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CLASSROOM ERROR CLIMATE:
TEACHER PROFESSIONAL DEVELOPMENT TO IMPROVE STUDENT MOTIVATION

by

SEAN M. O'DELL
B.A. University at Albany, 1994
M.A. Middlebury College, 1999
Ed.S. Barry University, 2010

A dissertation in practice submitted in partial fulfillment of the requirements
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Major Professor: Michele Gregoire Gill

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ABSTRACT

Student motivation and achievement are often low for students from low socioeconomic status households and may decline when children from all walks of life enter middle school. Despite years of studies describing these declines and efforts to improve learning outcomes, the trends continue. Motivation has been studied from several theoretical standpoints, among them, self-efficacy, beliefs, goal orientations, and emotions. This dissertation introduces error orientation: how teachers and students react to and use errors in the classroom. A positive error orientation, one that views errors as opportunities to learn rather than punishments, may help improve students' emotions, self-efficacy, and future goal orientations, while aligning their beliefs in a more adaptive direction, thus reducing maladaptive academic motivation. A professional development design is proposed here to train teachers in using errors to the advantage of the learner by creating a positive error climate in their classrooms.

Keywords: error orientation, error climate, error-handling, motivation, beliefs, emotions, achievement goal orientations, descriptive studies, professional development design

I dedicate this dissertation to God, to my parents, and to my son Matthew. Without the undying support of my parents, Pat and Phil Hampton, I might not have survived what has been one of the greatest challenges in my life. I have spent many hours writing while I could have been spending more quality time with Matt; I appreciate your patience with me. I love you all.

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CHAPTER ONE: INTRODUCTION

Problem of Practice

A persistent finding in extant research is that there is a decrease in student motivation, and subsequently achievement, during the transition to the middle school years (Anderman & Maehr, 1994; Eccles, et al., 1993; Pintrich, 2003). In addition, motivational deficits may appear in both elementary and middle school with low socioeconomic status (Ginsburg & Bronstein, 1993). At Mary, Queen of the Universe Catholic School (MQU, a pseudonym), achievement – as evidenced by standardized assessment scores – and motivation – as described anecdotally by teachers – are quite low, particularly in the middle grades.

Research in motivation occurs along many lines, including the study of beliefs and academic emotions (e.g., Pekrun, Elliot, & Maier, 2009) and achievement goals (e.g., Ames, 1992). One theory that unites these lines of research is *error climate theory* (Tulis & Ainley, 2011). Among many other potential factors, students' decreased motivation may be related to the way teachers handle student errors in the classroom (Steuer, Rosentritt-Brunn, & Dresel, 2013; Tulis, 2013; Tulis & Ainley, 2011). Pintrich (2003) reminds his readers that motivation comes from the Latin verb that means “to move” and that motivational science is concerned with what gets students moving toward educational pursuits (p. 669).

Teachers at MQU have noticed a lack of academic motivation in their students. One potential remedy may be a change in pedagogy. Recently, the Council of Chief State School Officers (2015) developed a set of model teaching standards using best practices and educational research as their guide. Standard 1(i) states that “The teacher is committed to using learners’

strengths as a basis for growth, and their misconceptions as opportunities for learning” (p. 10). When teachers handle student errors poorly, students exhibit greater fear of failure, avoidance behaviors, and negative emotions (Tulis, 2013). “Emotionally safe” classroom climates allow for errors without fear of losing self-worth (Tulis, 2013, p. 57). Additionally, error climate is related to academic goal structures (Steuer, Rosentritt-Brunn, & Dresel, 2013). In conversations with faculty members at MQU, I found that this foundational pedagogical principal (Bruce, 2005) is largely unknown to the teachers. The purpose of this study is to examine error climate at a local elementary/middle school and to develop professional development to educate teachers about its importance to student motivation and achievement.

Organizational Context

Mary, Queen of the Universe Catholic School is a private Catholic school serving 270 students in grades pre-kindergarten through eight. Founded in 1954 by the Irish Sisters of Mercy, the school is located on the east coast of Central Florida and serves children from a wide variety of socioeconomic statuses: 55% of MQU students qualify for free or reduced-price lunch and 65% attend on a low-income scholarship. The majority of students not served by the low-income scholarship are supported through parish-based financial assistance.

The mission of MQU is to change lives through a high quality Catholic education in a safe and supportive environment. Within fifteen miles of MQU, there are three other Catholic schools: two serve wealthier clientele to the north and south, while MQU’s main “competition” is a school just two miles away serving a similar demographic. Additionally, there are several other private schools in the area, all seeking to increase enrollments from the same pool of

potential applicants. This competition serves to keep the schools at the top of their game, since parents are very willing to leave one school for another. Anecdotally, many families choose MQU because of its reputation as a “family,” rather than simply a school.

In 2006, MQU was selected as a Department of Education Blue Ribbon School of Excellence. Students historically performed far above the average in their academic subjects and the school offered the enrichment programs that allowed it to qualify for the Blue Ribbon honor. In the intervening years, the demographics and the academic standing of the school have changed. While just ten years ago most children came to MQU from upper middle-class families, the majority of students now come from impoverished homes. This was originally the result of the recruiting efforts of the school’s pastor in the African-American community surrounding the school. While middle-income families require much tuition assistance, low-income families qualify for the Florida Corporate Tax Credit Scholarship (Step Up For Students), which has improved the school’s financial standing. As the reputation and enrollment of the school grew, more impoverished families began to seek a Catholic education at MQU for their children. Many of the long-time families at MQU began to move to other schools because, they said, they sensed that the discipline and academics were suffering (C. Drowns, personal communication, 2010).

MQU is a “parochial school,” meaning that it is a ministry of Mary Queen of the Universe parish. The Pastor is responsible for the school (Code of Canon Law 519, 1983) and hires a Principal to run the school’s operations. MQU is part of a large Catholic diocese with over thirty schools. At the diocesan level, there is an Office of Catholic Schools that supports

faith formation, governance, technology, teaching, and learning. While the Principal reports directly to the Pastor, the Bishop has delegated some leadership of schools to the Superintendent of Catholic Schools and the Office of Catholic Schools.

The diocese requires that all schools use the Iowa Assessments (formerly called the Iowa Test of Basic Skills) to gauge student learning progress. Since 2006, MQU student test scores have decreased to the point that its students are now among the lowest-scoring students in the diocese. While a decrease in achievement due to a higher proportion of students from low-socioeconomic status homes might be expected and has a long-standing history in educational research (Buckner, Bassuk, & Weinreb, 2001; Campbell & Ramey, 1994; Okpala, Okpala, & Smith, 2001), this has caused a great deal of anxiety among many of the teachers who are having to change the way they teach in order to meet greater student needs. From a motivational perspective, some researchers have suggested that intrinsic motivation decreases with family SES (Ginsburg & Bronstein, 1993), perhaps as a function of parenting styles that favor external control, although other research has found that resilient students from low-SES households can overcome motivational and achievement deficits (e.g., Cutuli, et al., 2013; Morales, 2010).

In faculty meetings, teachers at MQU bemoan the lack of student motivation, particularly in the middle grades. They frame the situation culturally, as being the result of poverty with a lack of educational support in the home as a primary factor (M. Brown, personal communication, 2014). Teachers have been reluctant to accept professional responsibility for the decreased test scores and low motivation they are seeing, placing the responsibility for change outside themselves and instead with families that do not place a high value on education (J. Prince,

personal communication, 2014). This self-protective point of view may be a factor hindering efforts at helping students achieve at higher levels. The principal has spent many meetings with teachers trying to explain their part in the success of the children at MQU, but explanations are simply not enough to prompt the instructional and climate changes necessary to affect student learning in a positive way.

While there are few teachers still on staff who remember the Blue Ribbon days, many teachers struggle with the daily realities of teaching low socioeconomic status students whose skills lag in comparison to their more economically advantaged peers. MQU exists to change lives, but in the eyes of the teachers, that mission is challenged politically on an organizational level, both because of a lack of funding for exceptional education staff or resources and a diocesan focus on test score comparison with high socioeconomic status schools (Iowa Assessments, 2013). Given the research on SES and the new reality of a changing population at MQU, error orientation, as one possible intervention rooted in educational psychology and motivational theory, may serve to lessen the motivational decline of all students, regardless of age, grade, or SES. Training in error orientation may also help teachers understand how they can have an impact on student motivation

Key Terms and Concepts

Academic Emotion: The emotion brought on by anticipation of or reaction to learning tasks (Huang, 2011)

Achievement Goal: “Competence-relevant aims that individuals strive for in achievement settings” (Pekrun, Elliot, & Maier, 2009, p. 115)

Error Climate: Classroom-level or school-wide perceptions of the value, consequence, or meaning of the errors learners make during learning tasks

Error Orientation: The way teachers understand, react to, and use student errors in the learning environment

Motivation: A force or influence that energizes someone to do something (Bandura, 2012; Merriam-Webster, n.d.; Pintrich, 2003)

Positive Error Orientation: The “evaluation and use of errors as integral elements of the learning process in the social learning environment of the classroom” (Steuer, Rosentritt-Brunn, & Dresel, 2013, p. 198)

Professional Development: Learning experiences designed for professionals in a field that are intended to increase knowledge or proficiencies

Parameters of the Dissertation in Practice

The Doctor of Education in Education (Ed.D.) at the University of Central Florida was revised in partnership with the Carnegie Project on the Education Doctorate (CPED) to be a professional practice program. The Ed.D. provides practitioners with the skills and knowledge to examine complex problems of practice and provides them with the skills and insights to transform organizations. Through the identification and analysis of problems within practitioners’ contexts, the Ed.D. forms leaders who can effect research-based changes to improve education. Given these parameters, I examined the problem of student motivation at

MQU with the goal of creating and reflecting on the implementation of professional development to understand for myself how motivational theory works in practice.

Theoretical Conceptualization of the Problem

Middle School Motivation

In middle schools across the nation, there is a focus on knowledge acquisition and grades, especially as teachers face mounting pressure in the current era of high accountability (Parker & Neuharth-Pritchett, 2009). The focus on grades also exists at MQU where the diocese publishes a graph of school performance for all schools across the diocese and intervenes to support low performing schools. This creates a problem called “stage-environment fit,” where the environment of the middle school does not meet the developmental needs of middle grades children (Eccles & Roeser, 2009).

Students in the middle grades prefer opportunities to learn actively while maintaining a sense of self-worth (Parker & Neuharth-Pritchett, 2009). Middle school teachers, many of whom may feel less competent in teaching than their elementary peers (Eccles, 2004; Parker & Neuharth-Pritchett, 2009), may not believe they have the time or ability to create the types of learning tasks that their students need, increasing the disconnect between learner and environment. This is also true at MQU.

There does not exist one single answer to the question of why motivation and achievement decrease when students enter middle school; in fact, there are many well-researched factors (Hoffman, 2015). It could be that the decreases in interest and engagement commonly

documented during the middle school transition are due to a lack of perceived autonomy upon entry to the middle grades (Wang & Eccles, 2013). The motivational decline may exist because middle schools have more of a focus on competition, rather than learning for its own sake (Anderman & Midgley, 1997). It may also be that students' beliefs in their math and reading abilities decrease at the move to grade 6, contributing to the decline (Anderman & Midgley, 1997), though a belief in the "malleability" of intelligence may relate to better outcomes (Romero, Master, Paunesku, Dweck, & Gross, 2014). Certainly, creating supportive and caring classroom environments holds promise for reversing the typical middle school motivational slide (Urda & Schoenfelder, 2006).

Wang and Pomerantz (2009) conducted a comparative study of U.S. and Chinese middle school students (grades 7 and 8) to determine whether the middle school motivational decline might be a cross-cultural phenomenon. The researchers studied 347 American students and 451 Chinese students from comparable schools (suburban) and backgrounds (working- and middle-class). They studied the value children place on learning, their relative mastery orientations – learning for learning's sake – the autonomy students perceive in their schoolwork, their self-regulated learning strategies, the time they spend on schoolwork, and their achievement. All factors other than achievement were assessed using self-reports. The data were collected at four points: fall of grade 7, spring of grade 7, fall of grade 8, and spring of grade 8. They found that, while Chinese students continued to value academics during middle school and American students did not, both groups experienced decreased motivation. The value placed on learning by the Chinese students mitigated some of the achievement losses experienced by American

students. The researchers found that motivation does decline during seventh and eighth grades and that motivation relates to achievement.

Middle schools in the U.S. are characterized by high departmentalization leading to decreased opportunities for students to build relationships with their teachers. Departmentalization derives from states' certification requirements, which move teachers from elementary generalists to middle grades specialists. In Florida, for example, teachers in the middle grades now require subject specialist certification (Stewart, 2011). Additionally, the larger number of students these teachers see every day decreases the amount of time they have to spend on individual student needs; this is the case at MQU. Middle schools tend to be much larger than elementary schools and they carry out their business in more formal ways (bells, movement between classes, structure of determined class periods, etc., Eccles, et al., 1993). In the absence of multiple certifications, middle school teachers will likely see students for one subject per day, leaving little time for building the supportive and caring relationships students desire (Eccles, et al., 1993; Parker & Neuharth-Pritchett, 2009).

Students seek teachers who are warm and involved in their learning, who create structured learning environments, and who support students' autonomy (Marchand & Skinner, 2007). These characteristics serve as motivational resources for students who then see teachers as partners in their learning rather than adversaries. A lack of these characteristics is related to academic disengagement, leading to decreased achievement. Because society tends to see the middle grades years as a time when children are behaviorally challenging (Eccles, et al., 1993), teachers are perhaps less likely to grant the autonomy students seek and, by controlling the

classroom environment in a way that appears more strict, may be viewed by students as less warm and caring. The relationship between middle grades students and their teachers has been researched for at least forty years (Tricket & Moos, 1974; Fraser & Fisher, 1982; Eccles, et al., 1993), and it is clear that underachieving students are at most risk for academic losses due to declines in this relationship (Eccles, et al., 1993) and its subsequently negative effects on motivation.

At MQU, the middle school follows the national norm. Students see specialist teachers for approximately fifty minutes per day. This is especially difficult for our sixth grade students who have just moved from a self-contained environment to the more independent middle school. Fortunately, as students matriculate through the middle school at MQU, they tend to see the same specialist teachers every year. Anecdotally, by the end of their seventh grade year, many students have formed supportive bonds with at least one of their teachers. This serves, eventually, to moderate the lack of caring relationships so typical in traditional American middle schools.

Middle grade students tend to adopt performance goals due to the more competitive nature of the middle school environment, which contrasts with the relatively collaborative nature of elementary classrooms (Anderman & Midgley, 1997). In other words, the context of the middle school relates to the adoption of performance goals, which are based on competition or demonstration of ability rather than learning for its own sake and are ego-involved rather than task-involved. Students may adopt avoidance goals when they wish to protect their self-worth (Ames, 1992; DeCastella, Byrne, & Covington, 2013). This is commonly seen as students

disengage from work that is likely to produce a negative outcome. If students are to adopt approach, rather than avoidance, goals, middle schools should attempt to create a context where positive outcomes are more likely.

Achievement motivation is “a mediator between the school environment and student engagement” (Wang & Eccles, 2013, p. 14). Engagement can be described as students’ perceptions of the fit between the school environment and their psychological needs (Deci & Ryan, 2000; Wang & Eccles, 2013). Motivation increases as the context of the school more closely matches students’ needs (Wang & Eccles, 2013). Since engagement is of paramount importance in student achievement (Wang & Eccles, 2013), making work relevant, or linking schoolwork to students’ interests and ambitions, supports students’ perceptions of autonomy and should increase their engagement (Pintrich, 2003; Reeve, 2009; Wang & Eccles, 2013). In this sense, increasing students’ engagement with the school context can be viewed as a motivating influence.

At MQU, where teachers and students in the middle grades have the opportunity over several years of forming bonds (M. Brown, personal communication, 2014), the context does eventually meet student needs. In a recent survey of all students in grades five through eight, the following item appeared: Adults in my school show that they care about how students are doing. In all, 67.4% of students agreed with this statement, while only 9% disagreed, pointing to a context where students feel valued and cared for. By eighth grade, we find that students begin to re-engage with their academics. While this does not alleviate the deleterious effects of lack of engagement from previous years, it is a hopeful sign. Additionally, in eighth grade, students

begin preparing to take the entrance exam for our local Catholic high school. This serves as a motivator for many students who wish to attend that school.

Many middle school teachers, including those at MQU, are at a loss when trying to determine the best ways to motivate their students' performance. To increase achievement, MQU recently added an honors track to its 7th and 8th grade course offerings. The idea behind the tracking was that more motivated students could move forward without being held back by those who would not complete their work, while lower-performing students could receive the additional support they need in an environment where they would not experience decreased self-esteem. Additionally, this was intended to decrease the problem of competition among students at widely varying levels of ability. While there is research that shows that ability grouping makes differences in achievement evident (Eccles, 2004), and conflicting evidence regarding positive or negative effects of tracking (Wigfield, Eccles, & Rodriguez, 1998), the thought was that within the classroom itself, students in the regular grouping might be more willing to try, since the more able students would not be present to cause low self-esteem. Due to the small size of the school, the teachers of honors and regular level classes are the same, preventing a common problem of lower quality teachers being assigned to lower-level classes.

In the two years since the honors track was created, MQU has seen growth in its honors students, both in terms of academic performance and motivation, but many regular-level students still perform below expectations and demonstrate low motivation. Research has shown that for higher achieving students, tracking may be beneficial, while that is not necessarily the case for low achieving students (Eccles, 2004); MQU's results support that finding, with honors students

performing above the 56th percentile and regular students performing below the 28th percentile in all subjects on a recent administration of the High School Placement Test (HSPT) used for admission to the local Catholic high school (Scholastic Testing Service, 2015). The contextual and political reality of MQU is that, with competition from higher socioeconomic status schools, something had to be done to improve the achievement of the highest achieving students while providing necessary supports for students at risk. The 28 percentile point gap between the performance levels is, however, very worrisome.

Socioeconomic Status

Students coming from low-socioeconomic status (SES) families tend to be placed more often in lower-track classes (Oakes, 2005 as cited in Eccles & Roeser, 2009), thus limiting potential academic growth. At MQU, this trend is evident: nearly all higher-SES students are enrolled in honors classes. Low-SES students are divided: about one-third of them are placed in honors classes and two-thirds are placed in regular classes. Placement decisions at MQU are based on previous academic performance, behavior, and effort. The implication is that low-SES students, who may never have had the advantages of parental support that high-SES students tend to receive, may have a more difficult time moving from low to higher performance unless the teachers can improve regular-level students' motivation for learning.

In schools with higher rates of poverty, teacher efficacy is lower (Eccles & Roeser, 2009) and teachers may be prone to blaming low achievement on a “culture of poverty” (Ullucci, & Howard, 2015, p. 178) as we have seen at MQU. While it is important not to excuse the low achievement of low-SES students, research has shown that children from poor families have

lower educational aspirations (Vaisey, 2010) and move more and thus change schools frequently (Ullucci, & Howard, 2015). At MQU in 2014, over thirty students have moved out of the area since the school year began, supporting the high mobility contention. There has been research that links low socio-economic status (SES) with decreased motivation (Dowson & McInerney, 1998), finding that low-SES students are particularly vulnerable to a school's environment, whereas "higher SES students' backgrounds may 'insulate' them, to some extent, from (particularly) negative motivational effects associated with their school environment" (p. 18). These factors may be important determinants in students' eventual educational success.

Protective factors are those circumstances or conditions that "enable individuals to circumvent life stressors" (Garmezy, 1991, p. 421). Among the protective factors that can help children living in poverty to overcome the obstacles with which they are faced is a strong and caring connection to an adult at the school (Eccles & Roeser, 2009; Seidman, Allen, Aber, Mitchell, & Feinman, 1994). This is true not only for low-SES students overall, but also for all students making the transition to middle school. Relatedness, along with competence and autonomy, are central to a psychological needs fulfillment theory of motivation (Skinner & Belmont, 1993). A positive error climate may serve as an additional protective factor for low-SES students by creating a supportive environment where making mistakes is acceptable, and even desirable, for learning, rather than an indication of low ability.

The effect of socioeconomic status on learning was recently researched from a neurobiological perspective. Mackey, et al. (2015) analyzed data from fifty-eight students in "public schools, summer camps, outreach programs, and teen centers" (p. 2) who were around

the ages of 14 to 15 years old. They divided the students into income levels based on free or reduced-price lunch status. Using standardized test scores from the Massachusetts Comprehensive Assessment System (MCAS) and structural neuro-imaging, the researchers found that students in higher-income families with higher MCAS scores had “greater cortical thickness in all lobes of the brain” (p. 6) than students from low-income families with lower MCAS scores. The differences in cortical thickness accounted for “almost half of the income achievement gap in this sample” (p. 6). While this research is interesting, it should not be interpreted to indicate inferiority of learning potential in low-socioeconomic status students since learning can impact brain structures (Mackey et al., 2015). Future research may describe educational practices that can affect brain structure in a positive way (Mackey et al., 2015).

Research on Error Orientation

Error orientation, or error climate, is the “evaluation and use of errors as integral elements of the learning process in the social learning environment of the classroom,” (Steuer, Rosentritt-Brunn, & Dresel, 2013, p. 198). Much of the research on error orientation in classroom contexts has been conducted in Germany and Switzerland (Steuer, Rosentritt-Brunn, & Dresel, 2013), so quite a bit of the information on how error handling relates to motivation is unknown to teachers in the United States. European research presents the possibility that creating a positive error orientation among middle school students and a positive error climate in middle schools may improve motivation, since error orientation relates to motivation through academic emotions and achievement goals. Research on errors in the United States is focused on organizational error climate and error feedback in specific disciplines.

In organizations, workplace learning from errors has been studied over the years (Harteis, Bauer, & Gruber, 2008; Keith & Frese, 2005). It has been found that guiding learners to make errors and correct them in training – known as Error Management Training, or EMT – promotes increased self-efficacy (Lorenzet, Salas, & Tannenbaum, 2005) when conscientiousness can be mitigated (Gully, Payne, Koles, & Whiteman, 2002), better learning outcomes, and better transfer to novel tasks than other training methods where errors are avoided or go undiscussed (Keith & Frese, 2008).

Keith and Frese (2005) conducted a study to determine whether EMT benefitted students learning to use PowerPoint. They composed a group of 55 volunteers who were university students and randomly assigned them to treatment groups. Initial training, along with a training manual, was provided in the same fashion to every learner during an “introductory phase” (p. 680). For the training, volunteers were split into three conditions: “error-avoidant training,” (p. 681), where learners were encouraged to complete a PowerPoint task by carefully following written directions; “error management training,” (p. 681), where learners were encouraged to use errors as learning experiences and to make errors as often as needed to successfully complete the task; and “error management training supplemented with a metacognitive module,” (p. 681), where learners received positive error messages supplemented with questions designed to foster metacognition, such as, “What do I know about the program so far that can be useful now?” (p. 681). The researchers used performance on the task, verbal utterances, emotion control scale items, and the Error Orientation Questionnaire (Rybowiak, Garst, Frese, & Batinic, 1999) as their measures. Keith and Frese found that error management training improved adaptive transfer by improving learners’ emotion control and metacognitive activity (2005, p. 687).

EMT's clear benefit to motivation is that it enhances metacognition and self-regulation, promotes control of emotions, and frames errors as positive aspects of learning (Keith & Frese, 2005). The implication of EMT for classroom contexts is that guiding children to make errors and then figure out how to avoid those errors in future tasks may improve achievement.

Frese and Keith (2015) describe how errors are inevitable and that most organizations attempt to prevent errors. Frese and Keith advocate for learning from errors and discuss benefits of a positive error climate in organizations, such as innovation (2015). They point out that a positive error climate is related to positive affective reactions when errors do occur (Frese & Keith, 2015). The organizational research helps us understand that error management can be useful in the learning process by allowing errors to occur while discovering ways to correct them. This, in turn, informs our research at the classroom-level.

Domain-Specific Error Research

In mathematics teaching, teacher beliefs regarding mathematics and students relate to how teachers react to student errors in the classroom (Bray, 2011). In her case study of four third grade teachers in the urban southeast, Bray (2011) examined the implementation of a reform-based mathematics program that encouraged conceptual understanding. She found that teacher beliefs and teacher knowledge related to different aspects of classroom instruction, and that teacher knowledge regarding mathematics and the types of roadblocks to understanding that students may encounter relates to the "quality of teachers' responses to student errors" (p. 35). This type of knowledge is called Mathematical Knowledge for Teaching, and it relates to how quickly a teacher will be able to identify the source of a learner's error and to the overall quality

of instruction (Ball, Thames, & Phelps, 2008). Teachers of mathematics are counseled to look for student errors, as they can help identify “misgeneralized rules” (Blando, Kelly, Schneider, & Sleeman, 1989, p. 307) that may cause students to make the same error over and over again. However, while both the literature and mathematics teaching organizations such as the National Council of Teachers of Mathematics endorse using errors as opportunities to learn, teachers are still in need of support in determining how to use errors to engage students in productive problem-solving conversations (Bray, 2011).

In second language teaching, errors in speaking may go uncorrected for fear of inhibiting communication attempts by learners (Lyster, Saito, & Sato, 2013) even though corrective feedback has been found effective at improving accuracy in production (Lyster, 1998). Even in first language reading instruction, error correction has been found to interrupt the flow of oral reading activities, diminishing struggling readers’ opportunities to learn (Allington, 2013). While in some cases, student anxiety over making errors halts production efforts and reduces students’ desire to communicate in the foreign language (Gregersen, 2003), research shows that some second language learners want corrective feedback (Lyster, Saito, & Sato, 2013) more often than teachers wish to give it. Fear of future errors, perhaps when in an authentic second language environment, makes some learners desire correction.

In an interview study, Gregersen (2003) selected eight native Spanish speakers who were enrolled in a university English class in Chile: the four most and four least anxious about speaking in English, based on results from the Foreign Language Classroom Anxiety Scale. Each student was interviewed in English for seven minutes. Gregersen found that highly anxious

students made more errors, self-corrected more often, reverted to their native language (code switched) more often, recognized fewer of their errors when watching the interview later, and overestimated the number of errors they had made. As an implication, teachers are encouraged to consider the anxiety level of foreign language learners and to encourage learners to not see errors as “devastating” (p. 31). Teachers should also be careful not to overcorrect in an effort to chastise learners they perceive as unmotivated, but who may simply be anxiety-ridden. The conflict between too much and too little error correction paints a complex picture of error handling in second language classrooms.

In the field of music education, errors take on a new meaning. Because music is a performance field, errors may be little tolerated once basic skills are in place. Researchers, drawing on organizational EMT research, have suggested that instrumental music educators should train students to think about the errors they make, the reasons for having made those errors, and ways to avoid the errors in the future (Kruse-Weber & Parncutt, 2014). This type of music education could create a positive error climate in music classrooms.

In science education, a seminal article over thirty years ago described a method of using student errors to integrate new concepts into long-term memory (Nussbaum & Novick, 1982). In their study, Nussbaum and Novick (1982) described a three-step error-handling process based on cognitive psychology: first, students’ misconceptions – or alternative frameworks – are uncovered. This unveiling of “tacit knowledge” (Clark, 2012) is a type of formative assessment that allows for discussions to analyze many different perspectives. Second, a “discrepant event” (Nussbaum & Novick, 1982, p. 187), an event that is observable but in conflict with the initial

misconception, is introduced. This creates the cognitive dissonance necessary to be open to a new idea. Third, the teacher guides students to a solution that accommodates the observed reality into their mental schemas. That science education courses do not focus more on error handling is surprising given the age and popularity of this research study; it has been cited in 162 other articles (Thomson Reuters, 2015).

While there is research indicating that student errors are useful in learning, teachers may be uninformed as to the value of errors and the opportunity that a positive error climate presents for improving student motivation. The impact of error handling on motivation is made clear in European research. Error handling relates to the academic emotions students experience (Tulis & Ainley, 2011), to the achievement goal orientations they adopt (Butler, 1987; Steuer, Rosentritt-Brunn, & Dresel, 2013), and to the beliefs they hold about their abilities (Steuer, Rosentritt-Brunn, & Dresel, 2013).

Relationship of Error Orientation to Academic Emotions and Achievement Goal Orientations

Beliefs regarding error orientation – whether students view errors as a learning opportunity or a personal failure – are related to positive or negative academic emotions respectively (Tulis & Ainley, 2011). Academic emotions come about, in part, based on attribution beliefs such as locus of causality (Weiner, Russell, & Lerman, 1979). Additionally, academic emotions are influenced whether or not the learner perceives learning outcomes as controllable and whether or not the learner places a value on the learning at hand, otherwise known as the Control-Value Theory (Pekrun, 2006; Pekrun, Elliot, & Maier, 2009). Positive

emotions promote “task-related attention, strengthening [of] motivation, and enhancing use of flexible learning strategies” (Lichtenfeld, Pekrun, Stupnisky, Reiss, & Murayama, 2012, p. 191).

In a series of studies of mathematics students in a German middle school, Tulis and Ainley (2011) sought to determine whether some learners would experience positive emotions even after a failure. They also hoped to discover the relationship between students’ emotions and motivational factors such as self-efficacy, value, locus of causality, error orientation, and achievement goal orientation. For the first of the two studies, the researchers selected 182 fifth graders, and used Merlin’s Math Mill (MMM), an adaptive mathematics software program. Tulis and Ainley measured self-efficacy, subject value, error orientation, and state emotions through self-report survey items and found that learners with positive error orientations experienced positive emotions such as pride, enjoyment, and interest after both successes and failures.

In the second study, Tulis and Ainley (2011) were hoping to validate the results of the first study, while determining whether achievement goal orientation and locus of causality would relate to experienced emotions. The researchers again used MMM to train 135 fifth grade students sampled from four middle schools in the same town in Germany. They found that students who experience positive emotions after failure were more likely to adopt mastery goal orientations, and likewise that students who held mastery orientations experienced more positive emotions after failure.

As Tulis and Ainley (2011) found, error orientation relates to achievement goal orientation – a component of motivation. The literature contains definitions of two main types of

goals that individuals adopt: mastery and performance. A mastery goal is motivation toward learning for its own sake (Ames, 1992; Huang, 2011). Mastery goals can be considered “task-involved,” since they focus on the task at-hand rather than on the individual (Eccles & Wigfield, 2002). Students who have adopted mastery goal orientations are likely to see errors as opportunities to learn (Covington, 2000). Performance goals may be defined as motivation toward learning in order to do better than others (Ames, 1992; Huang, 2011). These goals are “ego-involved” because students adopt them in order to feel good about themselves (Eccles & Wigfield, 2002) or to protect their self-worth (Ames, 1992). Students who have adopted performance goals may be more likely to see errors as personal failures. Achievement goals may each be subdivided into approach and avoidance valences (Elliot, 1999). The possibility of a positive outcome relates to an approach motivation, whereas expectation of a negative outcome relates to an avoidance motivation (Elliot, 1999; Graham, 1991). Achievement goals relate both to students’ error orientations and to their motivation by affecting their cognitions, beliefs, and emotions (Ames, 1992).

In a study of sixty university students, Van Dyck, Van Hooft, De Gilder, and Liesveld (2010) examined individual error orientation through a self-regulatory lens. The authors defined error mastery as “a positive approach of [sic] errors, optimally balancing the needs and possibilities for both prevention and management (e.g., correction and learning) of errors” (p. 429). They defined error aversion as “a negative view on errors and a rigid focus on prevention of errors” (p. 429). They wished to determine to what extent an error mastery or an error aversion approach to tasks would relate to achievement goal orientation, action-state orientation (the extent to which individuals take action or ruminate and hesitate when engaging in tasks),

self-focused attention, locus of control and causality. The researchers asked subjects to complete self-report questionnaires and work out Tangram (special ability) puzzles. They found that an error mastery orientation related to an achievement goal orientation and to internal-unstable locus and causality, both of which are considered desirable. Error aversion related to self-focused attention, which depletes cognitive resources that could be used for the task at hand (p. 445), and to internal-stable or external locus and causality. From this research, it is clear that training students to see errors favorably would have multiple motivational benefits.

Academic emotions such as fear of failure or personal standards may serve as antecedents to goal structure adoption (Puente-Diaz, 2013). In a research study on the effects of antecedent emotions in professional athletes, researchers found that the negative antecedent emotion “fear of failure” directed subjects away from mastery-approach goals (Puente-Diaz, 2013).

Perfectionism, defined in the studies as the positive antecedent emotion of high personal standards, directed subjects toward mastery-approach and performance-approach goals (Puente-Diaz, 2013). Concern over mistakes however, a component of perfectionism, influenced subjects toward performance-avoidance goals (Puente-Diaz, 2013). The importance of this research lies in the link between fear of failure and the adoption of goals other than mastery-approach, the implication being that students who fear mistakes may adopt less desirable goal orientations, causing a decrease in motivational resources. Some research indicates that perfectionism can be adaptive when it is self-induced, leading to mastery goal orientations, rather than socially expected, leading to performance orientations (Bong, Hwang, Noh & Kim, 2014), indicating that a classroom environment where perfectionism is important may be maladaptive. Indeed, in the middle school context where students are more competitive regarding their grades, fear of failure

may be more pronounced and socially expected perfectionism may exist, leading to less desirable goal adoption and more negative academic emotions. Because emotions relate to motivation, helping students see errors as learning opportunities rather than indicators of low ability may improve emotional responses and have a positive effect on middle school student motivation.

Since both achievement goals and academic emotions are related to error orientation, it is worth noting their reciprocal relationship. There is a positive relationship between mastery goals and such positive emotions as pride and satisfaction (Covington, 2000), and interest and enjoyment, whereas there is only a moderate positive relationship between performance-approach goals and enjoyment (Huang, 2011). There is no relationship between performance-approach goals and interest (Huang, 2011). There is also a positive relationship between performance-avoidance goals and negative emotions (Huang, 2011). From this research, it appears that students' adoption of mastery-approach goals is desirable if educators wish students to view errors as learning experiences and thus experience more positive emotions related to schooling. In this case, a positive error orientation, which focuses learners on learning from errors rather than attributing them to low ability, seems a desirable goal.

While the duality of the mastery and performance goal orientation research is compelling, it is important to note that students may adopt multiple goals at the same time (Senko, Hulleman, & Harackiewicz, 2011). For example, a student may hold a mastery goal due to interest, but also a performance goal due to a desire to perform well. Recent research with respect to performance goals shows that the positive effects of mastery goal orientations are not as clear-cut as once believed; normative performance goals may actually relate to achievement gains while mastery

goals do not (Senko, Hulleman, & Harackiewicz, 2011). There is some evidence linking mastery goals to adaptive learning practices and possibly to deeper processing, but these goals do not necessarily relate to improved achievement (Senko, Hulleman, & Harackiewicz, 2011).

Mastery experience, or past success, has been shown to be one of the best predictors of future success (Bandura, 2012) as it relates to the formation of a positive academic self-concept. Academic self-concept relates to motivational adaptivity when students make errors (Tulis, Grassinger, & Dresel, 2011, in German, as cited in Steuer, Rosentritt-Brunn, & Dresel, 2013), with lower self-concept students believing errors to be reflections of innate abilities, promoting maladaptive responses (Steuer, Rosentritt-Brunn, & Dresel, 2013).

Benefits of a Positive Error Orientation

Knowing that student error orientation relates to achievement goals and academic emotions, it is important to understand that when teachers handle student errors poorly, students exhibit greater fear of failure, avoidance behaviors, and negative emotions (Tulis, 2013). A series of three studies found that a constructivist classroom environment relates to a positive error orientation because, by nature, constructivist classrooms are open to discussing the ins and outs of various possible ways of completing tasks (Tulis, 2013). Additionally, “emotionally safe” classroom climates allow for errors without fear of losing self-worth (Tulis, 2013, p. 57).

Tulis enumerated four aspects of creating a classroom environment with a positive error orientation.

The first, error tolerance by the teacher, involves teachers' willingness to acknowledge and discuss students' mistakes. The second, irrelevance of errors for assessment, refers to regarding students' mistakes as learning opportunities rather than as negative indicators for performance. In this sense, errors are not being punished but are discussed with the student or with the whole class in order to use the mistake as a learning opportunity. Third, teacher support following errors includes teachers' patience and support of the student to correct the error by him- or herself. Finally, an absence of negative teacher reactions (verbal and nonverbal) implies that teachers do not express annoyance or ridiculing [sic] students if they make an error (Tulis, 2013, pp. 57-58).

Steuer, Rosentritt-Brunn, and Dresel (2013) conducted a study to "conceptualize perceived error climate" (p. 205) and create a student survey to assess it. They added four additional sub-dimensions of error climate related to the classroom context to those elaborated by Tulis (2013). The first two, "absence of negative classmate reactions" and "taking the error risk" (p. 198), relate to a climate where students do not fear negative consequences when they make an error. The second two, "analysis of errors" and "functionality of errors for learning" (p. 198), relate to a learning environment where the use of errors is seen as an integral starting point for learning. In their study, Steuer, Rosentritt-Brunn, and Dresel (2013) studied 1116 students in grades six and seven in Germany. They found that error climate is related to academic goal structures, linking motivation to error orientation. They also found that their additional factors together with Tulis' (2013) factors have created an instrument to accurately capture students' perceptions of classroom error climate.

Studies by German researchers show that, while using errors as opportunities to learn is a benefit, it may not be a common practice (Tulis, 2013). In an observation study of fifth through 13th grade mathematics, German, and economics classes in Bavaria, Tulis (2013) found that teachers used positive error correction more often than negative correction, though there were differences depending on the subject being taught. Tulis also found that redirecting a student's incorrect answer to another student occurred frequently across subjects and teachers. She also found that teachers seldom used errors as learning opportunities (Tulis, 2013).

In another study, Tulis (2013) studied three German teachers as she sought to determine how a teacher's responses to student errors would contribute to a positive error climate. She used student self-reports and video-recorded classroom observations to gather data. In this study, Tulis was also looking at students' reactions to error correction events to determine their affective responses to teacher corrections. This study also found more positive than negative teacher responses to student errors, but found many instances of redirection of student errors to another student (35% of responses), which related to negative affect.

In a third study, 685 students in fifth grade math classes in Bavaria were studied to determine whether teacher error handling related to students' own views regarding learning from errors. Tulis (2013) found that teachers' error handling did relate to the way students viewed errors. She also found that students who viewed errors as opportunities for learning experienced more positive emotions than students who viewed errors as indicative of innate abilities (Tulis, 2013). These studies are compelling in that they help us understand that teachers' error correction behaviors have an effect on students' emotions and their beliefs regarding the errors

they make. The studies also help us to focus on the possibility that teachers are unaware of ways to use errors as learning opportunities.

Error Orientation and Socioeconomic Status

To date, there have been no studies explicitly linking error orientation to socioeconomic status. That said, there has been some research into cultural differences in error handling at the organizational level. One example is power distance. Power distance is a cultural phenomenon where those in power are either close to or far from workers (Gelfand, Frese, & Salamon, 2011). Where power distance is great, inequality is seen as an accepted cultural norm. In such cultures, those in power wish to avoid errors, while subordinates may not feel comfortable addressing them (Gelfand, Frese, & Salamon, 2011). Poverty could be considered a power distance in that low-SES students may be uncomfortable discussing errors with higher power teachers. Indeed, this could even relate to low-SES parents and lack of parental involvement in schools.

Error Orientation Practices in U.S. Schools

Oser and Spychiger, in their 2005 German language title translated as *Learning is Painful: The Theory of Negative Knowledge and Practice of Error Culture*, (as cited in Tulis, 2013) refer to the redirection of one student's error to another student as the "Bermuda Triangle of Error Correction." This is based on a graphic showing the teacher at one vertex of the triangle and the two students (error-producing and error-correcting) at the other vertices. Teachers in the United States use the Bermuda Triangle in over 30% of error correction incidences (Tulis, 2013). Teachers in the United States seem to use a behavioral approach; moving as quickly as possible from a wrong answer to the correct answer focuses attention on the right way to do something

(Santagata, 2005). A consequence of the use of the Bermuda Triangle is a decrease in motivation and positive affect due to the error-producing student's loss of opportunity to reflect and self-correct, even though teachers may use this technique in an attempt to preserve students' self-esteem (Santagata, 2005; Bray, 2011).

In an earlier study, students in grades five and six were studied to determine the effects of anticipated error correction after a task (Butler, 1987). When middle grades students anticipated error correction as directed toward self-improvement, they adopted mastery goal orientations more often (Butler, 1987). When students anticipated error correction as directed toward comparison with others, they adopted performance goal orientations (Butler, 1987). Since comparison with others and performance goal orientations may be less desirable, this research indicates that a positive error orientation in the classroom may create the context needed for students to view errors as self-improvement opportunities.

The trend where the motivational effects of one learning event impact future motivation can be described as a feedback loop (Carver & Scheier, 1990). A student attempting learning may experience a discrepancy (error). If the student is able to correct the error, the student engages in future learning; if unsuccessful and feeling hopeless, the student may disengage from learning. The key is to give the student feedback that leads to a feeling of hopefulness, allowing the student to try again and produce correct information. While the concept of a feedback loop is not new, a classroom environment where errors are viewed as opportunities to learn rather than punishments may allow the student to move toward discrepancy reduction.

Anticipated feedback has been researched as a predictor of goal structure adoption with resultant academic emotions as a dependent variable (Pekrun, et al., 2014). A review of the literature and confirmatory research found that when students anticipated feedback focused on error correction, students adopted mastery orientations and experienced positive achievement emotions; when students anticipated feedback focused on comparison to others, they adopted performance orientations and generally negative achievement emotions (Pekrun, et al., 2014). The anticipation of feedback had direct effects on emotions, regardless of adopted achievement goals, and achievement goals had an impact on achievement emotions (Pekrun, et al., 2014).

While neither Tulis (2013), nor Butler (1987), nor Pekrun, et al. (2014) prescribed an intervention related to error correction, their discussions of the benefits of a positive error orientation within the classroom – whether anticipated or actual – suggest that interventions focusing on the positive nature of errors may be effective in directing students toward a mastery-goal orientation for future tasks. Administrators seeking to improve motivation in the middle grades should consider error orientation when conducting classroom walkthroughs and formal observations. This could foster open communication with teachers regarding the error culture they create in their classrooms.

Identifying the Problem of Error Climate at MQU

Anecdotally, the problem of low motivation in many students at MQU is clear. Teachers report that some students do not put effort into learning and they demonstrate a lack of concern over low assessment scores. I conducted two pilot studies using a teacher error climate survey, see Appendix B, I adapted from Steuer, Rosentritt-Brunn, and Dresel (2013). The eight factor,

thirty-one question survey was originally developed for students in math classes, so I adapted the items for teachers in any subject and added six self-constructed items to create a teacher beliefs sub-dimension. I was curious to learn what teachers believed about the usefulness of errors in learning.

In the spring of 2014, I administered the survey via Qualtrics to a sample of five teachers, three elementary and two middle school teachers, to get some initial data to analyze within SPSS. In the fall of 2014, I again administered the survey, this time for the purpose of obtaining some preliminary data (means and standard deviations) from teachers at MQU. The sample included seven teachers, four elementary and three middle school teachers, the small sample reflective of the size of the faculty at MQU (there are just eleven core content teachers from grades K to eight). Due to the small sample size, the results are not generalizable, but instead helped me to determine initially whether there might be a problem with error climate at MQU.

Means and standard deviations for the fall 2014 pilot study are presented in Appendix B. As a group, elementary teachers rated the sub-dimensions “error tolerance by the teacher” and “irrelevance of errors for assessment” more positively, perhaps indicating that they are not bothered by students’ errors. Middle grades teachers rated the sub-dimensions “analysis of errors” and “functionality of errors for learning” more highly (with the exception of one question), indicating that they spend time trying to understand why students make the errors they do and use those errors as teaching opportunities. The fact that there were differences between elementary and middle school teachers, even in such a small sample, indicates that error climate interventions at MQU should be aimed at both elementary and middle school teachers in order to

create a positive error climate school-wide. While middle grades teachers tend to be most vocal about students' lack of motivation, there is room for growth across the board. This might make the transition from elementary to middle school a bit smoother for MQU students.

Evidence does point to a developmental trajectory for failure, where a first failure compounds with further failures to create anxiety and hopelessness over time (Covington, 2000). This trajectory can begin in elementary school with a first failure experience; so developing a positive error climate school-wide seems a positive step in stemming future negative feelings toward failure including fear of failure.

At the conclusion of the professional development intervention I designed, I again surveyed teachers to determine if there had been any change in self-reported beliefs regarding errors in the classroom. I also surveyed students to determine their perceptions of their teachers' error handling in the classroom.

The research questions for this descriptive study are:

1. Did professional development help teachers create a positive error climate at MQU?
2. Did MQU teachers' beliefs regarding student errors become more adaptive? (e.g., errors are nothing bad, errors are a productive part of learning)

CHAPTER TWO: DETAILS AND RATIONALE FOR DESIGN

Problem of Practice

While teacher education generally includes some foundation in educational psychology, motivating students remains difficult for some teachers. Teachers at MQU worry about the lack of academic motivation they see in children, as evidenced by low levels of active participation in the learning process (e.g., assignment completion and low levels of achievement on classroom and standardized assessments), and indicate that they are unsure of ways to improve it.

Realizing that most teachers have not studied educational psychology since their undergraduate years, if at all, and knowing that classroom error climate is not a topic included in those courses, I designed a professional development unit to help pre-service and in-service teachers understand the basic tenets of motivational theory and how error climate influences students' motivation and to be able to apply this knowledge in their classrooms.

Context

My target population for this dissertation was the teaching staff at MQU, with a particular emphasis on middle school teachers. The target population for future use of this unit will be in-service and pre-service teachers in all subjects. While mathematics teachers with a background in mathematical knowledge for teaching (Ball, Thames, & Phelps, 2008) may have a slight advantage in understanding the importance of students' misconceptions, many teachers have never considered that the way in which they respond to student errors might impact motivation. Because motivation can seem so elusive, this training is intended to give teachers a theoretical understanding of some of the concepts surrounding error climate and to help them reflect on their

error handling practices with a view to adapting them to improve student motivation.

Goals and Outcomes

At the end of the training, teachers will:

- Relate how personal failure experiences can lead to learning and success
- Define some key motivational constructs
- Relate motivational factors to observed student behaviors
- Examine the research on teacher error handling
- Describe the ways motivational constructs interact
- Identify factors that create an error climate and relate those factors to personal experience
- Describe the ways error handling behaviors may affect motivation
- Compare and contrast error handling behaviors in terms of their impact on student motivation
- Examine and reflect on personal error handling behaviors
- Adapt personal error handling behaviors to positively affect student motivation

Key Elements of Design

This design project included a unit plan, teacher and student surveys, and a classroom observation instrument. The intent of the unit was to introduce teachers to several key concepts in student motivation – specifically beliefs, academic emotions, and goal orientations – to remind them that failure and mistakes are a natural part of all learning, and to focus them on their own error-correcting behaviors in the classroom. The global goal for the unit was that teachers would

create a positive error climate that may serve to improve student motivation.

Research on Professional Development Design

Professional development is a simple term used to describe a complex process of adult learning, practice change, and belief change. Evans (2014) sees professional development at a cognitive level as:

the enhancement of individuals' professionalism, resulting from their acquisition, through a consciously or unconsciously applied mental internalisation process, of professional work-related knowledge and/or understanding and/or attitudes and/or skills and/or competences that, on the grounds of what is consciously or unconsciously considered to be its/their superiority, displace(s) and replace(s) previously-held professional work-related knowledge and/or understanding and/or attitudes and/or skills and/or competences (p. 186)

Evans makes an important point: if teachers are going to truly change their professional practice, they must internalize new information and accept it as superior to whatever information they held previously. In terms of design, this means that new information must be presented in a way that facilitates internalization or, as Piaget (1970) put it, accommodation: a change in mental representation.

To facilitate accommodation, it may be helpful to consider affective issues that could negatively impact motivation to change. Gregoire (2003) proposed a cognitive-affective model of conceptual change to describe why teachers are resistant to school reform messages.

Changing MQU's error climate is certainly a reform effort, so this model is applicable.

Gregoire's model, in its simplest form, assumes that teachers will evaluate any proposed change in their practice in terms of whether they believe they are capable of doing what is asked, whether they have available resources, including time, to make changes, and finally, whether they are willing to yield their pre-existing beliefs to accommodate a new reality. A "no" answer to any of these considerations leads to the reform being viewed as a threat, rather than a challenge, and impedes true conceptual change. For the design of professional development, it is important to guide teachers to see new ideas as possible, not overly taxing in terms of time and resources, and within range of their existing beliefs about teaching practice.

Designing professional development continues with an understanding of practical considerations, such as the end user's goals for training, time constraints, and the content to be taught. Once these factors have been determined, curriculum can be designed. Wiggins and McTighe's "Understanding by Design" framework (2005) provides curriculum designers with a simple-to-use template for backward design, or a design that starts with the end in mind. With a curriculum in place, instructional activities can be designed.

Designing instruction for educators requires consideration of factors that will help adult learners derive maximum benefit from training. There is some research support to the notion that good professional development contains a "critical" set of features that ensure retention and transfer (Desimone, 2009). Drawing on the work of many researchers who have studied professional development over the years, Desimone (2009) suggested the following: content focus, collective participation, active learning, coherence, and duration. While many providers

of professional development include these features, there is not universal agreement (Opfer & Pedder, 2011). Independent of methods or programs, teachers may not always “equate [professional development] with continuing to learn” or may even find it to be time wasted (Webster-Wright, 2009, p. 725).

Hiebert and Morris (2012) suggested that a problem with professional development is an insistence on changing teachers rather than changing teaching practice. The authors hypothesized that activities focusing on instructional strategies may be more effective than activities focused on improving teachers. Anecdotally, teachers rate professional development higher when they come away with something that is immediately useful in their daily practice. The question then poses itself: should professional development be a set of take-away strategies or should it attempt to facilitate professional growth (i.e., improve teachers)? This design certainly included strategies, but its intent was behavioral change due to conceptual change. It is worth noting, however, that behavioral change may need to precede conceptual change; teachers may need to try out new behaviors and view positive results before conceptual change can occur (Guskey, 1986).

In the absence of full agreement regarding the qualities of effective professional development, Desimone’s model serves as the foundation for much of today’s professional development design and informed the design of this specific unit of professional development. Returning to Wiggins and McTighe’s (2005) backward design model for curriculum development, the first step is to identify the desired results of the training. This corresponds to Desimone’s content focus (2009); however, knowing the content to be presented is not sufficient.

Instructional objectives that include both the knowledge to be transmitted and the cognitive processes to be activated must be written (Mayer, 2011). These objectives come in three levels: global, educational, and instructional (Anderson, Krathwohl, & Bloom, 2001). The global objectives can be considered a vision (Anderson, et al.) for the unit of instruction; they may also be framed as “essential questions” or “enduring understandings” (Wiggins & McTighe, 2005) that lead teachers to see beyond the training and into the future of their practice. For this training, one essential question was, “Can a positive error climate improve motivation?”

Educational objectives are more specific (Anderson, Krathwohl, & Bloom, 2001) and guide curriculum development. They are usually composed of a verb and a noun. One of our educational objectives was, “Describe how motivational factors interact.” Instructional objectives help the teacher create daily lesson plans by focusing on very specific goals (Anderson, et al.). These statements can be framed as questions or as “I can” statements. One instructional objective for error climate training was, “Compare the way two teachers handle errors in a video scene.” While the content was those aspects of motivation that are important to the error climate model – beliefs, emotions, goal orientations, and error handling – the creation of quality objectives focuses professional development on the desired results of learning and fulfills the first requirement of backward design (Wiggins & McTighe, 2005).

The next step in backward design is the determination of acceptable evidence of learning. In a traditional classroom, evidence may take the form of a test or a performance assessment. In professional development, there is not usually a final assessment: the training is delivered and the teachers leave. To differentiate this training from what is generally offered, the Error

Climate Survey can be administered to teachers and to students to determine whether or not the training had any effect on teacher behavior. Additionally, administrators can use the Error Climate Observation Instrument to assess teachers. Holding teachers accountable for what they learn in professional development might seem controversial, but administrators who wish to substantiate professional growth may appreciate having the opportunity to follow-up with their teachers.

The final step in the backward design process is the creation of instructional activities that will lead learners to successful attainment of the instructional objectives. During this step, it is useful to keep in mind another of Desimone's (2009) design principles: active learning is preferable to passive learning. Instead of listening to a presenter lecturing about a topic, Desimone suggested that leading discussions, observing other professionals, and reviewing student work could improve teacher learning (p. 184). Research on a professional development program called the Problem-Solving Cycle (PSC) by Koellner et al. (2007) confirmed that situating learning in a teacher's context by using real situations could have an impact on teacher learning. Active learning does not necessarily refer to engaging a kinesthetic learning style, especially since the research on learning styles has been recently discredited (Pashler, McDaniel, Rohrer, & Bjork, 2008; Kirschner & van Merriënboer, 2013). Rather, activity at the cognitive level such as selecting, organizing, and integrating knowledge, promotes better learning (Mayer, 2011).

Not only should instruction be active, it must be coherent. Desimone described two ways to understand the concept of coherence: first, new information should be aligned to teachers'

existing knowledge and beliefs. According to Bartlett (as cited in Mayer, 2011), meaningful learning requires “assimilating new incoming information into existing schemas” (p. 29). If new information is too far removed from the prior knowledge held by a learner, preconceptions can get in the way of learning (Nussbaum & Novick, 1982). Second, the new information should not be at odds with policies in place at the school, district, state, or federal levels (Desimone, 2009). Professional development that seeks coherence should be attuned to teachers’ conceptions so that a pathway can be created to the new information being presented. In this unit, it was important to bring teachers’ professional experiences of working with children, as well as personal experiences of schooling, to the discussions. In that way, teachers may have been able to more readily make connections between the content and perceived reality.

To Opfer and Pedder, teacher learning is a “complex system” that occurs every day and at every moment of teaching practice (2011, p. 378). Conversations in the hallway, comments made by an administrator, and a question posed by a child are all aspects of professional learning that will impact the effectiveness of any professional development activity (Borko, 2004). Webster-Wright (2009) looked to Vygotsky when she described learning as being sociocultural in nature and said that “professional practice can be viewed as moment-by-moment continuing learning” (p. 707) as teachers interact with the world around them. This complex system theory connects to Desimone’s (2009) concept of collective participation.

Collective participation occurs when teachers from the same environment (school, grade, etc.) participate in professional learning together and form a community where “interaction and discourse” (p. 184) are possible, promoting learning. Borko (2004) agreed, writing, “strong

professional learning communities can foster teacher learning and instructional improvement” (p. 6). At MQU, the small staff of nineteen teachers works closely together during staff meetings and professional learning opportunities. It was important to structure learning activities to give teachers opportunities to talk to each other and share their experiences. For this reason, this unit of professional development included opportunities for teachers to observe each other and reflect on their practice in small groups.

Borko (2004) went further, situating teacher learning at both the psychological (individual) and sociocultural (group) levels. To reduce teacher learning to a “process-product” model (Opfer & Pedder, 2011, p. 377) ignores the reality of teaching practice and the reality of the limited research proving the reproducibility of the effects of specific professional development programs (Borko). Webster-Wright (2009) concurred that teacher learning is not something that schools can take off the shelf and dole out to teachers. Her literature review led her to the conclusion that “the discourse of [professional development] is focused on the development of professionals through delivering programs rather than understanding more about the experience of [professional learning] to support it more effectively” (p. 712). While this training can be “taken off the shelf,” the intent is that it may eventually become part of how pre-service teachers are trained in classroom instruction.

Design of Error Climate Professional Development

Needs Assessment

Teachers at MQU have indicated in conversations that they believe students lack academic achievement motivation. They feel that current students, most of whom come from

low-SES families, lack resources at home to help them stay motivated (J. Price, personal communication, 2014). I began asking teachers about strategies they use to motivate children and they did not have answers. Upon reading research on error orientation, I began to look for indicators of a positive error climate in classrooms at MQU. I found more instances of the Bermuda Triangle of error correction than anything else. I administered the Teacher Error Orientation Survey to a group of seven teachers and found inconsistent results (see Appendix B). These factors led me to believe that teachers did not have a formation in error handling and were thus in need of training.

Elements of the Design

To meet the needs of the teachers at MQU, I designed a professional development unit on error climate. This unit was delivered over the course of five hours, though the design includes enough material to expand over several more hours if desired. In the design, I incorporated Desimone's (2009) elements of professional development as described above: content focus, collective participation, active learning, and coherence. The design was aligned with standards for teachers and teaching practice including the Florida Educator Accomplished Practices standards (Florida Department of State, 2015) and the Interstate Teacher Assessment and Support Consortium standards (Council of Chief State School Officers, 2015).

The content focused on the objectives from the Goals and Objectives section above, with the essential question: Can a positive error climate improve motivation? The training covered the following topics: failure as feedback, errors as learning opportunities, self-efficacy beliefs, attribution beliefs, mindset beliefs, achievement emotions, achievement goal orientations, and

factors in error climate (error tolerance by the teacher, irrelevance of errors for assessment, teacher support following errors, absence of negative teacher reactions to errors, absence of negative classmate reactions to errors, taking the error risk, analysis of errors, functionality of errors for learning, Steuer, Rosentritt-Brunn, & Dresel, 2013), and teacher beliefs regarding errors.

Encouraging open discussion about error handling behaviors among the faculty members at MQU helped generate the collective participation that is so important in professional learning (Desimone, 2009). Coherence was maintained by bringing teachers' professional experiences of working with children, as well as personal experiences of schooling, to the discussions. This helped support the making of connections between the content and perceived reality. In terms of active learning, I facilitated that by using wait time as teachers considered answers to questions I posed and by using cooperative learning techniques like Think-Pair-Share to help teachers work through potential solutions to problems I posed. To assess the outcomes of the training, I looked for participation in reviews of prior material, I used Student Perception of Teacher Error Orientation surveys and follow-up Teacher Error Orientation surveys.

I used surveys to gauge pre and post professional development training beliefs and practices regarding error orientation. Using Steuer, Rosentritt-Brunn, and Dresel's (2013) Error Orientation Survey for students, and adapting that survey for teachers, I hoped to determine whether teachers' beliefs and practices changed after training. These surveys used a Likert scale from 1 to 5, where 1 indicated that respondents strongly disagreed with the statement while 5 indicated that respondents strongly agreed.

As a doctoral student with a concentration in educational psychology, I was uniquely prepared to present this training to the teachers at MQU. In the future, should others desire to use this training unit, the trainer would need a basic foundation in educational psychology. Using a list of seminal articles in the topics presented that I created, that individual should be able to present the training with ease. The training can be completed in as little as five hours or expanded to twenty hours by going much deeper into each topic. A college professor wishing to train pre-service teachers might be able to complete the training in one or two three-hour class sessions.

The design and delivery of this unit of professional development proceeded as follows: the initial Teacher Error Orientation Survey was administered in November 2014. Design and delivery of five sessions of professional development took place between November 2014 and March 2015, and the Student Perception of Teacher Error Orientation survey and follow-up Teacher Error Orientation Surveys were administered in April 2015. The final step in the design process was an analysis and evaluation of the design plan along with a description of the implications of this design and recommendations for future research.

CHAPTER THREE: RESULTS AND CONCLUSION

Design Analysis and Evaluation

This dissertation in practice sought to improve motivation at Mary, Queen of the Universe School (MQU) by focusing on one element in the complicated realm of motivation: training teachers to handle student errors in a way that promotes their use as an essential element in learning. I designed a unit of training that incorporated elements of effective professional development, as elaborated by Desimone (2009): content focus, collective participation, active learning, and coherence. Through training and between-training experiences, I expected teachers to grow in their understanding of positive error handling behaviors, adapt their practice to include these behaviors, and modify their beliefs about the usefulness of errors in the classroom.

The target audience for the training was the teaching staff at MQU, a group of nineteen educators who had noticed that motivation was poor in many students, especially those in the middle grades. While there were many possible reasons for low motivation, teacher error handling behaviors presented themselves as an interesting area for study. The group most likely to benefit from this design was the students at MQU. By creating a school climate where making errors was a natural part of the learning process, it was expected that students would begin to frame error-making as non-threatening to their self-efficacy and self-worth, and as a valuable learning experience.

I recently conducted a one-hour lesson on error climate for the attendees of the National Catholic Educational Association's Annual Convention. In the session, I touched on some of the key elements incorporated in my design: beliefs (self-efficacy, mindset, and locus of causality),

academic emotions, and achievement goal orientations, while discussing how error-handling behaviors can influence each of these constructs. I also presented the European research conducted by Tulis (2013), Tulis and Ainley (2011), Steuer, Rosentritt-Brun, and Dresel (2013), and Santagata (2005) on error climate and error treatment in classrooms. In post-session discussions with attendees, I found out that the information was inspirational and very useful for daily classroom practice. I also discovered that many of the attendees did not have a basic foundation in motivational science or a knowledge of error climate as a topic, confirming the fact that teachers do not currently possess this information.

Reflection on Professional Development Implementation and Efficacy

During the professional development sessions with teachers at MQU, I noticed that many teachers seemed to, in a general sense, have a positive view of the adaptivity of errors. They reacted well to messages regarding people who have become famous only after having failed. Conversation in the sessions reflected the teachers' beliefs that students should be asked to use errors to improve learning and not to see failure as a disaster, but rather as an opportunity to self-correct. Teachers also seemed to be interested in the motivational theories I described, participating in Think-Pair-Shares with colleagues, asking relevant questions, and volunteering to share their reflections with the group.

I asked teachers to complete simple homework assignments after each session. These assignments were designed to make a positive error orientation visible to students and to give teachers an opportunity to use positive error handling behaviors in the classroom. I found that many teachers did not complete the assigned activities, but those who did were able to participate

in a discussion that shined a light on how readily students were able to internalize the positive error orientation message. In the future, I may require teachers to do peer observations focused on error climate and to document conversations about those observations afterwards.

Some teachers expressed frustration at our using “faculty meeting” time for professional development rather than what they consider to be the real work of teaching. They indicated that they preferred team and vertical planning meetings to training sessions, even though the time was clearly communicated as professional learning time. This harkens back to Gregoire’s (2013) assertion that teachers will only experience conceptual change if they feel they have the available resources, such as time, to do so. These particular teachers often complain about a lack of time for any collegial work and had difficulty seeing professional learning in that light. For this reason, it may be useful to conduct this training with pre-service teachers or to use pre-planning time instead of time during the school year when the hustle of a teacher’s daily life interferes with the attention needed to fully integrate new knowledge.

Student Perceptions

At MQU, I anticipated that teachers would increase their use of positive error handling strategies in the classroom. In student surveys (n=50), results indicated that overall, elementary teachers displayed more positive error orientations after teachers’ professional development training than middle school teachers, though high scores (above 4/5) for positive error handling were rare.

To test for normality, I ran the Shapiro-Wilk Test of Normality (Table 1). Two sub-dimensions, “teacher support following errors” and “absence of negative teacher reactions to

errors,” did not meet normality standards and so I calculated a Mann-Whitney U value for them. For “teacher support following errors,” elementary students viewed teachers as more supportive following errors (Mean Rank = 29.12) than middle school students (Mean Rank = 19.48) ($U = 403, n = 48, p = 0.02$). For the sub-dimension “absence of negative teacher reactions to errors,” the null hypothesis was retained, with no significant difference between groups ($U = 330, n = 48, p = 0.38$).

Table 1 Tests for Normal Distribution for Student Perception of Error Climate Survey

	Shapiro-Wilk Test of Normality			Levine’s Test for Equality of Variances	
	<i>SW</i>	<i>df</i>	<i>p</i>	<i>F</i>	<i>p</i>
Error Tolerance by the Teacher	0.97	48	0.31	0.05	0.83
Irrelevance of Errors for Assessment	0.96	49	0.09	0.05	0.83
Teacher Support Following Errors	0.95	49	0.03	n/a	n/a
Absence of Negative Teacher Reactions to Errors	0.94	49	0.01	n/a	n/a
Absence of Negative Classmate Reactions to Errors	0.95	49	0.05	1.16	0.29
Taking the Error Risk	0.97	49	0.26	2.58	0.12
Analysis of Errors	0.96	49	0.06	0.08	0.77
Functionality of Errors for Learning	0.97	49	0.30	0.06	0.80

Note: $p = .05$

For the six other sub-dimensions where normality standards were met, I ran a t -test to see whether elementary and middle school students had differing perceptions (Table 2). I used a p value of .10 in the t -test due to the small sample size. The difference was significant at $p = .10$

for three sub-dimensions. In the sub-dimension “absence of negative classmate reactions to errors,” elementary students were significantly more likely to report that their classmates would react well when errors are made ($M = 4.07$) as compared to middle school students ($M = 3.17$). Likewise, elementary students were more likely than middle school students to take risks when errors were possible (elementary $M = 3.12$, middle school $M = 2.62$). This finding should be interpreted with caution, however, as a rating of 3 out of 5 on the Likert scale indicates that students were ambivalent about taking risks. Finally, for the sub-dimension “functionality of errors for learning,” elementary students believed more strongly ($M = 3.91$) than middle school students ($M = 3.57$) that errors were used in the classroom to help improve learning. The other sub-dimensions showed insignificant differences between elementary and middle school groups.

Table 2 *t*-Test Results Comparing Means for Student Perception of Error Climate Survey

	Elementary School ($n=25$)		Middle School ($n=23$)		t-test		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>df</i>	<i>p</i>
Error Tolerance by the Teacher	3.18	0.88	3.31	0.77	0.52	45	0.60
Irrelevance of Errors for Assessment	3.91	0.78	3.59	0.82	-1.38	46	0.17
Absence of Negative Classmate Reactions to Errors	4.07	0.81	3.17	0.63	-4.23	46	0.00
Taking the Error Risk	3.12	1.07	2.62	0.86	-1.77	46	0.08
Analysis of Errors	3.65	0.57	3.61	0.44	-0.28	46	0.78
Functionality of Errors for Learning	3.91	0.61	3.57	0.61	-1.97	46	0.06

Note. $p = .10$

Overall, it appears that elementary students at MQU did hold a more positive perception

of the error climate in their classrooms than middle school students, as indicated by four out of eight sub-dimensions with significantly higher ratings by the elementary children. While the differences for the other four sub-dimensions were not statistically significant, by looking at the means it is clear that elementary students did hold more positive views of their teachers' error-handling behaviors with the sole exception of the sub-dimension "error tolerance by the teacher." When we look at the survey statements in that sub-dimension such as, "in our class it is okay with the teacher if the assignments are not done correctly," it is possible that children understood the statement to mean that teachers wanted students to do well, so it would not be okay with the teacher if the student were to fail.

Unfortunately, students did not perceive the error climate as positively as I would have hoped after conducting the teacher professional development.

Teacher Perceptions

In the fall of 2014, I asked teachers to take a pre-training survey about error orientation in the hope of comparing pre and post results after the professional development training on error climate was completed. Only seven teachers took the initial survey and many of them forgot the anonymous codes they had used when they took the post-training survey. For this reason, with fifteen respondents in the post-training survey, it is impossible to compare results to determine the effectiveness of the professional development I conducted. I was curious, however, to see whether teachers rated themselves more highly than students did. Table 3 displays the Shapiro-Wilk Test for Normality for the teacher survey, which identifies five sub-dimensions where a normal distribution exists. Comparing this list with the Shapiro-Wilk test performed on student

data, there are three sub-dimensions where a comparison can be made: “irrelevance of errors for assessment,” “absence of negative classmate reactions to errors,” and “functionality of errors for learning.”

Table 3 Tests for Normal Distribution for Teacher Perception of Error Climate Survey

	Shapiro-Wilk Test of Normality		
	<i>SW</i>	<i>df</i>	<i>p</i>
Error Tolerance by the Teacher	0.85	15	0.02
Irrelevance of Errors for Assessment	0.92	15	0.17
Teacher Support Following Errors	0.91	15	0.13
Absence of Negative Teacher Reactions to Errors	0.91	15	0.13
Absence of Negative Classmate Reactions to Errors	0.92	15	0.17
Taking the Error Risk	0.82	15	0.01
Analysis of Errors	0.81	15	0.01
Functionality of Errors for Learning	0.90	15	0.10

Note. $p = .05$

Table 4 Comparison of Means for Students and Teachers

	Students (<i>n</i> =48)		Teachers (<i>n</i> =14)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Irrelevance of Errors for Assessment	3.77	0.81	4.09	0.51
Absence of Negative Classmate Reactions to Errors	3.61	0.87	3.89	0.47
Functionality of Errors for Learning	3.75	0.62	4.04	0.30

While there is no way to compare means or determine significance with the small sample of teachers, the trend was that teachers viewed their error-handling practices, at least in the three sub-dimensions with normal distributions for both teachers and students, more positively than students did. In other words, teachers at MQU were more positive about the error climate they created in their classrooms than were the children who inhabited those learning spaces every day.

While the small sample of teachers precludes more in-depth analysis, a simple comparison of means shows some differences between the perceptions of teachers and the perceptions of their students. The teacher group included teachers from kindergarten through grade eight, while the student group was composed of children in grades four through eight.

In the first two sub-dimensions, “error tolerance by the teacher,” and “irrelevance of errors for assessment,” the teachers believed that they were quite tolerant of errors ($M = 3.0-4.13$, $SD = .640-.799$) while the children were a bit less certain of their teachers’ ability to see errors as a positive ($M = 2.67-3.65$, $SD = 1.05-1.25$). Likewise, teachers tended to believe that mistakes did not necessarily translate into bad grades ($M = 3.85-4.4$, $SD = .54-.78$) whereas

students saw a more direct correlation between mistakes and poor grades ($M = 3.41-4.18$, $SD = .88-1.17$).

In the sub-dimension “teacher support following errors,” students gave the teachers more credit for patience than teachers gave themselves, but still students were less positive about receiving support from their teachers. In the sub-dimensions “absence of negative teacher reactions to errors,” teachers believed that they did not react negatively when students made errors ($M = 4.07-4.67$, $SD = .49-.96$) while students held less positive beliefs regarding their teachers’ reactions ($M = 3.53-4.23$, $SD = 1.09-1.27$). In the sub-dimension “absence of negative classmate reactions to errors,” teachers again believed that classmates would not react negatively to student errors ($M = 3.67-4.20$, $SD = .37-4.2$) while children did not hold the same view ($M = 3.31-3.8$, $SD = 1.0-1.19$). This may create an environment where children are unwilling to take risks, which is certainly possible given the responses on the sub-dimension “taking the error risk.” Here, we see that children did not wish to risk making errors ($M = 2.71-3.0$, $SD = 1.19-1.26$) while teachers did not perceive the same issue ($M = 3.73-4.2$, $SD = .57-.70$). This disconnect may mean that teachers at MQU were unaware of their students’ fears. Such a disconnect may have prevented teachers from making changes to improve the error climate in their classrooms. Given the training program conducted, this area should be a focus for future professional development.

The next sub-dimension, “analysis of errors,” shows that students felt that their teachers treated errors in detail ($M = 3.37-3.73$, $SD = .81-.97$) more strongly than the teachers themselves ($M = 3.07-3.6$, $SD = .51-1.03$). In the final sub-dimension, “functionality of errors for learning,”

teachers believed that errors could be productive ($M = 3.93-4.29$, $SD = .38-.47$) while the children may not have understood how teachers were using errors as learning opportunities ($M = 3.53-4.14$, $SD = .76-1.13$).

Finally, I surveyed teacher beliefs (Table 5) and found that for the more positive statements (1 through 3), teachers indicated less agreement from pre- to post-training, except on item 3, “as long as the student learns from mistakes and does not make them again, he will get a good grade,” which did improve. This may indicate that teachers saw more clearly that mistakes did not have to make a permanent impact on children’s grades, though they perhaps did not yet see how mistakes could be functional for learning. For the more negative statements, “poor grades demonstrate the importance of paying attention in class,” “students mostly get poor grades because they do not put enough effort into studying at home,” and “mistakes show that students are not paying attention in class,” teachers agreed more strongly after training. This result was startling at first glance, but does correspond to a belief system placing student success squarely on the student’s effort.

This may be the result of the training sessions where effort was equated with success. Using Mueller and Dweck’s (1998) research, the professional development sessions described mindset as a learner’s view of intelligence as either fixed or malleable. The adaptive view is that intelligence is malleable, meaning that with effort any student can succeed. Future use of this professional development unit should include the proviso that, while effort is central to success, an initial failure may not be the result of lack of effort, but perhaps of effort directed incorrectly or of a misunderstanding of presented information.

Table 5 Results of Survey Items for Teacher Beliefs Regarding Errors Post-Training

	Teacher Ratings (<i>n</i> =15)	
	<i>M</i>	<i>SD</i>
1. I believe that mistakes provide teachable moments.	4.4	0.507
2. When returning an assessment, I provide assistance to students who made mistakes.	4	0.535
3. As long as the student learns from mistakes and does not make them again, he will get a good grade.	3.2	0.941
4. Poor grades demonstrate the importance of paying attention in class.	2.8	1.014
5. Students mostly get poor grades because they do not put enough effort into studying at home.	2.71	0.726
6. Mistakes show that students are not paying attention in class.	2.14	0.864

I anticipated that the professional development training would provide teachers with the knowledge (Evans, 2014) to change their practice regarding handling errors in the classroom, specifically by using errors as opportunities to dig deeper into material to be learned and identify misconceptions that have led to errors (Bray, 2011). I further expected that in making these behavioral changes, a change would take place in the teachers' beliefs regarding the errors children make in learning (Guskey, 1986). I expected that students would perceive their teachers as being positive error handlers, and their classrooms as being safe places to make errors along the path to learning (Steuer, Rosentritt-Brun, & Dresel, 2013).

My expectations were not entirely met. Certainly, I have reason to believe that teachers now have knowledge of error climate as a factor (Steuer, Rosentritt-Brun, & Dresel, 2013) based on conversations I have had with them since training. Whether or not they are truly

digging deeper into student misconceptions remains to be seen as I observe their practice over time. While there are some differences in teachers' reported beliefs before and after training, the addition of teachers to the survey pool ($n=7$ pre-training, $n=15$ post-training) confounds the results. One thing that becomes clear in the belief surveys is that teachers said they believed in the tenets of a positive error climate while still indicating a tendency to blame poor grades on students' effort and attention.

Certainly, this is a maladaptive response on the part of the teachers, placing "blame" for lack of student success outside themselves, rather than on their own instructional practices. Attribution Theory, as described by Weiner (1985), helps us understand this problematic response. Teachers who see student success as out of their control (external) are perhaps unlikely to change their own practice, since student success will not be viewed as changeable. Emotions also play a part in the conundrum of attributions (Weiner). A teacher who sees student success as a result of his or her teaching practice may feel pride, while a teacher who sees student failure as his or her fault may feel humiliated. Avoiding the feeling of humiliation may be enough to prompt a teacher to redirect a failure's attribution back to the student. The powerful interplay between locus of causality and emotions needs to be addressed in error climate training to help teachers see their own failures as new opportunities rather than as shameful experiences.

I also found that teachers' self-perceptions and student perceptions differed, with teachers overall giving themselves more credit for creating a positive error climate than their students did. Spector (1994) stated that self-reports may be colored by the social desirability of the responses.

Wubbels, Brekelmans, and Hooymayers (1992) found that teacher self-reports may be more indicative of their ideals than their enacted practices. Although the teachers at MQU were responding anonymously, it is possible that after training they knew what the desired responses were, found those desired practices to be important, and thus responded more positively than their beliefs and practices would suggest.

Why then, did teacher beliefs not change, even after the provision of knowledge indicating the adaptive nature of change? This fact illustrates the difficulties inherent in conceptual change. Pintrich, Marx, and Boyle (1993) described conceptual change as being based upon “personal, motivational, social, and historical processes” (p. 170) and not simply based upon the identification and assimilation of new knowledge. As it turns out, helping teachers to change their beliefs is much more complicated than simple professional development, no matter how well-constructed or long in duration. In fact, Cooney (2002) pointed out that there must be evidence that leads someone to believe that a certain condition is true. If a teacher holds a belief that a certain set of classroom practices is effective, then she must have some evidence that proves this to be a fact.

For example, let’s take a typical middle school math teacher. That teacher has taught for twenty years and has had many parents and students over the years attest to the fact that her class was the best math class ever, that children never understood math before, and that those children wished the teacher could move through the rest of schooling with them. The teacher may well view these testimonials as evidence of effective teaching practice, even though several students fail her class every year. To Pintrich, Marx, and Boyle (1993), this would satisfy the

requirements of a difficult-to-change conceptual belief. Personally, the teacher feels good about the kudos she has received; this motivates similar teaching behaviors over time; those behaviors become known in the school community as effective; and this process occurs over many years. It is not difficult to see that changing teaching practices to be more effective for her lower-achieving students will be a great challenge to the teacher no matter how much research shows the benefits.

It would seem far easier to espouse several of the beliefs that teachers at MQU hold to be true, e.g., “poor grades demonstrate the importance of paying attention in class,” than to believe that near-and-dear teaching practices might need to be changed. Recall that in Gregoire’s (2003) model of conceptual change in teachers, teachers must assess a change in practice as possible, both in terms of motivation (such as self-efficacy for the change being presented) and ability (time and resources are available to be successful), before approaching the change as a challenge rather than a threat. They must also decide to implement the change, for even when a change is possible and viewed as potentially positive, the change must be implemented. Once implemented, Cooney (2002) would suggest that there would need to be evidence of the effectiveness of the change before the belief is finally reshaped.

At MQU, the professional development training I delivered made change possible for the teachers, as the creation of a positive error climate does not require very much additional preparation time and was relatively simple to implement. Of course, teachers had to be willing to try out the steps that were proposed to understand that reality. Teachers anecdotally reported being overwhelmed with the responsibilities of their profession (unit and lesson planning,

reporting progress to parents, keeping up with correcting, and the myriad of other components of the teacher's job), and so implementation may not have been carried out as faithfully as I had hoped, returning less evidence of the effectiveness of the intervention than planned. These factors may well have contributed to the lack of belief change I observed. That said, conceptual change for the students may not have occurred either ("I can be successful in my academic subjects"), which was an implicit, though unstudied, goal of my intervention.

Error Climate and a Beliefs, Emotions, and Goals Model of Motivation

The results of my surveys underscore the complex nature of error climate, and certainly of belief change in teachers. While teacher knowledge may have grown, students are not yet experiencing the full benefits of a positive error climate. The complexity of the error climate factor can be described by showing how error orientation fits into a social-cognitive motivational model (O'Dell & Gill, 2014; O'Dell, 2015) that includes beliefs, emotions, and achievement goal orientations. Because the results were not clear, I am going to describe this model before returning to an additional factor that may contribute to a positive error climate.

In this error climate model, error orientation is ever-present, influencing all other aspects of motivation. The model begins with the error climate teachers create in their classrooms. By sending a message that making mistakes is a normal and adaptive part of the learning process, students may undergo conceptual change about the instability of their abilities, affecting their beliefs and emotions regarding learning. Beliefs and emotions are in a reciprocal relationship: beliefs affect emotions and emotions affect beliefs (Leventhal & Scherer, 1987). Recall that Tulis and Ainley (2011) found that learners with positive error orientations experienced positive

emotions after both successes and failures and that students who experience positive emotions after failure were more likely to adopt mastery goal orientations; likewise, students who held mastery orientations experienced more positive emotions after failure.

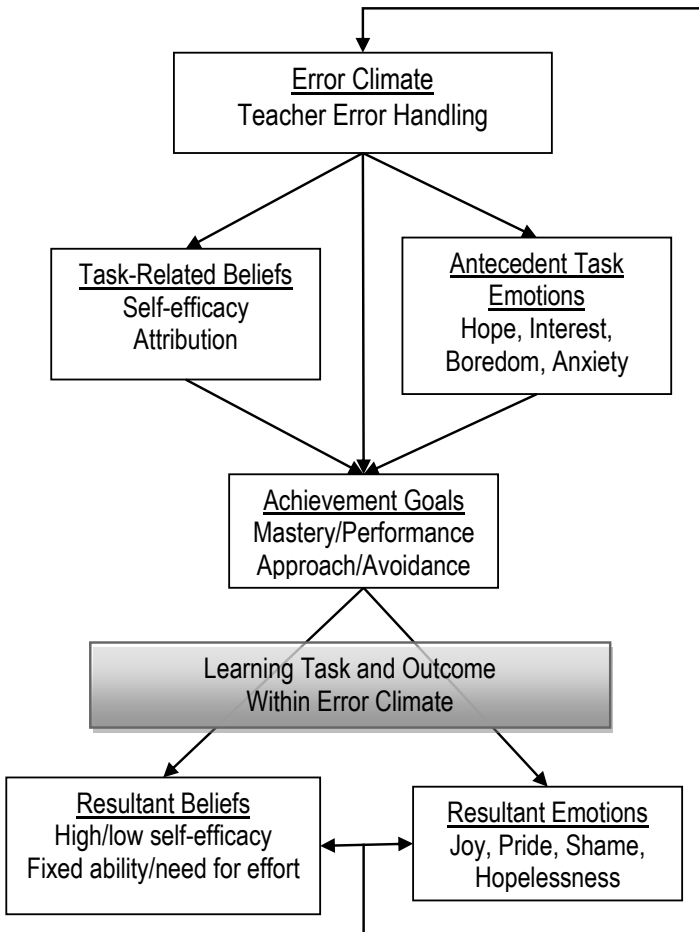


Figure 1 A Model of the Role of Error Climate on Motivation

In training, I described how teachers may be able to help frame mindsets through praise. While praise is not particularly effective in enhancing achievement (Hattie & Timperley, 2007), it may have an effect on whether learners see intelligence as stable or unstable. By directing praise toward effort, rather than toward intelligence (e.g. “You worked so hard to get this answer

and it's right!" versus "You got this answer right; you are so smart!"), the teacher may be able to help the student see success or failure as the result of effort rather than the result of intelligence (Mueller & Dweck, 1998). When failure is experienced and a learner believes that the failure is due to intelligence, negative self-evaluations can lead to decreased motivation (Mueller & Dweck, 1998).

In a study of 373 7th grade students, Blackwell, Trzesniewski, and Dweck (2007) found that when students believed that their intelligence was malleable, their grades actually improved during middle school. On the contrary, they found that when students viewed their intelligence as fixed, achievement did not improve. For this reason, praise for effort should be considered part and parcel of a classroom with a positive error climate, as it frames self-beliefs regarding intelligence and effort in a more effective way. In surveys, teachers at MQU indicated that they believe student effort to be an important factor in student success. In future studies, it would be interesting to add a section on mindset to the surveys to determine whether teachers and students believe that intelligence is malleable and whether or not that belief changes after training and implementation of positive error climate solutions in the classroom.

The error climate model acknowledges that students experience many emotions in learning contexts, including anxiety, interest, enjoyment, pride, shame, and fear of failure. Several of the items on the surveys address emotion, such as "in our class a lot of students hope they will not be called on, because they are afraid they will say something wrong." Achievement emotions are based on the perceived value and controllability of outcomes (Pekrun et al., 2009). Positive and activating emotions improve attention, motivation, and strategy use (Lichtenfeld et

al., 2012). There has been much debate in past years regarding which comes first, an emotion or a belief, and where cognition fits into the equation (e.g. Zajonc, 1980; Lazarus, 1982). For the purposes of this model, the primacy of belief or emotion is not as important as the relationship between these elements and the subsequent adoption of achievement goals. Error orientation enters into the discussion of emotions because positive emotions can be expected when students see their errors as new opportunities for improvement rather than as negative self-information (Tulis, 2013). In survey items such as, “In our class wrong answers on assignments are used to learn something,” students agreed that errors are used for improvement (elementary $M = 4.00$, $SD = .93$; middle school $M = 3.35$, $SD = 1.03$), so we could expect more positive emotions related to errors. In future studies, achievement emotions should be linked to error climate through survey items such as “I feel okay about myself when I make an error” and “failure does not make me feel bad about myself.”

The next part of the error climate model is students’ adoption of achievement goal orientations related to the learning task. This adoption is placed after beliefs and emotions because of research indicating that academic emotions may precede the adoption of goal orientations for specific tasks (Puente-Diaz, 2013). The achievement goals students select, based on their beliefs and emotions, can be positive (mastery-approach), potentially positive (performance-approach), or negative (mastery- and performance-avoidance).

The adoption of desirable goal orientations is critical: it influences and is influenced by error climate (Tulis & Ainley, 2011; Van Dyck, Van Hooft, De Gilder, & Liesveld, 2010). Covington (2000) found that students who have adopted mastery goal orientations are likely to

see errors as opportunities to learn, while students who have adopted performance goals are likely to see errors as personal failures. Van Dyck, Van Hooft, De Gilder, and Liesveld (2010) found that taking a positive approach to errors relates to the adoption of mastery goal orientations. Performance-avoidance goals relate to negative emotions, whereas mastery-approach goals and performance-approach goals may relate to more positive emotions (Huang, 2011).

It is important that teachers attempt to create a classroom environment where mastery goals are encouraged. In this way, students will compare their achievement to the progress they have made rather than making a social comparison between themselves and others. At MQU and in many schools around the nation, norm-referenced tests are administered annually and the results are shared with students, families, and teachers. The reports of student achievement on these tests are National Percentile Rankings (NPR), which display a student's performance in comparison to a norm group, rather to a set of objective standards. This type of school-wide focus on comparison surely does not help to create the mastery-oriented climate that is so important to a positive error climate. Rather, it creates competition between students, teachers, and schools. While competition may be viewed as a motivating force in some instances, it can also be a demoralizing force, focusing students and teachers on comparison rather achievement of standards.

In a small study (Arenas, Taberero, & Briones, 2006), thirty-five Spanish university students of business participated in a fifteen-week simulation. The simulation consisted of working as a manager in a furniture factory, supervising the production of furnishings. The

researchers wished to determine whether job insecurity, goal orientation, and error orientation would relate to self-regulation, self-efficacy, affective reactions, and performance. The experimental group was given information that created insecurity for the simulated job, while the control group was not. At various times throughout the fifteen weeks, participants took questionnaires to assess these factors. The researchers did not find support for their hypothesis about job insecurity but did find that participants with a mastery goal orientation were more willing to take error risks, that positive affect related to a mastery goal orientation and to error risk taking, and that participants with lesser levels of performance goal orientations and more positive attitudes toward errors had higher self-efficacy. The MQU study did not assess how achievement goals relate to error orientation; future research in U.S. schools should attempt to make that connection.

Upon completion of a learning task, O'Dell and Gill (2014) suggest that students will undergo a reappraisal of beliefs and emotions. Depending on the error climate the teacher has created in the classroom, students may react positively or negatively to the results of learning. The resultant emotion derives from both antecedent beliefs and emotions, and the achievement goal orientation originally adopted, combined with the result of learning, which may be expected or unexpected, all within the context of the error climate the teacher has created.

Tulis (2013) found that with a negative error climate, students tend to exhibit fear of failure, avoidance behaviors, and negative emotions. Hattie and Timperley (2007) found that feedback is most effective when the classroom climate is conducive to the use of errors to improve future achievement. It is also possible that the failure experience will shape

attributional beliefs by causing students to see a negative outcome as a reflection of innate ability and/or an uncontrollable condition. Success or failure at a learning task generates emotions framed by students' beliefs in their abilities and the effects of their efforts. Since the reinforcement or contradiction of beliefs carries over to future learning tasks, it is important that teachers provide mastery opportunities, even in the face of failure. This can potentially be achieved by allowing students to correct errors and gain back lost points or by measuring achievement based on personal growth, rather than basing it on comparative achievement with other learners (O'Connor, 2007; Tulis, 2013). The beliefs that are changed or strengthened are potentially set in place for a new task, with its associated emotions and goals.

In a study of forty-seven students (who received extra course credit for participation), Spieker and Hinsz (2004) measured personal goals (not to be confused with goal orientations) and self-efficacy after a series of failures and successes. They found that, while self-efficacy may not be affected by failure experiences, there is a positive relationship between repeated successes and self-efficacy. They also determined that the goals learners choose for future tasks are affected by repeated successes. In other words, repeated success related to improved self-efficacy and to participants setting loftier goals for themselves in future tasks. In terms of the motivational model presented here, this research helps substantiate the link from the learning task to the resultant beliefs.

This model serves as a call to action for the importance of error climate training. Having as broad an influence on student motivation as research suggests, error climate certainly holds promise as an environmental factor that should be in place in today's classrooms.

Standards-Based Grading and Error Climate

Educators today hear that grades cause stress to students (Docan, 2006), but many grading systems still rely on the use of points that cannot be earned back even by eventual mastery (O'Connor, 2007). This practice contradicts Tulis' (2013) idea that errors should be opportunities to learn, rather than punishments. A truly positive error climate could certainly help to mitigate the stress that learners feel when they make mistakes in learning.

Grades are a large part of the error climate model, as errors generally equate to lowered grades. Standards-based grading is a possible solution to some of the problems created by a traditional grading system. Grades are emotionally charged for all stakeholders in the educational process (Brookhart, 1994). Standards-based grading has taken hold in the world of education today (O'Connor, 2007, 2009) and is in practice in the elementary grades at MQU. In a standards-based system, the traditional ABCDF grading system is either replaced or augmented by ratings of proficiency on clearly delineated standards for learning. In such a system, students are graded on what they can prove they know and opportunities to try again allow for replacing earlier unsuccessful grades with those earned with eventual success (O'Connor, 2007, 2009). Survey results indicated that at MQU, where elementary students are graded in a standards-based system and middle school students are graded more traditionally, elementary students had more positive responses in the sub-dimension "irrelevance of errors for assessment" (elementary $M = 3.52-4.28$, $SD = .84-1.21$; middle school $M = 3.21-4.08$, $SD = .94-1.17$). This result suggests that standards-based grading may have an effect on error climate at MQU.

Teachers mostly grade the way they were graded (Guskey, 2006), and teachers at MQU are no exception. This creates a system in which grading can be viewed as unfair or capricious. A standards-based grading system and some changes to grading practices can alleviate some of these issues by focusing only on student achievement and by separating out behaviors like effort and responsibility from the achievement grade (O'Connor, 2007, 2009).

In the past (and even today), an unsuccessful grade would be averaged with the successful grade, leaving no true indication of eventual success. Take, for example, a student who earns a 25% on the first assessment of the second grade Common Core standard “Add and subtract within 20” (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010). That student works with the teacher and then earns an 85%. While the end result is proficiency, an averaged grade would be 55% or F. In a standards-based system, the 85% replaces the earlier 25% and the student obtains a B.

If a goal of education is to ensure student proficiency, the end result of learning should determine the grade. This is in line with Tulis (2013) when she says that errors should be irrelevant for assessment and that teachers must support learners when they make errors. Surely, assigning a 55% is maladaptive and does not reflect the resulting student achievement, whereas giving learners additional opportunities to prove proficiency with additional effort can improve the learning environment by sending students a message that ability is malleable and a one-time performance will not determine your quality as a student (Ames, 1992). While introducing changes to grading systems is a challenge, teachers who adopt a positive error orientation will be able to see how much more valuable such a change will be for students. After all, the second

grader who receives an F after attaining proficiency might not be motivated to continue the hard work needed to achieve at higher levels.

O'Connor (2007, 2009) also suggested that zeroes never be given as grades unless the zero can be replaced with eventual success. Take, for example, a student with the following grades in English: 85, 90, 0, 85. The mathematical average is a 65, or a D. It is clear from the grades that this student is proficient in most material, but the resulting D average does not communicate that truth. Using zeroes to punish students for incomplete or missing assignments turns grades into something to be feared, rather than a reflection of learning. It invalidates the grade as a measure of achievement by including effort (Brookhart, 1994), making the grade less meaningful. It also communicates to the student that her mistake in not submitting an assignment is unforgivable and that achievement is secondary.

Another of O'Connor's fixes for grading (2007) is the suggestion that formative assessments not be used in the calculation of a final grade. Formative assessment is a useful tool for teachers and students to gauge how well learning is progressing before taking a final, summative, assessment. When formative assessment is not included in a final grade, students are free to make errors and learn from them. This is the most obvious practice aligned with Tulis' (2013) irrelevance of errors for assessment. Once the teacher and student feel confident that mastery is imminent, based on formative assessments, a summative assessment can be administered and counted into the grade. At MQU, many of these practices are policy, but many teachers do not agree with this new system, leading perhaps to the moderately low-rating for the

teacher belief that “as long as the student learns from mistakes and does not make them again, he will get a good grade” (pre-training $M = 2.83$, $SD = .98$; post-training $M = 3.2$, $SD = .94$)

Implications and Recommendations

While the creation of a positive error climate holds promise as a motivational intervention, it is clear that teachers’ beliefs regarding errors and their ability to correctly diagnose misunderstandings and guide learners to correct performance are primary factors affecting successful implementation (Seifried & Wuttke, 2010). Seifried and Wuttke (2010) conducted two pilot studies: one to determine how students view the error climate in their classrooms, and another to identify how teachers respond to student errors. For the first study, the authors surveyed a sample of 1,136 Bavarian vocational students (college and secondary level) to determine the perceived error climate. They found that students perceived a mostly positive error climate, and that the positive error climate correlated with students’ adoption of a mastery goal orientation. For the second study, the researchers identified 76 error situations from video segments of teaching from two vocational teachers with similar demographics. They found that the teachers rarely attempted to understand the sources of student errors and frequently moved on from a student who had produced an incorrect answer without giving the student an opportunity to arrive at the correct response.

Though the video analyses took place with only two teachers, making the data ungeneralizable, the results suggest that teacher competency may be lacking (Seifried & Wuttke, 2010). The authors suggest that there are three teacher competencies that are required if they are to be successful at creating a positive error climate: the first is “knowledge of possible error

types,” (p. 150) where teachers know before the lesson the types of errors learners are likely to make. The second competency is “available strategies of action/teachers reaction,” (p. 150) where teachers know and use effective methods for guiding students to understanding. This correlates with Tulis’ (2013) analysis of errors. The final competency is “a constructive view on errors and their use in classroom processes” (p. 150), where teachers take the time to work through student errors; this correlates with teacher support following errors (Tulis, 2013). This dissertation research has produced a training program that may be effective in leading teachers toward these competencies, especially when it comes to teacher reactions and the use of errors for learning.

Another promising area of research lies in the investigation of the peer networks within which students learn in the classroom and how those networks influence students’ “fear of making mistakes” and their “positive learning orientation towards mistakes” (Zander, Kreutzmann, & Wolter, 2014, p. 206). Zander, Kreutzmann, and Wolter (2014) used social network analysis to better understand how these peer networks might relate to student error handling in terms of the social realm of the classroom. In a study of 448 fifth and sixth grade students in Berlin, researchers used questionnaires to determine students’ level of fear of making mistakes, their learning orientation toward making errors, and their self-efficacy beliefs. The advantage of this research is that it did not depend solely on self-report surveys, but included social network analysis.

Zander, Kreutzmann, and Wolter (2014) found that, when students hold high self-efficacy beliefs and their classrooms have “high collaborative network density” (many potential people

with whom to work, p. 219), they are less afraid of making mistakes and have a more positive view of learning from mistakes. Additionally, those students with high self-efficacy who had reciprocal collaborative relationships (someone with whom the student wishes to work, who also wishes to work with that student) were less afraid of making mistakes and held a more positive view of the use of mistakes in learning. The researchers believe that the high self-efficacy beliefs allow these students to proactively make use of the collaborative networks that are available. This research supplements that of Tulis (2013) and Steuer, Rosentritt-Brunn, and Dresel (2013) by focusing on the importance of creating a collaborative environment in the classroom if a teacher wishes to facilitate a positive error climate.

This dissertation in practice focused on a very narrow option for improving motivation in students: creating a positive classroom error climate. Having stumbled upon the work of German and Swiss researchers (Tulis, 2013; Tulis & Ainley, 2011; Steuer, Rosentritt-Brunn, & Dresel, 2013) in my educational psychology concentration courses, I realized that error handling was a topic little explored in U.S. educational contexts, while error management training (EMT), or learning by examining potential errors, was well-known in the organizational training literature (Keith & Frese, 2008). As I focused more and more on the interaction between self-efficacy beliefs, mindset beliefs, attribution beliefs, academic emotions, achievement goal orientations, and teacher error orientation, I became convinced that positive error handling could relate to improved student motivation.

It is important to keep in mind that motivational improvements may not necessarily be reflected in improved student achievement, especially in the beginning. Carole Ames (1992)

stated that, “motivation is too often equated with quantitative changes in behavior (e.g., higher achievement, more time on task) rather than qualitative changes in the ways students view themselves in relation to the task, engage in the process of learning, and then respond to the learning activities and situation” (p. 268). The creation of a positive error climate will not be a panacea for MQU, solving all of the achievement deficits that exist, but it may just improve the way students engage in their classrooms and view themselves as learners.

My coursework in the University of Central Florida Doctor of Education program gave me a foundation in using research literature to understand complex problems of practice, framing problems of practice, and designing and evaluating the effectiveness of programs that can improve learning institutions. Beginning with our first course, *Facilitating Learning, Development, and Motivation*, I became interested in educational psychology. The program was flexible enough to allow me to concentrate on that field, exposing me to literature that is very relevant every day in my position as principal, for the research on cognitive learning and instruction is the foundation for education everywhere.

MQU is a small Catholic school at a crossroads. A shift in the student demographic has led some teachers to feel that they are not able to meet the needs of the children in our classrooms. While a diversity of learning needs points to the need for training on instructional best practices such as differentiation, a lack of motivation points to the need for teachers who understand student motivation and have access to strategies that will help them motivate their students. This dissertation in practice sought to design a training program that would give teachers an arrow in their quivers that could help improve their students’ motivation. It should

be clear that an error orientation training program will not solve all of the problems at MQU, but may provide one more insight to help teachers adapt to the children they serve. In this study, student data showed that, overall, elementary students at MQU found their teachers to create more positive error climates in their classrooms than middle school students, somewhat confirming the research that suggests that stage-environment fit for middle school students is poor (Eccles & Roeser, 2009).

Limitations and Future Directions

A major limitation of this study from the beginning was its reliance on me, the principal, as the conductor of the professional development training. Principals generally do not have the time or resources needed to prepare for the delivery of such intensive professional development. Additionally, my being in a position of power with regard to the teachers may skew the results in favor of desirable self-reports while not actually creating the cognitive change necessary for improvement. The lack of a principal's time is certainly reflected in my inability to complete all of the aspects of training I had wished, such as creating and making use of video scenes of error correction events for teachers to analyze.

A further limitation of the present study was the fine-grained approach to student motivation, in terms of error climate, that was examined. The teachers at MQU stated that the professional development was interesting but may not have been motivated to make changes for a variety of reasons. Gregoire's (2003) conceptual change model and the comments made by teachers regarding the training enlighten the finding that the teachers felt threatened by the proposed changes due to their perception that they simply did not have the resources or time to

be able to complete assigned tasks and readings or to truly reflect on how error handling may affect student motivation. When changes are viewed as a threat, heuristic processing of new information takes the place of true change (Gregoire, 2003).

There may have been larger issues at hand in working with the staff at MQU. Based on conversations I have had with teachers over the past few years, they believe that the motivational and achievement deficits they see in their students are outside of their control. When introducing the fact that teachers can impact student motivation, it is possible that the teachers felt “blamed.” My interactions with teachers suggest that they do not see how their own practices can motivate their students. That belief may have led teachers to be closed to the potential of integrating a change to their practice. In retrospect, this larger issue of the locus of control for student achievement and motivational outcomes should have been addressed first, by helping teachers to understand their role in academic motivation and achievement.

Future researchers should refine this study by including a student pre-survey to determine whether or not professional development for the teachers had an effect on the students’ perception of error climate. A true experimental design would be beneficial to determine whether the error handling interventions impact classroom error climate. Additionally, survey items that view error climate from a more complete standpoint such as that presented in the model of error climate proposed by O’Dell & Gill (2014) and O’Dell (2015) may shed light on the effects of error climate on multiple motivational constructs.

The present design was created for delivery over a short period of time, and so must be expanded to meet the duration requirements of many professional development programs. While

the program was designed with the MQU teachers in mind, there is nothing in the training that is specific to MQU, and so the unit of professional development may be used by anyone who is interested in classroom error climate. In fact, I recently presented an abbreviated version of this research at a national convention. Simply knowing the research and rediscovering some of the basic educational psychology learned as an undergraduate could be enough to prompt teachers to investigate the relevant theories.

I would recommend that a larger-scale study of error orientation in U.S. schools take place. While the German and Swiss data is compelling, the MQU data is sparse. It certainly warrants a more extensive empirical investigation. Psychometricians may be able to devise a better observation instrument that administrators can use to evaluate error handling practices in their teachers' classrooms, while instructional designers may be able to create the video scenes of teachers handling errors for use in training. For example, it would be useful to have scenes of teachers experiencing frustration with students along with actual teachers using the eight factors of a positive error climate with their students. Testimonials from students, describing how a positive error orientation makes classroom learning more enjoyable and less stressful would also be helpful. The use of an observation instrument may be beneficial in reducing the error brought on by overreliance on self-reports.

While the original premise of this descriptive study was to research whether teacher training in error climate might affect the decrease in motivation across the transition to middle school, I eventually identified that elementary teachers may be similarly in need of training in motivation. The training conducted as part of this study may not have been as effective as I had

desired, but perhaps in a longer format (twenty or more hours) and with the use of the teacher observation instrument, greater changes in error handling behaviors may be obtained. This study contributes to the study of student motivation by providing U.S. educators with information and ideas for improving motivation that were not widely available or studied here before. At MQU, there is still work to be done.

**APPENDIX A:
IRB APPROVAL LETTER**



University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Approval of Human Research

From: **UCF Institutional Review Board #1
FWA00000351, IRB00001138**

To: **Sean M. O'Dell**

Date: **June 18, 2014**

Dear Researcher:

On 6/18/2014, the IRB approved the following human participant research until 6/17/2015 inclusive:

Type of Review: UCF Initial Review Submission Form
Project Title: Error Climate in the Classroom
Investigator: Sean M. O'Dell
IRB Number: SBE-14-10333
Funding Agency:
Grant Title:
Research ID: N/A

The scientific merit of the research was considered during the IRB review. The Continuing Review Application must be submitted 30 days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at <https://iris.research.ucf.edu>.

If continuing review approval is not granted before the expiration date of 6/17/2015, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., UCF IRB Chair, this letter is signed by:

IRB Coordinator

**APPENDIX B:
PILOT STUDY MEANS AND STANDARD DEVIATIONS**

Table 6 Pilot Study Means and Standard Deviations

	Elementary (n=4)		Middle School (n=3)	
	Mean	SD	Mean	SD
Error Tolerance by the Teacher				
It is okay with me if the assignments are not done correctly.	3.25	0.96	2.33	0.58
Mistakes are nothing bad for me.	3.75	0.50	3.67	0.58
I don't like if something is done incorrectly.*	3.75	0.96	3.33	0.58
It is okay with me if someone says something incorrect.	3.75	0.50	3.33	1.16
Irrelevance of Errors for Assessment				
If someone makes a mistake, he will get a bad grade.*	4.50	0.58	4.33	0.58
If someone says something wrong, it has an immediate effect on his grade.*	4.75	0.50	4.67	0.58
If someone does something incorrectly, he will get a bad grade.*	4.50	0.58	4.33	0.58
If someone does not do his assignment correctly, he will immediately get a bad grade.*	4.50	0.58	4.33	0.58
Teacher Support Following Errors				
If someone can't solve an exercise correctly, I will help him.	4.25	0.50	4.67	0.58
If someone does something wrong, he will get very little support from me.*	4.00	0.82	4.33	0.58
If someone says something incorrect, I will patiently explain the problem.	4.00	0.00	4.00	0.00
If someone does something wrong, he will get support from me.	4.25	0.50	4.33	0.58
Absence of Negative Teacher Reactions to Errors				
If someone does something incorrectly, I might mock him.*	4.25	0.50	4.67	0.58
If someone makes mistakes, I often get annoyed.*	3.75	0.50	4.00	0.00
If someone says something wrong, sometimes I may embarrass him in front of the entire class.*	3.50	1.29	4.67	0.58
If someone solves an assignment incorrectly, once in a while I will become angry.*	3.75	1.26	3.33	2.08
Absence of Negative Classmate Reactions to Errors				
If someone does something wrong, he will sometimes be ridiculed by his classmates.*	2.50	0.58	4.00	0.00
If someone says something incorrect, he will later have to put up with teasing from his classmates.*	4.00	0.00	4.33	0.58
If someone makes mistakes, his classmates will sometimes make fun of him.*	2.00	0.00	4.00	0.00
If someone solves an assignment incorrectly, his classmates will mock him.*	3.50	0.58	4.00	0.00
Taking the Error Risk				
In my class a lot of students would rather say nothing at all than something that is wrong.*	4.25	0.50	3.67	0.58
In my class a lot of students hope they will not be called on, because they are afraid they will say something wrong.*	4.00	0.82	4.00	0.00
In my class a lot of students don't dare to say anything because they are afraid it is wrong.*	4.00	0.00	4.33	0.58
Analysis of Errors				
We discuss it in detail when something is done incorrectly.	3.25	0.96	4.00	0.00
We think about it in detail when someone says something wrong.	2.50	0.58	3.67	0.58

Mistakes are investigated in detail.	3.00	0.82	4.00	0.00
Assignments that are done incorrectly are discussed in detail.	3.00	0.82	3.67	0.58
Functionality of Errors for Learning				
The mistakes students make are often used to make sure they really understand the subject.	4.00	0.00	4.33	0.58
Students learn a lot from assignments that were not done correctly.	3.75	0.50	3.67	0.58
Wrong answers on assignments are used to teach something.	4.25	0.50	4.33	0.58
Wrong answers are often a good opportunity to help students really understand the material.	4.25	0.50	4.67	0.58
Teacher Beliefs Regarding Errors				
I believe that mistakes provide teachable moments.	4.75	0.50	4.67	0.58
When returning an assessment, I provide assistance to students who made mistakes.	4.00	0.00	4.3	0.58
As long as the student learns from mistakes and does not make them again, he will get a good grade.	2.67	1.16	3.00	1.00
Poor grades demonstrate the importance of paying attention in class.	2.25	0.96	3.00	1.00
Students mostly get poor grades because they do not put enough effort into studying at home.	2.00	0.82	3.00	1.00
Mistakes show that students are not paying attention in class.	2.00	0.82	1.67	0.58

Note. Negatively coded items marked with an asterisk. Beliefs items were not recoded.

**APPENDIX C:
UNIT PLAN**

Error Climate Unit Plan

Florida Educator Accomplished Practices Standards:

(7a) The accomplished teacher uses an understanding of learning and human development to provide a ***positive learning environment*** which [sic] supports the intellectual, personal, and social development of all students.

Interstate Teacher Assessment and Support Consortium (InTASC) Standards:

(1i) The teacher is committed to using learners' strengths as a basis for growth, ***and their misconceptions as opportunities for learning.***

(3) The teacher works with others to create environments that support individual and collaborative learning, and that encourage positive social interaction, active engagement in learning, and ***self-motivation.***

(9) The teacher ***engages in ongoing professional learning*** and uses evidence to continually evaluate his/her practice, particularly the effects of his/her choices and actions on others (learners, families, other professionals, and the community), and adapts practice to meet the needs of each learner.

Essential Question: Can a positive error climate improve motivation?

Table 7 Professional Development Session Outlines

SESSION 1/4	
Essential Question	What do teachers do when children make errors?
Advance Work	Read Bandura (1977), Ames (1992), Mueller & Dweck (1998)
Objectives	<ul style="list-style-type: none"> • Educational Objective: <ul style="list-style-type: none"> ○ Is failure always a negative? • Instructional Objective: <ul style="list-style-type: none"> ○ Relate how personal failure experiences can lead to learning and success.
Content	<ul style="list-style-type: none"> • Quotes and video clips regarding the adaptive role of failure in the lives of successful people • Classroom practices that do or do not reflect the content of those quotes • Failure as feedback • Teacher Error Orientation Questionnaire (Steuer, Rosentritt-Brunn, & Dresel, 2013 as adapted for teachers by O’Dell, 2014)
“Practice Oriented” Homework	<ul style="list-style-type: none"> • Post a quote about the positive/ adaptive role of errors in your classroom. • Lead a class discussion about how errors help you learn. • Direct the children to read the quote each day. • Observe their reactions to the errors they make. • Discuss what you observe with a colleague. • Deliverables: <ul style="list-style-type: none"> ○ The lesson plan used to present the error quote. ○ A one-page summary of observations to share in a group at the next session.
Materials	<ul style="list-style-type: none"> • Presentation • Video Clips: <ul style="list-style-type: none"> ○ Famous failures ○ Design flops • Teacher Error Orientation Questionnaire
Assessment	<ul style="list-style-type: none"> • Discussion • Q&A

SESSION 2/4	
Essential Question	What are some factors that contribute to motivation?
Advance Work	Read Weiner (1985), Pekrun, Goetz, Titz, & Perry (2002)
Objectives	<ul style="list-style-type: none"> • Educational Objective: <ul style="list-style-type: none"> ○ Define some key motivational constructs. • Instructional Objectives: <ul style="list-style-type: none"> ○ Identify personal and professional beliefs ○ Relate those beliefs to personal behaviors ○ Relate motivational constructs to observed student behaviors
Content	<ul style="list-style-type: none"> • What are beliefs? • What are some beliefs that can affect motivation? • Self-efficacy beliefs, attribution beliefs, mindsets <ul style="list-style-type: none"> ○ Ohio Teacher Sense of Efficacy Scale (http://u.osu.edu/hoy.17/files/2014/09/TSES-+-scoring-zted8m.pdf) ○ Seligman Attributional Style Questionnaire (obtained through Dr. Martin Seligman at SeligmanInfo@psych.upenn.edu) ○ Dweck's Mindset Self-Assessment (http://mindsetonline.com/testyourmindset/step1.php) • In what ways do achievement goal orientations direct effort? <ul style="list-style-type: none"> ○ Achievement Goal Questionnaire-Revised (http://koumurayama.com/download.php?file=AGQR) • How do academic emotions come about? <ul style="list-style-type: none"> ○ Achievement Emotions Questionnaire – Elementary Students (example) (http://koumurayama.com/download.php?file=AEQ-Elementary%20School%20boys)
“Practice Oriented” Homework	<ul style="list-style-type: none"> • Poll students about how they feel about tasks (emotions) and whether they believe they will be successful (beliefs). • Observe for emotions they experience. • Observe for students comparing themselves to others. • Discuss what you observe with a colleague. • Deliverable: <ul style="list-style-type: none"> ○ A one-page summary of your observations to share with your group at the next session.

Materials	<ul style="list-style-type: none"> • Presentation • Mindset Handout • Self-Efficacy Video (Bandura) • Attribution Video (Weiner) • Questionnaires: <ul style="list-style-type: none"> ○ TSES, ASQ, Mindset, AGQ, AEQ-ES
Assessment	<ul style="list-style-type: none"> • Review of Homework • Discussion • Q&A

SESSION 3/4	
Essential Question	How should student errors be handled?
Advance Work	Read Tulis (2013), Steuer, Rosentritt-Brunn, & Dresel (2013)
Objectives	<ul style="list-style-type: none"> • Educational Objective: <ul style="list-style-type: none"> ○ Describe the research on teacher error handling. • Instructional Objectives: <ul style="list-style-type: none"> ○ Identify factors that create an error climate and relate those factors to personal experience ○ Compare and contrast error-handling behaviors in terms of their impact on student motivation.
Content	<ul style="list-style-type: none"> • The effect of error-making on self-efficacy • Placing the blame for making errors • The effect of error-making on emotions about a subject • Nine factors that create a classroom error climate • The Bermuda Triangle of Error Correction • How a positive error climate looks in action • Video scenes of error handling for training on the observation instrument
“Practice Oriented” Homework	<ul style="list-style-type: none"> • Observe a colleague’s lesson. <ul style="list-style-type: none"> ○ Use the observation instrument to note the error handling behaviors you observe. ○ Discuss the observation with your colleague. • Have a colleague observe a lesson you deliver, using the observation instrument on you. • Deliverable: <ul style="list-style-type: none"> ○ A one-page summary of the observation you conducted and the observation conducted on you. <ul style="list-style-type: none"> ▪ Do you agree with what the observer witnessed? ▪ Do you believe you are handling errors in the best way possible? ▪ What further help do you need to create a positive error climate in your classroom?
Materials	<ul style="list-style-type: none"> • Presentation • Observation Instrument
Assessment	<ul style="list-style-type: none"> • Review of Homework • Discussion • Q&A

SESSION 4/4	
Essential Question	Can a positive error climate improve motivation?
Objectives	<ul style="list-style-type: none"> • Educational Objectives: <ul style="list-style-type: none"> ○ Describe the ways motivational constructs interact. ○ Describe the ways error-handling behaviors may affect motivation. • Instructional Objectives: <ul style="list-style-type: none"> ○ Examine and reflect on personal error handling behaviors. ○ Adapt personal error handling behaviors to positively affect student motivation.
Content	<ul style="list-style-type: none"> • A model representing beliefs, emotions, goals, and error climate as they work together to affect motivation • Reflections on error handling behaviors • Review and discussion of peer observations • Discussion of the results of Student Perception of Teacher Error Orientation surveys • Discussion of video scenes of error handling
Materials	<ul style="list-style-type: none"> • Presentation • Teacher Error Orientation Survey
Assessment	<ul style="list-style-type: none"> • Post-Training Teacher Error Orientation Survey • Teacher Observations • Student Perception of Teacher Error Orientation Surveys

Seminal Articles for Advance Reading:

Ames, C. (1992). Classrooms: Goals, structures, and student motivation. *Journal of Educational Psychology*, 84(3), 261-271.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, 84(2), 191-215.

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Pekrun, R., Goetz, T., Titz, W., & Perry, R. P. (2002). Academic emotions in students' self-regulated learning and achievement: A program of qualitative and quantitative research. *Educational Psychologist*, 37(2), 91-105.

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- Tulis, M. (2013). Error management behavior in classrooms: Teachers' responses to student mistakes. *Teaching and Teacher Education, 33*, 56-68.
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References for Survey Instruments:

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**APPENDIX D:
STUDENT PERCEPTION OF TEACHER ERROR ORIENTATION
SURVEY**

Please indicate how much you agree or disagree with the following statements.

1 = Strongly Disagree

2 = Disagree

3 = Neither Agree Nor Disagree

4 = Agree

5 = Strongly Agree

A.1. Error tolerance by the teacher

1. In our class it is okay with our teacher if the assignments are not done correctly.
2. In our class mistakes are nothing bad for our teacher.
3. In our class our teacher doesn't like if something is done incorrectly.
4. In our class it is not at all bad for our teacher if someone says something incorrect.

A.2. Irrelevance of errors for assessment

5. If someone in our class makes a mistake, he will get a bad grade.
6. If someone in our class says something wrong, it has an immediate effect on his grade.
7. If someone in our class does something incorrectly, he will get a bad grade.
8. If someone in our class does not do his assignment correctly, he will immediately get a bad grade.

A.3. Teacher support following errors

9. If someone in our class can't solve an exercise correctly, the teacher will help him.
10. If someone in our class does something wrong, he will get very little support from the teacher.

11. If someone in our class says something incorrect, the teacher will patiently explain the problem.

12. If someone in our class does something wrong, he will get support from the teacher.

A.4. Absence of negative teacher reactions to errors

13. If someone in our class does something incorrectly, he might be mocked by the teacher.

14. If someone in our class makes mistakes, the teacher often looks annoyed.

15. If someone in our class says something wrong, sometimes the teacher will embarrass him in front of the entire class.

16. If someone in our class solves an assignment incorrectly, once in a while the teacher will become angry.

A.5. Absence of negative classmate reactions to errors

17. If someone in our class does something wrong, he will sometimes be ridiculed by his classmates.

18. If someone in our class says something incorrect, he will later have to put up with teasing from his classmates.

19. If someone in our class makes mistakes, his classmates will sometimes make fun of him.

20. If someone in our class solves an assignment incorrectly, his classmates will mock him.

A.6. Taking the error risk

21. In our class a lot of students would rather say nothing at all than something that is wrong.

22. In our class a lot of students hope they will not be called on, because they are afraid they will say something wrong.

23. In our class a lot of students don't dare to say anything because they are afraid it is wrong.

A.7. Analysis of errors

- 24. In our class we discuss it in detail when something is done incorrectly.
- 25. In our class we think about it in detail when someone says something wrong.
- 26. In our class mistakes are investigated in detail.
- 27. In our class assignments that are done incorrectly are discussed in detail.

A.8. Functionality of errors for learning

- 28. In our class the mistakes students make are often used to make sure you really understand Math.
- 29. In our class we learn a lot from assignments that were not done correctly.
- 30. In our class wrong answers on assignments are used to learn something.
- 31. In our class wrong answers are often a good opportunity to really understand the material.

**APPENDIX E:
TEACHER ERROR ORIENTATION SURVEY**

Please indicate how much you agree or disagree with the following statements.

1 = Strongly Disagree

2 = Disagree

3 = Neither Agree Nor Disagree

4 = Agree

5 = Strongly Agree

A.1. Error tolerance by the teacher

1. It is okay with me if the assignments are not done correctly.
2. Mistakes are nothing bad for me.
3. I don't like if something is done incorrectly.
4. It is okay with me if someone says something incorrect.

A.2. Irrelevance of errors for assessment

5. If someone makes a mistake, he will get a bad grade.
6. If someone says something wrong, it has an immediate effect on his grade.
7. If someone does something incorrectly, he will get a bad grade.
8. If someone does not do his assignment correctly, he will immediately get a bad grade.

A.3. Teacher support following errors

9. If someone can't solve an exercise correctly, I will help him.
10. If someone does something wrong, he will get very little support from me.
11. If someone says something incorrect, I will patiently explain the problem.
12. If someone does something wrong, he will get support from me.

A.4. Absence of negative teacher reactions to errors

13. If someone does something incorrectly, I might mock him.
14. If someone makes mistakes, I often get annoyed.
15. If someone says something wrong, sometimes I may embarrass him in front of the entire class.
16. If someone solves an assignment incorrectly, once in a while I will become angry.

A.5. Absence of negative classmate reactions to errors

17. If someone does something wrong, he will sometimes be ridiculed by his classmates.
18. If someone says something incorrect, he will later have to put up with teasing from his classmates.
19. If someone makes mistakes, his classmates will sometimes make fun of him.
20. If someone solves an assignment incorrectly, his classmates will mock him.

A.6. Taking the error risk

21. In my class a lot of students would rather say nothing at all than something that is wrong.
22. In my class a lot of students hope they will not be called on, because they are afraid they will say something wrong.
23. In my class a lot of students don't dare to say anything because they are afraid it is wrong.

A.7. Analysis of errors

24. We discuss it in detail when something is done incorrectly.
25. We think about it in detail when someone says something wrong.
26. Mistakes are investigated in detail.
27. Assignments that are done incorrectly are discussed in detail.

A.8. Functionality of errors for learning

- 28. The mistakes students make are often used to make sure they really understand the subject.
- 29. Students learn a lot from assignments that were not done correctly.
- 30. Wrong answers on assignments are used to teach something.
- 31. Wrong answers are often a good opportunity to help students really understand the material.

A.9. Teacher beliefs regarding errors

- 32. I believe that mistakes provide teachable moments.
- 33. When returning an assessment, I provide assistance to students who made mistakes.
- 34. As long as the student learns from mistakes and does not make them again, he will get a good grade.
- 35. Poor grades demonstrate the importance of paying attention in class.
- 36. Students mostly get poor grades because they do not put enough effort into studying at home.
- 37. Mistakes show that students are not paying attention in class.

**APPENDIX F:
CLASSROOM OBSERVATION INSTRUMENT**

Error Climate Teacher Observation Worksheet

TEACHER NAME _____

CLASS _____ **DATE** _____

Using the table on the next page, place a mark for each positive occurrence or for each negative occurrence next to each rubric area. Use Observation Notes section for specific notes, referring to rubric area numbers with each note. A.1. and A.4. are grouped together due to similarities expected in observation. Add up the total positive occurrences and the total negative occurrences in the bottom row of the chart.

A.1. Error tolerance by the teacher

Errors are handled positively.

- Teacher does not appear upset when students make mistakes.
- It is clear that errors are okay with the teacher.
- Having to redirect teaching to correct errors seems natural to the teacher (occurs without a visible transition).
- Bermuda Triangle of Error Correction is NOT used.

A.4. Absence of negative teacher reactions to errors

The teacher does not ridicule or show annoyance when students make errors.

- Teacher reacts to errors positively (no negative facial or verbal reactions).

A.2. Irrelevance of errors for assessment

The teacher uses errors formatively rather than summatively in classroom learning.

- Teacher reacts to errors to determine the need for additional instruction.

A.3. Teacher support following errors

When students make errors, the teacher provides positive support.

- Teacher help is available.
- Teacher help is patient.

A.5. Absence of negative classmate reactions to errors

Students do not ridicule or show annoyance when other students make errors.

- Students react to errors positively (no negative facial or verbal reactions).

A.6. Taking the error risk

Students volunteer to answer questions without fear of making errors.

- All students participate in classroom discussions.
- Students make mistakes freely and don't appear upset by them.

A.7. Analysis of errors

The teacher explores student errors in detail to determine the source of misunderstanding.

- Teacher spends time with a student making an error to examine the reason for the error.

- Other students participate in working through errors rather than simply offering additional possible answers.

A.8. Functionality of errors for learning

The teacher uses errors as “teachable moments” to help students understand subject matter more deeply.

- Common errors are used as a “jumping off point” for learning that will correct the error.
- Teacher reacts to errors positively, seeming happy to use the error to explore the subject.

Observation Notes With Rubric Areas Listed:

<i>Area</i>	<i>Positive Occurrence</i>	<i>Negative Occurrence</i>
A.1. Error Tolerance/ A.4. Negative Teacher Reactions		
A.2. Irrelevance for Assessment		
A.3. Teacher Support		
A.5. Negative Classmate Reactions		
A.6. Error Risk		
A.7. Analysis		
A.8. Functionality		
<i>Overall Totals</i>		

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