emotion state. Data from this study suggests that if participating teachers were in a more negative mood, they were less likely to attribute the occurrence of the scenario to students and time. This could be due to negative moods having the potential to increase self-critical beliefs and therefore cause teachers to see situations as more internally attributed (Ekkekakis, 2013).

The research accomplished regarding emotions and appraisals supports the identified appraisal factors extracted from Scenario 2 (Lazarus, 1991; Schutz, 2014; Sutton & Wheatley, 2003). While authors of previous studies geared toward assessing teachers' emotions and regulation habits have not always assessed teachers' appraisals (e.g., Chan, 1994; Cukur, 2009), the study of these appraisals is important in better understanding why teachers report experiencing negative emotions (Lazarus, 2006; Schutz, 2014). Together, this data indicates that the TEACH-FIBI is able to validly and

reliably assess seven appraisals that the participating middle and high school science teachers used. However, the extracted factors indicate that the judgments participating teachers make do not always fall into distinct or predicted categories. For example, items designed to measure problem efficacy and goal congruence loaded together and were determined to measure ego-involvement. Given the research concerning teachers, there are more appraisals teachers make that the current study was not able to determine (Chang, 2013; Ritchie, et al., 2013; Schutz, 2014; Sutton & Knight, 2006; Zembylas, 2004). This could be due to the specificity of the situation provided. The differences in the factors extracted between Scenario 1 and 2 support this assumption as the extracted factors and loaded items were different between scenarios. While providing teachers with a specific scenario may limit the type of appraisals used, this study does suggest that providing a specific challenging situation has utility in designing context-specific instruments that can assess teachers' appraisals.

Coping scales and items. The results of the present study suggest that Scenario 2 provided for the most reliable data regarding anticipated coping strategies. Only one coping strategy, denial, did not have acceptable reliability scores for Scenario 2; however, a low reliability score for this strategy was also obtained for Scenario 1. The low reliability scores of the denial coping scale suggest denial is not a strategy that participating teachers could reliably respond to because it may not be a realistic coping strategy within this context. While the results of this study can only be applied to the current sample, this finding does suggest that context-specific instruments may be beneficial when assessing coping strategies (Lazarus, 2006). Additionally, the acceptance

coping strategy in Scenario 2 was influenced by the participating teachers' mood. This relationship suggests that, in the current form, participating teachers' mood may dictate the use of acceptance as a coping strategy.

Boekaerts' (2007) Dual Processing Self-Regulation Model speaks to the importance of coping when pursuing learning goals. When a difficult situation is encountered in the attempt to achieve learning goals, individuals who engage in mostly emotion-focused coping tend to move along the well-being pathway (Boekaerts, 2007). This pathway inhibits individuals from focusing on tasks that increase his or her chances of achieving the set learning goals. Individuals who enlist problem-focused coping during these challenging situations have a better chance of maintaining their progress toward learning goals. The TEACH-FIBI was able to reliably assess coping strategies for the participating teachers. Therefore, the data collected with the TEACH-FIBI can address the emotion regulation aspect of Boekaerts' (2007) model and may provide insight into the teaching practices (i.e., the facilitation of inquiry-based instruction) of the participating teachers.

Whole instrument correlations. The correlation analyses suggest that moving ahead with Scenario 2 as the prompt for the TEACH-FIBI is advisable. The first assumption was that more intense negative emotions would be reported if teachers' goals and beliefs were threatened by the student confusion described in the scenario (Lazarus, 1991; Schutz, et al., 2006). A second assumption was that situations that elicited more intense negative emotions would increase the amount of emotion-focused coping (Boekaerts, 2007; Fredrickson, 2001; Sutton & Wheatley, 2003). The third assumption

regarding expected relationships was based on the idea that coping can serve as a mediator of negative emotions by impacting appraisals (Lazarus, 1984).While these assumptions were not supported by all scales, some of the correlations that existed were supported by theoretical assumptions.

Negative emotions and appraisal correlations. Participating teachers tended to report the feeling of fear when their teacher identity (i.e., ego-involvement) and belief about assessments (i.e., goal congruence) were threatened. Additionally, participating teachers reported feeling more frustration when their teacher identity was threatened, when they felt they were responsible for the situation (i.e., agency), and when the goals they had for having a structured learning environment (i.e., goal congruence) were threatened. While not predictive in nature, these relationships do suggest that goal congruence and ego-involvement are important in the initiation of fear and frustration. However, what the participating teachers attributed the situation to (i.e., more externally or less externally) may be a distinguishing factor between the initiation of fear and frustration. Sutton and Wheatley (2003) described these relationships and support the finding of attribution being a distinguishing factor of the initiation of different emotions; however, in previous research, agency was not a contributor of the negative emotions experienced (Chang, 2013). These relationships suggest that the participating teachers may need assistance in registering success and failure differently. Teachers may benefit from focusing on their growth mindset more instead of their fixed mindset during challenging inquiry-based situations (Dweck, 2006). Focusing on a growth mindset would allow teachers to see the challenge or failure as a way to develop their teaching

abilities rather than a judgment that they are not good teachers. Further, if these teachers were provided with more resources and learned new skills regarding inquiry-based instruction, the data suggest that they may experience less intense negative emotions. Perhaps, by receiving more resources, learning more skills, and encouraging more of a growth mindset, these teachers would also be more comfortable letting go of some of the control they are used to having (i.e., goal congruence: structure learning environment) (Crawford, 2000, 2007; Deters, 2004)

Surprsingly, neither of the goal relevant factors were found to have any relationship with the emotions reported. Chang (2013) found this same phenomenon in her study. It is expected that situations that threaten or enhance goals which are important should have a relationship with the intensity of emotions felt (Lazarus, 1991; Shcutz, 2014). This may be the result of the current version of the TEACH-FIBI not including reliable factors which directly tie to the discrepancy between important goals and whether or not the goal is being threatened by the scenario. This was the initial plan when designing factors; however, the extracted factors did not offer this opportunity. The future research steps discussed later may assist in rectifying this issue.

Negative emotions and coping strategies. In Scenario 2, an increase in teacher confusion was positively related with participating teachers reporting their engagement in self-blame and humor (i.e., emotion-focused coping strategies). Similarly, an increase in the participating teachers' frustration which resulted from reading Scenario 2 was directly related with an increase in seeking emotional support, venting, and self-blame. There were no significant relationships found between teachers' fear and their coping strategies.

These data suggest that participating teachers may be more prone to use emotion-focus coping, especially self-critical coping, when experiencing a challenge like Scenario 2. Previous research (e.g., Boekaerts, 2007; Fredrickson, 2001; Sutton & Wheatley, 2003) supports this finding. Additionally, this data indicates that participating teachers do not increase their use of problem-focus coping strategies when experiencing highly stressful situations; therefore, these teachers may benefit from development in how to initiate more problem-focused coping in high stress situations. Given the knowledge that coping can be a mediator of how individuals appraise situations and therefore influence the initiation of negative emotions (Chang, 2013; Lazarus, 1984), I sought to discover if relationships existed between coping strategies reported and the appraisal factors extracted. Some of the results from this correlation analysis were expected; however, some of the results provided interesting insights regarding the participating teachers.

Coping strategies and appraisals. Lazarus and Folkman (1984) and Folkman and Lazarus (1988) discuss coping strategies having the potential to influence the appraisals individuals make. As a linear regression was not possible for the current study, coping strategies could not be assessed as predictors of appraisals. However, correlation analyses of the current study suggest paying attention to this relationship in future phases. Six significant relationships existed between coping strategies and appraisals.

First, the data from the current study showed that the emotion-focused coping strategy of self-blame had an inverse relationship with ego-involvement. This indicates that for participating teachers, as self-blame increased, ego-involvement appraisals decreased. Previous research supports this relationship. Researchers have shown that

people who engage in self-blame often derogate themselves and therefore are less happy and less well adjusted (Kleinke, 1988, 2007; Revenson & Felton, 1989). Kleinke (2007) noted the difference between self-blame and self-responsibility. Whereas engaging in self-blame inhibits personal growth, taking self-responsibility encourages internal control and learning to effectively adjust to difficult situations. For the teachers in this study, developing the ability to take self-responsibility instead of engaging in self-blame may help to increase ego-inovlement appraisals.

Seeking emotional support had a positive relationship with the external agency factor; therefore, when the participating teachers decreased attributing the situation to external factors of time and students, they also reported seeking more emotional support. Often, individuals seek out emotional support when they feel insecure, which can result from perceiving a situation as being less externally attributed (Carver et al., 1989). When individuals seek emotional support as a method of increasing one's efficacy, it can help individuals push toward engaging in more problem-focused coping strategies. However, many individuals use seeking out emotional support in order to vent, and this response can be maladaptive (Carver et al., 1989). Further research regarding why the participating teachers engage in this type of emotion-focused coping is necessary.

The results from this study also showed that as the participating teachers reported using more humor, they also reported an increase in their problem efficacy beliefs. While this relationship was not expected, other researchers have shown that the use of humor can be influential in helping revive an individual's self-efficacy beliefs (Bobek, 2002; Evans-Palmer, 2010; O'Neill & Stephenson, 2012). It could be the case that in this study,

participating teachers' use of humor allowed them to see the situation in a less threatening light and therefore their problem efficacy beliefs were also able to increase as a result (Martin, 2007).

This study showed that as participating teachers reported using more acceptance and positive reframing, they also reported that the situation did not threaten their need for structure. The relationship regarding positive reframing is not surprising and supports previous research that it is an adaptive (i.e. positive) coping strategy (Kleinke, 2007). While acceptance was categorized as an emotion-focused coping strategy in this study, Carver et al. (1989) note that acceptance may be better categorized as a problem-focused coping strategy. They made the argument that an individual who accepts that a challenging situation is occurring would probably engage in dealing with the situation instead of ignoring it. It may be the case that by accepting that the challenging situation was occurring, participating teachers were better able to deal with their lack of control and the sacrifice of time. There is research that supports that acceptance of a challenging situation can improve workplace well-being (Bond & Donaldso-feilder, 2004); however, determining how and why the participating teachers used acceptance in this study is needed in order to support or to challenge previous research.

Finally, as participating teachers reported using more active coping, they also reported seeing the scenario as being attributed more to the external factors of time and student misbehavior. It may be the case that when participating teachers attribute events to external causes, they also believe they can more effectively influence (i.e., actively cope) with the situation. For instance, if a teacher knows that time is running low, he or

she may choose to bring the class together to discuss the exploration with the goal of pointing them in the right direction. This was stated by several of the teachers interviewed in the focus groups.

Perhaps the associations found between coping strategies and appraisals in this study suggest the existence of the relationship that Lazarus and Folkman (1984) addressed; however, without more data points and more complex statistical analyses, this study cannot confidently support their assertions. Gaining a deeper understanding of the reason why the participating teachers use coping strategies would be beneficial. This would necessitate the use of more qualitative methods in partnership with the TEACH-FIBI.

Implications

While not the case for all designed items and scales, the initial pilot of the TEACH-FIBI showed that it was able to collect data on middle and high school science teachers' appraisals, emotions, and coping strategies regarding facilitating a challenging inquiry-based scenario in a reliable and valid fashion. In an environment where researchers are encouraging more attention to one's emotions and how they influence teachers (Schutz, 2014; Schutz & DeCuir, 2002; Sutton & Wheatley, 2003), there is an increased expectation for systematic ways to measure the emotional responses of teachers. It is still necessary to create instruments that can assess teachers emotional responses in context-specific environments (Lazarus, 2006). In creating the TEACH-FIBI, I sought to address the gap for a context-specific, emotional response instrument for inquiry-based instruction in science education.

Currently, the data suggest that the instrument did collect information from the participating science teachers regarding how they appraise and emotionally respond to stressful inquiry-based scenarios. Specifically, Scenario 2 provides for the collection of more reliable and valid data. Given this information, inquiry PD facilitators could start becoming aware of the internal mental processes that impact how secondary science teachers respond when faced with in-class challenges as they facilitate inquiry-based instruction. Addtionally, PD facilitators can determine how teachers believe they will respond in the context of challenging inquiry-based instruction.

Armed with this knowledge, PD facilitators can aim to aide teachers in dealing with the negative emotions when they are initiated. If PD facilitators see that teachers have negative emotional responses and cope in maladaptive ways as a result of reading this inquiry instruction-based scenario, then the facilitators should increase the participants' awareness of the emotional aspects of attempting to engage in new teaching practices. During institutes, PD facilitators can spend time increasing teachers' awareness of the reality of the negative emotions they may experience when attempting to facilitate inquiry-based instruction. PD facilitators may do this by sharing their own emotional responses when attempting to facilitate inquiry-based instruction. This could lead to a discussion where participants share their initial feelings (e.g., fear, frustration) about this instructional strategy. PD facilitators should guide this discussion and ask questions that get teachers thinking about the reasons behind the potential emotions (i.e., secondary and primary appraisals), highlighting that these appraisals are a result of each of the teachers personal backgrounds and the contemporary educational context (Schutz et al., 2006;

Sutton & Wheatley, 2003; Zembylas, 2004). For example, if teachers have little belief in their ability to deal with the challenging situation (i.e., low problem efficacy) PD facilitators can allow for time to discuss how to deal with challenges when they occur. This is a step in increasing teachers' problem efficacy and can be the difference in whether teachers are anxioius or hopeful during challenging situations (Smith, 1991).

Additionally, a discussion of Boekaerts' (2007) Dual Processing Self-Regulation Model should take place so the teachers can understand the implications of the well-being versus growth pathway. After particpants fill out the TEACH-FIBI, PD facilitators should provide them with their coping habits. In concert with the discussion of Boekaerts' model, having the teachers become aware of their coping habits can begin to bring attention to the emotional blockades that threaten their professional growth regarding facilitating inquiry-based instruction (Boekaerts, 2007). Again, conversations between fellow participants and with PD facilitators becomes essential. Conversations should focus on how to engage in more problem-focused coping strategies so that teachers can ensure more time spent in the growth pathway. Additionally, modeling this type of conversation during PD (i.e., instrumental support) shows teachers what kind of converstation they should engage in when they return to their perspective schools and face challenges when attempting to facilitate inquiry-based instruction. Engaging in more problem-focused coping also encourages that teachers don't burnout from trying to improve their inquiry-based teaching (Borrachero et al., 2014). In order to assist in providing opprotunities for teachers to engage in problem-focus coping strategies such as seeking instrumental support (Kleinke, 2007), PD facilitators should seek to obtain

several teachers from the same school in order to encourage professional learning communities (Loucks-Horsley et al., 2010).

Spending time during PD institutes discussing and educating participants regarding the emotional components that may influence their enactment of inquiry-based instruction is important. However, this instrument also allows the PD facilitators to attend to the individual teachers when post-institute observations take place. During post-observation reflections, PD facilitators can engage in cognitive coaching (Costa & Garmston, 2002). By engaging in cognitive coaching, PD facilitators can bring participants' focus to their inquiry teaching as well as make them consider whether their emotional responses helped or hindered their current and future practice. Cognitive coaches aim to ask effective questions geared towards transforming thought and practice so that teachers can become more self-managing, self-monitoring, and self-modifying (Costa & Garmston, 2002). If a PD facilitator knows that a teacher utilizes venting as a coping strategy when things become challenging, post-observation questions can focus on improving awareness of this practice, determining why the negative emotions were initiated, and cultivating more constructive means of coping.

While Boekaerts' (2007) model brings attention to the need to engage in coping to get off of the well-being track and/or stay on the growth track, it should be noted that simply educating teachers to engage in problem-focus coping may not be the answer. Researchers have stated that the two types of coping often occur together (e.g., Carver et al., 1989). The participating teachers in this study followed this pattern as they used multiple types of coping. Lazarus further stated that problem- and emotion-focused

coping are complementary. Kleinke (2007) stated that individuals need to develop both types of coping. More importantly, he stated that people need to know when to engage in the different types of coping in order to achieve their desired results. PD facilitators and the teachers they help need to be aware of when it might be beneficial to emotionally-cope with a challenging situation versus trying to expend energy and mental capacity actively coping with the situation. For instance, sometimes it can be effective to express some frustration or disappointment to get students back on task. As an overarching goal, PD facilitators using this instrument would want to seek to develop teachers' ability to make accurate appraisals, anticipate the short- and long-term impacts of coping strategies, and consider alternative coping plans (Kleinke, 2007).

Limitations

This instrument was designed to measure high school and middle school science teachers' appraisals, emotions, and coping habits in the context of challenging inquiry-based instruction. Although other researchers have been successful in creating quantitative instruments to measure these aspects of teachers, self-report instruments always run the risk of respondents answering in ways that make them seem favorable (Neuman, 2005). Therefore, the data collected from this study runs the risk of not being representative of what the participating teachers actually do in situations like the written scenarios. Additionally, the current instrument chose stressful scenarios for the participating teachers instead of having the teachers think about stressful scenarios themselves as Chang (2013) did in her study. While teachers reported the initiation of more negative emotions in Scenario 2, there is still uncertainty regarding whether the

teachers were able to respond as reliably as they could if they had thought of their own challenging inquiry-based scenario. I made the decision to provide scenarios to make sure teachers responded to specific features which characterize inquiry-based learning environments since researchers have shown that individuals conceptualize inquiry-based instruction in a variety of ways (Anderson, 2007; McLaughlin & MacFadden, 2014).

Sample size was also a limitation of this study. Only 49 teachers responded in the pilot phase. Though I executed a factor analysis on an instrument designed to measure 12 appraisals constructs, more participants were needed. Comrey and Lee (1992) stated that when performing a factor analysis, 200 responses is fair, 300 responses is good, and 500 responses is very good. Additionally, other researchers have recommended having at least 10-15 respondents for each construct measured (Field, 2013). Given these recommendations, a sample size of at least 120 science teachers should have been obtained. This limitation impacts the implications that can be made from this study (i.e., results can only be in reference to the participating science teachers). Additionally, the data collected on the items did not display normal distribution patterns. This also limits the generalizability of the findings from this study (Field, 2013). The small sample size also did not provide for the diversity in participants that was needed to fully substantiate or challenge claims made by other studies regarding gender and content specification (e.g., Borrachero et al., 2014; Gonzalez-Morales et al., 2010). However, I plan to address this as I push the validation of the instrument further in my future research.

Future Steps

While the aforementioned limitations do exist, I plan to push the current study further to attend to these limitations. To completely embrace the implications of this study, more participants are needed to respond to the survey. Adding respondents will aide in the factor analysis as well as potentially aide in determining whether the data is normally distributed (Comrey & Lee, 1992; Field, 2013). Adding participants may result in the extraction of more reliable and valid factors. This could help in explaining more of the variance between participating teachers' responses. Adding participants may also result in data that is more normally distributed. In the current study, lacking normally distributed data limited which statistical analyses could be used. If this issue is fixed when more respondents are added, more powerful analyses such as ANOVA, t-tests, regressions, and structural equation models (SEM) could be used, and results would be generalized to the larger population of middle and high school science teachers (Field, 2013). Furthermore, the addition of respondents and thus the ability to execute more powerful analyses will assist in determining relationships that may help support the validity of the instrument.

I plan on obtaining approximately 100 more participants to respond to this initial survey. Collecting this data will serve to support the findings from the current study or cause me to make additional changes to the instrument before final administration. Based on the knowledge of recommended sample sizes for factor analysis, adding 150 more data points to this initial instrument may very well change how the items load (Field, 2013). This would have an impact on which factors are included in the final instrument and therefore would clarify the implications drawn from the new data. Additionally, a

change in the factors of the instrument will also impact correlates (from correlation analyses) and predictors (from regression analyses). I plan to recruit these additional 150 middle and high school science teachers from two of the largest school districts in the Southeast. Both school systems contain urban, suburban, and rural schools and therefore will provide a variety of experiences for the employed science teachers.

Results from the addition of respondents to Phase 2 (i.e., Phase 2b) will assist in moving forward with Phase 3. Phase 3 will only continue with the scenario that leads to the collection of the most reliable and valid data. This may or may not be Scenario 2 as was found in the piloting of the instrument. Regardless of which scenario moves forward in this final phase, the goal will be to make the instrument as parsimonious as possible based on the results from Phase 2b. The first step in assisting with this goal is getting rid of one of the scenarios. However, additional steps will be taken regarding retaining only the appraisal factors found to be valid and reliable. Therefore, only appraisal factors with Cronbach's α above .70 will be retained. Additionally, only appraisal factors that hold together theoretically will be retained. Correlations between appraisal factors will be analyzed to determine if certain factors are too highly correlated. Redundancy is a potential problem that can result when factors are too highly correlated (Field, 2013). As was accomplished with the current study, reliability analyses of the items from the Brief COPE (Carver, 1997) will determine which coping factors and/or items are retained or deleted for the Phase 3 TEACH-FIBI.

In order to assist with the construct validity determined in Phase 2b, I will add items to the Phase 3 TEACH-FIBI. Since negative emotions have been tied to lower job

satisfaction and higher burnout (Borrachero et al., 2014), a modified Maslach Burnout Inventory-Educator Survey will assess teacher burnout (Schaufeli & Salanova, 2007). This inventory has 12 Likert scale items and responses range from "never" to "almost daily." If a positive, direct relationship exists between the reporting of frustration and teacher burnout, this will support the construct validity of the instrument. Additionally, there should be a mediating relationship between the coping strategies teachers report using and the extent of teacher burnout reported (Chang, 2013; Lazarus & Folkman, 1984). This is due to the finding that coping can transform how an individual appraises the transactional event they are attending to (Lazarus & Folkman, 1984).

In order to make this instrument as generalizable as possible, I will pay attention to specific variables in selecting states and schools. Both states that have adopted *NGSS* and those that have not will be targeted for data collection. Teachers in states that have adopted *NGSS* will more than likely already be in the learning phases of using teaching strategies like inquiry-based instruction since many of these states adopted *NGSS* in 2013 and 2014. This will ensure that the sample for this study includes science teachers who have experience trying inquiry-based teaching. It will also provide a sample of teachers who may feel as though they are being forced to embrace teaching styles that they may not believe in, which researchers state is a major cause of teacher stress (Moriarty, Edmonds, Blatchford, & Martin, 2001). *NGSS* states that will be targeted are CA, NV, OR, IL, KS, MD, and WV. Non-NGSS states that will be targeted are SC, NC, GA, TX, AR, FL, and OH. SC, GA, TX, and AR have been selected for this study because I am aware that certain districts in these states have received professional development geared

at improving the quality of inquiry-based instruction. Having this population represented in this study's sample will provide information about whether teachers who have experienced inquiry PD differ in the appraisals, emotions, and coping strategies they use.

Given that other researchers identified gender differences in the coping strategies used to regulate emotions (Borrachero, et al., 2014; Gonzalez-Morales, et al., 2010; Sutton & Knight, 2006), I purpose to achieve representation from both genders in sampling from these states. While this is the intention, teaching is a female dominated occupation (Gonzalez-Morales, et al., 2010) and thus the sample may be skewed towards females. Additionally, Borrachero et al. (2014) found that the initiation of emotions differed depending on the type of science taught. This suggests that the sample of this phase have representation from Life, Earth, Physical, and Chemical sciences (these were the subjects addressed in Borrachero's study). With this in mind, I intend to enlist entire departments to fill out the designed instrument with the hope of capturing responses from various science content areas. In order to collect information regarding these different variables, there will be a demographic portion to the online survey. While demographics will be collected (e.g., gender, years of teaching experience, subject taught), no names or other specific identifiers will be obtained during Phase 3.

A sample size of 200 – 500 middle and high school science teachers will be recruited for this phase. As Phase 2a found issues with homogeneity of variance with certain items between the middle and high school science teachers, I will see if the data for Phase 3 show this same issue by running a Levene's test on the items. If there continue to be issues with homogeneity of variance, certain items (i.e., items that display

heterogeneity of variance) and/or scales may be deleted when the Phase 3 instrument is finalized. I believe that the steps taken in Phase 2b and Phase 3 will attend to the limitations that were experienced in Phase 2a. By the end of Phase 3, the goal is to have a context-based instrument that can reliably and validly measure middle and high school science teachers' appraisals, emotions, and coping habits regarding the facilitation of inquiry-based teaching.

Instrument creation is an iterative process and continued changes will more than likely occur in years to come. Additionally, more scenarios may be created in order to determine how different features of inquiry-based instruction impact teachers' appraisals, emotions, and coping strategies. There is also the potential to revisit Scenario 1 and determine whether additional modifications would improve the respondents' responses. Perhaps, the focus on one student asking a question in Scenario 1 was not salient enough to initiate reliable and valid responses. Since the instrument is a self-report and predictive measure, there is a need to pair the instrument with in-class observations to determine if responses are representative of what the teachers actually do; therefore, the creation of an observation protocol which measures emotion responses would be beneficial. This could then be paired with the TEACH-FIBI to ensure what teachers are reporting is actually what they do in the classroom.

APPENDICES

Appendix A

District Consent Email

Subject: Participation in a Research Study

To Whom it May Concern,

My name is Daniel Alston. I am a Ph.D. student at Clemson University and in my final year of my program. During this year, I will be engaging in my dissertation research which focuses on investigating how science teachers evaluate and emotionally respond to challenging situations that can occur during inquiry-based instruction.

I am writing you this email to request permission to ask middle and high school teachers in your district to be a part of my dissertation research study. Involvement in this study will only require about 30 minutes of a teacher's time to fill out a survey. While the survey mainly focuses on teachers' evaluation and emotional responses to challenging situations that can occur during inquiry-based instruction, it also asks for certain pieces of demographic data (e.g., subject(s) taught, years teaching, gender). These data will be used to aggregate the responses so that I can look to see if response patterns are different or similar across groups.

For further information regarding the study, please open the document that I have attached to this email. Once you read over this document, please email me back and let me know if your district would be willing to participate in this study.

Appendix B

Principal Consent Email

Subject: Participation in a Research Study

To Whom it May Concern,

My name is Daniel Alston. I am a Ph.D. student at Clemson University and in my final year of my program. During this year, I will be engaging in my dissertation research which focuses on investigating how science teachers evaluate and emotionally respond to challenging situations that can occur during inquiry-based instruction.

I am writing you this email because your district has given me permission to ask you to be a part of my dissertation research study. Specifically, I will be asking for the participation of the science teachers at your school. Involvement in this study will only require about 30 minutes of a teacher's time to fill out a survey. While the survey mainly focuses on teachers' evaluation and emotional responses to challenging situations that can occur during inquiry-based instruction, it also asks for certain pieces of demographic data (e.g., subject(s) taught, years teaching, gender). These data will be used to aggregate the responses so that I can look to see if response patterns are different or similar across groups.

For further information regarding the study, please open the document that I have attached to this email. Once you read over this document, please email me back and let me know if you would be willing to allow me to ask the science teachers at your school to participate in this study.

Appendix C

Teacher Consent Email

Subject: Participation in a Research Study

Dear Fellow Science Educator,

My name is Daniel Alston. I am a Ph.D. student at Clemson University and in my final year of my program. During this year, I will be engaging in my dissertation research which focuses on investigating how science teachers evaluate and emotionally respond to challenging situations that can occur during inquiry-based instruction.

I am writing you this email because your district and principal have given me permission to ask you to be a part of my dissertation research study. Involvement in this study only requires about 30 minutes of your time to fill out a survey. While the survey mainly focuses on your evaluation and emotional responses to challenging situations that can occur during inquiry-based instruction, it also asks for certain pieces of demographic data (e.g., subject(s) taught, year teaching, gender). These data will be used to aggregate the responses so that I can look to see if response patterns are different or similar across groups.

For further information regarding the study, please open the document that I have attached to this email. Once you read over this document, please email me back and let me know if you are willing to participate in this study by filling out the survey.

Appendix D

Teacher Information Letter

Information about Being in a Research Study
Clemson University

Science Teacher Emotions and Emotional Regulation Within the Context of Inquiry-based Instruction

Description of the Study

Daniel Alston is inviting you to take part in a research study. Daniel Alston is a Ph.D. student at Clemson University. The purpose of this research is to build our knowledge concerning the emotions science teachers experience when facilitating student-centered instruction and how they regulate the emotions that they experience.

Your part in the study will be to fill out a survey designed to measure: 1) how you evaluate challenging situations that can occur during inquiry-based lessons; 2) the negative emotions that you experience within the context of facilitating inquiry-based instruction; and 3) how you regulate the negative emotions you experience during challenging situations that can occur when you are facilitating inquiry-based lessons.

It will take you about 30 minutes to fill out the survey.

Risks and Discomforts

I do not know of any risks or discomforts to you in this research study.

Possible Benefits

By filling out this survey, you will be contributing to research that intends to better understand science teachers' emotional responses to facilitating inquiry-based instruction. Gaining understanding in this aspect is important because of past and current reforms that encourage science teachers to plan and teach inquiry-based lessons. Additionally, filling out this survey provides you with the opportunity to reflect on how you evaluate and respond to challenging situations that can occur when you facilitate inquiry-based instruction. This reflection could be beneficial by allowing you to begin thinking about how these surveyed aspects may relate to your past successes and/or struggles when facilitating inquiry-based instruction.

Protection of Privacy and Confidentiality

I will do everything I can to protect your privacy and confidentiality. I will not tell anybody outside of the research team that you were in this study or what information I collected about you in particular. You will not be providing a name on the survey, so all of your answers to the survey questions will be anonymous. Additionally, all collected information will be kept on a password protected hard drive.

We might be required to share the information we collect from you with the Clemson University Office of Research Compliance and the federal Office for Human Research Protections. If this happens, the information would only be used to find out if I ran this study properly and protected your rights in the study.

Choosing to Be in the Study

You do not have to be in this study. You may choose not to take part and you may choose to stop taking part at any time. You will not be punished in any way if you decide not to be in the study or to stop taking part in the study. If you choose to stop taking part in this study, the information you have already provided will be used in a confidential manner.

Contact Information

If you have any questions or concerns about this study or if any problems arise, please contact Daniel Alston at 803-422-5079.

If you have any questions or concerns about your rights in this research study, please contact the Clemson University Office of Research Compliance (ORC) at 864-656-6460 or irb@clemson.edu. If you are outside of the Upstate South Carolina area, please use the ORC's toll-free number, 866-297-3071.

A copy of this form will be given to you.

Appendix E

Focus Group Procedural Script

Questions	Resources	Sequence/Instructions	Data Collected	Analysis
Opening Questions				
Tell us your name, what grade you teach, and your past experience with inquiry-based instruction.	None	Provide the participants with a definition of inquiry-based instruction: Inquiry-based instruction refers to any intentional, student-centered instruction where a teacher designs and facilitates experiences that enable students the opportunity to deepen their understanding of scientific content and formulate an accurate conception of the process undergone by scientists to find out and validate new knowledge (Marshall & Horton, 2009; NRC, 2012)	-Audio recorded -Notes taken by facilitator during focus group -Demographic Information	No analysis necessary

Transition Questions				
Think back to when first heard about inquiry-based instruction. What were your first impressions of inquiry-based instruction when you were learning about it?	None	-Make clear that these impressions are when they were first hearing (learning) about inquiry-based instruction. -If they start going into when they first practiced that is fine but the next question will focus more on that.	-Audio recorded	-Transcribe -Open coding of impressions
What were your impressions if and when you first tried this type of instruction?	None	-This focuses on actual implementation and what their impressions were when trying.	-Audio recorded -Notes taken by facilitator during focus group	-Transcribe -Open coding of impressions

Key Questions				
How do the following scenarios make you feel? (Scenarios will be read one at a time for each of these sequences).	-3 or more scenarios of challenging situations that can occur when teachers are facilitating inquiry-based instruction (See Scenarios Document). -The scenarios will be designed to initiate high, medium, and low stressful responses. -List of discrete emotions -List of general affects -Paper and writing tools	- Scenarios will be read from low to high stress scenarios. -Teachers will be asked to embody the scenario as if they were experiencing it. -**As I read the scenario, try to see yourself in the same scenario as if it is happening now.** -Teachers will be read the scenario and given copies of the scenario to re-read as they need to. -Teachers will be asked to write down how they feel before sharing, as well as how intense the feeling(s) are. It is okay if they are feeling several things, they do not have to choose only one. -**How are you feeling in this scenario and how intense are these feelings?** **-Write your answers on the piece of paper in front of you. In a moment we will share these with each other.** -The facilitator will let the teachers know that they can share and feel free to respond to others comments in this group talk session.	-Audio recorded -Notes taken by facilitator during focus group.	-Transcribe -Coding with discrete emotions and general affect groups in mind.

		-Group will share their feelings based upon the scenario read. -Facilitator will make sure to keep the conversation focused on the emotions and/or affects experienced and how intense these different feelings are. -After all parties have spoken, facilitator will then hand out a list of discrete emotions and general affect and ask **the participants to choose if there are any that they did not consider and to what degree they experienced said emotions or affects**.		
How do teachers appraise challenging situations that can occur when facilitating inquiry-based instruction?	-Scenarios will direct each question group.	-Facilitator will begin inquiry into this question by asking the participants: **- What prompted you to feel _____?** -Follow-up questions can include: **-What features of the situation do you like/not like?** **-What could make you feel better about the situation?** **-Is it something in or out of your control?**	-Audio recorded -Notes taken by facilitator	-Transcribed -Coded with current appraisals (prim. and sec.)
What coping strategies do teachers use when they experience negative emotions due	-Scenarios will guide this line of questioning. -Carver, 1997 (Brief COPE)	-The facilitator will ask the teachers what they do once they experience these emotions. Teachers will once again be instructed to embody	-Audio recorded -Notes taken by facilitator during focus group.	-Transcribe -Code with COPE strategies and categories in mind.

to challenging situations that can occur when facilitating inquiry-based instruction?		the scenario as they answer the questions. Facilitator: "Imagine you are in the class and dealing with this situation…" **-How do you deal with these emotions?** **-What about these strategies causes you to use them?** -Facilitator will allow the participants to discuss and respond to others comments. -The facilitator will then hand out a list of coping strategies and asked to choose any of the ones they may have overlooked.		
Closing Questions				
Are there any other challenging situations that you have experienced when facilitating inquiry-based instruction?	None	Allow the participants to share any other situations that were not represented in the prepared scenarios and encourage other participants to respond to comments. **-Think back to your experiences facilitating inquiry-based instruction. Describe other challenging situations you have experienced.**	-Audio recorded -Notes taken by facilitator during focus group.	-Transcribe -Open coding regarding similarities and differences of situations.

Appendix F

Discrete Emotions Coding List

Angry	Depressed	Confused	Helpless	Afraid	Hurt	Sad
Irritated	Disappointed	Uncertain	Incapable	Fearful	Crushed	Sorrowful
Annoyed	Discouraged	Perplexed	Paralyzed	Terrified	Rejected	Unhappy
Upset	Ashamed	Embarrassed	Useless	Anxious	Offended	Dismayed
Unpleasant	Dissatisfied	Hesitant	Overwhelmed	Alarmed		Downhearted
Frustrated	Lousy	Lost	Incompetent	Panicked		Devastated
Infuriated	Pessimistic	Unsure	Inept	Nervous		Blindsided
Furious	Self-critical	Tense	Trapped	Scared		Down
Perturbed	Disheartened	Stressed	Inadequate	Worried		
Agitated	Despondent	Uncomfortable		Frightened		
Mad	Stuck	Bewildered		Insecure		
Exasperated	Despairing	Mixed Up		Troubled		
Impatient	Hopeless	Puzzled		Intimidated		
Enraged		Baffled		Self-conscious		
Aggravated				Threatened		
Seething				Shocked		
				Apprehensive		
				Timid		
				Distressed		

Appendix G

Emotional Responses During Inquiry Instruction Self Report

Demographic Questions:

1. What level of school do you teach? Middle School or High School
2. In what state do you teach?
3. Which subjects do you teach?
4. Have you gone through a professional development program geared toward improving your inquiry-based teaching practice?
    a. If yes, how many programs or workshops have you completed?
5. Gender?
6. Ethnicity?
7. How many years have you taught?
8. What school district do you teach in?

Goal Importance:

Items in this section are designed to assess the goals that science teachers value. These questions are only asked once after the demographic information.

Scale
SA – Strongly Agree
A – Agree
D – Disagree
SD – Strongly Disagree

1. It is important to have a structured learning environment.
2. It is important for teachers to control the events that take place in the classroom.
3. It is important that students have a sense of freedom in the learning process.
4. It is important that students see their teacher as competent.
5. It is important to cover content in a specified time.
6. It is important for teachers to predict how their students will perform on assessments.
7. It is important for students to know that their teacher does not know everything.
8. It is important that students feel their curiosity is cultivated by their teacher.
9. It is important that teachers use class time efficiently.
10. It is important to use different methods of instruction.
11. It is important to cover all the standards before the course ends.
12. It is important to keep multiple sections of the same course on track with each other.
13. It is important that students do well on assessments.

14. It is important that students feel prepared for assessments.
15. It is important for students to trust their teacher.

Mood Assessment: (PANAS)
This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you have felt like this in the past few hours. Use the following scale to record your answers.

Scale
1 – Very slightly or not at all
2 – A little
3 – Moderately
4 – Quite a bit
5 – Extremely

1. ___ Interested
2. ___ Distressed
3. ___ Excited
4. ___ Upset
5. ___ Strong
6. ___ Guilty
7. ___ Scared
8. ___ Hostile
9. ___ Enthusiastic
10. ___ Proud
11. ___ Irritable
12. ___ Alert
13. ___ Ashamed
14. ___ Inspired
15. ___ Nervous
16. ___ Determined
17. ___ Attentive
18. ___ Jittery
19. ___ Active
20. ___ Afraid

Read the scenario below carefully and try to imagine yourself in this scenario as if it was happening now. Read the scenario three times in order to really put yourself in the scenario. Once you are finished reading the scenario, answer the questions that follow.

Scenario #1:
You are facilitating a discussion to make sense of an investigation your students have just finished. You have questions planned so that you can facilitate a deep discussion that will allow your students to talk about the investigation. The goal of this discussion is to allow students the chance make sense of the exploration and therefore build their conceptual understanding of the science concepts investigated. During the discussion, you are getting students to explain their answers with evidence from the investigation. In the middle of the discussion, a student asks you a tough question about the science concept you all are discussing. You do not know the answer to the question.

Emotional Response Scale:
0 – None
5 – Extreme

Fear
Confusion
Frustration

Scale:
SA – Strongly Agree
A - Agree
D - Disagree
SD – Strongly Disagree

1. During this situation, I believe I am an effective teacher.
2. During this situation, I believe I'm doing a good job.
3. During this situation, I feel good about myself as a teacher.
4. During this situation, I do not feel like a successful teacher.
5. It is important for students to trust their teacher.
6. This situation promotes a structured learning environment.
7. I feel in control of the learning environment during this situation.
8. This situation keeps me from covering content in a timely manner.
9. This situation increases my confidence in how my students will perform on assessments.
10. This situation makes me appear competent to my students.
11. This situation makes me want to use new methods of teaching.
12. This situation keeps me from using class time efficiently.
13. This situation encourages my students to be curious.
14. This situation increases how my students will perform on assessments.
15. This situation helps prepare students for assessments.

16. This situation allows me to move at the pace I want to go.
17. This situation causes my students to trust my teaching ability.
18. I have difficulty coming up with strategies to deal with this situation.
19. I have the skills to deal with this situation.
20. I have the resources to deal with this situation.
21. I am responsible for this situation.
22. Limited time is responsible for this situation.
23. If I was a better facilitator, this situation would not have occurred.
24. If students were better behaved, this situation would not have occurred.
25. If students were more focused, this situation would not have occurred.
26. If I planned better, this situation would not have happened.
27. There is nothing that can be done to prevent situations like these from occurring.
28. If I had more resources, this situation would not have occurred.
29. If I had more professional development on inquiry, this situation would not have occurred.

Coping Assessment

Scale:
0 – I don't do this at all
1 – I do this a bit
2 – I do this a medium amount
3 – I do this a lot

1. In this situation, I say things to my students to let my feelings escape.
2. In this situation, I express my negative feelings to my students.
3. In this situation, I keep my feelings to myself.
4. In this situation, I want emotional support from others.
5. In this situation, I want to discuss my feelings with someone.
6. In this situation, I want comfort and understanding from someone.
7. I say to myself "this situation isn't real."
8. I refuse to believe that this situation is happening.
9. In this situation, I go on as if nothing has happened.
10. I give up the attempt to cope with this situation.
11. I give up trying to deal with this situation.
12. I reduce the amount of effort I'm putting into solving this situation.
13. I accept that situations like this can't be changed.
14. I accept the reality that this situation has occurred.
15. I learn to live with situations like this.
16. In this situation, I criticize myself.
17. I blame myself for this situation.
18. In this situation I focus on my inadequacies.
19. I laugh about this situation.
20. I make jokes about this situation.

21. I make fun of the situation.
22. I try to grow as a result of this situation.
23. I try to see this situation in a different light, to make it seem more positive.
24. I look for something good in what is happening.
25. I get help or advice from someone about this situation.
26. I talk to someone who could do something concrete about this situation.
27. I try to get advice or help from other people about what to do in this situation.
28. I try to come up with a strategy about what to do in this situation.
29. I think about how I might best handle the situation.
30. I think hard about what steps to take.
31. I concentrate my efforts on doing something about this situation
32. I take action to try to make this situation better.
33. In this situation, I do what has to be done one step at a time.

Read the scenario below carefully and try to imagine yourself in this scenario as if it was happening now. Read the scenario three times in order to really put yourself in the scenario. Once you are finished reading the scenario, answer the questions that follow.

Scenario #2
Your students are engaging in an investigation that allows them to explore an important science concept before an explanation of the concept has occurred. During this investigation, students are collecting and analyzing data. You have them doing this so that they can begin to see patterns that will build their conceptual understanding of the particular concept. As you walk around and facilitate the activity, you hear the groups working and talking about what they are noticing. You realize that they are going in a totally different direction than you intended. What you thought they would have no problem understanding, they are not understanding at all. The activity is not turning out the way you wanted it to.

Emotional Response Scale:
0 – None
5 – Extreme

Fear
Confusion
Frustration

Scale:
SA – Strongly Agree
A - Agree
D - Disagree
SD – Strongly Disagree

1. During this situation, I believe I am an effective teacher.
2. During this situation, I believe I'm doing a good job.
3. During this situation, I feel good about myself as a teacher.
4. During this situation, I do not feel like a successful teacher.
5. It is important for students to trust their teacher.
6. This situation promotes a structured learning environment.
7. I feel in control of the learning environment during this situation.
8. This situation keeps me from covering content in a timely manner.
9. This situation increases my confidence in how my students will perform on assessments.
10. This situation makes me appear competent to my students.
11. This situation makes me want to use new methods of teaching.
12. This situation keeps me from using class time efficiently.
13. This situation encourages my students to be curious.
14. This situation increases how my students will perform on assessments.

15. This situation helps prepare students for assessments.
16. This situation allows me to move at the pace I want to go.
17. This situation causes my students to trust my teaching ability.
18. I have difficulty coming up with strategies to deal with this situation.
19. I have the skills to deal with this situation.
20. I have the resources to deal with this situation.
21. I am responsible for this situation.
22. Limited time is responsible for this situation.
23. If I was a better facilitator, this situation would not have occurred.
24. If students were better behaved, this situation would not have occurred.
25. If students were more focused, this situation would not have occurred.
26. If I planned better, this situation would not have happened.
27. There is nothing that can be done to prevent situations like these from occurring.
28. If I had more resources, this situation would not have occurred.
29. If I had more professional development on inquiry, this situation would not have occurred.

Coping Assessment

Scale:
0 – I don't do this at all
1 – I do this a bit
2 – I do this a medium amount
3 – I do this a lot

1. In this situation, I say things to my students to let my feelings escape.
2. In this situation, I express my negative feelings to my students.
3. In this situation, I keep my feelings to myself.
4. In this situation, I want emotional support from others.
5. In this situation, I want to discuss my feelings with someone.
6. In this situation, I want comfort and understanding from someone.
7. I say to myself "this situation isn't real."
8. I refuse to believe that this situation is happening.
9. In this situation, I go on as if nothing has happened.
10. I give up the attempt to cope with this situation.
11. I give up trying to deal with this situation.
12. I reduce the amount of effort I'm putting into solving this situation.
13. I accept that situations like this can't be changed.
14. I accept the reality that this situation has occurred.
15. I learn to live with situations like this.
16. In this situation, I criticize myself.
17. I blame myself for this situation.
18. In this situation I focus on my inadequacies.
19. I laugh about this situation.

20. I make jokes about this situation.
21. I make fun of the situation.
22. I try to grow as a result of this situation.
23. I try to see this situation in a different light, to make it seem more positive.
24. I look for something good in what is happening.
25. I get help or advice from someone about this situation.
26. I talk to someone who could do something concrete about this situation.
27. I try to get advice or help from other people about what to do in this situation.
28. I try to come up with a strategy about what to do in this situation.
29. I think about how I might best handle the situation.
30. I think hard about what steps to take.
31. I concentrate my efforts on doing something about this situation
32. I take action to try to make this situation better.
33. In this situation, I do what has to be done one step at a time.

In two weeks, can I send this survey to you again to retake it?

a. If yes,
    i. First Name:
    ii. Last Name:
    iii. Email:

Appendix H

Item Abbreviations and Scales

Abbreviation	Item
Positive and Negative Affect Scale (a – positive; b – negative)	
Mood1a	Interested
Mood2a	Distressed
Mood1b	Excited
Mood2b	Upset
Mood1c	Strong
Mood2c	Guilty
Mood2d	Scared
Mood2e	Hostile
Mood1d	Enthusiastic
Mood1e	Proud
Mood2f	Irritable
Mood1f	Alert
Mood2g	Ashamed
Mood1g	Inspired
Mood2h	Nervous
Mood1h	Determined
Mood1i	Attentive
Mood2i	Jittery
Mood1j	Active
Mood2j	Afraid
Goal Relevance Appraisals: Learning Environment (GILE)	
GILE1	It is important to have a structured learning environment.
GILE2	It is important for teachers to control the events that take place in the classroom.
GILE3	It is important that students have a sense of freedom in the learning process.
GILE4	It is important to use different methods of instruction.
Goal Relevance Appraisals: Time (GITIME)	
GITIME1	It is important to cover content in a specified time.
GITIME2	It is important that teachers use class time efficiently.
GITIME3	It is important to cover all the standards before the course ends.
GITIME4	It is important to keep multiple sections of the same course on track with each other.
Goal Relevance Appraisals: Beliefs about Assessments (GIASSE)	

GIASSE1	It is important for teachers to predict how their students will perform on assessments.
GIASSE2	It is important that students do well on assessments.
GIASSE3	It is important that students feel prepared for assessments.
Goal Relevance Appraisals: Student Perception of Teachers (GISP)	
GISP1	It is important that students see their teacher as competent.
GISP2	It is important for students to know that their teacher does not know everything.
GISP3	It is important that students feel their curiosity is cultivated by their teacher.
GISP4	It is important for students to trust their teacher.
Negative Emotions	
FEAR	Fear
CONFS	Confusion
FRUS	Frustration
Ego-Involvement Appraisals (EI)	
EI1	During this situation, I believe I'm doing a good job.
EI2	During this situation, I believe I am an effective teacher.
EI3	During this situation, I feel good about myself as a teacher.
EI4	During this situation, I do not feel like a successful teacher.
Goal Congruence Appraisals: Learning Environment (GCLE)	
GCLE1	This situation promotes a structured learning environment.
GCLE2	I feel in control of the learning environment during this situation.
GCLE3	This situation makes me want to use new methods of teaching.
Goal Congruence Appraisals: Time (GCTIME)	
GCTIME1	This situation keeps me from covering content in a timely manner.
GCTIME2	This situation keeps me from using class time efficiently.
GCTIME3	This situation allows me to move at the pace I want to go.
Goal Congruence Appraisals: Beliefs about Assessments (GCASSE)	
GCASSE1	This situation increases my confidence in how my students will perform on assessments.
GCASSE2	This situation increases how my students will perform on assessments.
GCASSE3	This situation helps prepare students for assessments.
Goal Congruence Appraisals: Student Perceptions of Teacher (GCSP)	
GCSP1	This situation makes me appear competent to my students.
GCSP2	This situation encourages my students to be curious.
GCSP3	This situation causes my students to trust my teaching ability.
Problem Efficacy Appraisals (PE)	
PE1	I have difficulty coming up with strategies to deal with this situation.
PE2	I have the skills to deal with this situation.
PE3	I have the resources to deal with this situation.
Agency Appraisals: Internal (AGINT) vs External (AGEXT)	

AGINT1	I am responsible for this situation.
AGINT2	If I was a better facilitator, this situation would not have occurred.
AGINT3	If I planned better, this situation would not have happened.
AGEXT1	Limited time is responsible for this situation.
AGEXT2	If students were better behaved, this situation would not have occurred.
AGEXT3	If students were more focused, this situation would not have occurred.
Agency Appraisal: Controllable (AGC) vs Uncontrollable (AGUC)	
AGC1	If I had more resources, this situation would not have occurred.
AGC2	If I had more professional development on inquiry, this situation would not have occurred.
AGUC1	There is nothing that can be done to prevent situations like these from occurring.
Emotion-focused Coping: Venting of Emotions (VENT)	
VENT1	In this situation, I say things to my students to let my feelings escape.
VENT2	In this situation, I express my negative feelings to my students.
VENT3	In this situation, I keep my feelings to myself.
Emotion-focused Coping: Use of Emotional Support (EMSPT)	
EMSPT1	In this situation, I want emotional support from others.
EMSPT2	In this situation, I want to discuss my feelings with someone.
EMSPT3	In this situation, I want comfort and understanding from someone.
Emotion-focused Coping: Denial (DENIAL)	
DENIAL1	I say to myself "this situation isn't real."
DENIAL2	I refuse to believe that this situation is happening.
DENIAL3	In this situation, I go on as if nothing has happened.
Emotion-focused Coping: Behavioral Disengagement (BEHDIS)	
BEHDIS1	I give up the attempt to cope with this situation.
BEHDIS2	I give up trying to deal with this situation.
BEHDIS3	I reduce the amount of effort I'm putting into solving this situation.
Emotion-focused Coping: Acceptance (ACCPT)	
ACCPT1	I accept that situations like this can't be changed.
ACCPT2	I accept the reality that this situation has occurred.
ACCPT3	I learn to live with situations like this.
Emotion-focused Coping: Self-blame (BLAME)	
BLAME1	In this situation, I criticize myself.
BLAME2	I blame myself for this situation.
BLAME3	In this situation I focus on my inadequacies.
Emotion-focused Coping: Humor (HUMOR)	
HUMOR1	I laugh about this situation.
HUMOR2	I make jokes about this situation.
HUMOR3	I make fun of the situation.
Problem-focused Coping: Positive Reframing (POSREF)	

POSREF1	I try to grow as a result of this situation.
POSREF2	I try to see this situation in a different light, to make it seem more positive.
POSREF3	I look for something good in what is happening.
Problem-focused Coping: Use of Instrumental Support (INSPT)	
INSPT1	I get help or advice from someone about this situation.
INSPT2	I talk to someone who could do something concrete about this situation.
INSPT3	I try to get advice or help from other people about what to do in this situation.
Problem-focused Coping: Planning (PLAN)	
PLAN1	I try to come up with a strategy about what to do in this situation.
PLAN2	I think about how I might best handle the situation.
PLAN3	I think hard about what steps to take.
Problem-focused Coping: Active Coping (ACTIVE)	
ACTIVE1	I concentrate my efforts on doing something about this situation.
ACTIVE2	I take action to try to make this situation better.
ACTIVE3	In this situation, I do what has to be done one step at a time.

Appendix I

TEACH-FIBI Item Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Mood1a	49	2	5	3.76	.902
Mood2a	49	1	5	2.12	1.148
Mood1b	49	1	5	3.29	1.061
Mood2b	49	1	5	1.82	1.074
Mood1c	49	1	5	3.47	1.023
Mood2c	49	1	4	1.45	.818
Mood2d	49	1	5	1.33	.875
Mood2e	49	1	5	1.29	.677
Mood1d	49	2	5	3.65	.969
Mood1e	49	1	5	3.67	.966
Mood2f	49	1	5	1.90	1.085
Mood1f	49	1	5	3.73	1.151
Mood2g	49	1	4	1.12	.484
Mood1g	49	1	5	3.37	1.185
Mood2h	49	1	5	1.47	.938
Mood1h	49	1	5	3.84	1.231
Mood1i	49	1	5	3.96	.912
Mood2i	49	1	5	1.41	.911
Mood1j	49	1	5	3.43	1.021
Mood2j	49	1	4	1.20	.645

GILE1	49	1	2	1.33	.474
GILE2	49	1	3	1.86	.612
GILE3	49	1	3	1.59	.537
GILE3R	49	2	4	3.41	.537
GISP1	49	1	3	1.20	.456
GITIME1	49	1	3	2.02	.559
GIASSE1	49	1	3	2.10	.549
GISP2	49	1	3	1.49	.545
GISP3	49	1	3	1.43	.540
GITIME2	49	1	2	1.29	.456
GILE4	49	1	2	1.08	.277
GILE4R	49	3	4	3.92	.277
GITIME3	49	1	4	2.14	.736
GITIME4	49	1	4	2.39	.702
GIASSE2	49	1	3	1.86	.577
GIASSE3	49	1	2	1.33	.474
GISP4	49	1	2	1.14	.354
FEARS1	49	0	3	.90	.963
CONFS1	49	0	3	.67	.875
FRUSS1	49	0	3	.69	.847
EI1	49	1	3	1.69	.548
EI2	49	1	3	1.73	.531
EI3	49	1	3	1.76	.596
EI4	49	2	4	3.43	.612
EI4R	49	1	3	1.57	.612

GCLE1	49	1	3	2.12	.564
GCLE2	49	1	3	1.76	.560
GCTIME1	49	1	3	1.90	.549
GCAsse1	49	1	4	2.10	.586
GCSP1	49	1	3	2.16	.624
GCLE3	49	1	4	2.39	.862
GCLE3R	49	1	4	2.61	.862
GCTIME2	49	1	4	1.86	.612
GCSP2	49	1	2	1.37	.487
GCAsse2	49	1	4	2.22	.654
GCAsse3	49	1	3	1.88	.526
GCTime3	49	1	4	2.33	.591
GCSP3	49	1	4	1.94	.592
PE1	49	1	3	1.71	.577
PE2	49	1	2	1.51	.505
PE3	49	1	3	1.61	.571
AgInt1	49	1	4	2.37	.859
AgExt1	49	2	4	3.04	.576
AGEXT1R	49	1	3	1.96	.576
AgInt2	49	1	4	3.31	.585
AgExt2	49	3	4	3.61	.492
AGEXT2R	49	1	2	1.39	.492
AgExt3	49	2	4	3.47	.544
AGEXT3R	49	1	3	1.53	.544
AgInt3	49	1	4	3.20	.763

AgUC1	49	1	4	1.86	.791
AGUC1R	49	1	4	3.14	.791
AgC1	49	2	4	3.16	.590
AgC2	49	2	4	3.29	.540
Vent1	49	1	4	1.31	.619
Vent2	49	1	3	1.08	.344
Vent3	49	1	4	2.08	1.017
EmSpt1	49	1	4	1.51	.767
EmSpt2	49	1	4	1.61	.885
EmSpt3	49	1	4	1.49	.711
Denial1	49	1	2	1.04	.200
Denial2	49	1	4	1.14	.612
Denial3	49	1	4	1.82	1.093
BehDis1	49	1	4	1.27	.758
BehDis2	49	1	4	1.08	.449
BehDis3	49	1	3	1.35	.631
Accpt1	49	1	4	2.84	1.124
Accpt2	49	1	4	3.49	.711
Accpt3	49	1	4	2.98	1.031
Blame1	49	1	4	1.55	.792
Blame2	49	1	4	1.35	.723
Blame3	49	1	4	1.53	.868
Humor1	49	1	4	1.90	1.005
Humor2	49	1	4	1.57	.816
Humor3	49	1	3	1.47	.680

PosRef1	49	2	4	3.59	.610
PosRef2	49	1	4	3.18	.950
PosRef3	49	2	4	3.51	.545
InSpt1	49	1	4	2.47	.981
InSpt2	49	1	4	2.12	1.111
InSpt3	49	1	4	2.49	1.023
Plan1	49	1	4	3.29	.791
Plan2	49	2	4	3.47	.680
Plan3	49	1	4	2.88	.949
Active1	49	1	4	2.96	.841
Active2	49	1	4	3.33	.774
Active3	49	1	4	3.39	.671
FearS2	49	0	3	.63	.883
ConfS2	49	0	5	1.22	1.177
FrusS2	49	0	4	1.53	1.226
TEI2	49	1	4	1.98	.777
TEI1	49	1	3	2.22	.587
TEI4	49	2	4	3.16	.624
TEI4R	49	1	3	1.84	.624
TEI3	49	1	3	2.10	.586
TAgInt1	49	1	4	2.20	.866
TGCLE2	49	1	4	2.08	.702
TPE1	49	1	4	3.08	.571
TPE1R	49	1	4	1.92	.571
TPE3	49	1	3	1.67	.516

TPE2	49	1	3	1.55	.542
TAgC2	49	2	4	3.10	.714
TAgC1	49	2	4	3.20	.499
TAgInt3	49	1	4	2.73	.700
TAgInt2	49	1	4	2.92	.731
TAgExt2	49	1	4	3.18	.782
TAGEXT2R	49	1	4	1.82	.782
TAgExt3	49	1	4	2.94	.747
TAGEXT3R	49	1	4	2.06	.747
TAgExt1	49	2	4	3.00	.612
TAGEXT1R	49	1	3	2.00	.612
TAgUC1	49	1	4	2.37	.929
TAGUC1R	49	1	4	2.63	.929
TGCTime3	49	1	4	2.69	.652
TGCSP3	49	1	3	2.27	.569
TGCSP2	49	1	3	1.78	.654
TGCAsse3	49	1	3	2.10	.586
TGCAsse2	49	2	4	2.47	.544
TGCAsse1	49	1	4	2.59	.643
TGCTime1	49	1	4	2.67	.658
TGCTIME1R	49	1	4	2.33	.658
TGCTime2	49	1	4	2.71	.577
TGCTIME2R	49	1	4	2.29	.577
TGCSP1	49	1	3	2.12	.600
TGCLE3	49	1	4	2.22	.798

TGCLE3R	49	1	4	2.78	.798
TGCLE1	49	1	4	2.29	.677
TAccpt1	49	1	4	2.06	1.049
TAccpt2	49	1	4	3.47	.819
TBlame2	49	1	4	1.63	.834
TActive1	49	1	4	3.45	.709
TInSpt1	49	1	4	2.27	.953
TBehDis1	49	1	4	1.12	.526
TBehDis2	49	1	3	1.12	.439
THumor1	49	1	4	1.78	.872
TAccpt3	49	1	4	2.63	.994
TPosRef3	49	1	4	3.31	.871
THumor3	49	1	3	1.39	.671
THumor2	49	1	4	1.45	.709
TBehDis3	49	1	3	1.22	.550
TDenial2	49	1	3	1.04	.286
TDenial1	49	1	2	1.02	.143
TActive2	49	1	4	3.51	.711
TInSpt2	49	1	4	2.20	1.020
TPlan2	49	1	4	3.45	.738
TPlan3	49	1	4	3.20	.935
TPlan1	49	1	4	3.31	.847
TInSpt3	49	1	4	2.49	.960
TPosRef1	49	1	4	3.61	.702
TPosRef2	49	1	4	3.06	.944

TBlame3	49	1	4	1.61	.909
TBlame1	49	1	4	1.71	.935
TActive3	49	1	4	3.45	.765
TVent2	49	1	2	1.12	.331
TDenial3	49	1	4	1.45	.765
TVent3	49	1	4	2.10	1.026
TVent1	49	1	4	1.35	.631
TEmSpt3	49	1	4	1.49	.739
TEmSpt1	49	1	4	1.41	.734
TEmSpt2	49	1	4	1.67	.801

Appendix J

Shapiro-Wilks Normality Test for All Items

	Shapiro-Wilk		
	Statistic	df	Sig.
Mood1a	.873	49	.000
Mood2a	.829	49	.000
Mood1b	.909	49	.001
Mood2b	.760	49	.000
Mood1c	.881	49	.000
Mood2c	.609	49	.000
Mood2d	.425	49	.000
Mood2e	.453	49	.000
Mood1d	.864	49	.000
Mood1e	.888	49	.000
Mood2f	.792	49	.000
Mood1f	.839	49	.000
Mood2g	.277	49	.000
Mood1g	.892	49	.000
Mood2h	.562	49	.000
Mood1h	.823	49	.000
Mood1i	.839	49	.000
Mood2i	.520	49	.000
Mood1j	.905	49	.001
Mood2j	.356	49	.000

GILE1	.592	49	.000
GILE2	.768	49	.000
GILE3	.695	49	.000
GILE3R	.695	49	.000
GISP1	.492	49	.000
GITIME1	.731	49	.000
GIASSE1	.722	49	.000
GISP2	.691	49	.000
GISP3	.674	49	.000
GITIME2	.566	49	.000
GILE4	.306	49	.000
GILE4R	.306	49	.000
GITIME3	.829	49	.000
GITIME4	.814	49	.000
GIASSE2	.744	49	.000
GIASSE3	.592	49	.000
GISP4	.417	49	.000
FEARS1	.812	49	.000
CONFS1	.750	49	.000
FRUSS1	.768	49	.000
EI1	.713	49	.000
EI2	.699	49	.000
EI3	.753	49	.000
EI4	.738	49	.000
EI4R	.738	49	.000

GCLE1	.734	49	.000
GCLE2	.727	49	.000
GCTime1	.722	49	.000
GCTIME1R	.722	49	.000
GCAsse1	.728	49	.000
GCSP1	.774	49	.000
GCLE3	.874	49	.000
GCLE3R	.874	49	.000
GCTime2	.726	49	.000
GCTIME2R	.726	49	.000
GCSP2	.611	49	.000
GCAsse2	.803	49	.000
GCAsse3	.699	49	.000
GCTime3	.755	49	.000
GCSP3	.714	49	.000
PE1	.738	49	.000
PE1R	.738	49	.000
PE2	.637	49	.000
PE3	.726	49	.000
AgInt1	.870	49	.000
AgExt1	.745	49	.000
AGEXT1R	.745	49	.000
AgInt2	.660	49	.000
AgExt2	.618	49	.000

AGEXT2R	.618	49	.000
AgExt3	.696	49	.000
AGEXT3R	.696	49	.000
AgInt3	.811	49	.000
AgUC1	.811	49	.000
AGUC1R	.811	49	.000
AgC1	.753	49	.000
AgC2	.707	49	.000
Vent1	.547	49	.000
Vent2	.256	49	.000
Vent3	.825	49	.000
VENT3R	.825	49	.000
EmSpt1	.674	49	.000
EmSpt2	.705	49	.000
EmSpt3	.692	49	.000
Denial1	.201	49	.000
Denial2	.244	49	.000
Denial3	.729	49	.000
BehDis1	.392	49	.000
BehDis2	.182	49	.000
BehDis3	.589	49	.000
Accpt1	.827	49	.000
Accpt2	.704	49	.000
Accpt3	.808	49	.000
Blame1	.699	49	.000

Blame2	.538	49	.000
Blame3	.652	49	.000
Humor1	.799	49	.000
Humor2	.709	49	.000
Humor3	.680	49	.000
PosRef1	.662	49	.000
PosRef2	.762	49	.000
PosRef3	.691	49	.000
InSpt1	.881	49	.000
InSpt2	.825	49	.000
InSpt3	.877	49	.000
Plan1	.789	49	.000
Plan2	.720	49	.000
Plan3	.856	49	.000
Active1	.854	49	.000
Active2	.753	49	.000
Active3	.736	49	.000
FearS2	.718	49	.000
ConfS2	.855	49	.000
FrusS2	.880	49	.000
TEI2	.840	49	.000
TEI1	.748	49	.000
TEI4	.774	49	.000
TEI4R	.774	49	.000
TEI3	.752	49	.000

TAgInt1	.863	49	.000
TGCLE2	.824	49	.000
TPE1	.684	49	.000
TPE1R	.684	49	.000
TPE3	.676	49	.000
TPE2	.697	49	.000
TAgC2	.805	49	.000
TAgC1	.666	49	.000
TAgInt3	.783	49	.000
TAgInt2	.836	49	.000
TAgExt2	.798	49	.000
TAGEXT2R	.798	49	.000
TAgExt3	.825	49	.000
TAGEXT3R	.825	49	.000
TAgExt1	.770	49	.000
TAGEXT1R	.770	49	.000
TAgUC1	.879	49	.000
TAGUC1R	.879	49	.000
TGCTime3	.783	49	.000
TGCSP3	.733	49	.000
TGCSP2	.782	49	.000
TGCAsse3	.752	49	.000
TGCAsse2	.687	49	.000

TGCAsse1	.797	49	.000
TGCTime1	.807	49	.000
TGCTIME1R	.807	49	.000
TGCTime2	.668	49	.000
TGCTIME2R	.668	49	.000
TGCSP1	.760	49	.000
TGCLE3	.858	49	.000
TGCLE3R	.858	49	.000
TGCLE1	.817	49	.000
TAccpt1	.832	49	.000
TAccpt2	.656	49	.000
TBlame2	.738	49	.000
TActive1	.726	49	.000
TInSpt1	.871	49	.000
TBehDis1	.251	49	.000
TBehDis2	.305	49	.000
THumor1	.782	49	.000
TAccpt3	.873	49	.000
TPosRef3	.762	49	.000
THumor3	.609	49	.000
THumor2	.663	49	.000
TBehDis3	.458	49	.000
TDenial2	.127	49	.000
TDenial1	.127	49	.000

TActive2	.692	49	.000
TInSpt2	.858	49	.000
TPlan2	.725	49	.000
TPlan3	.748	49	.000
TPlan1	.746	49	.000
TInSpt3	.882	49	.000
TPosRef1	.609	49	.000
TPosRef2	.825	49	.000
TBlame3	.699	49	.000
TBlame1	.749	49	.000
TActive3	.718	49	.000
TVent2	.384	49	.000
TDenial3	.637	49	.000
TVent3	.845	49	.000
TVENT3R	.845	49	.000
TVent1	.589	49	.000
TEmSpt3	.685	49	.000
TEmSpt1	.614	49	.000
TEmSpt2	.771	49	.000

Appendix K

Normality: Skewness and Kurtosis *z*-scores

Item	Skewness z-scores	Kurtosis z-scores
Mood2a	**3.07**	0.80
Mood2b	**3.60**	0.98
Mood2c	**5.41**	**3.89**
Mood2d	**9.94**	**17.71**
Mood2e	**11.12**	**27.71**
Mood2f	**3.02**	0.27
Mood1f	**-2.92**	0.82
Mood2g	**14.49**	**40.35**
Mood2h	**7.48**	**10.28**
Mood1h	**-2.96**	0.30
Mood1i	**-2.79**	1.87
Mood2i	**7.43**	**9.14**
Mood2j	**10.81**	**20.54**
GILE1	**2.25**	**-2.21**
GISP1	**6.42**	**6.45**
GISP3	**2.09**	-1.00
GITIME2	**2.88**	-1.63
GILE4	**9.28**	**12.39**
GILE4R	**-9.28**	**12.39**
GIASSE3	**2.25**	**-2.21**
GISP4	**6.20**	**3.80**

FEARS1	**2.34**	-0.53
CONFS1	**3.21**	0.39
FRUSS1	**3.16**	0.71
GCAsse1	1.87	**2.87**
GCTime2	-1.91	**3.43**
GCTIME2R	1.91	**3.43**
GCSP2	1.67	**-2.62**
GCSP3	1.88	**3.89**
PE2	-0.12	**-3.12**
AgInt2	**-2.39**	**5.04**
AgExt2	-1.40	**-2.77**
AGEXT2R	1.40	**-2.77**
AgUC1	**2.33**	0.79
AGUC1R	**-2.33**	0.79
Vent1	**7.18**	**10.48**
Vent2	**13.50**	**33.08**
Vent3	**2.05**	-0.79
EmSpt1	**4.99**	**4.36**
EmSpt2	**4.20**	1.92
EmSpt3	**4.38**	**3.26**
Denial1	**14.09**	**32.67**
Denial2	**13.12**	**28.85**
Denial3	**2.88**	-0.76
BehDis1	**9.14**	**13.36**
BehDis2	**18.09**	**58.95**
BehDis3	**4.86**	**2.36**

Accpt2	**-4.16**	**2.98**
Accpt3	**-2.33**	-0.66
Blame1	**4.50**	**3.15**
Blame2	**7.24**	**9.26**
Blame3	**4.98**	**3.20**
Humor1	**2.13**	-1.05
Humor2	**3.52**	0.58
Humor3	**3.39**	0.17
PosRef1	**-3.62**	0.81
PosRef2	**-3.37**	0.82
Plan1	**-2.44**	-0.03
Plan2	**-2.71**	-0.44
Active2	**-3.57**	**2.38**
Active3	**-3.17**	**2.81**
FearS2	**4.06**	1.79
ConfS2	**2.65**	0.95
TPE1	**-2.01**	**4.92**
TPE1R	**2.01**	**4.92**
TAgExt2	**-2.60**	1.20
TAGEXT2R	**2.60**	1.20
TGCTime2	**-3.70**	**2.56**
TGCTIME2R	**3.70**	**2.56**
TAccpt2	**-5.28**	**4.58**
TBlame2	**3.00**	-0.11
TActive1	**-3.75**	2.55
TBehDis1	**13.65**	**32.97**

TBehDis2	**10.93**	**19.92**
TPosRef3	**-3.08**	0.32
THumor3	**4.43**	1.45
THumor2	**4.86**	**3.92**
TBehDis3	**7.16**	**7.45**
TDenial2	**20.60**	**73.35**
TDenial1	**20.60**	**73.35**
TActive2	**-4.38**	**3.26**
TPlan2	**-3.76**	**2.00**
TPlan3	**-3.61**	1.28
TPlan1	**-3.79**	**2.04**
TPosRef1	**-5.67**	**5.28**
TPosRef2	**-2.19**	-0.47
TBlame3	**4.09**	1.46
TBlame1	**3.21**	0.21
TActive3	**-3.75**	1.52
TVent2	**6.99**	**5.69**
TDenial3	**4.80**	**2.78**
TVent1	**6.38**	**8.54**
TEmSpt3	**4.38**	**2.68**
TEmSpt1	**5.35**	**4.10**
TEmSpt2	**2.72**	0.05

Note: Bolded numbers are greater than the absolute value of 1.96.

Appendix L

Scenario 1: Exploratory Factor Analysis Loadings

Item	Ego-Involvement: Teacher Identity	Problem Efficacy	Goal Relevance: Classroom Culture of Exploration	Goal Congruence: Teacher Beliefs about Assessments	Goal Relevance: Pressure of Time	Agency: Internal Attribution
EI2	**.936**	-.274			.230	
EI3	**.799**				.230	
EI4R	**.728**				-.212	
GCSP3	**.708**	-.207		.324		
GCAsse2	.531	.230	-.241	.456		
AgInt3	-.473	-.227		.330	.206	
GCSP1	.397	.384				
EI1	.379	.304			.236	
PE1	-.226	**.942**				
PE2		**.762**				
PE3		**.742**			-.233	
GCTime3		.490				
GISP2			**.957**			
GISP3	-.295		**.894**	.336	.206	
AGEXT3			.569	-.211		

GCSP2			.476	.362		
AgInt2			-.403	.269		
GCAsse1				**.905**		.214
GCAsse3	.223		.224	**.611**	-.228	-.270
GCTIME2	.294	-.205	.308	-.449	-.309	
GITIME3					**.944**	
GITIME1		-.220	.235		**.875**	
AGUC1						
GITIME4				-.428	.325	
GCLE2	.206					.257
AgInt1						**1.003**
GCLE3						**-.621**
AGEXT1	.203					
AGEXT2		.356	.225			.254
GCTIME1		.470				
GCLE1				.226		
GITIME2						
GIASSE2		.274	-.431		.244	
GILE4						
GILE3R	-.421		-.239			-.281
GIASSE3		.296				-.312
GISP1	-.213	.281				

GILE1				-.272	.283	-.215
GIASSE1						.245
Eigenvalues	7.65	3.30	2.97	2.58	2.20	1.92
% of variance	19.63	8.47	7.62	6.48	5.65	4.92
α	.78	.77	.76	.62	.69	.65

Note: Factor loadings over .60 appear in bold. Factors with an absolute value below .10 are not shown.

Appendix M

Scenario 2: Exploratory Factor Analysis Loadings

Item	Ego-Involvement: Positive Teacher Perception	Goal Congruence: Beliefs about Assessments	Agency: External Attribution	Goal Congruence: Need for Structure	Problem Efficacy	Goal Relevance: Classroom Culture of Exploration	Goal Relevance: Efficient Use of Class Time
TPE2	**.860**						
TEI4	**.741**				.211	-.228	
TPE3	**.722**					.261	
TGCSP1	**.658**		-.272		.365		
TEI2	.550	.440					
TEI3	.511			.293	-.259		
TGCAsse3	.451				-.331	.343	
TAgC2	-.308	.211	-.258		-.262		-.259
TGCAsse2		**.855**				-.286	
TGCAsse1		**.847**			.203		
TGCTime3	.214	.553					.240
TGCSP2		.350	.300		.256	.285	
TAGEXT2			**.904**				
TAGEXT3			**.810**				
TAGEXT1			**.699**	.308			
TGCTIME1				**.923**			
TGCLE2	.230			**.721**			
TGCLE1		.255		**.652**	-.267		
TGCSP3	.341	-.219		.387			
TPE1					**.893**		-.212
TAgC1			-.256		**-.764**		

GISP2						**.920**	
GISP3		-.354	-.203			**.756**	
GITIME1	-.350						**.904**
GITIME3					-.277		**.845**
GILE4							
GILE3						-.362	
GITIME2		-.258	.269				.297
GIASSE2	.345					-.375	.315
TAGUC1							
GITIME4							.408
GILE1		-.347					
GIASSE1			-.231	.245			
GIASSE3	.384			-.289			
GISP1			.284				-.227
TAgInt1		.340	-.374				
TGCLE3							
Eigenvalues	7.18	3.67	3.06	2.40	2.12	1.96	1.65
% of variance	19.41	9.91	8.26	6.49	5.73	5.28	4.46
α	.79	.76	.77	.75	.80	.76	.69

Note: Factor loadings over .60 appear in bold. Factors with an absolute value below .10 are not shown.

Appendix N

Factor Items for Scenario 1

Factor: Ego-Involvement: Positive Teacher Self-Perception	
EI2	During this situation, I believe I am an effective teacher.
EI3	During this situation, I feel good about myself as a teacher.
EI4R	During this situation, I do not feel like a successful teacher.
GCSP3	This situation causes my students to trust my teaching ability.
Factor: Problem Efficacy: Able to Deal with the Situation	
PE1	I have difficulty coming up with strategies to deal with this situation.
PE2	I have the skills to deal with this situation.
PE3	I have the resources to deal with this situation.
Factor: Goal Relevance: Classroom Culture of Exploration	
GISP2	It is important for students to know that their teacher does not know everything.
GISP3	It is important that students feel their curiosity is cultivated by their teacher.
Factor: Goal Congruence: Beliefs about Assessments	
GCASSE1	This situation increases my confidence in how my students will perform on assessments.
GCASSE3	This situation helps prepare students for assessments.
Factor: Goal Relevance: Class Time Used Efficiently	
GITIME1	It is important to cover content in a specified time.
GITIME3	It is important to cover all the standards before the course ends.
Factor: Agency: Internal Attribution	
AGINT1	I am responsible for this situation.
GCLE3	This situation makes me want to use new methods of teaching.

Appendix O

Factor Items for Scenario 2

Factor: Ego-Involvement: Positive Teacher Self-Perception	
PE2	I have the skills to deal with this situation.
PE3	I have the resources to deal with this situation.
EI4R	During this situation, I do not feel like a successful teacher.
GCSP1	This situation makes me appear competent to my students.
Factor: Problem Efficacy: Able to Deal with the Situation	
PE1	I have difficulty coming up with strategies to deal with this situation.
AGC1	If I had more resources, this situation would not have occurred.
Factor: Goal Relevance: Classroom Culture of Exploration	
GISP2	It is important for students to know that their teacher does not know everything.
GISP3	It is important that students feel their curiosity is cultivated by their teacher.
Factor: Goal Congruence: Beliefs about Assessments	
GCASSE1	This situation increases my confidence in how my students will perform on assessments.
GCASSE2	This situation increases how my students will perform on assessments.
Factor: Goal Relevance: Class Time Used Efficiently	
GITIME1	It is important to cover content in a specified time.
GITIME3	It is important to cover all the standards before the course ends.
Factor: Agency: External Attribution	
AGEXT1	Limited time is responsible for this situation.
AGEXT2	If students were better behaved, this situation would not have occurred.
AGEXT3	If students were more focused, this situation would not have occurred.
Factor: Goal Congruence: Need for Structure	
GCLE1	This situation promotes a structured learning environment.
GCLE2	I feel in control of the learning environment during this situation.

GCTIME1	This situation keeps me from covering content in a timely manner.

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